EVLA Scientific Commissioning



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Atacama Large Millimeter/submillimeter Array Expanded Very Large Array Robert C. Byrd Green Bank Telescope Very Long Baseline Array





Commissioning Goal

- To bring the EVLA into full operation at the end of 2012 offering the maximum possible range of capabilities to the user community given our commissioning resources
- How to do this?
- Structured approach to provide:
 - Accountability (to the NSF, to review committees, and to colleagues)
 - Clarity so that participants are working toward common goals
 - Milestones so that we can assess objectively what we are able to offer to the community
 - Good communication within the commissioning effort



Commissioning Approach

- Test end-to-end operation of specified EVLA observing modes using a range of different targets
- Test reduction tools
- Provide feedback to operations
- Demonstrate the potential of these modes to a wide community
- Include the community through the RSRO program
 - Foster early scientific return
 - Offer users science data from a new mode of EVLA and involve them in prompt scientific exploitation
 - Maximize and optimize resources for the commissioning effort



Commissioning Products

- Reports documenting and quantifying:
 - System performance
 - Exceptions
 - Recommendations for improvement
 - Test data
 - Performance vs. design requirements from the Project Book
- Operational procedures and documentation for operation of the EVLA as a science facility, including end-to-end data management





Commissioning Tasks

- Commissioning tasks derived from "data flow view" of EVLA data:
 - OSRO commissioning
 - Observing with wide bandwidths
 - Scheduling heuristics
 - Data distribution
 - Flagging
 - External calibrations
 - Special calibrations
 - Self-calibration topics
 - Correlator/observing modes
 - Imaging topics
 - Data analysis
 - High performance computing
 - (Low frequency [<I GHz] bands)</p>





Commissioning Tasks

- Spreadsheet of commissioning tasks
 - commissioning 20100208.xls
- Dates derived from:
 - Receiver delivery dates
 - 3-bit sampler delivery
 - Prioritized list of correlator configurations and capabilities
- Aimed at obtaining a complete list while minimizing the duplication that would result from, e.g., a view derived from science-based use cases





Commissioning Organization

- Group targets by technique and match to staff scientific interests and expertise
- Assign experienced NRAO/EVLA "lead" to each target
 - Roughly translates into "teams" working in the different areas comprising in-house and RSRO scientists
- Team lead responsibilities:
 - Define requirements (cf. Project Book Chapter 2)
 - Specify tests needed
 - Coordinate effort
 - Present status updates





EVLA Commissioning Teams

Area	Team lead(s)	Other NRAO	RSRO
Sub-GHz frequencies	Owen	Cotton, Durand, Intema, Perley	Lazio
Low-frequencies	Momjian, Perley	Bhatnagar, Goss, Owen	Chomiuk, Heesen, Lazio, van Gorkom
Mid-frequencies	Dhawan	Frail, Momjian, Owen, Rupen	Lazio, Leroy, Heesen, Taylor
High-frequencies	Claussen, Sjouwerman	Carilli, Chandler, Marvil, Owen, Pannella, Strazzullo	Aravena, Brogan, Corder, Hunter, Leroy, Perez
Spectral lines	Goss, Ott	Carilli, Chandler, Dickman, Momjian, Sjouwerman, Wrobel	Aravena, Brogan, Chomiuk, Corder, Hunter, Linz, van Gorkom
Scheduling	Frail	Carilli, Claussen, Dhawan, Goss, Momjian, Perley, Owen, Sjouwerman, Wrobel	Heesen, Lazio, Leroy, Linz, Miller-Jones, Perez, van Gorkom





EVLA Commissioning Teams

Area	Team lead(s)	Other NRAO	RSRO
Polarization	Myers	Bhatnagar, Cotton, Dhawan, Greisen, Kogan, Moellenbrock, Owen, Perley	Green, Heesen, Taylor
Rapid response	Frail	Rupen, Wrobel	Chomiuk
Pulsars	Brisken	Frail, Rupen, CASA developers	Deller
VLBA/VLBI compatibility	Brisken, Walker	Mioduszewski, Romney	Deller
Astrometry	Brisken	Dhawan, Fomalont, Mioduszewski, Rupen	
Mosaicing	Ott	Dickman, Golap, Goss	Chomiuk, Miller-Jones, Taylor
Planets	Butler	Hesman	
Solar	Perley, Butler	Bastian	





