



A short guide to using the ELWA

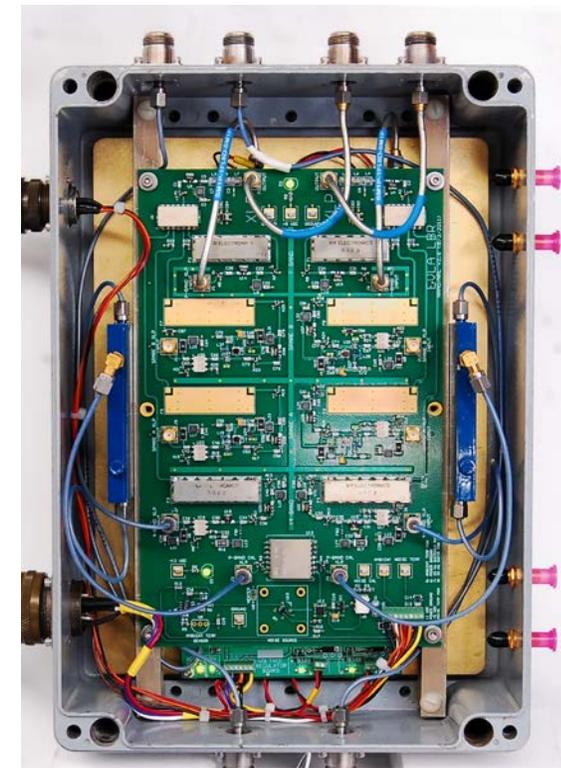
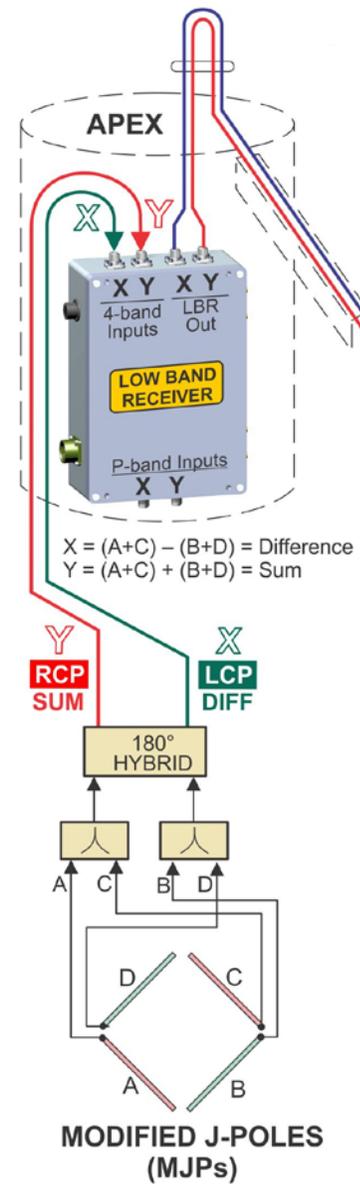
Frank Schinzel (NRAO)



