Atacama
Large
Millimeter
Array

SDM Tables Short Description

COMP-70.75.00.00-00?-A-DSN

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Design Document

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Contents

1 List of ASDM Tables

This document is just a container for the list of ASDM Tables. More documentation is envisaged in the final document which will include a general introduction.

Note: The order of keys in this document is NOT alphabetical; the hierarchical order matters and is actually different. In particular it has been changed in the CalDM Tables.

1.1 Versioning information for the ASDM.

- Version : 3
- CVS revision : -1
- CVS branch :

1.2 Main Table

Contains links to all data subsets. Each data subset is contained in a separate entity, usually a BLOB.

Main		
Name	Type (Shape)	Comment
Key		
`time`	`ArrayTime`	mid point of scheduled period.
`configDescriptionId`	`Tag`	Configuration description identifier.
`fieldId`	`Tag`	Field identifier.
Required Data		
N_{Ante} (N_{Ante})	`int`	Number of antennas.
`timeSampling`	`TimeSampling`	time sampling mode.
`interval`	`Interval`	data sampling interval.
N_{Inte} (N_{Inte})	`int`	number of integrations.
`scanNumber`	`int`	scan number.
`subscanNumber`	`int`	subscan number.
`dataSize`	`int64_t`	size of the binary data , as a number of bytes.
`dataUID`	`EntityRef`	reference to the binary data.
`stateId`	`Tag [numAntenna]`	State identifier.
`execBlockId`	`Tag`	ExecBlock identifier.

Column Descriptions:

`time` : The mid-point of the scheduled period for the row, thus not taking into account the effects of data blanking and any overhead.

`configDescriptionId` : The Configuration Description Table identifier. Note that two or more sub-arrays cannot refer to the same Configuration Description row. The Configuration Description thus makes possible to identify the various subarrays if more than one have been used in the same data set.

`fieldId` : The Field Identifier used in the Field Table.

N_{Ante} : The number of antennas. Provides the size of `stateId`.

`timeSampling` : This specifies whether the sampling interval is divided into simple integrations, or into integrations further divided into sub-integrations (for channel averaged correlator data).

`interval` : This is the nominal data interval, as scheduled, for the whole row. This means that data taking was scheduled to start a `time-interval/2` and end at `time+interval/2`. `Interval` corresponds to the sum of all integrations and does not include the effects of blanking (bad data) or partial integrations. In ALMA this is the scheduled duration of the subscan. For the actual subscan start and end times see the Subscan Table.

N_{Inte} : The number of integrations in `interval`. For Alma this is is either true integrations (for full spectral resolution data), or the total number of subintegrations in `interval` (for channel -averaged spectral data).

`scanNumber` : In Alma a scan is an amount of data taken to reach a single result (e.g. a simple calibration). The scan numbers increment from 1 inside an Execution Block.

`subscanNumber` : In Alma a Subscan is the minimum amount of data taken by executing a single Control Command Language (CCL) command. There can be several data cells for each subscan corresponding to different backends (correlator, total power detectors) or different results of the same backend (channel averaged or full-resolution data from a Correlator). In each scan there is at least one subscan.

`dataSize` : Total size, in bytes, of the binary data file.

`dataUID` : This is a string that specifies the data object.

`stateId` : The State indentifier used in the State Table.

`execBlockId` : The ExecBlock identifier used in the ExecBlock Table. For ALMA the ExecBlocks represent each execution of a Scheduling Block.

1.3 AlmaRadiometer Table

Properties of the Radiometer receiver/backend (used to monitor water vapour content and correct phases). Note that standard properties (like spectral coverage) are in the generic tables (like SpectralWindow).

AlmaRadiometer		
Name	Type (Shape)	Comment
Key		
`almaRadiometerId`	`Tag`	identifies a unique row in the table.
Required Data		
Optional Data		
N_{Ante} (N_{Ante}) `spectralWindowId`	`int` `Tag [numAntenna]`	the number of antennas. the references to the actual spectral windows (one spectral window per antenna).

Column Descriptions:

`almaRadiometerId` : Alma Radiometer Table identifier.

N_{Ante} : The number of antennas to which the data refer.

`spectralWindowId` : enter tag descr. here

1.4 Annotation Table

The Annotation Table is intended to offer space for unexpected data to be added in the software development process at short notice, without redefining the data model.

Annotation		
Name	Type (Shape)	Comment
Key		
`annotationId`	`Tag`	identifies a unique row in the table.
Required Data		
`time`	`ArrayTime`	mid point of the interval of time on which the recorded information is pertinent.
`issue`	`string`	name of this annotation.
`details`	`string`	details of this annotation.
Optional Data		
N_{Ante} (N_{Ante})	`int`	number of antennas.
`basebandName`	`BasebandName [numBaseband]`	an array of numBaseband baseband names.
N_{Base} (N_{Base})	`int`	number of basebands.
`interval`	`Interval`	time interval
`dValue`	`double`	scalar data.
`vdValue`	`double []`	useful to store an array of double values.
`vvdValues`	`double [] []`	useful to store an array of array(s) of double values.
`llValue`	`int64_t`	useful to record a long long data.
`vllValue`	`int64_t []`	useful to store an array of array(s) of long long values.
`vvllValue`	`int64_t [] []`	useful to store an array of array(s) long long values.
`antennaId`	`Tag [numAntenna]`	refers to a collection of rows in the AntennaTable.

Column Descriptions:

`annotationId` : Annotation Table identifier.

`time` : The midpoint of the time interval the data in this row are referring to. This is for documentation purposes only.

`issue` : A short (preferably 1-word) string that identifies the type of annotation.

`details` : Details of this entry: this should explain the motivation, the dimensionality and contents of the generic columns: `dValue`, `llValue` , `vdValue`, `vllValue`, `vvdValues`, `vvllValue`.

N_{Ante} : The number of antennas to which the data refer.

`basebandName` : The basebands that the baseband-based data in this table refer to.

N_{Base} : The number of basebands to which the data refer.

`interval` : Time interval during which the recorded information is pertinent.

`dValue` : space for a scalar floating-point number.

`vdValue` : space for a 1-dimensional array of floating-point data; shape must be made explicit in `details`.

`vvdValues` : space for a 2-dimensional array of floating-point data; shape must be made explicit in `details`.

`llValue` : space for a scalar integer.

`vllValue` : space for a 1-dimensional array of integer data; shape must be made explicit in `details`.

`vvllValue` : space for a 2-dimensional array of integer data; shape must be made explicit in `details`.

`antennaId` : Antenna Table identifier.

1.5 Antenna Table

Antenna characteristics.

Antenna		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	identifies a unique row in the table.
Required Data		
`name`	`string`	the antenna's name.
`antennaMake`	`AntennaMake`	the antenna's make.
`antennaType`	`AntennaType`	the antenna's type.
`dishDiameter`	`Length`	the diameter of the main reflector.
`position`	`Length [3]`	the antenna's position.
`offset`	`Length [3]`	the position's offset.
`time`	`ArrayTime`	the time of position's measurement.
`stationId`	`Tag`	refers to the station where this antenna is located (i.e. one row in the Station table).
Optional Data		
`assocAntennaId`	`Tag`	refers to an associate antenna (i.e. one row in the Antenna table).

Column Descriptions:

`antennaId` : Identifies the row in the Antenna Table.

`name` : Provides a unique string identification for the antenna hardware. *Examples:* DV01 or DA41 for ALMA antenna prototypes

`antennaMake` : Identifies the antenna manufacturer. Antennas with same optical design may have subtle differences if built according to different designs.

`antennaType` : Generic antenna type; e.g. radio antennas are either for ground use of space use.

`dishDiameter` : The diameter of the main reflector (or the largest dimension for non-circular apertures).

`position` : The position of the antenna pedestal reference point, relative to the station reference point, measured in the horizon system at the station position. The antenna pedestal reference point is on the elevation axis, nominally at the same height as the station reference point (ground level), so that the antenna position should be always close to zero if the antenna is well positioned on the station. This is the quantity that has to be re-measured whenever the antenna is moved to a new station.

`offset` : The position of the antenna phase reference point in the Yoke, relative to the antenna pedestal reference point. This is an antenna characteristic that should be unchanged when the antenna is moved to a new station.

- The X component is horizontal along the elevation axis and has no effect of the interferometer phase; it can be set arbitrarily to zero.

– The Y component is horizontal and perpendicular to the elevation axis; it produces an elevation dependent interferometer phase term and has to be accurately calibrated.
– The Z component is vertical and can be kept equal to the nominal height of the elevation axis above ground for the antenna's mount. Small variations from the nominal value have the same phase effect as the Z component of `position`, so they can be ignored.

YOKEAntenna.position - The YOKE reference system is defined in ALMA-80.05.00.00-009-B-SPE document; not known in Measures (CASA)
- Note - The relevant distance between axes is in the y coordinate, not x...

`time` : Gives the time at which the positions were measured.

`stationId` : enter tag descr. here

`assocAntennaId` : Identifies an associated antenna in the Table. This can refer to the same antenna with a position measured at a different time.

1.6 CalAmpli Table

Amplitude Calibration Result from Telescope Calibration. This calibration checks that observing amplitude calibrators provide reasonable results: From the antenna-based fringe amplitudes rough aperture efficiencies are determined.

CalAmpli		
Name	Type (Shape)	Comment
Key		
`antennaName`	`string`	the antenna's name.
`atmPhaseCorrection`	`AtmPhaseCorrection`	qualifies how the atmospheric phase correction has been applied.
`receiverBand`	`ReceiverBand`	the name of the receiver band.
`basebandName`	`BasebandName`	The name of the 'baseband pair' which is measured. For ALMA a baseband pair is the signal path identified by a second local oscillator and has two polarizations. BB ALL may be used if all basebands are fitted together.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
N_{Rece} (N_{Rece})	`int`	the number of receptors.
`polarizationTypes`	`PolarizationType [numReceptor]`	the polarizations of the receptors (an array containing one value per receptor).
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
`frequencyRange`	`Frequency [2]`	the frequency range over which the result is valid.
`apertureEfficiency`	`float [numReceptor]`	the aperture efficiency without correction.
`apertureEfficiencyError`	`float [numReceptor]`	the aperture efficiency error.
Optional Data		
`correctionValidity`	`bool`	the correction validity.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`atmPhaseCorrection` : the atmospheric phase corrections states for which result is given.

`receiverBand` : The name of the front-end frequency band being used.

`basebandName` : long doc missing

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`polarizationTypes` : The polarization types of the receptors being used.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`frequencyRange` : Frequency range over which the result is valid TOPO

`apertureEfficiency` : Antenna aperture efficiency with and/or without phase correction.

`apertureEfficiencyError` : Error on aperture efficiency measurement.

`correctionValidity` : Deduced validity of atmospheric path length correction (from Water Vapour Radiometers).

1.7 CalAppPhase Table

The CalAppPhase table is relevant to the ALMA observatory when the antennas are being phased to form a coherent sum during the observation. For each scan, the table provides information about which antennas are included in the sum, their relative phase adjustments, the efficiency of the sum (relative to best performance) and the quality of each antenna participating in the system. This data is used in real-time to provide the phased sum signal, and after the observation to analyze the result.

CalAppPhase		
Name	Type (Shape)	Comment
Key		
`basebandName`	`BasebandName`	identifies the baseband.
`scanNumber`	`int`	The number of the scan processed by TELCAL. Along with an ExecBlock Id (which should be ExecBlock_0 most of the time), the value of scanNumber can be used as the key to retrieve informations related to the scan (e.g. its start time).
`calDataId`	`Tag`	identifies a unique row in the CalData table.
`calReductionId`	`Tag`	identifies a unique row in the CalReduction table.
Required Data		
`startValidTime`	`ArrayTime`	start of phasing solution validity.
`endValidTime`	`ArrayTime`	end of phasing solution validity.
`adjustTime`	`ArrayTime`	The time of the last adjustment to the phasing analysis via the ParameterTuning interface.
`adjustToken`	`string`	A parameter supplied via the ParameterTuning interface to indicate the form of adjustment(s) made at adjustTime. Note that TELCAL merely passes this datum and adjustTime through to this table.
`phasingMode`	`string`	The mode in which the phasing system is being operated.
N_p (N_p)	`int`	the number of antennas in phased sum, N_p.
`phasedAntennas`	`string [numPhasedAntennas]`	the names of the phased antennas.
`refAntennaIndex`	`int`	the index of the reference antenna in the array phasedAntennas . It must be an integer value in the interval $[0, N_p - 1]$.

CalAppPhase – continued from previous page		
Name	Type (Shape)	Comment
`candRefAntennaIndex`	`int`	tne index of a candidate (new) reference antenna in the array phasedAntennas; it must be a integer in the interval $[0, N_p - 1]$.
`phasePacking`	`string`	how to unpack phaseValues.
N_r (N_r)	`int`	the number of receptors per antenna, N_r.The number ($N_r \leq 2$) of receptors per antenna, usually two (polarizations), but it might be one in special cases.
N_d (N_d)	`int`	the number of data channels, N_d.
N_v (N_v)	`int`	The number of phase data values present in the table, N_v.
`phaseValues`	`float [numPhaseValues]`	the array of phase data values.
N_c (N_c)	`int`	the number of comparison antennas, N_c.
N_e (N_e)	`int`	the number of efficiencies, N_e.
`compareArray`	`string [numCompare]`	the names of the comparison antennas.
`efficiencyIndices`	`int [numEfficiencies]`	indices of the antenna(s) in çompareArray used to calculate efficiencies; they must be distinct integers in the interval $[0, N_c]$.
`efficiencies`	`float [numEfficiencies] [numChannels]`	an array of efficiencies of phased sum.
`quality`	`float [numPhasedAntennas+numCompare]`	quality of phased antennas.
`phasedSumAntenna`	`string`	the name of the phased sum antenna.
Optional Data		
`typeSupports`	`string`	encoding of supporting data values.
N_s (N_s)	`int`	the number of supporting data values, N_s.
`phaseSupports`	`float [numSupports]`	an array of supporting data values.

Column Descriptions:

`basebandName` : identifies the baseband.

`scanNumber` : The number of the scan processed by TELCAL. Along with an ExecBlock Id (which should be ExecBlock_0 most of thetime), thevalue of scanNumber can be used as the key to retrieve informations related to the scan (e.g. its start time).

`calDataId` : identifies a unique row in the CalData table.

`calReductionId` : identifies a unique row in the CalReduction table.

`startValidTime` : The start of the interval in which the phase solution was calculated. Normally the first few seconds of each scan include data before the previous slow phasing solution can be applied, so the valid interval corresponds to the last phasing correction.

`endValidTime` : The end of the interval in which the phase solution was calculated. Note that $startTime < startValidTime < endValidTime \leq endTime$.

`adjustTime` : Usually, this is the timestamp of the commanding of the last slow phasing correction. However, other adjustments might also have been made (e.g. phasedArray membership changed in the correlator hardware).

`adjustToken` : A parameter supplied via the ParameterTuning interface to indicate the form of adjustment(s) made at adjustTime . Note that TELCAL merely passes this datum and adjustTime through to this table.

`phasingMode` : The mode in which the phasing system is being operated.

N_p : The number of antennas included in the phased sum.

`phasedAntennas` : The names of the N_p antennas contributing to the phased sum.

`refAntennaIndex` : the index of the reference antenna in the array phasedAntennas. It must be an integer value in the array phasedAntennas.

`candRefAntennaIndex` : TELCAL may recommend the adoption of a candidate (new) refAntenna with this entry (index in phasedAntennas). This recommendation is always available (in case the current reference antenna becomes unsuitable for some reason), but the VOM is not obliged to adopt the recommendation. It must be an integer in the interval $[0, Np - 1]$.

`phasePacking` : Indicates one of several possibilities for converting the phase data into TFB commands.

N_r : the number of receptors per antenna, N_r.The number ($N_r \leq 2$) of receptors per antenna usually two (polarizations), but it might be one in special cases.

N_d : The number of data channels for which efficiency data is presented, N_d.

N_v : The number of phase data values present in the table, N_v.

`phaseValues` : An array containing the N_v phase data values.

N_c : The number of antennas not included in the phased sum, N_c.

N_e : The number N_e of antennas in the array compareArray used to calculate efficiencies.

`compareArray` : The names of the antennas not in the phased sum, which could be used as comparison antenna. The array of available antennas (to the observation) has $(N_p + 1 + N_c)$ members; N_p are in the phase-sum, one is the phased-sum, and N_c are not.

`efficiencyIndices` : A list of N_e indices in compareArray for which efficiencies are calculated. The first index in the list refers to the nominal comparison antenna, the second index refers to a candidate replacement (should the first become unusable), and others may be listed.

`efficiencies` : An array of normalized efficiencies for the phased sum for each data channel. Those for the compAntenna are to be used for decisions; the other values are advisory. The efficiencies are provided per channel for each antenna of compareArray mentioned in the list efficiencyIndices .

`quality` : A normalized figure of merit ($0.0 \leq q \leq 1.0$) expressing the quality of the solution for every antenna.

`phasedSumAntenna` : The name of the antenna whose data is discarded in favor of the phased sum. The antenna is also known as cai63Antenna . The efficiency is calculated through the correlation of this antenna with antennas referenced by efficiencyIndices.

`typeSupports` : An indicator of which supporting data is being provided.

N_s : The number of supporting data values present, N_s.

`phaseSupports` : An array of Ns supporting data values. The presence and use of this array is unspecified; but might include channel average frequencies or supplementary quality data as an assist in the implementation. (Indeed, there is a long list of such items that TelCal could compute.)

1.8 CalAtmosphere Table

Results of atmosphere calibration by TelCal. This calibration determines the system temperatures corrected for atmospheric absorption. Ionospheric effects are not dealt with in the Table.

CalAtmosphere		
Name	Type (Shape)	Comment
Key		
antennaName	string	the name of the antenna.
receiverBand	ReceiverBand	identifies the receiver band.
basebandName	BasebandName	identifies the baseband.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
N_{Freq} (N_{Freq})	int	the number of frequency points.
N_{Load} (N_{Load})	int	the number of loads.
N_{Rece} (N_{Rece})	int	the number of receptors.
forwardEffSpectrum	float [numReceptor] [numFreq]	the spectra of forward efficiencies (one value per receptor, per frequency).
frequencyRange	Frequency [2]	the frequency range.
groundPressure	Pressure	the ground pressure.
groundRelHumidity	Humidity	the ground relative humidity.
frequencySpectrum	Frequency [numFreq]	the frequencies.
groundTemperature	Temperature	the ground temperature.
polarizationTypes	PolarizationType [numReceptor]	the polarizations of the receptors (an array with one value per receptor).
powerSkySpectrum	float [numReceptor] [numFreq]	the powers on the sky (one value per receptor per frequency).
powerLoadSpectrum	float [numLoad] [numReceptor] [numFreq]	the powers on the loads (one value per load per receptor per frequency).
syscalType	SyscalMethod	the type of calibration used.
tAtmSpectrum	Temperature [numReceptor] [numFreq]	the spectra of atmosphere physical temperatures (one value per receptor per frequency).
tRecSpectrum	Temperature [numReceptor] [numFreq]	the spectra of the receptors temperatures (one value per receptor per frequency).
tSysSpectrum	Temperature [numReceptor] [numFreq]	the spectra of system temperatures (one value per receptor per frequency).
tauSpectrum	float [numReceptor] [numFreq]	the spectra of atmosheric optical depths (one value per receptor per frequency).
tAtm	Temperature [numReceptor]	the atmosphere physical temperatures (one value per receptor).

CalAtmosphere – continued from previous page		
Name	Type (Shape)	Comment
tRec	Temperature [numReceptor]	the receptors temperatures (one value per receptor).
tSys	Temperature [numReceptor]	the system temperatures (one value per receptor).
tau	float [numReceptor]	the atmospheric optical depths (one value per receptor).
water	Length [numReceptor]	the water vapor path lengths (one value per receptor).
waterError	Length [numReceptor]	the uncertainties of water vapor contents (one value per receptor).
Optional Data		
alphaSpectrum	float [numReceptor] [numFreq]	the alpha coefficients, two loads only (one value per receptor per frequency).
forwardEfficiency	float [numReceptor]	the forward efficiencies (one value per receptor).
forwardEfficiencyError	double [numReceptor]	the uncertainties on forwardEfficiency (one value per receptor).
sbGain	float [numReceptor]	the relative gains of LO1 sideband (one value per receptor).
sbGainError	float [numReceptor]	the uncertainties on the relative gains of LO1 sideband (one value per receptor).
sbGainSpectrum	float [numReceptor] [numFreq]	the spectra of relative sideband gains (one value per receptor per frequency).

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`receiverBand` : The name of the front-end frequency band being used.

`basebandName` : long doc missing

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

N_{Freq} : Number of frequency points for which the results are given.

N_{Load} : N_{Load} Number of loads used in calibration.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`forwardEffSpectrum` : The value of the forward efficiency for each frequency point.

`frequencyRange` : Frequency range over which the result is valid TOPO

`groundPressure` : The atmospheric pressure at the altitude of the observatory.

`groundRelHumidity` : The relative atmospheric humidity (%) at the altitude of the observatory.

`frequencySpectrum` : The frequency values for which the results are given.

`groundTemperature` : The ambient temperature at the observatory.

`polarizationTypes` : The polarization types of the receptors being used.

`powerSkySpectrum` : Observed power on sky.

`powerLoadSpectrum` : Observed power on loads.

`syscalType` : The type of calibration used: a single-direction measurement, or a series of measurements at different elevations ('SkyDip')

`tAtmSpectrum` : The value of atmosphere physical temperature for each frequency point.

`tRecSpectrum` : The value of the receiver temperature for each frequency point.

`tSysSpectrum` : The value of the system temperature for each frequency point.

`tauSpectrum` : The value of the optical depth for each frequency point.

`tAtm` : The physical temperature of the atmosphere absorbing layers.

`tRec` : The receiver noise temperature (the reference plane is at the level where the calibration loads are inserted in the signal path).

`tSys` : The system temperature (corrected for atmospheric absorption and antenna losses).

`tau` : The optical depth of the atmosphere along the line of sight.

`water` : The amount of precipitable water vapour in the atmosphere.

`waterError` : The uncertainty of the amount of precipitable water vapour in the atmosphere.

`alphaSpectrum` : alpha coefficient (two-load only); see *Amplitude Calibration steps* memo.

`forwardEfficiency` : This is the coupling factor to the sky, that is the fraction of the antenna beam that sees the emission from the atmosphere.

`forwardEfficiencyError` : The uncertainty of `forwardEfficiency`

`sbGain` : The relative gain of the side band. This is the ratio of the gain in the first LO sideband used to obtain the `frequencyRange` relative to the total (dual-sideband) gain.

`sbGainError` : Uncertainty on `sbGain`.

`sbGainSpectrum` : The value of the relative side band gain for each spectral point. Optional for EVLA, mandatory for ALMA.

1.9 CalBandpass Table

Result of passband calibration performed on-line by TelCal.

