

Shared Risk Science with the EVLA

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Motivation

- *Science:*
 - Want to get EVLA science capabilities into the hands of the general community as soon as possible
 - Want to minimize transition pains in going from the old VLA correlator to WIDAR
 - Want to encourage creative use of the emerging EVLA as soon as possible
 - Want to make our limited resources go as far as we can
- *Turning off the VLA correlator also helps move the EVLA project to completion:*
 - Cannot commission 27-station WIDAR unless turn off the VLA correlator (limited to 10-stations otherwise)
 - VLA maintenance takes manpower away from EVLA construction

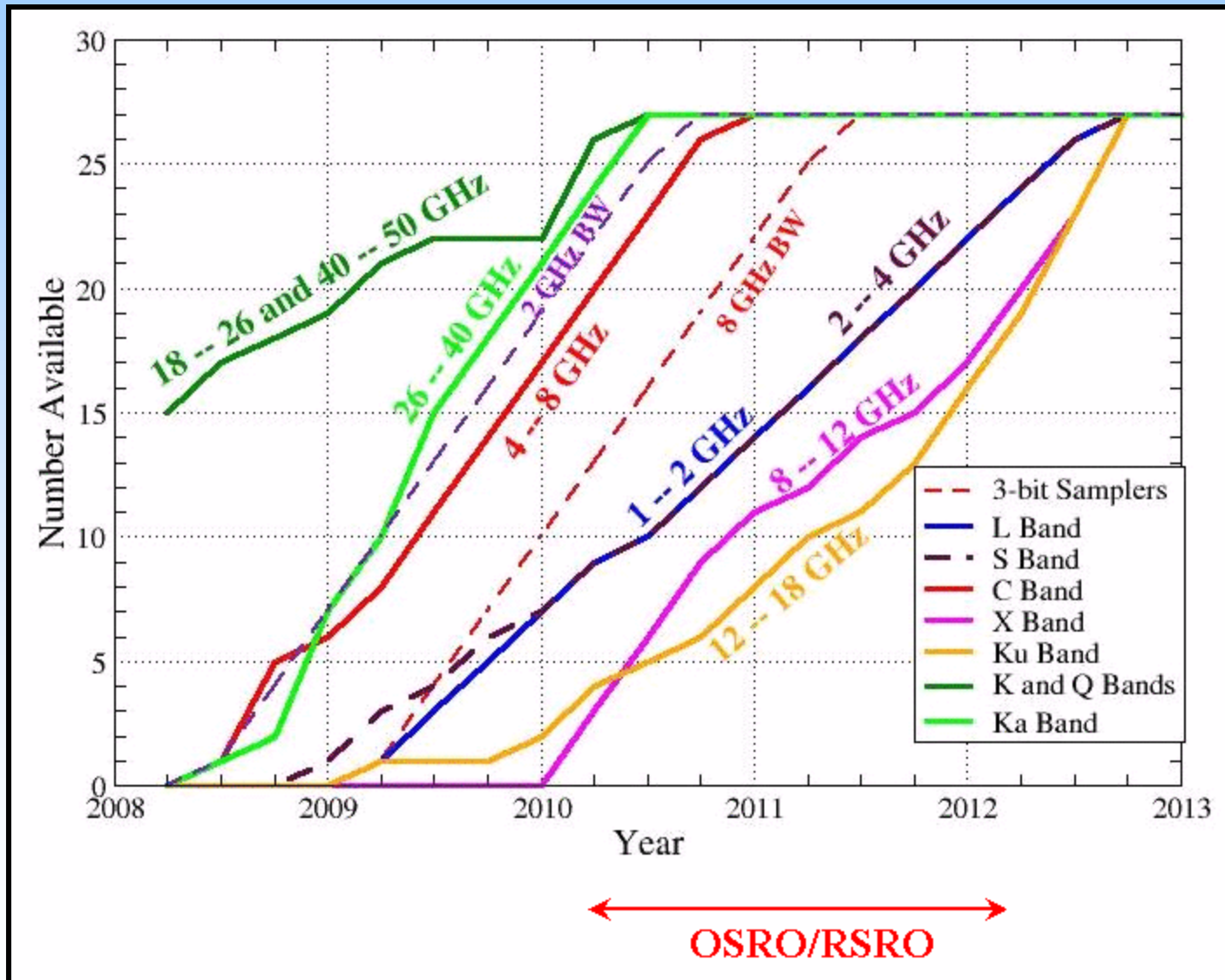
Shared Risk

- Want to enable early science while recognizing:
 - NRAO has limited resources for commissioning the EVLA; we will not be able to commission everything by 2012 with current manpower
 - NRAO has limited resources for user support while commissioning the EVLA
 - NRAO may not have some expertise needed for commissioning special observing modes
 - The EVLA is an instrument undergoing commissioning
- ⇒ *Use of EVLA/WIDAR will be Shared Risk*
- *we'll allocate time, but no guarantee of data or data quality*
- ⇒ *Full access to current EVLA/WIDAR capabilities by outside users will be quid pro quo*

Programs

- We propose two programs to run concurrently for two years, 2010–2011:
 - The *Open Shared Risk Observing (OSRO)* program
 - Access for the whole user community to a number of capabilities beyond those of the VLA
 - The *Resident Shared Risk Observing (RSRO)* program
 - Full access to current EVLA capabilities for peer-reviewed science in return a period of residence in Socorro to help commissioning WIDAR, EVLA, and related software systems

Capabilities



Open Shared Risk Observing

- NRAO has been offering shared risk observing since the EVLA construction project began
 - New EVLA electronics
 - New on-line computing system
 - New receiver bands
 - *New correlator!*
- Initially plan to configure WIDAR in two modes that will emulate the VLA correlator but with significant enhancements
 - Data rates will be up to 10 times higher than current VLA maximum
 - We plan to support this for general users

OSRO WIDAR modes (1)

