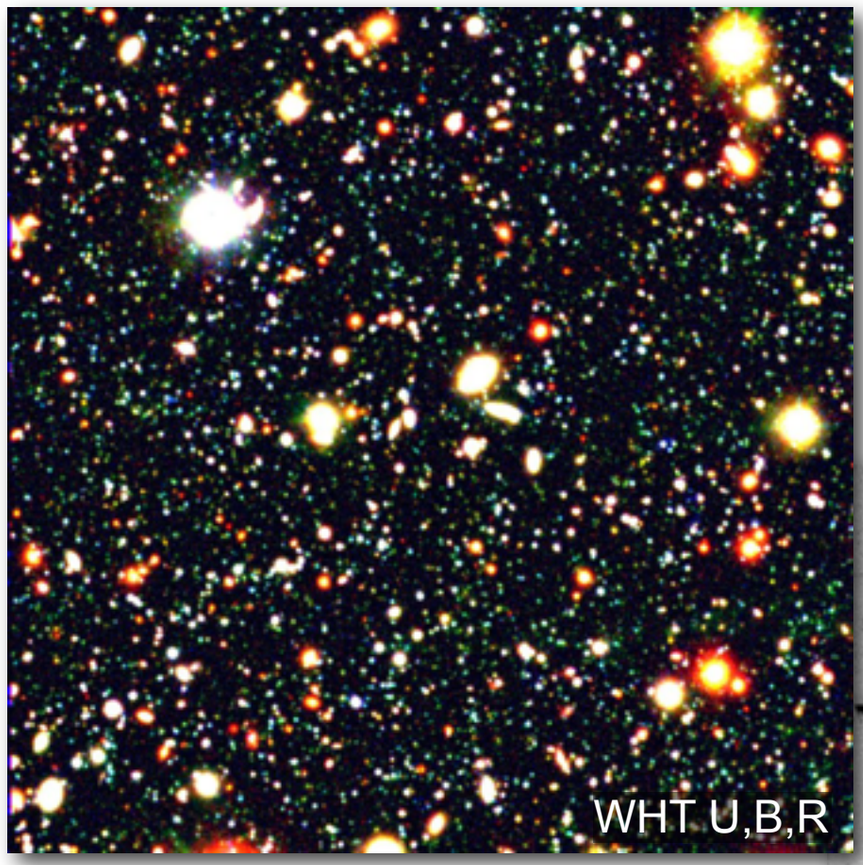
The PDF version of these slides might not make much sense without the accompanying narrative.

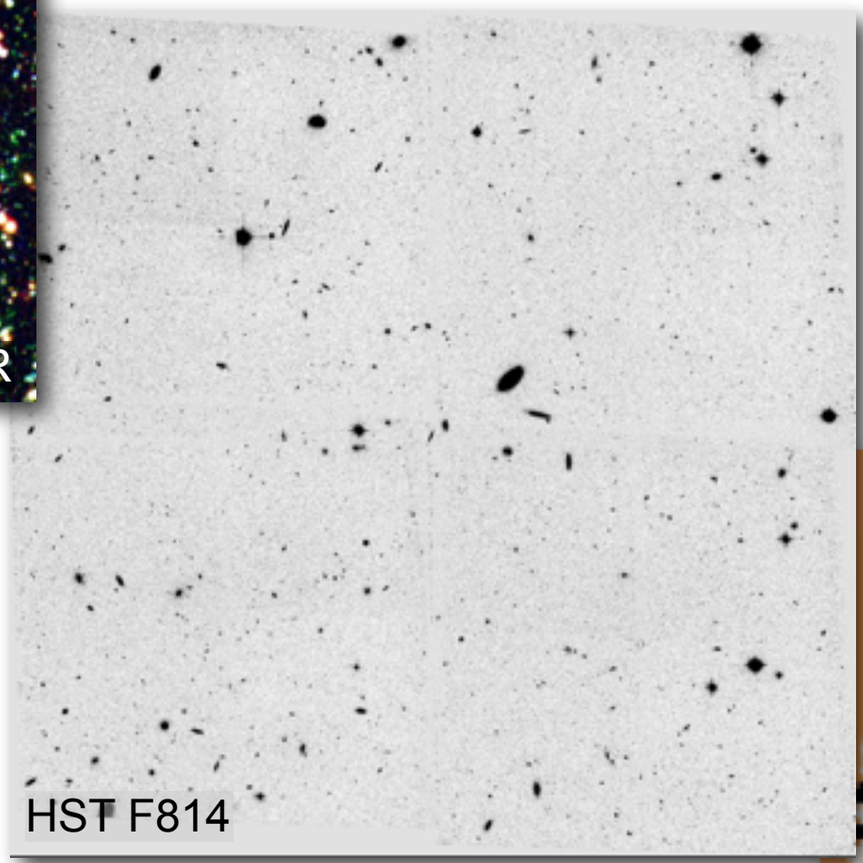
Please email me with any questions: ianh@astro.ox.ac.uk

A self-imposed rule (as much as it pains me...)

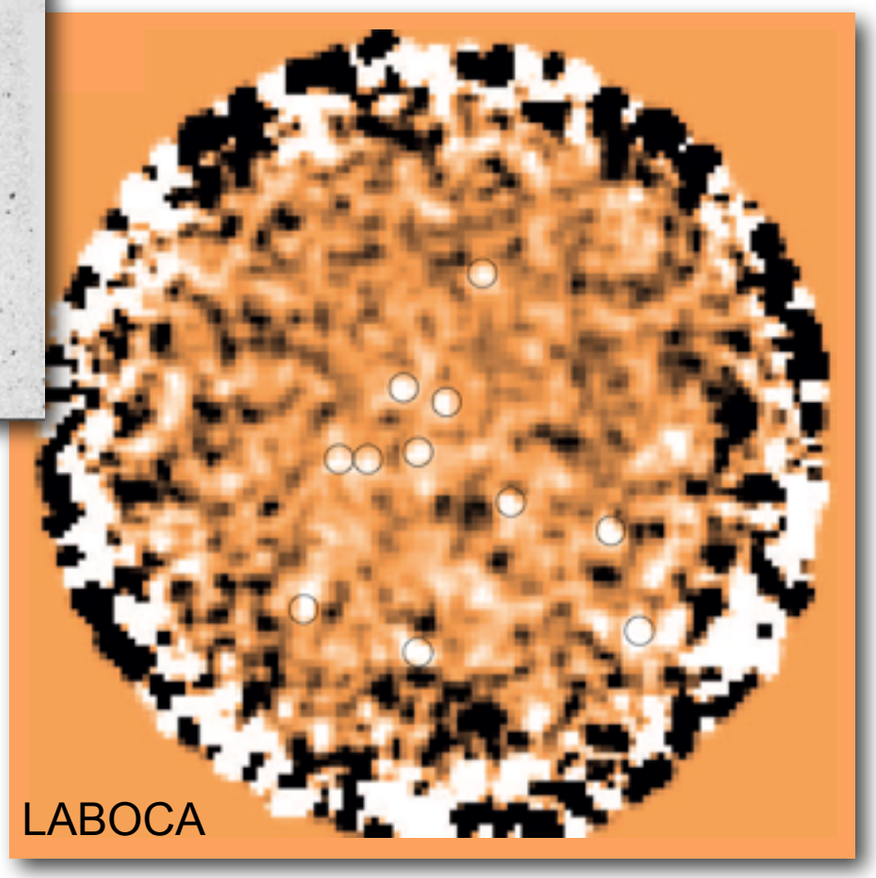
Context: sub-mm galaxies and QSOs in the William Herschel Deep Field



WHT	*U B R I Z* imaging (*B* < 27.9 mag)
UKIRT	*H K* imaging
HST ACS	High-resolution *I* band imaging



Chandra	X-ray 10^{-15} erg s^{-1} cm^{-2} (70 ks)
LABOCA	870 μm sub-mm survey (21 h)
EVLA	Deep 8.4 GHz radio (35 h)



EVLA observations of the WHDF

- 35 hours with EVLA D-configuration
- 25 independent datasets (SBs) of 1.5 or 3.5 hours
- Frequency range 8.332 - 8.558 GHz
- 128 × 2 MHz channels over 2 SPW
- 8:1 channel averaging, no time averaging
- Principal Investigator: Michael Hill (Durham)