CalBandpass		
Name	Type (Shape)	Comment
Key		
basebandName	BasebandName	identifies the baseband.
sideband	NetSideband	identifies the first LO sideband.
atmPhaseCorrection	AtmPhaseCorrection	qualifies how the atmospheric phase correction has been applied.
typeCurve	CalCurveType	identifies the type of curve.
receiverBand	ReceiverBand	identifies the receiver band.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
N_{Ante} (N_{Ante})	int	the number of antennas.
N_{Poly} (N_{Poly})	int	the number of coefficients of the polynomial.
N_{Rece} (N_{Rece})	int	the number of receptors.
antennaNames	string [numAntenna]	the names of the antennas.
refAntennaName	string	the name of the reference antenna.
freqLimits	Frequency [2]	the frequency range for the polynomial description of the passband.
polarizationTypes	PolarizationType [numReceptor]	the polarizations of the receptors (one value per receptor).
curve	float [numAntenna] [numReceptor] [numPoly]	the amplitude or phase coefficients, depending on the value of typeCurve (one array of numPoly values per antenna per receptor).
reducedChiSquared	double [numReceptor]	measures the quality of the least squares fits (one value per receptor).
Optional Data		
N_{Base} (N_{Base})	int	the number of baselines.
rms	float [numReceptor] [numBaseline]	the amplitude or phase residuals (one array of numBaseline values per receptor).

Column Descriptions:

basebandName : The name of the 'baseband pair' which is measured. For ALMA a baseband pair is the signal path identified by a second local oscillator and has two polarizations. BB_ALL may be used if all basebands

are fitted together.

`sideband` : First LO Sideband: For sideband-separated spectra one must use different bandpasses for each individual sideband.

`atmPhaseCorrection` : the atmospheric phase corrections states for which result is given.

`typeCurve` : Defines the quantity which is fitted: amplitude ot phase.

`receiverBand` : The name of the front-end frequency band being used.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

N_{Ante} : Number of antennas for which the result is valid.

N_{Poly} : Number of polynomial coefficients.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`antennaNames` : Refer uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`refAntennaName` : The name of the antenna used as reference to get the antenna-based phases.

`freqLimits` : The frequency limits for the polynomial description of the passband. This frequency interval is reduced to the (-1, 1) interval over which the Chebychev polynomials are defined.

`polarizationTypes` : The polarization types of the receptors being used.

`curve` : The amplitude or phase coefficients.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit. This is a single number for each polarization as the baselines are to be fitted consistently.

N_{Base} : Number of baselines for which the result is given

`rms` : The rms of the amplitude/phase residuals for each baseline/polarisation.

1.10 CalCurve Table

Result of time-dependent calibration performed on-line by TelCal

CalCurve		
Name	Type (Shape)	Comment
Key		
`atmPhaseCorrection`	`AtmPhaseCorrection`	qualifies how the atmospheric phase correction has been applied.
`typeCurve`	`CalCurveType`	identifies the type of curve.
`receiverBand`	`ReceiverBand`	identifies the receiver band.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
`frequencyRange`	`Frequency [2]`	the range of frequencies over which the result is valid.
N_{Ante} (N_{Ante})	`int`	the number of antennas.
N_{Poly} (N_{Poly})	`int`	the number of coefficients of the polynomials.
N_{Rece} (N_{Rece})	`int`	the number of receptors.
`antennaNames`	`string [numAntenna]`	the names of the antennas.
`refAntennaName`	`string`	the name of the reference antenna.
`polarizationTypes`	`PolarizationType [numReceptor]`	identifies the polarizations of the receptors (one value per receptor).
`curve`	`float [numAntenna] [numReceptor] [numPoly]`	the coefficients of the polynomials (one array of numPoly coefficients per receptor per antenna).
`reducedChiSquared`	`double [numReceptor]`	measures the quality of the least squares fits (one value per receptor).
Optional Data		
N_{Base} (N_{Base})	`int`	the number of baselines.
`rms`	`float [numReceptor] [numBaseline]`	the amplitude or phase residuals (one array of numBaselines values per receptor).

Column Descriptions:

`atmPhaseCorrection` : the atmospheric phase correction state for which result is given.

`typeCurve` : Defines the quantity which is fitted: amplitude or phase.

`receiverBand` : The name of the front-end frequency band being used.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`frequencyRange` : Frequency range over which the result is valid. TOPO

N_{Ante} : Number of antennas for which the result is valid.

N_{Poly} : The number of coefficients in the Chebichev polynomials used to fit the data.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`antennaNames` : Refer uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`refAntennaName` : The name of the antenna used as reference to get the antenna-based phases.

`polarizationTypes` : The polarization types of the receptors being used.

`curve` : These are Chebichev polynomial coefficients. The interval between startValidTime and endValidTime is reduced to the $-1, 1$ interval over which the Chebychev coefficients are defined. For interferometer amplitude, data is expressed in terms of correlation coefficient; for interferomete phase, coefficients are given in radians.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

N_{Base} : Number of baselines ffor which the result is given.

`rms` : The root means square deviations of fit residuals.

1.11 CalData Table

This table describes the data used to derive the calibration results.

CalData		
Name	Type (Shape)	Comment
Key		
`calDataId`	`Tag`	identifies a unique row in the table.
Required Data		
`startTimeObserved`	`ArrayTime`	the start time of observation.
`endTimeObserved`	`ArrayTime`	the end time of observation.
`execBlockUID`	`EntityRef`	the UID of the Execution Block.
`calDataType`	`CalDataOrigin`	identifies the origin of the data used for the calibration.
`calType`	`CalType`	identifies the type of performed calibration.
N_{Scan} (N_{Scan})	`int`	the number of scans (in this Execution Block).
`scanSet`	`int [numScan]`	the set of scan numbers.
Optional Data		
`assocCalDataId`	`Tag`	refers to an associate row in CalDataTable.
`assocCalNature`	`AssociatedCalNature`	identifies the nature of the relation with the associate row in CalDataTable.
`fieldName`	`string [numScan]`	the names of the fields (one name per scan).
`sourceName`	`string [numScan]`	the names of the sources as given during observations (one source name per scan).
`sourceCode`	`string [numScan]`	the special characteristics of sources expressed in a textual form (one string per scan).
`scanIntent`	`ScanIntent [numScan]`	identifies the intents of the scans (one value per scan).

Column Descriptions:

`calDataId` : Row identifier.

`startTimeObserved` : The start time of the data set used.

`endTimeObserved` : The end time of the data set used.

`execBlockUID` : Archive UID of the ExecBlock.

`calDataType` : The origin of the data used: Correlator (full resolution or channel averaged data), Total power detectors, WVR receivers, etc. This information is added as e.g. a pointing scan may have been reduced using either total power or interferometry, or the atmosphere may be calibrated using autocorrelations or total power detectors.

`calType` : This enumerated item tells in which calibration table the results is.

N_{Scan} : The number of scans in the scan set used.

`scanSet` : The list of scan numbers in the set of scans used.

`assocCalDataId` : This is used to chain data sets obtained in different ExecBlocks, for which scan numbers are re-used.

`assocCalNature` : Nature of the association established by `assocCalDataId`. Normally this is used to refer to data in different execution blocks, for which scan numbers may be re-used.

`fieldName` : The name of the field the array was aimed at.

`sourceName` : Names of the sources as given during observations.

`sourceCode` : Special characteristics of source, e.g. passband calibrator, phase calibrator, flux calibrator.

`scanIntent` : The list of the intents associated with each scan in the data set.

1.12 CalDelay Table

Result of delay offset calibration performed on-line by TelCal. This calibration determines the delay offsets to be added in the correlator to compensate for residual cable delays. Delays are entered in seconds but represented as double precision floating point numbers.

CalDelay		
Name	Type (Shape)	Comment
Key		
`antennaName`	`string`	the name of the antenna.
`atmPhaseCorrection`	`AtmPhaseCorrection`	qualifies how the atmospheric phase correction has been applied.
`basebandName`	`BasebandName`	Name of the Baseband
`receiverBand`	`ReceiverBand`	identifies the receiver band.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
`startValidTime`	`ArrayTime`	the start time of the result validity period.
`endValidTime`	`ArrayTime`	the end time of the result validity period.
`refAntennaName`	`string`	the name of the reference antenna.
N_{Rece} (N_{Rece})	`int`	the number of receptors.
`delayError`	`double [numReceptor]`	the uncertainties on the measured delay offsets (one value per receptor).
`delayOffset`	`double [numReceptor]`	the measured delay offsets (one value per receptor).
`polarizationTypes`	`PolarizationType [numReceptor]`	identifies the polarizations of the receptors (one value per receptor).
`reducedChiSquared`	`double [numReceptor]`	measure of the quality of the fit (one value per receptor).
`appliedDelay`	`double [numReceptor]`	the delay that was applied (one value per receptor).
Optional Data		
`crossDelayOffset`	`double`	the measured cross delay offset (reference antenna only).
`crossDelayOffsetError`	`double`	the uncertainty for the cross delay offset.
N_{Side} (N_{Side})	`int`	the number of sideband.
`refFreq`	`Frequency [numSideband]`	the reference frequencies (one value per sideband).
`refFreqPhase`	`Angle [numSideband]`	the phases at reference frequencies (one value per sideband).
`sidebands`	`ReceiverSideband [numSideband]`	identifies the receiver's sidebands (one value per sideband).

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`atmPhaseCorrection` : The atmospheric phase corrections states for which result is given.

`basebandName` : The name of the 'baseband pair' which is measured. For ALMA a baseband pair is the signal path identified by a second local oscillator and has two polarizations. `BB_ALL` may be used if all basebands are fitted together.

`receiverBand` : The name of the front-end frequency band being used.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`refAntennaName` : The name of the antenna used as reference to get the antenna-based phases.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`delayError` : The statistical uncertainty on the delay offset found by TelCal for the specified antenna, receiver band, and baseband.

`delayOffset` : The delay offset found by TelCal for the specified antenna, receiver band, and baseband.

`polarizationTypes` : The nominal polarization types of the receptors being used.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

`appliedDelay` : long doc missing

`crossDelayOffset` : The cross-polarization delay offset found by TelCal for the specified receiver band, and baseband . Note : this must be the same for all antennas; this is the delay to be added to Y signals relative to X signals to get a flat frequency dependence of phases for a polarized point source.

`crossDelayOffsetError` : The uncertainty on the cross-polarization delay offset found by TelCal for the specified receiver band, and baseband.

N_{Side} : N_{Side} Number of Sidebands: in the side-band separated case, data from both sidebands are available for a given baseband. The delay offset should be the same for both sidebands, but the phase in `refFreqPhase` should be sideband-dependent.

`refFreq` : A reference frequency within the band.

`refFreqPhase` : Phase fitted at the frequency refFreq.

`sidebands` : Receiver side bands of the reference frequencies given in `refFreq`.

1.13 CalDevice Table

Calibration device characteristics. This table is not part of the Calibration Data Model but describes the actual observations; it refers to the amplitude calibration device which includes the hot loads. Calibration device properties are assumed independent of frequency throughout a spectral window.

CalDevice		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindow Table.
`timeInterval`	`ArrayTimeInterval`	the period of validity of the data recorded in this row.
`feedId`	`int`	refers to the collection of rows in FeedTable having this value of feedId in their key.
Required Data		
N_{Call} (N_{Call})	`int`	the number of calibration loads.
`calLoadNames`	`CalibrationDevice [numCalload]`	identifies the calibration loads (an array with one value per load).
Optional Data		
N_{Rece} (N_{Rece})	`int`	the number of receptors.
`calEff`	`float [numReceptor] [numCalload]`	the calibration efficiencies (one value per receptor per load).
`noiseCal`	`double [numCalload]`	the equivalent temperatures of the of the noise sources used (one value per load).
`coupledNoiseCal`	`float [numReceptor] [numCalload]`	doc missing
`temperatureLoad`	`Temperature [numCalload]`	the physical temperatures of the loads for a black body calibration source (one value per load).

Column Descriptions:

`antennaId` : Antenna Table identifier.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Validity time interval for the data in the row.

`feedId` : Specifies which feed was used in the Feed Table.

N_{Call} : The number of calibration loads for which data are given.

`calLoadNames` : The names of the calibration loads for which data are provided.

N_{Rece} : The number of receptors.

`calEff` : The coupling factor of the calibration source to the receiver beam.

`noiseCal` : The equivalent temperature of the noise source used.

`coupledNoiseCal` : missing

`temperatureLoad` : The physical temperature of the load (for a black-body calibration source).

1.14 CalFlux Table

Result of flux calibration performed on-line by TelCal. Atmospheric absorption is corrected for. No ionosphere correction has been applied.

CalFlux		
Name	Type (Shape)	Comment
Key		
`sourceName`	`string`	the name of the source.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
N_{Freq} (N_{Freq})	`int`	the number of frequency ranges.
N_{Stok} (N_{Stok})	`int`	the number of Stokes parameters.
`frequencyRanges`	`Frequency [numFrequencyRanges] [2]`	the frequency ranges (one pair of values per range).
`fluxMethod`	`FluxCalibrationMethod`	identifies the flux determination method.
`flux`	`double [numStokes] [numFrequencyRanges]`	the flux densities (one value par Stokes parameter per frequency range) expressed in Jansky (Jy).
`fluxError`	`double [numStokes] [numFrequencyRanges]`	the uncertainties on the flux densities (one value per Stokes parameter per frequency range).
`stokes`	`StokesParameter [numStokes]`	the Stokes parameter.
Optional Data		
`direction`	`Angle [2]`	the direction of the source.
`directionCode`	`DirectionReferenceCode`	identifies the reference frame of the source's direction.
`directionEquinox`	`Angle`	equinox associated with the reference frame of the source's direction.
`PA`	`Angle [numStokes] [numFrequencyRanges]`	the position's angles for the source model (one value per Stokes parameter per frequency range).
`PAError`	`Angle [numStokes] [numFrequencyRanges]`	the uncertainties on the position's angles (one value per Stokes parameter per frequency range).
`size`	`Angle [numStokes] [numFrequencyRanges] [2]`	the sizes of the source (one pair of angles per Stokes parameter per frequency range).

CalFlux – continued from previous page		
Name	Type (Shape)	Comment
`sizeError`	`Angle [numStokes] [numFrequencyRanges] [2]`	the uncertainties of the sizes of the source (one pair of angles per Stokes parameter per frequency range).
`sourceModel`	`SourceModel`	identifies the source model.

Column Descriptions:

`sourceName` : The name of the source for which flux density information was derived.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReductionTable identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

N_{Freq} : The number of frequency ranges for which flux density information was derived

N_{Stok} : The number of Stokes parameters which were measured for this source.

`frequencyRanges` : Frequency ranges over which the result is valid. TOPO

`fluxMethod` : The method which was used to derive flux densities.

`flux` : The derived flux density values expressed in Jansky (Jy).

`fluxError` : The statistical uncertainties of the flux densities which were derived.

`stokes` : The names of the Stokes parameters which were derived.

`direction` : The reference code for `direction`, if not `J2000`.

`directionCode` : The direction to the source in celestial coordinates.

`directionEquinox` : The reference equinox for `direction`, if required by `directionCode`

`PA` : Position angle for source model.

`PAError` : Uncertainty on position angle for source model.

`size` : Half power sizes of source (main axes of ellipse).

`sizeError` : Uncertainties on half power size of source (main axes of ellipse)

`sourceModel` : Model used for source, e.g., point-like or Gaussian.

1.15 CalFocus Table

Result of focus calibration performed on-line by TelCal.

CalFocus		
Name	Type (Shape)	Comment
Key		
antennaName	string	the name of the antenna.
receiverBand	ReceiverBand	identifies the receiver band.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of the result validity period.
endValidTime	ArrayTime	the end time of the result validity period.
ambientTemperature	Temperature	the ambient temperature.
atmPhaseCorrection	AtmPhaseCorrection	qualifies how the atmospheric phase correction has been applied.
focusMethod	FocusMethod	identifies the method used during the calibration.
frequencyRange	Frequency [2]	the frequency range over which the result is valid.
pointingDirection	Angle [2]	the antenna pointing direction (horizontal coordinates).
N_{Rece} (N_{Rece})	int	the number of receptors.
polarizationTypes	PolarizationType [numReceptor]	identifies the polarization types (one value per receptor).
wereFixed	bool [3]	coordinates were fixed (true) or not fixed (false) (one value per individual coordinate).
offset	Length [numReceptor] [3]	the measured focus offsets in X,Y,Z (one triple of values per receptor).
offsetError	Length [numReceptor] [3]	the statistical uncertainties on measured focus offsets (one triple per receptor).
offsetWasTied	bool [numReceptor] [3]	focus was tied (true) or not tied (false) (one value per receptor and focus individual coordinate).
reducedChiSquared	double [numReceptor] [3]	a measure of the quality of the fit (one triple per receptor).
position	Length [numReceptor] [3]	the absolute focus position in X,Y,Z (one triple of values per receptor).
Optional Data		
polarizationsAveraged	bool	Polarizations were averaged.
focusCurveWidth	Length [numReceptor] [3]	half power width of fitted focus curve (one triple per receptor).

CalFocus – continued from previous page		
Name	Type (Shape)	Comment
focusCurveWidthError	Length [numReceptor] [3]	Uncertainty of the focus curve width.
focusCurveWasFixed	bool [3]	each coordinate of the focus curve width was set (true) or not set (false) to an assumed value.
offIntensity	Temperature [numReceptor]	the off intensity levels (one value per receptor).
offIntensityError	Temperature [numReceptor]	the uncertainties on the off intensity levels (one value per receptor).
offIntensityWasFixed	bool	the off intensity level was fixed (true) or not fixed (false).
peakIntensity	Temperature [numReceptor]	the maximum intensities (one value per receptor).
peakIntensityError	Temperature [numReceptor]	the uncertainties on the maximum intensities (one value per receptor).
peakIntensityWasFixed	bool	the maximum intensity was fixed (true) or not fixed (false).
astigmPlus	Length [numReceptor]	the astigmatism component with 0 degree symmetry axis.
astigmPlusError	Length [numReceptor]	the statistical error on astigmPlus
astigmMult	Length [numReceptor]	the astigmatism component with 45 degrees symmetry axis.
astigmMultError	Length [numReceptor]	the statistical error on astigmMult
illumOffset	Length [numReceptor] [2]	the illumination offset of the primary reflector expressed as a pair of values.
illumOffsetError	Length [numReceptor] [2]	the statistical error on illumOffset.
fitRMS	Length [numReceptor]	The RMS of the half path length after removing the best fit parabola.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`receiverBand` : The name of the front-end frequency band being used.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`ambientTemperature` : Ambient temperature at the time of measurement. For mm-wave antennas a temperature dependence of the focus correction is expected.

`atmPhaseCorrection` : The atmospheric phase correction states for which result is given.

`focusMethod` : Method used, e.g., 'Interferometry' or '5 points'

`frequencyRange` : Frequency range over which the result is valid. TOPO

`pointingDirection` : The antenna pointing direction (horizontal coordinates). For mm-wave antennas an elevation dependence of the focus correction is expected. AZELNOWAntenna.position

N_{Rece} : Number of receptors.

`polarizationTypes` : The relevant polarizations for the measured focus parameters.

`wereFixed` : Indicates which focus coordinates were kept fixed during measursment (and thus were not measured).

`offset` : The measured focus offsets in X, Y, Z. This offset is relative to the nominal position of the focus, once the focus model has been applied.

`offsetError` : Uncertainty of `offset`.

`offsetWasTied` : True for a polarization and focus coordinate when this quantity was assumed fixed relative to the corresponding coordinate in the other polarization.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

`position` : long doc missing

`polarizationsAveraged` : Set when polarizations were averaged over to improve sensitivity.

`focusCurveWidth` : Half-power width of fitted focus curve.

`focusCurveWidthError` : Statistical uncertainty of the half-power width of the fitted focus curve.

`focusCurveWasFixed` : Indicates that the half-power width of the fitted focus curvewas fixed to an assumed value.

`offIntensity` : Off intensity level. This is needed for completeness to define the fitted beam function whenever the off level is non-zero (single-dish pointing).

`offIntensityError` : Off intensity level uncertainty

`offIntensityWasFixed` : Off intensity level was fixed.

`peakIntensity` : Fitted maximum intensity of signal.

`peakIntensityError` : Statistical uncertainty of the fitted maximum signal intensity.

`peakIntensityWasFixed` : Indicates that the maximal signal intensity was fixed to an assumed value.

`astigmPlus` : long doc missing

`astigmPlusError` : long doc missing

`astigmMult` : long doc missing

`astigmMultError` : long doc missing

`illumOffset` : long doc missing

`illumOffsetError` : long doc missing

`fitRMS` : long doc missing

1.16 CalFocusModel Table

Result of focus model calibration performed by TelCal.

CalFocusModel		
Name	Type (Shape)	Comment
Key		
antennaName	string	the name of the antenna.
receiverBand	ReceiverBand	identifies the receiver band.
polarizationType	PolarizationType	identifies the polarization type for which this focus model is valid.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
antennaMake	AntennaMake	identifies the antenna make.
N_{Coef} (N_{Coef})	int	the number of coefficients.
N_{Sour} (N_{Sour})	int	the number of source directions observed to derive the model.
coeffName	string [numCoeff]	the names given to the coefficients in the model.
coeffFormula	string [numCoeff]	the coefficients formula (one string per coefficient).
coeffValue	float [numCoeff]	the fitted values of the coefficients.
coeffError	float [numCoeff]	the statistical uncertainties on the derived coefficients (one value per coefficient).
coeffFixed	bool [numCoeff]	one coefficient was fixed (true) or not fixed (false) (one boolean value per coefficient).
focusModel	string	the name of this focus model.
focusRMS	Length [3]	the RMS deviations of residuals of focus coordinates.
reducedChiSquared	double	a measure of the quality of the least-square fit.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`receiverBand` : The name of the front-end frequency band being used.

`polarizationType` : Polarization component for which the focus model is valid.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`antennaMake` : The antenna make (e.g., for ALMA, the manufacturer name such as AEC, Vertex, or Melco).

N_{Coef} : Number of coefficients in the focus model.

N_{Sour} : Number of source directions observed to derive the model.

`coeffName` : The given names of the coefficients in the model.

`coeffFormula` : The formula describing the fitted functional dependence for the focus coordinate.

`coeffValue` : The fitted value for the coefficient.

`coeffError` : The statistical uncertainty on the derived coefficients.

`coeffFixed` : A boolean specifying that the coefficient was fixed to an assumed value.

`focusModel` : Name of this focus model.

`focusRMS` : The root mean square deviation of residuals in focus coordinates.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

1.17 CalGain Table

This Table is a placeholder to be used to wrap up casa gain tables produced in the Science Pipeline and Offline so that they can be archived in the ALMA Calibration Data Base.

CalGain		
Name	Type (Shape)	Comment
Key		
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReductionTable.
Required Data		
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
`gain`	`float`	TBD
`gainValid`	`bool`	TBD
`fit`	`float`	TBD
`fitWeight`	`float`	TBD
`totalGainValid`	`bool`	TBD
`totalFit`	`float`	TBD
`totalFitWeight`	`float`	TBD

Column Descriptions:

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`gain` : TBD

`gainValid` : TBD

`fit` : TBD

`fitWeight` : TBD

`totalGainValid` : TBD

`totalFit` : TBD

`totalFitWeight` : TBD

1.18 CalHolography Table

Result of holography calibration performed by TelCal.

