VLA Observation Preparation

Emmanuel Momjian (NRAO)

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

NRAO

Observational Considerations

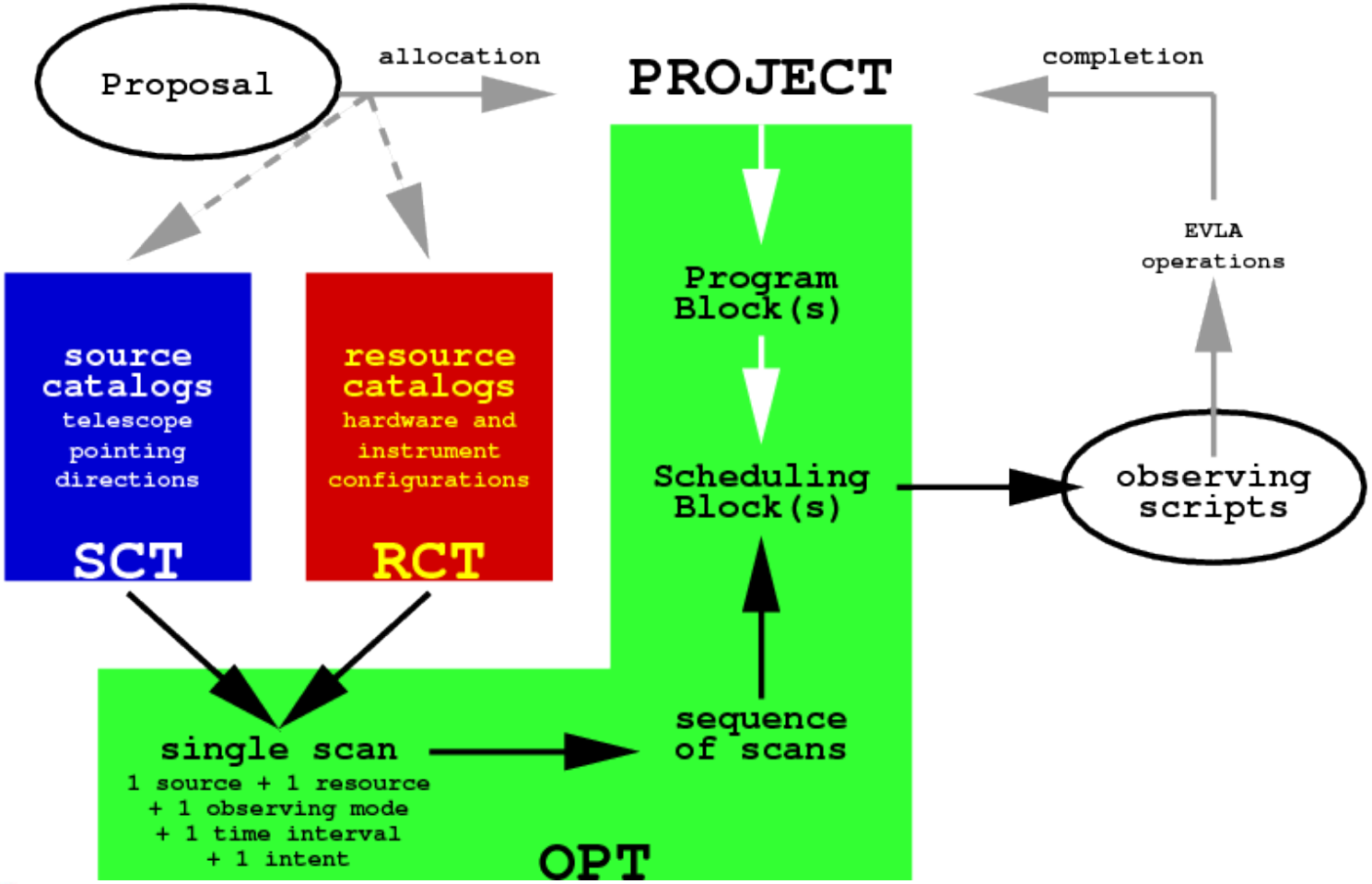
- The EVLA primarily uses dynamic scheduling (i.e., hard to know at what exact time your project will be on the array).
  - Each scheduling block must include a range of scheduling constraints:
    - LST start range
    - Weather (atmospheric phase noise and wind limits)
  - Anticipate and protect against unknown startup slew time and cable wrap
  - Anticipate and protect against availability of calibrators/ slew for different starting times

Observational Considerations

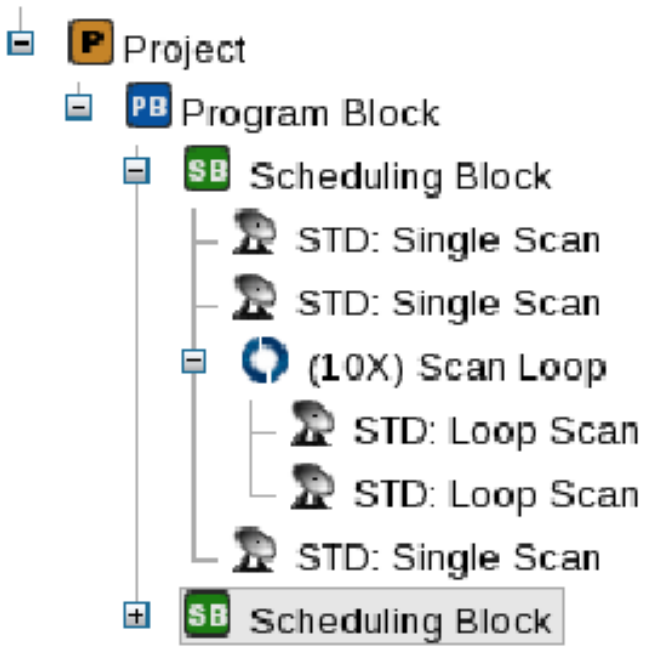
Where are my calibrators and target sources on the sky?

- Strong, point like calibrators are good for bandpass and delay calibration.
- Nearby calibrators are good for phase calibration.
- Pointing calibrators should be in the same general region of the sky.
- What are the choices for a flux calibrator?
- Can certain calibrations be combined with fewer calibrator sources?

Flow diagram



Example project "tree"



- Project has Program Blocks (PB)
- PB has ***Scheduling Blocks*** (SB)
  - Is "observing run" script
  - Sequence of scans and/or (loops of) loops of scans
  - Includes science target and various calibration sources.

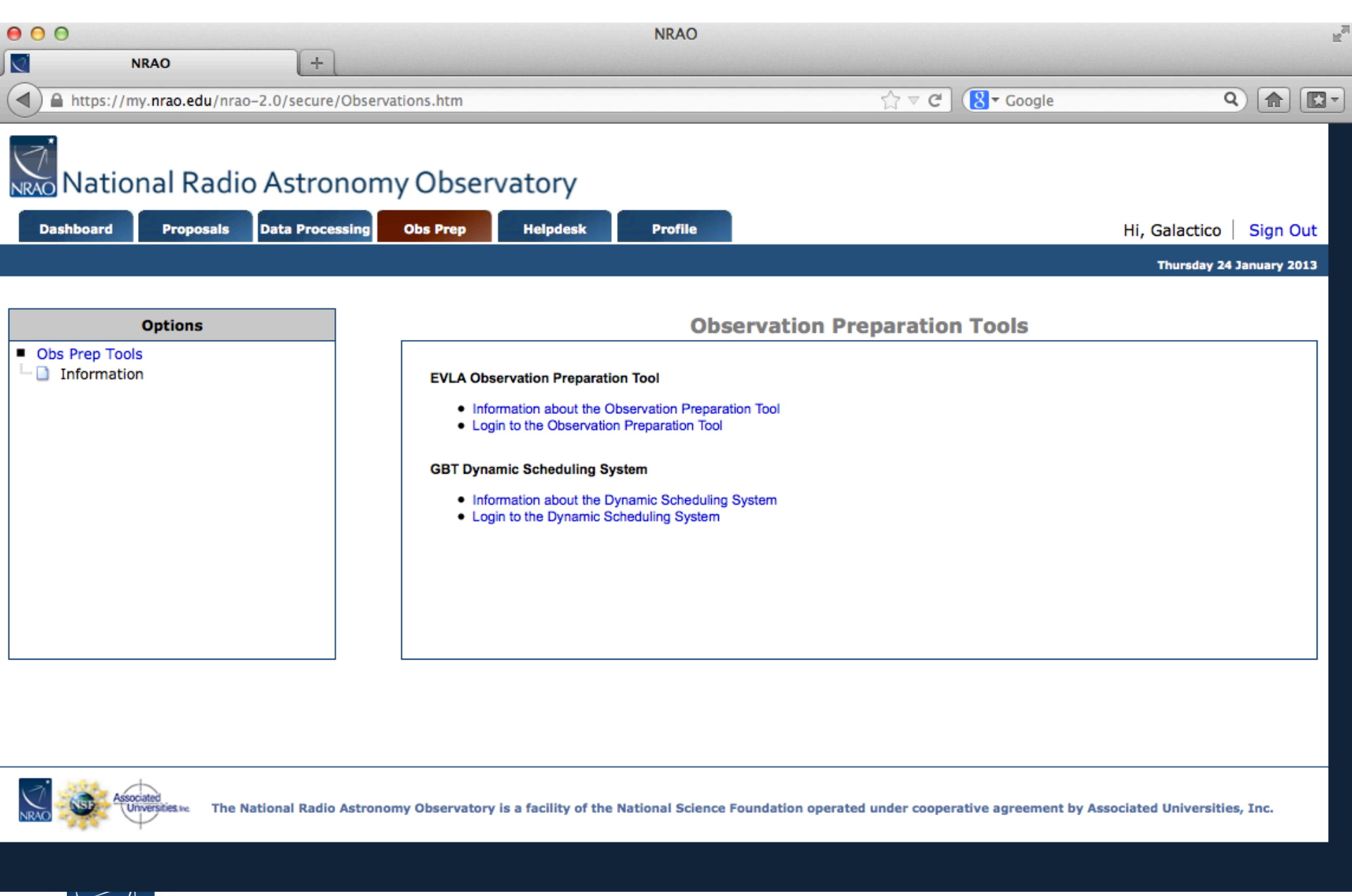
Designing a schedule

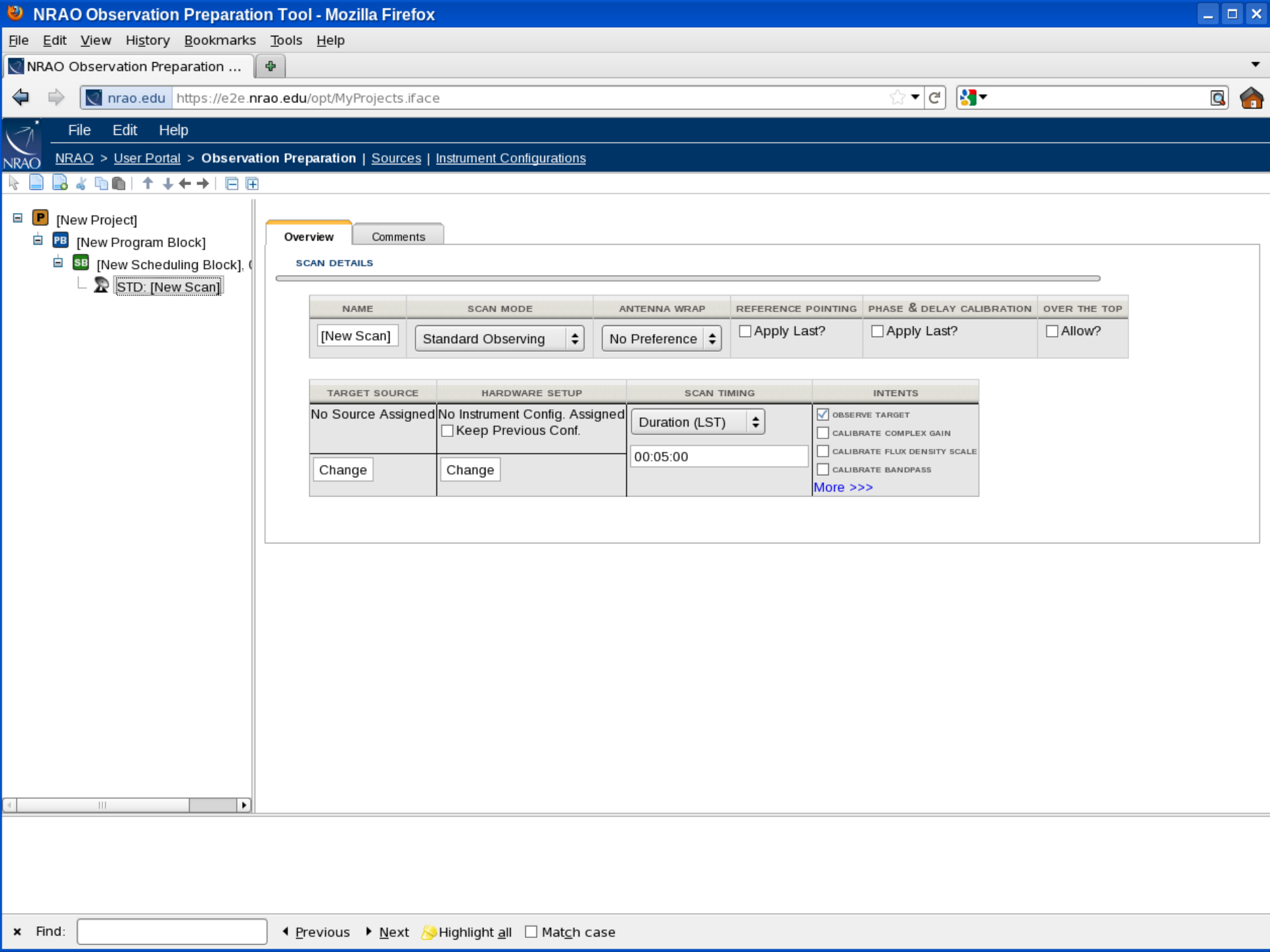
- Designing a schedule: determine which/what
  - Sources to observe, and for how long (with each setup).
  - Setups ("resources") to use
    - Receivers, (baseband/subband) signals, correlator
  - Calibrations to perform
    - Extra sources/resources? (e.g. pointing)

How to start the OPT

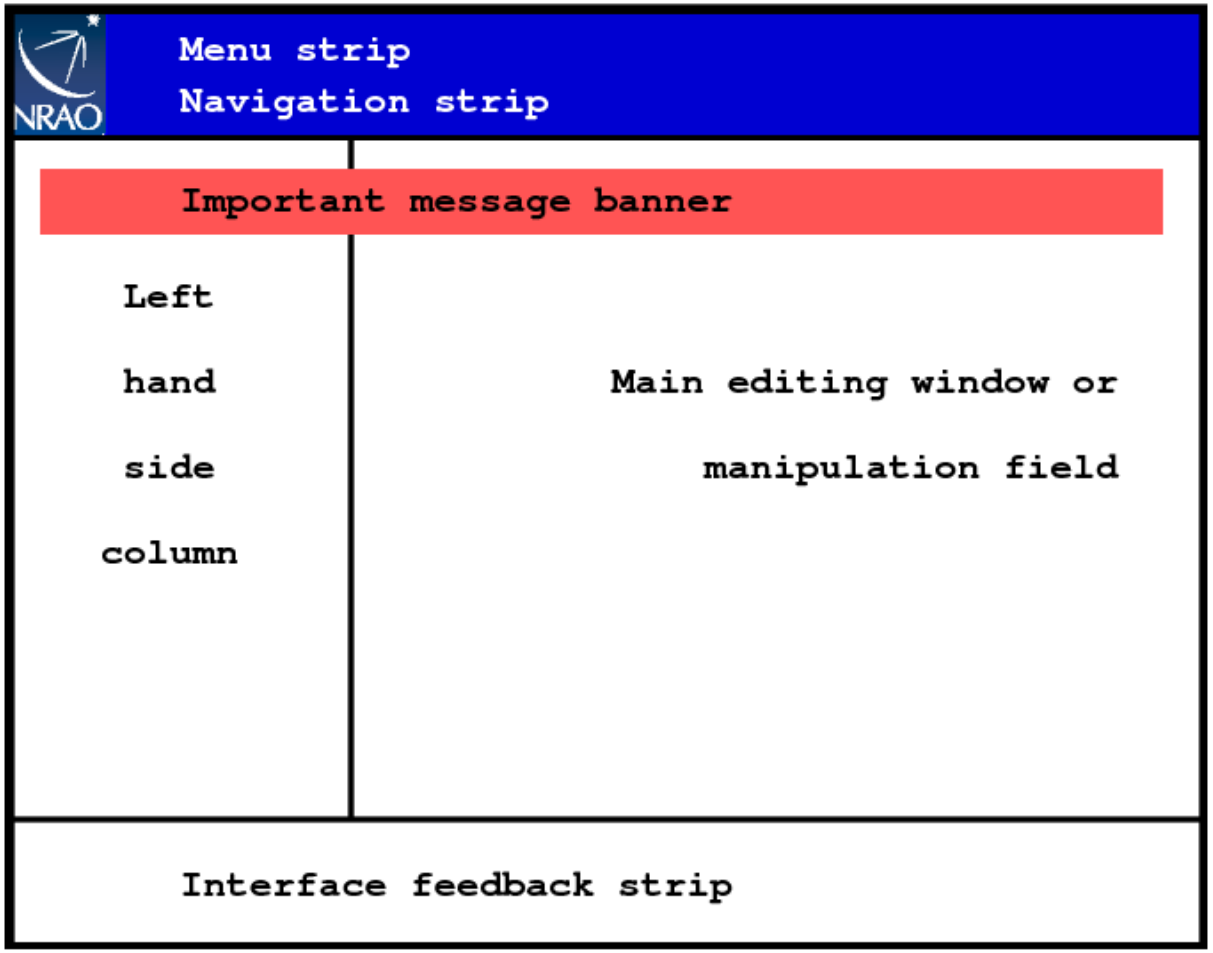
- Register at

  https://my.nrao.edu


NRAO
NRAO
https://my.nrao.edu/nrao-2.0/secure/Observations.htm
Google
National Radio Astronomy Observatory
Dashboard
Proposals
Data Processing
Obs Prep
Helpdesk
Profile
Hi, Galactico
Sign Out
Thursday 24 January 2013
Options
Obs Prep Tools
Information
Observation Preparation Tools
EVLA Observation Preparation Tool
Information about the Observation Preparation Tool
Login to the Observation Preparation Tool
GBT Dynamic Scheduling System
Information about the Dynamic Scheduling System
Login to the Dynamic Scheduling System
The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.