- Continuum applications and spectro-polarimetry
 - Two independently-tunable sub-band pairs (IFs), full polarization, each with bandwidth $128/2^n$ MHz ($n=0,\dots,12$), 64 channels

Sub-band BW (MHz)	Number of poln. products	Number of channels/poln product	Channel width (kHz)	Channel width (kms ⁻¹ at 1 GHz)	Total velocity coverage (kms ⁻¹ at 1 GHz)
128	4	64	2000	600/v(GHz)	38,400/v(GHz)
64	4	64	1000	300	19,200
32	4	64	500	150	9,600
16	4	64	250	75	4,800
8	4	64	125	37.5	2,400
4	4	64	62.5	19	1,200
2	4	64	31.25	9.4	600
1	4	64	15.625	4.7	300
0.5	4	64	7.813	2.3	150
0.25	4	64	3.906	1.2	75
0.125	4	64	1.953	0.59	37.5
0.0625	4	64	0.977	0.29	18.75
0.03125	4	64	0.488	0.15	9.375

OSRO WIDAR modes (2)

- Spectral line applications
 - One tunable sub-band pair (IF), dual polarization, with bandwidth $128/2^n$ MHz ($n=0,\dots,12$), 256 channels

Sub-band BW (MHz)	Number of poln. products	Number of channels/poln product	Channel width (kHz)	Channel width (kms ⁻¹ at 1 GHz)	Total velocity coverage (kms ⁻¹ at 1 GHz)
128	2	256	500	150/v(GHz)	38,400/v(GHz)
64	2	256	250	75	19,200
32	2	256	125	37.5	9,600
16	2	256	62.5	19	4,800
8	2	256	31.25	9.4	2,400
4	2	256	15.625	4.7	1,200
2	2	256	7.813	2.3	600
1	2	256	3.906	1.2	300
0.5	2	256	1.953	0.59	150
0.25	2	256	0.977	0.29	75
0.125	2	256	0.488	0.15	37.5
0.0625	2	256	0.244	0.073	18.75
0.03125	2	256	0.122	0.037	9.375

OSRO details

- Other technical details:
 - Spectral smoothing available
 - Integration times as short as 1 second
- Time allocation
 - Via current time allocation process
- Configurations
 - Configuration cycle will be reversed when VLA correlator is turned off at the end of next D-configuration, ~Jan 2010
 - EVLA/WIDAR configurations will run D→C→B→A, beginning with D; helps with managing increased data rates and volumes
- Capabilities will be expanded as and when we can support them

Resident Shared Risk Observing

- Aims to attract expert users to make the most of the early science opportunities with WIDAR, in return for commissioning help
- Capabilities available to RSRO users will be all those being commissioned at the time of observation (indeed, we hope RSRO users will commission the mode they wish to use for their science, but they may use other modes as well)
 - Details to be announced at a workshop tentatively scheduled for the week of April 20, 2009