CalHolography		
Name	Type (Shape)	Comment
Key		
antennaName	string	the name of the antenna.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
antennaMake	AntennaMake	identifies the antenna make.
startValidTime	ArrayTime	Start time of result validity period
endValidTime	ArrayTime	the end time of result validity period.
ambientTemperature	Temperature	the ambient temperature.
focusPosition	Length [3]	the focus position.
frequencyRange	Frequency [2]	the range of frequencies for which the measurement is valid.
illuminationTaper	double	the amplitude illumination taper.
N_{Rece} (N_{Rece})	int	the number of receptors.
polarizationTypes	PolarizationType [numReceptor]	identifies the polarization types (one value per receptor).
N_{Pane} (N_{Pane})	int	the number panel modes fitted.
receiverBand	ReceiverBand	identifies the receiver band.
beamMapUID	EntityRef	refers to the beam map image.
rawRMS	Length	the RMS of the pathlength residuals.
weightedRMS	Length	the weigthted RMS of the pathlength residuals.
surfaceMapUID	EntityRef	refers to the resulting antenna surface map image.
direction	Angle [2]	the direction of the source.
Optional Data		
N_{Scre} (N_{Scre})	int	the number of screws.
screwName	string [numScrew]	the names of the screws (one value per screw).
screwMotion	Length [numScrew]	the prescribed screw motions (one value per screw).
screwMotionError	Length [numScrew]	the uncertainties on the prescribed screw motions (one value per screw).
gravCorrection	bool	indicates if a gravitational correction was applied (true) or not (false).
gravOptRange	Angle [2]	the range of gravitational optimization.
tempCorrection	bool	indicates if a temperature correction was applied (true) or not (false).

CalHolography – continued from previous page		
Name	Type (Shape)	Comment
`tempOptRange`	`Temperature [2]`	the range of temperature optimization.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`antennaMake` : The antenna make (e.g., for ALMA, the manufacturer name such as AEC, Vertex, or Melco).

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`ambientTemperature` : Ambient temperature at the time of measurement. The surface deformations are expected to depend on temperature.

`focusPosition` : The optimal focus position (in XYZ) as derived from the aperture map phases. REFLECTOR

`frequencyRange` : Frequency range over which the result is valid. TOPO

`illuminationTaper` : Power illumination taper assumed to calculate weighted rms.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`polarizationTypes` : The polarization types of the receptors being used.

N_{Pane} : The number of panel independent position/deformation modes that have been fitted.

`receiverBand` : The name of the front-end frequency band being used.

`beamMapUID` : The beam map UID provides a link to the resulting beam map image either as a disk file or in the ALMA Archive. The disk file name is built from the UID string by replacing all colons and slashes by underscores.

`rawRMS` : The root mean square of the pathlength residuals, measured along Z, that is perpendicular to the aperture plane when looking a source at infinite distance.

`weightedRMS` : The root mean square of pathlength residuals (along Z); weighted assuming a primary beam illumination as specified by `illuminationTaper`.

`surfaceMapUID` : The surface map UID provides a link to the resulting antenna surface map image either as a disk file or in the ALMA Archive. The disk file name is built from the UID string by replacing all colons and slashes by underscores.

`direction` : The antenna pointing direction (horizontal coordinates) AZELNOWAntenna..position

N_{Scre} : Number of screws to be adjusted using surface map data.

`screwName` : The string identification of the panel screws.

`screwMotion` : The prescribed panel screw adjustments derived from the panel fit to the aperture map phases.

`screwMotionError` : The statistical uncertainties on the prescribed panel screw adjustments derived from the panel fit to the aperture map phases.

`gravCorrection` : Optimization target elevation range for the gravitaionnal correction applied.

`gravOptRange` : Optimization target elevation range for the gravitaionnal correction applied.

`tempCorrection` : A temperature correction was applied in the screw motion data.

`tempOptRange` : Optimization target temperature range.

1.19 CalPhase Table

Result of the phase calibration performed by TelCal.

CalPhase		
Name	Type (Shape)	Comment
Key		
basebandName	BasebandName	identifies the baseband.
receiverBand	ReceiverBand	identifies the receiver band.
atmPhaseCorrection	AtmPhaseCorrection	describes how the atmospheric phase correction has been applied.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
N_{Base} (N_{Base})	int	the number of baselines.
N_{Rece} (N_{Rece})	int	the number of receptors.
ampli	float [numReceptor] [numBaseline]	the amplitudes (one value per receptor per baseline).
antennaNames	string [numBaseline] [2]	the names of the antennas (one pair of strings per baseline).
baselineLengths	Length [numBaseline]	the physical lengths of the baselines (one value per baseline).
decorrelationFactor	float [numReceptor] [numBaseline]	the decorrelation factors (one value per receptor per baseline).
direction	Angle [2]	the direction of the source.
frequencyRange	Frequency [2]	the frequency range over which the result is valid.
integrationTime	Interval	the integration duration for a data point.
phase	float [numReceptor] [numBaseline]	the phases of the averaged interferometer signal (one value per receptor per baseline).
polarizationTypes	PolarizationType [numReceptor]	identifies the polarization types of the receptors (one value per receptor).
phaseRMS	float [numReceptor] [numBaseline]	the RMS of phase fluctuations relative to the average signal (one value per receptor per baseline).
statPhaseRMS	float [numReceptor] [numBaseline]	the RMS of phase deviations expected from the thermal fluctuations (one value per receptor per baseline).
Optional Data		

CalPhase – continued from previous page		
Name	Type (Shape)	Comment
`correctionValidity`	`bool [numBaseline]`	the deduced validity of atmospheric path length correction (from water vapor radiometers).
N_{Ante} (N_{Ante})	`int`	the number of antennas. Defines the size singleAntennaName, phaseAnt, phaseAntRMS. One must pay attention to the fact that numBaseline and numAntenna must verify the the relation : numBaseline == numAntenna * (numAntenna - 1) / 2
`singleAntennaName`	`string [numAntenna]`	the ordered list of antenna names. The size of the array must be equal to the number of antennas.
`refAntennaName`	`string`	the name of the antenna used as a reference to get the antenna-based phases.
`phaseAnt`	`float [numReceptor] [numAntenna]`	the antenna based phase solution averaged over the scan (one value per receptor per antenna). See singleAntennaName for the association of the values of this array with the antennas.
`phaseAntRMS`	`float [numReceptor] [numAntenna]`	the RMS of the phase fluctuations relative to the antenna based average phase (one value per receptor per antenna). See singleAntennaName for the association of the values of this array with the antennas.

Column Descriptions:

`basebandName` : The name of the 'baseband pair' which is measured. For ALMA, a baseband pair is the signal path identified by a second local oscillator and has two polarizations.

`receiverBand` : The name of the front-end frequency band being used.

`atmPhaseCorrection` : The atmospheric phase corrections states for which result is given.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

N_{Base} : Number of baselines for which the result is given.

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`ampli` : Amplitude of averaged signal.

`antennaNames` : Refer uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`baselineLengths` : The physical length of each baseline.

`decorrelationFactor` : The calculated decorrelation factor (amplitude loss) due to non-thermal phase fluctuations.

`direction` : The antenna pointing direction in horizontal coordinates. AZELNOWAntenna.position

`frequencyRange` : Frequency range over which the result is valid TOPO

`integrationTime` : Integration time on a data point, to calculate rms.

`phase` : The phase of the averaged interferometer signal.

`polarizationTypes` : The polarization types of the receptors being used.

`phaseRMS` : The root mean square of phase fluctuations relative to the average signal.

`statPhaseRMS` : The root mean square of phase deviations expected from thermal fluctuations.

`correctionValidity` : Deduced validity of atmospheric path length correction (from Water Vapour Radiometers; remark: It is not clear that correctionValidity is really an array. What about its size?).

N_{Ante} : long doc missing

`singleAntennaName` : long doc missing

`refAntennaName` : long doc missing

`phaseAnt` : long doc missing

`phaseAntRMS` : long doc missing

1.20 CalPointing Table

Result of the pointing calibration performed on-line by TelCal.

CalPointing		
Name	Type (Shape)	Comment
Key		
antennaName	string	Antenna Name
receiverBand	ReceiverBand	identifies the receiver band.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
ambientTemperature	Temperature	the ambient temperature.
antennaMake	AntennaMake	identifies the antenna make.
atmPhaseCorrection	AtmPhaseCorrection	describes how the atmospheric phase correction has been applied.
direction	Angle [2]	the antenna pointing direction.
frequencyRange	Frequency [2]	the frequency range over which the result is valid.
pointingModelMode	PointingModelMode	identifies the pointing model mode.
pointingMethod	PointingMethod	identifies the pointing method.
N_{Rece} (N_{Rece})	int	the number of receptors.
polarizationTypes	PolarizationType [numReceptor]	identifies the polarizations types (one value per receptor).
collOffsetRelative	Angle [numReceptor] [2]	the collimation offsets (relative) (one pair of angles per receptor).
collOffsetAbsolute	Angle [numReceptor] [2]	the collimation offsets (absolute) (one pair of angles per receptor).
collError	Angle [numReceptor] [2]	the uncertainties on collimation (one pair of angles per receptor)
collOffsetTied	bool [numReceptor] [2]	indicates if a collimation offset was tied (true) or not tied (false) to another polar (one pair of boolean values per receptor).
reducedChiSquared	double [numReceptor]	a measure of the quality of the least square fit.
Optional Data		
averagedPolarizations	bool	true when the polarizations were averaged together to improve sensitivity.
beamPA	Angle [numReceptor]	the fitted beam position angles (one value per receptor).
beamPAError	Angle [numReceptor]	the uncertaintes on the fitted beam position angles (one value per receptor).

CalPointing – continued from previous page		
Name	Type (Shape)	Comment
`beamPAWasFixed`	`bool`	indicates if the beam position was fixed (true) or not fixed (false).
`beamWidth`	`Angle [numReceptor] [2]`	the fitted beam widths (one pair of angles per receptor).
`beamWidthError`	`Angle [numReceptor] [2]`	the uncertainties on the fitted beam widths (one pair of angles per receptor).
`beamWidthWasFixed`	`bool [2]`	indicates if the beam width was fixed (true) or not fixed (true) (one pair of booleans).
`offIntensity`	`Temperature [numReceptor]`	the off intensity levels (one value per receptor).
`offIntensityError`	`Temperature [numReceptor]`	the uncertainties on the off intensity levels (one value per receptor).
`offIntensityWasFixed`	`bool`	indicates if the off intensity level was fixed (true) or not fixed (false).
`peakIntensity`	`Temperature [numReceptor]`	the maximum intensities (one value per receptor).
`peakIntensityError`	`Temperature [numReceptor]`	the uncertainties on the maximum intensities (one value per receptor).
`peakIntensityWasFixed`	`bool`	the maximum intensity was fixed.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object as present in the original ASDM Antenna table.

`receiverBand` : The name of the front-end frequency band being used.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`ambientTemperature` : Ambient temperature at the time of measurement. For mm-wave antennas, a temperature dependence of the pointing correction may be expected.

`antennaMake` : The antenna make (e.g., for ALMA, the antenna manufacturer name such as AEC, Vertex, or Melco).

`atmPhaseCorrection` : The atmospheric phase correction states for which result is given.

`direction` : The antenna pointing direction (horizontal coordinates) AZELNOWAntenna.position

`frequencyRange` : Frequency range over which the result is valid TOPO

`pointingModelMode` : Radio pointing or Optical pointing.

`pointingMethod` : Observing method used to determine the collimation offsets.

N_{Rece} : Number of receptors.

`polarizationTypes` : The relevant polarizations for the measured pointing parameters.

`collOffsetRelative` : The collimation offsets found required to center the source, relative to the expected direction of the source, using a predetermined pointing model. These are the collimation offsets to be applied for reference pointing, or for a more refined local pointing model. AZELNOWAntenna.position[virtual]

`collOffsetAbsolute` : The collimation offsets found required to center the source, relative to the expected direction of the source assuming a perfect antenna mount. These are collimation offsets to be used for determination of the pointing model. AZELNOWAntenna.positiontarget

`collError` : Statistical uncertainties in the determination of azimuth and elevation collimations.

`collOffsetTied` : True for a polarization coordinate when this quantity was assumed fixed relative to the corresponding coordinate in the other polarization.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

`averagedPolarizations` : Set when polarizations were averaged together to improve sensitivity.

`beamPA` : Position angle of fitted antenna beam.

`beamPAError` : Statistical uncertainty of position angle of fitted antenna beam.

`beamPAWasFixed` : Indicates that the position angle of the fitted antenna beam was fixed to an assumed value.

`beamWidth` : Half-power width of fitted antenna beam.

`beamWidthError` : Statistical uncertainty of the half-power width of the fitted antenna beam.

`beamWidthWasFixed` : Indicates that the half-power width of antenna beam was fixed to an assumed value.

`offIntensity` : Off intensity level. This is needed for completeness to define the fitted beam function whenever the off level is non-zero (single-dish pointing).

`offIntensityError` : Off intensity level uncertainty.

`offIntensityWasFixed` : Off intensity level was fixed.

`peakIntensity` : Fitted maximum intensity of signal.

`peakIntensityError` : Statistical uncertainty of the fitted maximum signal intensity.

`peakIntensityWasFixed` : Indicates that the maximal signal intensity was fixed to an assumed value.

1.21 CalPointingModel Table

Result of pointing model calibration performed by TelCal.

CalPointingModel		
Name	Type (Shape)	Comment
Key		
`antennaName`	`string`	the name of the antenna.
`receiverBand`	`ReceiverBand`	identifies the receiver band.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
`antennaMake`	`AntennaMake`	the antenna make.
`pointingModelMode`	`PointingModelMode`	identifies the pointing model mode.
`polarizationType`	`PolarizationType`	identifies the polarization type.
N_{Coef} (N_{Coef})	`int`	the number of coefficients in the pointing model.
`coeffName`	`string [numCoeff]`	the names of the coefficients (one string per coefficient).
`coeffVal`	`float [numCoeff]`	the values of the coefficients resulting from the pointing model fitting (one value per coefficient).
`coeffError`	`float [numCoeff]`	the uncertainties on the pointing model coefficients (one value per coefficient).
`coeffFixed`	`bool [numCoeff]`	indicates if one coefficient was fixed (true) or not fixed (false) (one boolean per coefficient).
`azimuthRMS`	`Angle`	Azimuth RMS (on Sky)
`elevationRms`	`Angle`	Elevation rms (on Sky)
`skyRMS`	`Angle`	rms on sky
`reducedChiSquared`	`double`	measures the quality of the least square fit.
Optional Data		
N_{Obs} (N_{Obs})	`int`	the number of source directions observed to derive the pointing model.
`coeffFormula`	`string [numCoeff]`	formulas used for the fitting (one string per coefficient).

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`receiverBand` : The name of the front-end frequency band being used.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`antennaMake` : The antenna make (e.g., for ALMA, the manufaturer name such as AEC, Vertex, or Melco).

`pointingModelMode` : Pointing Model mode (Radio or optical)

`polarizationType` : Polarization component for which the pointing model is valid.

N_{Coef} : The number of coefficients in the pointing model.

`coeffName` : The names of the coefficients, following `tpoint` software conventions (generic functions, see `tpoint` software documentation by P. Wallace).

`coeffVal` : The fitted pointing model coefficients.

`coeffError` : Statistical uncertainties of pointing model coefficients.

`coeffFixed` : Indicates that the coefficient was kept fixed to an assumed value.

`azimuthRMS` : Root mean squared of azimuth residuals (as a true angle on the sky).

`elevationRms` : Root mean of squared elevation residuals (as a true angle on the sky).

`skyRMS` : Root mean squared of angular distance deviations.

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

N_{Obs} : The number of source directions observed used to derive the pointing model.

`coeffFormula` : Formula used. This describes the functions fitted, for the corresponding coefficient. This is useful when `tpoint` software has not been used.

1.22 CalPosition Table

Result of antenna positions calibration performed by TelCal.

CalPosition		
Name	Type (Shape)	Comment
Key		
`antennaName`	`string`	the name of the antenna.
`atmPhaseCorrection`	`AtmPhaseCorrection`	describes how the atmospheric phase correction has been applied.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
`antennaPosition`	`Length [3]`	the position of the antenna.
`stationName`	`string`	the name of the station.
`stationPosition`	`Length [3]`	the position of the station.
`positionMethod`	`PositionMethod`	identifies the method used for the position calibration.
`receiverBand`	`ReceiverBand`	identifies the receiver band.
N_{Ante} (N_{Ante})	`int`	the number of antennas of reference.
`refAntennaNames`	`string [numAntenna]`	the names of the antennas of reference (one string per antenna).
`axesOffset`	`Length`	the measured axe's offset.
`axesOffsetErr`	`Length`	the uncertainty on the determination of the axe's offset.
`axesOffsetFixed`	`bool`	the axe's offset was fixed (true) or not fixed (false).
`positionOffset`	`Length [3]`	the measured position offsets (a triple).
`positionErr`	`Length [3]`	the uncertainties on the measured position offsets (a triple).
`reducedChiSquared`	`double`	measures the quality of the fit.
Optional Data		
`delayRms`	`double`	the RMS deviation for the observed delays.
`phaseRms`	`Angle`	the RMS deviation for the observed phases.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`atmPhaseCorrection` : The atmospheric phase correction states for which result is given.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`antennaPosition` : The antenna position measured values in the X, Y, Z horizontal system, relative to the station. AZELStation.position

`stationName` : The name of the station where the antenna was set.

`stationPosition` : The station position in the X, Y, Z geocentric system. These are included as references for `stationPosition`.

`positionMethod` : Position measurement method used (fit to delays or fit to phases).

`receiverBand` : The name of the front-end frequency band being used.

N_{Ante} : The number of antennas used as reference for the antenna with unknown position.

`refAntennaNames` : The names of the antennas used as reference to get the antenna unknown position.

`axesOffset` : Measured offsets between azimuth and elevation axes. This is the horizontal component perpendicular to the elevation axis, counted positive in the direction where the antenna is pointed at, when horizon-looking.

`axesOffsetErr` : Statistical uncertainties of measured offsets between azimuth and elevation axes.

`axesOffsetFixed` : The offsets between azimuth and elevation axes were held fixed at an assumed value.

`positionOffset` : The measured position offsets in the X, Y, Z horizontal system, relative to the values assumed at the time of observing and used to track the phases. AZELstationPosition

`positionErr` : The statistical uncertainties of the measured position offsets in the X, Y, Z horizontal system. AZELstationPosition

`reducedChiSquared` : Reduced χ^2 indicating the quality of the least-squares fit.

`delayRms` : The root mean squared deviations for the observed delays.

`phaseRms` : The root mean squared deviations for the observed phases.

1.23 CalPrimaryBeam Table

Result of Primary Beam Map measurement.

CalPrimaryBeam		
Name	Type (Shape)	Comment
Key		
antennaName	string	the name of the antenna.
receiverBand	ReceiverBand	identifies the receiver band.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to a unique row in CalReduction Table.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
antennaMake	AntennaMake	the antenna make.
N_{Subb} (N_{Subb})	int	the number of subband images (frequency ranges simultaneously measured).
frequencyRange	Frequency [numSubband] [2]	the range of frequencies over which the result is valid.
N_{Rece} (N_{Rece})	int	the number of receptors.
polarizationTypes	PolarizationType [numReceptor]	identifies the polarizations types of the receptors (one value per receptor).
mainBeamEfficiency	double [numReceptor]	the main beam efficiency as derived from the beam map.
beamDescriptionUID	EntityRef	refers to the beam description image.
relativeAmplitudeRms	float	the RMS fluctuations in terms of the relative beam amplitude.
direction	Angle [2]	the center direction.
minValidDirection	Angle [2]	the minimum center direction of validity.
maxValidDirection	Angle [2]	the maximum center direction of validity.
descriptionType	PrimaryBeamDescription	quantity used to describe beam.
imageChannelNumber	int [numSubband]	channel number in image for each subband.
imageNominalFrequency	Frequency [numSubband]	nominal frequency for subband.

Column Descriptions:

antennaName : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

receiverBand : The name of the front-end frequency band being used.

calDataId : CalData Table identifier.

calReductionId : CalReduction Table identifier.

startValidTime : The start of the time validity range for the result.

`endValidTime` : The start of the time validity range for the result.

`antennaMake` : The antenna make (e.g., for ALMA, the manufacturer name such as AEC, Vertex, or Melco).

N_{Subb} : long doc missing

`frequencyRange` : Frequency range over which the result is valid. TOPO

N_{Rece} : The number or polarization receptors (one or two) for which the result is given.

`polarizationTypes` : The polarization types of the receptors being used.

`mainBeamEfficiency` : The main beam efficiency as derived for the beam map.

`beamDescriptionUID` : long doc missing

`relativeAmplitudeRms` : The root mean square fluctuations in terms of relative beam amplitude, i.e. the antenna gain scaled by its maximal value (on axis).

`direction` : long doc missing

`minValidDirection` : long doc missing

`maxValidDirection` : long doc missing

`descriptionType` : long doc missing

`imageChannelNumber` : long doc missing

`imageNominalFrequency` : long doc missing

1.24 CalReduction Table

Generic items describing the data reduction process.

CalReduction		
Name	Type (Shape)	Comment
Key		
`calReductionId`	`Tag`	identifies a unique row in the table.
Required Data		
N_{Appl} (N_{Appl})	`int`	the number of applied calibrations prior the reduction.
`appliedCalibrations`	`string [numApplied]`	the list of applied calibrations (one string per calibration).
N_{Para} (N_{Para})	`int`	the number of listed parameters used for calibration.
`paramSet`	`string [numParam]`	the input parameters expressed as (keyword,value) pairs (one string per parameter).
N_{Inva} (N_{Inva})	`int`	the number of invalidating conditions.
`invalidConditions`	`InvalidatingCondition [numInvalidConditions]`	invalidating use cases (one string per case).
`timeReduced`	`ArrayTime`	the epoch at which the data reduction was finished.
`messages`	`string`	messages issued by the data reduction software.
`software`	`string`	the name of the data reduction software reduction used.
`softwareVersion`	`string`	version information about the data reduction software used.

Column Descriptions:

`calReductionId` : CalReduction row identifier.

N_{Appl} : The number of calibrations applied to data before solving for the result.

`appliedCalibrations` : List of calibrations applied before solving for the result.

N_{Para} : The number of listed parameters as used for this calibration.

`paramSet` : The list of parameters needed to specfy the calibration applied given as (keyword,value) pairs.

N_{Inva} : The number of use cases that may invalidate the result.

`invalidConditions` : The list of use cases that may invalidate the result.

`timeReduced` : The epoch at which the data reduction was finished.

`messages` : Messages issued by the data reduction software.

`software` : The name of the data reduction software used to derive the result.

`softwareVersion` : The version of the data reduction spftware used to derive the result.