AS1008_sb1094913_1_000.55349.39414662037
AS1008_sb1094913_1.55326.477696724534
AS1008_sb1094913_1.55329.46954527778
AS1008_sb1094913_1.55344.4072031713
AS1008_sb1094913_1.55353.44451736111
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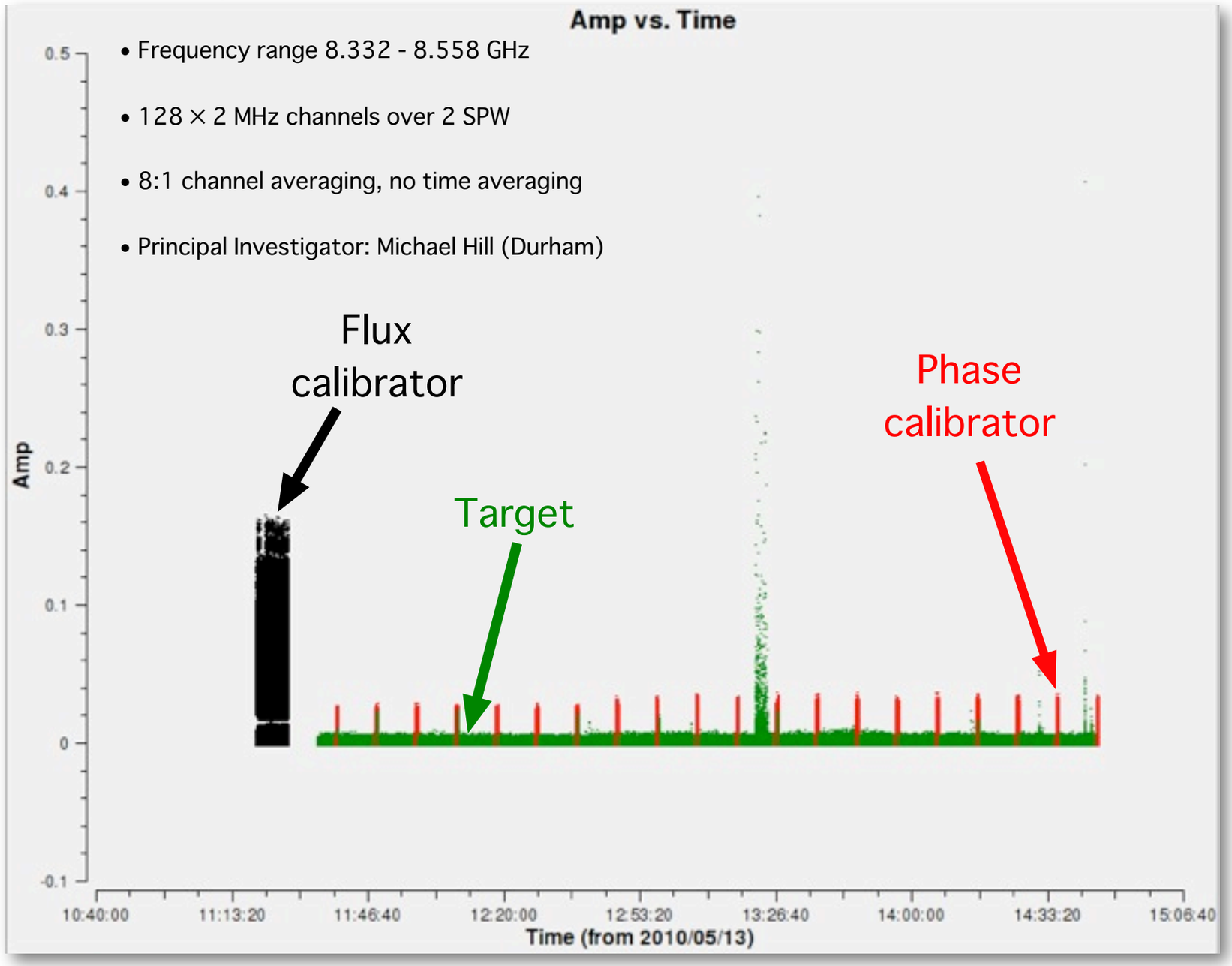
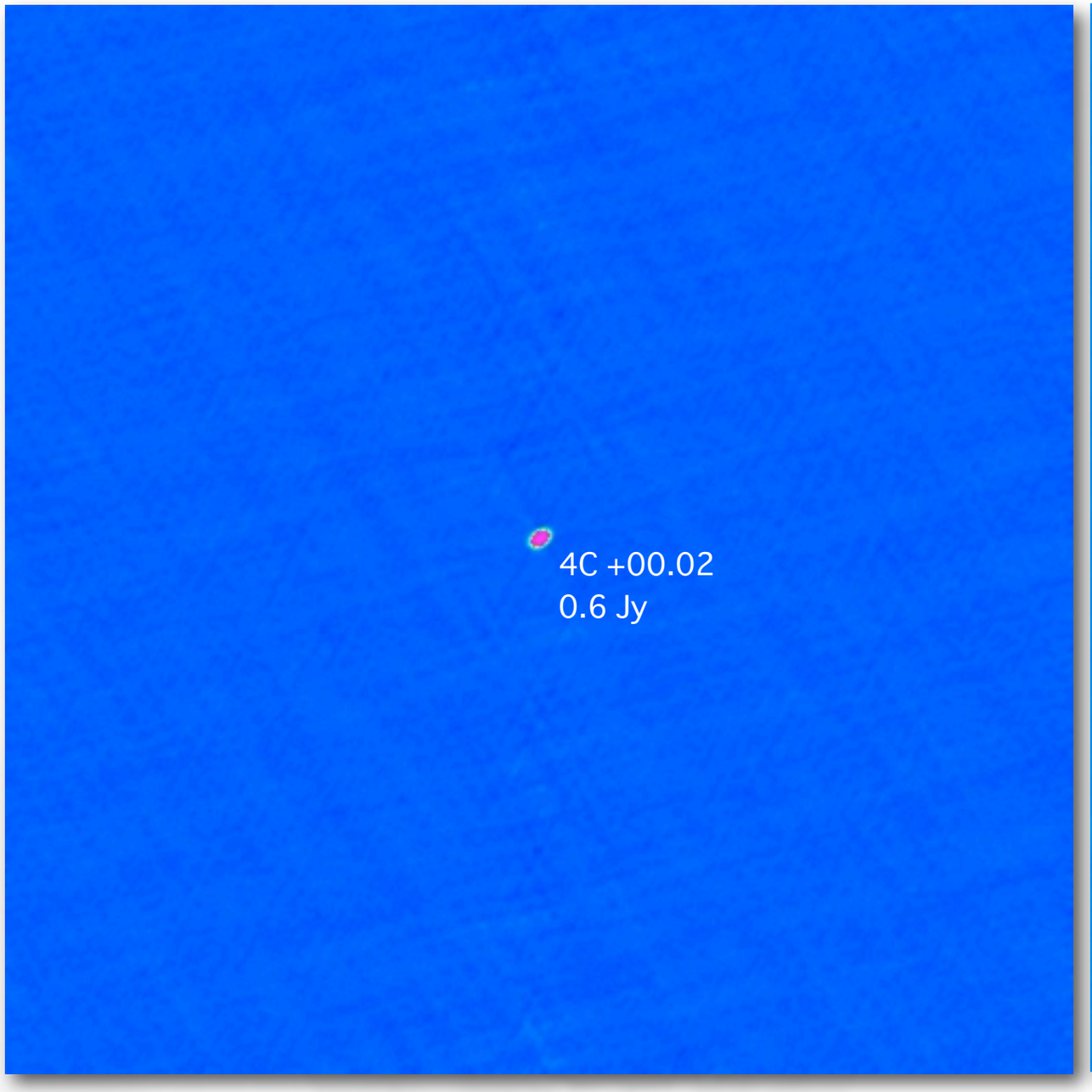