Commissioning needs (1)

- Development of WIDAR modes
 - General correlator resource allocation
 - Multiple spectral lines for Galactic and extragalactic applications
 - Solar observing
 - Planetary observing
 - Astrometry
 - Phased array and VLBI
 - Pulsars
- Development of data reduction strategies and algorithms
 - Automated flagging
 - Wideband, wide-field imaging
 - High dynamic range imaging
 - Algorithm development
 - Algorithm implementation
 - Post-processing computing and networking optimization
 - On-the-fly imaging

Commissioning needs (2)

- Development of observing and calibration strategies
 - Wideband calibration methods
 - High frequency calibration
 - Improved referenced pointing
 - Ionospheric calibration
 - Calibrator models
 - Polarimetry
 - Mosaicing
 - RFI excision

RSRO requirements

- At least one expert from each participating group must be in residence in Socorro
 - must contribute effectively to commissioning
 - limited support for salaries or accommodation may be available
- Proposals will have three parts:
 1. Scientific justification, to be peer reviewed as part of NRAO's current time allocation process
 2. Technical section describing personnel and expertise to be involved in the residency, to be reviewed by NRAO staff
 3. Budget specifying the level and nature of any support requested from NRAO; proposals that do not require Observatory support will have a substantial advantage over those that request NRAO resources