1.25 CalSeeing Table

The seeing parameters deduced from TelCal calibrations.

CalSeeing		
Name	Type (Shape)	Comment
Key		
`atmPhaseCorrection`	`AtmPhaseCorrection`	describes how the atmospheric phase correction has been applied.
`calDataId`	`Tag`	refers to a unique row in CalData Table.
`calReductionId`	`Tag`	refers to a unique row in CalReduction Table.
Required Data		
`startValidTime`	`ArrayTime`	the start time of result validity period.
`endValidTime`	`ArrayTime`	the end time of result validity period.
`frequencyRange`	`Frequency [2]`	the range of frequencies over which this result is valid.
`integrationTime`	`Interval`	the duration of averaging for the evaluation of the RMS.
N_{Base} (N_{Base})	`int`	the number of baselines for which the the RMS phase data is evaluated.
`baselineLengths`	`Length [numBaseLengths]`	the lengths of the baselines (one value per baseline).
`phaseRMS`	`Angle [numBaseLengths]`	the RMS of phase fluctuations (one value per baseline).
`seeing`	`Angle`	the seeing parameter, deduced for the LO1.
`seeingError`	`Angle`	the uncertainty on the seeing parameter.
Optional Data		
`exponent`	`float`	the exponent of the spatial structure function.
`outerScale`	`Length`	the outer scale.
`outerScaleRMS`	`Angle`	the RMS of phase fluctuations at scale length outerScale.

Column Descriptions:

`atmPhaseCorrection` : The atmospheric phase correction states for which result is given.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`frequencyRange` : Frequency range over which the result is valid.TOPO

`integrationTime` : Averaging time for evaluation of rms fluctuations.

N_{Base} : The number of baselines for which the rms phase data is evaluated.

`baselineLengths` : The baseline lengths at which the phase rms is evaluated.

`phaseRMS` : Root mean squared phase fluctuations for each baseline length.

`seeing` : The seeing parameter deduced for the calculated rms phases. This is the half-power width of the beam that would be synthesized if those phase fluctuations were not corrected.

`seeingError` : The uncertainty on `seeing`.

`exponent` : The exponents of the fitted power laws in the phase rms data. There may be two values (inner, outer) if an outer scale is given.

`outerScale` : The outer scale of turbulence (validity limit of power law in phase structure function).

`outerScaleRMS` : Root mean squared phase fluctuations at scale length `outerScale`. This number allows to calculate the modelled phase structure function at any scale (above and below `outerScale`).

1.26 CalWVR Table

Result of the water vapour radiometric calibration performed by TelCal.

CalWVR		
Name	Type (Shape)	Comment
Key		
antennaName	string	the name of the antenna.
calDataId	Tag	refers to a unique row in CalData Table.
calReductionId	Tag	refers to unique row in CalReductionTable.
Required Data		
startValidTime	ArrayTime	the start time of result validity period.
endValidTime	ArrayTime	the end time of result validity period.
wvrMethod	WVRMethod	identifies the method used for the calibration.
N_{Inpu} (N_{Inpu})	int	the number of input antennas (i.e. equiped with functional WVRs).
inputAntennaNames	string [numInputAntennas]	the names of the input antennas (one string per antenna).
N_{Chan} (N_{Chan})	int	the number of frequency channels in the WVR receiver.
chanFreq	Frequency [numChan]	the channel frequencies (one value per channel).
chanWidth	Frequency [numChan]	the widths of the channels (one value per channel).
refTemp	Temperature [numInputAntennas] [numChan]	the reference temperatures (one value per input antenna per channel).
N_{Poly} (N_{Poly})	int	the number of polynomial coefficients.
pathCoeff	float [numInputAntennas] [numChan] [numPoly]	the path length coefficients (one value per input antenna per channel per polynomial coefficient).
polyFreqLimits	Frequency [2]	the limits of the interval of frequencies for which the path length coefficients are computed.
wetPath	float [numPoly]	The wet path as a function frequency (expressed as a polynomial).
dryPath	float [numPoly]	The dry path as a function frequency (expressed as a polynomial).
water	Length	The precipitable water vapor corresponding to the reference model.

Column Descriptions:

`antennaName` : Refers uniquely to the hardware antenna object, as present in the original ASDM Antenna table.

`calDataId` : CalData Table identifier.

`calReductionId` : CalReduction Table identifier.

`startValidTime` : The start of the time validity range for the result.

`endValidTime` : The end of the time validity range for the result.

`wvrMethod` : Method used, e.g, ab initio, Empirical.

N_{Inpu} : The number of antennas equipped with functional WVRs, from which the data should be interpolated, using the path length coefficients calculated, to obtain the pathlength correction to be applied to the antenna given as 'antennaName'.

`inputAntennaNames` :

`inputAntennaNames` : The names of the antennas equipped with functional WVRs, from which the data should be interpolated, using the path length coefficients calculated, to obtain the pathlength correction to be applied to the antenna given as 'antennaName'.

N_{Chan} : Number of frequency channels in the WVR receiver.

`chanFreq` : The center frequency of the WVR channels. TOPO

`chanWidth` : The frequency width of the WVR channels.

`refTemp` : The reference temperature T_{Rcj} for each WVR channel to be used in the path length formula.

N_{Poly} : The number of polynomial coefficients given, to obtain the frequency dependence of the pathlength correction.

`pathCoeff` : The path length coefficients to be used to obtain the pathlength correction to be applied to the antenna given as 'antennaName'. These are the coefficients C_{kcj} $(k = 1,N_{Poly})$ used to obtain the path length as a linear combinations of the data from the N_{Chan} WVR channels (in temperature units). Each coefficient is a term of a polynomial expansion (N_{Poly} coefficients) of the predicted path length as a function of observing frequency in the astronomical band (frequency limits in PolyFreqLimits). These polynomials are Chebichev polynomials in this frequency interval reduced to $[-1.,1.]$). For the given Antenna (antennaName), the path length correction to be applied is:

$$\sum_{j=1,N_{InpA}} \Big[\sum_{c=1,N_{Chan}} P_{cj}(\nu)(T_{cj} - T_{Rcj}) \Big]$$

where

- T_{Rcj} is the reference WVR temperature for channel c of antenna j
- T_{cj} is the observed WVR temperature for channel c of antenna j
- $P_{cj}(\nu)$ is the value of the Chebichev polynomial with coefficients evaluated at sky frequency ν with coefficents C_{kcj} $(k = 1, N_{Poly})$

In the most frequent case there is a single input antenna (AntennaName). If the WVR device on a given antenna is not available or fails, the above formula gives the desired way to interpolate the correction for that antenna, based of other antennas (close neighbours).

`polyFreqLimits` : Frequency limits of the frequency interval for which the path length coefficients are computed.

`wetPath` : The wet path as a function of frequency expressed as Chebichev polynomial in the frequency range reduced to $[-1, 1]$. This corresponds to the reference model that reproduces the average line shape and is used in the delay server to track the phases and delays, while the departures from the average water line shape are used for the pathlength correction applied to the correlator.

`dryPath` : The dry path as a function of frequency expressed as a Chebicehv polynomial in the frequency range reduced to $[-1, 1]$. This corresponds to the same reference model as wetPath.

`water` : long doc missing

1.27 ConfigDescription Table

Defines the hardware configuration used to obtain the science data.

ConfigDescription		
Name	Type (Shape)	Comment
Key		
`configDescriptionId`	`Tag`	identifies a unique row in the table.
Required Data		
N_{Ante} (N_{Ante})	`int`	the number of antennas.
N_{Data} (N_{Data})	`int`	the number of data descriptions.
N_{Feed} (N_{Feed})	`int`	the number of feeds.
`correlationMode`	`CorrelationMode`	identifies the correlation mode.
N_{AtmP} (N_{AtmP})	`int`	the number of descriptions of the atmospheric phase correction.
`atmPhaseCorrection`	`AtmPhaseCorrection [numAtmPhaseCorrection]`	describe how the atmospheric phase corrections have been applied (one value per correction).
`processorType`	`ProcessorType`	identifies the generic processor's type.
`spectralType`	`SpectralResolutionType`	identifies the spectral type of the data.
`antennaId`	`Tag [numAntenna]`	identifies numAntenna rows in AntennaTable.
`feedId`	`int [numAntenna*numFeed]`	refers to many collections of rows in the Feed Table.
`switchCycleId`	`Tag [numDataDescription]`	refers to a unique row in the SwitchCycle Table.
`dataDescriptionId`	`Tag [numDataDescription]`	refers to one or more rows in DataDescriptionTable.
`processorId`	`Tag`	refers to a unique row in ProcessorTable.
Optional Data		
`phasedArrayList`	`int [numAntenna]`	phased array identifiers.
N_{Asso} (N_{Asso})	`int`	the number of associated config descriptions.
`assocNature`	`SpectralResolutionType [numAssocValues]`	the natures of the associations with other config descriptions (one value per association).
`assocConfigDescriptionId`	`Tag [numAssocValues]`	refers to one or more rows in ConfigDescriptionTable.

Column Descriptions:

`configDescriptionId` : Identifies the row in the Configuration Description Table.

N_{Ante} : The number of antennas used (given by the `antennaId` array).

N_{Data} : Number of data descriptions for this row. This is equal to the number of spectral windows.

N_{Feed} : Number of feeds (given by the `feedId` array). For ALMA, `numFeed` is always one and `feedId` is zero.

`correlationMode` : The correlation mode used; for ALMA this is either Autocorrelation only, or Correlation and Autocorrelation.

N_{AtmP} : Number of Atmospheric Phase Corrections.

`atmPhaseCorrection` : The atmospheric phase correction states of data given (corrected, uncorrected, or both).

`processorType` : The generic processor type, such as, e.g., CORRELATOR, SPECTROMETER, or RADIOMETER.

`spectralType` : The spectral type of this data. It may be e.g direct spectral processor data (at full resolution), or channel averaged spectral procesor data, or total power detector data.

`antennaId` : The number of antennas used (given by the `antennaId` table).

`feedId` : Specifies which feed was used in the Feed Table.

`switchCycleId` : SwitchCycle Table identifier.

`dataDescriptionId` : DataDescription Table identifier.

`processorId` : The Processor Identifier provides a direct link to a row in the Processor Table.

`phasedArrayList` : List of phased array identifiers; normally not used for ALMA.

N_{Asso} : The number of associated config descriptions.

`assocNature` : The nature of the associations established by the `assocConfigDescriptionId` array.

`assocConfigDescriptionId` : ConfigDescription Table identifier

1.28 CorrelatorMode Table

Contains information on a Correlator processor.

CorrelatorMode		
Name	Type (Shape)	Comment
Key		
`correlatorModeId`	`Tag`	refers to a unique row in the table.
Required Data		
N_{Base} (N_{Base})	`int`	the number of basebands.
`basebandNames`	`BasebandName [numBaseband]`	identifies the basebands (one value per basebands).
`basebandConfig`	`int [numBaseband]`	encodes the basebands configurations (one value per baseband).
`accumMode`	`AccumMode`	identifies the accumulation mode.
`binMode`	`int`	the binning mode.
N_{Axes} (N_{Axes})	`int`	the number of axes in the binary data blocks.
`axesOrderArray`	`AxisName [numAxes]`	the order of axes in the binary data blocks.
`filterMode`	`FilterMode [numBaseband]`	identifies the filters modes (one value per baseband).
`correlatorName`	`CorrelatorName`	identifies the correlator's name.

Column Descriptions:

`correlatorModeId` : Identifies the row in the Correlator Mode Table.

N_{Base} : The number of baseband pairs used; this may be up to four for ALMA. A pair has two orthogonal polarization channels.

`basebandNames` : Baseband names, that is the baseband pairs that are used ; there are four for ALMA.

`basebandConfig` : Baseband Configuration; for ALMA currently expressed as a number like '103' for Time division mode, or '1' for tunable filter mode; there is one of these for each baseband pair.

`accumMode` : The accumulation mode: for ALMA this is either FAST (For 1ms dumps, autocorrelation only) or NORMAL (for 16ms minimum dumps, and simultaneous correlation and autocorrelation).

`binMode` : The number of data bins: data bins are used together for switch cycles. For instance we have two for frequency switching of nutator switching, but one only for interferometry.

N_{Axes} : The number of axes in the binary data blocks.

`axesOrderArray` : The standard order of axes in the binary data blocks. Axes may be omitted (See the BDF documentation).

`filterMode` : The mode of operation of the digital filters used at the input of the ALMA correlator. These are the TDM (Time Division Mode) or TFB (Tunable Filter Bank) modes.

`correlatorName` : The name of the correlator; in ALMA we have the 'baseline' correlator and the 'ACA' correlator.

1.29 DataDescription Table

Spectro-polarization description.

DataDescription		
Name	Type (Shape)	Comment
Key		
`dataDescriptionId`	`Tag`	identifies a unique row in the table.
Required Data		
`polOrHoloId`	`Tag`	refers to a unique row in PolarizationTable or HolograpyTable.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.

Column Descriptions:

`dataDescriptionId` : DataDescription Table identifier.

`polOrHoloId` : Polarization Table identifier or Holography Table identifier.

`spectralWindowId` : SpectralWindow Table identifier.

1.30 DelayModel Table

Contains the delay model components. For ALMA this includes all TMCDB delay model components.

DelayModel		
Name	Type (Shape)	Comment
Key		
antennaId	Tag	refers to a unique row in AntennaTable.
spectralWindowId	Tag	refers to a unique row in SpectraWindowTable.
timeInterval	ArrayTimeInterval	time interval for which the row's content is valid.
Required Data		
N_{Poly} (N_{Poly})	int	the number of coefficients of the polynomials.
phaseDelay	double [numPoly]	the phase delay polynomial (rad).
phaseDelayRate	double [numPoly]	Phase delay rate polynomial (rad/s).
groupDelay	double [numPoly]	Group delay polynomial (s).
groupDelayRate	double [numPoly]	Group delay rate polynomial (s/s)
fieldId	Tag	doc missing
Optional Data		
timeOrigin	ArrayTime	value used as the origin for the evaluation of the polynomials.
atmosphericGroupDelay	double	Atmosphere group delay.
atmosphericGroupDelayRate	double	Atmosphere group delay rate.
geometricDelay	double	Geometric delay.
geometricDelayRate	double	Geometric delay.
N_{LO} (N_{LO})	int	the number of local oscillators.
LOOffset	Frequency [numLO]	Local oscillator offset.
LOOffsetRate	Frequency [numLO]	Local oscillator offset rate.
dispersiveDelay	double	Dispersive delay.
dispersiveDelayRate	double	Dispersive delay rate.
atmosphericDryDelay	double	the dry atmospheric delay component.
atmosphericWetDelay	double	the wet atmospheric delay.
padDelay	double	Pad delay.
antennaDelay	double	Antenna delay.
N_{Rece} (N_{Rece})	int	doc missing
polarizationType	PolarizationType [numReceptor]	describes the polarizations of the receptors (one value per receptor).
electronicDelay	double [numReceptor]	the electronic delay.
electronicDelayRate	double [numReceptor]	the electronic delay rate.
receiverDelay	double [numReceptor]	the receiver delay.
IFDelay	double [numReceptor]	the intermediate frequency delay.
LODelay	double [numReceptor]	the local oscillator delay.
crossPolarizationDelay	double	the cross polarization delay.

Column Descriptions:

`antennaId` : Antenna identifier, as indexed from an element in the antennaArray collection in the configDescription table.

`spectralWindowId` : long doc missing

`timeInterval` : Time interval for which the parameters in the row are valid. The same reference used for the Time column in the Main Table must be used.

N_{Poly} : Series order for the delay time polynomial expansions.

`phaseDelay` : long doc missing

`phaseDelayRate` : long doc missing

`groupDelay` : long doc missing

`groupDelayRate` : long doc missing

`fieldId` : missing

`timeOrigin` : long doc missing

`atmosphericGroupDelay` : long doc missing

`atmosphericGroupDelayRate` : long doc missing

`geometricDelay` : long doc missing

`geometricDelayRate` : long doc missing

N_{LO} : long doc missing

`LOOffset` : long doc missing

`LOOffsetRate` : long doc missing

`dispersiveDelay` : long doc missing

`dispersiveDelayRate` : long doc missing

`atmosphericDryDelay` : Dry atmosphere delay component.

`atmosphericWetDelay` : Wet atmosphere delay component.

`padDelay` : long doc missing

`antennaDelay` : long doc missing

N_{Rece} : missing

`polarizationType` : long doc missing

`electronicDelay` : long doc missing

`electronicDelayRate` : long doc missing

`receiverDelay` : long doc missing

`IFDelay` : long doc missing

`LODelay` : long doc missing

`crossPolarizationDelay` : long doc missing

1.31 DelayModelFixedParameters Table

missing documentation

DelayModelFixedParameters		
Name	Type (Shape)	Comment
Key		
delayModelFixedParametersId	Tag	identifies a unique row in the table.
Required Data		
delayModelVersion	string	should include the name of the software and its version. Something like "CALC v11" or "VDT v1.0" or "MODEST v2.1".
execBlockId	Tag	refers to a unique row of the ExecBlock table.
Optional Data		
gaussConstant	AngularRate	the Gauss gravitational constant (should be of order $1.720209895.10^{-2} rad/d$ but in SI units of $rads^{-1}$).
newtonianConstant	double	the newtonian constant of gravitation (should be of order $6.67259.10^{-11} m^3 kg^{-1} s^2$).
gravity	double	the gravity acceleration in ms^{-2}.
earthFlattening	double	the ratio of equatorial to polar radii.
earthRadius	Length	the earth equatorial radius in m.
moonEarthMassRatio	double	doc missing
ephemerisEpoch	string	should always be 'J2000'.
earthTideLag	double	doc missing
earthGM	double	the earth gravitation constant in $m^3 s^{-2}$.
moonGM	double	the moon gravitation constant in $m^3 s^{-2}$.
sunGM	double	the sun gravitation constant in $m^3 s^{-2}$.
loveNumberH	double	the earth global Love number H.
loveNumberL	double	the earth global Love number L.
precessionConstant	AngularRate	the general precession constant in $arcsec\ s^{-1}$.
lightTime1AU	double	the light time for 1 AU in seconds.
speedOfLight	Speed	the speed of light in ms^{-1}.
delayModelFlags	string	the delay model switches.

Column Descriptions:

delayModelFixedParametersId : long doc missing

delayModelVersion : long doc missing

execBlockId : long doc missing

`gaussConstant` : long doc missing
`newtonianConstant` : long doc missing
`gravity` : long doc missing
`earthFlattening` : long doc missing
`earthRadius` : long doc missing
`moonEarthMassRatio` : missing
`ephemerisEpoch` : long doc missing
`earthTideLag` : missing
`earthGM` : long doc missing
`moonGM` : long doc missing
`sunGM` : long doc missing
`loveNumberH` : long doc missing
`loveNumberL` : long doc missing
`precessionConstant` : long doc missing
`lightTime1AU` : long doc missing
`speedOfLight` : long doc missing
`delayModelFlags` : long doc missing

1.32 DelayModelVariableParameters Table

missing documentation

DelayModelVariableParameters		
Name	Type (Shape)	Comment
Key		
delayModelVariableParametersId	Tag	identifies a unique row in the table.
Required Data		
time	ArrayTime	the day and time relevant for the data in this row.
ut1_utc	double	$UT1 - UTC$ in *second*.
iat_utc	double	$IAT - UTC$ in *second*.
timeType	DifferenceType	the type of the two time differences expressed in ut1$_u$tcandiat$_u$tc |
gstAtUt0	Angle	in *radian*.
earthRotationRate	AngularRate	in *radian* s^{-1} (the seconds are in IAT).
polarOffsets	double [2]	the X, Y polar offsets in *arcsec*.
polarOffsetsType	DifferenceType	the type of the polar offsets (values found in polarOffsets).
delayModelFixedParametersId	Tag	refers to a unique row of the DelayModelFixedParameters table.
Optional Data		
nutationInLongitude	Angle	the nutation in longitude (the part parallel to the ecliptic) in *radian*.
nutationInLongitudeRate	AngularRate	the rate of nutation in longitude in *radian* s^{-1}.
nutationInObliquity	Angle	the nutation in obliquity (the part perpendicular to the ecliptic) in *radian*.
nutationInObliquityRate	AngularRate	the rate of nutation in obliquity in *radian* s^{-1}.

Column Descriptions:

delayModelVariableParametersId : long doc missing

time : long doc missing

ut1_utc : long doc missing

iat_utc : long doc missing

timeType : long doc missing

gstAtUt0 : long doc missing

earthRotationRate : long doc missing

polarOffsets : long doc missing

`polarOffsetsType` : long doc missing

`delayModelFixedParametersId` : long doc missing

`nutationInLongitude` : long doc missing

`nutationInLongitudeRate` : long doc missing

`nutationInObliquity` : long doc missing

`nutationInObliquityRate` : long doc missing

1.33 Doppler Table

Doppler tracking information. This table defines how velocity information is converted into a frequency offset to compensate in real time for the Doppler effect. This table may be omitted for ALMA when the Doppler tracking is not corrected.

Doppler		
Name	Type (Shape)	Comment
Key		
`dopplerId`	`int`	identifies a collection of rows in the table.
`sourceId`	`int`	refers to a collection of rows in SourceTable.
Required Data		
`transitionIndex`	`int`	selects the transition in the source table for which the doppler tracking is done.
`velDef`	`DopplerReferenceCode`	identifies the definition of the velocity.

Column Descriptions:

`dopplerId` : Identifies the row in the Doppler Table.

`sourceId` : Identifies a source in the Source table.

`transitionIndex` : Identifies a particular spectral transition (for a source in the Source Table).

`velDef` : Velocity definition of the Doppler Shift, e.g. RADIO or OPTICAL. The value of the velocity is found in the Source Table as `sysVel[transitionIndex]`.

1.34 Ephemeris Table

Ephemeris		
Name	Type (Shape)	Comment
Key		
`timeInterval`	`ArrayTimeInterval`	interval of time during which the data are relevant.
`ephemerisId`	`int`	identifies a collection of rows in the table.
Required Data		
`observerLocation`	`double [3]`	a triple of double precision values defining the observer location. This triple contains in that order the longitude, the latitude and the altitude of the observer : – the longitude is expressed in radian. An east (resp. west) longitude is denoted as a positive (resp. negative) quantity. – the latitude is expressed in radian. A north (resp. south) latitude is denoted as a positive (resp. negative) quantity. – the altitude is expressed in meter. It's the altitude above the reference ellipsoid. A triple with all its elements equal to 0.0 will mean that a geocentric coordinate system is in use instead of a topocentric one.
`equinoxEquator`	`double`	epoch at which equator and equinox were calculated for ephemeris. Expresses a year as a decimal value (J2000 would be represented as 2000.0).
N_{Poly} (N_{Poly})	`int`	the number of coefficients of the polynomial stored in phaseDir. It has to be ≥ 1.