NRAO Observation Preparation Tool - Mozilla Firefox
File Edit View History Bookmarks Tools Help
NRAO Observation Preparation ...
nrao.edu https://e2e.nrao.edu/opt/MyProjects.iface
File Edit Help
NRAO > User Portal > Observation Preparation | Sources | Instrument Configurations
[New Project]
[New Program Block]
[New Scheduling Block],
STD: [New Scan]
Overview
Comments
SCAN DETAILS
NAME
SCAN MODE
ANTENNA WRAP
REFERENCE POINTING
PHASE & DELAY CALIBRATION
OVER THE TOP
[New Scan]
Standard Observing
No Preference
Apply Last?
Apply Last?
Allow?
TARGET SOURCE
HARDWARE SETUP
SCAN TIMING
INTENTS
No Source Assigned
No Instrument Config. Assigned
Keep Previous Conf.
Duration (LST)
00:05:00
OBSERVE TARGET
CALIBRATE COMPLEX GAIN
CALIBRATE FLUX DENSITY SCALE
CALIBRATE BANDPASS
More >>>
Change
Change
Find:
Previous
Next
Highlight all
Match case

Layout of the OPT



What are we observing?

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- Array Configuration: D
- 3 hr long scheduling block
- Ka –band targeting the HC3N (ν_o=36.39232 GHz) and the SiS (ν_o= 36.30963 GHz) lines.
- V (radio, LSR) = -26 km/s
- ΔV ~ 35 km/s

NRAO

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66

➢ **In the OPT: click on Sources (top menu).**

NRAO Observation Preparation Tool - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NRAO Observation Preparation ...

nrao.edu https://e2e.nrao.edu/opt/MyProjects.iface

File Edit Help

NRAO > User Portal > Observation Preparation | Sources | Instrument Configurations

- [New Project]
  - [New Program Block]
    - [New Scheduling Block],
      - STD: [New Scan]

Overview | Comments

SCAN DETAILS

NAME	SCAN MODE	ANTENNA WRAP	REFERENCE POINTING	PHASE & DELAY CALIBRATION	OVER THE TOP
[New Scan]	Standard Observing	No Preference	Apply Last?	Apply Last?	Allow?

TARGET SOURCE	HARDWARE SETUP	SCAN TIMING	INTENTS
No Source Assigned	No Instrument Config. Assigned Keep Previous Conf.	Duration (LST)	OBSERVE TARGET CALIBRATE COMPLEX GAIN CALIBRATE FLUX DENSITY SCALE CALIBRATE BANDPASS
Change	Change	00:05:00	More >>>

Find: Previous Next Highlight all Match case

NRAO Source Catalog Management Tool - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NRAO Source Catalog Managem...

nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602766

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

Search

Search Aliases As Well

External Search

Advanced Search

Advanced Search

Personal Catalog

VLA

SOURCES IN 'PERSONAL CATALOG' (0)

There are currently no Sources in this group!

Find: Previous Next Highlight all Match case

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66

➢ **File → create new → catalog. Fill out the name field (e.g. NRAO_CD_OPT).**

NRAO Source Catalog Management Tool - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NRAO Source Catalog Managem...

nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602766

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

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Advanced Search

Advanced Search

Personal Catalog

VLA

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Find: Previous Next Highlight all Match case

NRAO Source Catalog Management Tool - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NRAO Source Catalog Managem...

nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602772

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

Search

Search Aliases As Well

External Search

Advanced Search

Advanced Search

Personal Catalog

NRAO_CD_OPT

VLA

SOURCES IN 'NRAO_CD_OPT' (0)

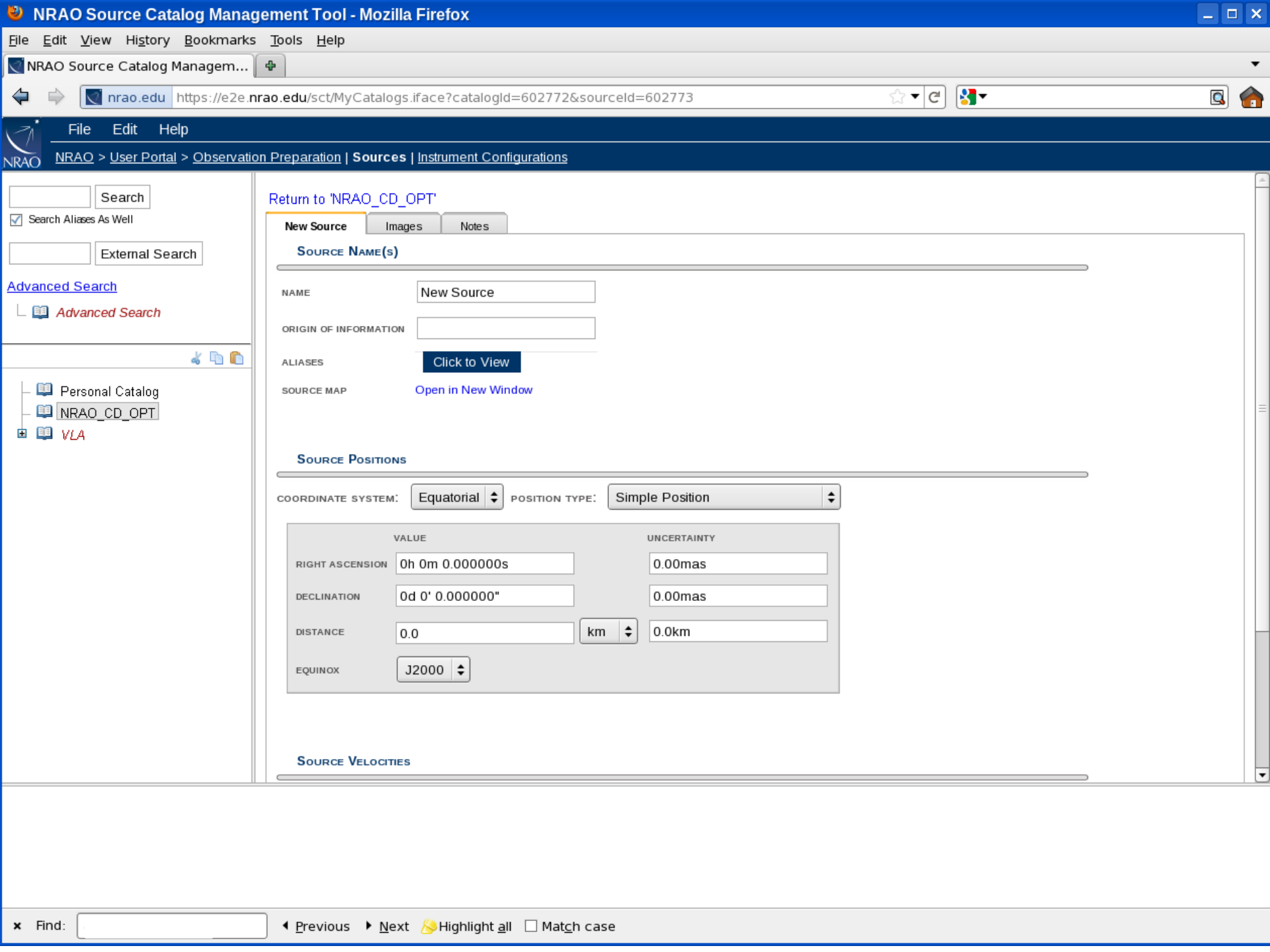
There are currently no Sources in this group!

Find: Previous Next Highlight all Match case

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66

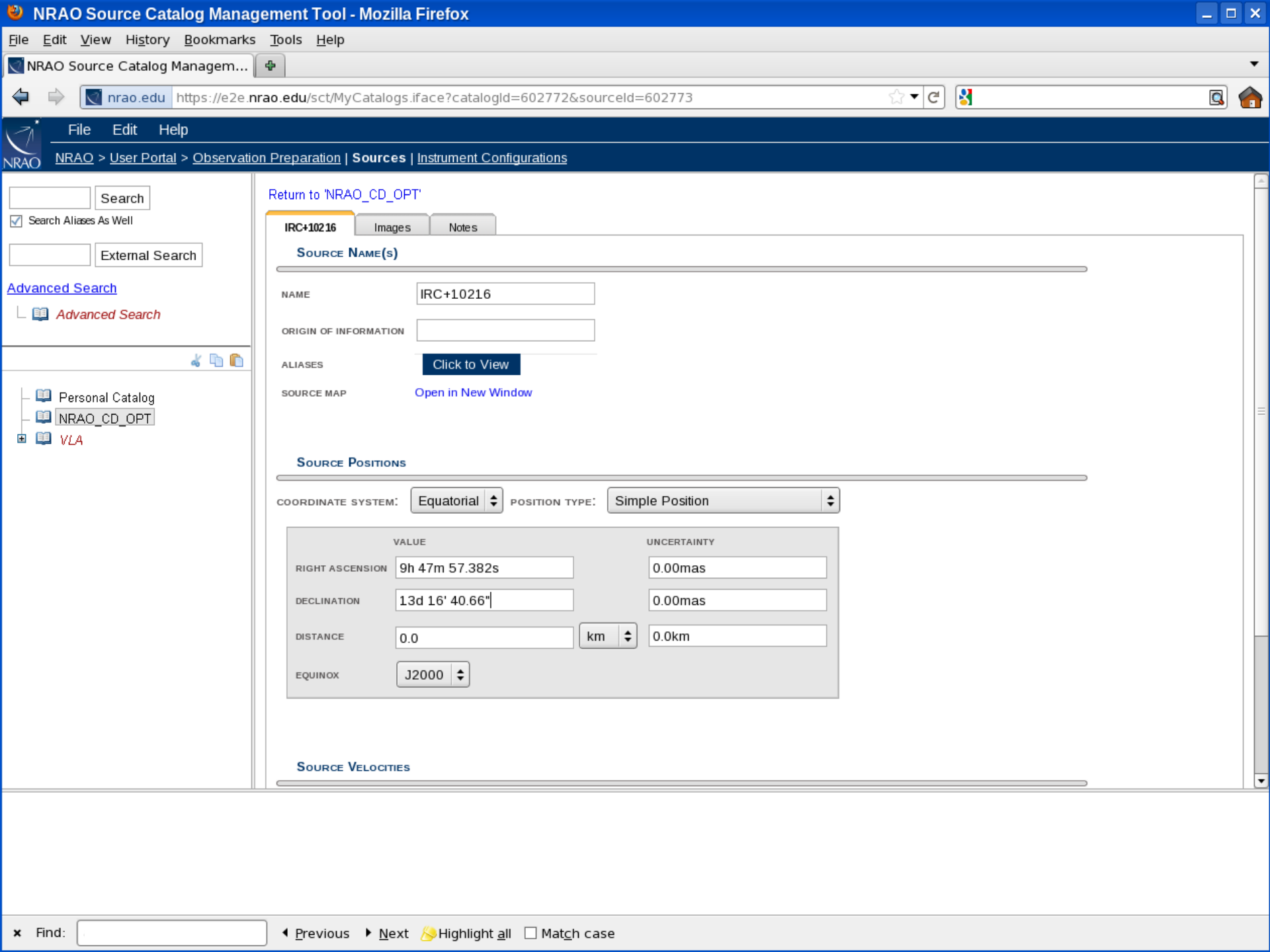
➢ **Click on the catalog NRAO_CD_OPT, and go to File → create new → Source**


NRAO Source Catalog Management Tool - Mozilla Firefox
File Edit View History Bookmarks Tools Help
NRAO Source Catalog Managem...
nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602772&sourceId=602773
File Edit Help
NRAO > User Portal > Observation Preparation | Sources | Instrument Configurations
Search
Search Aliases As Well
External Search
Advanced Search
Advanced Search
Personal Catalog
NRAO_CD_OPT
VLA
Return to 'NRAO_CD_OPT'
New Source
Images
Notes
Source Name(s)
NAME
New Source
ORIGIN OF INFORMATION
ALIASES
Click to View
SOURCE MAP
Open in New Window
Source Positions
COORDINATE SYSTEM:
Equatorial
POSITION TYPE:
Simple Position
VALUE
UNCERTAINTY
RIGHT ASCENSION
0h 0m 0.000000s
0.00mas
DECLINATION
0d 0' 0.000000"
0.00mas
DISTANCE
0.0
km
0.0km
EQUINOX
J2000
Source Velocities
Find:
Previous
Next
Highlight all
Match case

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66

➢ **Populate Name, R.A., Dec. fields.**


NRAO Source Catalog Management Tool - Mozilla Firefox
File Edit View History Bookmarks Tools Help
NRAO Source Catalog Managem...
nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602772&sourceId=602773
File Edit Help
NRAO > User Portal > Observation Preparation | Sources | Instrument Configurations
Search
Search Aliases As Well
External Search
Advanced Search
Advanced Search
Personal Catalog
NRAO_CD_OPT
VLA
Return to 'NRAO_CD_OPT'
IRC+10216
Images
Notes
Source Name(s)
NAME
IRC+10216
ORIGIN OF INFORMATION
ALIASES
Click to View
SOURCE MAP
Open in New Window
Source Positions
COORDINATE SYSTEM:
Equatorial
POSITION TYPE:
Simple Position
VALUE
UNCERTAINTY
RIGHT ASCENSION
9h 47m 57.382s
0.00mas
DECLINATION
13d 16' 40.66"
0.00mas
DISTANCE
0.0
km
0.0km
EQUINOX
J2000
Source Velocities
Find:
Previous
Next
Highlight all
Match case

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66

➢ **Target's LST range: Click on the 'images'.**

NRAO Source Catalog Management Tool

NRAO Source Catalog Managem...

https://obs.vla.nrao.edu/sct/MyCatalogs.jsf;jsessionid=2A5AB02C26A76285D6A4E582CBE73D42?catalogId=602772&sour

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

Hello, Dr. Galactico Armenian Exit

Notice: every day at **15:30** and **23:30 UTC** this program may be taken offline for a few minutes.

Search

Search Aliases As Well

External Search

Advanced Search

Advanced Search

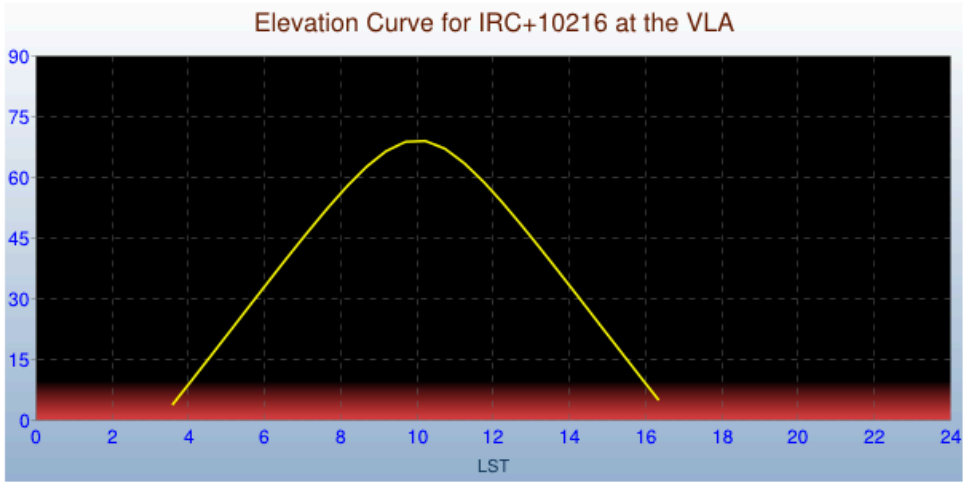
VLA

NRAO_CD_OPT

Personal Catalog

IRC+10216 | **Images** | Notes

VISIBILITY CHART



Elevation	LST (Rising)	LST (Setting)
8	03:51	15:45
10	04:01	15:35
15	04:25	15:11
20	04:49	14:47
25	05:13	14:22
30	05:38	13:58
80		

Azimuth Curve for IRC+10216 at the VLA

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- LST target: 05:45→13:45 (high elevations for high frequencies)

- **What calibrators are needed?**
  - **Phase calibrator.**
  - **Reference pointing calibrator (C or X-band).**
  - **Bandpass Calibrator.**
  - **Flux density Calibrator.**

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- LST target: 05:45→13:45 (high elevations for high frequencies)

➢ **Finding a phase calibrator: Click on the catalog name 'NRAO_CD_OPT' on the side menu, then choose 'sky map'**

NRAO Source Catalog Management Tool - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NRAO Source Catalog Managem...

nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602772

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

Search

Search Aliases As Well

External Search

Advanced Search

Advanced Search

Personal Catalog

NRAO_CD_OPT

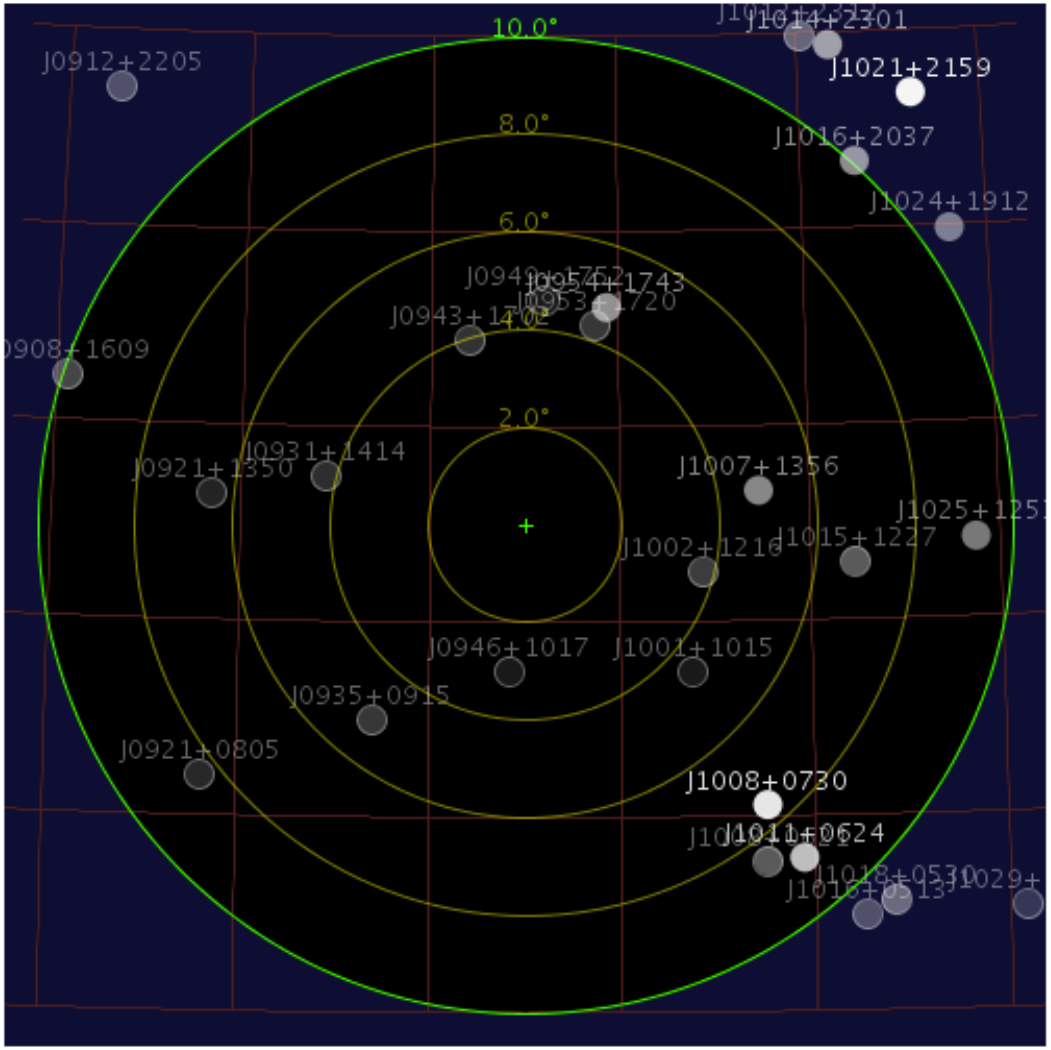
VLA

SOURCES IN 'NRAO_CD_OPT' (1)