VLA Low Band System

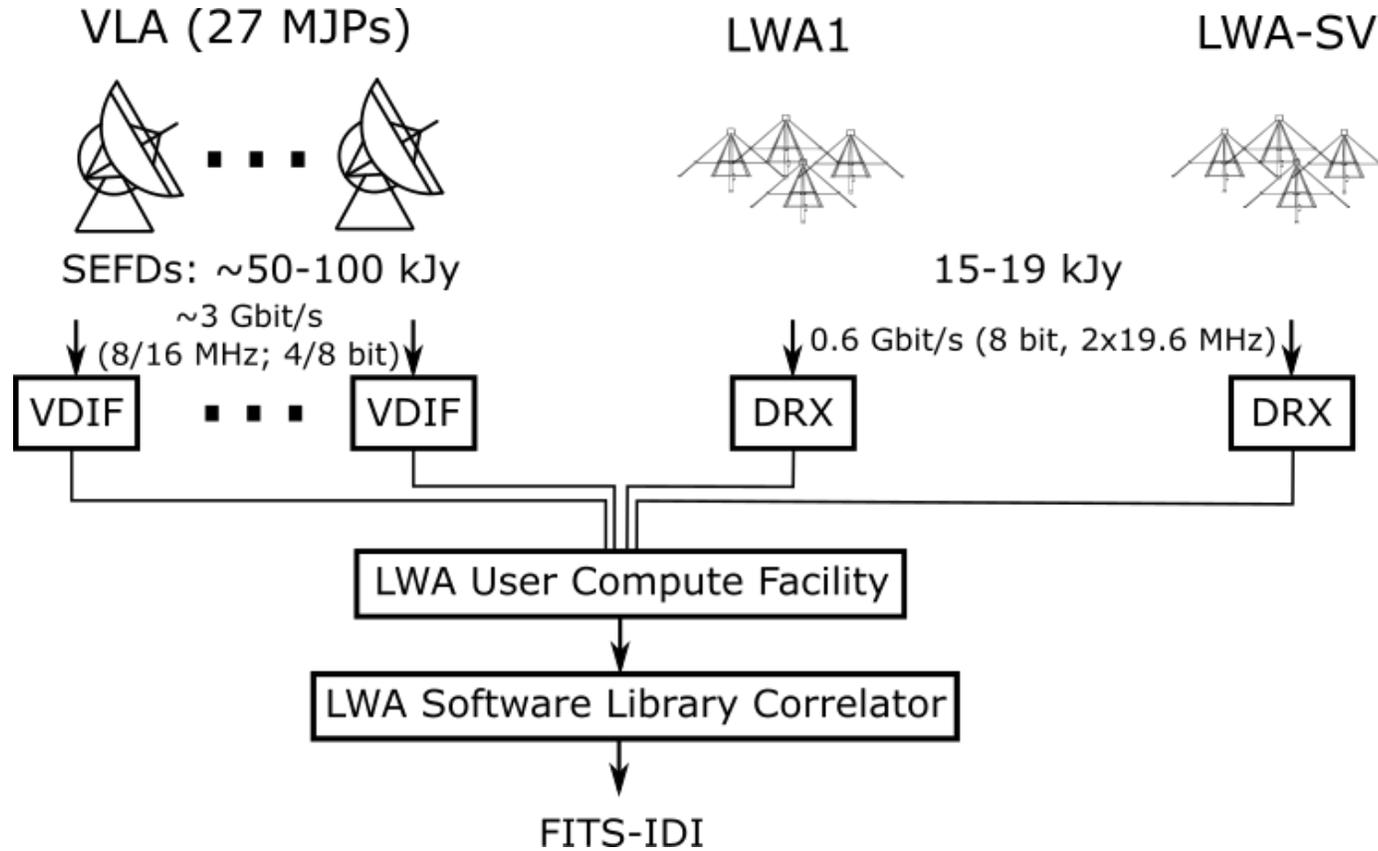
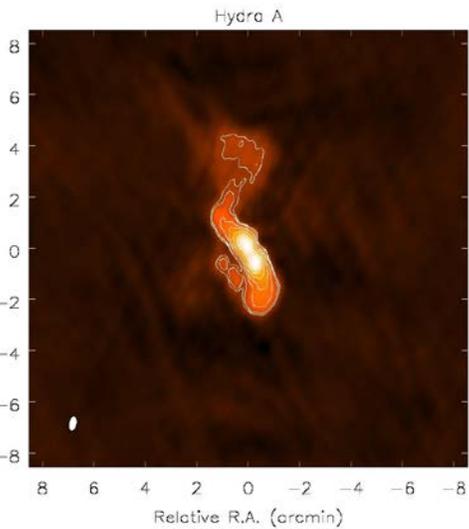
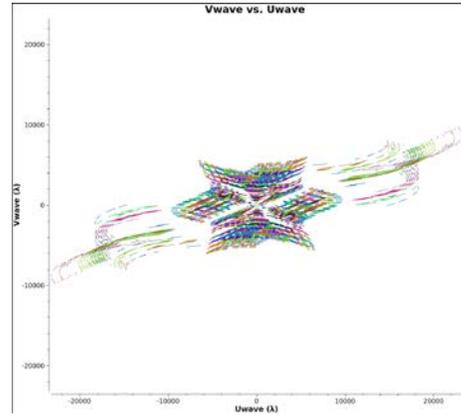


