



Software Planning and Testing

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ALMA Software Planning

ALMA software was originally planned by the Science Software Requirements (SSR) Committee, which produced a series of software requirements, and the use cases by which these were developed.

Requirements and use cases were provided to Computing Integrated Product Team (CIPT) for implementation. The SSR Committee continues, but their role is gradually changing as software implementation and deployment on working arrays progresses.



Evolution of the SSR

- The SSR has now expanded to form the eSSR (the extended SSR) which will act as a single point of contact to CIPT. (Expanded not in the sense of more people on the telecon, but more active in user testing and planning.)
- The eSSR will be based at the JAO, as most implementation and end-to-end testing will take place in Chile. Science Team members are assigned to perform regular subsystem tests, organized by subsystem scientists, and also integrated tests at the OSF.
- In addition, AIV, CSV and SciOps have identified further software functionality needed for their activities during the period preceding full science operations. In particular, AIV and CSV need tools for single dish checkout, and for arrays with very few antennas and reduced tuning/correlator/etc capabilities, for working with pre-production hardware.



eSSR Structure and Roles

eSSR provides:

Input to CIPT on:

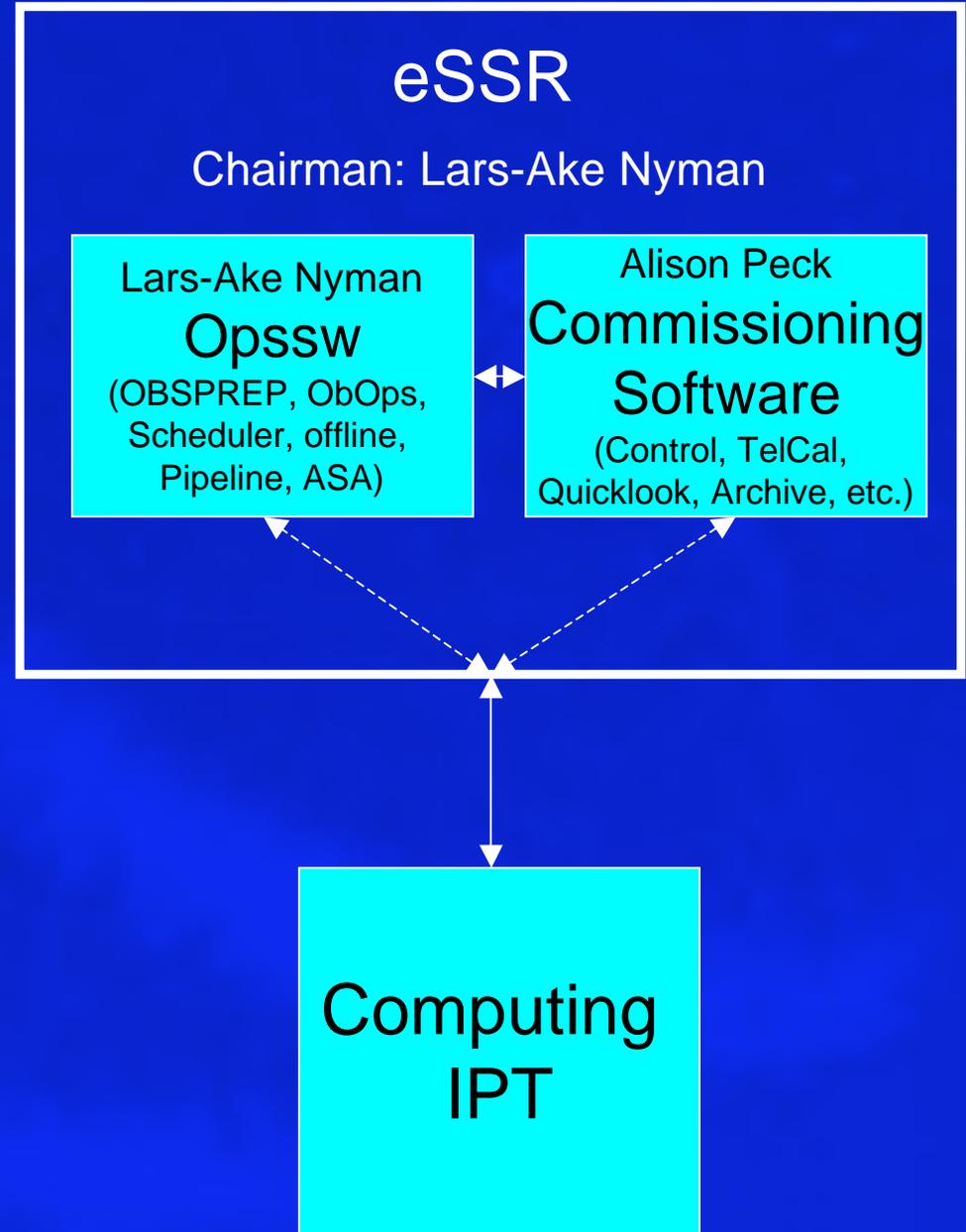
- Science and operations requirements
- Priorities
- Results of continuous user testing at OSF to support the validation of new releases
- Incremental Acceptance Test reports
- Input to developers on operational issues
- Status overview reviews