Select: All | None Show: 25 | 50 | 100 | 200 SELECT COORDINATE SYSTEM: Equatorial

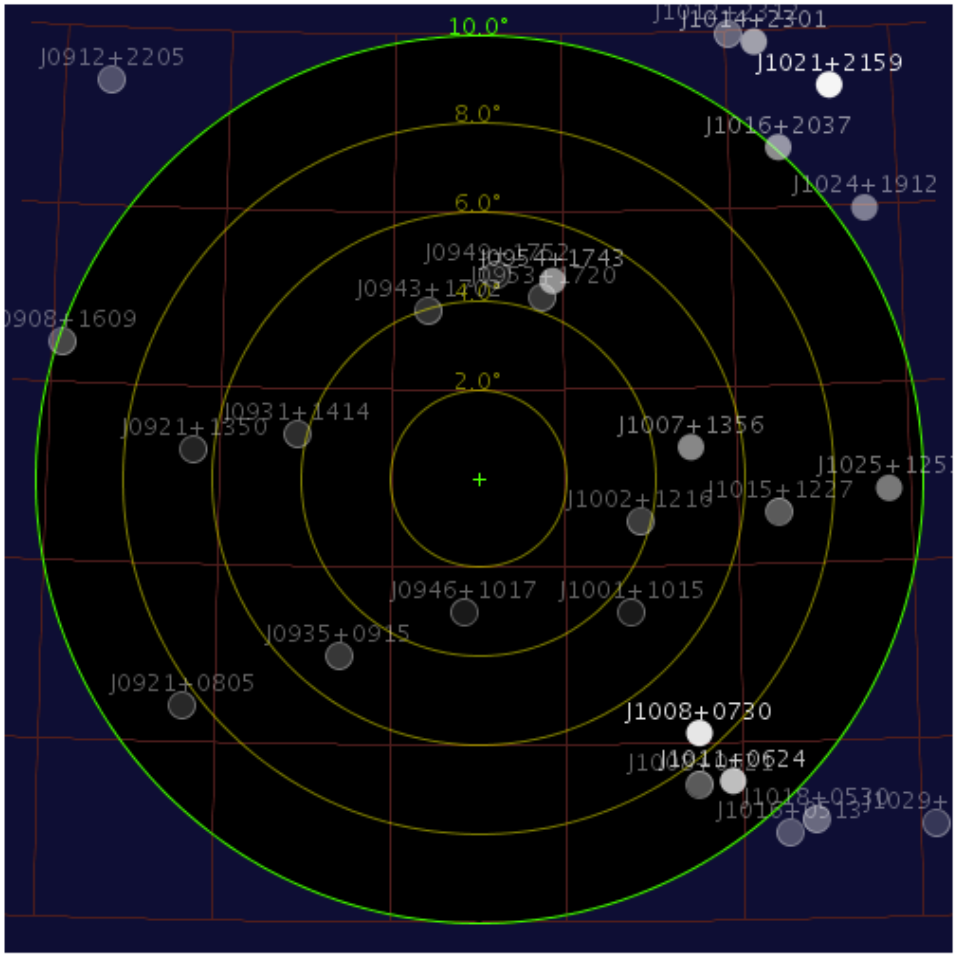
		Name	Right Ascension	Declination	Velocity	Flux / Structure		Sky Map
☐		IRC+10216	9h 47m 57.382s	13d 16' 40.66"	-26.0 km/s LSRK Radio	DETAILS	ALIASES	

Find: Previous Next Highlight all Match case



Objective: Finding a nearby phase calibrator.
Hover over source to see information

NRAO



J0954+1743

Aliases: 0954+177 B0952+1757 0952+179

Positions:
RA: 9h 54m 56.824s
Dec: 17° 43' 31.222"

Uncertainties (mas):
RA: 2.0
Dec: 2.0

Flux / Structure

Band	Flux	A	B	C	D	UV_{min} (kλ)	UV_{max} (kλ)
L (20.0cm)	1.1Jy	P	X	X	X	45.0	
C (5.0cm)	0.7Jy	S	S	S	X	20.0	
X (3.0cm)	0.61Jy	P	P	P	P		
Ku (2.0cm)	0.6Jy	S	S	S	S		
Q (0.7cm)	0.4Jy	W	W	W	W		

Velocities:
No Information

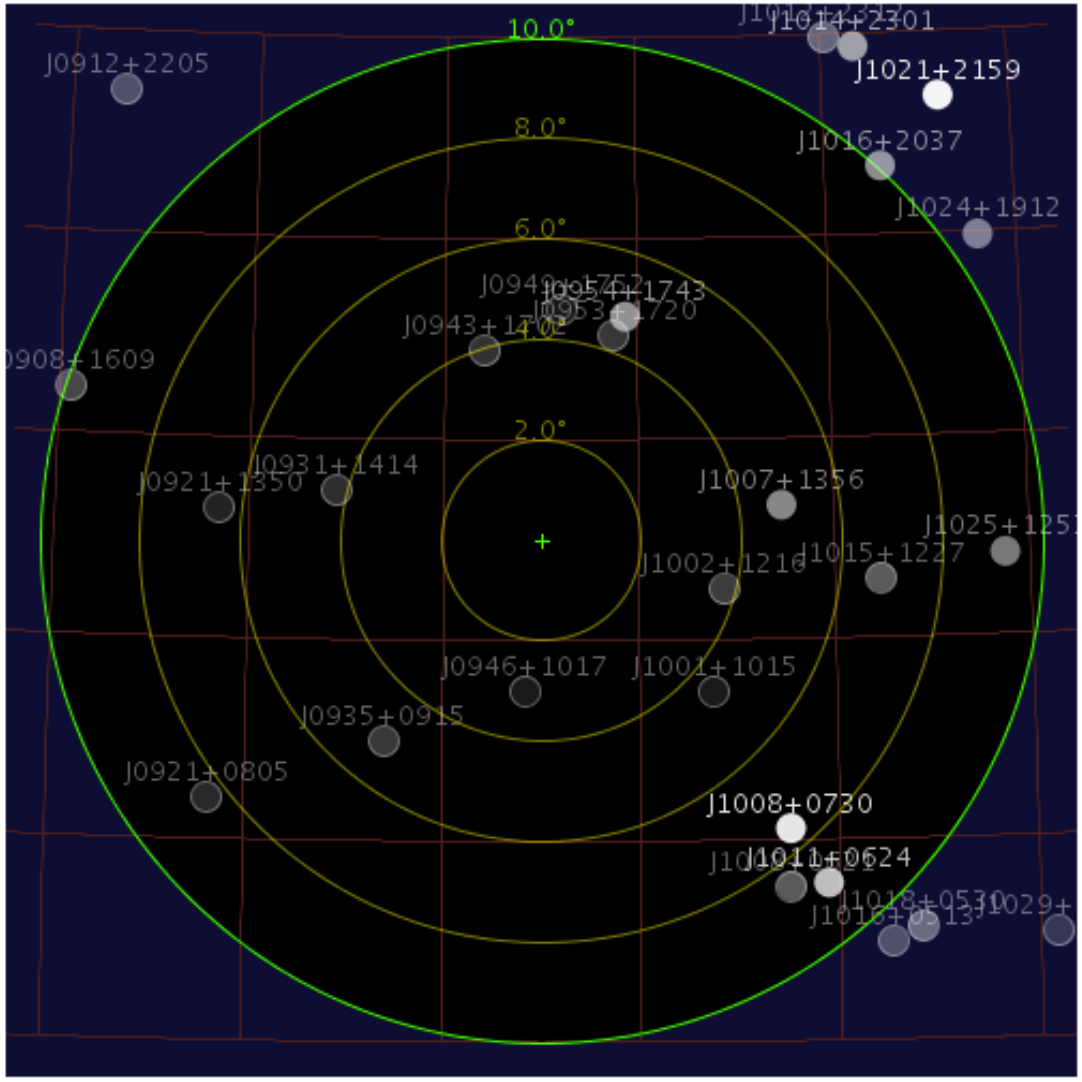
Images:
None

A good gain calibrator for this frequency band would be **J0954+1743**

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- LST target: 05:45→13:45 (high elevations for high frequencies)
- Phase calibrator: J0954+1743

➢ **Finding a reference pointing calibrator (C or X-band, for the target and the phase calibrator).**



J1008+0730

Aliases: 3C237 1008+075 B1005+0744 1005+077

Positions:
RA: 10h 8m 0.016s
Dec: 7° 30' 16.552"

Uncertainties (mas):
RA: 1000.0
Dec: 1000.0

Flux / Structure

Band	Flux	A	B	C	D	UV_{min} (kλ)	UV_{max} (kλ)
L (20.0cm)	6.63Jy	X	X	S	P		15.0
C (5.0cm)	2.5Jy	X	X	X	S		15.0
Ku (2.0cm)	0.5Jy	X	X	X	X		
Q (0.7cm)	0Jy	X	X	X	X		

Velocities:
No Information

Images:
None

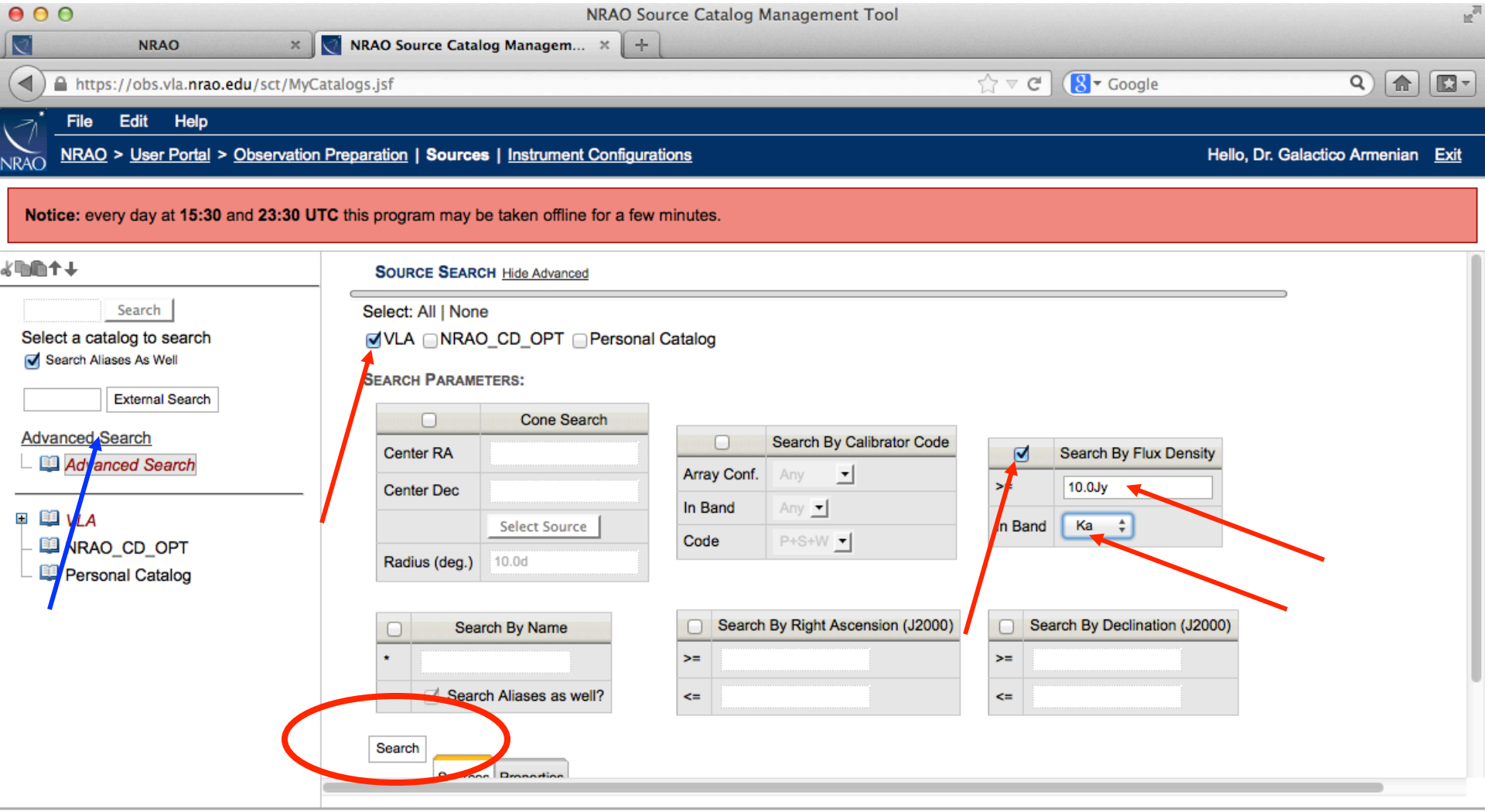
Objective: Finding a nearby reference pointing calibrator.
At C-band, a good reference pointing calibrator would be **J1008+0730**

NRAO

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- LST target: 05:45→13:45 (high elevations for high frequencies)
- Phase calibrator: J0954+1743
- Reference pointing (C-band): J1008+0730

➢ **Finding a bandpass calibrator: use the 'Advanced Search' (on the left).**


NRAO Source Catalog Management Tool
NRAO
NRAO Source Catalog Managem...
https://obs.vla.nrao.edu/sct/MyCatalogs.jsf
Google
File Edit Help
NRAO > User Portal > Observation Preparation | Sources | Instrument Configurations
Hello, Dr. Galactico Armenian Exit
Notice: every day at 15:30 and 23:30 UTC this program may be taken offline for a few minutes.
Search
Select a catalog to search
Search Aliases As Well
External Search
Advanced Search
Advanced Search
VLA
NRAO_CD_OPT
Personal Catalog
SOURCE SEARCH Hide Advanced
Select: All | None
VLA NRAO_CD_OPT Personal Catalog
SEARCH PARAMETERS:
Cone Search
Center RA
Center Dec
Select Source
Radius (deg.)
10.0d
Search By Calibrator Code
Array Conf.
Any
In Band
Any
Code
P+S+W
Search By Flux Density
>=
10.0Jy
In Band
Ka
Search By Name
*
Search Aliases as well?
Search By Right Ascension (J2000)
>=
<=
Search By Declination (J2000)
>=
<=
Search

Search

Sources | Properties

SOURCES IN '1. SEARCH RESULTS' (5)

Select: All | None Show: 25 | 50 | 100 | 200 SELECT COORDINATE SYSTEM: Equatorial

		Catalog	Name	Right Ascension	Declination	Velocity	Flux / Structure		Sky Map
☐		VLA	J1229+0203	12h 29m 6.699729s	2d 3' 8.59819"		DETAILS	ALIASES	
☐		VLA	J1230+1223	12h 30m 49.423381s	12d 23' 28.04393"		DETAILS	ALIASES	
☐		VLA	J1256-0547	12h 56m 11.16656s	-5d 47' 21.52458"		DETAILS	ALIASES	
☐		VLA	J1642+3948	16h 42m 58.809951s	39d 48' 36.99395"		DETAILS	ALIASES	
☐		VLA	J2253+1608	22h 53m 57.747932s	16d 8' 53.56089"		DETAILS	ALIASES	

Search

Sources | Properties

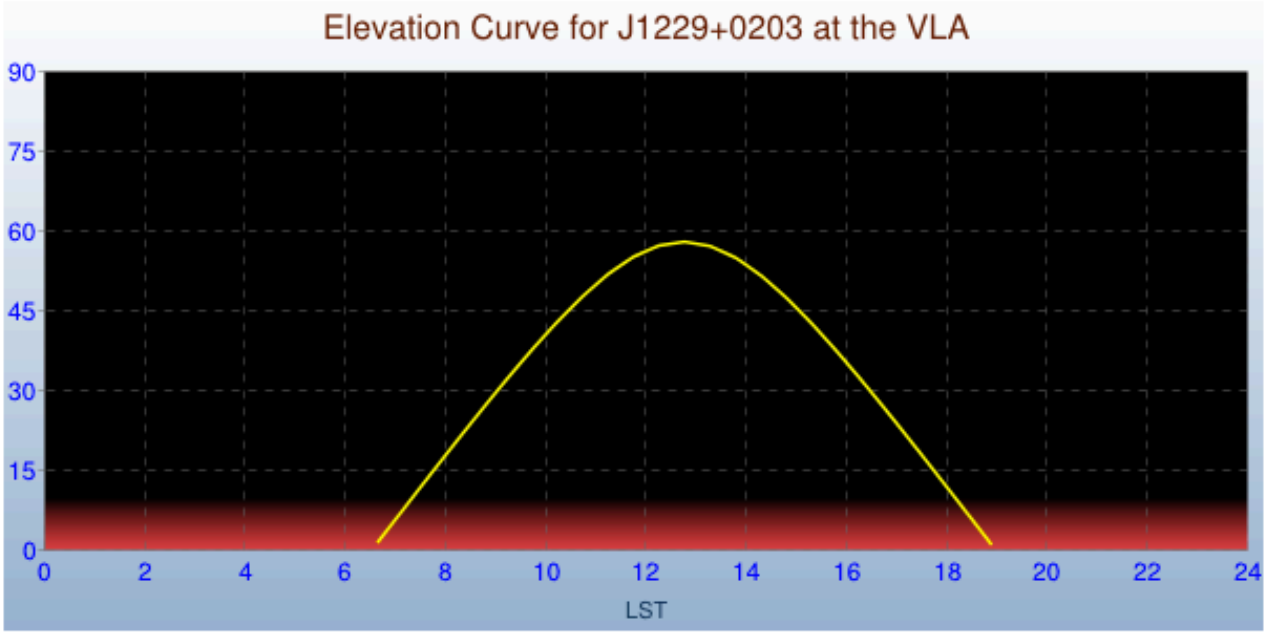
Sources in '1. Search Results' (5)

