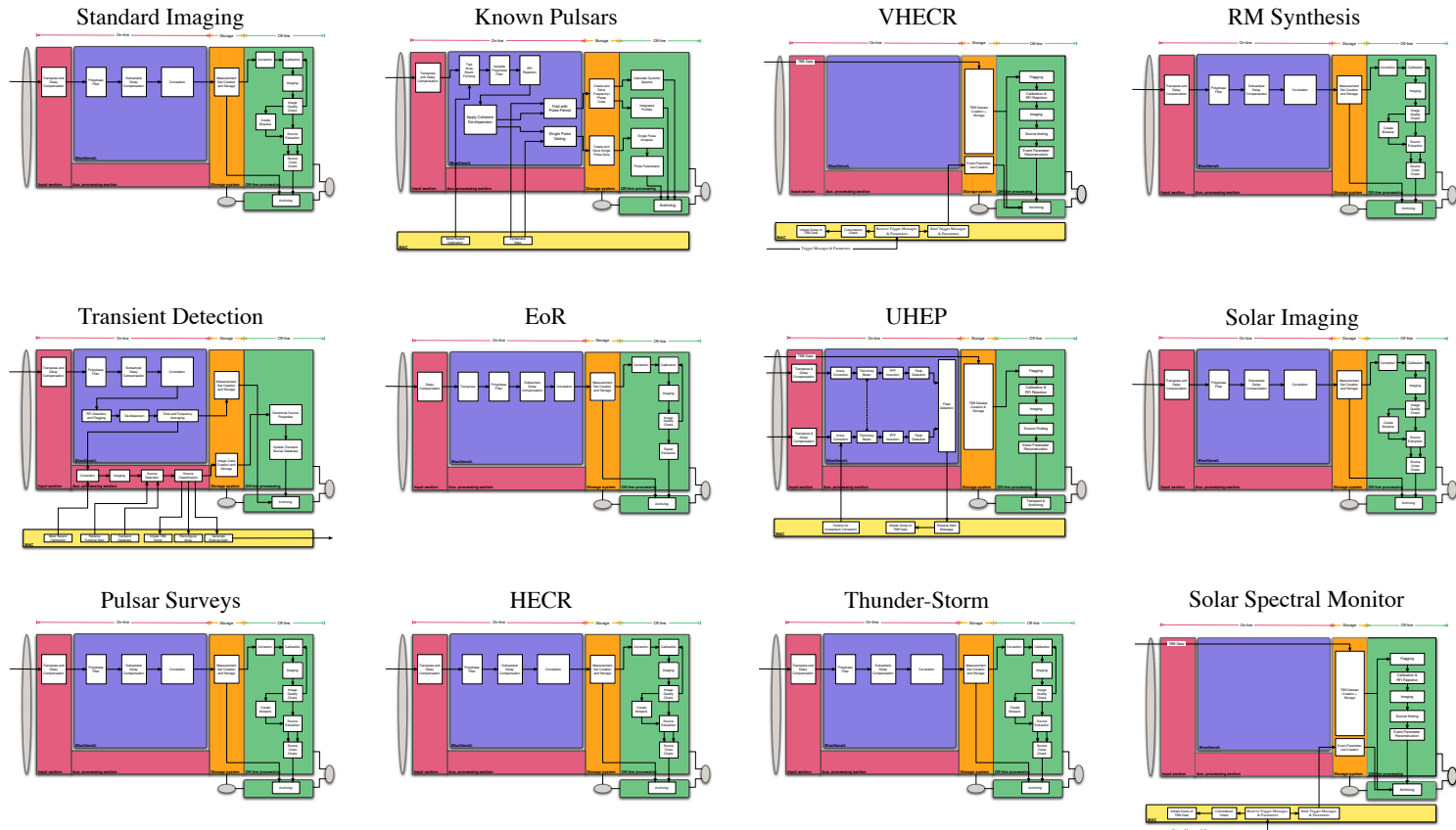




LOFAR Data Products

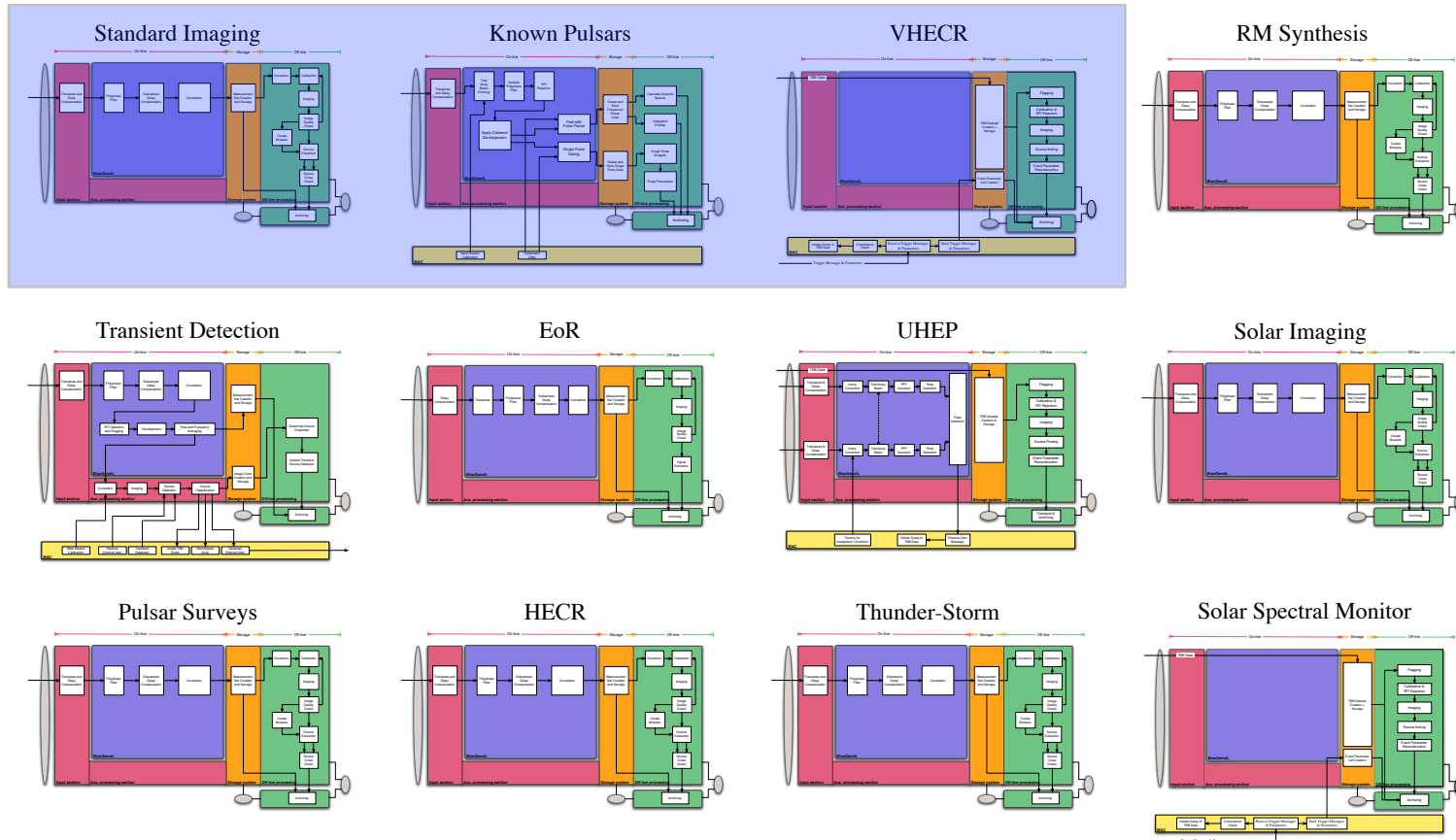
*First LOFAR Data Processing School
10 February 2009*