CIPT provides:

- Status reports on development
- Verification matrices for user and acceptance tests

eSSR Members:

- Staff from Science Team
- Subsystem scientists
- CIPT members
- Others





Isolated subsystem tests

These are organized by the subsystem scientists as necessary and involve external testers selected by the subsystem scientists. This will continue to take place as desired, and the eSSR will now provide dedicated testers from the JAO Science Team. The majority of the tests run in Santiago will be organized by Mark Rawlings for Operations. This is not expected to take a significant fraction of any individual's time, because the pool of potential testers is large. The goal is to have different testers for each iteration, to uncover the largest number of issues or areas for improvement.

Acceptances will not be done on isolated subsystems, as all subsystems need to work together to be successful.



Integrated user tests in Chile

The Science Team will be using most recent stable software version at the OSF continuously. The sequence of events will be:

1. CIPT tests new version in simulation, at Executives and on Standard Test Environment (STE) in Santiago.
2. CIPT tests new version on real system at OSF during dedicated shifts when satisfied with simulations, and provide documentation.
3. Science staff test new version at OSF on working antennas with much CIPT support, during dedicated shifts.
4. When CIPT and Science staff feel the version is “stable,” that version will be released, and used by the Science Team to carry out normal OSF operations. (Local computing support still available, obviously.)
5. Incremental Acceptance Tests.



Incremental Acceptance Tests

- Integrated acceptance tests will be incremental and typically take place twice per year to match the CIPT version release cycle.
- Acceptance tests will follow the user tests, and are expected to take place 2-3 months after the release of each of Rx.0 and of Rx.1.
- The acceptance test organization will be done by L.-A. Nyman, A. Peck and J. McMullin, with testers selected semi-randomly from the Science Team who work at the OSF.
- Compliance matrices will be produced by CIPT (based on priorities given by AIV/CSV/Ops) and reviewed before presentation to the testers. The testers will then write reports, eSSR will review reports, consolidate results and comments, and pass comments, requests and new requirements back to CIPT 2-3 months before next release.



How to create a new requirement

- Anyone can propose a new software requirement when a need is discovered.
- It can be presented to the relevant subsystem scientist or directly to the eSSR
- It will be reviewed by the eSSR and considered for delivery to CIPT.
- Proposed requirements will be sorted based on:
 - urgency
 - the level of effort required.
- Some requirements may need a CRE, others may be added informally after agreement with CIPT management.
- a subset of the eSSR will decide whether the new requirement or functionality will be forwarded to CIPT (Nyman and Peck or their representatives, as well as the subsystem scientist where needed and CIPT management).



Oversight of Software Deployment by Control Software Coordination Group

The CSCG was formed in 2007 after testing began at the ATF. The group meets biweekly to monitor deployment of software, re-evaluate priorities for development as testing and integration needs evolve, and to make sure all parties have the resources required to continue development and testing in an efficient manner.