EVLA Commissioning Teams

Area	Team lead(s)	Other NRAO	RSRO
OSRO tests	Van Moorsel	McMullin, Ott, Rupen	
Correlator	Rupen	Carilli, Chandler, Dhawan, Frail, Goss, Momjian, Ott, Sjouwerman, Wrobel	Aravena, Brogan, Chomiuk, Hunter, van Gorkom
Calibrator survey/ models/DB	Mioduszewski	Greisen, Hesman, Moellenbrock, Owen, Sjouwerman	
Demo science	Chandler	Butler, Claussen, Dickman, Greisen, Hesman, McMullin, Ott	Miller-Jones
Algorithms (imaging, self-cal, advanced data analysis, HPC)	Bhatnagar, Owen	Carilli, Chandler, Cotton, Golap, Greisen, Goss, Kogan, Marvil, Momjian, Perley, Rao, Robnett	All RSRO
Documentation	McMullin	All	Chomiuk, Greaves





Commissioning Organization

- Minimize duplication of effort at the same time as preventing targets from falling through the cracks
- Move toward standardization and documentation of activities to improve:
 - New team member/RSRO integration and ramp up
 - Clear history of testing/results
 - Establish "accepted/recommended" paths for different observing modes, including observing scripts and reduction scripts for inclusion in user documentation and pipeline development





Commissioning Organization

- For each commissioning task the lead should produce a minimum of the following:
 - One or more goals with a description of the required test(s), participant(s), timescale, and a definition of what it means for this goal to be complete
 - E.g.: <u>polarization</u> (thanks to Steve for this)
 - The level of detail is up to the lead to define
 - Negotiation on delivery dates for completion
 - Each target will be reviewed on a quarterly basis; decision on whether a target is complete will be made by lead





Commissioning tasks beg. 2009 Q4-2010 Q1

- OSRO commissioning tests: van Moorsel
- OPT tests for primary frequencies (L/C/K/Ka/Q/VLA-X): Sjouwerman
- L/S/C observing methodology (incl. polcal for Stokes I); 8-bit samplers: Momjian
- L/C/K/Ka/Q complex gain stability: Perley
- L/C/K/Ka/Q bandpass stability: Perley
- Narrow-field, wide-band imaging of unconfused fields: Owen
- Identical sub-bands in correlator: Rupen
- Planetary observing (correlator/executor): Butler
- Planetary observing (OPT): Butler
- Reference pointing: Perley
- ToO scheduling heuristics: Frail
- Spectral line set-up and calibration procedures: Ott
- Narrow-field, wide-band imaging of confused fields: Owen
- K/Ka/Q observing methodology (incl. polcal for Stokes I); 8/3-bit samplers: Sjouwerman
- Archive functionality: Sjouwerman
- Data distribution via alternative media: van Moorsel
- L/C/K/Ka/Q observing recommendations documented: McMullin
- RM synthesis imaging: Owen





Commissioning tasks beg. 2010 Q2 (planning needed Q1)

- Trading sub-bands for channels: Rupen
- Phased array for VLBI: Brisken
- Phased array for pulsars: Brisken
- L/C/K/Ka/Q delays/fringe fitting: Dhawan
- L/C/K/Ka/Q polarization calibration: Myers
- Calibrator survey: Mioduszewski
- X/Ku scheduling heuristics: Frail
- CASA multi-thread capability: Golap
- L/C/K/Ka/Q polarization stability: Myers
- VLBI observing set-up (SCHED/OPT):Walker
- Gain curves: Perley
- CASA cluster testing: Golap
- Imaging of ~FWHM of primary beam: Owen
- Full field, narrow-band polarization imaging: Owen
- Pointing self-calibration: ARDG

- Flagging algorithm development: Owen
- L/C/K/Ka/Q flux calibrator models: Mioduszewski
- L/S/C flagging: Owen
- RFI excision/subtraction: Owen
- Flagging recommendations documented: McMullin