Michael Wise



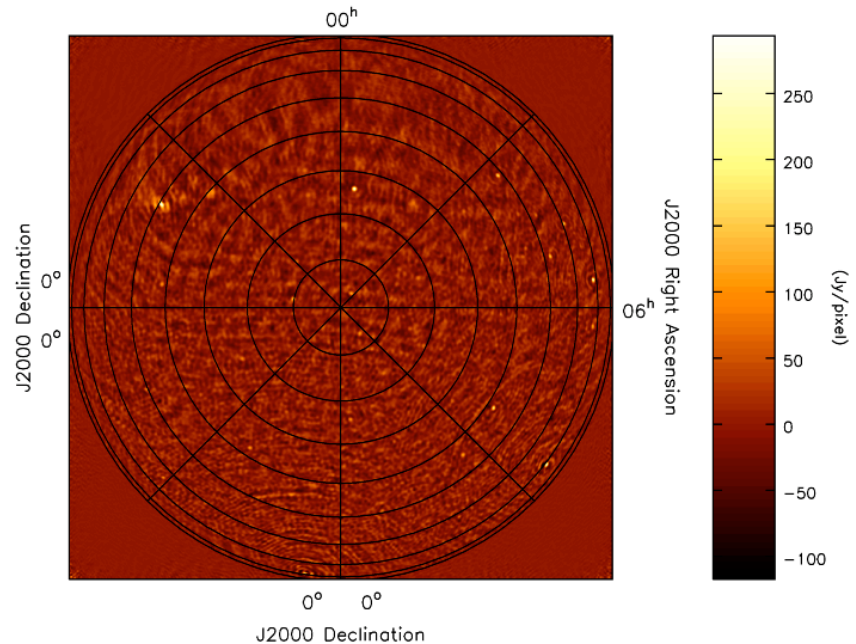
⇒ *Derived from combined KSP science*

Available in 2009



⇒ Derived from combined KSP science

- Standard Imaging
 - Visibilities
 - Image Cubes
 - Calibration model parameters
 - Sky models (LSM/GSM)
- Known Pulsars
 - Beam-formed time series
 - Frequency-phase cubes
 - Dynamic spectra
 - Pulse profiles
- VHECR
 - TBB time series
 - Dynamic spectra
 - Near-field image cubes



For all products:

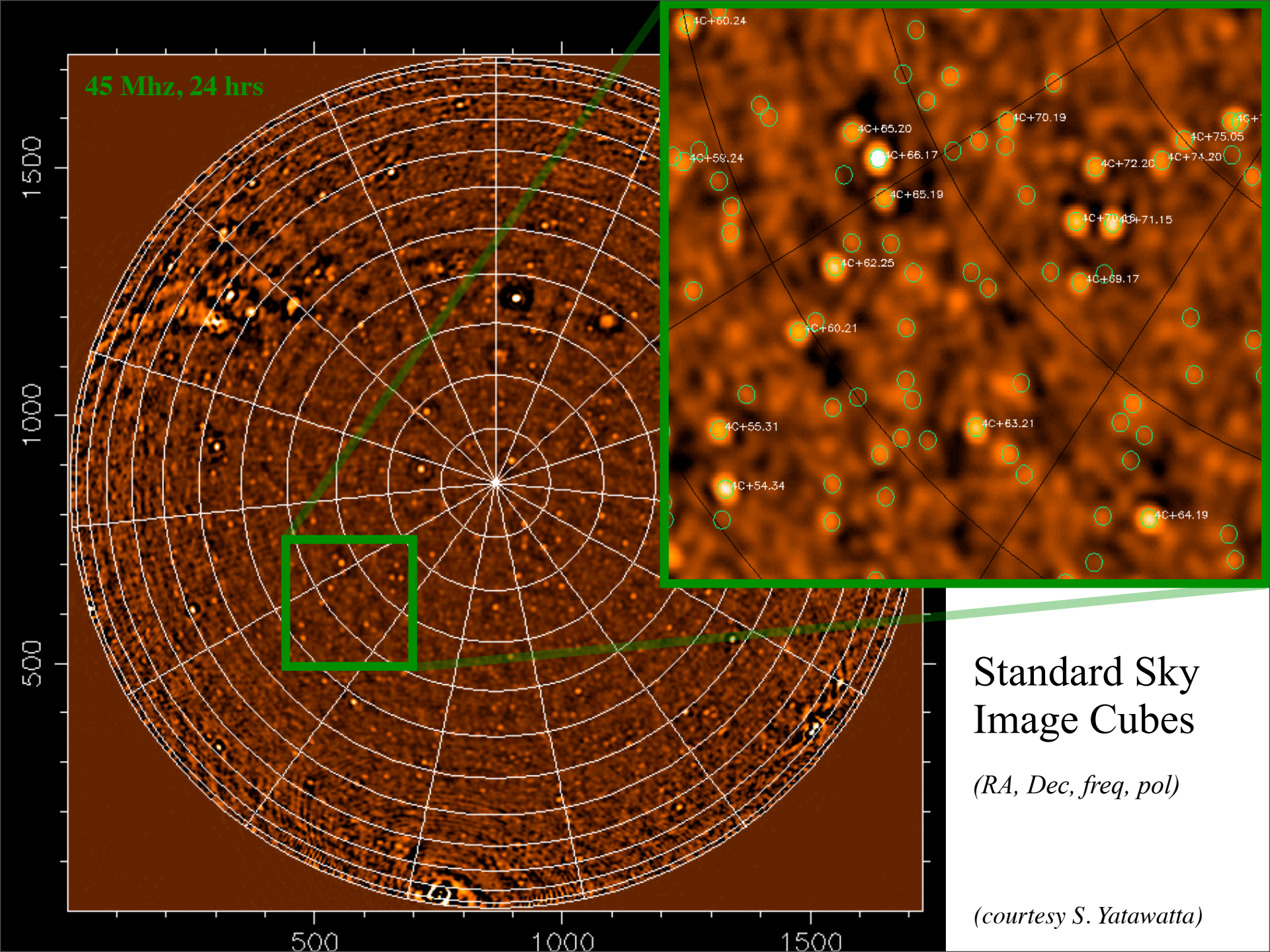
Parsets

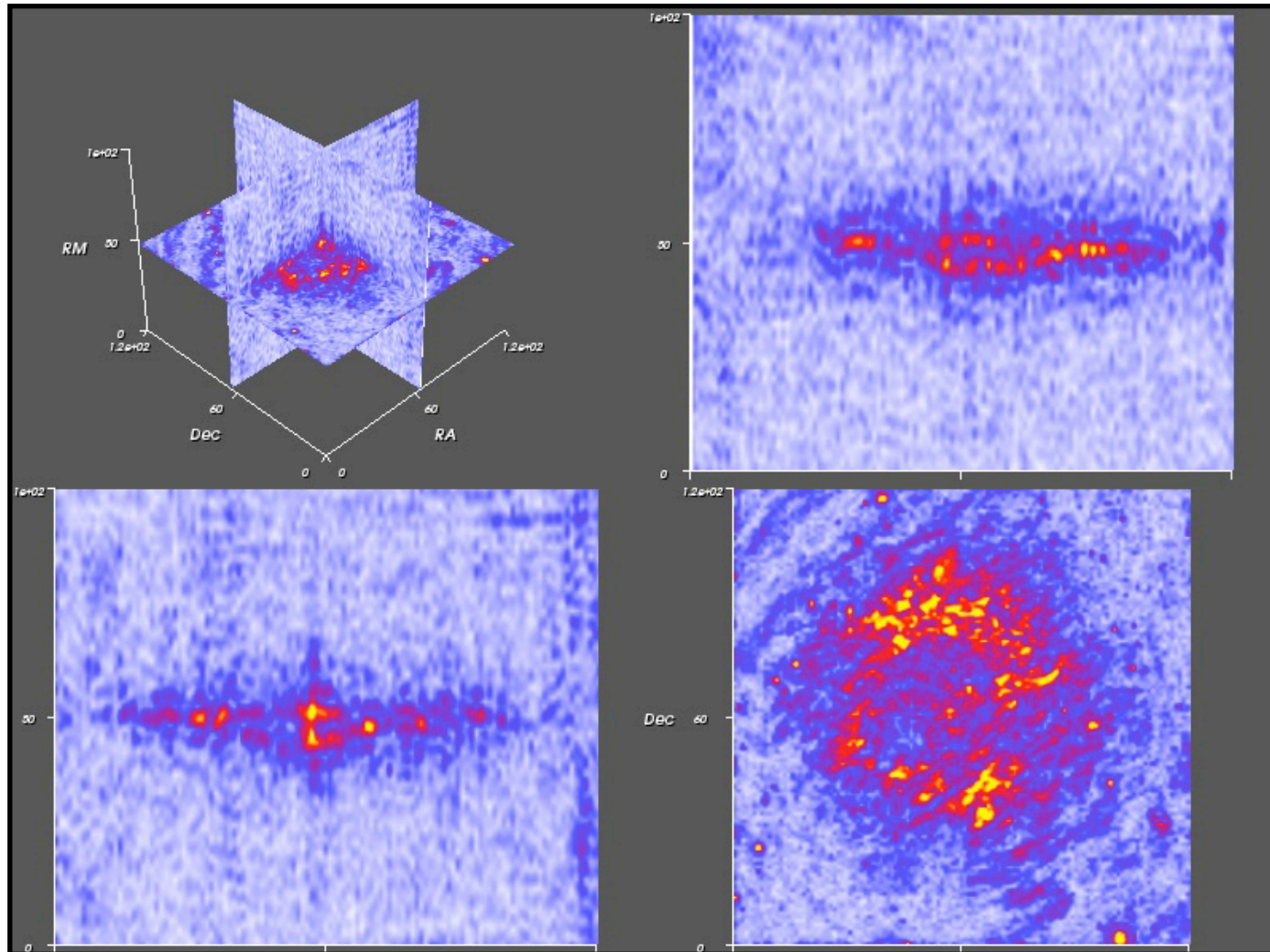
Processing logs

Version info

Other metadata

.....

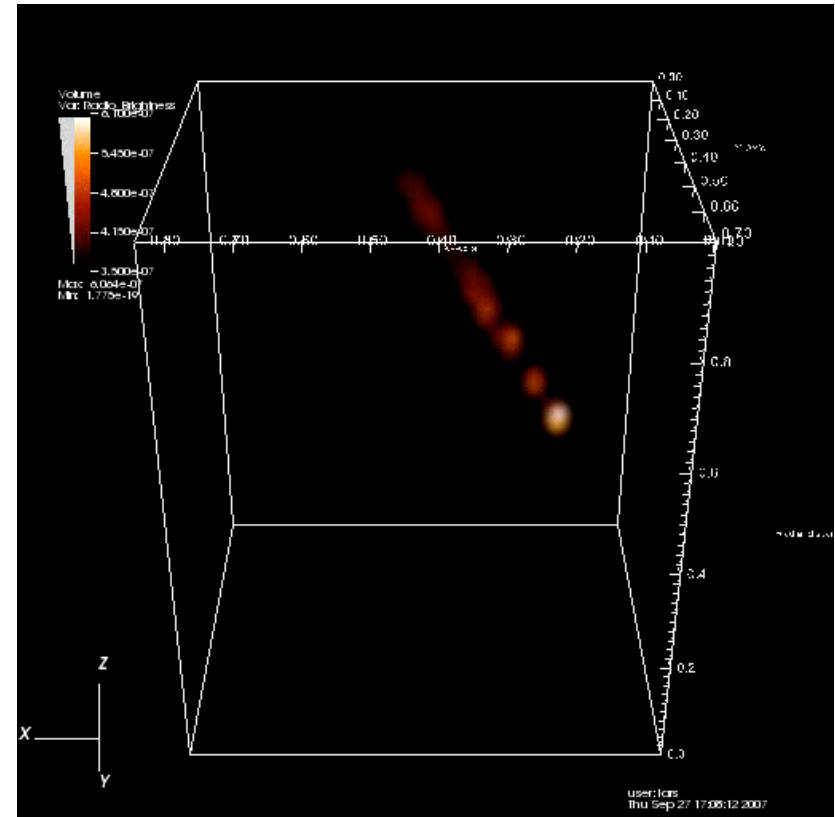
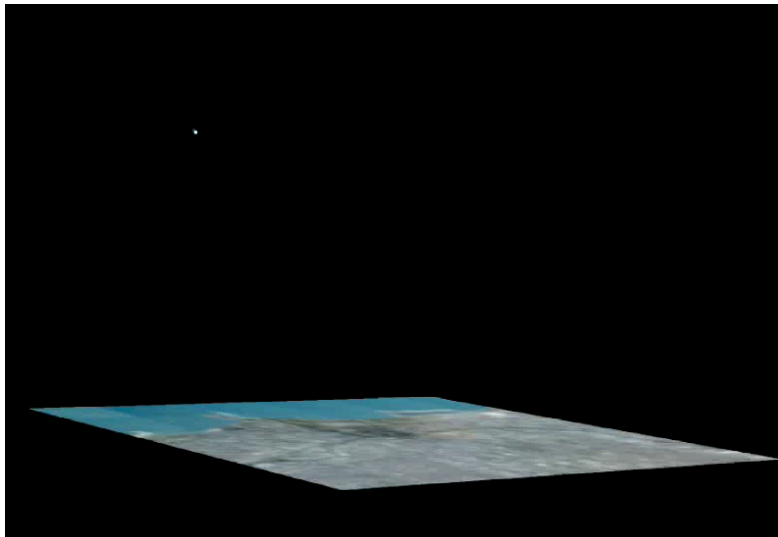