Comprised of: Peck (DPS, Chair), McMullin (AIV Lead), Kern (Control S/w Lead), Ibsen (JAO Computing Lead), Allaert (CIPT)



Long-term planning done by larger group in face to face meetings

Recent meetings - Joint planning meeting in Jan 2009,
Santiago:

Attended by reps from AIV, CSV, Operations and CIPT
Output is Software Schedule spreadsheet
Spreadsheet then reviewed by all groups independently
and approved ~2 months later.

CDR7 - July 2009

Incremental Design Review to track progress and
identify problems which could slow development

Also External Software Review, Nov 2008 (Wim Brouw, chair)



Software development and deployment schedule

Item ID	Task Description	Responsible Party	Duration	Start Date	End Date	Dependencies
86	Observing Functionality:		653 days?	Tue 08-09-30	Fri 11-04-01	tionality:
87	Obs Mode: Astronomical Holography		147 days	Tue 09-03-10	Thu 09-10-01	ode: Astronomical Holography
88	Astro Holography Observing Mode / CCL Interface (Control, TelCal, ObsF	Control	3 wks	Tue 09-03-10	Tue 09-03-31	erface (Control, TelCal, ObsPrep)
89	Holography reduction & results archiving (TelCal - GILDAS/Robert)	TelCal	0 days	Thu 09-10-01	Thu 09-10-01	phy reduction & results archiving (TelCal - GILDAS/Robert)
90	## Obs Mode: Production Optical telescope (control)		58 days	Mon 09-08-03	Wed 09-10-21	Obs Mode: Production Optical telescope (control)
91	Device Testing & control code development	Control	4.2 wks	Mon 09-08-03	Mon 09-08-31	Device Testing & control code development
92	Obs mode development	Control	22 days	Tue 09-09-01	Wed 09-09-30	Obs mode development
93	System Integration	Control	3 wks	Thu 09-10-01	Wed 09-10-21	System Integration
94	Obs Mode: Focus		143 days	Mon 09-03-16	Wed 09-09-30	Obs Mode: Focus
95	Develop the observing mode (Control)	Control	12 days	Mon 09-03-16	Tue 09-03-31	lop the observing mode (Control)
96	Autofocus/autocollimation for secondary	Control	2 mons	Thu 09-08-06	Wed 09-09-30	Autofocus/autocollimation for secondary
97	Obs Mode: Total Power Pointing (Control)	Control	20 days	Fri 09-05-29	Thu 09-06-25	Obs Mode: Total Power Pointing (Control)
98	Track Jovian Satellites (Control, CASA)	Control	1 mon	Fri 09-05-29	Thu 09-06-25	Track Jovian Satellites (Control, CASA)
99	Obs Mode: Sky Dip	Control	22 days	Mon 09-03-02	Tue 09-03-31	Obs Mode: Sky Dip
100	On-line application of TelCal results, e.g. pointing/focus		64 days?	Thu 09-01-01	Tue 09-03-31	ts, e.g. pointing/focus
101	## Development of capability	Control	1 day?	Thu 09-01-01	Thu 09-01-01	elopment of capability
102	Integrated Testing at OSF (TelCal, Control, Science)	TelCal	1 wk	Wed 09-03-25	Tue 09-03-31	g at OSF (TelCal, Control, Science)
103	## Obs Mode: Square law detector		195 days	Thu 09-01-01	Wed 09-09-30	: Square law detector
104	OTF square law detector maps (last 5%)	Control	2 wks	Tue 09-03-17	Tue 09-03-31	uare law detector maps (last 5%)
105	## Develop Nutator Switching Mode (Control, ObsPrep, Corr/ACA, TelCal	Control	13.2 wks	Wed 09-07-01	Wed 09-09-30	hing Mode (Control, ObsPrep, Corr/ACA, TelCal)
106	TelCal analysis of nutator modes (TelCal)	TelCal	4 wks	Thu 09-01-01	Wed 09-01-28	nutator modes (TelCal)
107	Provide primary beam maps	TelCal	0 days	Tue 09-03-31	Tue 09-03-31	Provide primary beam maps
108	Obs Mode: Autocorrelation		392 days	Tue 08-09-30	Thu 10-04-01	orrelation
109	OTF total power autocorrelation maps (Control)	Control	2 wks	Tue 09-03-31	Mon 09-04-13	wer autocorrelation maps (Control)
110	Obs Mode: Single Raster scan (Control)	Control	0 days	Tue 08-09-30	Tue 08-09-30	(Control)
111	Obs Mode: OTF raster scan maps (Control)	Control	0 days	Tue 08-09-30	Tue 08-09-30	(Control)
112	## Develop Nutator Switching Mode (Control, ObsPrep, Corr/ACA, TelCal	Control	13.2 wks	Wed 09-07-01	Wed 09-09-30	hing Mode (Control, ObsPrep, Corr/ACA, TelCal)
113	Develop Frequency Switching Mode (Control, ObsPrep, Corr, ACA, TelCa	Control	3 wks	Thu 10-03-11	Thu 10-04-01	Develop Frequency Switching Mode (Control, ObsPrep, Corr
114	Pipeline/Quicklook processing	PL	2 mons	Thu 09-08-06	Thu 09-10-01	Pipeline/Quicklook processing