Prioritization

- There is a lot to do! Already we are behind this "ideal" schedule due to time code and system integration issues with correlator
- Commissioning task list is already in an approximately prioritized order
- Work through list in this order
- Priorities
 - OSRO functionality for 2010A-2011A (affects the most users)
 - Commissioning for OSRO 2011B-2012B: 2 GHz BW (8-bit samplers);
 simple correlator set-ups (no recirculation); limited advanced modes (e.g., VLBI-compatibility; TBD)
 - Further discussion of this is warranted in the next couple of months
 - More advanced set-ups for RSRO projects





Task Tracking and Documentation

- Commissioning tasks, RSRO projects, demonstration science
 - Organize using JIRA
 - Already in use and adequate for our needs
 - Provides transparency within the group, notification as broad or as restricted as needed; archive/history of activities and results
 - Two projects
 - ECSV: EVLA Commissioning and Science Verification
 - This provides the backbone/structure for the known observations that we will take to characterize the observatory and also enables open/idea-based investigations
 - RSRO: Resident Shared Risk Observing
 - This provides structure for the visiting scientists to demonstrate progress toward proposal fulfillment





Task Tracking and Documentation

- Test datasets, procedures (acquisition, analysis)
 - Use NRAO Twiki
 - https://staff.nrao.edu/wiki/bin/view/EVLA/EVLACommissioning
 - maintain in a single location accessible to everyone, automatically archived; likely easier to search than e-mails
 - Discussion?
 - Post detailed descriptions of test data sets and archive addresses
 - Post procedures used, test results





Task Tracking and Documentation

- Meetings
 - Monday mornings: report on status by team leads; discuss test observations for the week
 - Monthly EVLA Transition slot for in-depth review of selected targets
 - Monthly EVLA test meeting for presenting test results
 - Individual teams should probably meet weekly at times convenient for the team
 - Results from tests that might be useful for targets other than that for which the data were originally taken should be communicated to the relevant team lead and/or posted on the data wiki and/or included in the relevant JIRA ticket

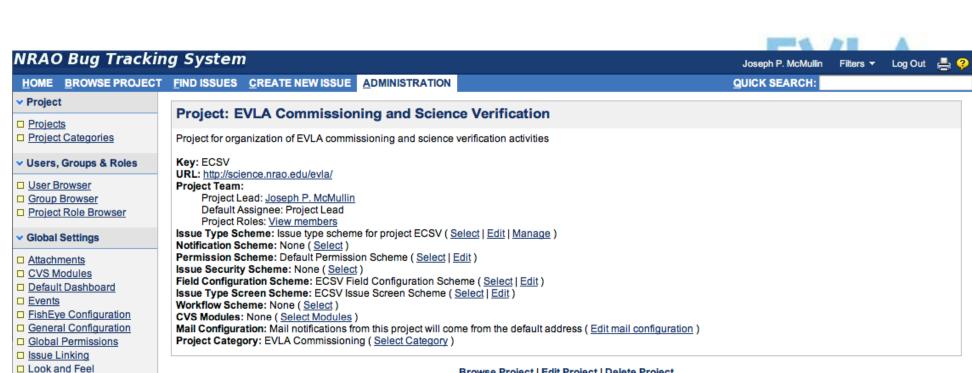


ECSV Project:

https://bugs.aoc.nrao.edu/browse/ECSV

- Draft Project plan based on the spreadsheet targets and quarter resolution deadlines; additional details added based on Rupen's OSRO testing plan; added Myers' Polarization calibration test plan as an example)
 - http://www.alma.cl/aiv/EVLA CSV.htmld/
 - Gantt chart:
 http://www.alma.cl/aiv/EVLA_CSV.htmld/EVLA_CSVGantt.
 httml
- Initial targets for Q1/Q2 2010 posted to JIRA