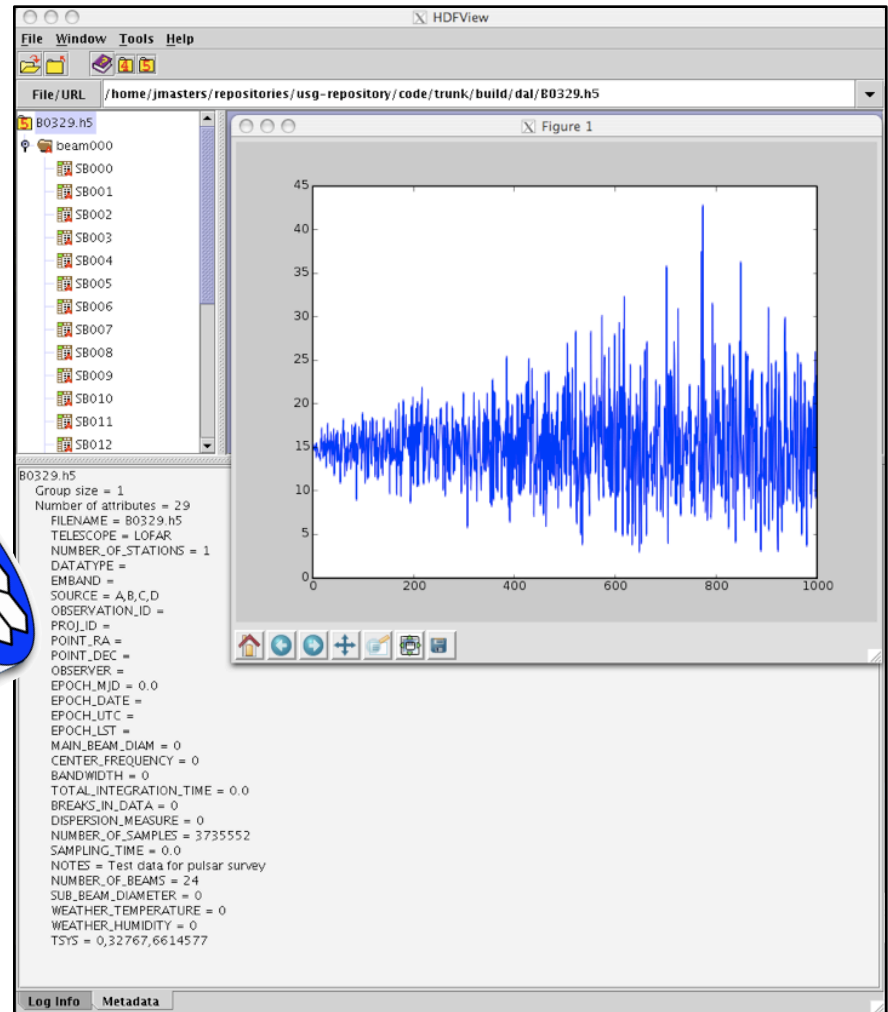
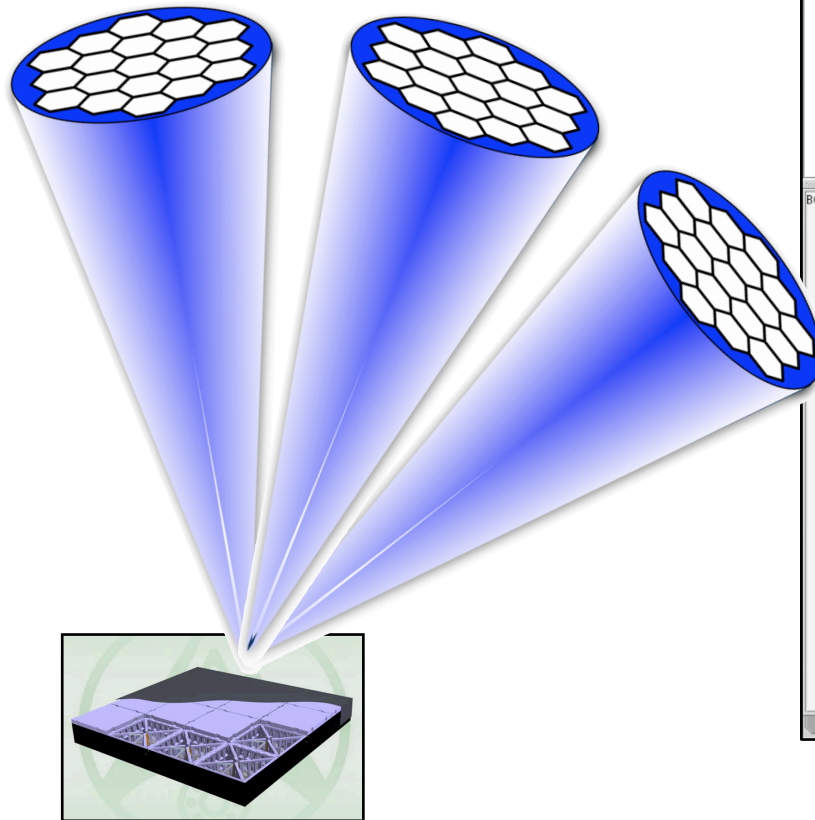
(RA, Dec, RM, pol)

(courtesy E. Carretti and G. Bernardi)

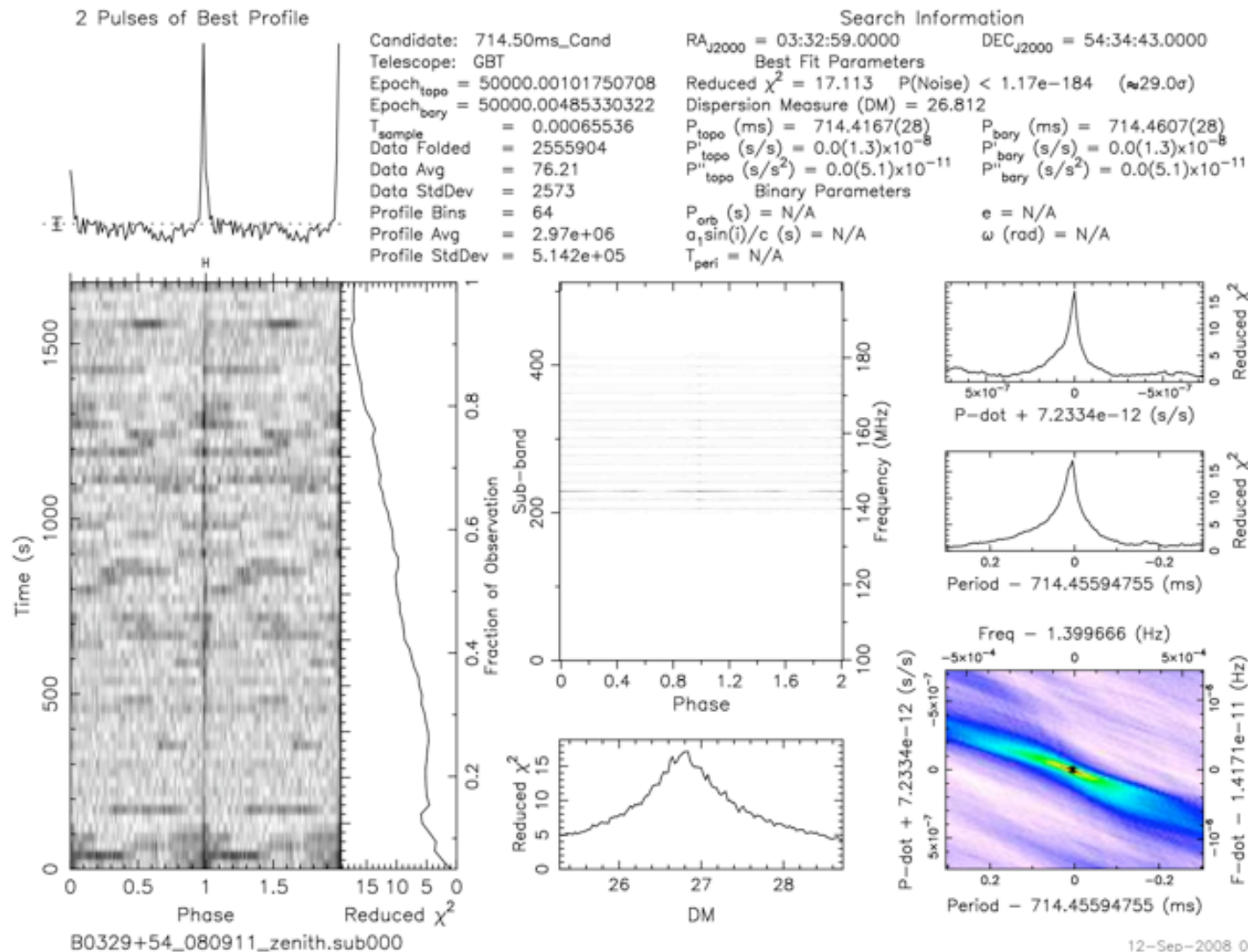
- Cosmic Ray Air Showers produce radio pulses as liberated electrons spiral in the earth's magnetic field (geosynchrotron emission)
- Pulse can be imaged as a function position, frequency, and time