All 28 VLA antennas equipped with MJP dipoles
 (50-86 MHz; Ellingson, Coffey, Mertely EVLA Memo #172)

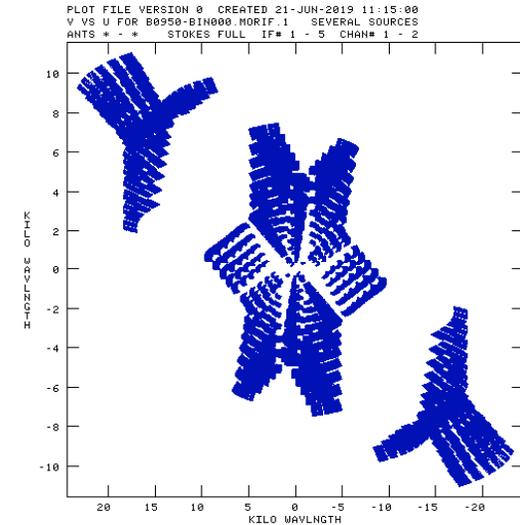


ELWA

Provides maximum baseline length of 80 km/10" resolution.
Increases sensitivity of VLA by about a factor of two (mJy sensitivity)



*LWA I /LWA-SV record in beam-forming mode
with pointings following VLA issued commands*



ELWA is available through Shared-Risk Observing via VLA

How to propose for time using ELWA?



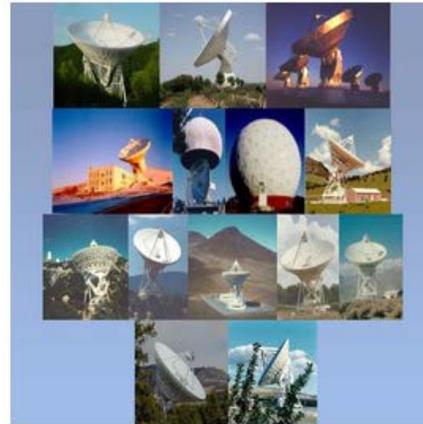
● VLA



○ GBT



○ VLBA/HSA



○ GMVA

Submit regular VLA proposal requesting ELWA (VLA+LWA) resource on <https://my.nrao.edu>

More information VLA proposing:
<https://go.nrao.edu/vla-prop>

ELWA Proposal Specifics

Select Receiver: **4 Band**

VLA RESOURCES

Options: My Proposals > VLA/2021-07-072 > Resources

Order	Name	Configuration	Receiver	Back End	Session
	ELWA	A	4 Band 400 cm 54 - 86 MHz	General and Shared Risk Observing - Wideband	

Subband: 4 Band 400 cm 54 - 86 MHz
 Total Bandwidth (GHz): 4/P Band 400/90 cm 54-86/200-500 MHz
 Subband Centers (GHz): P Band 90 cm 200 - 500 MHz
 Polarization Products: L Band 20 cm 1000 - 2000 MHz
 Dump Time (s): S Band 10 cm 2000 - 4000 MHz
 Data Rate: C Band 6 cm 4000-8000 MHz

Buttons: Validate, Print, Submit, Copy Resources, Help, Save, Delete, Cancel

Select Back End: **VLA+LWA**

VLA RESOURCES

Options: My Proposals > VLA/2021-07-072 > Resources

Order	Name	Configuration	Receiver	Back End	Session
	ELWA	A	4 Band 400 cm 54 - 86 MHz	VLA+LWA	

Subband: 4 Band 400 cm 54 - 86 MHz
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ELWA Proposal Specifics

VLA RESOURCES

Order	Name	Configuration	Receiver	Back End	Session
	ELWA	A	4 Band 400 cm 54 - 86 MHz	VLA+LWA	

The defaults for the VLA+LWA backend cannot be modified. if you need to observe with different values, you must select the VLA+LWA RSRO backend.