Ephemeris – continued from previous page		
Name	Type (Shape)	Comment
`dir`	`double [numPolyDir] [2]`	the ephemeris direction expressed in radian. The nominal entry in the phaseDir, delayDir, or ReferenceDir in the Field table serves as additional offset to the direction described by "dir". The actual direction is obtained by composition, e.g. actual phase direction = [phasDir value from Field table] + [dir]. The direction described by dir is the result of the sum $dir_{0,i} + dir_{1,i} * dt + dir_{2,i} * dt^2 + ... + dir_{numPolyDir-1,i} * dt^{numPolyDir-1}, \forall i \in \{0, 1\}$ where $dt = t - timeOrigin$
N_{Poly} (N_{Poly})	`int`	the number of coefficients of the polynomial stored in distance. It has to be ≥ 1.
`distance`	`double [numPolyDist]`	the coefficiens of the polynomial used to calculate the distance, expressed in meter, to the object from the position of the antenna along the given direction. This distance is the result of the sum : $distance_0 + distance_1 * dt + distance_2 * dt^2 + ... + distance_{numPolyDist-1} * dt^{numPolyDist-1}$ where $dt = t - timeOrigin$.
`timeOrigin`	`ArrayTime`	the time origin used in the evaluation of the polynomial expressions.
`origin`	`string`	the origin of the ephemeris information.
Optional Data		
N_{Poly} (N_{Poly})	`int`	the number of coefficients of the polynomial stored in radVel . It has to be ≥ 1.
`radVel`	`double [numPolyRadVel]`	the coefficients of a polynomial expressing a radial velocity as a function of the time expressed in m/s. The time origin used to tabulate the polynomial is stored in timeOrigin.

Column Descriptions:

`timeInterval` : long doc missing

`ephemerisId` : long doc missing

`observerLocation` : long doc missing

`equinoxEquator` : long doc missing

N_{Poly} : long doc missing

`dir` : long doc missing

N_{Poly} : long doc missing

`distance` : long doc missing

`timeOrigin` : long doc missing

`origin` : Typically one should see here e.g. a JPL identifier, eventually orbital parameters, etc...". for example, one might see in that string:
origin = 'JPL Horizons - DE405,JUP230'
In any case, the observing system of ALMA or VLA should feel free to put in there whatever string they think best describes the information.

N_{Poly} : long doc missing

`radVel` : long doc missing

1.35 ExecBlock Table

Characteristics of the Execution block.

ExecBlock		
Name	Type (Shape)	Comment
Key		
execBlockId	Tag	identifies a unique row in ExecBlock Table.
Required Data		
startTime	ArrayTime	the start time of the execution block.
endTime	ArrayTime	the end time of the execution block.
execBlockNum	int	indicates the position of the execution block in the project (sequential numbering starting at 1).
execBlockUID	EntityRef	the archive's UID of the execution block.
projectUID	EntityRef	the archive's UID of the project.
configName	string	the name of the array's configuration.
telescopeName	string	the name of the telescope.
observerName	string	the name of the observer.
N_{Obse} (N_{Obse})	int	the number of elements in the (array) attribute observingLog.
observingLog	string [numObservingLog]	logs of the observation during this execution block.
sessionReference	EntityRef	the observing session reference.
baseRangeMin	Length	the length of the shortest baseline.
baseRangeMax	Length	the length of the longest baseline.
baseRmsMinor	Length	the minor axis of the representative ellipse of baseline lengths.
baseRmsMajor	Length	the major axis of the representative ellipse of baseline lengths.
basePa	Angle	the baselines position angle.
aborted	bool	the execution block has been aborted (true) or has completed (false).
N_{Ante} (N_{Ante})	int	the number of antennas.
antennaId	Tag [numAntenna]	refers to the relevant rows in AntennaTable.
sBSummaryId	Tag	refers to a unique row in SBSummaryTable.
Optional Data		
releaseDate	ArrayTime	the date when the data go to the public domain.
schedulerMode	string	the mode of scheduling.
siteAltitude	Length	the altitude of the site.
siteLongitude	Angle	the longitude of the site.
siteLatitude	Angle	the latitude of the site.

ExecBlock – continued from previous page		
Name	Type (Shape)	Comment
observingScript	string	The text of the observation script.
observingScriptUID	EntityRef	A reference to the Entity which contains the observing script.
scaleId	Tag	refers to a unique row in the table Scale.

Column Descriptions:

execBlockId : Identifies the row in the ExecBlock Table.

startTime : Scheduled time of start of data taking.

endTime : Scheduled time of end of data taking.

execBlockNum : Number of the ExecBlock: in ALMA Execution blocks in a project are consecutively numbered starting from 1.

execBlockUID : Archive UID of the ExecBlock (the container of the data set).

projectUID : The archive UID of the Project.

configName : Name of the array baseline configuration.

telescopeName : Name of the telescope (e.g. 'ALMA')

observerName : Name of the observer.

N_{Obse} : long doc missing

observingLog : Logs of observations (information entered at execution time by the Operator).

sessionReference : This is useful for grouping execblocks. Data capture know the session reference so this information is easily available.

baseRangeMin : Length of the minimum baseline. For Alma this is expected to be filled from the unprojected baselines available in the array being used in this ExecBlock.

baseRangeMax : Length of the maximum baseline. For Alma this is expected to be filled from the unprojected baselines available in the array being used in this ExecBlock.

baseRmsMinor : Minor axis of the representative ellipse of baseline lengths. For Alma this is expected to be filled from the unprojected baselines available in the array being used in this ExecBlock.

baseRmsMajor : Major axis of the representative ellipse of baseline lengths. For Alma this is expected to be filled from the unprojected baselines available in the array being used in this ExecBlock.

basePa : Position angle of the major axis on the representative ellipse of baseline lengths. For Alma this is expected to be filled from the unprojected baselines available in the array being used in this ExecBlock.

aborted : Set when the execution was aborted.

N_{Ante} : Number of antennas used in the ExecBlock.

antennaId : Antenna Table identifier.

sBSummaryId : SBSummary Table identifier.

`releaseDate` : The date when the data will become public.

`schedulerMode` : Mode of the Scheduling when this data was taken (Dynamic, Interactive, ...)

`siteAltitude` : Latitude of the site (array center).

`siteLongitude` : Longitude of the site (array center).

`siteLatitude` : Latitude of the site (array center).

`observingScript` : long doc missing

`observingScriptUID` : long doc missing

`scaleId` : long doc missing

1.36 Feed Table

Contains characteristics of the feeds.

Feed		
Name	Type (Shape)	Comment
Key		
antennaId	Tag	refers to a unique row in AntennaTable.
spectralWindowId	Tag	refers to a unique row in SpectralWindowTable.
timeInterval	ArrayTimeInterval	the time interval of validity of the content of the row.
feedId	int	identifies a collection of rows in the table.
Required Data		
N_{Rece} (N_{Rece})	int	the number of receptors.
beamOffset	double [numReceptor] [2]	the offsets of the beam (one pair per receptor).
focusReference	Length [numReceptor] [3]	the references for the focus position (one triple per receptor).
polarizationTypes	PolarizationType [numReceptor]	identifies the polarization types (one value per receptor).
polResponse	Complex [numReceptor] [numReceptor]	the polarization response (one value per pair of receptors).
receptorAngle	Angle [numReceptor]	the receptors angles (one value per receptor).
receiverId	int [numReceptor]	refers to one or more collections of rows in ReceiverTable.
Optional Data		
feedNum	int	the feed number to be used for multi-feed receivers.
illumOffset	Length [2]	the illumination offset.
position	Length [3]	the position of the feed.
skyCoupling	float	the sky coupling is the coupling efficiency to the sky of the WVR radiometer's. Note that in general one expects to see whether no sky coupling efficiency recorded or only one of the two forms scalar (skyCoupling) or array (skyCouplingSpectrum, numChan).

Feed – continued from previous page		
Name	Type (Shape)	Comment
N_{Chan} (N_{Chan})	`int`	the size of skyCouplingSpectrum. This attribute must be present when the (array) attribute skyCouplingSpectrum is present since it defines its number of elements. The value of this attribute must be equal to the value of numChan in the row of the SpectralWindow table refered to by spectralWindowId.
`skyCouplingSpectrum`	`float [numChan]`	the sky coupling is the coupling efficiency to the sky of the WVR radiometer's. This column differs from the skyCoupling column because it contains one value for each of the individual channels of that spectralWindow. See the documentation of numChan for the size and the presence of this attribute. Note that in general one expects to see whether no sky coupling efficiency recorded or only one of the two forms scalar (skyCoupling) or array (skyCouplingSpectrum, numChan).

Column Descriptions:

`antennaId` : Antenna Table identifier.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Time Interval of validity of the feed information.

`feedId` : Feed Table identifier.

N_{Rece} : The number of receptors for which the result is given.

`beamOffset` : Offset of the beam.

`focusReference` : Reference for the focus position.

`polarizationTypes` : The polarization types of the receptors being used.

`polResponse` : The polarization response of the receptors.

`receptorAngle` : Position angle for X polarization direction.

`receiverId` : Points to the receivers corresponding to this feed.

`feedNum` : Feed number is to be used for multi-feed receivers (there are none in ALMA; so `feedNum` is always one).

`illumOffset` : Illumination offset for this feed, measured in linear distance from the center of the primary reflector. REFLECTOR

`position` : The position of the feed.

`skyCoupling` : long doc missing

N_{Chan} : long doc missing

`skyCouplingSpectrum` : long doc missing

1.37 Field Table

The field position for each source.

Field		
Name	Type (Shape)	Comment
Key		
`fieldId`	`Tag`	identifies a unique row in the table.
Required Data		
`fieldName`	`string`	the name of the field.
N_{Poly} (N_{Poly})	`int`	number of coefficients of the polynomials.
`delayDir`	`Angle [numPoly] [2]`	the delay tracking direction.
`phaseDir`	`Angle [numPoly] [2]`	the phase tracking direction.
`referenceDir`	`Angle [numPoly] [2]`	the reference direction.
Optional Data		
`time`	`ArrayTime`	value used as the origin for the polynomials.
`code`	`string`	describes the function of the field.
`directionCode`	`DirectionReferenceCode`	the direction reference code of the field.
`directionEquinox`	`ArrayTime`	the direction reference equinox of the field.
`assocNature`	`string`	identifies the nature of the association with the row refered to by fieldId.
`ephemerisId`	`int`	refers to a collection of rows in the EphemerisTable.
`sourceId`	`int`	refers to a collection of rows in SourceTable.
`assocFieldId`	`Tag`	Associated Field ID

Column Descriptions:

`fieldId` : Field Table identifier.

`fieldName` : Name of this Field (usually a representative source, or one of several fields in a mosaic).

N_{Poly} : Number of coefficients used for polynomial expansion of tracked directions.

`delayDir` : Direction in the sky for which delays due to Earth motion are compensated in real time directionCodedirectionEquinox-

`phaseDir` : Direction in the sky for which phases due to Earth motion are tracked in real time directionCodedirectionEquinox-

`referenceDir` : Direction of reference.
- In Interferometry this is the correlated field center (common pointing direction for all antennas)
- In single dish this is the reference direction directionCodedirectionEquinox-

`time` : Used as an origin for expansion polynomials for tracked directions.

`code` : Used to identify the function of this field (target, calibration, etc.). Purely informative.

`directionCode` : The common reference code for field directions in the row, if not `J2000`.

`directionEquinox` : The common reference equinox for field directions in the row, if required by `directionCode`.

`assocNature` : Gives the meaning of Associated Field rows.

`ephemerisId` : long doc missing

`sourceId` : Source Table identifier.

`assocFieldId` : Refers to a unique associate row in the table.

1.38 Flag Table

This table is used for flagging visibility data and is used in addition to the Binary Data Format flags produced by the correlator software.

Flag		
Name	Type (Shape)	Comment
Key		
`flagId`	`Tag`	identifies a unique row in the table.
Required Data		
`startTime`	`ArrayTime`	the start time of the flagging period.
`endTime`	`ArrayTime`	the end time of the flagging period.
`reason`	`string`	Extensible list of flagging conditions.
N_{Ante} (N_{Ante})	`int`	The number of antennas to which the flagging refers.By convention numAntenna== 0 means that the flag applies to all the existing antennas, in such a case the array antennaId can be left empty.
`antennaId`	`Tag [numAntenna]`	An array of Tag which refers to a collection of rows in the Antenna table. The flag applies to the antennas described in these rows. It is an error to have different elements with a same value in this array.
Optional Data		
N_{Pola} (N_{Pola})	`int`	The number of polarization types , i.e. the size of the attribute polarizationType. By convention numPolarizationType == 0 means that the flag applies to all the defined polarization types. Remark : numPolarizationType and polarizationType, both optional, must be both present or both absent in one same row of the table, except if numPolarizationType==0 in which case all the defined polarization types are involved in the flagging.

Flag – continued from previous page		
Name	Type (Shape)	Comment
N_{Spec} (N_{Spec})	`int`	The number of spectral windows targeted by the flagging. By convention numSpectralWindow == 0 means that the flag applies to all the existing spectral windows. Remark : numSpectralWindow and spectralWindow, both optional, must be both present or both absent in one same row of the table, except if numSpectralWindow==0, in which case all the declared spectral windows are involved in the flagging.
N_{Pair} (N_{Pair})	`int`	The number of antennas to be paired with to form the flagged baselines. By convention, numPairedAntenna == 0 means that the flag applies to all baselines built on the antennas declared in the attribute antennaId. Remark: numPairedAntenna and pairedAntenna, both optional, must be both present or both absent except if numPairedAntenna==0 in which case one has to consider all the baselines defined upon the antennas announced in antennaId.
`polarizationType`	`PolarizationType [numPolarizationType]`	An array of values of type PolarizationType. It specifies the polarization types where the flagging applies. It is an error to have different elements with a same value in this array.
`pairedAntennaId`	`Tag [numPairedAntenna]`	An array of Tag which refers to rows in the Antenna table. These rows contain the description of the antennas which are paired to form the flagged baselines. It is an error to have distinct elements with a same value in this array.
`spectralWindowId`	`Tag [numSpectralWindow]`	An array of Tag which refers to a collection of rows in the SpectralWindow table. The flag applies to the spectral windows described in these rows. It is an error to have different elements with a same value in this array.

Column Descriptions:

`flagId` : long doc missing
`startTime` : long doc missing
`endTime` : long doc missing
`reason` : long doc missing
N_{Ante} : long doc missing
`antennaId` : long doc missing
N_{Pola} : long doc missing
N_{Spec} : long doc missing
N_{Pair} : long doc missing
`polarizationType` : long doc missing
`pairedAntennaId` : long doc missing
`spectralWindowId` : long doc missing

1.39 Focus Table

Contains the focus information.

Focus		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`timeInterval`	`ArrayTimeInterval`	time interval for which the row's content is valid.
Required Data		
`focusTracking`	`bool`	the focus motions have been tracked (true) or not tracked (false).
`focusOffset`	`Length [3]`	focus offset relative to the tracked position (a triple).
`focusRotationOffset`	`Angle [2]`	focus rotation offset relative to the tracked position (tip, tilt).
`focusModelId`	`int`	refers to a collection of rows in FocusModelTable.
Optional Data		
`measuredFocusPosition`	`Length [3]`	the measured focus position.
`measuredFocusRotation`	`Angle [2]`	the measured focus rotation (tip, tilt).

Column Descriptions:

`antennaId` : Antenna Table identifier.

`timeInterval` : Time Interval of validity of the focus information.

`focusTracking` : Set if the subreflector was tracking the focus motions.

`focusOffset` : Focus offset introduced relative to the tracked position REFLECTORVirtual

`focusRotationOffset` : long doc missing

`focusModelId` : Specifies which Focus Model was used (FocusModel Table).

`measuredFocusPosition` : Measured Focus position. REFLECTOR

`measuredFocusRotation` : long doc missing

1.40 FocusModel Table

Contains the focus model data (function of elevation and temperature).

FocusModel		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`focusModelId`	`int`	refers to a collection of rows in the table.
Required Data		
`polarizationType`	`PolarizationType`	identifies the polarization type.
`receiverBand`	`ReceiverBand`	identifies the receiver band.
N_{Coef} (N_{Coef})	`int`	the number of coefficients.
`coeffName`	`string [numCoeff]`	the names of the coefficients (one string per coefficient).
`coeffFormula`	`string [numCoeff]`	textual representations of the fitted functions (one string per coefficient).
`coeffVal`	`float [numCoeff]`	the values of the coefficients used (one value per coefficient).
`assocNature`	`string`	nature of the association with the row refered to by associatedFocusModelId.
`assocFocusModelId`	`int`	refers to a collection of rows in the table.

Column Descriptions:

`antennaId` : Antenna Table identifier.

`focusModelId` : Identifies the focus model.

`polarizationType` : Polarization component for which the focus model is valid.

`receiverBand` : The name of the front-end frequency band being used.

N_{Coef} : The number of coefficients in the analytical form of the model.

`coeffName` : Given names of coefficients.

`coeffFormula` : Analytical formula: explains the function fitted (e.g. $\cos(el)$ or $\ln(T)$).

`coeffVal` : The values of the coefficients used.

`assocNature` : Nature of associated focus model,e.g., receiver-specific, local, ...

`assocFocusModelId` : Associates another focus model used in addition. Used for the auxiliary pointing model (e.g. the local pointing model). The actual associated row is obtained by associating the current `antennaId` with `associatedFocusModelId` to form the key.

1.41 FreqOffset Table

Frequency offset information. Contains an additional antenna-based frequency offset relative to the frequencies in the Spectral Windows. Useful for such thing as Doppler tracking.

FreqOffset		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.
`timeInterval`	`ArrayTimeInterval`	the time interval of validity of the row's content.
`feedId`	`int`	refers to a collection of rows in FeedTable.
Required Data		
`offset`	`Frequency`	frequency offset.

Column Descriptions:

`antennaId` : Antenna Table identifier.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Time Interval of validity of the frequency offset information.

`feedId` : Specifies which feed was used in the Feed Table.

`offset` : Frequency offset to be added to the frequency set in the spectral window Table.

1.42 GainTracking Table

Gain tracking information. Contains variable control parameters affecting the signal coming from a receiver in an antenna.

GainTracking		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.
`timeInterval`	`ArrayTimeInterval`	time interval for which the row's content is valid.
`feedId`	`int`	refers to a unique row in Feed Table
Required Data		
N_{Rece} (N_{Rece})	`int`	the number of receptors.
`attenuator`	`float [numReceptor]`	the nominal value of the attenuator (one value per receptor).
`polarizationType`	`PolarizationType [numReceptor]`	describes the polarizations of the receptors (one value per receptor).
Optional Data		
`samplingLevel`	`float`	the sampling level.
N_{AttF} (N_{AttF})	`int`	the sizes of attSpectrum and attFreq.
`attFreq`	`double [numAttFreq]`	the attenuator frequencies.
`attSpectrum`	`Complex [numAttFreq]`	the attenuator's measured spectrum.

Column Descriptions:

`antennaId` : Antenna Table identifier.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Time Interval of validity of the feed information.

`feedId` : Specifies which feed was used in the Feed Table.

N_{Rece} : The number of receptors.

`attenuator` : Gain due to the hardware attenuation selected for the Spectral window in this antenna. This is the nominal value of the attenuator.

`polarizationType` : The polarization types of the receptors being used.

`samplingLevel` : Correlator sampling level. Cannot change for ALMA...

N_{AttF} : Number of frequency points in `attSpectrum`

`attFreq` : Frequencies for the values in `attSpectrum`.

`attSpectrum` : Gain due to the hardware attenuation selected for the Spectral window in this antenna. This is the actual calibrated spectrum measured in the lab (complex values) as a function of frequency.

1.43 Holography Table

Used for Single-Dish holography with a fixed transmitter.

Holography		
Name	Type (Shape)	Comment
Key		
`holographyId`	`Tag`	identifies a unique row in the table.
Required Data		
`distance`	`Length`	the distance to transmitter.
`focus`	`Length`	displacement of the feed from the primary nominal focus.
N_{Corr} (N_{Corr})	`int`	the number of stored correlations.
`type`	`HolographyChannelType [numCorr]`	identifies the types of the correlation signals.

Column Descriptions:

`holographyId` : Identifies the row in the Holography Table.

`distance` : Distance from intersection of mount axes to transmitter.

`focus` : Displacement of signal feed from the primary nominal focus, used to compensate for the finite distance of transmitter.

N_{Corr} : Number of correlations stored (3 autocorrelations, 3 correlations from the 3 receptors (signal feed, reference feed, quadrature signal feed).

`type` : Identifies each of the numCorr correlation signals.

1.44 Pointing Table

Antenna pointing information.

Pointing		
Name	Type (Shape)	Comment
Key		
antennaId	Tag	refers to a unique row in AntennaTable.
timeInterval	ArrayTimeInterval	the time interval of validity of the row's content.
Required Data		
N_{Samp} (N_{Samp})	int	the number of time samples.
encoder	Angle [numSample] [2]	Encoder values
pointingTracking	bool	the antenna was in tracking mode (true) or not (false).
usePolynomials	bool	use polynomials expansions (true) or not (false).
timeOrigin	ArrayTime	the value used as origin in the polynomials expansions.
N_{Term} (N_{Term})	int	the number of terms of the polynomials.
pointingDirection	Angle [numTerm] [2]	the commanded pointing direction.
target	Angle [numTerm] [2]	the direction of the target.
offset	Angle [numTerm] [2]	Horizon mapping offsets
pointingModelId	int	refers to a collection of rows in PointingModelTable.
Optional Data		
overTheTop	bool	pointing ar elevations larger than 90 degrees (true) or lower (false).
sourceOffset	Angle [numTerm] [2]	sources offsets (one pair per term of the polynomial).
sourceOffsetReferenceCode	DirectionReferenceCode	the direction reference code associated to the source offset.
sourceOffsetEquinox	ArrayTime	the equinox information (if needed by sourceReferenceCode).
sampledTimeInterval	ArrayTimeInterval [numSample]	an array of ArrayTimeInterval which must be given explicitly as soon as the data are irregularily sampled.
atmosphericCorrection	Angle [numTerm] [2]	This is the correction applied to the commanded position to take into account refraction and any other atmospheric effects. This term will always be zero if there is no atmosphere. For ALMA this is the atmospheric refraction correction and will result in a correction in just the elevation axis.

Column Descriptions:

`antennaId` : Antenna Table identifier.

`timeInterval` : Time Interval of validity of the feed information.

N_{Samp} : The number of time samples for `encoder`. The sampling intervals divide `timeInterval` into N_{Samp} contiguous intervals of equal duration. This is also used for the other direction columns (`offset`, `pointingDirection`, `target`, `sourceOffset`) when `usePolynomials` is `false`: in that case N_{Term}= N_{Samp}.

`encoder` : The values measured from the antenna. They may be however affected by metrology, if applied. Note that for ALMA this column will contain positions obtained using the AZ_POSN_RSP and EL_POSN_RSP monitor points of the ACU and not the GET_AZ_ENC and GET_EL_ENC monitor points (as these do not include the metrology corrections). It is agreed that the the vendor pointing model will never be applied. AZELNOWAntenna.position

`pointingTracking` : Indicates that the antenna is in tracking mode.

`usePolynomials` : See `numSample` and `numTerm`.