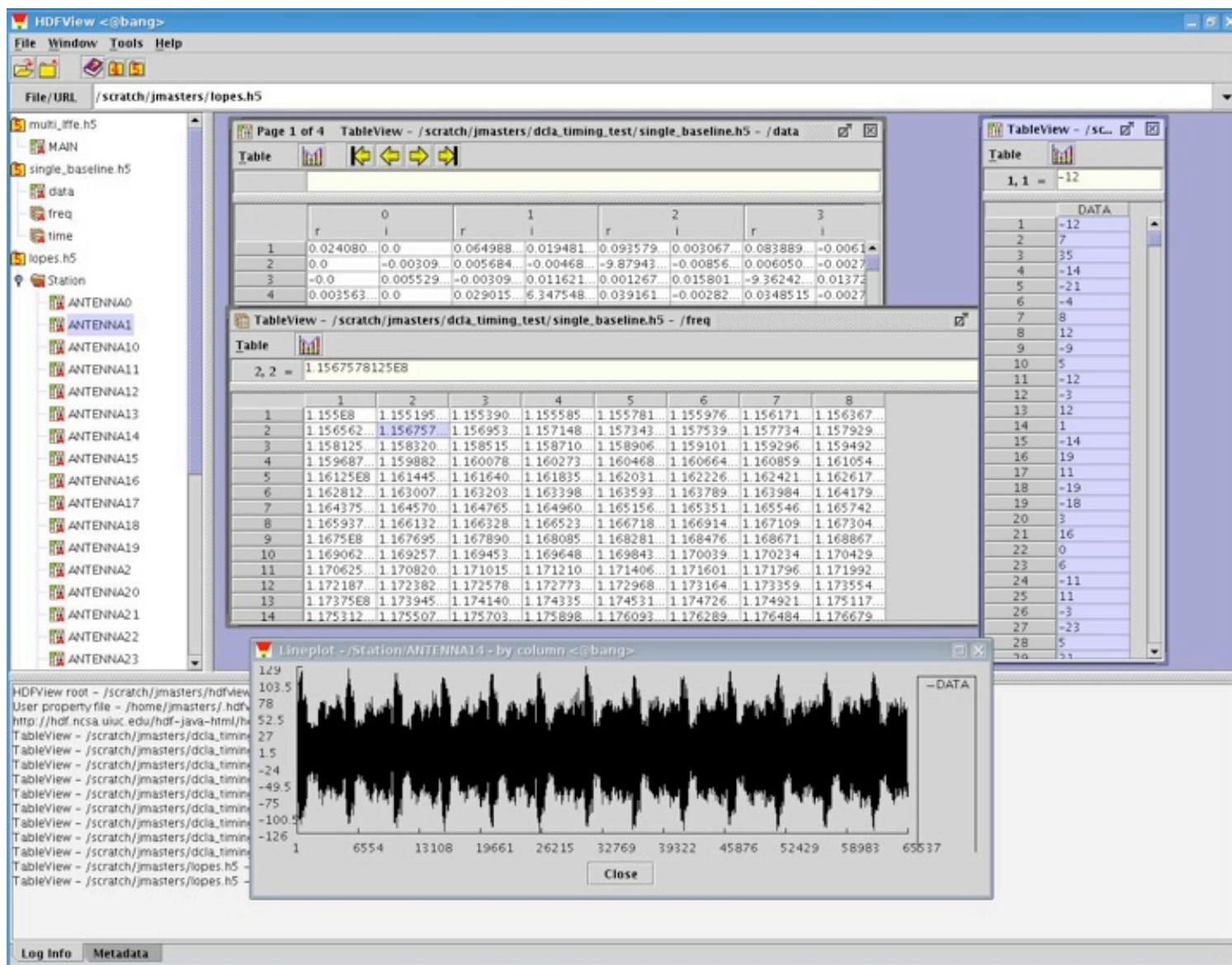
*Near-field imaging
(x, y, z, freq, pol, time)*

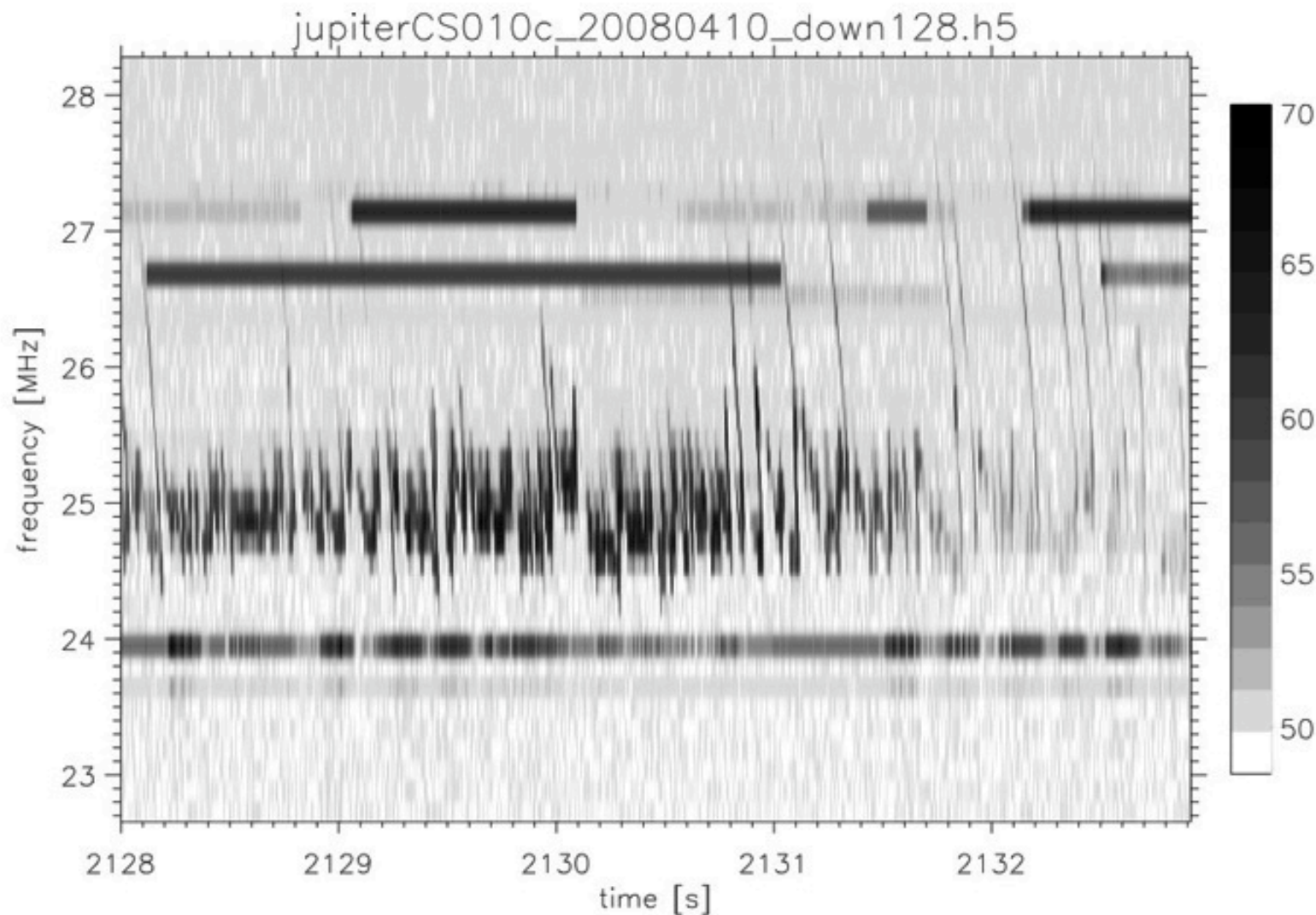


Beam-formed data product



B0329+54 (courtesy J. Hessels)





Jupiter bursts (courtesy J.-M. Grießmeier)

- LOFAR Common Headers
 - Minimum observation information (observer, OBSID, etc.)
 - Coordinates, data scales, etc.
 - Definitions for all data products (ICDSs)
- Image Headers
 - LOFAR specific (sky, RM, near-field, etc.)
 - FITS versions for 2D (3D?) slices
- Updated MS Description
 - Extension of MS2.0 for phased-arrays (SKA?)
 - Keyword updates? Flag bit-masks? Etc., etc.
- Modification Tracking
 - Changes logged to header

Common header info

3.2.2 LOFAR common metadata

FIELD/KEYWORD	TYPE	UNIT	Description
TELESCOPE	string	—	Name of the telescope
OBSERVER	string	—	Name(s) of the observer(s)
PROJECT_ID	string	—	Unique identifier for the project
PROJECT_NAME	string	—	Name of the project
PROJECT_DESCRIPTION	string	—	Brief project description
OBSERVATION_ID	string	—	Unique identifier for the observation
OBSERVATION_MODE	string	—	Observation mode (i.e. Mode 1: 30–90MHz, Mode 2: 120–190MHz etc.)

```

B0329.h5
Group size = 1
Number of attributes = 29
FILENAME = B0329.h5
TELESCOPE = LOFAR
NUMBER_OF_STATIONS = 1
DATATYPE =
EM BAND =
SOURCE = A,B,C,D
OBSERVATION_ID =
PROJ_ID =
POINT_RA =
POINT_DEC =
OBSERVER =
EPOCH_MJD = 0.0
EPOCH_DATE =
EPOCH_UTC =
EPOCH_LST =
MAIN_BEAM_DIAM = 0
CENTER_FREQUENCY = 0
BANDWIDTH = 0
TOTAL_INTEGRATION_TIME = 0.0
BREAKS_IN_DATA = 0
DISPERSION_MEASURE = 0
NUMBER_OF_SAMPLES = 373552
SAMPLING_TIME = 0.0
NOTES = Test data for pulsar survey
NUMBER_OF_BEAMS = 24
SUB_BEAM_DIAMETER = 0
WEATHER_TEMPERATURE = 0
WEATHER_HUMIDITY = 0
TSYS = 0,32767,6614577
    
```