Subband:	<input checked="" type="radio"/> 1 x 8 MHz
Total Bandwidth (GHz):	0.008
Subband Centers (GHz):	0.076
Polarization Products:	Full
Dump Time (s):	1.0
Data Rate:	425 MB/s, 1530 GB/h

Save
Delete
Cancel

VLA+LWA: Shared-risk observing fixed on 76 MHz center frequency and 8 MHz bandwidth.

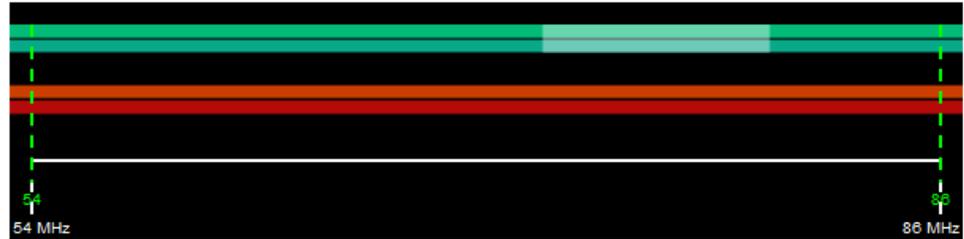
VLA+LWA RSRO: Different center frequency or bandwidths up to 32 MHz possible.

***If time granted through NRAO TAC,
LWA time will be automatically given – no separate proposal needed.***

ELWA Observation Setup / Scheduling – Instrument Configuration

for more details see VLA+LWA section under <https://go.nrao.edu/opt-vdif>

4P » VDIF 8 MHz



Total BI. BPs Used:	1 of 64
Total Data Rate:	0.73 MB/s or 2.64 GB/h
Total Spectral Points:	128
Total Bandwidth:	8.0MHz
Capability Mode:	General observing

Basics | Lines | Basebands | **Line Placement** | Subbands | **Special Modes** | Validation

ID
3720170

Name

Receiver Band

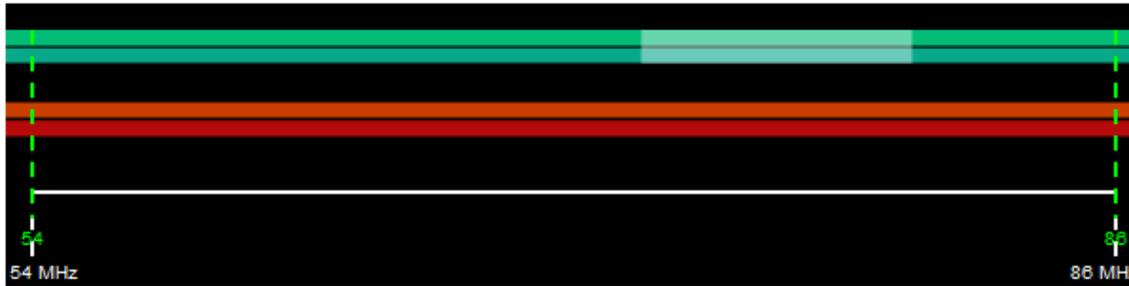
Correlator Integration Time (s)

Comments

You will need two instrument setups. One for your target scans and an identical dummy one with baseband frequencies shifted.