Browse Project | Edit Project | Delete Project

Components ☐ Add a new component ☐ Select assignees for components	
Astrometry (Lead: Walter Brisken)	(Edit Delete)
Calibrator Surveys/Models/DBs (Lead: Amy Mioduszewski)	(Edit Delete)
High Frequency (Lead: Lorant Sjouwerman)	(Edit Delete)
Low Frequency (Lead: Emmanuel Momjian)	(Edit Delete)
Mid Frequency (Lead: Vivek Dhawan)	(Edit Delete)
SRO (Lead: Gustaaf Van Moorsel)	(Edit Delete)
Planetary (Lead: Bryan Butler)	(Edit Delete)
Polarization (Lead: Steve Myers)	(Edit Delete)
Pulsar (Lead: Walter Brisken)	(Edit Delete)
Rapid Response (Lead: Dale Frail)	(Edit Delete)
RSRO (Lead: Joseph P. McMullin)	(Edit Delete)
Solar (Lead: Rick Perley)	(Edit Delete)
Spectral Line (Lead: Jurgen Ott)	(Edit Delete)
L VLBAVLBI Compatibility (Lead: Craig Walker)	(Edit Delete)

■ Mail Servers □ Sub-Tasks □ Time Tracking □ Trackbacks User Defaults ■ Workflows Schemes

□ Screens □ Screen Schemes The leave Type Serger

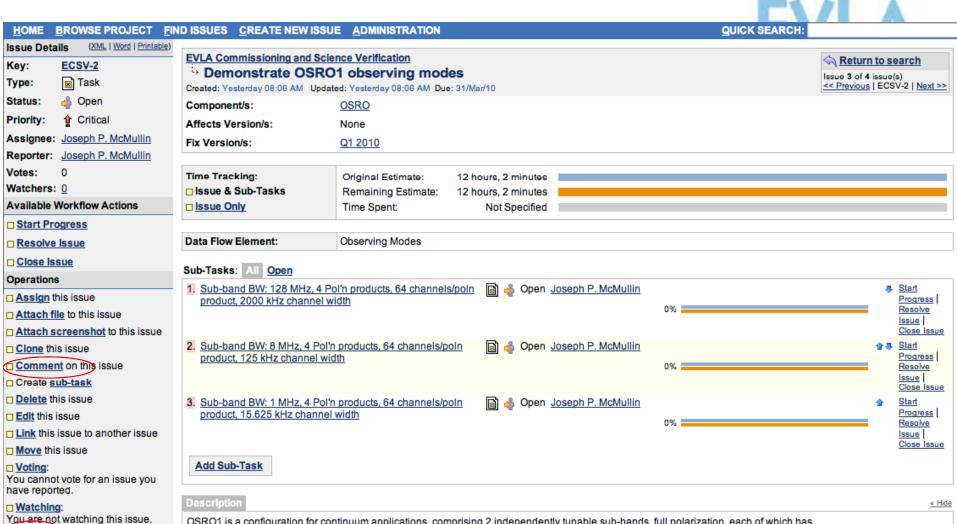
□ Issue Security Schemes ■ Notification Schemes □ Permission Schemes ■ Workflow Schemes Scheme Tools Issue Fields Custom Fields □ Field Configurations □ Field Configuration **Schemes** ■ Navigator Columns

Versions □ Manage versions (displayed in the order of newest first	1)
Q2 2011	30/Jun/11
6 Q1 2011	31/Mar/11
Q4 2010	31/Dec/10
Q3 2010	30/Sep/10
Q2 2010	30/Jun/10
(a) Q1 2010	31/Mar/10



How to interact with JIRA

- Log in; should see list of targets assigned to you
 - Can customize the view (later demo)
- There are 5 principal activities to be done while in JIRA
 - Provide an update on an assigned task (use the Comment link to enter a description)
 - Provide a comment on a task on someone else (use the Comment link to enter a description)
 - Log observing time obtained (use the Log work done to enter the amount of time and description, data file)
 - Decide to be notified of all updates to someone else's task (use the Watch It link)
 - Create a new task/subtask (break down a large task into component pieces, ideas for new observations/tests, etc)



OSRO1 is a configuration for continuum applications, comprising 2 independently tunable sub-bands, full polarization, each of which has

128 MHz bandwidth with 64 channels (with the possibility of smoothing in frequency to reduce dataset sizes or to improve spectral response offline). It is also possible to decrease the bandwidth by powers of two, keeping the same number of channels, to provide spectro-polarimetry capabilities.