Log Info Metadata

Beam-formed data header

Visibility Data

- Continue to support CASA MS sets
- Native support for CASA tables and HDF5
- No FITS support (except through translators)
- MS 3.0 specification under development

Image Cubes

- Native support for CASA tables and HDF5
- Support for both already in casacore, DAL
- FITS supported provided through translators

Time Series

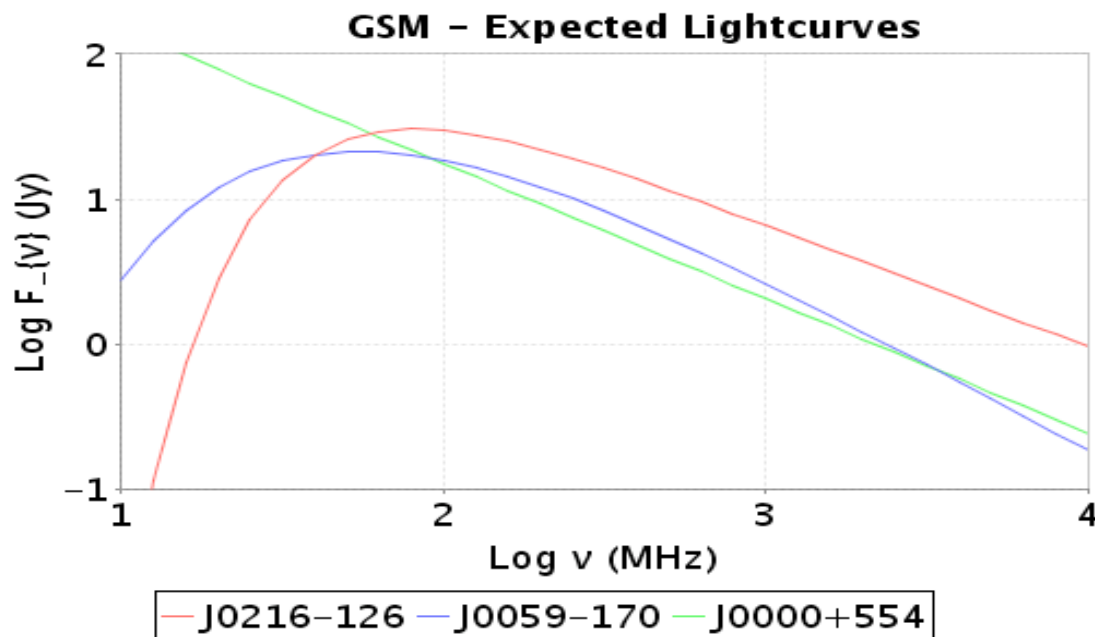
- BF and TBB time series stored as HDF5 tables
- Support for PRESTO pulsar formats
- Support for ROOT, LOPES, etc.

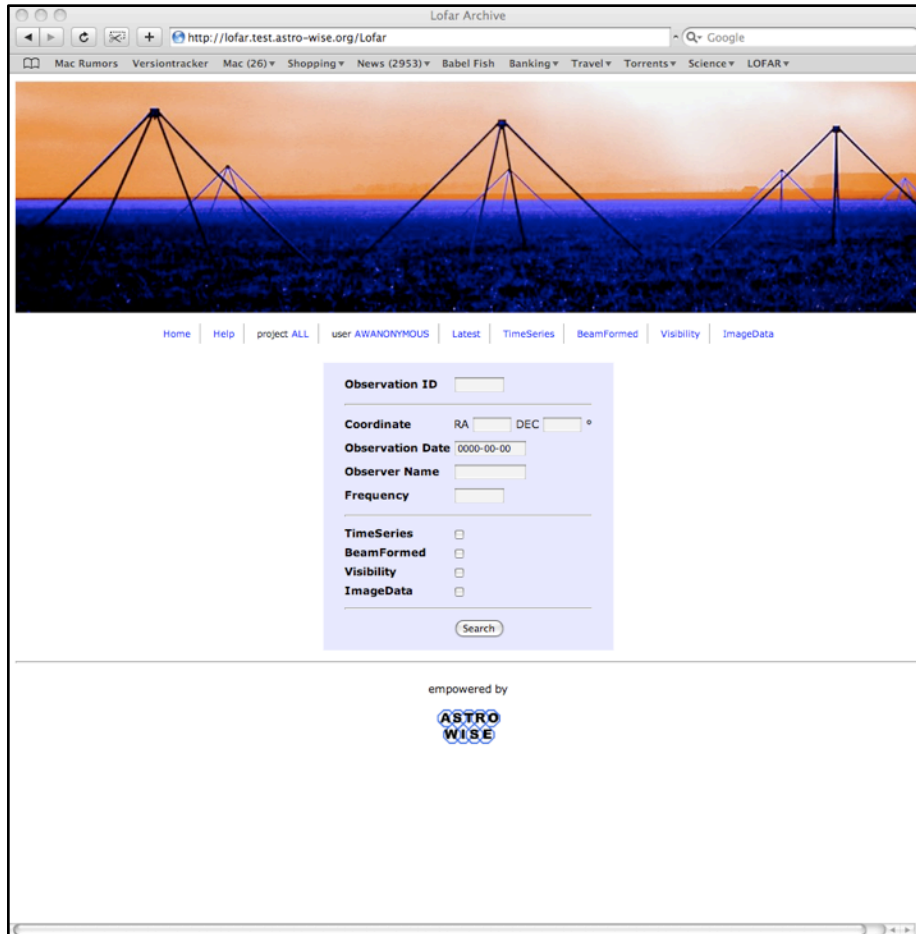
Data	Formats	ICD	I/O	Availability
Time series	HDF5	1.0	R+W	Now
Beam-formed	HDF5	1.0	R+W	Now
Image cubes	CASA/HDF5	1.0	R+W	Now
UV data	CASA/HDF5	2.0/0.0	R+W/R	Q2 09