ELWA Observation Setup / Scheduling – Instrument Configuration

4P » VDIF 8 MHz



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Capability Mode:	General observing

Basics | Lines | **Basebands** | Line Placement | Subbands | Special Modes | Validation

Sampler Input Mode
 Two 1-GHz 8-bit samplers (A0/C0 and B0/D0) ▾

Name	Bits	Center Frequency	Sky Range
A0/C0 1.024GHz	8	536.0MHz	24MHz - 1.048GHz
B0/D0 1.024GHz	8	536.0MHz	24MHz - 1.048GHz

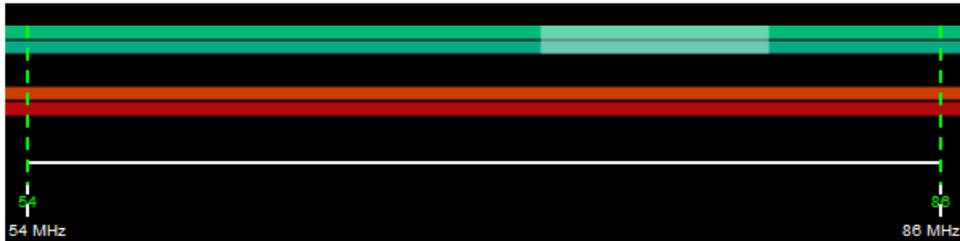
Make sure center frequencies match for A/C and B/D

⚠ Warning: You must enter a source position before you can set a doppler line!

Name	Doppler Line	Offset From Center	Target Sky Frequency	Position	Velocity	Rest Frame	Convention
A0/C0	<input type="checkbox"/> ▾	0GHz	536MHz				
B0/D0	<input type="checkbox"/> ▾	0GHz	536MHz				

ELWA Observation Setup / Scheduling – Instrument Configuration

4P » VDIF 8 MHz



Total Bl. BPs Used:	1 of 64
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Total Bandwidth:	8.0MHz
Capability Mode:	General observing

Setup a single sub-band:
center frequency 76 MHz
8 MHz bandwidth

Basics Lines Basebands Line Placement **Subbands** Special Modes Validation

All Subbands: Selection:

A0/C0

B0/D0

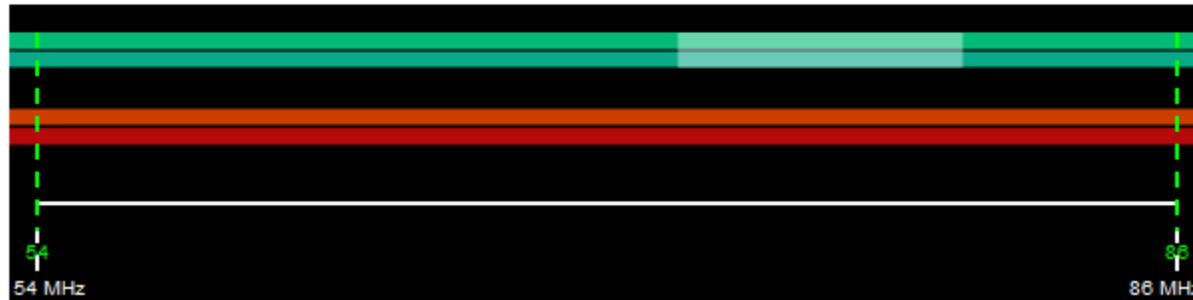
Subbands in Baseband: Selection:



SBP	BW	Snap To Grid	Central Frequency	Fix To Baseband	Polarization	Array Summing	Bl. BPs	Recirculation	Channels	Min HW	CC	LTA	CBE	MB/s	Priority	Comments	Delete	Select All None
0	8MHz 31600km/s	<input checked="" type="checkbox"/>	BB _{center} + -460.0MHz 72MHz - 80MHz	<input checked="" type="checkbox"/>	Dual	None	1	1x	128 × 62.5kHz (128 × 247km/s)	400.0000us	1	2500	1	0.733	Essential	1x8 MHz	<input type="button" value="Delete"/>	<input type="checkbox"/>

ELWA Observation Setup / Scheduling – Instrument Configuration

4P » VDIF 8 MHz



Total BI. BPs Used:	1 of 64
Total Data Rate:	0.73 MB/s or 2.64 GB/h
Total Spectral Points:	128
Total Bandwidth:	8.0MHz
Capability Mode:	General observing

Basics Lines Basebands Line Placement Subbands **Special Modes** Validation

Pulsar **VDIF**

Recording
 No Yes

Enable VDIF Recording mode

We will be providing a default setup through "NRAO defaults".