The minimum testing includes:

- Test if the line is present at the expected location in the passband given the relative motion of the Earth around the Sun and the overall local standard of rest velocity in all resolution modes.
- For different integration and repetition times, test whether the noise level is consistent between observations.
- Test the stability of the baseline; make sure there are no standing waves present over the noise level.
- Is the intensity of the line consistent between equal set of observations and polarization products?



Watch it to be notified of changes

Worked on this issue? Log work

■ Worklog:

done

Create Issue	
Step 2 of 2: Enter the details of the issue	
Project:	EVLA Commissioning and Science Verification
Issue Type:	⊠ Task
* Summary:	
Component/s:	Unknown Astrometry Calibrator Surveys/Models/DBs High Frequency Low Frequency
Data Flow Element:	None Element in the end-to-end data acquisition to reduction.
Priority:	Major 🗘 🖓
Due Date:	
Fix Version/s:	Unknown Unreleased Versions Q1 2010 Q2 2010 Q3 2010 Q4 2010 Q4 2010
Original Estimate:	An estimate of how much work remains until this issue will be resolved. The format of this is ' *w *d *h *m' (representing weeks, days, hours and minutes - where * can be any number) Examples: 4d, 5h 30m, 60m and 3w.
Assignee:	- Automatic - Assign to me
* Reporter:	jmcmulli Start typing to get a list of possible matches.
Description:	
Attach	
Attachment:	Choose File no file selected The maximum file upload size is 10.00 MB. Please zip files larger than this.
Environment:	
	For example operating system, software platform and/or hardware specifications (include as appropriate for the issue).

Create Cancel



ECSV

- Currently, notifications are turned off; they will be turned on by the end of the day; this means:
 - Science teams should log into JIRA and sign up to 'Watch' relevant tickets for their areas to insure that they receive all updates/comments as they happen
 - Science Leads will automatically be notified of any new targets created under their area
 - Subsequent comments/activity on tickets that are assigned or watched by you will send an e-mail notification
- JIRA Overhead
 - Fundamentally, the only overhead should be logging into JIRA; standard recording of activities and notes just get pushed here rather than into e-mails/elsewhere. Exploit notification scheme to know that everyone interested is hearing the information



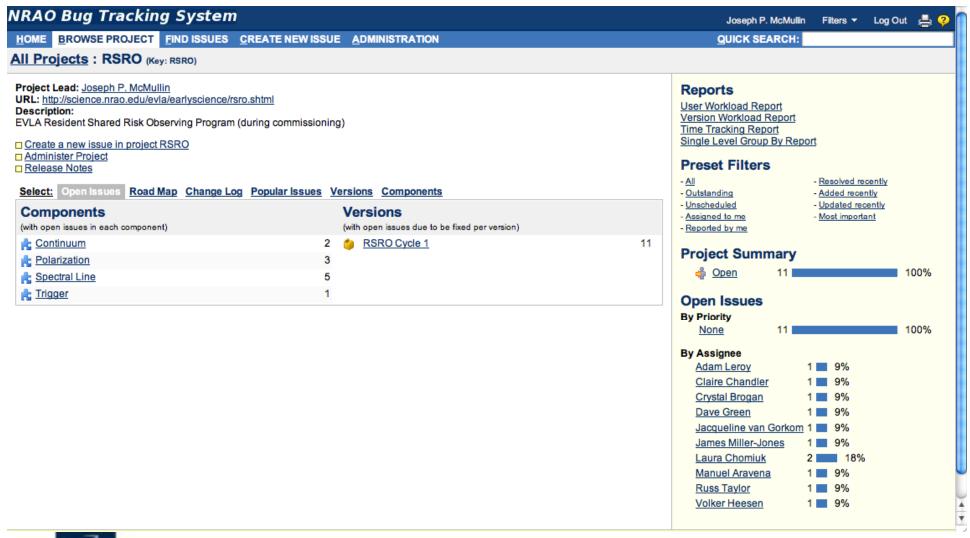
RSRO Proposal Tracking

- JIRA Project:
 - https://bugs.aoc.nrao.edu/browse/RSRO
- Organized by Proposal Cycle
- Dynamically scheduled
- JIRA Parent Ticket for recording observing proposal progress
- All interested team members (others?) may watch the ticket for any updates
- Generate sub-task(s) to enable leads/residents to organize and assign work within the team