Supporting several formats

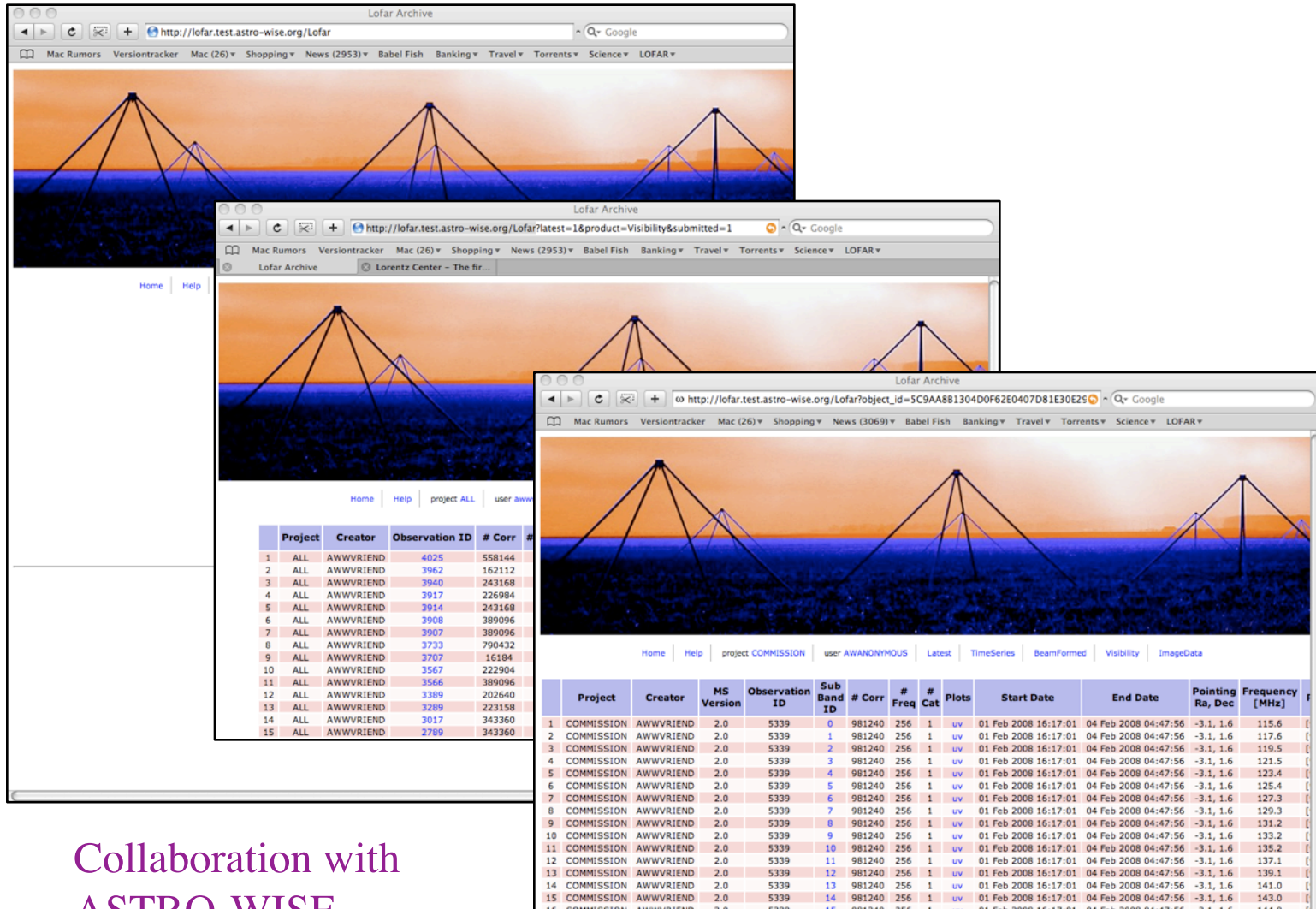
- CASA measurement sets, tables (*CASACORE*)
- FITS images, tables (*CFITSIO*)
- HDF5 tables, image cubes (*HDF5IO*)
- Raw telemetry formats (*TBB, beam-formed, etc..*)
- LOPES, ROOT, PRESTO, etc...

- GSM stored as a database (*MySQL, PostgreSQL, MonetDB*)
- Many predictive functions implemented in database
- Python interfaces provided for database access
- Simulated maps created using external tools (*SKP, N. Mohan*)





Collaboration with
ASTRO-WISE



The screenshot shows the LOFAR Archive website interface. The top navigation bar includes links for Home and Help. The main content area displays a list of observations with columns for Project, Creator, Observation ID, and # Corr. Below this, a detailed view of a specific observation is shown, including a table with columns for Project, Creator, MS Version, Observation ID, Sub Band ID, # Corr, # Freq, # Cat, Plots, Start Date, End Date, Pointing Ra, Dec, and Frequency [MHz].

Project	Creator	Observation ID	# Corr
1	ALL	AWVRIEND 4025	558144
2	ALL	AWVRIEND 3962	162112
3	ALL	AWVRIEND 3940	243168
4	ALL	AWVRIEND 3917	226984
5	ALL	AWVRIEND 3914	243168
6	ALL	AWVRIEND 3908	389096
7	ALL	AWVRIEND 3907	389096
8	ALL	AWVRIEND 3733	790432
9	ALL	AWVRIEND 3707	16184
10	ALL	AWVRIEND 3567	222904
11	ALL	AWVRIEND 3566	389096
12	ALL	AWVRIEND 3389	202640
13	ALL	AWVRIEND 3289	223158
14	ALL	AWVRIEND 3017	343360
15	ALL	AWVRIEND 2789	343360

Project	Creator	MS Version	Observation ID	Sub Band ID	# Corr	# Freq	# Cat	Plots	Start Date	End Date	Pointing Ra, Dec	Frequency [MHz]	
1	COMMISSION	AWVRIEND	2.0	5339	0	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	115.6
2	COMMISSION	AWVRIEND	2.0	5339	1	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	117.6
3	COMMISSION	AWVRIEND	2.0	5339	2	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	119.5
4	COMMISSION	AWVRIEND	2.0	5339	3	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	121.5
5	COMMISSION	AWVRIEND	2.0	5339	4	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	123.4
6	COMMISSION	AWVRIEND	2.0	5339	5	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	125.4
7	COMMISSION	AWVRIEND	2.0	5339	6	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	127.3
8	COMMISSION	AWVRIEND	2.0	5339	7	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	129.3
9	COMMISSION	AWVRIEND	2.0	5339	8	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	131.2
10	COMMISSION	AWVRIEND	2.0	5339	9	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	133.2
11	COMMISSION	AWVRIEND	2.0	5339	10	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	135.2
12	COMMISSION	AWVRIEND	2.0	5339	11	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	137.1
13	COMMISSION	AWVRIEND	2.0	5339	12	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	139.1
14	COMMISSION	AWVRIEND	2.0	5339	13	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	141.0
15	COMMISSION	AWVRIEND	2.0	5339	14	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	143.0

Collaboration with
ASTRO-WISE

(courtesy W.-J. Friend and J. McFarland)

Home | Help | project ALL | user aww

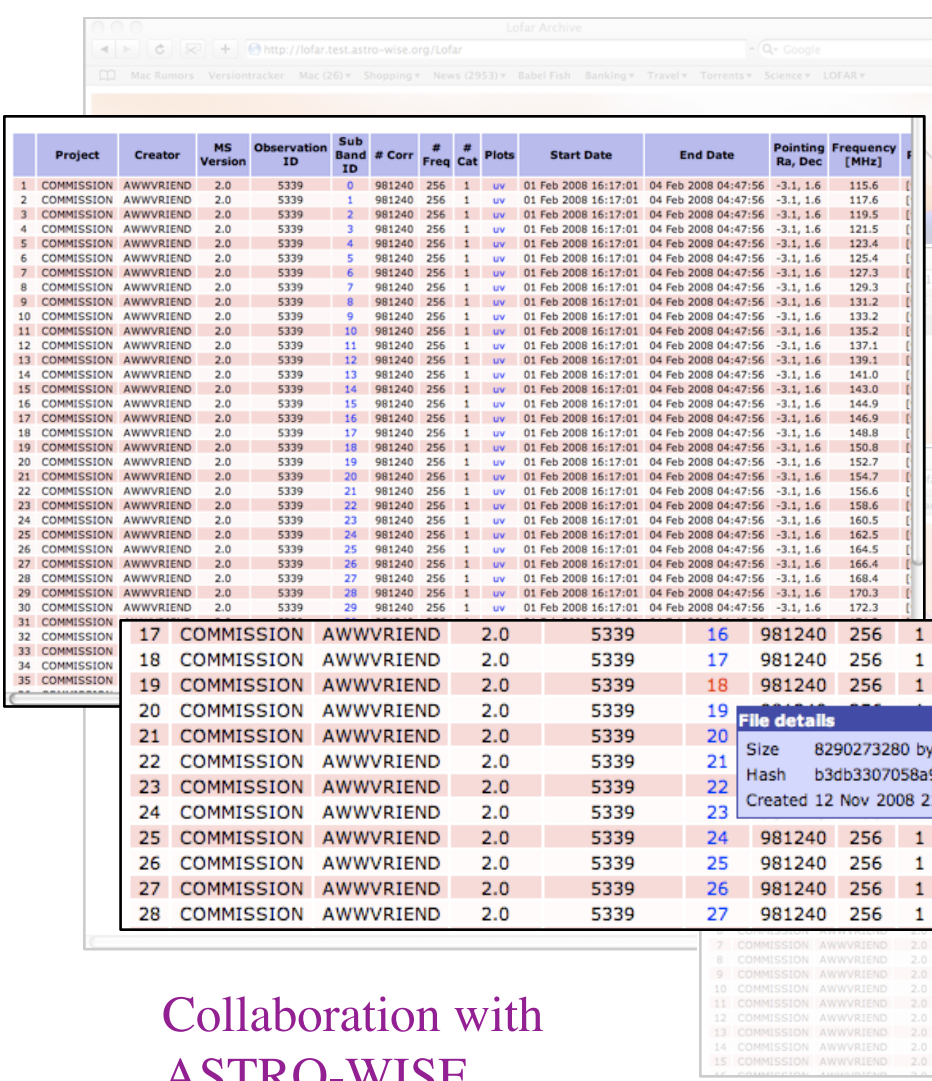
Project	Creator	Observation ID	# Corr	#
1	ALL	AWWVRIEND	4025	558144
2	ALL	AWWVRIEND	7962	162112
3	ALL	AWWVRIEND	3940	243168
4	ALL	AWWVRIEND	3917	226984
5	ALL	AWWVRIEND	3914	243168
6	ALL	AWWVRIEND	3908	389096
7	ALL	AWWVRIEND	3907	389096
8	ALL	AWWVRIEND	3723	790432
9	ALL	AWWVRIEND	3707	16184
10	ALL	AWWVRIEND	3567	222904
11	ALL	AWWVRIEND	3566	389096
12	ALL	AWWVRIEND	3389	202640
13	ALL	AWWVRIEND	3289	223158
14	ALL	AWWVRIEND	3017	343360
15	ALL	AWWVRIEND	2789	343360