Current software face-to-face meetings and workshops

Sept 18-20: Observing modes workshop

Kern, Lucas, Bridger, Peck: translate first few observing modes for Early Science to control scripts for conversion to Observing Modes in OT

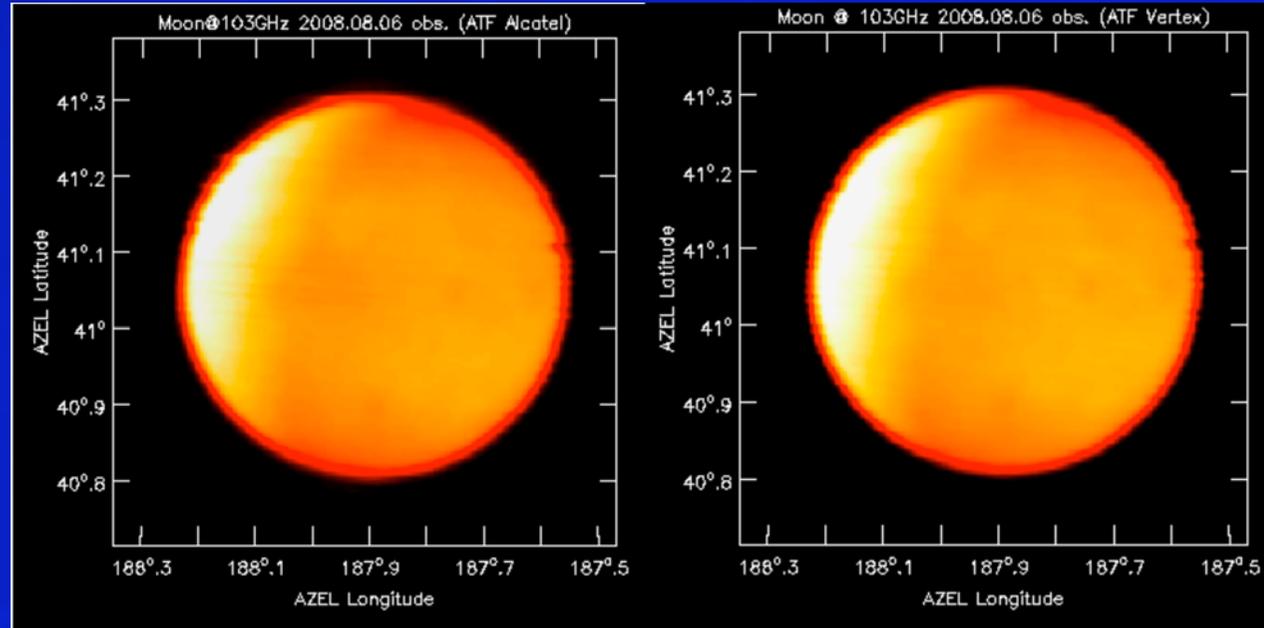
End of Jan, 2010: Scheduling meeting

update 2009 plan, also hope to have participation from System Verification and Technical Services