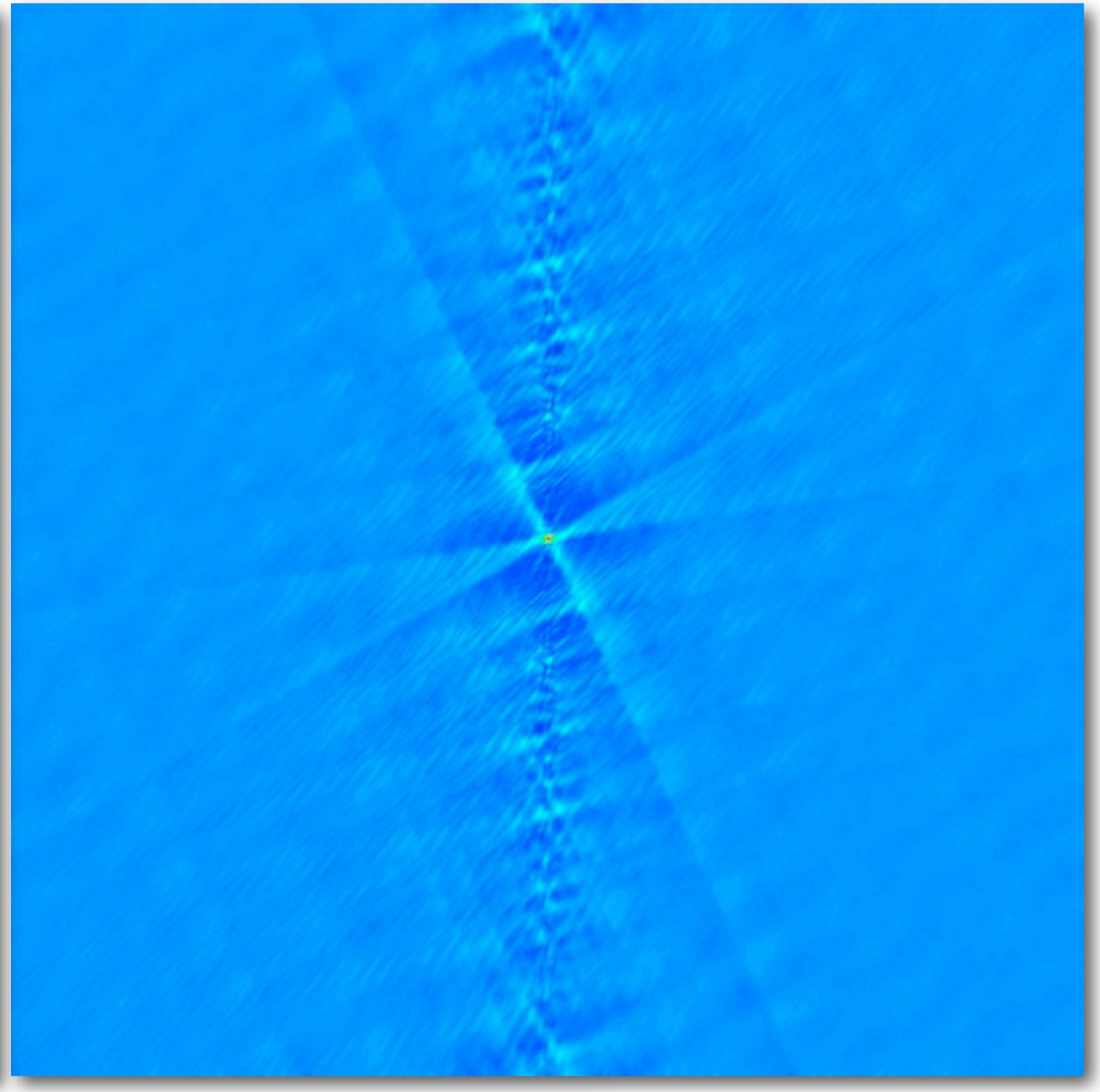
Post-flagging, post-averaging gain calibration performed with CASA
flux scale → bandpass → complex gain

Two features of this target field that an estate agent would describe as ‘quirky’