Select: All | None Show: 25 | 50 | 100 | 200 SELECT COORDINATE SYSTEM: Equatorial

		Catalog	Name	Right Ascension	Declination	Velocity	Flux / Structure		Sky Map
☐		VLA	J1229+0203	12h 29m 6.699729s	2d 3' 8.59819"		DETAILS	ALIASES	
☐		VLA	J1230+1223	12h 30m 49.423381s	12d 23' 28.04393"		DETAILS	ALIASES	
☐		VLA	J1256-0547	12h 56m 11.16656s	-5d 47' 21.52458"		DETAILS	ALIASES	

J1229+0203 | Images | Notes

Visibility Chart



Elevation	LST (Rising)	LST (Setting)
8	07:02	17:56
10	07:12	17:46
15	07:36	17:22
20	08:01	16:58
25	08:26	16:33
30	08:51	16:07
80		

Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- LST target 05:45→13:45 (high elevations for high frequencies)
- Phase calibrator: J0954+1743
- Reference pointing (C-band): J1008+0730
- Bandpass calibrator: J1229+0203 (LST range: 9:00→16:00)

➢ **Finding a Flux calibrator: Click on the + of the 'VLA' catalog, then on 'VLA Flux Cal'.**

NRAO Source Catalog Management Tool - Mozilla Firefox

File Edit View History Bookmarks Tools Help

NRAO Source Catalog Managem...

nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602772

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

Search

Search Aliases As Well

External Search

Advanced Search

Advanced Search

1. Search Results

2. Search Results

Personal Catalog

NRAO_CD_OPT

VLA

RA Groups

Dec Groups

VLA Flux Cal

SOURCES IN 'VLA FLUX CAL' (5)

Select: All | None Show: 25 | 50 | 100 | 200 SELECT COORDINATE SYSTEM: Equatorial

		Name	Right Ascension	Declination	Velocity	Flux / Structure		Sky Map
☐		0137+331=3C48	1h 37m 41.299431s	33d 9' 35.13299"		DETAILS	ALIASES	
☐		0542+498=3C147	5h 42m 36.137916s	49d 51' 7.23356"		DETAILS	ALIASES	
☐		1331+305=3C286	13h 31m 8.287984s	30d 30' 32.95885"		DETAILS	ALIASES	
☐		0521+166=3C138	5h 21m 9.886021s	16d 38' 22.05122"		DETAILS	ALIASES	
☐		1411+522=3C295	14h 11m 20.6477s	52d 12' 9.141"		DETAILS	ALIASES	

Find: Previous Next Highlight all Match case

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NRAO Source Catalog Managem...

nrao.edu https://e2e.nrao.edu/sct/MyCatalogs.iface?catalogId=602772

File Edit Help

NRAO > User Portal > Observation Preparation | **Sources** | Instrument Configurations

Search

Search Aliases As Well

External Search

Advanced Search

Advanced Search

1. Search Results

2. Search Results

Personal Catalog

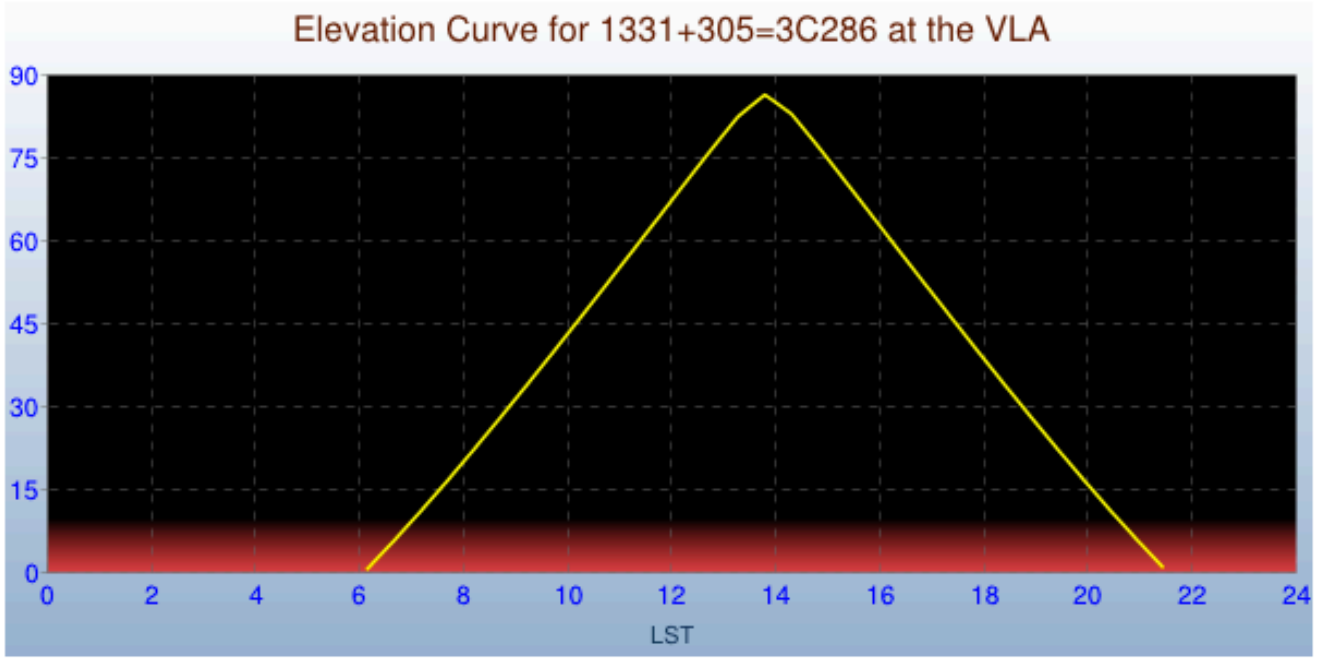
NRAO_CD_OPT

VLA

SOURCES IN 'VLA FLUX CAL' (5)

Select: All | None Show: 25 | 50 | 100 | 200 SELECT COORDINATE SYSTEM: Equatorial

		Name	Right Ascension	Declination	Velocity	Flux / Structure		Sky Map
☐		0137+331=3C48	1h 37m 41.299431s	33d 9' 35.13299"		DETAILS	ALIASES	
☐		0542+498=3C147	5h 42m 36.137916s	49d 51' 7.23356"		DETAILS	ALIASES	
☐		1331+305=3C286	13h 31m 8.287984s	30d 30' 32.95885"		DETAILS	ALIASES	
☐		0521+166=3C138	5h 21m 9.886021s	16d 38' 22.05122"		DETAILS	ALIASES	
☐		1411+522=3C295	14h 11m 20.6477s	52d 12' 9.141"		DETAILS	ALIASES	



Elevation	LST (Rising)	LST (Setting)
8	06:44	20:18
10	06:55	20:07
15	07:23	19:39
20	07:50	19:13
25	08:16	18:46
30	08:41	18:21
80	12:47	14:15

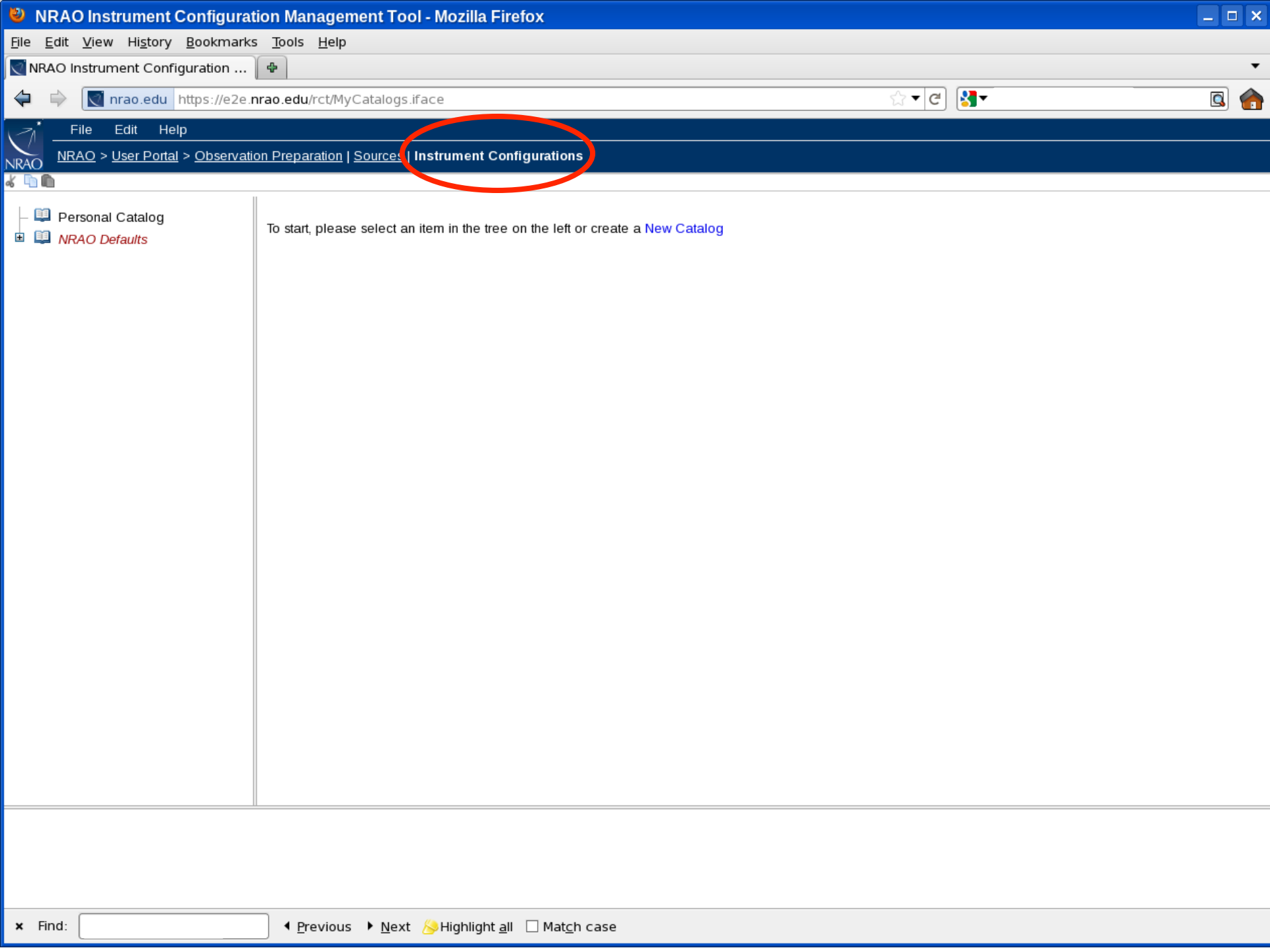
Source Catalog (SCT)

- Target source: the AGB star IRC+10216
- RA (J2000): 09:47:57.382, DEC (J2000)= +13:16:40.66
- LST target: 05:45→13:45 (high elevations for high frequencies)
- Phase calibrator: J0954+1743
- Reference pointing (C-band): J1008+0730
- Bandpass calibrator: J1229+0203 (LST range~ 9:00→16:00)
- Flux density calibrator: J1331+305=3C286 (LST range~ 8:30→18:30, gap between 12:45 – 14:15 to avoid elevations > 80 degrees).

- Note that the bandpass and flux density calibrators do not require separate reference pointing calibrators.

Resource Catalog (RCT)

- Ka –band targeting the HC3N (ν_o=36.39232 GHz) and the SiS (ν_o= 36.30963 GHz) lines.
- V (radio, LSR) = -26 km/s
- ΔV ~ 35 km/s


NRAO Instrument Configuration Management Tool - Mozilla Firefox
File Edit View History Bookmarks Tools Help
NRAO Instrument Configuration ...
nrao.edu https://e2e.nrao.edu/rct/MyCatalogs.iface
File Edit Help
NRAO > User Portal > Observation Preparation | Sources | Instrument Configurations
Personal Catalog
NRAO Defaults
To start, please select an item in the tree on the left or create a New Catalog
Find: Previous Next Highlight all Match case

Resource Catalog (RCT)

- File → Create New → Catalog, fill out the name (e.g., NRAO_CD).
- File → Create New → 8-bit Instrument Configuration

NRAO Instrument Configuration Tool – [New Resource] – Basics

NRAO | NRAO Instrument Configuration...

https://obs.vla.nrao.edu/rct/secure/catalogs/680614/resources/680615/basics.xhtml?group=0

File Edit Help

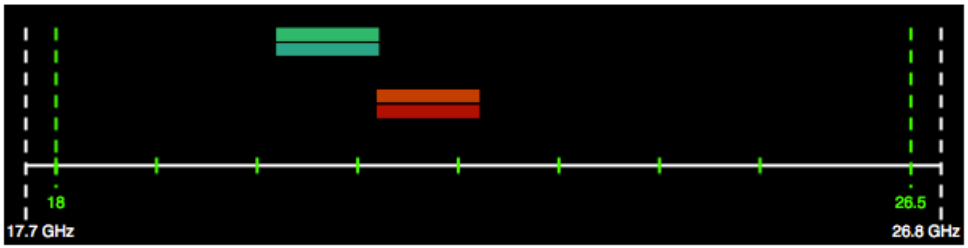
NRAO > User Portal > Observation Preparation | Sources | **Instrument Configurations**

Hello, Dr. Galactico Armenian Exit

Notice: every day at **15:30** and **23:30 UTC** this program may be taken offline for a few minutes.

- *NRAO Defaults*
- *old OSRO NRAO Defaults*
- *NRAO Defaults*
- Old CD
- Personal Catalog
- NRAO_CD

NRAO_CD » [New Resource]

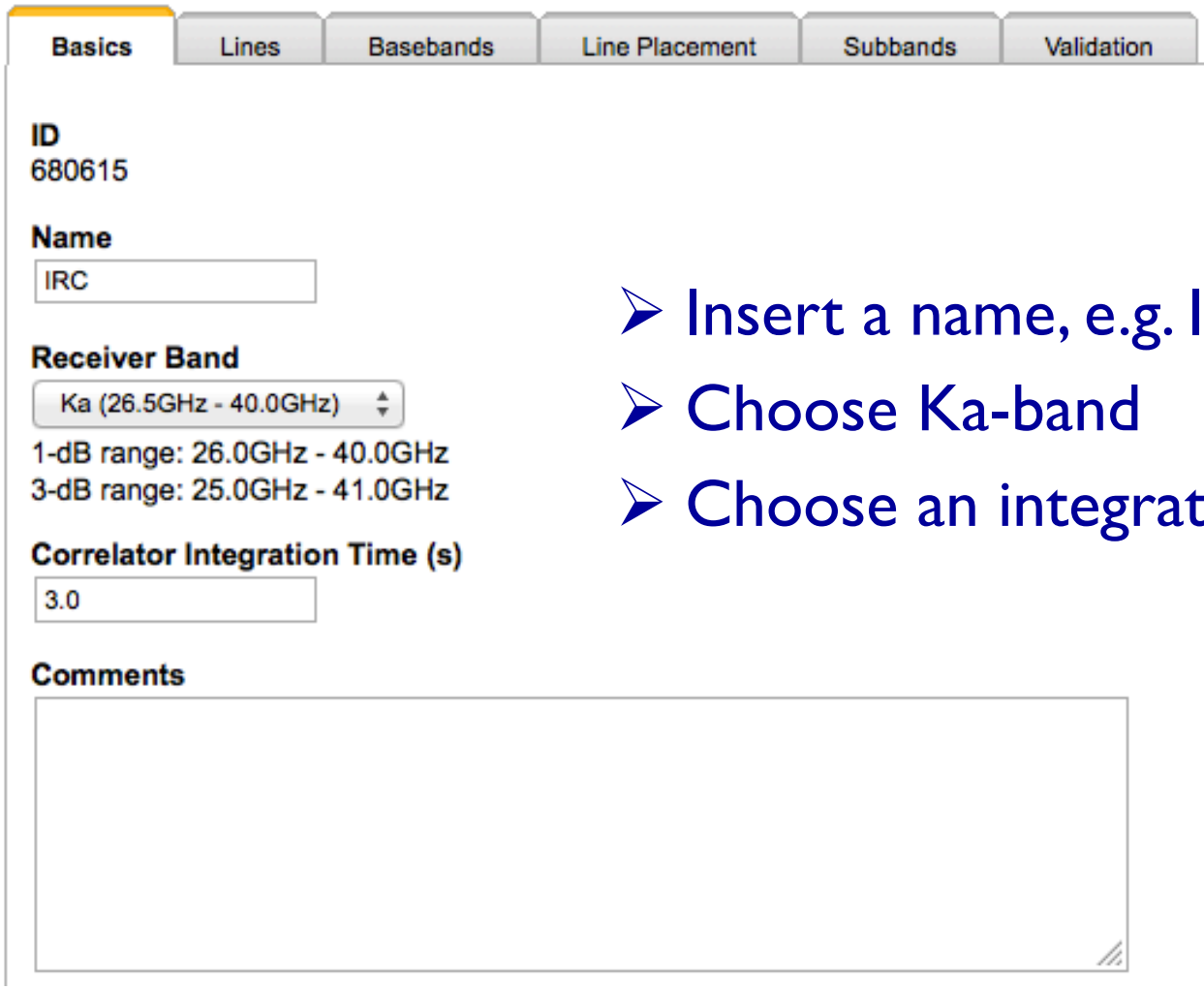


Total Bl. BPs Used:	0 of 64
Total Data Rate:	0.00 MB/s or 0.00 GB/h
Total Spectral Points:	0
Total Bandwidth:	0.0GHz
Capability Mode:	General observing