CDR8 - July 2010

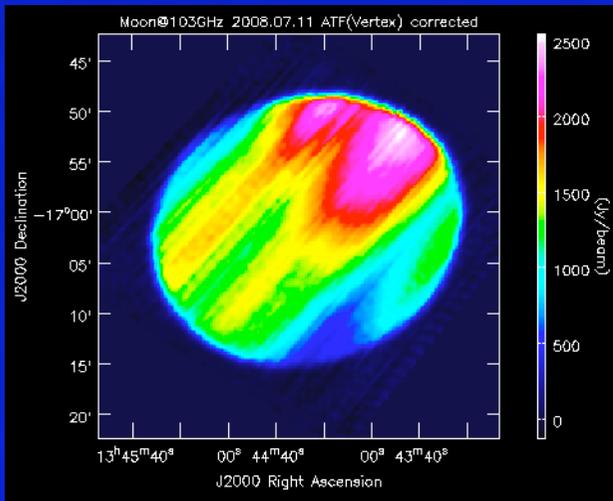


Data Reduction in CASA - progress in SD reduction



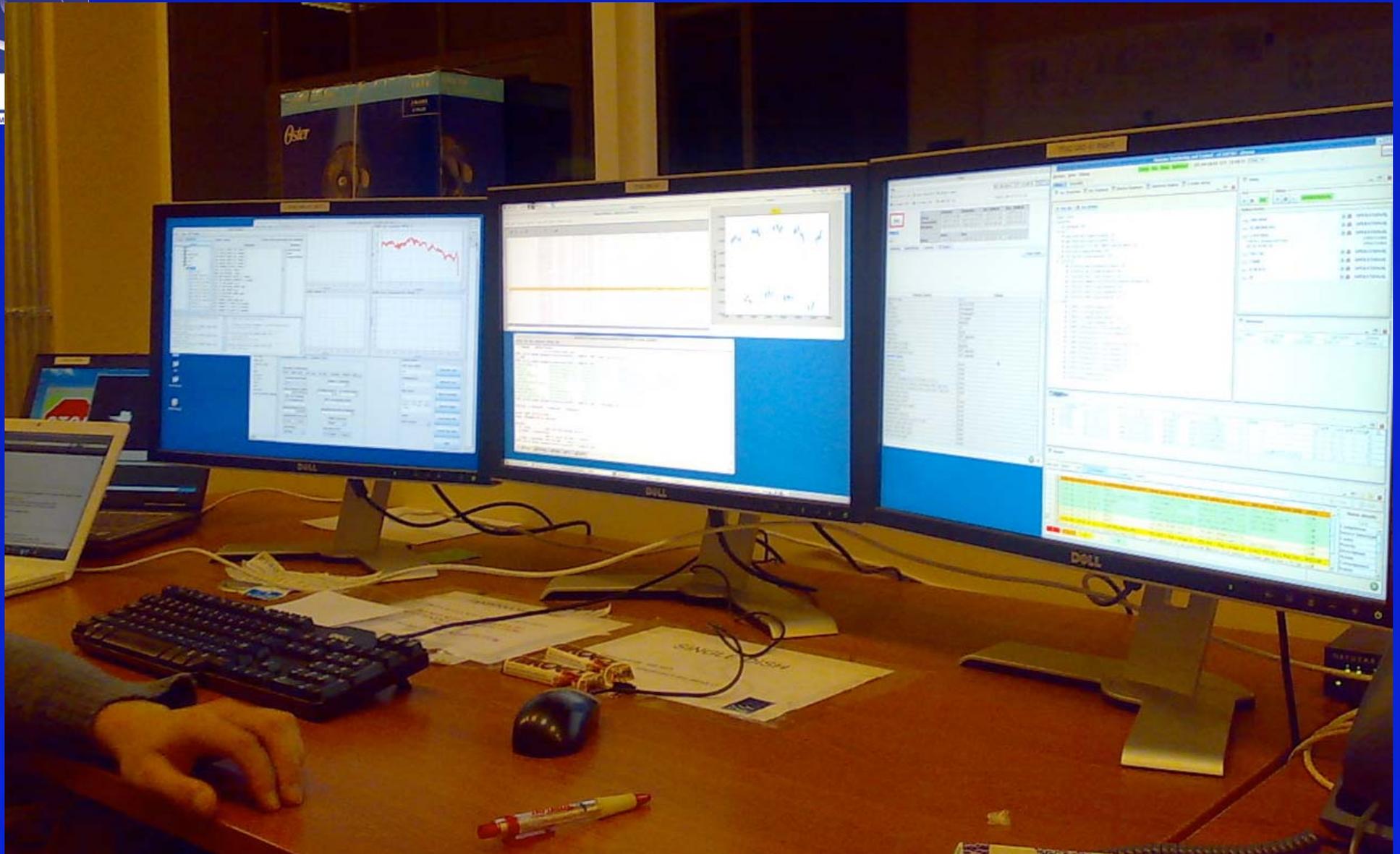
**Raster on Moon with Total Power
(square law detectors, 2 antennas)**