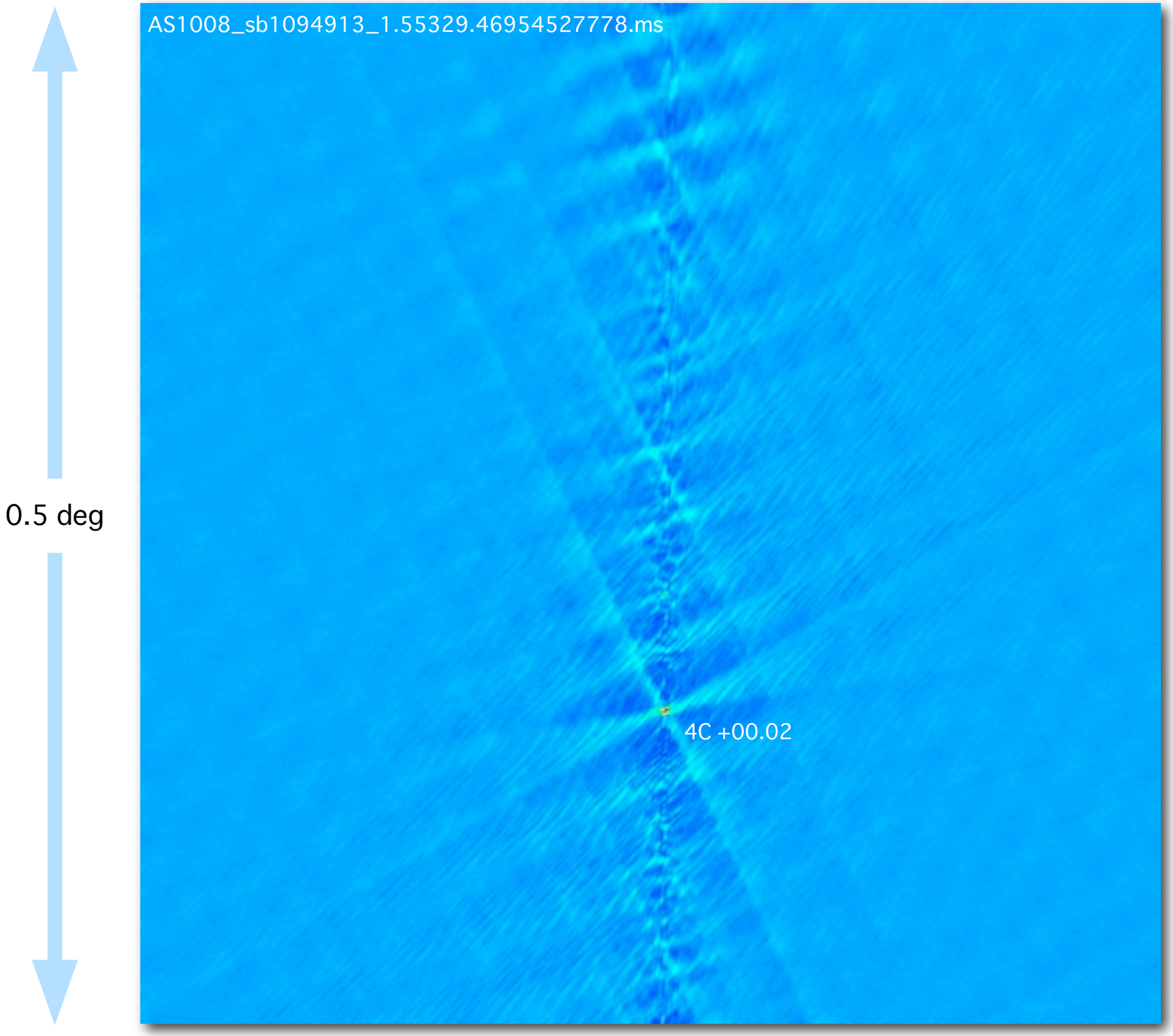
The phase calibrator



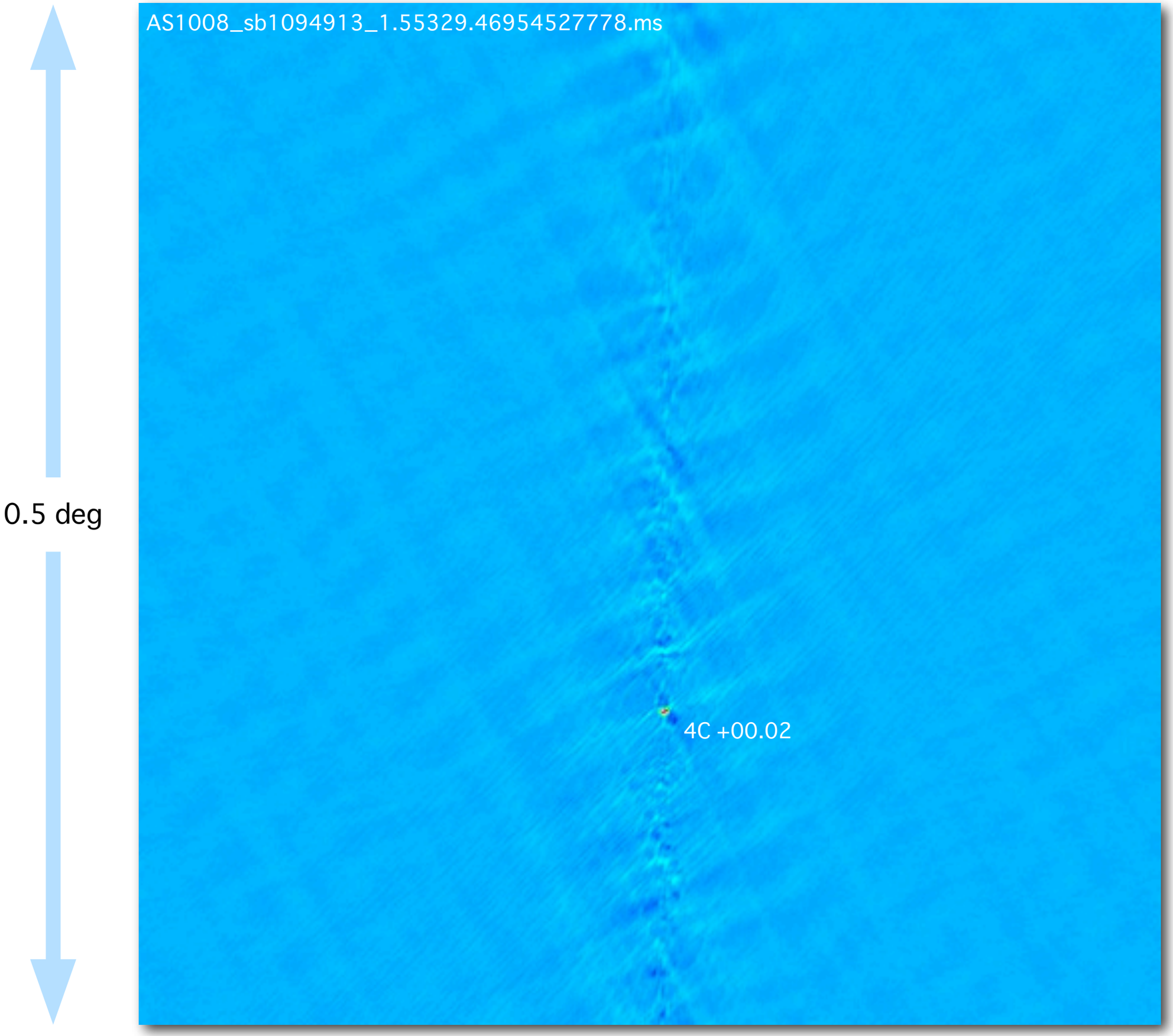
The point-spread function



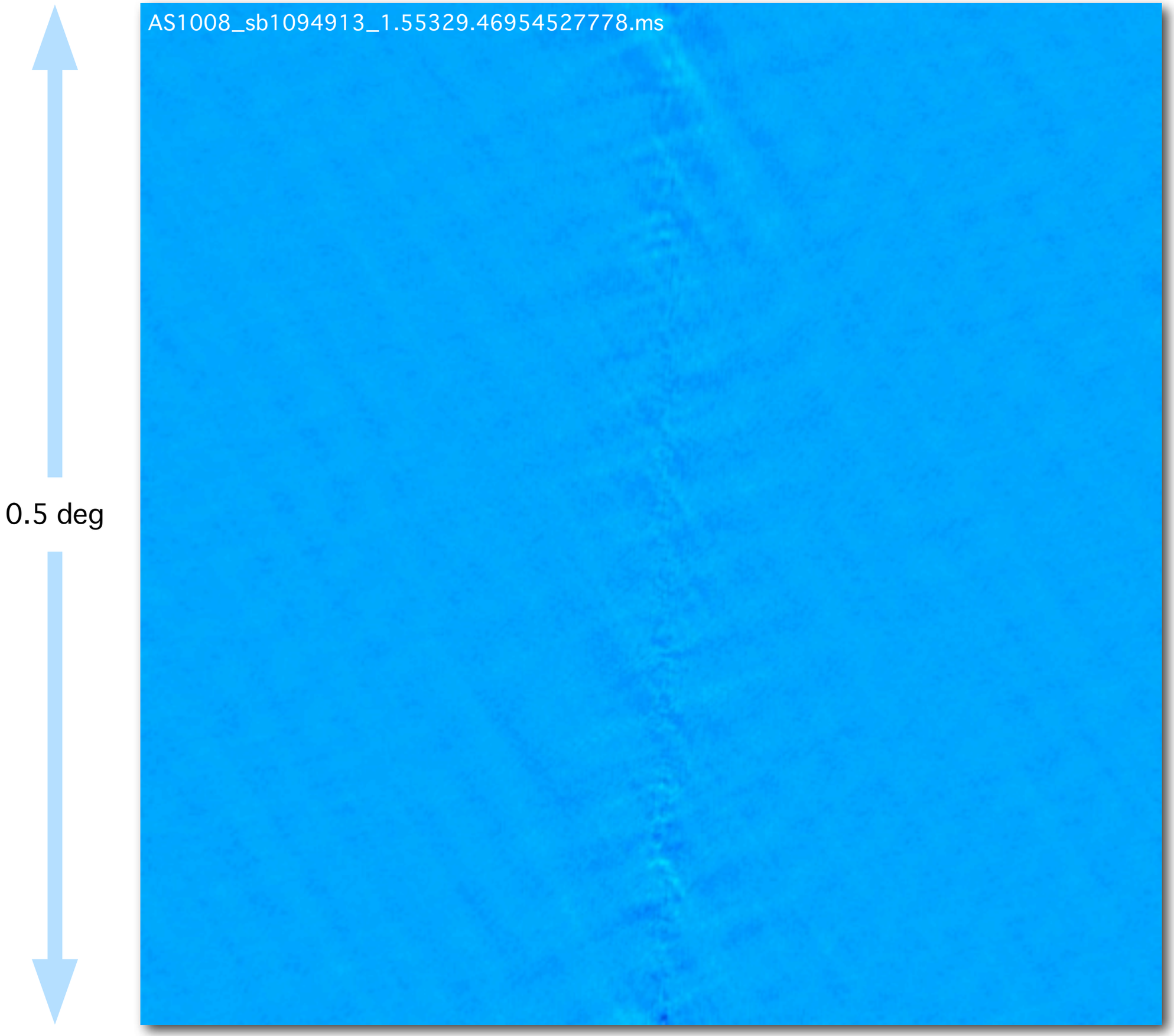
Wide-field dirty image of target



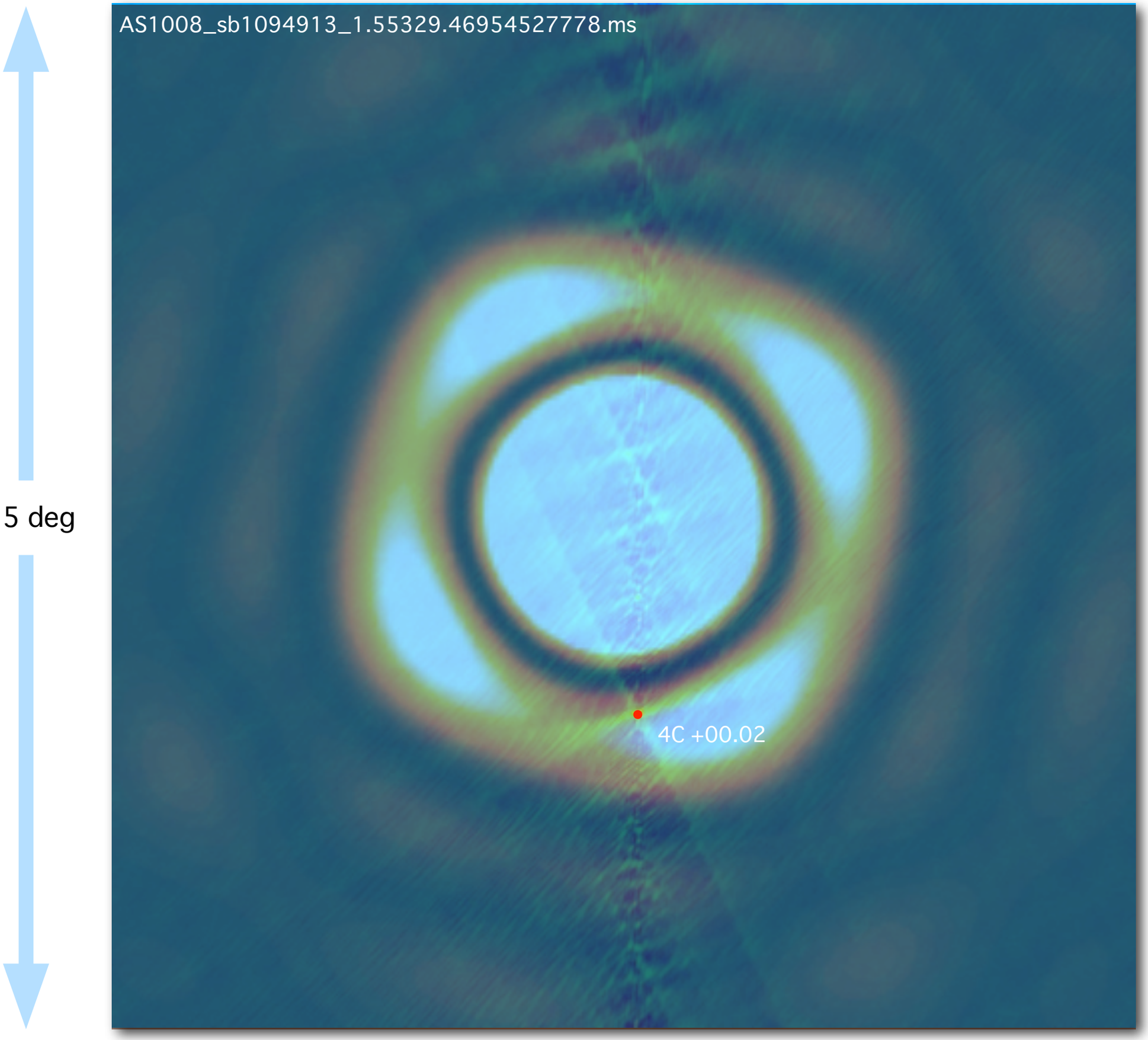