ELWA Observation Setup / Scheduling – Setting up observation

Example schedule

- ELWA
 - A
 - 4 Band, 08:00:00
 - STD: Initial Slew
 - STD: Attenuator setup
 - STD: Requantizer setu
 - (12X) Source3c196
 - STD: 3C196
 - (12X) Source3c295
 - STD: 3C295
 - STD: Flux cal
 - STD: Requantizer slew
 - STD: Requantizer setu
 - STD: Bandpass cal

- 18B-362
- 19A-391
- 18B-397
- TCAL0009
- 19A-046
- 19A-065
- TPHA0001
- TCAL0004
- CalSur15+TCal8
- 17B-370
- SC1006
- BS278
- 19B-313
- 20A-170
- SL0115
- 20A-439
- 20A-465
- 20B-296
- 20B-252
- 21A-257
- VLA_PolCal
- ELWA
 - A
 - 4 Band, 08:00:00
 - STD: Initial Slew
 - STD: Attenuator setup
 - STD: Requantizer setu
 - (12X) Source3c196
 - STD: 3C196
 - (12X) Source3c295
 - STD: 3C295
 - STD: Flux cal
 - STD: Requantizer slew
 - STD: Requantizer setu
 - STD: Bandpass cal

Information | Reports | Validation and Submission | Bulk Scan Edit | Executions

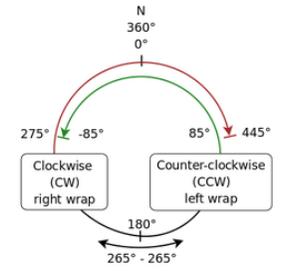
SCHEDULING BLOCK DETAILS

GENERATED ID: 40040021
 NAME: 4 Band
 STATUS: NOT_SUBMITTED
 ACCEPTABLE CONFIGURATIONS: A
 COUNT: 1
 COMPLETED: 0
 TOTAL TIME: 08:00:00
 TIME PER EXECUTION: 08:00:00
 SCHEDULE TYPE: Dynamic
 LST START RANGE: 06 : 35 - 10 : 10
 EARLIEST UT START DATE/TIME: 2021/08/13 21:43:27
 LATEST UT START DATE/TIME: 2021/08/13 21:43:27
 AVOID SUNRISE:
 AVOID SUNSET:

Description	Wind	Atmospheric Phase Limit
<input checked="" type="checkbox"/> Lowest Frequencies (4, P, and L)	Any	Any
<input type="checkbox"/> 2.0GHz - 4.0GHz (S)	Any	60.0 degrees
<input type="checkbox"/> 4.0GHz - 8.0GHz (C)	Any	45.0 degrees
<input type="checkbox"/> 8.0GHz - 12.0GHz (X)	15.0 m/s	30.0 degrees
<input type="checkbox"/> 12.0GHz - 18.0GHz (Ku)	10.0 m/s	15.0 degrees
<input type="checkbox"/> 18.0GHz - 26.5GHz (K)	7.0 m/s	10.0 degrees
<input type="checkbox"/> 26.5GHz - 40.0GHz (Ka)	6.0 m/s	7.0 degrees
<input type="checkbox"/> 40.0GHz - 50.0GHz (Q)	5.0 m/s	5.0 degrees
<input type="checkbox"/> Specified Constraints	m/s	degrees

COMMENTS TO THE OPERATOR

This is an ELWA/VDIF recording observations at 4m band, the fringe display won't show anything useful, that is normal for this mode. Please turn off hand radios so the RFI does not interfere with the observation. This should also not be run while the array is controlled from Socorro and potential interference from webcams is present.