Basics | Lines | Basebands | Line Placement | Subbands | Validation

ID
680615

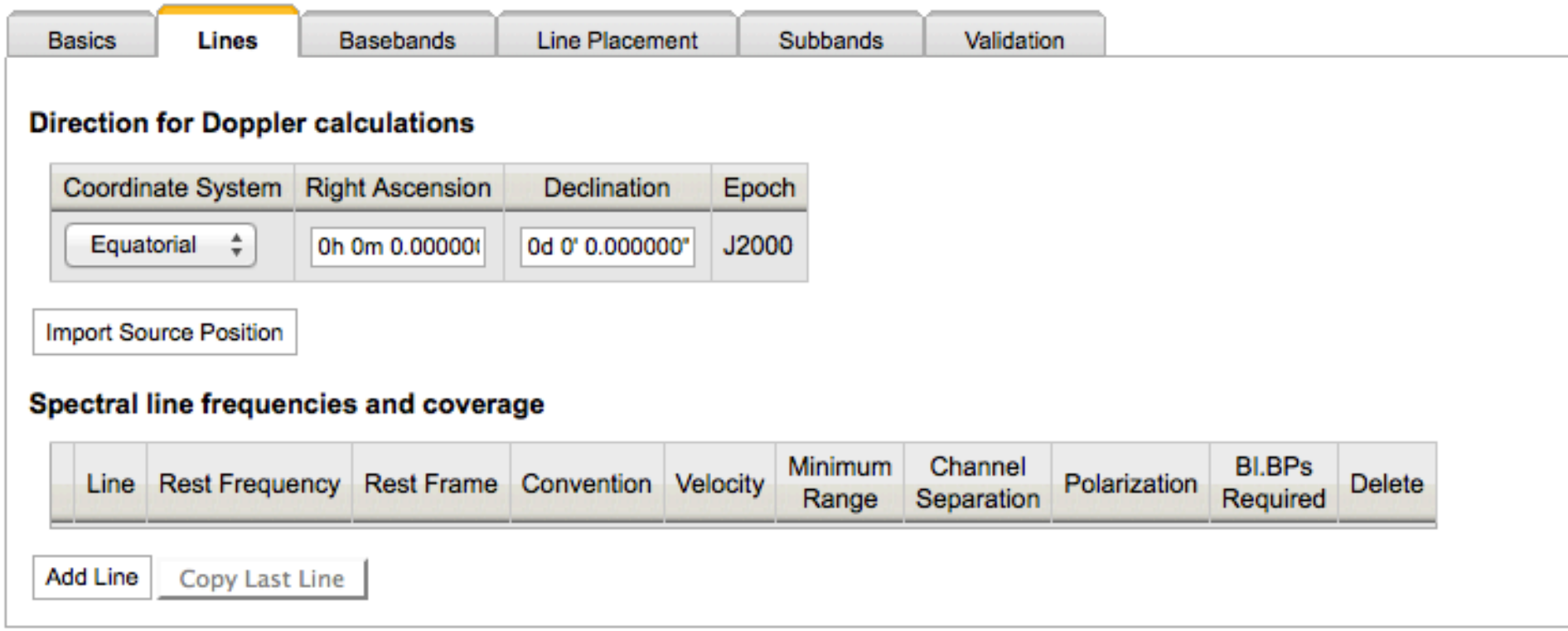
Resource Catalog (RCT)



- Insert a name, e.g. IRC
- Choose Ka-band
- Choose an integration time (e.g., 3 sec)

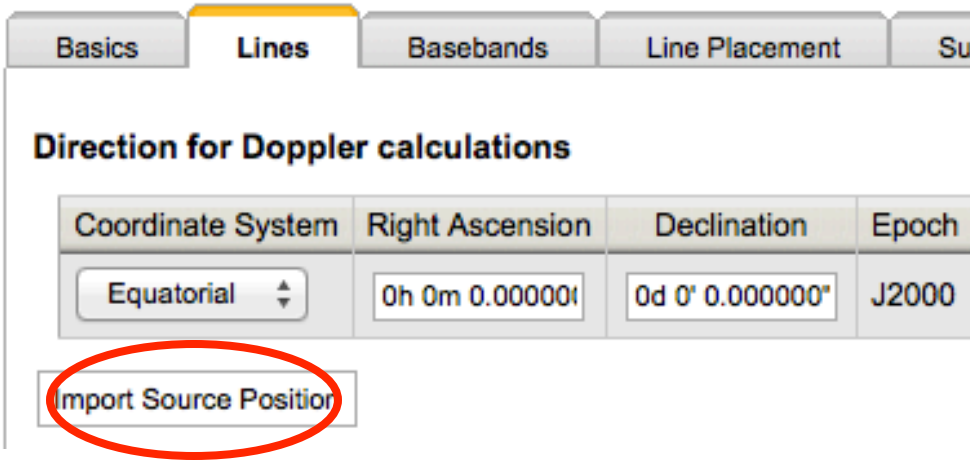
Resource Catalog (RCT)

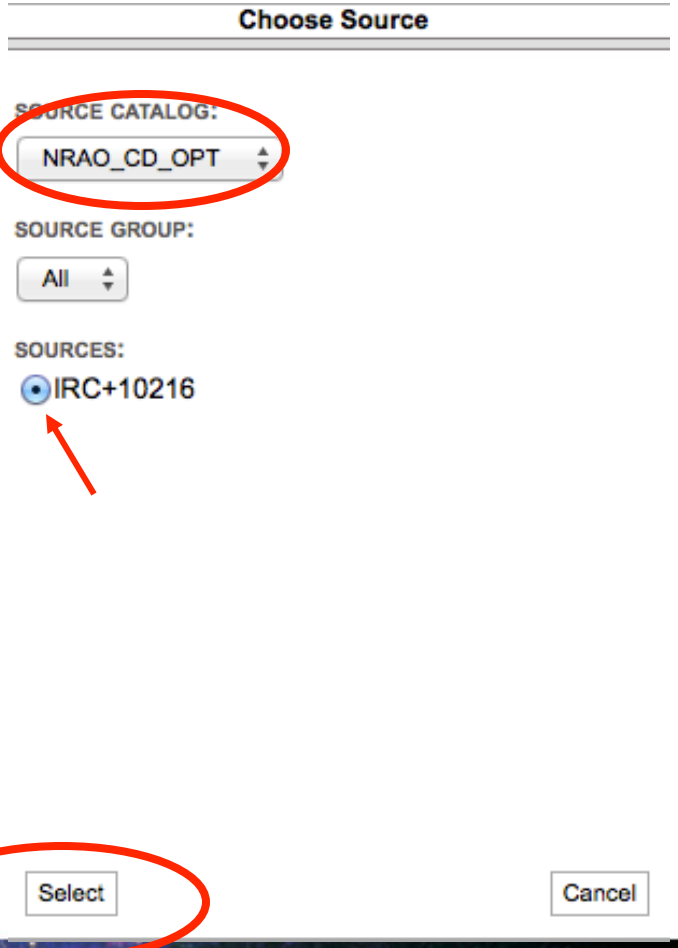
- Go to "Lines" tab



Resource Catalog (RCT)

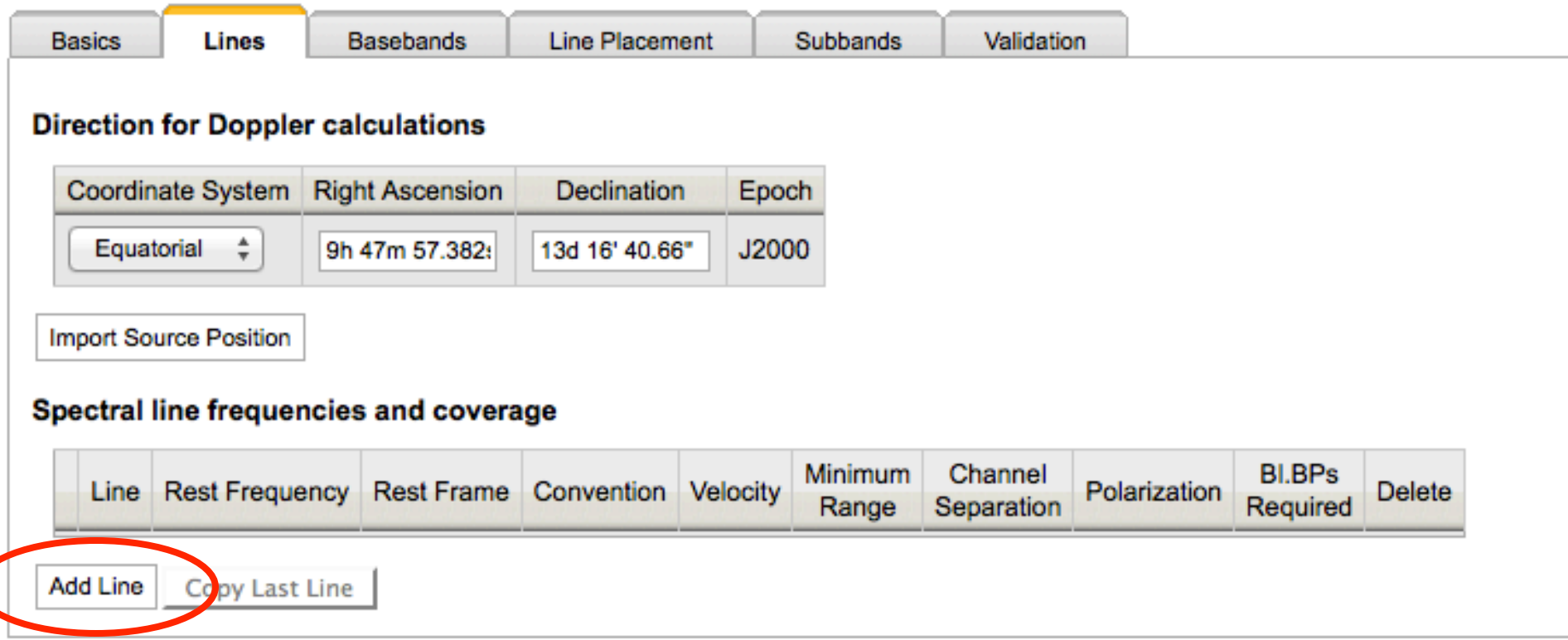
- Insert or Import Source Position





Resource Catalog (RCT)

- Add Line



Resource Catalog (RCT)

- HC3N (ν_o=36.39232 GHz).
- V (radio, LSR) = -26 km/s
- Minimum Range = 35 km/s
- Channel Separation = 2 km/s

	Line	Rest Frequency	Rest Frame	Convention	Velocity	Minimum Range	Channel Separation	Polarization
L1	HC3N	36.39232 36.396GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.249MHz	2.0 km/s 242.783kHz	Full

Add Line | Copy Last Line

Resource Catalog (RCT)

- HC3N (ν_o=36.39232 GHz).
- V (radio, LSR) = -26 km/s
- Minimum Range = 35 km/s
- Channel Separation = 2 km/s

	Line	Rest Frequency	Rest Frame	Convention	Velocity	Minimum Range	Channel Separation	Polarization
L1	HC3N	36.39232 36.396GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.249MHz	2.0 km/s 242.783kHz	Full

Add Line | Copy Last Line

- SiS (ν_o=36.30963 GHz).

Spectral line frequencies and coverage

	Line	Rest Frequency	Rest Frame	Convention	Velocity	Minimum Range	Channel Separation	Polarization
L1	HC3N	36.39232 36.396GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.249MHz	2.0 km/s 242.783kHz	Full
L2	SiS	36.30963 36.313GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.239MHz	2.0 km/s 242.232kHz	Full

Resource Catalog (RCT)

- HC3N (ν_o=36.39232 GHz).
- V (radio, LSR) = -26 km/s
- Minimum Range = 35 km/s
- Channel Separation = 2 km/s

	Line	Rest Frequency	Rest Frame	Convention	Velocity	Minimum Range	Channel Separation	Polarization
L1	HC3N	36.39232 36.396GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.249MHz	2.0 km/s 242.783kHz	Full

Add Line | Copy Last Line

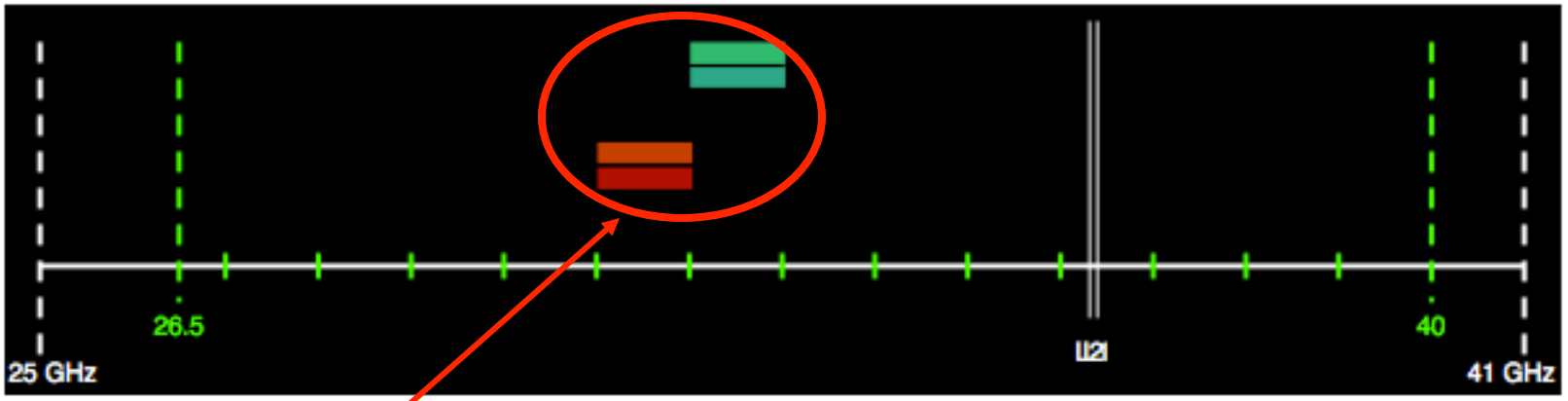
- SiS (ν_o=36.30963 GHz).

Spectral line frequencies and coverage

	Line	Rest Frequency	Rest Frame	Convention	Velocity	Minimum Range	Channel Separation	Polarization
L1	HC3N	36.396GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.249MHz	2.0 km/s 242.783kHz	Full
L2	SiS	36.313GHz	LSR	Radio (km/s)	-26.0 km/s	35.0 km/s 4.239MHz	2.0 km/s 242.232kHz	Full

Resource Catalog (RCT)

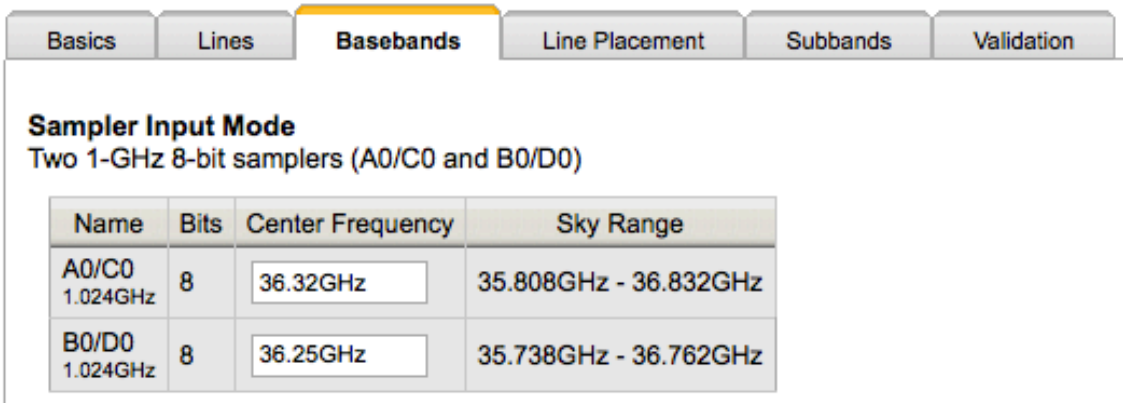
NRAO_CD » IRC



These are the two 1 GHz wide basebands of the 8 bit samplers. We need to overlap them with the lines.

Resource Catalog (RCT)

- Go to "Basebands" tab



Resource Catalog (RCT)

- Still under "Basebands" tab:

- We will Doppler set the baseband A0/C0 on HC3N
- We will Doppler set the baseband B0/D0 on SiS

Name	Doppler Line	Offset From Center	Target Sky Frequency	Position	Velocity	Rest Frame	Convention
A0/C0	☑ HC3N - 36.392GHz	-75.898MHz	36.396GHz	9h 47m 57.382s 13d 16' 40.66"	-26.0km/s	Lsr Kinematic	Radio
B0/D0	☑ SiS - 36.310GHz	-63.200MHz	36.313GHz	9h 47m 57.382s 13d 16' 40.66"	-26.0km/s	Lsr Kinematic	Radio

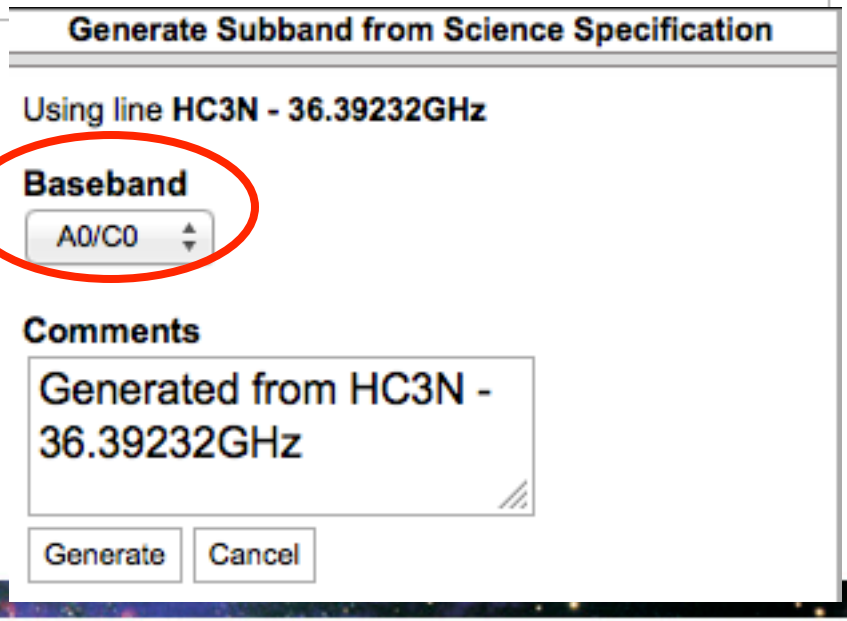
Resource Catalog (RCT)