Deconvolved image



Subtract MODEL_DATA column and image residuals

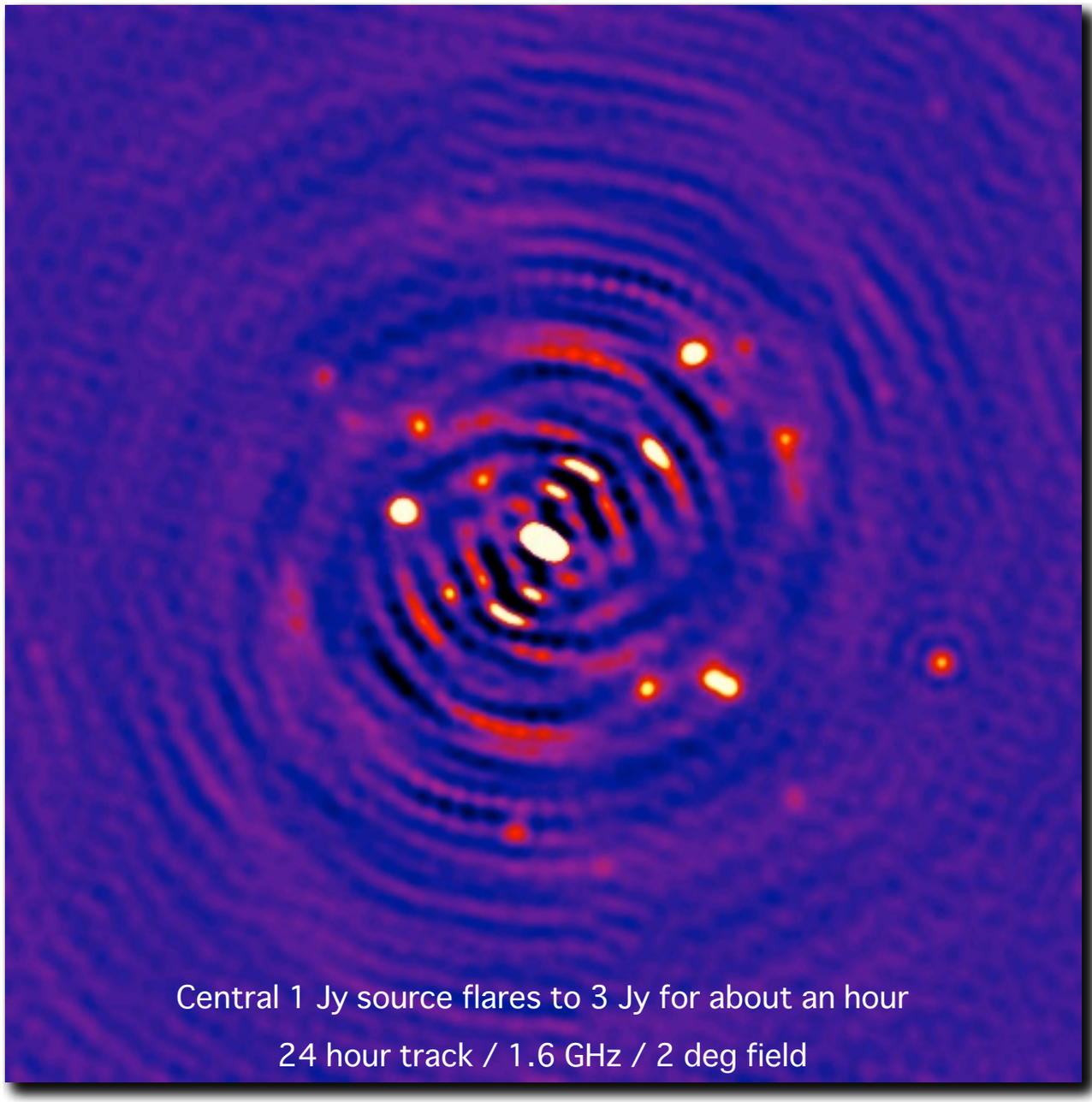


The EVLA primary beam



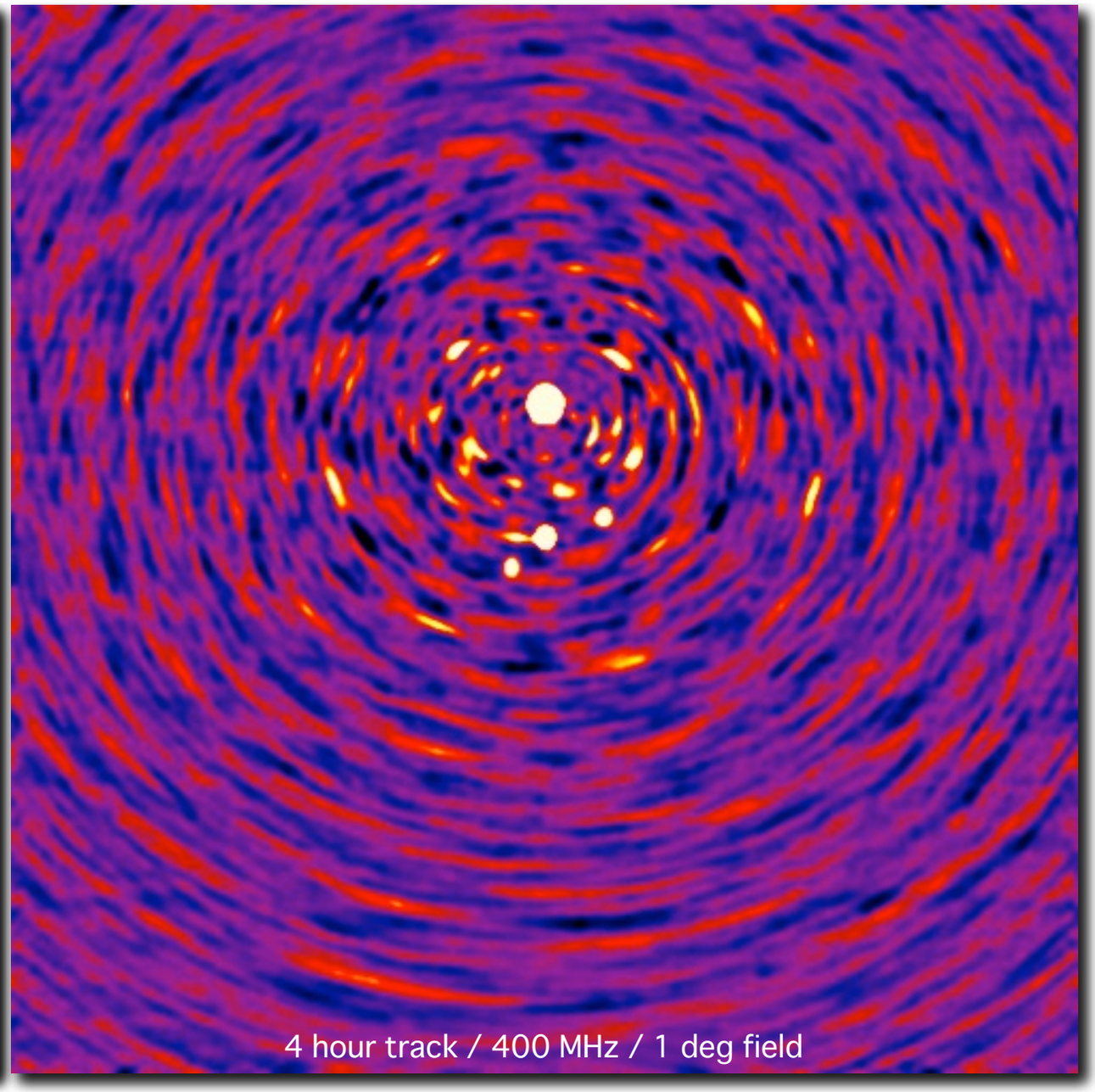
Intrinsic or apparent transients? Either way your continuum map is a mess