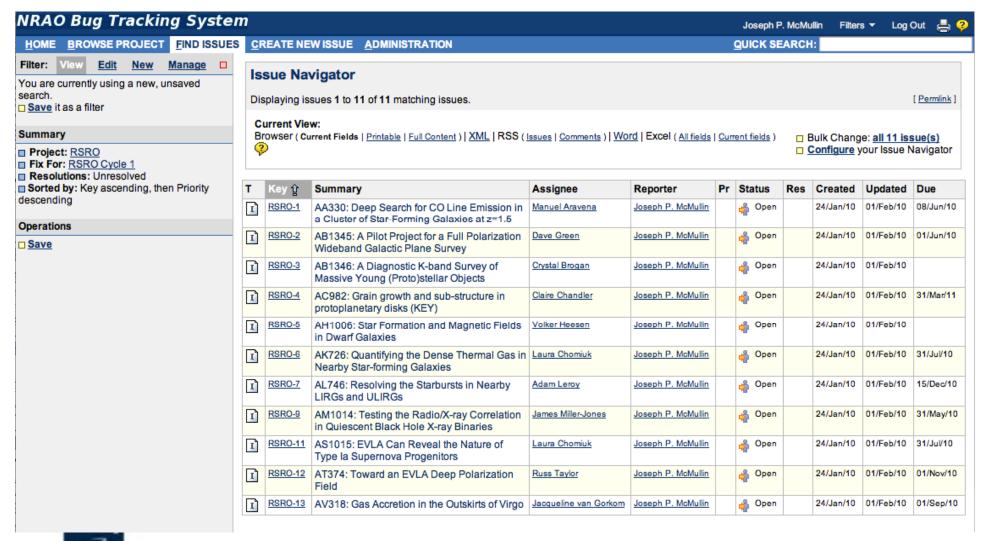
Illustration (next)















NRAO Bug Tracking System

Dashboard AIV Test Portal Category: EVLA Commissioning [hide] Project: EVLA Commissioning and Science Verification (ECSV) [hide] Project Lead: Joseph P. McMullin Reports: Open Issues | Road Map | Change Log | Popular Issues Open Issues: (By Priority) No open Issues Filter Issues: - Resolved recently - Outstanding - Added recently - Unscheduled - Updated recently - Assigned to me - Most important Reported by me Project: RSRO (RSRO) [hide] Project Lead: Joseph P. McMullin Reports: Open Issues | Road Map | Change Log | Popular Issues | Versions | Components Filter Issues: - All - Resolved recently Outstanding - Added recently Unscheduled - Updated recently - Assigned to me Most important Reported by me

Statistics: RSRO (Status)		Total Issues: 13
n Open	13	100%

Configure: ON | OFF Manage Dashboard My Unresolved Reported Issues | Watches | Votes Favourite Filters (Create New | Manage Filters) 13 RSRO Proposals <u>575</u> Unresolved Open Issues: In Progress (Displaying 0 of 0) You have no issues in progress at the moment. Statistics Table: RSRO Proposals RSRO Band 0.7 cm (Q) 1 cm (Ka) [26.5 1.3 cm (K) 20 cm (L) 3 cm (X) [8.0 6 cm (C) [4.0 Requirement [40.0 - 50.0 - 40.0 GHz] [18.0 - 26.5 [1.0 - 2.0]- 12.0 GHz] -8.0 GHz] RSRO GHz] GHz] GHz] Configuration A [0.68 - 36.4 3 1 1 km]

3

1

3

0

1

0

1

3

6

B [0.21 - 11.1

C [0.035 - 3.4

D [0.035 -1.03 km]

km]