- Go to "Line Placement" tab

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

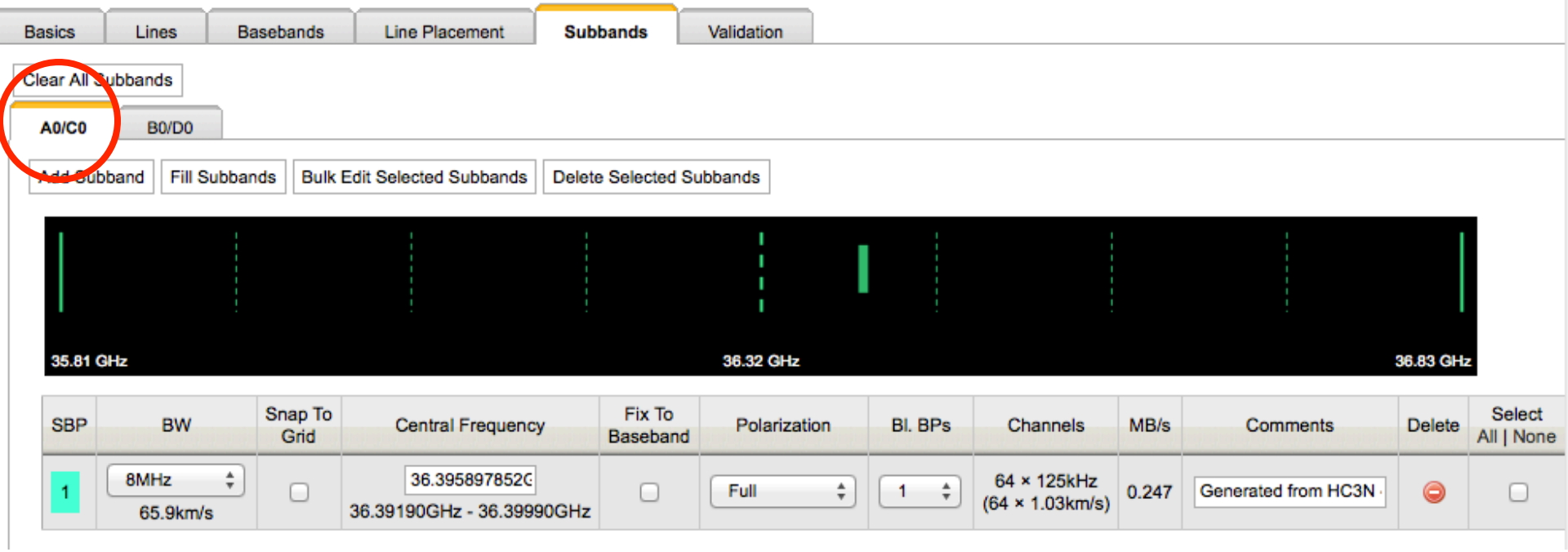
	Line	Rest Frequency	Rest Frame	Convention	Velocity	Minimum Range	Channel Separation	Polarization	Bl.BPs Required	Generate
L1	HC3N	36.39232GHz 36.396GHz	Lsr Kinematic	Radio	-26km/s	35.0 km/s 4.249MHz	2.0 km/s 242.783kHz	FULL	1	Generate
L2	SiS	36.30963GHz 36.313GHz	Lsr Kinematic	Radio	-26km/s	35.0 km/s 4.239MHz	2.0 km/s 242.232kHz	FULL	1	Generate

- Click on Generate for HC3N.
- Choose **A0/C0**, Generate
- Repeat for SiS.
- Choose **B0/D0**, Generate.



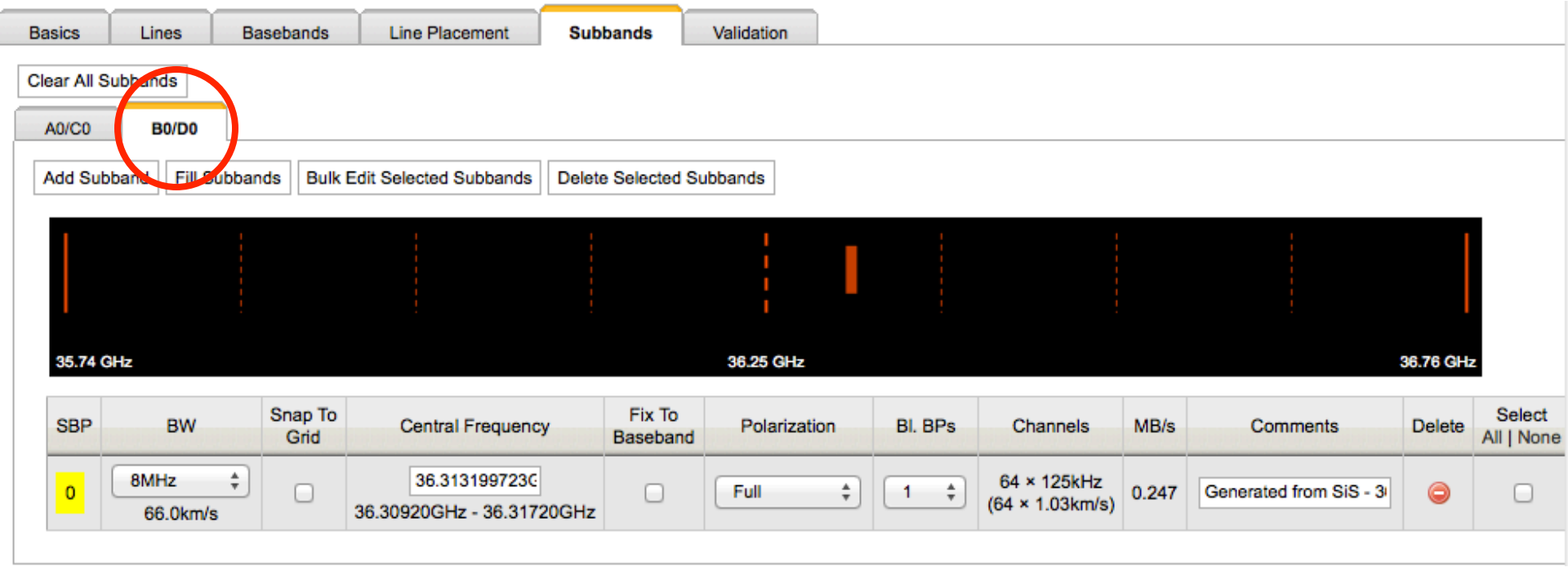
Resource Catalog (RCT)

- Go to "Subbands" tab



Resource Catalog (RCT)

- Go to "Subbands" tab



Resource Catalog (RCT)

- Go to "Validation" tab to view the summary and see if there are any warning messages.

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

Name:	IRC
Tint:	3.0
Receiver Band:	Ka (26.5GHz - 40.0GHz)

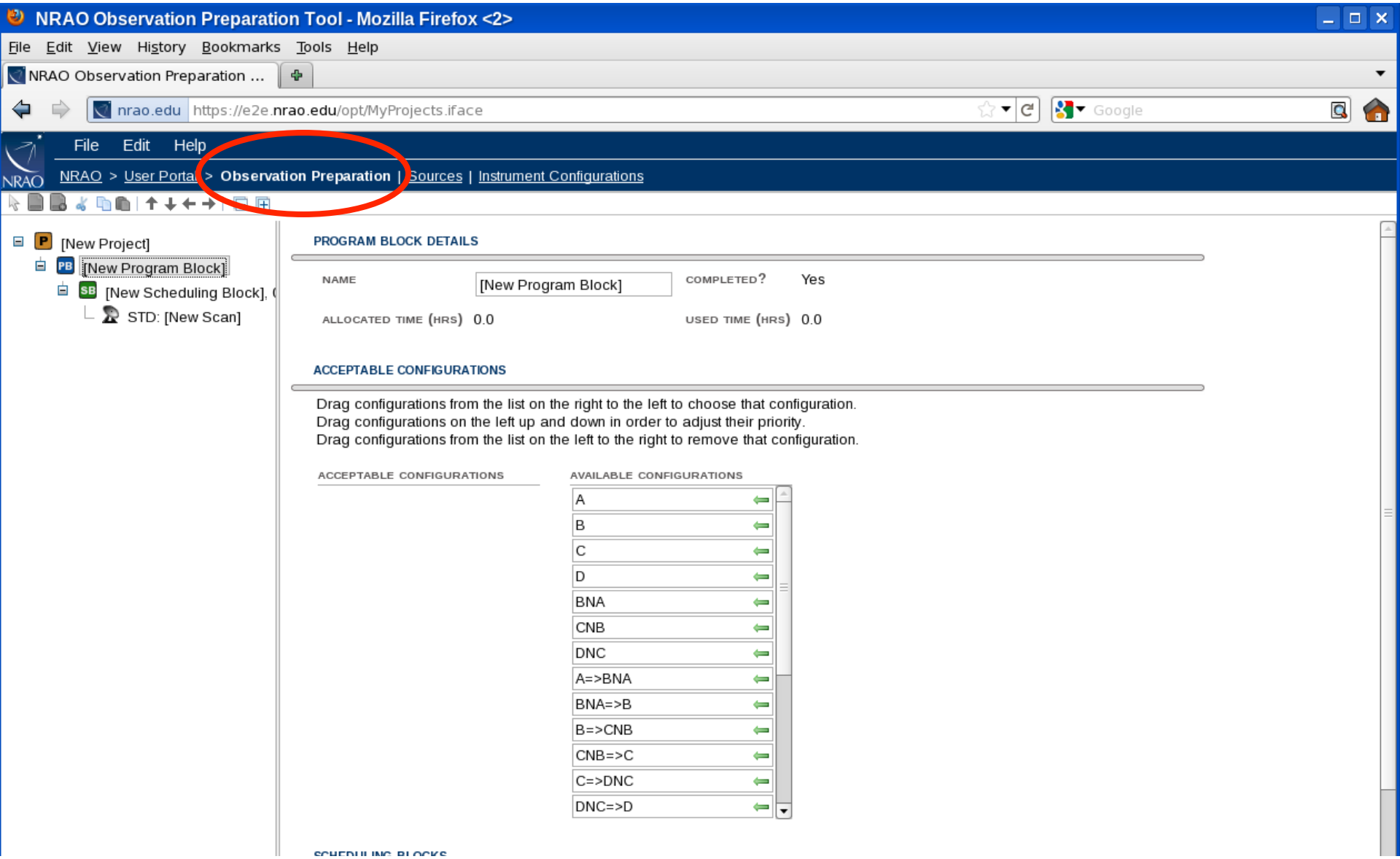
T_{int}	AC BB_{center} Freq	AC Summed BW	AC Coverage	Req. BIBPs	# Channels	AC Doppler Line	AC Doppler Vel.	AC Doppler Pos.	AC Doppler
Band	BD BB_{center} Freq	BD Summed BW	BD Coverage	Total BIBPs	Min/Max Width	BD Doppler Line	BD Doppler Vel.	BD Doppler Pos.	BD Doppler
3s	36.31911053GHz	8.0MHz	0.78125 %	2	128	36.39232GHz	-26.0km/s LSR Radio	9h 47m 57.382s 13d 16' 40.66"	-75.837683
Ka	36.24911255GHz	8.0MHz	0.78125 %	2	125.0kHz / 125.0kHz	36.30963GHz	-26.0km/s LSR Radio	9h 47m 57.382s 13d 16' 40.66"	-63.13969

Baseband	ID	SB Bandwidth	Frequency Range	Center	Polarization	BIBPs	Channels	Ch. Width	Phased	Data Rate	Priority	C
A0/C0	0	8MHz	36.39183768GHz - 36.39983768GHz	36.39583768GHz	Full	1	64	125.0kHz	No	0.247 MB/s	0	Generated from
B0/D0	0	8MHz	36.30919972GHz - 36.31719972GHz	36.31319972GHz	Full	1	64	125.0kHz	No	0.247 MB/s	0	Generated from

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Q1	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q3	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Data Rate
0.494 MB/s
1.777 GB/h

Observation Preparation



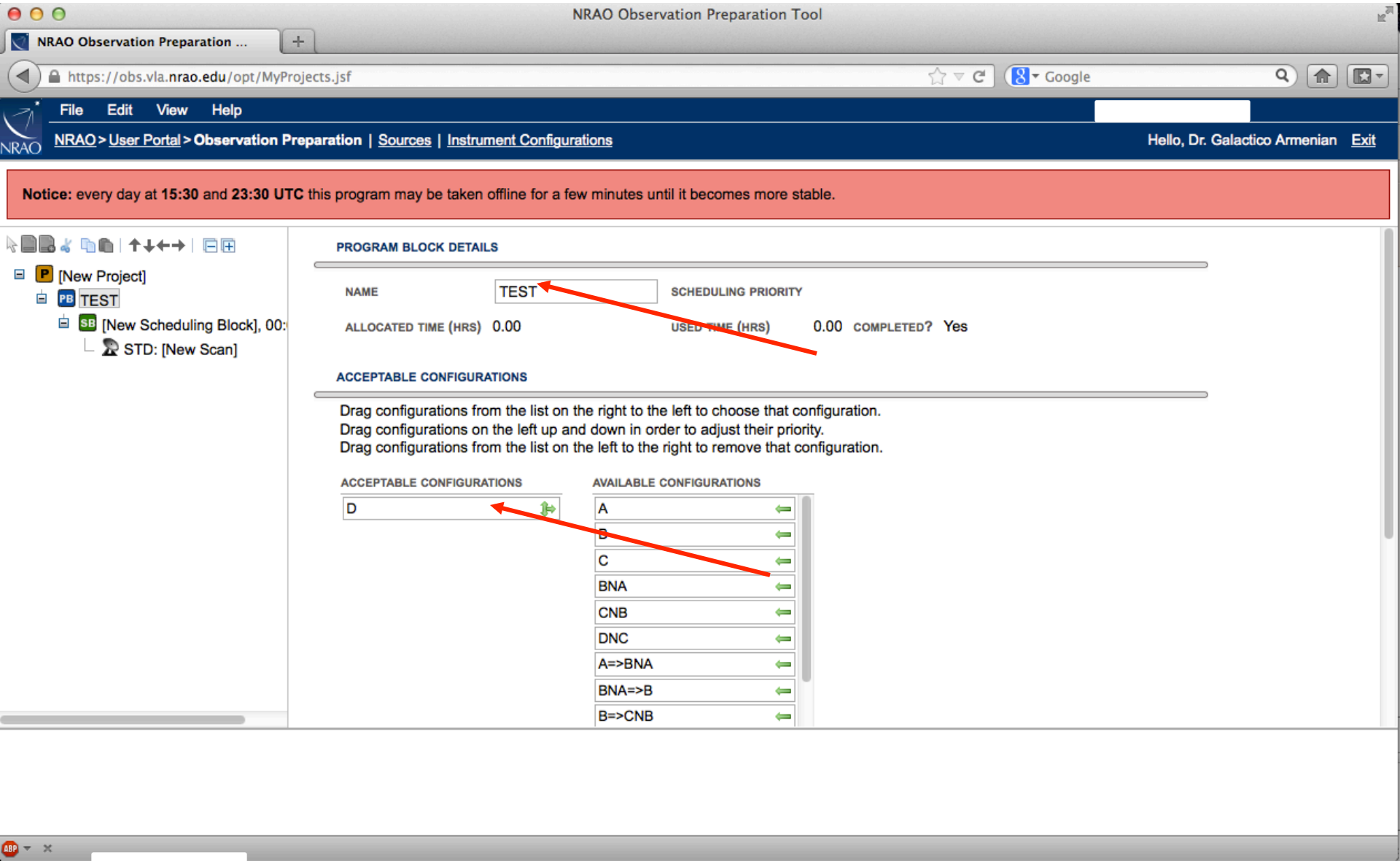
Observation Preparation

- If you don't have "New Project" on the left menu:
  - File → Create New → Test Project
- Click on Program Block 

  - Insert a name: TEST
  - Acceptable array configuration: drag the desired configuration

NRAO

Observation Preparation



Observation Preparation

- Scheduling Block: Information tab.
- Name: TEST SB
- LST range (uncheck "no constraint"):
  - LST target/phase_cal/ref_cal: 05:45→13:45
  - LST BP_cal: 9:00→16:00
  - LST Flux_cal: 08:30→18:30 (gap between 12:45 – 14:15)

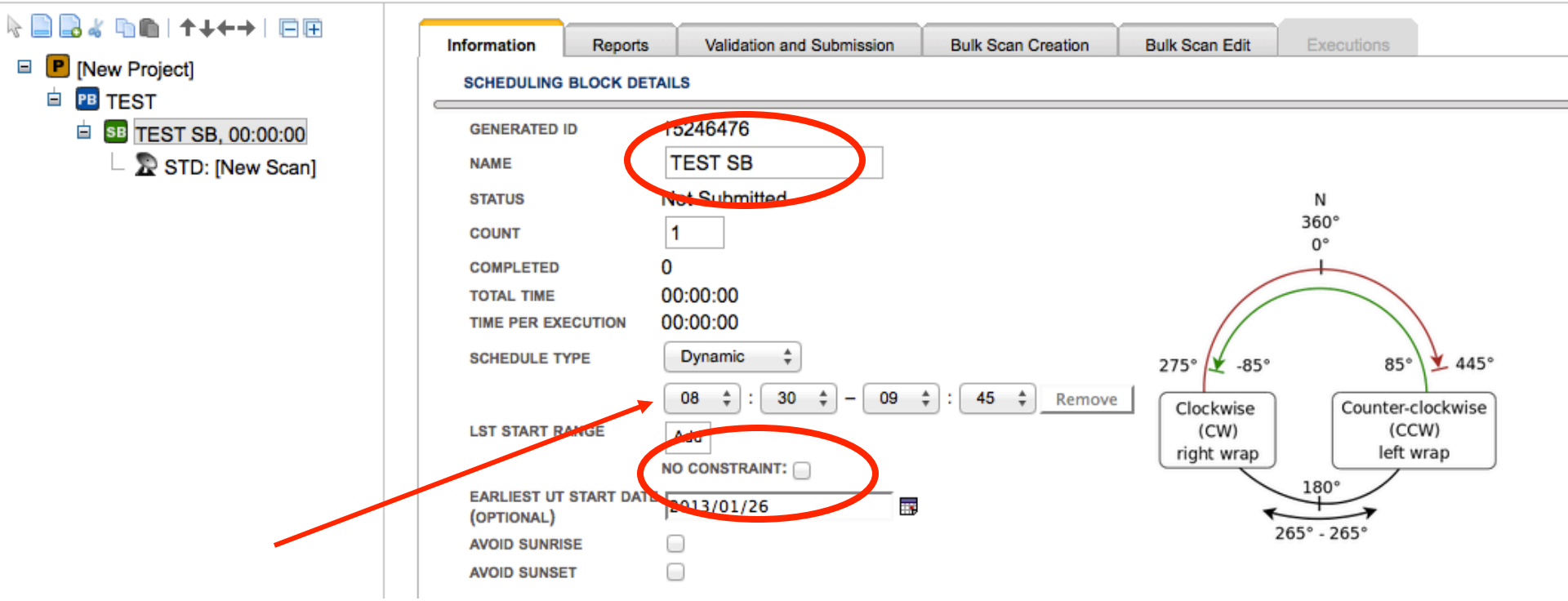
Assuming a 3 hr long SB:

One possible LST start range: 08:30 → 09:45

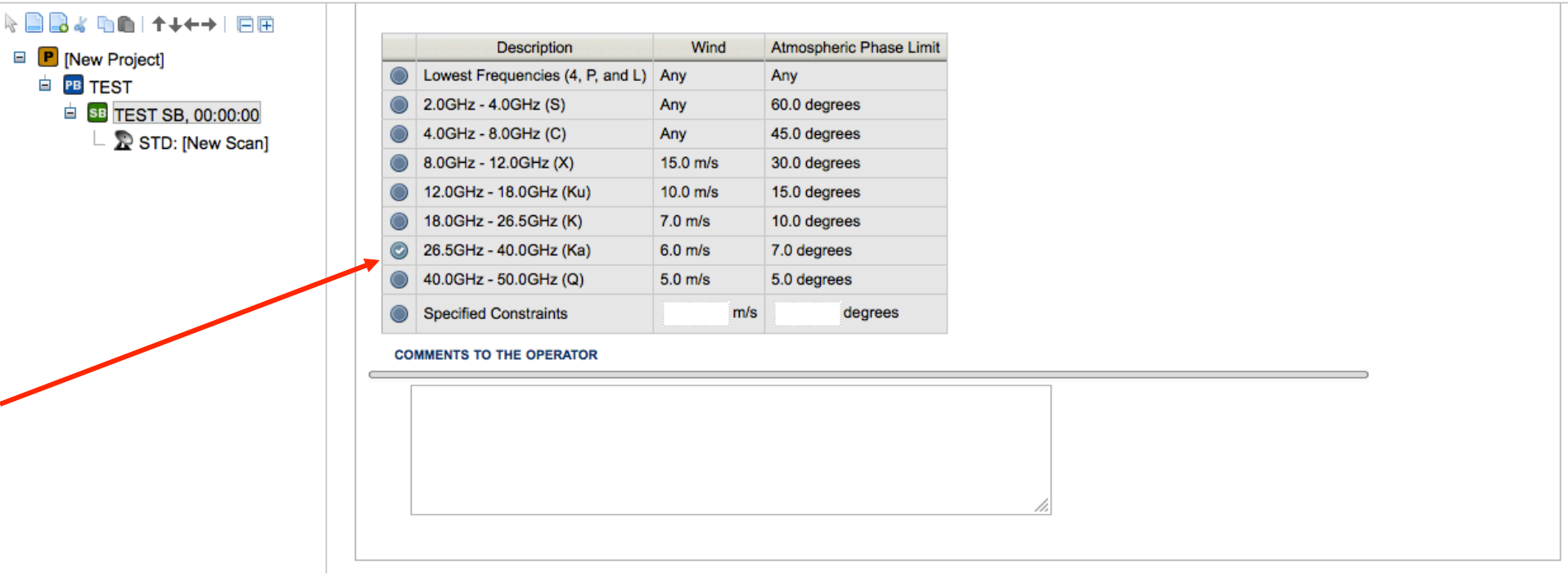
(if the flux cal is observed toward the end)

- Scheduling constraints: choose Ka band's

Observation Preparation: Scheduling Block



Observation Preparation: Scheduling Block

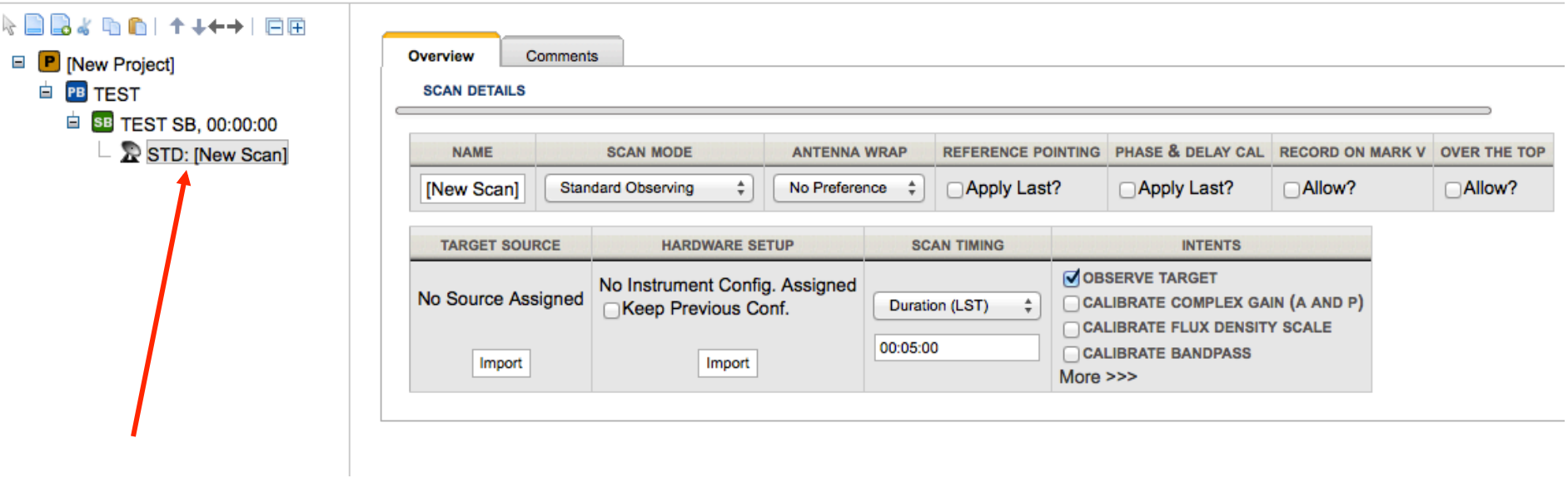


Observation Preparation: Scheduling Block

- Scheduling Block: Scans
  - Dummy scan for each correlator configuration
    - The Ka-band configuration
    - The C-band reference pointing configuration
  - Reference pointing scan on J1008+0730
    - The above three scans should sum up to 10-12 min.
  - Phase calibrator J0954+0743
  - Target-Phase cal loop
  - Repeat the last three steps
  - Ref. point. on BP cal, Ka-band scan on BP cal
  - Ref. point. on Flux cal, Ka-band scan on Flux cal

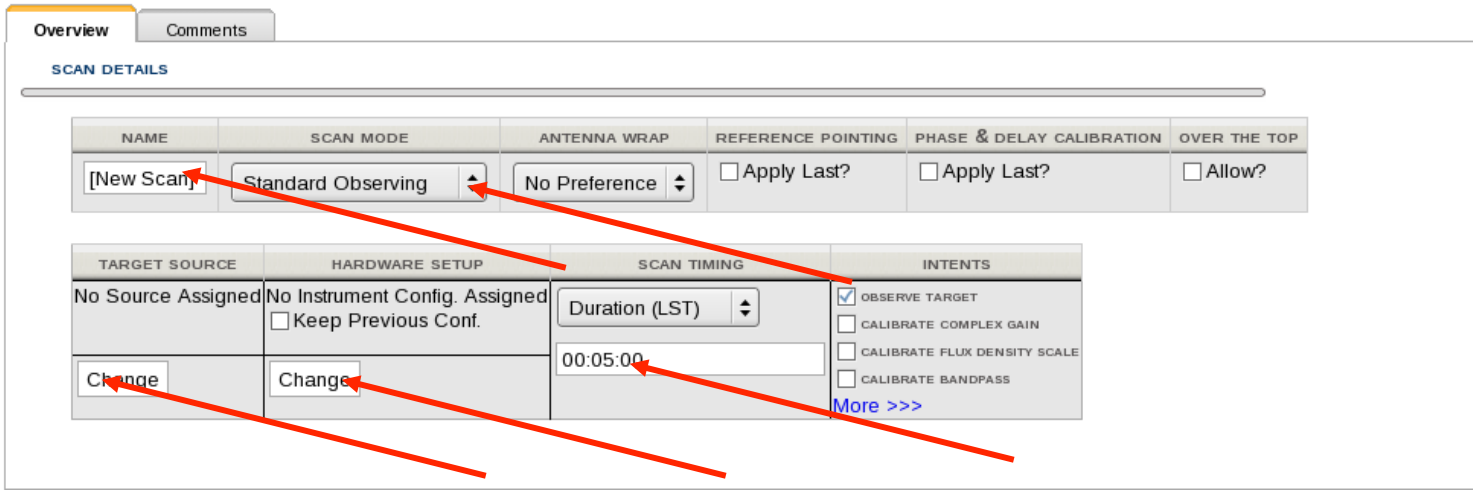
Observation Preparation: Scans

– How to set a reference pointing scan.



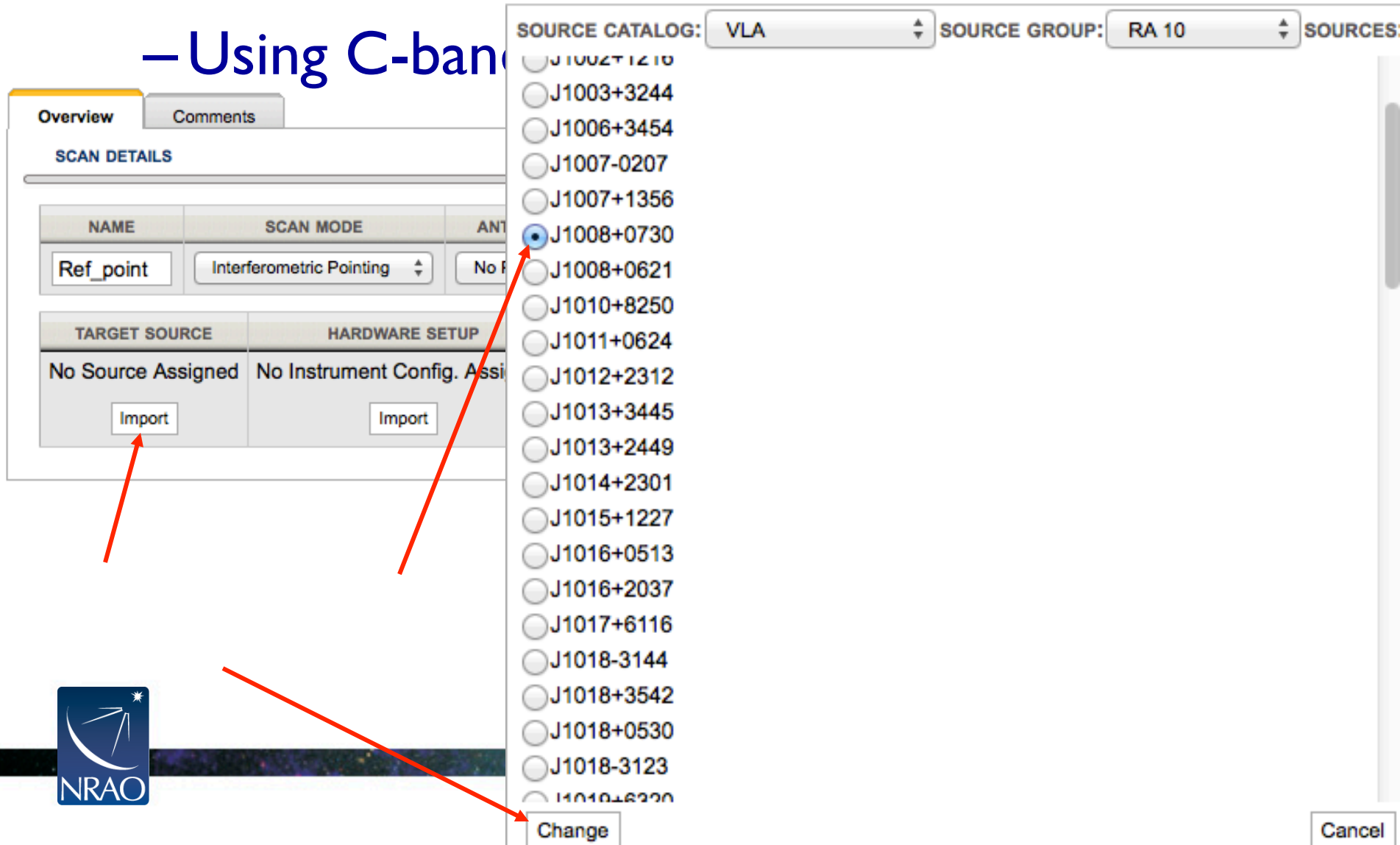
Reference Pointing Scan

- Using the calibrator : J1008+0730.
- Using C-band.



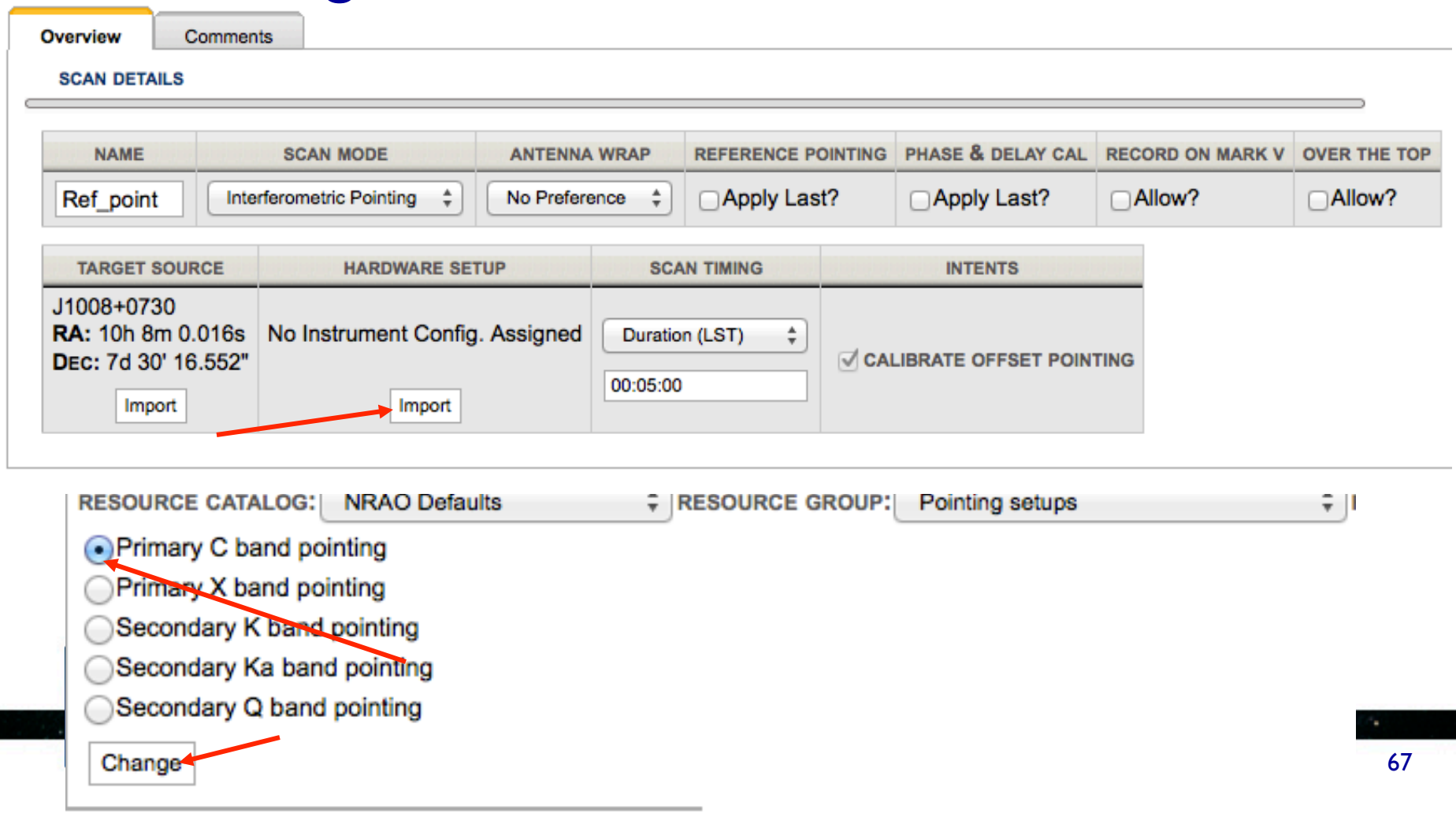
Reference Pointing Scan

- Using the calibrator : J1008+0730.
- Using C-ban



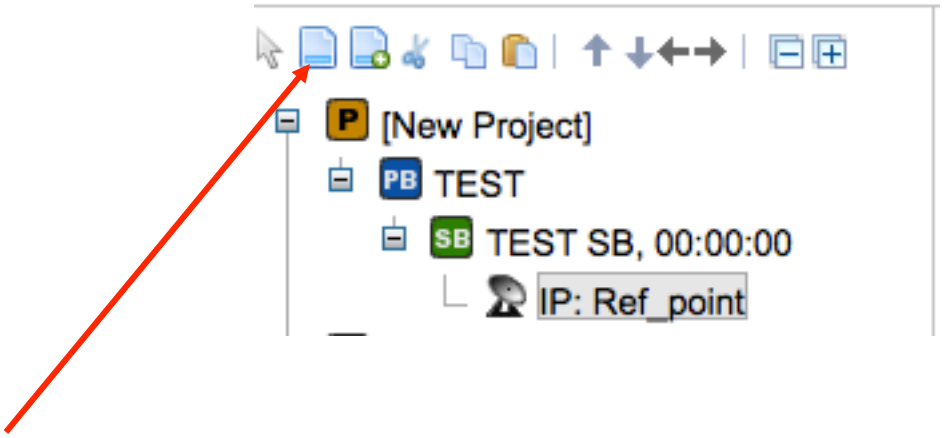
Reference Pointing Scan

- Using the calibrator : J1008+0730.
- Using C-band.