MeqTrees KAT-7 simulation



Deconvolved image, Briggs weighting

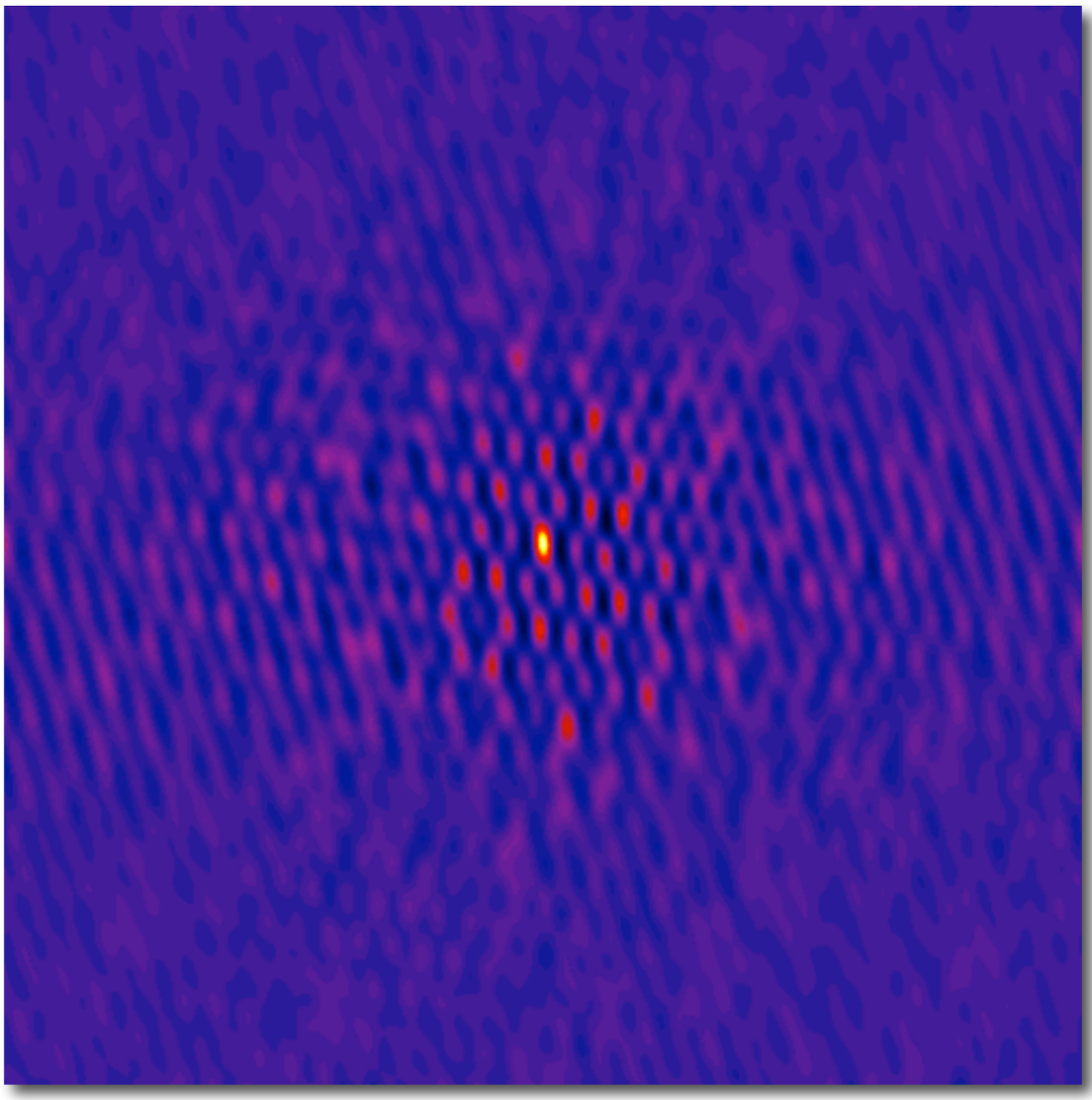
OeRC SKA AA simulation (Dulwich, Mort, Salvini)



Deconvolved image, natural weighting

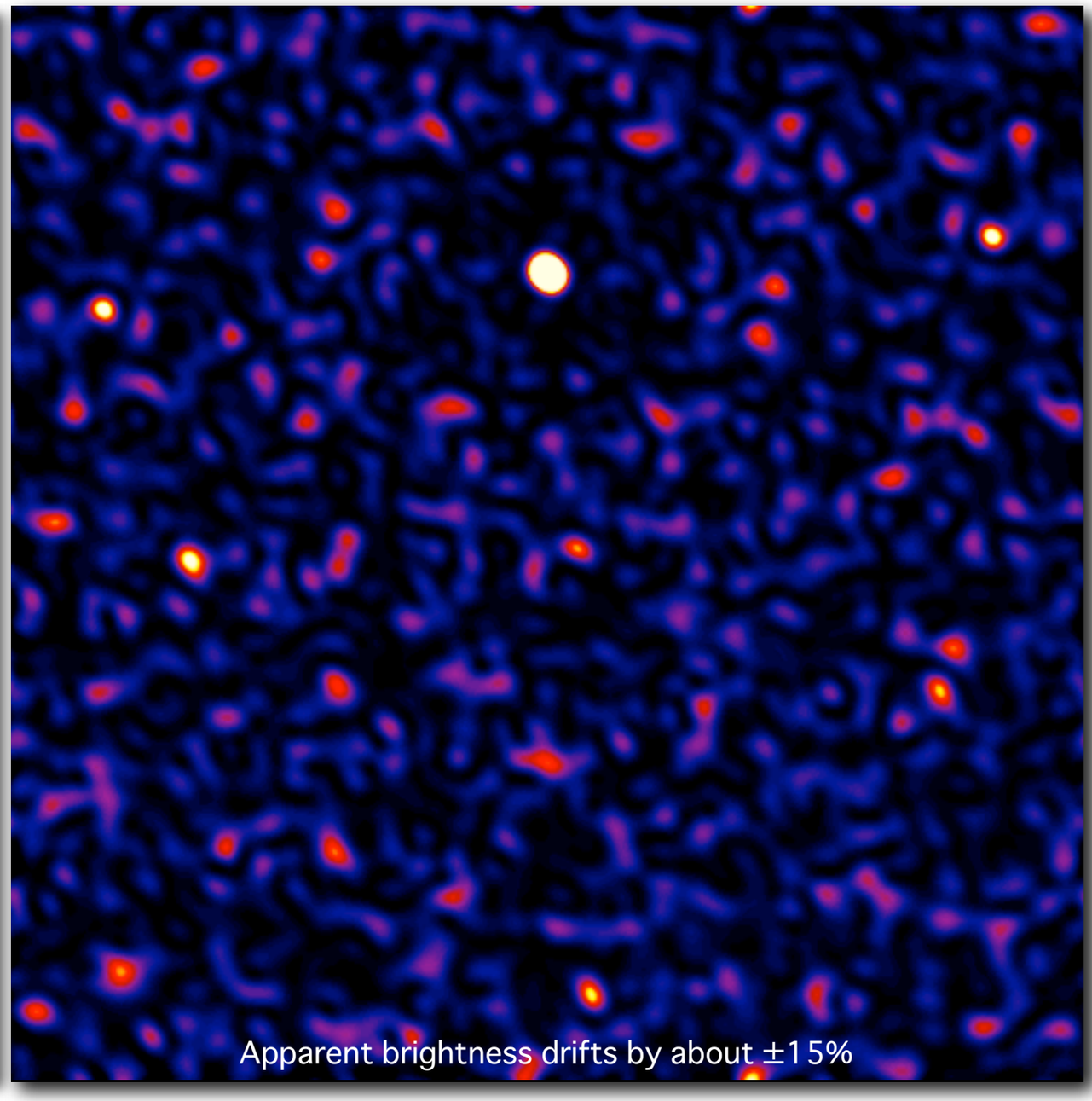
Intrinsic or apparent transients? Either way your continuum map is a mess

MeqTrees KAT-7 simulation



48 × 30-minute snapshot dirty images

OeRC SKA AA simulation (Dulwich, Mort, Salvini)



48 × 5-minute snapshot dirty images

Direction-dependent calibration to the rescue

Peeling

AIPS HELP file (version 31DEC) | peel

www.aips.nrao.edu/cgi-bin/ZXHLP2.PL?PEELR

AIPS HELP file for PEELR in 31DEC11

As of Mon Jul 25 5:08:21 2011

PEELR: RUN PEELR for proc to calibrate interfering sources

INPUTS

INNAME			Input UV file name (name)
INCLASS			Input UV file name (class)
INSEQ	0.0	9999.0	Input UV file name (seq. #)
INDISK	0.0	9.0	Input UV file disk unit #
IN2NAME			Input image name (name)
IN2CLASS			Input image name (class)
IN2SEQ	0.0	9999.0	Input image name (seq. #)
IN2DISK	0.0	9.0	Input image disk unit #
OUTNAME			Output UV file name (name)
OUTCLASS			Output UV file name (class)
OUTSEQ	-1.0	9999.0	Output UV file name (seq. #)
OUTDISK	0.0	9.0	Output UV file disk unit #.
NFIELD	1.0	4096.0	Number facets in IN2NAME
NGAUSS	1.0	10.0	Number resolutions in IN2NAME
PPARM	0.0		List of <= 100 facets to peel
BCHAN	0.0	16384.0	Lowest channel number 0=>all
ECHAN	0.0	16384.0	Highest channel number
SOLINT			CALIB solution interval (min)
SOLTYPE			Soln type,' ','L1','GCON', 'R', 'L1R', 'GCOR'
SOLMODE			'P' phase only, else 'A&P'
WEIGHTIT	0.0	3.0	Modify data weights function
APARM			General CALIB parameters 1=min. no. antennas 2 > 0 => data divided 3 > 0 => avg. RR,LL