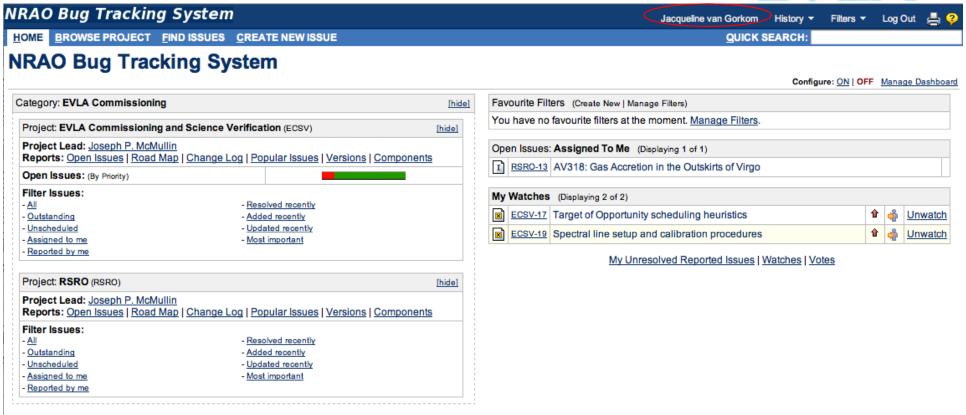
1

1

2







Note: All non-NRAO (and new NRAO) accounts have been set up to have this view of JIRA as their home screen (just see the EVLA Commissioning projects and activities that they are leading or watching.





BROWSE PROJECT FIND ISSUES CREATE NEW ISSUE QUICK SEARCH: HOME (XML | Word | Printable) **Issue Details RSRO** Return to search Key: RSRO-13 AV318: Gas Accretion in the Outskirts of Virgo Type: I RSRO Proposal Created: 24/Jan/10 11:07 PM Updated: 01/Feb/10 10:33 PM Due: 01/Sep/10 Open Status: Component/s: Spectral Line Assignee: Jacqueline van Gorkom Fix Version/s: RSRO Cycle 1 Reporter: Joseph P. McMullin Votes: 0 Time Tracking: Original Estimate: 12 hours Watchers: 0 Remaining Estimate: 12 hours Available Workflow Actions Time Spent: Not Specified ☐ Start Progress RSRO Project Code: AV318 Resolve Issue **RSRO Proposal Time** □ Close Issue 12h Allocation: Operations **RSRO Band Requirement:** 20 cm (L) [1.0 - 2.0 GHz] Assign this issue RSRO Configuration: D [0.035 - 1.03 km] Attach file to this issue RSRO Observation Type: spectral line Attach screenshot to this issue RSRO Residency Start: 01/Feb/10 Clone this issue RSRO Residency End: 01/Sep/10 Comment on this issue □ Create sub-task Delete this issue All Comments Work Log Change History Sort Order: 4 □ Edit this issue [Permlink | « Hide] Joseph P. McMullin added a comment - 01/Feb/10 10:31 PM Link this issue to another issue DSOC Room Assigment: 200F Move this issue □ Convert to sub-task Joseph P. McMullin added a comment - 01/Feb/10 10:33 PM [Permlink | « Hide] Voting: Guidelines: You have not voted for this issue. Create sub-tasks as needed to organize/complete the proposal effort. Vote for it if you wish it to be fixed Provide project code to collaborators so they way choose to "Watch it" (see left column Operations). Provide comments as updates as appropriate. Watching: When observations are scheduled/executed; log work to indicate the amount of observing time received/usable. You are not watching this issue. - Provide information on antennas available, time/date, scheduling block name, name of data file in the archive. Watch it to be notified of changes

■ Worklog:



RSRO Feedback Loop

- Any issues/problems encountered during the RSRO observations/analysis will become ECSV JIRA tickets
 - These will be followed up by the EVLA team at the appropriate priority





Immediate "to dos"

- Finalize target/team leads: contact me or Joe with any concerns, questions, or team additions
- Immediate commissioning priority: preparation for start of OSRO observing
- Plans for all other upcoming targets nominally beginning 2009 Q4 through
 2010 Q1 are due February 22
- Plans for future targets are due I month ahead of the start of the quarter (e.g., March I for Q2) so that test time can be planned and impact of commissioning on astronomical observing assessed
- NB: EVLA commissioning will continue to take priority, but we should be mindful that EVLA commissioning tests do impact users, so duplicate tests should be avoided if possible