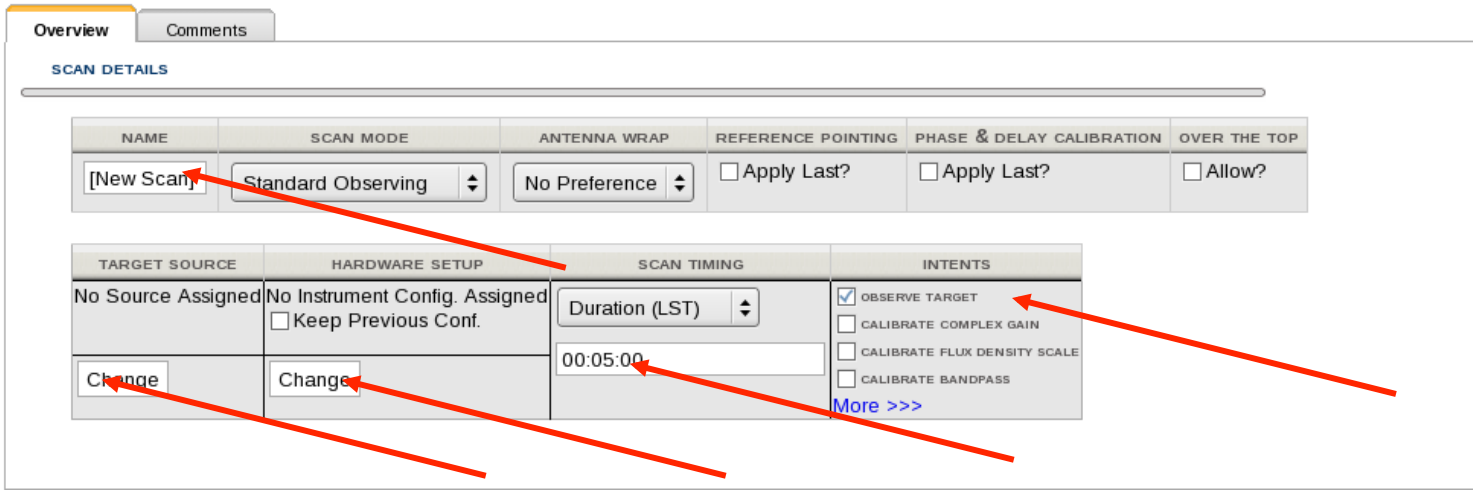
Observation Preparation: Scans

- How to set a regular scan using target source and resource.
  - 1st we need to add a new scan



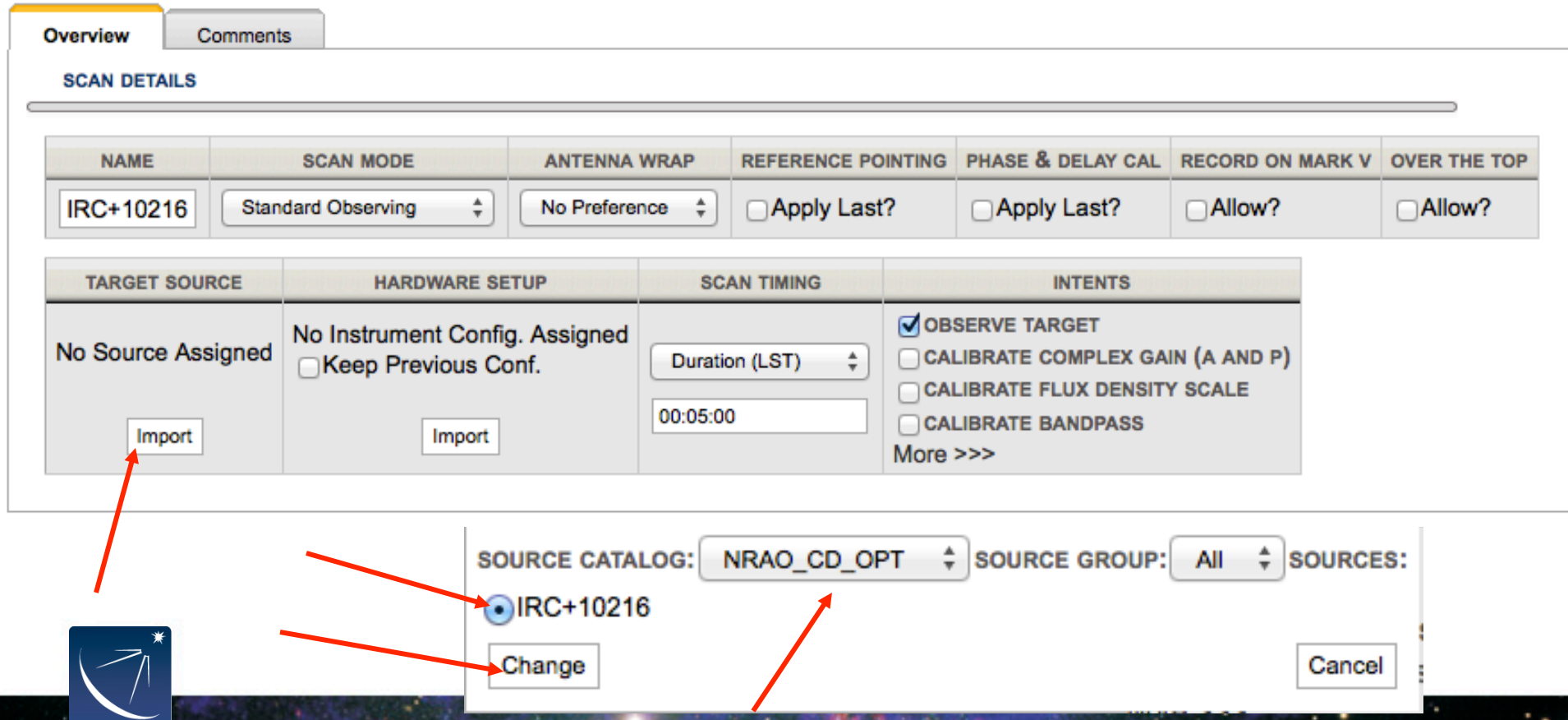
Target Source Scan

- Using the target source: IRC+10216
- Using the Ka-band resource we made.



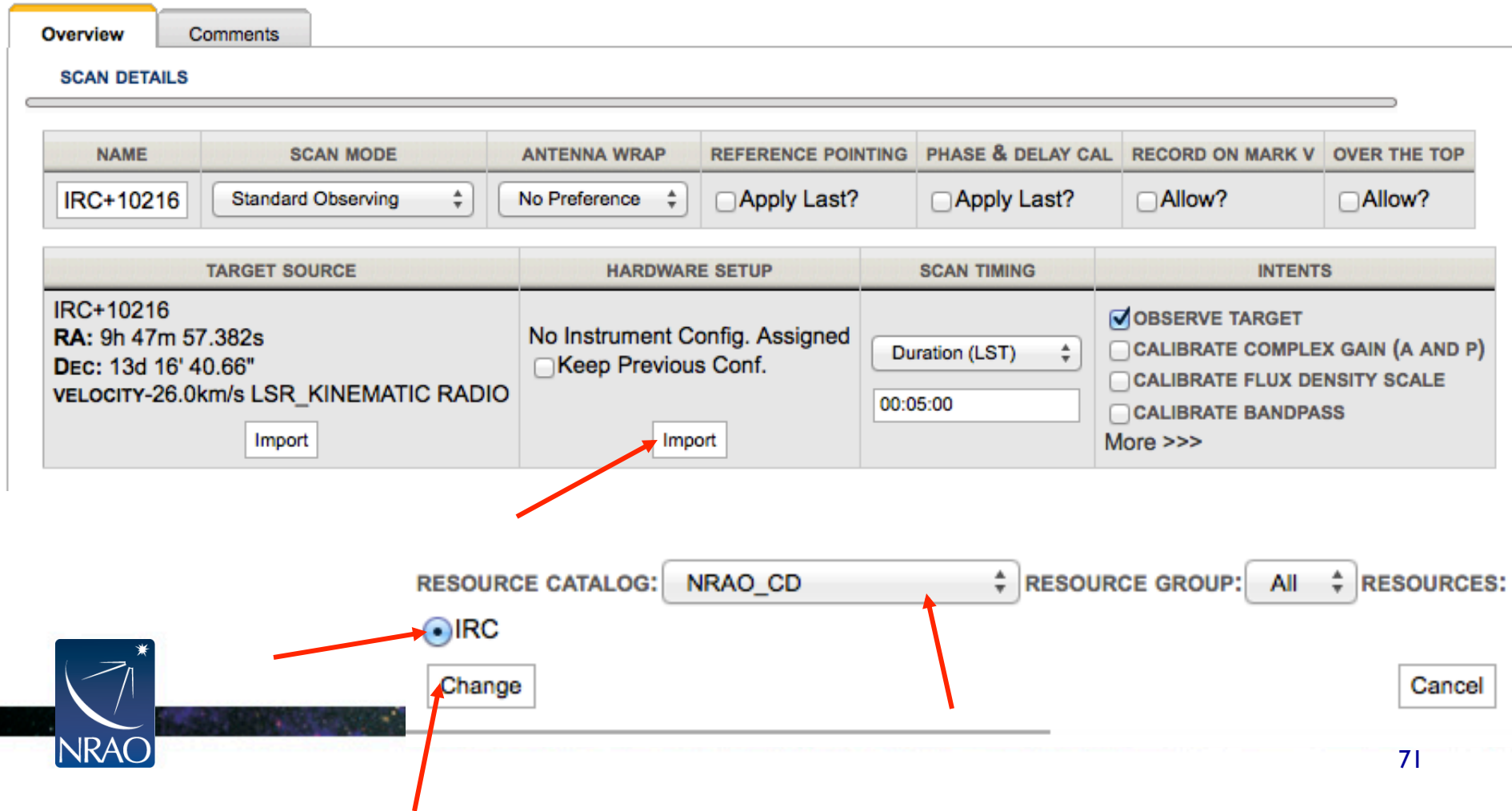
Target Source Scan

- Using the target source: IRC+10216
- Using the Ka-band resource we made.



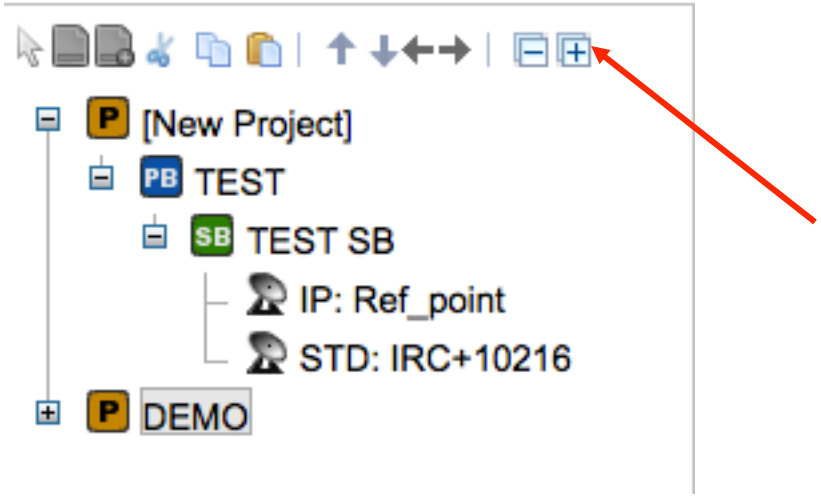
Target Source Scan

- Using the target source: IRC+10216
- Using the Ka-band resource we made.

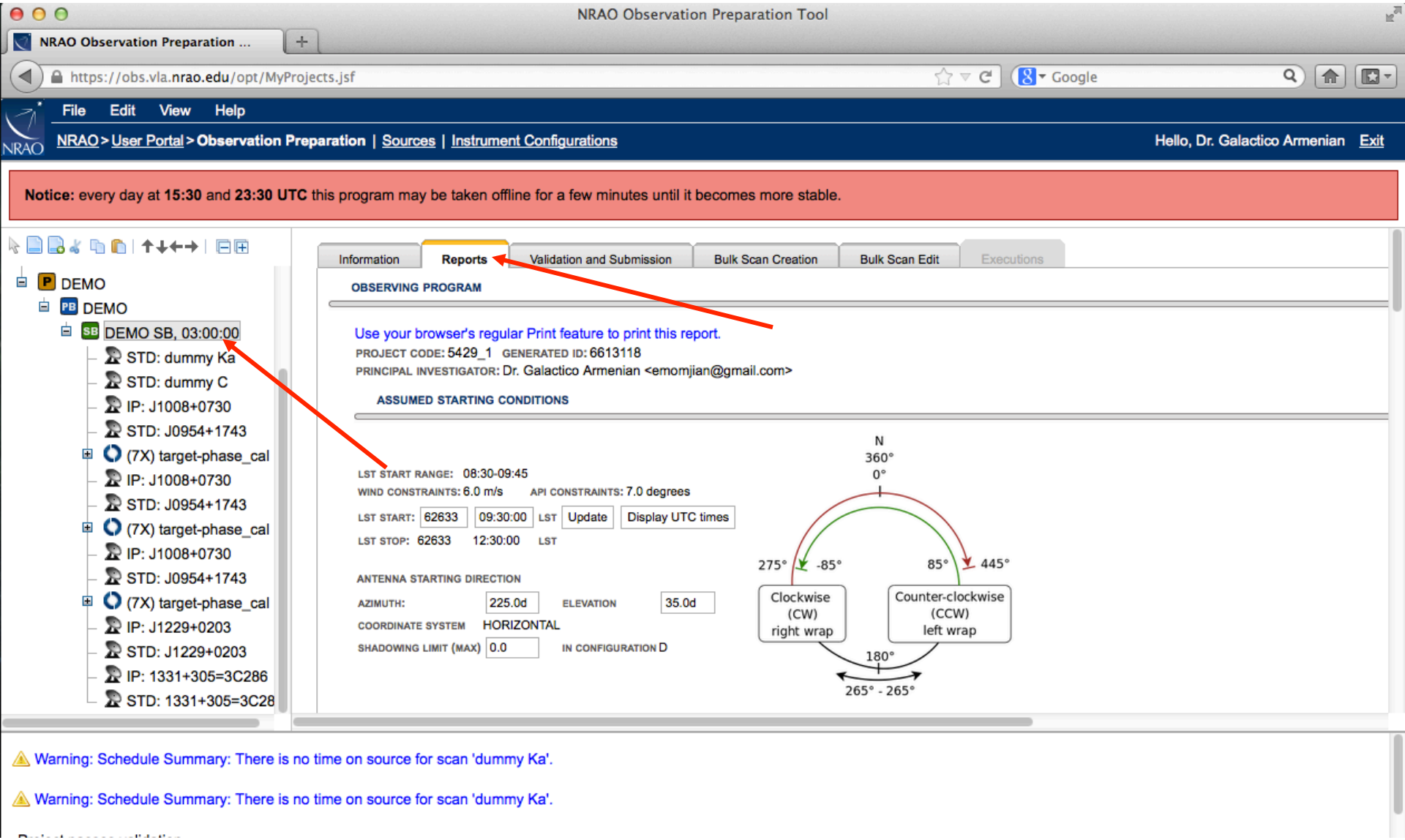


Observation Preparation

- You were provided with a file called OPT_demo.xml
- File → Import Project, Browse to locate the file and import (click once and wait for a few seconds).
- Expand its content



Observation Preparation



Observation Preparation

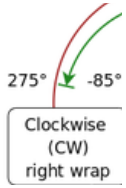
- SB: 'Reports' to view all you have done

- Check
  - Instrument configuration summary
  - Time on source summary
  - Schedule summary.

Observation Preparation

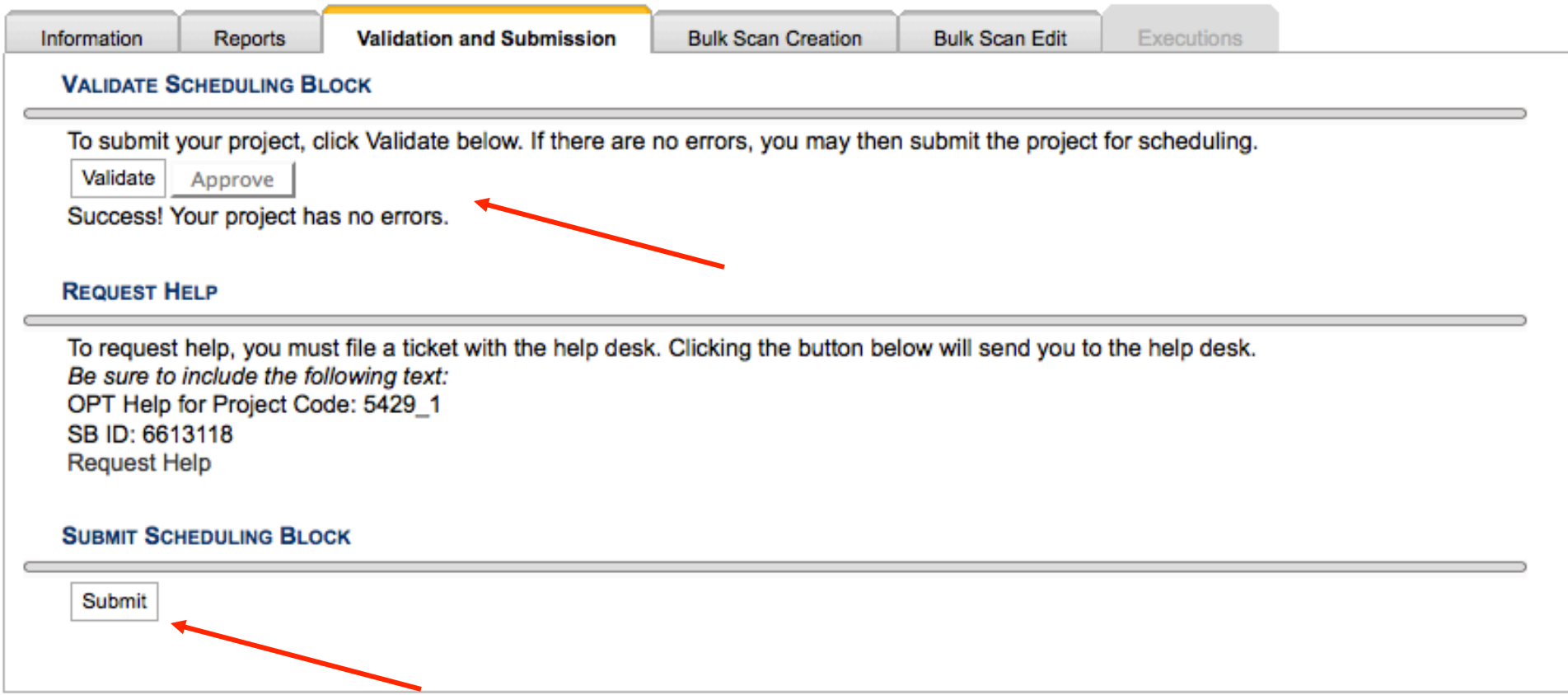
- SB: Reports to view all you have done.

- Change the ‘assumed schedule start’ at the top to assess whether all the scans in the SB are OK at all possible start times in the assumed LST range.



Observation Preparation

- SB:Validation and Submission.



Observation Preparation

Logout of the OPT as soon as you are done!

Wait for an email from the VLA operator notifying that the observations have been carried out!