0.1.57 peel

Requires:

Synopsis Do direction dependent selfcal(s) and optionally remove annoying sources. **Description**

Arguments

Inputs	
vis	Name of the input visibility set. allowed: string Default:
dirs	List of directions to peel. allowed: any Default: variant ""
remove	Subtract the selfcalibrated source(s) from the data. allowed: bool Default: True
calmode	Type of selfcal to do. (p: Phase only, a: Ampl only. ap: both allowed: string Default: p

Example

Peeling

$$\mathsf{D}_{pq}^{(1)} = \mathsf{D}_{pq} - \tilde{\boldsymbol{G}}_p \mathsf{X}_{s_0 pq} \tilde{\boldsymbol{G}}_q^H$$

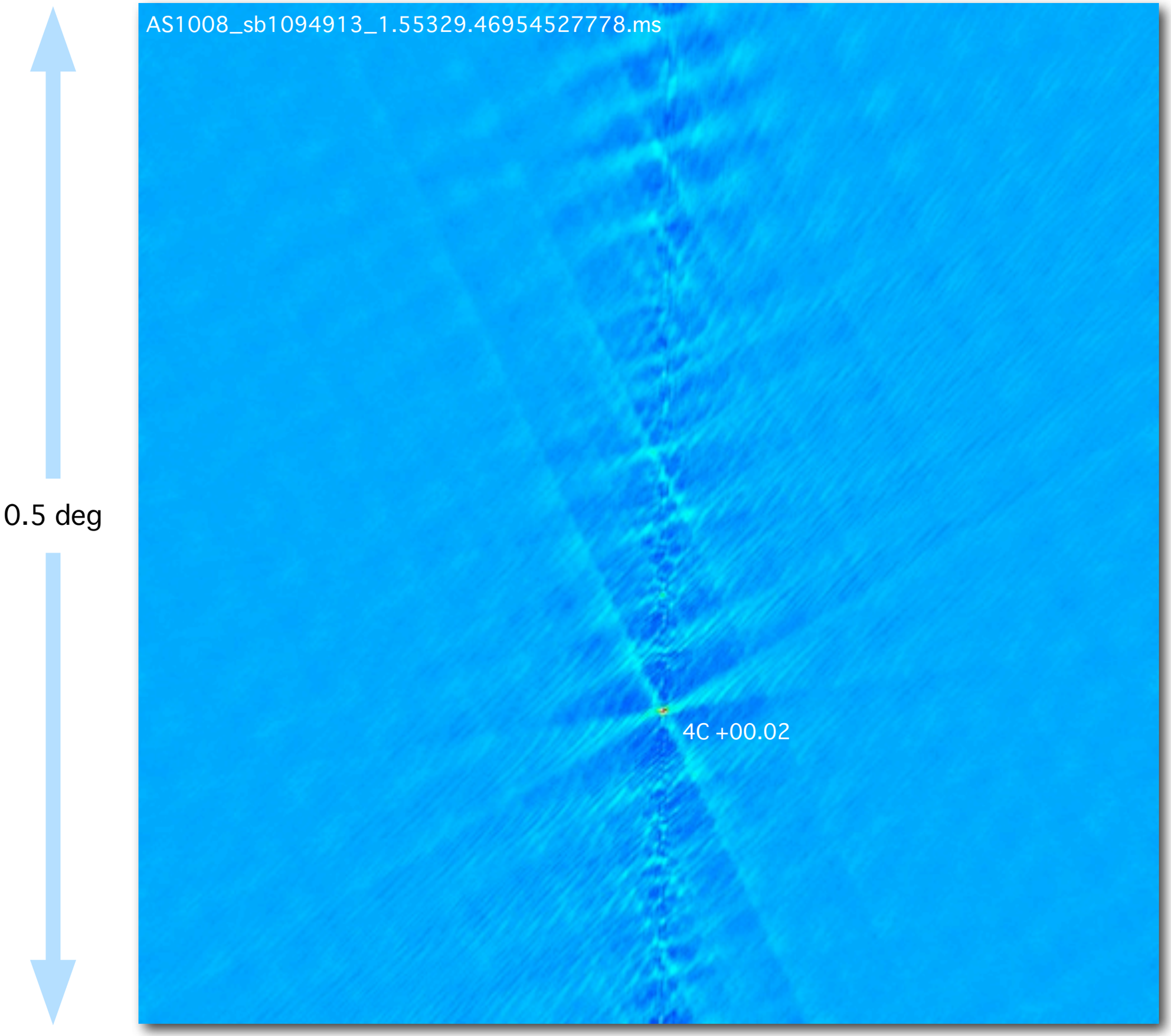
Smirnov, A&A, 572, 107, 2011 following Noordam, SPIE, 5489, 817, 2004

Solve for differential gains

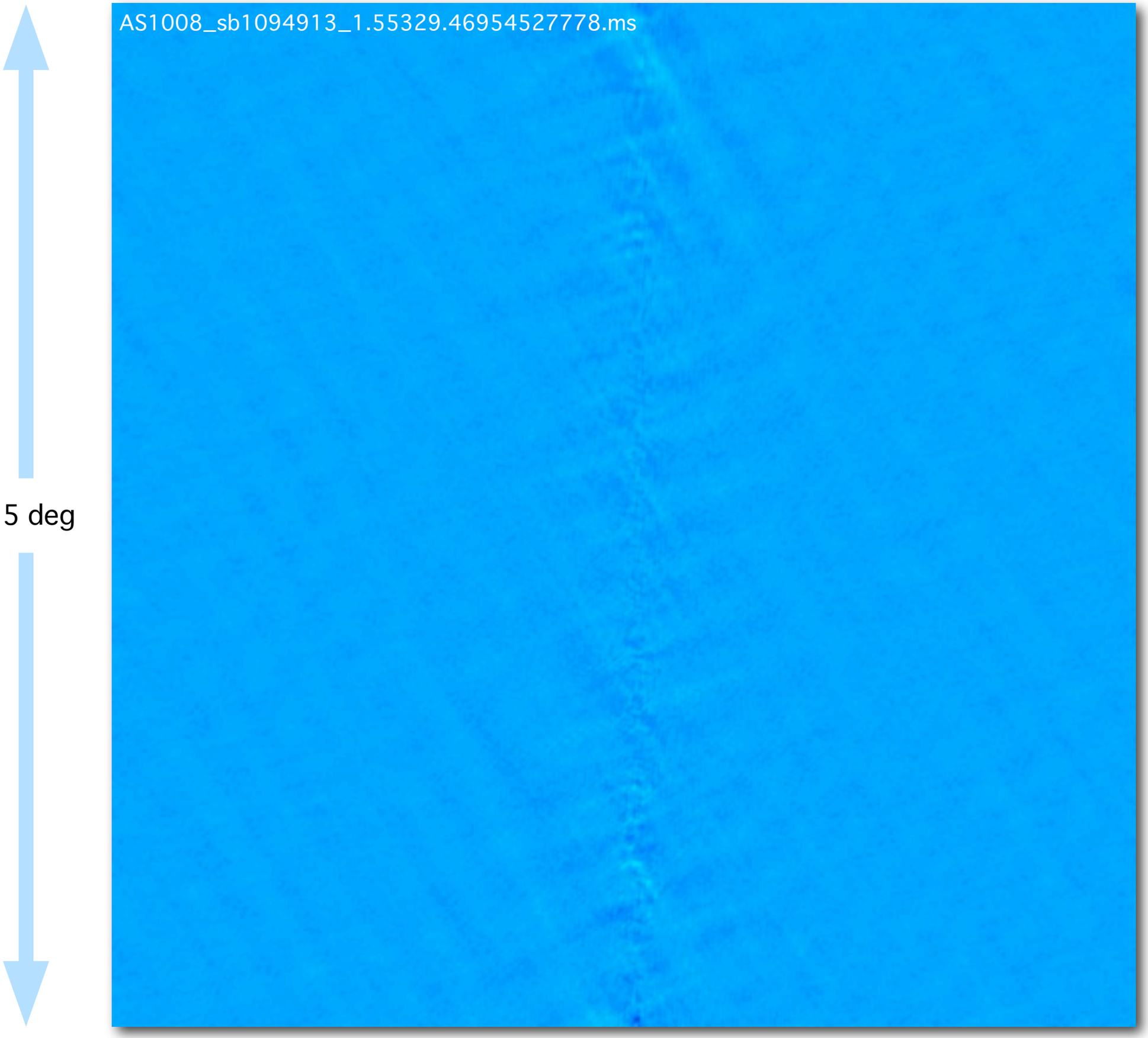
$$\mathbf{V}_{pq} = \boldsymbol{G}_p \left(\sum_s \Delta \boldsymbol{E}_{sp} \mathbf{X}_{spq} \Delta \boldsymbol{E}^H_{sq} \right) \boldsymbol{G}^H_q$$