ELWA Observation Setup / Scheduling – Setting up observation

Overview | Comments

SCAN DETAILS

NAME ?	SCAN MODE ?
Flux cal	Standard Observing

TARGET SOURCE ?	HARDWARE SETUP ?	SCAN TIMING ?	INTENTS ?
0137+331=3C48 RA: 1h 37m 41.299431s DEC: 33d 9' 35.13299" <input type="button" value="Import"/>	VDIF 8 MHz Receiver: 4-band A0/C0: 536.0MHz B0/D0: 536.0MHz <input type="checkbox"/> Keep Previous Conf. <input type="button" value="Import"/>	Duration (LST) <input type="button" value="v"/> 00:04:00	<input type="checkbox"/> OBSERVE TARGET <input type="checkbox"/> CALIBRATE COMPLEX GAIN (A AND P) <input checked="" type="checkbox"/> CALIBRATE FLUX DENSITY SCALE <input type="checkbox"/> CALIBRATE BANDPASS <input type="checkbox"/> SETUP INTENT More >>>

ANTENNA WRAP ?	REFERENCE POINTING ?	OVER THE TOP ?
No Preference	<input type="checkbox"/> Apply Last?	<input type="checkbox"/> Allow?

RECORD ON MARK VI ?	PULSAR RECORDING ?	VDIF RECORDING ?
<input type="checkbox"/> Enable?	<input type="checkbox"/> Enable?	<input checked="" type="checkbox"/> Allow?

PHASE & DELAY CAL ?	10 HZ SWITCHED POWER ?
<input type="checkbox"/> Apply Last?	<input checked="" type="checkbox"/> Disable

ELWA scan:

- Make sure you have VDIF Recording enabled
- Make sure 10 Hz switched power is disabled
- There is a delay of 30s for LWA stations to start recording after a VLA scan begins.

ELWA Observation Setup / Scheduling – Setting up observation

Elements of a typical ELWA observation:

Duration	Instr. Setup	Intent	10 Hz disabled	VDIF record	Purpose
09m00s	Dummy	Setup	no	no	Slew to first target
01m00s	ELWA/VDIF	Setup	no	no	Set attenuator levels
00m10s	ELWA/VDIF	Setup	no	no	Set requantizer levels
03m00s	ELWA/VDIF	FluxCal	yes	yes	Cygnus A (fringe finder, delays)
00m45s	Dummy	Setup	no	no	slew to next target
00m10s	ELWA/VDIF	Setup	no	no	Set requantizer levels
03m00s	ELWA/VDIF	Complex Gain	yes	yes	Observe phase calibrator
10m00s	ELWA/VDIF	Target	yes	yes	Slew to target and observe
...

ELWA Observation Setup / Scheduling – Setting up observation

for more details see <https://go.nrao.edu/vla-obs>

Special notes for ELWA observations:

- ***Currently, you cannot mix ELWA observations with other VLA observing bands within the same scheduling block. This could be proposed through Resident-Shared Risk. Note: You can get simultaneous VLITE observations at P-band.***
- Recommend to set requantizers when switching between a bright and a fainter part of the sky, e.g. going from Cygnus A to any other part of the sky.
- There will be a dataset available from the NRAO archive that contains the WIDAR correlator output and metadata. This cannot be easily used for further processing, because the geometric model of the correlator was disabled and every spectral window only contains information for a single antenna, i.e. no useful cross-correlation products are provided by WIDAR in this mode.

After submission of schedule

- After submission: checked & approved by data analysts (if questions, communication through NRAO helpdesk)
- After approval: added to VLA dynamic queue
- If picked for observation: LWA listens to VLA executor and automatically triggers LWA stations to follow VLA+LWA observations.
- After observation is complete data will be aggregated on LWA User Computer Facility and correlated by software correlator, generating FITS-IDI compatible files.
- After correlation: FITS-IDI files are ingested into LWA and VLA archives for retrieval.
- Calibration & Imaging through AIPS (or CASA).

Summary

- ELWA (VLA+LWA) observations can now be proposed through regular shared-risk observing (center of 76 MHz/8 MHz bandwidth).
- ELWA is exposed to the user through the same interface and procedures like regular VLA observations.
- All intermediate steps from observation to correlation are meant to be transparent to the user.
- Final data products are provided in FITS-IDI format and will eventually be available through the NRAO archive (in the meanwhile through the LWA data archive).



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