Home | Help | project COMMISSION | user AWANONMOUS | Latest | TimeSeries | BeamFormed | Visibility | ImageData

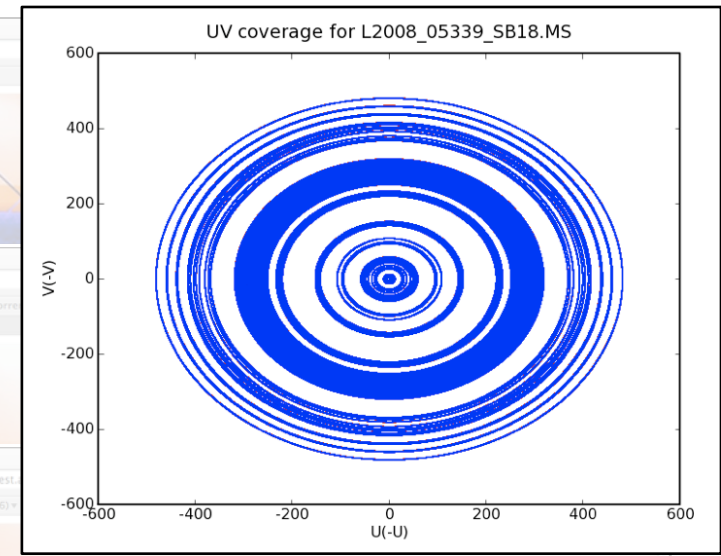
	Project	Creator	MS Version	Observation ID	Sub Band ID	# Corr	# Freq	# Cat	Plots	Start Date	End Date	Pointing Ra, Dec	Frequency [MHz]
1	COMMISSION	AWWVRIEND	2.0	5339	0	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	115.5
2	COMMISSION	AWWVRIEND	2.0	5339	1	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	117.6
3	COMMISSION	AWWVRIEND	2.0	5339	2	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	119.5
4	COMMISSION	AWWVRIEND	2.0	5339	3	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	121.5
5	COMMISSION	AWWVRIEND	2.0	5339	4	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	123.4
6	COMMISSION	AWWVRIEND	2.0	5339	5	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	125.4
7	COMMISSION	AWWVRIEND	2.0	5339	6	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	127.3
8	COMMISSION	AWWVRIEND	2.0	5339	7	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	129.3
9	COMMISSION	AWWVRIEND	2.0	5339	8	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	131.2
10	COMMISSION	AWWVRIEND	2.0	5339	9	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	133.2
11	COMMISSION	AWWVRIEND	2.0	5339	10	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	135.2
12	COMMISSION	AWWVRIEND	2.0	5339	11	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	137.1
13	COMMISSION	AWWVRIEND	2.0	5339	12	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	139.1
14	COMMISSION	AWWVRIEND	2.0	5339	13	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	141.0
15	COMMISSION	AWWVRIEND	2.0	5339	14	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	143.0

Collaboration with
ASTRO-WISE

(courtesy W.-J. Friend and J. McFarland)



Project	Creator	MS Version	Observation ID	Sub Band ID	# Corr	# Freq	# Cat	Plots	Start Date	End Date	Pointing Ra, Dec	Frequency [MHz]	
1	COMMISSION	AWWVRIEND	2.0	5339	0	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	115.6
2	COMMISSION	AWWVRIEND	2.0	5339	1	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	117.6
3	COMMISSION	AWWVRIEND	2.0	5339	2	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	119.5
4	COMMISSION	AWWVRIEND	2.0	5339	3	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	121.5
5	COMMISSION	AWWVRIEND	2.0	5339	4	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	123.4
6	COMMISSION	AWWVRIEND	2.0	5339	5	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	125.4
7	COMMISSION	AWWVRIEND	2.0	5339	6	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	127.3
8	COMMISSION	AWWVRIEND	2.0	5339	7	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	129.3
9	COMMISSION	AWWVRIEND	2.0	5339	8	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	131.2
10	COMMISSION	AWWVRIEND	2.0	5339	9	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	133.2
11	COMMISSION	AWWVRIEND	2.0	5339	10	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	135.2
12	COMMISSION	AWWVRIEND	2.0	5339	11	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	137.1
13	COMMISSION	AWWVRIEND	2.0	5339	12	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	139.1
14	COMMISSION	AWWVRIEND	2.0	5339	13	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	141.0
15	COMMISSION	AWWVRIEND	2.0	5339	14	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	143.0
16	COMMISSION	AWWVRIEND	2.0	5339	15	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	144.9
17	COMMISSION	AWWVRIEND	2.0	5339	16	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	146.9
18	COMMISSION	AWWVRIEND	2.0	5339	17	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	148.8
19	COMMISSION	AWWVRIEND	2.0	5339	18	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	150.8
20	COMMISSION	AWWVRIEND	2.0	5339	19	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	152.7
21	COMMISSION	AWWVRIEND	2.0	5339	20	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	154.7
22	COMMISSION	AWWVRIEND	2.0	5339	21	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	156.6
23	COMMISSION	AWWVRIEND	2.0	5339	22	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	158.6
24	COMMISSION	AWWVRIEND	2.0	5339	23	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	160.5
25	COMMISSION	AWWVRIEND	2.0	5339	24	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	162.5
26	COMMISSION	AWWVRIEND	2.0	5339	25	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	164.5
27	COMMISSION	AWWVRIEND	2.0	5339	26	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	166.4
28	COMMISSION	AWWVRIEND	2.0	5339	27	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	168.4
29	COMMISSION	AWWVRIEND	2.0	5339	28	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	170.3
30	COMMISSION	AWWVRIEND	2.0	5339	29	981240	256	1	uv	01 Feb 2008 16:17:01	04 Feb 2008 04:47:56	-3.1, 1.6	172.3



UV coverage for L2008_05339_SB18.MS

The plot shows the UV plane with U (horizontal axis) and V (vertical axis) ranging from -600 to 600. Concentric circles represent the sampling of the sky, with the innermost circle at the origin (0,0) and subsequent circles representing larger baselines.

File details

- Size: 8290273280 bytes (7.7 GB)
- Hash: b3db3307058a931a4382212b1760cb38f6f245e8
- Created: 12 Nov 2008 21:56:13

Collaboration with
ASTRO-WISE

(courtesy W.-J. Friend and J. McFarland)