`timeOrigin` : The time origin for polynomial expansions of `pointingDirection`, `target`, `offset`, and `sourceOffset`. Equal to the midpoint of `timeInterval` if N_{Term}=1.

N_{Term} :

- If `usePolynomials` is `false`: N_{Term}= N_{Samp}, and the values in the direction columns (`offset`, `pointingDirection`, `target`, `sourceOffset`) correspond to the same sampling intervals used for `encoder`.
- If `usePolynomials` is `true`: $N_{Term}$is the number of terms in the polynomial expansion for the direction columns (`offset`, `pointingDirection`, `target`, `sourceOffset`) . The time origin for these polynomials is `timeOrigin`.

`pointingDirection` : This is the commanded direction of the antenna. It is obtained by adding the target and offset columns, and then applying the pointing model referenced by PointingModelId. The pointing model can be the composition of the absolute pointing model and of a local pointing model. In that case their coefficients will both be in the PointingModel table.

`target` : This is the field center direction (as given in the Field Table), possibly affected by the optional antenna-based `sourceOffset`. This column is in horizontal coordinates. AZELNOWAntenna.position

`offset` : Additional offsets in horizontal coordinates (usually meant for measuring the pointing corrections, mapping the antenna beam, ...). AZELNOWAntenna.positiontarget

`pointingModelId` : Link to the pointing model applied.

`overTheTop` : The antenna is pointing at elevations larger than 90 degrees. Deprecated for ALMA, should not happen.

`sourceOffset` : Optionally, the antenna-based mapping offsets in the field. These are in the equatorial system, and used, for instance, in on-the-fly mapping when the antennas are driven independently across the field.

`sourceOffsetReferenceCode` : Source offset reference code, defaults to J2000.

`sourceOffsetEquinox` : Source offset equinox, if needed by `sourceOffsetReference`.

`sampledTimeInterval` : long doc missing

`atmosphericCorrection` : long doc missing

1.45 PointingModel Table

The pointing models used to point the antennas.

PointingModel		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`pointingModelId`	`int`	pointingModel identifier
Required Data		
N_{Coef} (N_{Coef})	`int`	the number of coefficients used in the analytical form of the model.
`coeffName`	`string [numCoeff]`	the names of the coefficients.
`coeffVal`	`float [numCoeff]`	the values of the coefficients.
`polarizationType`	`PolarizationType`	identifies the polarization type.
`receiverBand`	`ReceiverBand`	identifies the receiver band.
`assocNature`	`string`	nature of the association with the row refered to by associatedPointingModelId.
`assocPointingModelId`	`int`	refers to a collection of rows in the table.
Optional Data		
`coeffFormula`	`string [numCoeff]`	the fitted functions

Column Descriptions:

`antennaId` : Antenna Table identifier.

`pointingModelId` : Identifies the pointing model used.

N_{Coef} : The number of coefficients in the analytical form of the model.

`coeffName` : Standard names used by tpoint.

`coeffVal` : The values of the coefficients used.

`polarizationType` : Polarization component for which the pointing model is valid.

`receiverBand` : The name of the front-end frequency band being used.

`assocNature` : Nature of the associated pointing model: e.g. local pointing model, receiver-specific.

`assocPointingModelId` : Associates another pointing model used in addition. Used for the auxiliary pointing model (e.g. local pointing model, ...). The actual associated row is obtained by associating the current `antennaId` with `associatedPointingModelId` to form the key.

`coeffFormula` : Analytical formulae. This is not needed for ALMA as we use tpoint generic coefficients.

1.46 Polarization Table

Polarization information.

Polarization		
Name	Type (Shape)	Comment
Key		
`polarizationId`	`Tag`	Polarization Table identifier
Required Data		
N_{Corr} (N_{Corr})	`int`	Number of correlation products
`corrType`	`StokesParameter` `[numCorr]`	Correlation type
`corrProduct`	`PolarizationType` `[numCorr] [2]`	Correlation product.

Column Descriptions:

`polarizationId` : Polarization Table identifier.

N_{Corr} : The number of correlation products. This could be 1 (e.g. XX or YY), 2 (e.g. XX and YY), 3 (full polarization for auto-correlation), or 4 (full polarization for cross-correlation).

`corrType` : For each correlation product this indicates the Stokes type as defined in the Stokes parameters enumeration.

`corrProduct` : For each correlation product, a pair of integers, specifying the receptors from which the signal originated. The polarization of each receptor is defined in the `polarizationType` column in the Feed table. An example would be (0,0), (0,1), (1,0), (1,1) to specify all possible correlation prodicts between two receptors.

1.47 Processor Table

Processor characteristics. This table holds summary information for the back-end processing devices used to generate the basic science data.

Processor		
Name	Type (Shape)	Comment
Key		
`processorId`	`Tag`	Processor identifier
Required Data		
`modeId`	`Tag`	refers to a unique row in CorrelatorModeTable or SquareLawDetectorTable or AlmaRadiometerTable.
`processorType`	`ProcessorType`	identifies the generic type of the processor.
`processorSubType`	`ProcessorSubType`	identifies the type of processor refered to by modeId.

Column Descriptions:

`processorId` : Processor Table identifier.

`modeId` : Processor table identifier.

`processorType` : The generic type of processor used.

`processorSubType` : Identifies the SDM table containing the processor-dependent information.

1.48 Receiver Table

Receiver properties.

Receiver		
Name	Type (Shape)	Comment
Key		
`receiverId`	`int`	Receiver identifier
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.
`timeInterval`	`ArrayTimeInterval`	time interval for which the content is valid.
Required Data		
`name`	`string`	the name of the frontend.
N_{LO} (N_{LO})	`int`	the number of frequencies of the local oscillator.
`frequencyBand`	`ReceiverBand`	identifies the band of frequencies.
`freqLO`	`Frequency [numLO]`	the frequencies of the local oscillator.
`receiverSideband`	`ReceiverSideband`	the receiver sideband used.
`sidebandLO`	`NetSideband [numLO]`	the sideband conversions.

Column Descriptions:

`receiverId` : Receiver Table identifier. Note that this is always zero for ALMA.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Time Interval ofy validity of the receiver information.

`name` : Name of the frontend.

N_{LO} : The number of frequency changes in the receiver chain.

`frequencyBand` : The name of this frequency band (bands 1 to 10 for ALMA) These correspond to receiver cartridges in the ALMA dewars.

`freqLO` : Frequencies of the Local Oscillators in the receiving chain.

`receiverSideband` : The receiver sideband used.

`sidebandLO` : The sideband conversion for each of the local oscillators. Used to check the frequency plan.

1.49 SBSummary Table

Characteristics of the Scheduling Block that has been executed. Much of the data here is reproduced from the Scheduling block itself.

SBSummary		
Name	Type (Shape)	Comment
Key		
sBSummaryId	Tag	refers to a unique row in the table.
Required Data		
sbSummaryUID	EntityRef	the scheduling block archive's UID.
projectUID	EntityRef	the projet archive's UID.
obsUnitSetUID	EntityRef	the observing unit set archive's UID.
frequency	double	a representative frequency.
frequencyBand	ReceiverBand	the frequency band.
sbType	SBType	the type of scheduling block.
sbDuration	Interval	the duration of the scheduling block.
N_{Obse} (N_{Obse})	int	the number of observing modes.
observingMode	string [numObservingMode]	the observing modes.
N_{berR} (N_{berR})	int	the number of repeats.
N_{Scie} (N_{Scie})	int	the number of scientific goals.
scienceGoal	string [numScienceGoal]	the scientific goals.
N_{Weat} (N_{Weat})	int	the number of weather constraints.
weatherConstraint	string [numWeatherConstraint]	the weather constraints.
Optional Data		
centerDirection	Angle [2]	the representative target direction.
centerDirectionCode	DirectionReferenceCode	identifies the direction reference frame associated with centerDirection.
centerDirectionEquinox	ArrayTime	the equinox associated to centerDirectionReferenceCode (if needed).

Column Descriptions:

sBSummaryId : Identifies each row of the SBSummary table.

sbSummaryUID : Archive UID of the scheduling block.

projectUID : Archive UID of the project.

obsUnitSetUID : Archive UID of the observing unit set.

frequency : Representative frequency.

frequencyBand : Frequency band used for the SB.

sbType : Type of Scheduling Block (e.g. science, calibration, ...)

`sbDuration` : The duration of this SB (as planned).

N_{Obse} : The number of observing modes.

`observingMode` : Standard observing mode, e.g. singleField, mosaic. One SB cannot have more than one standard observing mode. Examples: Single Field Interferometry, Pointed Mosaic, ...

N_{berR} : Number of executions scheduled for this SB.

N_{Scie} : Number of science goals.

`scienceGoal` : The science goals.

N_{Weat} : The number of weather constraints.

`weatherConstraint` : Weather scheduling constraints, as specified in the Observing Tool.

`centerDirection` : Direction of the representative target.

`centerDirectionCode` : The center direction reference code, if not `J2000`.

`centerDirectionEquinox` : The center direction reference equinox, if required by `centerDirectionCode`.

1.50 Scale Table

Specifies the time scales and units used in the dataset.

Scale		
Name	Type (Shape)	Comment
Key		
`scaleId`	`Tag`	identifies a unique row in the table Scale.
Required Data		
`timeScale`	`TimeScale`	a TimeScale value.
`crossDataScale`	`DataScale`	the unit of the cross data in the BDF.
`autoDataScale`	`DataScale`	the unit of the auto data in the BDF.
`weightType`	`WeightType`	a type of weighting.

Column Descriptions:

`scaleId` : long doc missing

`timeScale` : long doc missing

`crossDataScale` : long doc missing

`autoDataScale` : long doc missing

`weightType` : long doc missing

1.51 Scan Table

A summary of information for each scan.

Scan		
Name	Type (Shape)	Comment
Key		
`execBlockId`	`Tag`	refers to a unique row in ExecBlockTable.
`scanNumber`	`int`	the scan number.
Required Data		
`startTime`	`ArrayTime`	the actual start time of the scan.
`endTime`	`ArrayTime`	the actual end time of the scan.
N_{Inte} (N_{Inte})	`int`	the number of intents for this scan.
N_{Subs} (N_{Subs})	`int`	the number of subscans contained by this scan.
`scanIntent`	`ScanIntent [numIntent]`	identifies the intents of this scan.
`calDataType`	`CalDataOrigin [numIntent]`	identifies the calibration data types (one value per intent).
`calibrationOnLine`	`bool [numIntent]`	the online calibration was required (true) or not (false) (one value per intent).
Optional Data		
`calibrationFunction`	`CalibrationFunction [numIntent]`	identifies the calibration functions (one value per intent).
`calibrationSet`	`CalibrationSet [numIntent]`	attaches this scan to a calibration set (one value per intent).
`calPattern`	`AntennaMotionPattern [numIntent]`	identifies the antenna motion patterns used for the calibration.
N_{Fiel} (N_{Fiel})	`int`	the number of fields observed.
`fieldName`	`string [numField]`	the names of the observed fields (one value per field).
`sourceName`	`string`	the name of the observed source.

Column Descriptions:

`execBlockId` : ExecBlock Table identifier.

`scanNumber` : The scan number. This increments starting from 1 in each Execution Block.

`startTime` : The time when this scan actually started acquiring data.

`endTime` : The time when this scan actually finished acquiring data.

N_{Inte} : The scan intents for this scan.

N_{Subs} : The number of subscans used to achieve this scan.

`scanIntent` : The scan intents for this scan.

`calDataType` : Calibration data type used for data reduction.

`calibrationOnLine` : True if on-line calibration was required.

`calibrationFunction` : Function of the scan in the calibration set. This is used in on-line calibration.

`calibrationSet` : Identifies that the scan is part of a set of scans aimed at a particular calibration.

`calPattern` : Identifies the antenna motion pattern used for calibration; data reduction may used this information.

N_{Fiel} : The number of fields observed during this scan.

`fieldName` : The names of of the fields observed during this scan.

`sourceName` : The name of the source observed (optional).

1.52 Source Table

Summary of astromomical source information.

Source		
Name	Type (Shape)	Comment
Key		
`sourceId`	`int`	identifies a collection of rows in the table.
`timeInterval`	`ArrayTimeInterval`	the time interval of validity of the row's content.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.
Required Data		
`code`	`string`	indicates the nature of the source.
`direction`	`Angle [2]`	the direction of the source.
`properMotion`	`AngularRate [2]`	the proper motion of the source.
`sourceName`	`string`	the name of the source.
Optional Data		
`directionCode`	`DirectionReferenceCode`	identifies the direction reference frame associated to direction.
`directionEquinox`	`ArrayTime`	the equinox associated to the direction reference frame (if required).
`calibrationGroup`	`int`	the calibration group number.
`catalog`	`string`	the name of the catalog.
`deltaVel`	`Speed`	the velocity resolution.
`position`	`Length [3]`	the position of the source.
N_{Line} (N_{Line})	`int`	the number of line transitions.
`transition`	`string [numLines]`	the names of the transitions.
`restFrequency`	`Frequency [numLines]`	the rest frequencies (one value per transition line).
`sysVel`	`Speed [numLines]`	the systemic velocity.
`rangeVel`	`Speed [2]`	the velocity range.
`sourceModel`	`SourceModel`	identifies the source model.
`frequencyRefCode`	`FrequencyReferenceCode`	the frequency reference code.
N_{Freq} (N_{Freq})	`int`	the number of frequencies.
N_{Stok} (N_{Stok})	`int`	the number of Stokes parameters.
`frequency`	`Frequency [numFreq]`	the array of frequencies (one value per frequency).
`frequencyInterval`	`Frequency [numFreq]`	an array of frequency intervals (one value per interval).
`stokesParameter`	`StokesParameter [numStokes]`	the array of Stokes parameters (one value per parameter).
`flux`	`Flux [numFreq] [numStokes]`	the array of flux densities expressed in Jansky (Jy).

Source – continued from previous page		
Name	Type (Shape)	Comment
`fluxErr`	`Flux [numFreq] [numStokes]`	the array of uncertainties on flux densities.
`positionAngle`	`Angle [numFreq]`	the major axis position angles (one value per frequency).
`positionAngleErr`	`Angle [numFreq]`	the uncertainties on major axis position angles.
`size`	`Angle [numFreq] [2]`	the sizes of source (one pair of values per frequency).
`sizeErr`	`Angle [numFreq] [2]`	the uncertainties on the source sizes (one pair of value per frequency).
`velRefCode`	`RadialVelocityReferenceCode`	the velocity reference code for velocities: sysVel, rangeVel, deltaVel.

Column Descriptions:

`sourceId` : Identifies each row of the Source table.

`timeInterval` : Time Interval of validity of the source information.

`spectralWindowId` : SpectralWindow Table identifier.

`code` : Source code, e.g., Bandpass calibrator.

`direction` : The source direction, usually EQ J2000. directionCodedirectionEquinox-

`properMotion` : Source proper motion (change of directiuon with time).

`sourceName` : The source name (please respect UAI/IAU standard conventions).

`directionCode` : The source direction reference code, if not `J2000`.

`directionEquinox` : The source direction reference equinox , if required by `directionCode`.

`calibrationGroup` : Used to group sources for calibration purposes (kept for further use).

`catalog` : Gives the origin for source information if taken from a catalog.

`deltaVel` : Velocity resolution required for this source (from observer input; kept for further use).

`position` : Source position (when 3-dimentional information is available, like a local transmitter). ITRF

N_{Line} : Number of line transitions for which information is given.

`transition` : The line of each spectral line transition.

`restFrequency` : The rest frequency for each transition considered. LABREST

`sysVel` : The source radial velocity in each of the line transitions. LSR

`rangeVel` : Range of radial velocities present in the source (for spectroscopy).

`sourceModel` : A model for source.

`frequencyRefCode` : The reference code for `frequency` (if not `LSRK`)

N_{Freq} : The number of frequencies for which parameters are provided.

N_{Stok} : The number of Stokes parameters that are provided at each freqeuncy.

`frequency` : The list of frequencies for the flux densities LSRK

`frequencyInterval` : The list of frequency intervals over which flux densities were measured.

`stokesParameter` : The array of Stokes parameters (one value per parameter).

`flux` : The values of fluxes provided in Jansky (Jy).

`fluxErr` : The statistical uncertainties on the fluxes.

`positionAngle` : Position angles of the major axes for the elliptical sources.

`positionAngleErr` : Statistical uncertainties for the major axis position angles.

`size` : Source sizes measured along the major and minor axis.

`sizeErr` : Statistical uncertainties on the source sizes.

`velRefCode` : long doc missing

1.53 SpectralWindow Table

Spectral window description. The convention in ALMA is to describe the frequency axis in the topocentric reference frame. If this is not the case (for instance if active Doppler tracking is implemented) then `measFreqRef` should be set accordingly.

SpectralWindow		
Name	Type (Shape)	Comment
Key		
`spectralWindowId`	`Tag`	identifies a unique row in the table.
Required Data		
`basebandName`	`BasebandName`	identifies the baseband.
`netSideband`	`NetSideband`	identifies the net sideband.
N_{Chan} (N_{Chan})	`int`	the number of frequency channels.
`refFreq`	`Frequency`	the reference frequency.
`sidebandProcessingMode`	`SidebandProcessingMode`	identifies the sideband processing mode.
`totBandwidth`	`Frequency`	the total bandwidth.
`windowFunction`	`WindowFunction`	identifies the window function.
Optional Data		
`chanFreqStart`	`Frequency`	the frequency of the first channel.
`chanFreqStep`	`Frequency`	the increment between two successive frequencies.
`chanFreqArray`	`Frequency [numChan]`	the frequencies defined as an array (`numChan` values).
`chanWidth`	`Frequency`	the width of the frequency channel (supposedly constant).
`chanWidthArray`	`Frequency [numChan]`	Array of channel widths
`correlationBit`	`CorrelationBit`	identifies the number of bits used in the signal representation.
`effectiveBw`	`Frequency`	the effective noise bandwidth.
`effectiveBwArray`	`Frequency [numChan]`	array of effective bandwidths (one value per channel).
`freqGroup`	`int`	the frequency group number.
`freqGroupName`	`string`	the frequency group name.
`lineArray`	`bool [numChan]`	indicates lines (true) versus baselines (false).
`measFreqRef`	`FrequencyReferenceCode`	the reference frame of the frequencies.
`name`	`string`	a name for this spectral window.
`oversampling`	`bool`	data are "oversampled" (true) or not (false).
`quantization`	`bool`	a quantization correction has been applied (true) or not applied (false).
`refChan`	`double`	the reference channel "number".
`resolution`	`Frequency`	the half power frequency resolution (supposedly constant for all the channels).

SpectralWindow – continued from previous page		
Name	Type (Shape)	Comment
`resolutionArray`	`Frequency [numChan]`	the frequency resolutions (possibly variable)(one value per channel).
N_{Asso} (N_{Asso})	`int`	the number of associated values.
`assocNature`	`SpectralResolutionType [numAssocValues]`	the natures of the associations with the rows refered to by assocSpectralWindowId.
`assocSpectralWindowId`	`Tag [numAssocValues]`	refers to a collection of associated rows in the table.
`imageSpectralWindowId`	`Tag`	refers to a unique row in the table (image sideband description).
`dopplerId`	`int`	refers to a collection of rows in DopplerTable.

Column Descriptions:

`spectralWindowId` : Identifies each row of the SpectralWindow table.

`basebandName` : Name of the baseband this spectral window is connected to.

`netSideband` : Equivalent sideband of spectrum frequency axis. Can be USB, LSB but also DSB , or NOSB (in the case of direct amplification).

N_{Chan} : The number of frequency channels.

`refFreq` : This is the reference frequency of the spectrum, it corresponds to the channel number `refChan` in the case of equidistant channels. This is normally set to the zero-frequency edge of the spectral window, for correlation data, for compatibility with the Measurement Set. TOPO

`sidebandProcessingMode` : In the case of single side band data, provides information on how side bands were separated, or how image sideband data was eliminated.

`totBandwidth` : The total bandwidth for the spectral window.

`windowFunction` : Indicates which window function was applied to the time-domain data before performing Fourier transform, for correlator data. Applying a window spectrum provides apodization of the spectral response to a monochromatic line.

`chanFreqStart` : The central frequency for the first channel of the spectrum. Used for regularily spaced frequencies. Either the couple (chanFreqStart, chanFreqStep) or chanFreqArray must be present. TOPO

`chanFreqStep` : The channel frequency separation. Used for regularily spaced frequencies. Either the couple (chanFreqStart, chanFreqStep) or chanFreqArray must be present. TOPO

`chanFreqArray` : The central frequency for each channel of the spectrum. Present for irregularily spaced frequencies. Either the couple (chanFreqStart, chanFreqStep) or chanFreqArray must be present. TOPO

`chanWidth` : The channel width (at half power) of all channels. Used an array of identical channels. Either `chanWidth` or `chanWidthArray` must be present.

`chanWidthArray` : The channel width at half power. Either `chanWidth` or `chanWidthArray` must be present.

`correlationBit` : Indicates how many bits were used to represent the signal to be correlated.

`effectiveBw` : The effective noise bandwidth of all channels in the spectrum (that is the white noise bandwidth that produces the same output noise fluctuations). Either `effectiveBw` or `effectiveBwArray` must be present.

`effectiveBwArray` : The array of effective noise bandwidth for each channel in the spectrum (that is the white noise bandwidth that produces the same output noise fluctuations). Either `effectiveBw` or `effectiveBwArray` must be present.

`freqGroup` : Frequency group number. Used to associate spectral windows for calibration purposes.

`freqGroupName` : Name of the frequency group. Used to associate spectral windows for calibration purposes.

`lineArray` : Indicates line vs. baseline. For channel averaged data, indicates the channels with line signal as opposed to the ones with baseline data. Used for single-dish spectral line pointing.

`measFreqRef` : The reference frame for frequencies (if not topocentric).

`name` : Name of this spectral window.

`oversampling` : Oversampling is true if the data is sampled at more than the Nyquist rate (improving signal to noise).

`quantization` : True if the quantization correction has been applied to the data.

`refChan` : This is the channel number corresponding to the frequency `refFreq`. It does not need to be an integer (for instance the reference frequency may fall between two channels if a half-channel is introduced in the correlator software).

`resolution` : The half-power width of the frequency channels. Used for identical channels. Either `resolution` or `resolutionArray` must be present.

`resolutionArray` : The array of half-power widths of the frequency channels. Either `resolution` or `resolutionArray` must be present.

N_{Asso} : Number of associated spectral windows.

`assocNature` : Nature of association between spectral windows. In some cases two spectral windows are generated with the same data (full resolution and channel averaged); the association mechanism links these together.

`assocSpectralWindowId` : Associates another focus model used in addition. Used for the auxiliary pointing model (e.g. local pointing model, ...). The actual associated row is obtained by associating the current `antennaId` with `associatedFocusModelId` to form the key.

`imageSpectralWindowId` : The row in the SpectralWindow table which contains the description of the image sideband.

`dopplerId` : Doppler Table identifier.

1.54 SquareLawDetector Table

Processor information for total power detectors.