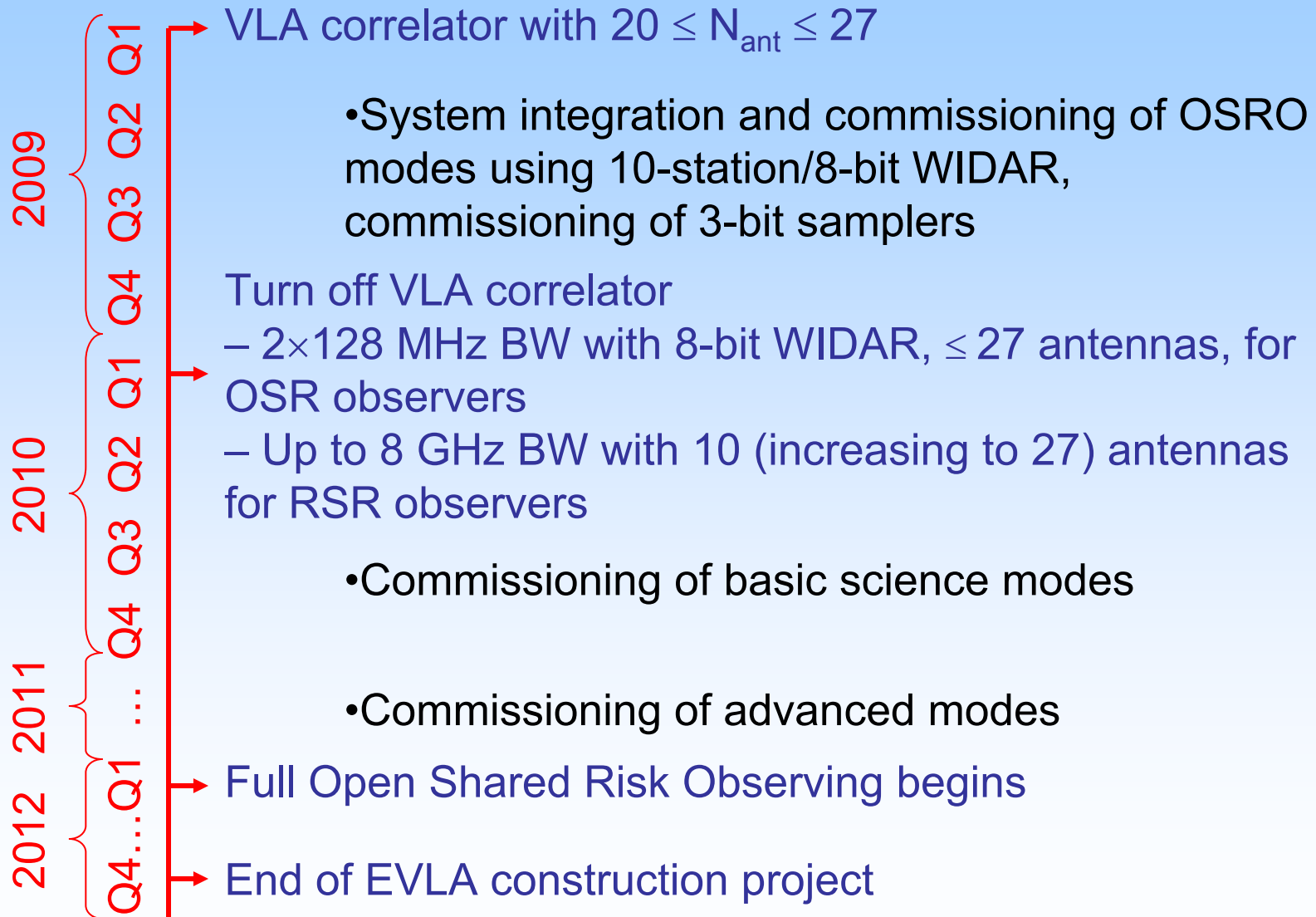
RSRO details

- Time available:
 - Up to 25% of the time available for astronomy will go to RSRO programs (~100 hours/month)
- Residency:
 - Minimum of *one month* of resident commissioning effort is required for every *20 hours* of time allocated, with a minimum residency of *3 months*
 - May take place before the observations, but observers must be present for observations
 - NRAO collaborators will not satisfy the residency requirement
 - Graduate students will not satisfy the residency requirement
 - Resident personnel will work under NRAO management and well-defined deliverables will be set out in an agreement negotiated with their institutions

EVLA Commissioning Staff Observing Program

- NRAO EVLA commissioning staff are in the best position to test and push the EVLA capabilities
- EVLA commissioning staff should have access to the same capabilities as those available through the RSRO program
- Up to 200 hours/yr will be set aside for peer-reviewed science for EVLA commissioning staff, to include short (< 10 hours) exploratory proposals from both commissioning staff and RSRO residents
- Shared risk

Transition to full operations



Reduction of SR data

- A generic dataset produced by the EVLA will not be easily described by AIPS data structures
 - Potentially many files needed for a single observation
- Exception:
 - Any dataset that has the same number of channels for every sub-band, uniform channel spacing for all sub-bands
 - Can be written out of CASA as UVFITS and read into AIPS
 - Has already been demonstrated for testing prototype WIDAR
 - Having multiple reduction packages has led to improvements in both CASA and AIPS
- It is expected that OSRO projects will be able to use either AIPS or CASA for data reduction; it is expected that data taken by RSRO projects will be reduced using CASA
 - One of the goals of the commissioning is to commission the software
 - All RSR observers will be expected to use and test CASA at least for initial calibration

Size and cost of RSRO program

- Assume that we continue to observe 60% of the total hours, 25% of which go to RSRO
- **~1200 hours/yr**
- 1 month resident commissioning effort/20 hours
→ **5 FTEs/yr**
- Estimate that half of these will need support at \$100k/yr → **\$250k/yr**
- **~0.5–1 FTE/yr** for management of the program
- Various other requirements are placed on the EVLA project, software systems, and computing infrastructure to be ready for *both* SR programs

Summary

- We propose two shared risk programs which we believe are optimized for delivering the best early science with the EVLA/WIDAR, given limited NRAO resources
- OSRO provides VLA-like capabilities for all users, with significant improvements over current capabilities
- RSRO provides full access to WIDAR for peer-reviewed science in return for a period of residency in Socorro to help with commissioning

Backup slides

Current VLA capabilities

Bandwidth MHz	Single Pol. Prod.		Two Pol. Prod.		Four Pol. Prod.	
	No. Channels	Freq. Separ. kHz	No. Channels per pol	Freq. Separ. kHz	No. Channels per pol	Freq. Separ. kHz
100	16	6250	8	12500	2	50000
50	16	3125	8	6250	4	12500
25	32	781.25	16	1562.5	8	3125
12.5	64	195.313	32	390.625	16	781.25
6.25	128	48.828	64	97.656	32	195.313
3.125	256	12.207	128	24.414	64	48.828
1.5625	512	3.052	256	6.104	128	12.207
0.78125	512	1.526	256	3.052	128	6.104
0.19531	512	0.381	256	0.763	128	1.526