(Early bugs: weird ellipticity
and poor sky subtraction)



ASAC Meeting, Garching

Array Control and Monitoring (OMC)



Oct 13 2009

ASAC Meeting, Garching



Current Status of Tools in “Manual” mode

Manual meaning the control script is written by the scientists with assistance from Computing, and run from the command line - this mode has just been improved to include metadata.

Single-dish:

- Amplitude Calibration
- OTF Mapping (TP and Spec)
- Subreflector optimization
on 3 axes

Interferometry:

- Delay Measurements
- Baseline Measurements
- System Stability Measurements
- Setting correlator modes still complicated
but possible to test polarization
and/or multiple basebands



Current Status of Tools in “Scheduling Block” mode

The goal of manual mode is to develop and optimize procedures which can then be handed to CIPT to convert to “observing modes” which can be run as SBs created in the OT. This allows AOs to carry out AIV tests on subsequent antennas. First handover last June with version 6.1.0

·Single-dish:

- Holography
- Optical pointing
- Radio pointing
- Spectral Line Pointing
- Beam patterns
- Focus (z axis)

Interferometry:

- Basic modes (single target, single calibrator)
- Various correlator configurations
- Baseline determination/ Calibrator Survey
- Pointed mosaic



Risks / concerns

- Robustness (container crashes)
- Latency (delay between issuing command and response)
- Scalability (adding 60 more antennas)
- Restart time (more problem for CSV than Ops, because frequent changes and testing result in more frequent crashes)



How these are being addressed...

Robustness:

- Weekly regression testing by JAO Computing
- Increased communication between CG and Science Team, feeding back not just that the problem has been resolved, but the cause, the resolution, and ways to differentiate the types of failures
- Also, as the rate of new features decreases, robustness will increase

Latency:

- Some sources of delay have been identified (for instance, there is currently no queuing of subscans for the correlator) these are being addressed as they are found, and resources can be allocated (Queued correlator observations start with ALMA-7.0, Dec 2009)
- Other sources need investigation. CIPT is aware of the high latency in the system and is attempting to determine the causes and resolve them.



How these are being addressed...

Scalability:

- CIPT is currently engaged in discussions to use a large cluster to simulate the full deployed system. These simulations will point out the trouble spots with sufficient time for CIPT to address them before they impact CSV / Ops

Restart time:

- Some obvious parallelization is already in the works, expect ~50% increase with the ALMA-7 release (Dec 2009)
- Further optimizations are more difficult but have been identified, these could bring as much as another 30% decrease in the cycle time.