SquareLawDetector		
Name	Type (Shape)	Comment
Key		
`squareLawDetectorId`	`Tag`	identifies a unique row in the table.
Required Data		
N_{Band} (N_{Band}) `bandType`	`int` `DetectorBandType`	the number of bands. identifies the band type.

Column Descriptions:

`squareLawDetectorId` : Identifies each row of the Square law detector table.

N_{Band} : The number of band detectors.

`bandType` : Band type, e.g. BASEBAND (for Alma there is also a detector higher in the chain, covering all basebands).

1.55 State Table

State information.

State		
Name	Type (Shape)	Comment
Key		
`stateId`	`Tag`	identifies a unique row in the table.
Required Data		
`calDeviceName`	`CalibrationDevice`	the name of the calibration device.
`sig`	`bool`	data to be used for signal measurement (true) or not (false).
`ref`	`bool`	data to be used for reference measurement (true) or not (false).
`onSky`	`bool`	the beam is on the sky (true) or not (false).
Optional Data		
`weight`	`float`	used for combining data.

Column Descriptions:

`stateId` : Identifies each row of the State table.

`calDeviceName` : Name of the calibration device (must be there if onSky is false).

`sig` : Data will be used for signal measurement.

`ref` : Data will be used for reference measurement.

`onSky` : True if the receiver is getting radiation from the sky.

`weight` : Weight to be used for combining data (useful when there are more than one signal or reference states).

1.56 Station Table

Antenna station information.

Station		
Name	Type (Shape)	Comment
Key		
`stationId`	`Tag`	Station identifier.
Required Data		
`name`	`string`	the name of the station.
`position`	`Length [3]`	the position of the station.
`type`	`StationType`	identifies the type of the station.
Optional Data		
`time`	`ArrayTime`	the time of position measurement.

Column Descriptions:

`stationId` : Identifies each row of the Station table.

`name` : The name of the station.

`position` : The position of the station in geocentric frame of reference (X, Y, Z coordinates). ITRF

`type` : The station type, e.g. ANTENNA or WEATHER.

`time` : long doc missing

1.57 Subscan Table

Subscan-based information.

Subscan		
Name	Type (Shape)	Comment
Key		
`execBlockId`	`Tag`	identifies a unique row in ExecBlockTable.
`scanNumber`	`int`	the number of the scan this subscan belongs to.
`subscanNumber`	`int`	the subscan number.
Required Data		
`startTime`	`ArrayTime`	the actual start time of the subscan.
`endTime`	`ArrayTime`	the actual end time of the subscan.
`fieldName`	`string`	the name of the observed field.
`subscanIntent`	`SubscanIntent`	the intent of the subscan.
N_{Inte} (N_{Inte})	`int`	the number of integrations during the scan.
N_{Subi} (N_{Subi})	`int [numIntegration]`	the number of subintegrations for each integration.
Optional Data		
`subscanMode`	`SwitchingMode`	identifies the data acquisition mode during the subscan.
`correlatorCalibration`	`CorrelatorCalibration`	identifies the correlator calibration during the subscan.

Column Descriptions:

`execBlockId` : ExecBlock Table identifier.

`scanNumber` : The scan number. This increments starting from 1 in each Execution Block.

`subscanNumber` : The subscans in a scan are numbered incrementally starting from 1 in each new scan.

`startTime` : The time when the subscan started collecting science data.

`endTime` : The time when the subscan finished collecting science data.

`fieldName` : The name of the field observed during this subscan.

`subscanIntent` : The intent for this subscan.

N_{Inte} : The number of integrations in this subscan.

N_{Subi} : The number of sub-integrations in each one of the integrations of this subscan.

`subscanMode` : Describe the mode in which data was taken. Can be e.g. nutator switching, frequency switching, or no switching.

`correlatorCalibration` : Indicates whether this subscan is used for correlator internal calibration.

1.58 SwitchCycle Table

Cycle information in switching modes. Describe each step in a switching cycle.

SwitchCycle		
Name	Type (Shape)	Comment
Key		
`switchCycleId`	`Tag`	identifies a unique row in the table.
Required Data		
N_{Step} (N_{Step})	`int`	the number of steps.
`weightArray`	`float [numStep]`	the weights (one value per step).
`dirOffsetArray`	`Angle [numStep] [2]`	the pointing direction offsets (one pair per step).
`freqOffsetArray`	`Frequency [numStep]`	the frequencies offsets (one value per step).
`stepDurationArray`	`Interval [numStep]`	the duration of the steps (one value per steps).
Optional Data		
`directionCode`	`DirectionReferenceCode`	the reference frame associated to dirOffsetArray.t
`directionEquinox`	`ArrayTime`	the equinox associated to directionCode (if required).

Column Descriptions:

`switchCycleId` : Identifies each row of the Switch Cycle table.

N_{Step} : The number of steps in the swtching cycle.

`weightArray` : Specify a weight to be used for each step of the switching cycle, when combining data (useful to differenciate signal and reference steps).

`dirOffsetArray` : Gives the pointing direction offsets in each step of the switching cycle AZELNOWAntenna.position

`freqOffsetArray` : Gives the frequency offsets in each step of the switching cycle.

`stepDurationArray` : The durations of the steps in the switching cycle.

`directionCode` : The reference frame associated to dirOffsetArray.

`directionEquinox` : The source direction reference equinox , if required by `directionCode` (e.g. being other than `AZEL` or `J2000`)

1.59 SysCal Table

System calibration. Gives information on the conversion of data to temperature scale. This table is reduced to follow the contents of the Measurement Set SysCal table. Use only spectral values (use a single channel spectral window for single numbers). `numChan` can be found in the SpectralWindow Table. The contents of this table are used to scale the data in the filler.

SysCal		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.
`timeInterval`	`ArrayTimeInterval`	time interval for which the row's content is valid.
`feedId`	`int`	refers to a collection of rows in FeedTable.
Required Data		
N_{Rece} (N_{Rece})	`int`	the number of receptors.
N_{Chan} (N_{Chan})	`int`	the number of frequency channels.
Optional Data		
`tcalFlag`	`bool`	the calibration temperature flag.
`tcalSpectrum`	`Temperature [numReceptor] [numChan]`	the calibration temperatures (one value per receptor per channel).
`trxFlag`	`bool`	the receiver temperature flag.
`trxSpectrum`	`Temperature [numReceptor] [numChan]`	the receiver temperatures (one value per receptor per channel).
`tskyFlag`	`bool`	the sky temperature flag.
`tskySpectrum`	`Temperature [numReceptor] [numChan]`	the sky temperatures (one value per receptor per channel).
`tsysFlag`	`bool`	the system temperature flag.
`tsysSpectrum`	`Temperature [numReceptor] [numChan]`	the system temperatures (one value per receptor per channel).
`tantFlag`	`bool`	the tant flag.
`tantSpectrum`	`float [numReceptor] [numChan]`	the Tant spectrum (one value per receptor per channel).
`tantTsysFlag`	`bool`	the Tant/Tsys flag.
`tantTsysSpectrum`	`float [numReceptor] [numChan]`	the Tant/Tsys spectrum(one value per receptor per channel) .
`phaseDiffFlag`	`bool`	the phase difference flag.
`phaseDiffSpectrum`	`float [numReceptor] [numChan]`	the phase difference spectrum (one value per receptor per channel).

Column Descriptions:

`antennaId` : Specifies which antenna was used in the Antenna Table.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Time Interval of validity of the SysCal information

`feedId` : Specifies which feed was used in the Feed Table.

N_{Rece} : The number of receptors.

N_{Chan} : The number of frequency channels.

`tcalFlag` : Calibration temperature flag.

`tcalSpectrum` : Calibration temperature for each channel.

`trxFlag` : Receiver temperature flag.

`trxSpectrum` : Receiver temperature for each channel.

`tskyFlag` : Sky temperature flag.

`tskySpectrum` : Sky temperature for each channel

`tsysFlag` : System temperature flag.

`tsysSpectrum` : System temperature for each channel.

`tantFlag` : Tant Flag (MS compatibility).

`tantSpectrum` : Tant Spectrum (MS compatibility).

`tantTsysFlag` : Tant/Tsys Flag (MS compatibility).

`tantTsysSpectrum` : Tant/Tsys Spectrum (MS compatibility).

`phaseDiffFlag` : Phase Difference Flag (MS compatibility)

`phaseDiffSpectrum` : Phase Difference Spectrum (MS compatibility)

1.60 SysPower Table

This table is intended to store power measurements based on a synchronous power detector as used at the EVLA. While the table is intended to be general enough for use with other arrays, it is deeply entwined with the EVLA data acquisition scheme. The units of P_{diff} and P_{sum} are such that the system temperature, T_{sys}, is : $T_{sys} = \frac{P_{sum}}{P_{diff}}.\frac{T_{cal}}{2}$ where T_{cal} is the temperature of the noise tube.

SysPower		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	doc missing
`spectralWindowId`	`Tag`	doc missing
`feedId`	`int`	doc missing
`timeInterval`	`ArrayTimeInterval`	time interval over which the content of the row was measured.
Required Data		
N_{Rece} (N_{Rece})	`int`	The number of receptors.
Optional Data		
`switchedPowerDifference`	`float [numReceptor]`	the switched power difference P_{diff} defined by $P_{diff} = G * (P_{on} - P_{off})$.
`switchedPowerSum`	`float [numReceptor]`	the switched power sum P_{sum} defined by $P_{sum} = G(P_{on} + P_{off})$.
`requantizerGain`	`float [numReceptor]`	refers to the gain inserted after the synchronous power detector. For WIDAR, it is the requantizer gain (G).

Column Descriptions:

`antennaId` : missing

`spectralWindowId` : missing

`feedId` : missing

`timeInterval` : long doc missing

N_{Rece} : long doc missing

`switchedPowerDifference` : long doc missing

`switchedPowerSum` : long doc missing

`requantizerGain` : long doc missing

1.61 WVMCal Table

Coefficients to use water vapour monitor information to correct for pathlength variations. This contains the coefficients actually used, while CalWVR contains the coefficients derived from TelCal calibration.

WVMCal		
Name	Type (Shape)	Comment
Key		
`antennaId`	`Tag`	refers to a unique row in AntennaTable.
`spectralWindowId`	`Tag`	refers to a unique row in SpectralWindowTable.
`timeInterval`	`ArrayTimeInterval`	the time interval for which the row's content is valid.
Required Data		
`wvrMethod`	`WVRMethod`	identifies the calibration method.
`polyFreqLimits`	`Frequency [2]`	the range of frequencies in which the computation is performed.
N_{Inpu} (N_{Inpu})	`int`	The number of antennas used for the calculations.
N_{Chan} (N_{Chan})	`int`	the number of WVR channels.
N_{Poly} (N_{Poly})	`int`	the number of coefficients used in the polynomial expansions.
`pathCoeff`	`float [numInputAntenna] [numChan] [numPoly]`	the pathlengths coefficients (one value per antenna per chan per coefficient).
`refTemp`	`Temperature [numInputAntenna] [numChan]`	the reference temperatures (one value par antenna per channel).
`inputAntennaId`	`Tag [numInputAntenna]`	Refers to row(s) in the Antenna table describing the antenna(s) used for the calculations. It is a 1D array expected to have numInputAntenna elements.

Column Descriptions:

`antennaId` : Antenna Table identifier.

`spectralWindowId` : SpectralWindow Table identifier.

`timeInterval` : Time Interval of validity of the Water Vapour information.

`wvrMethod` : Calibration method (see CalWVR table).

`polyFreqLimits` : Frequency limits of the frequency interval for which the path length coefficients are computed.

N_{Inpu} : long doc missing

N_{Chan} : The number of WVR channels.

N_{Poly} : Number of coefficients in polynomial expansion on frequency.

`pathCoeff` : Pathlength coefficients (see CalWVR table).

`refTemp` : Reference temperatures (see CalWVR table).

`inputAntennaId` : long doc missing

1.62 Weather Table

Weather station information.

Weather		
Name	Type (Shape)	Comment
Key		
`stationId`	`Tag`	refers to a unique row in StationTable.
`timeInterval`	`ArrayTimeInterval`	the time interval for which the row's content is valid.
Required Data		
Optional Data		
`pressure`	`Pressure`	the ambient pressure.
`relHumidity`	`Humidity`	the relative humidity.
`temperature`	`Temperature`	the ambient temperature.
`windDirection`	`Angle`	the wind direction.
`windSpeed`	`Speed`	the wind speed.
`windMax`	`Speed`	the maximum wind speed
`dewPoint`	`Temperature`	the dew point's value.
N_{Laye} (N_{Laye})	`int`	NLayer the number of layers in the temperature profile.
`layerHeight`	`Length [numLayer]`	the height of each layer for the temperature profile.
`temperatureProfile`	`Temperature [numLayer]`	the temperature on the atmosphere at each height.
`cloudMonitor`	`Temperature`	the temperature of the cloud monitor.
N_{WVR} (N_{WVR})	`int`	the number of WVR channels.
`wvrTemp`	`Temperature [numWVR]`	the observed temperature in each WVR channel.
`water`	`double`	the water precipitable content.

Column Descriptions:

`stationId` : Station Table identifier.

`timeInterval` : Time Interval of validity of the weather information.

`pressure` : Ambient pressure (observatory ground level).

`relHumidity` : Relative humidity (related to dewpoint temperature).

`temperature` : Ambient temperature.

`windDirection` : Wind direction (counted East from North).

`windSpeed` : Average wind speed in interval.

`windMax` : Maximal wind speed in time interval.

`dewPoint` : Dewpoint temperature (related to humidity)

N_{Laye} : long doc missing

`layerHeight` : long doc missing

`temperatureProfile` : long doc missing

`cloudMonitor` : long doc missing

N_{WVR} : long doc missing

`wvrTemp` : long doc missing

`water` : long doc missing

2 List of Enumerations

2.1 Versioning information for the enumerations.

- UML description : `/diskb/data/src/branches/COMMON-FEB2017-TEMP/ICD/HLA/Enumerations/idl/ASDM_Enumerat`
- CVS revision : -1
- CVS branch :

2.2 ACAPolarization

version 1 ACA-specific ways to store pre-processed data products

ACA_STANDARD : Data product is the standard way (it is a standard observed Stokes parameter)

ACA_XX_YY_SUM : ACA has calculated I by averaging XX and YY

ACA_XX_50 : ACA has averaged XX and XX delayed by half a FFT period

ACA_YY_50 : ACA has averaged YY and YY delayed by half a FFT period

2.3 AccumMode

version 1 Accumulation modes for the Correlator

FAST : fast dump time. ALMA use case : 1 ms dump time, available only for autocorrelation.

NORMAL : normal dump time. ALMA use case : 16ms dump time, available for both autocorrelation and cross-orrelation.

UNDEFINED : Not defined or not applicable.

2.4 AntennaMake

version 1 The physical types of antenna

AEM_12 : 12m AEM antenna

MITSUBISHI_7 : 7-m Mitsubishi antenna (ACA)

MITSUBISHI_12_A : 12-m Mitsubishi antenna (ACA) (refurbished prototype)

MITSUBISHI_12_B : 12-m Mitsubishi antenna (ACA) (production)

VERTEX_12_ATF : 12-m Vertex antenna prototype

AEM_12_ATF : 12-m AEM antenna prototype

VERTEX_12 : 12-m Vertex antenna

IRAM_15 : 15-m IRAM antenna

UNDEFINED : Not defined or not applicable.

2.5 AntennaMotionPattern

version 1 Motion pattern of antenna , e.g. in a calibration scan.

NONE : No pattern.

CROSS_SCAN : Crossed scan (continuous pattern)

SPIRAL : Spiral pattern

CIRCLE : Circular pattern

THREE_POINTS : Three points pattern.

FOUR_POINTS : Four points pattern.

FIVE_POINTS : Five points pattern.

TEST : Reserved for development.

UNSPECIFIED : Unspecified pattern.

STAR :

LISSAJOUS :

2.6 AntennaType

version 1 Functional types of antenna

GROUND_BASED : Ground-based antenna

SPACE_BASED : Antenna in a spacecraft

TRACKING_STN : Space-tracking station antenna

2.7 AssociatedCalNature

version 1 These are the associated calibration natures

ASSOCIATED_EXECBLOCK : The associated execblock id concatenated to produce the data set

2.8 AssociatedFieldNature

version 1 [ASDM.Field] Nature of the associated field

ON : The associated field is used as ON source data

OFF : The associated field is used as OFF source data

PHASE_REFERENCE : The associated field is used as Phase reference data

2.9 AtmPhaseCorrection

version 1 Status of Phase correction

AP_UNCORRECTED : Data has no WVR phase correction

AP_CORRECTED : Data phases have been corrected using WVR data

2.10 AxisName

version 1 Axis names.

TIM : Time axis.

BAL : Baseline axis.

ANT : Antenna axis.

BAB : Baseband axis.

SPW : Spectral window axis.

SIB : Sideband axis.

SUB : Subband axis.

BIN : Bin axis.

APC : Atmosphere phase correction axis.

SPP : Spectral point axis.

POL : Polarization axis (Stokes parameters).

STO : Stokes parameter axis.

HOL : Holography axis.

2.11 BasebandName

version 1 Baseband names

NOBB : Baseband not applicable.

BB_1 : Baseband one

BB_2 : Baseband two

BB_3 : Baseband three

BB_4 : Baseband four

BB_5 : Baseband five (not ALMA)

BB_6 : Baseband six (not ALMA)

BB_7 : Baseband seven (not ALMA)

BB_8 : Baseband eight (not ALMA)

BB_ALL : All ALMA basebands (i.e. all available basebands)

A1C1_3BIT :

A2C2_3BIT :

AC_8BIT :

B1D1_3BIT :

B2D2_3BIT :

BD_8BIT :

2.12 BaselineReferenceCode

version 1 defines reference frames to qualify the measure of a baseline.

J2000 : mean equator, equinox J2000.0

B1950 : mean equator, equinox B1950.0

GALACTIC : galactic coordinates.

SUPERGAL : supergalactic coordinates.

ECLIPTIC : ecliptic for J2000.0

JMEAN : mean equator.

JTRUE : true equator.

APP : apparent geocentric.

BMEAN : mean equator.

BTRUE : true equator.

JNAT : geocentric natural frame.

MECLIPTIC : ecliptic for mean equator.

TECLIPTIC : ecliptic for true equator.

TOPO : apparent geocentric

MERCURY : from JPL DE table.

VENUS :

MARS :

JUPITER :

SATURN :

NEPTUN :

SUN :

MOON :

HADEC :

AZEL :

AZELGEO :

AZELSW : topocentric Az/El (N =¿ E).

AZELNE : idem AZEL.

ITRF : ITRF earth frame.

2.13 BinaryDataFlags

version 1 This enumeration declares an ordered list of flagging conditions used to build the flag part in the BDF content. Each enumerator is associated to one bit in a bitset. A bit set to one (resp. zero) means that the corresponding flagging condition is set (resp. unset). The current convention limits the length of the enumeration to 32; the position (0-based) of the enumerator in the enumeration defines the bit position. Any bit whose position is greater or equal to the length of the enumeration and less than 32 should be ignored by the software since it does not correspond to any flagging condition.

INTEGRATION_FULLY_BLANKED : All dumps within an integration duration are blanked. When this flag is raised the effect is to have the bin part actualDurations containing zeros? In other words it means 'all dumps affected'. Bit position == 0

WVR_APC : Coefficients not received.Apply to all BAL involving the antenna. Bit position == 1

CORRELATOR_MISSING_STATUS : Correlator status was not retrieved for the period. So yielded data are not reliable. Apply to all BBs handled by the correlator. Bit position == 2

MISSING_ANTENNA_EVENT : Antenna delay event was not retrieved for the period. So yielded data are not reliable. BALs including the antenna. Bit position == 3

DELTA_SIGMA_OVERFLOW : In data transmission between the MTI cards, there are one or more channels whose absolute value differences between adjacent channel values are bigger than the maximum number. Bit position == 4

DELAY_CORRECTION_NOT_APPLIED : no residual delay correction was applied. It implies that either base-band offset delays from TMCDB were not available or that delay events from the delay server were not received on time to compute and apply a phase rotation to base-lines in the array. == 5

SYNCRONIZATION_ERROR : cdp node(s) not properly synchronized to the array timing signal (48ms.) All data produced by that node(s) are suspicious.Lags and spectral processing goes as normal, it is just the flag presence in the bdf what indicates that something is suspicious. Bit position == 6

FFT_OVERFLOW : Overflowed POL and derived outputs from it. Dumps between the timestamp marked as FFT overflowed and the time back to 96msec before. Bit position == 7

TFB_SCALING_FACTOR_NOT_RETRIEVED : CCC cannot retrieve scaling factors during calibration for specific antennas the calibration would still end successfully but the cdp will record the faulty scaling factors and add a flag to all involved base-lines. Bit position == 8

ZERO_LAG_NOT_RECEIVED : CDP node handling only cross antenna intersections did not receive lag zero information from node(s) handling auto intersections for involved antennas in that cross intersection. Bit position == 9

SIGMA_OVERFLOW : Auto-correlation sigma levels makes impossible any 2 bits quantization correction on lags data. One sigma value out of range affects that antenna itself and all base-lines containing that antenna. Is it possible to merge this flags with DELTA$_{S}IGMA_{O}VERFLOW?Thedifferenceseemstobethegranularity.IfitisPOLACACORRwouldhavetorepeatth$
$Theoutputspectraaremadefrominvalidinputsignals, e.g., brokenopticalframes, missingsynchronizationornoinputsig$

UNUSABLE_CAI_OUTPUT_QUANTAILED : Quantization correction not applied due to unsuitable lag zero value. BL-CORR note: every possible signal level should be actually accepted (too small or too big), the presence of this bit signals more a software problem than an antenna signal problem. Bit position == 12

NOISY_TDM_CHANNELS : First TDM channels are normally noisy and they have a large amplitude. If that excess of amplitude in those channels would be the sole reason for keeping the integration storage at 32 bits integers then the software clips those channels and flags the data. Thus preventing large storage for otherwise 16 bits friendly dynamic range. Bit position == 13

SPECTRAL_NORMALIZATION_FAILED : Auto-correlation and zero-lags figures are required to normalize cross-correlation spectra as prescribed in Scott's 'Specifications and Clarifications of ALMA Correlator Details'. If those figures are not available on time during on-line processing then crosscorrelations are not normalized and the integration flagged. Bit position == 14

DROPPED_PACKETS : T.B.D. Bit position == 15

DETECTOR_SATURATED : T.B.D. Bit position == 16

NO_DATA_FROM_DIGITAL_POWER_METER : The current data from digital power meter are available for the calculation of the 3-bit linearity correction. An old correction factor is applied. Bit position == 17

RESERVED_18 : Not assigned.

RESERVED_19 : Not assigned.

RESERVED_20 : Not assigned.

RESERVED_21 : Not assigned.

RESERVED_22 : Not assigned.

RESERVED_23 : Not assigned.

RESERVED_24 : Not assigned.

RESERVED_25 : Not assigned.

RESERVED_26 : Not assigned.

RESERVED_27 : Not assigned.

RESERVED_28 : Not assigned.

RESERVED_29 : Not assigned.

RESERVED_30 : Not assigned.

ALL_PURPOSE_ERROR : This bit designates data flagged in the correlator but does not provide information as to the reason for the flag. Readers are expected not to process the data when this bit is set. Bit position == 31.

2.14 CalCurveType

version 1 [CalDM.CalCurve] type pf calibration curve

AMPLITUDE : Calibration curve is Amplitude

PHASE : Calibration curve is phase

UNDEFINED : Not applicable.

2.15 CalDataOrigin

version 1

TOTAL_POWER

WVR

CHANNEL_AVERAGE_AUTO

CHANNEL_AVERAGE_CROSS

FULL_RESOLUTION_AUTO

FULL_RESOLUTION_CROSS

OPTICAL_POINTING

HOLOGRAPHY

NONE

2.16 CalType

version 1 [CalDM.CalData] Used to point to a given CalResult table

CAL_AMPLI :

CAL_ATMOSPHERE :

CAL_BANDPASS :

CAL_CURVE :

CAL_DELAY :

CAL_FLUX :

CAL_FOCUS :

CAL_FOCUS_MODEL :

CAL_GAIN :

CAL_HOLOGRAPHY :

CAL_PHASE :

CAL_POINTING :

CAL_POINTING_MODEL :

CAL_POSITION :

CAL_PRIMARY_BEAM :

CAL_SEEING :

CAL_WVR :

CAL_APPPHASE : Calibration for phasing of ALMA. Applicable at ALMA.

2.17 CalibrationDevice

version 1 Devices that may be inserted in the optical path in front of the receiver.

AMBIENT_LOAD : An absorbing load at the ambient temperature.

COLD_LOAD : A cooled absorbing load.

HOT_LOAD : A heated absorbing load.

NOISE_TUBE_LOAD : A noise tube.

QUARTER_WAVE_PLATE : A transparent plate that introduces a 90-degree phase difference between othogonal polarizations.

SOLAR_FILTER : An optical attenuator (to protect receiver from solar heat).

NONE : No device, the receiver looks at the sky (through the telescope).

2.18 CalibrationFunction

version 1 Function of a scan in a calibration set. Useful only in real time.

FIRST : the scan is the first in a calibration set.

LAST : the scan is the last in a calibration set.

UNSPECIFIED : the function is not specified.

2.19 CalibrationMode

version 1 Modes of calibration

HOLOGRAPHY : Holography receiver

INTERFEROMETRY : interferometry

OPTICAL : Optical telescope

RADIOMETRY : total power

WVR : water vapour radiometry receiver

2.20 CalibrationSet

version 1 Defines sets of calibration scans to be reduced together for a result.

NONE : Scan is not part of a calibration set.

AMPLI_CURVE : Amplitude calibration scan (calibration curve to be derived).

ANTENNA_POSITIONS : Antenna positions measurement.

PHASE_CURVE : Phase calibration scan (calibration curve to be derived).

POINTING_MODEL : Pointing calibration scan (pointing model to be derived).

ACCUMULATE : Accumulate a scan in a calibration set.

TEST : Reserved for development.

UNSPECIFIED : Unspecified calibration intent.

2.21 CorrelationBit

version 1 [APDM] Number of bits used for correlation

BITS_2x2 : two bit correlation

BITS_3x3 : three bit correlation

BITS_4x4 : four bit correlation

2.22 CorrelationMode

version 1 [ASDM.Binary] Actual data products in binary data

CROSS_ONLY : Cross-correlations only [not for ALMA]

AUTO_ONLY : Auto-correlations only

CROSS_AND_AUTO : Auto-correlations and Cross-correlations

2.23 CorrelatorCalibration

version 1 Internal correlator calibrations performed duting this subscan

NONE : No internal correlator calibration

CORRELATOR_CALIBRATION : Internal correlator calibration.

REAL_OBSERVATION : A 'real' observation.

2.24 CorrelatorName

version 1

ALMA_ACA

ALMA_BASELINE

ALMA_BASELINE_ATF

ALMA_BASELINE_PROTO_OSF

HERSCHEL

IRAM_PDB

IRAM_30M_VESPA

IRAM_WILMA

NRAO_VLA

NRAO_WIDAR

2.25 CorrelatorType

version 1 defines the type of a correlator.

FX : identifies a digital correlator of type FX.

XF : identifies a digital correlator of type XF.

FXF : identifies a correlator of type FXF.

2.26 DataContent

version 1 [ASDM.Binaries] Contents of binary data attachment

CROSS_DATA : Cross-correlation data

AUTO_DATA : Auto-correlation data

ZERO_LAGS : Zero-lag data

ACTUAL_TIMES : :Actual times (mid points of integrations)

ACTUAL_DURATIONS : Actual duration of integrations

WEIGHTS : Weights

FLAGS : Baseband based flags

2.27 DataScale

version 1 Units of the cross and auto data in the BDF.

K : Visibilities in Antenna temperature scale (in Kelvin).

JY : Visibilities in Flux Density scale (Jansky).

CORRELATION : Correlated Power: WIDAR raw output, normalised by DataValid count.

CORRELATION_COEFFICIENT : Correlation Coe4;cient (Correlated Power scaled by autocorrelations).

2.28 DetectorBandType

version 1 [ASDM.SquareLawDetector] Types of detectors

BASEBAND : Detector in Baseband Processor

DOWN_CONVERTER : Detector in Down - Converter

HOLOGRAPHY_RECEIVER : Detector in Holography Receiver

SUBBAND : Detector in subband (tunable digital filter).

2.29 DifferenceType

version 1 An enumeration to qualify the values in the columns polarOffsetsType and timeType in the table DelayModelVariableParameters.

PREDICTED :

PRELIMINARY :

RAPID :

FINAL :

2.30 DirectionReferenceCode

version 1 defines reference frames to qualify the measure of a direction.

J2000 : mean equator and equinox at J2000.0

JMEAN : mean equator and equinox at frame epoch.

JTRUE : true equator and equinox at frame epoch.

APP : apparent geocentric position.

B1950 : mean epoch and ecliptic at B1950.0.

B1950_VLA :

BMEAN : mean equator and equinox at frame epoch.

BTRUE : true equator and equinox at frame epoch.

GALACTIC : galactic coordinates.

HADEC : topocentric HA and declination.

AZELSW : topocentric Azimuth and Elevation (N through E).

AZELSWGEO :

AZELNE : idem AZEL

AZELNEGEO :

JNAT : geocentric natural frame.

ECLIPTIC : ecliptic for J2000.0 equator, equinox.

MECLIPTIC : ecliptic for mean equator of date.

TECLIPTIC : ecliptic for true equatorof date.

SUPERGAL : supergalactic coordinates.

ITRF : coordinates wrt ITRF earth frame.

TOPO : apparent topocentric position.

ICRS :

MERCURY : from JPL DE table.

VENUS :

MARS :

JUPITER :

SATURN :

URANUS :

NEPTUNE :

PLUTO :

SUN :

MOON :

2.31 DopplerReferenceCode

version 1 defines reference frames to qualify the measure of a radial velocity expressed as doppler shift.

RADIO : radio definition : $1 - F$

Z : redshift : $-1 + 1/F$

RATIO : frequency ratio : F

BETA : relativistic : $(1 - F^2)/(1 + F^2)$

GAMMA : $(1 + F^2)/(2 * F)$

OPTICAL : ZZ

RELATIVISTIC : idem BETA

2.32 DopplerTrackingMode

version 1 Enumerations of different modes used in doppler tracking.

NONE : No Doppler tracking.

CONTINUOUS : Continuous (every integration) Doppler tracking.

SCAN_BASED : Doppler tracking only at scan boundaries. This means we update the observing frequency to the correct value, but only at scan boundaries.

SB_BASED : Doppler tracking only at the beginning of the Scheduling Block. We set the frequency at the beginning of the observation but leave it fixed thereafter. For the EVLA this is referred to as 'Doppler setting'.

2.33 FieldCode

version 1 [ASDM.Field] code for Field

NONE :

2.34 FilterMode

version 1 [APDM.Correlator] Modes of correlator input filtering

FILTER_NA : Not Applicable (2 antenna prototype). The Tunable Filter Banks are not implemented

FILTER_TDM : Time Division Mode. In this mode the Tunable Filter banks are bypassed

FILTER_TFB : The Tunable Filter Bank is implemented and used

UNDEFINED : Not defined or not applicable.

2.35 FluxCalibrationMethod

version 1 [CalDM.CalFlux] Methods for flux calibration

ABSOLUTE : Absolute flux calibration (based on standard antenna)

RELATIVE : Relative flux calibration (based on a primary calibrator)

EFFICIENCY : Flux calibrator based on tabulated antenna efficiciency

2.36 FocusMethod

version 1 [CalDM.CalFocus] Method of focus measurement

THREE_POINT : Three-point measurement

FIVE_POINT : Five-point measurement

HOLOGRAPHY :

2.37 FrequencyReferenceCode

version 1 defines reference frames to qualify the measure of a frequency.

LABREST : spectral line rest frequency.

LSRD : dynamic local standard of rest.

LSRK : kinematic local standard rest.

BARY : barycentric frequency.

REST : spectral line frequency

GEO : geocentric frequency.

GALACTO : galactocentric frequency.

TOPO : topocentric frequency.

2.38 HolographyChannelType

version 1 [ASDM.Holography] Type sof holography receiver output channels

Q2 : Quadrature channel auto-product

QR : Quadrature channel times Reference channel cross-product

QS : Quadrature channel times Signal channel cross-product

R2 : Reference channel auto-product

RS : Reference channel times Signal channel cross-product

S2 : Signal channel auto-product

2.39 InvalidatingCondition

version 1 [CalDM.CalReduction] Contitions invalidating result

ANTENNA_DISCONNECT : Antenna was disconnected

ANTENNA_MOVE : Antenna was moved

ANTENNA_POWER_DOWN : Antenna was powered down

RECEIVER_EXCHANGE : Receiver was exchanged

RECEIVER_POWER_DOWN : Receiver was powered down

2.40 NetSideband

version 1 [ASDM.SpectralWindow] Equivalent side band of spectrum frequency axis

NOSB : No side band (no frequency conversion)

LSB : Lower side band

USB : Upper side band

DSB : Double side band

2.41 PointingMethod

version 1 [CalDM.CalPointing] Method of pointing measurement

THREE_POINT : Three-point scan

FOUR_POINT : Four-point scan

FIVE_POINT : Five-point scan

CROSS : Cross scan

CIRCLE : Circular scan

HOLOGRAPHY :

2.42 PointingModelMode

version 1 [CalDM.PointingModel] Mode of Pointing Model

RADIO : Radio pointing model

OPTICAL : Optical Pointing Model

2.43 PolarizationType

version 1 The polarizations a single receptor can detect

R : Right-handed Circular

L : Left-handed Circular

X : X linear

Y : Y linear

BOTH : The receptor responds to both polarizations.

2.44 PositionMethod

version 1 [CalDM.CalPositions] Method used for measuring antenna positions

DELAY_FITTING : Delays are measured for each source; the delays are used for fitting antenna position errors.

PHASE_FITTING : Phases are measured for each source; these phases are used to fit antenna position errors.

2.45 PositionReferenceCode

version 1 defines reference frames to qualify the measure of a position.

ITRF : International Terrestrial Reference Frame.

WGS84 : World Geodetic System.

SITE : Site reference coordinate system (ALMA-80.05.00.00-009-B-SPE).

STATION : Antenna station reference coordinate system (ALMA-80.05.00.00-009-SPE).

YOKE : Antenna yoke reference coordinate system (ALMA-980.05.00.00-009-B-SPE)

REFLECTOR : Antenna reflector reference coordinate system (ALMA-80.05.00.00-009-B-SPE).

2.46 PrimaryBeamDescription

version 1 Nature of the quantity tabulated to describe the primary beam.

COMPLEX_FIELD_PATTERN : Electric Field Pattern image at infinite distance from antenna.

APERTURE_FIELD_DISTRIBUTION : Electric Field aperture distribution.

2.47 PrimitiveDataType

version 1 [ASDM.Binaries] Primitive data types for binary MIME attachments

INT16_TYPE : 2 bytes signed integer (short).

INT32_TYPE : 4 bytes signed integer (int).

INT64_TYPE : 8 bytes signed integer (long long).

FLOAT32_TYPE : 4 bytes float (float).

FLOAT64_TYPE : 8 bytes float (double).

2.48 ProcessorSubType

version 1 [ASDM.Processor] The tables used to contain device configuration data

ALMA_CORRELATOR_MODE : ALMA correlator.

SQUARE_LAW_DETECTOR : Square law detector.

HOLOGRAPHY : Holography.

ALMA_RADIOMETER : ALMA radiometer.

2.49 ProcessorType

version 1 [ASDM.Processor] Types of processors

CORRELATOR : A digital correlator

RADIOMETER : A radiometer

SPECTROMETER : An (analogue) multi-channel spectrometer

2.50 RadialVelocityReferenceCode

version 1

LSRD

LSRK

GALACTO

BARY

GEO

TOPO

2.51 ReceiverBand

version 1 [ASDM.Receiver] Receiver band names

ALMA_RB_01 : ALMA Receiver band 01

ALMA_RB_02 : ALMA Receiver band 02

ALMA_RB_03 : ALMA Receiver band 03

ALMA_RB_04 : ALMA Receiver band 04

ALMA_RB_05 : ALMA Receiver band 05

ALMA_RB_06 : ALMA Receiver band 06

ALMA_RB_07 : ALMA Receiver band 07

ALMA_RB_08 : ALMA Receiver band 08

ALMA_RB_09 : ALMA Receiver band 09

ALMA_RB_10 : ALMA Receiver band 10

ALMA_RB_ALL : all ALMA receiver bands.

ALMA_HOLOGRAPHY_RECEIVER : Alma transmitter Holography receiver.

BURE_01 : Plateau de Bure receiver band 1.

BURE_02 : Plateau de Bure receiver band 2.

BURE_03 : Plateau de Bure receiver band 3.

BURE_04 : Plateau de Bure receiver band 4

EVLA_4 :

EVLA_P :

EVLA_L :

EVLA_C :

EVLA_S :

EVLA_X :

EVLA_Ku :

EVLA_K :

EVLA_Ka :

EVLA_Q :

UNSPECIFIED : receiver band of unspecified origin.

2.52 ReceiverSideband

version 1 [ASDM.SpectralWindow] The type of receiver output a spectral window is fed with

NOSB : direct output signal (no frequency conversion).

DSB : double side band ouput.

SSB : single side band receiver.

TSB : receiver with dual output.

2.53 SBType

version 1 [ASDM.SBSummary] Types of Scheduling Block

OBSERVATORY : Observatory mode scheduling block

OBSERVER : Observer mode scheduling block

EXPERT : Expert mode scheduling block

2.54 ScanIntent

version 1 [ASDM.Scan] Scan intents

CALIBRATE_AMPLI : Amplitude calibration scan

CALIBRATE_ATMOSPHERE : Atmosphere calibration scan

CALIBRATE_BANDPASS : Bandpass calibration scan

CALIBRATE_DELAY : Delay calibration scan

CALIBRATE_FLUX : flux measurement scan.

CALIBRATE_FOCUS : Focus calibration scan. Z coordinate to be derived

CALIBRATE_FOCUS_X : Focus calibration scan; X focus coordinate to be derived

CALIBRATE_FOCUS_Y : Focus calibration scan; Y focus coordinate to be derived

CALIBRATE_PHASE : Phase calibration scan

CALIBRATE_POINTING : Pointing calibration scan

CALIBRATE_POLARIZATION : Polarization calibration scan

CALIBRATE_SIDEBAND_RATIO : measure relative gains of sidebands.

CALIBRATE_WVR : Data from the water vapor radiometers (and correlation data) are used to derive their calibration parameters.

DO_SKYDIP : Skydip calibration scan

MAP_ANTENNA_SURFACE : Holography calibration scan

MAP_PRIMARY_BEAM : Data on a celestial calibration source are used to derive a map of the primary beam.

OBSERVE_TARGET : Target source scan

CALIBRATE_POL_LEAKAGE :

CALIBRATE_POL_ANGLE :

TEST : used for development.

UNSPECIFIED : Unspecified scan intent

CALIBRATE_ANTENNA_POSITION : Requested by EVLA.

CALIBRATE_ANTENNA_PHASE : Requested by EVLA.

MEASURE_RFI : Requested by EVLA.

CALIBRATE_ANTENNA_POINTING_MODEL : Requested by EVLA.

SYSTEM_CONFIGURATION : Requested by EVLA.

CALIBRATE_APPPHASE_ACTIVE : Calculate and apply phasing solutions. Applicable at ALMA.

CALIBRATE_APPPHASE_PASSIVE : Apply previously obtained phasing solutions. Applicable at ALMA.

OBSERVE_CHECK_SOURCE :

CALIBRATE_DIFFGAIN : Enable a gain differential target type

2.55 SchedulerMode

version 1 [ASDM.SBSummary] Scheduler operation mode

DYNAMIC : Dynamic scheduling

INTERACTIVE : Interactive scheduling

MANUAL : Manual scheduling

QUEUED : Queued scheduling

2.56 SidebandProcessingMode

version 1 [ASDM.SpectralWindow] Real-time processing to derive sideband data

NONE : No processing

PHASE_SWITCH_SEPARATION : Side band separation using 90-degree phase switching

FREQUENCY_OFFSET_SEPARATION : Side band separation using offsets of first ans second oscillators

PHASE_SWITCH_REJECTION : Side band rejection 90-degree phase switching

FREQUENCY_OFFSET_REJECTION : Side band rejection using offsets of first and second oscillators

2.57 SourceModel

version 1 [CalDM.CalFlux] Source Model

GAUSSIAN : Gaussian source

POINT : Point Source

DISK : Uniform Disk

2.58 SpectralResolutionType

version 1 [ASDM.SpectralWindow] The types of spectral resolutions for spectral windows.

CHANNEL_AVERAGE :

BASEBAND_WIDE :

FULL_RESOLUTION :

2.59 StationType

version 1 [ASDM.Station] Type of antenna station

ANTENNA_PAD : Astronomical Antenna station

MAINTENANCE_PAD : Maintenance antenna station

WEATHER_STATION : Weather station

2.60 StokesParameter

version 1 Stokes parameters (CASA definition)

I :

Q :

U :

V :

RR :

RL :

LR :

LL :

XX : Linear correlation product

XY :

YX :

YY :

RX : Mixed correlation product

RY : Mixed correlation product

`LX` : Mixed LX product

`LY` : Mixed LY correlation product

`XR` : Mixed XR correlation product

`XL` : Mixed XL correlation product

`YR` : Mixed YR correlation product

`YL` : Mixel YL correlation product

`PP` :

`PQ` :

`QP` :

`QQ` :

`RCIRCULAR` :

`LCIRCULAR` :

`LINEAR` : single dish polarization type

`PTOTAL` : Polarized intensity $((Q^2 + U^2 + V^2)^(1/2))$: $Linearly Polarized intensity((Q^2 + U^2)^(1/2))$

`PLINEAR` : Polarization Fraction (Ptotal/I)

`PFLINEAR` : Linear Polarization Fraction (Plinear/I)

`PANGLE` : Linear Polarization Angle (0.5 arctan(U/Q)) (in radians)

2.61 `SubscanIntent`

version 1 [ASDM.Subscan] Precise the intent for a subscan

`ON_SOURCE` : on-source measurement

`OFF_SOURCE` : off-source measurement

`MIXED` : Pointing measurement, some antennas are on -ource, some off-source

`REFERENCE` : reference measurement (used for boresight in holography).

`SCANNING` : antennas are scanning.

`HOT` : hot load measurement.

`AMBIENT` : ambient load measurement.

`SIGNAL` : Signal sideband measurement.

`IMAGE` : Image sideband measurement.

`TEST` : reserved for development.

`UNSPECIFIED` : Unspecified

2.62 SwitchingMode

version 1 Switching modes: there are two categories of switching modes, those at high rate (chopper wheel, nutator and frequency switch) which involve the BIN axis and those at low rate (frequency, position, load and phase switching) unrelated to the bin axis. Note that in case of frequency switching mode it is the context which tells in which of these two categories it is used.

NO_SWITCHING : No switching

LOAD_SWITCHING : Receiver beam is switched between sky and load

POSITION_SWITCHING : Antenna (main reflector) pointing direction is switched

PHASE_SWITCHING : 90 degrees phase switching (switching mode used for sideband separation or rejection with DSB receivers)

FREQUENCY_SWITCHING : LO frequency is switched (definition context sensitive: fast if cycle shrorter than the integration duration, slow if e.g. step one step per subscan)

NUTATOR_SWITCHING : Switching between different directions by nutating the sub-reflector

CHOPPER_WHEEL : Switching using a chopper wheel

2.63 SynthProf

version 1

NOSYNTH

ACACORR

ACA_CDP

2.64 SyscalMethod

version 1 [CalDM.CalAtmosphere] Atmosphere calibration methods

TEMPERATURE_SCALE : Use single direction data to compute ta* scale

SKYDIP : Use a skydip (observing the sky at various elevations) to get atmospheric opacity

SIDEBAND_RATIO : Measure the sideband gain ratio.

2.65 TimeSampling

version 1 Time granularity for data

SUBINTEGRATION : Part of an integration

INTEGRATION : Part of a subscan. An integration may be composed of several sub-integrations.

2.66 TimeScale

version 1 Time standards.

UTC : Coordinated Universal Time.

TAI : International Atomic Time.

2.67 WVRMethod

version 1 [CalDM.CalWVR] Methods for WVR Data processing in TelCal

ATM_MODEL : WVR data reduction uses ATM model

EMPIRICAL : WVR data reduction optimized using actual phase data

2.68 WeightType

version 1

K

JY

COUNT_WEIGHT

2.69 WindowFunction

version 1 [APDM; ASDM.ALmaCorrelatorMode] Windowing functions for spectral data apodization

UNIFORM : No windowing

HANNING : Raised cosine: $0.5 * (1 - cos(x))$ where $x = 2 * \pi * i/(N-1)$

HAMMING : The classic Hamming window is $W_M(x) = 0.54 - 0.46 * \cos(x)$. This is generalized to $W_M(x) = \beta - (1-\beta) * \cos(x)$ where β can take any value in the range $[0, 1]$. $\beta = 0.5$ corresponds to the Hanning window.

BARTLETT : The Bartlett (triangular) window is $1 - |x/\pi|$, where $x = 2 * \pi * i/(N-1)$.

BLACKMANN : The window function is $W_B(x) = (0.5-\beta)-0.5*\cos(x_j)+\beta*\cos(2x_j)$, where $x_j = 2*\pi*j/(N-1)$. The classic Blackman window is given by $\beta = 0.08$.

BLACKMANN_HARRIS : The BLACKMANN$_H ARRIS windowis 1.0$ - 1.36109*cos(x) + $0.39381 * \cos(2 * x) - 0.032557 * \cos(3 * x)$, where $x = 2 * \pi * i/(N-1)$.

WELCH : The Welch window (parabolic) is $1 - (2 * i/N)^2$.