Smirnov, A&A, 572, 107, 2011

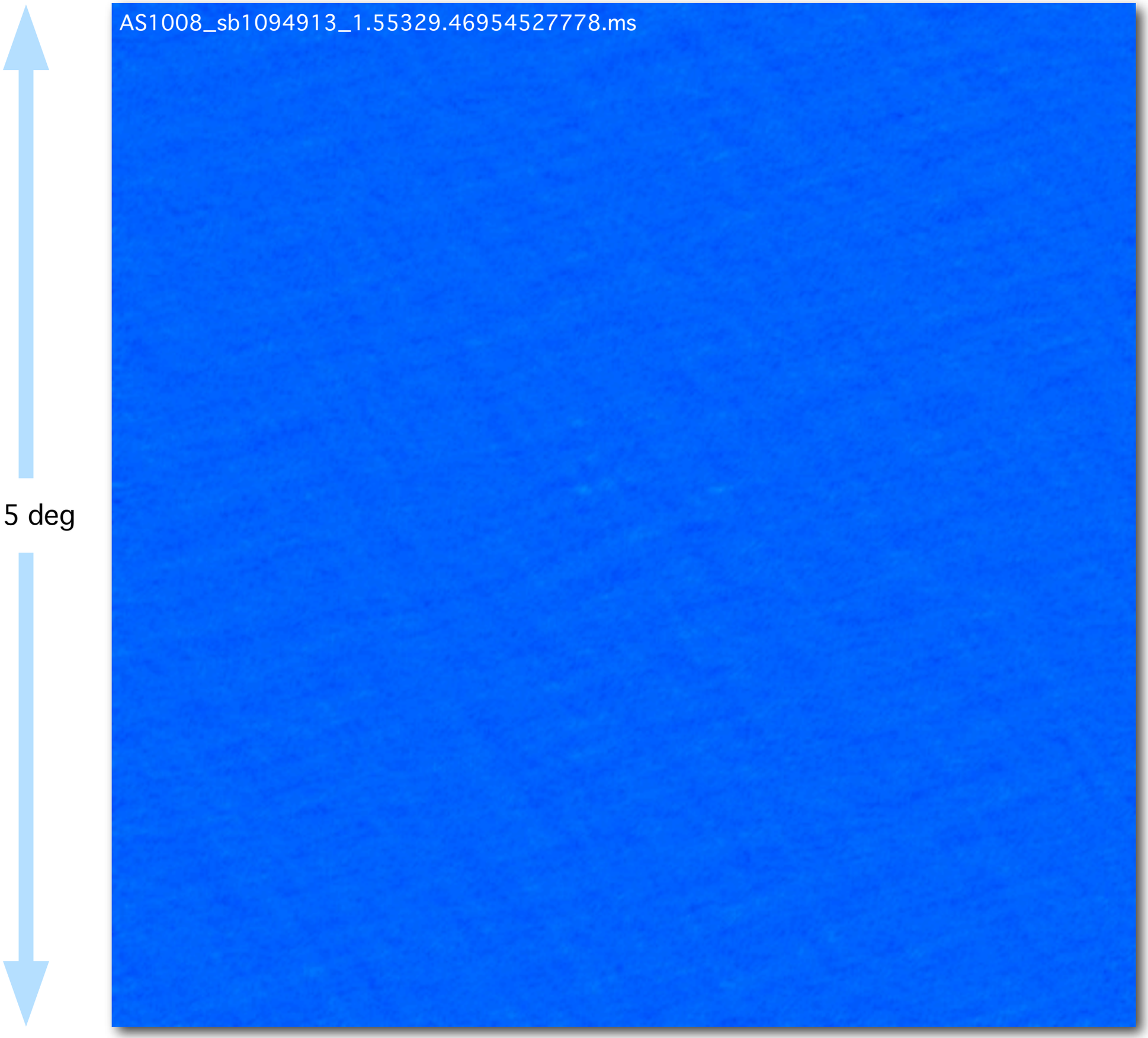
Dirty image



Best ‘traditional-cal’ image

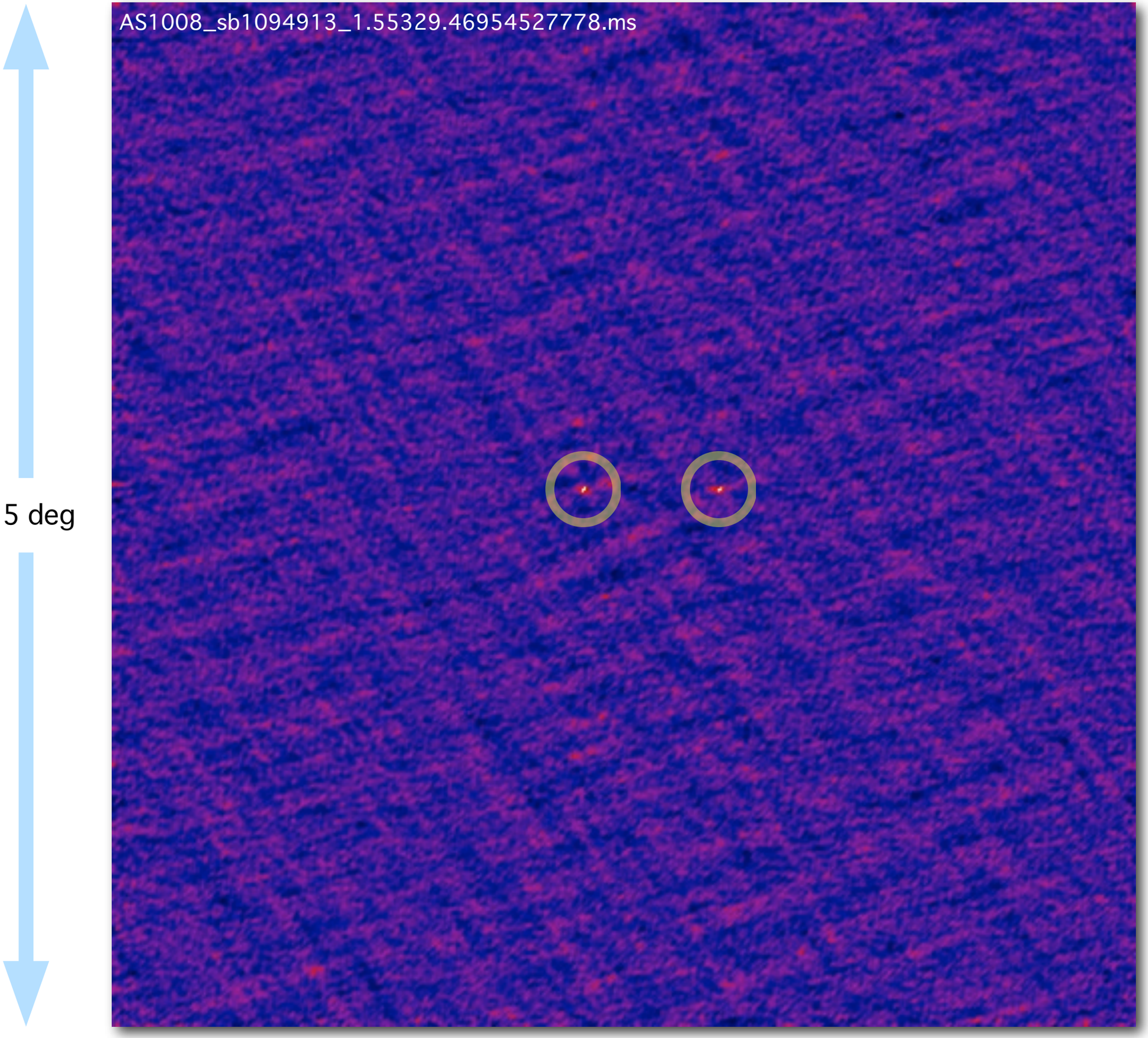


Solve for differential gains with MeqTrees, subtract model and image residuals



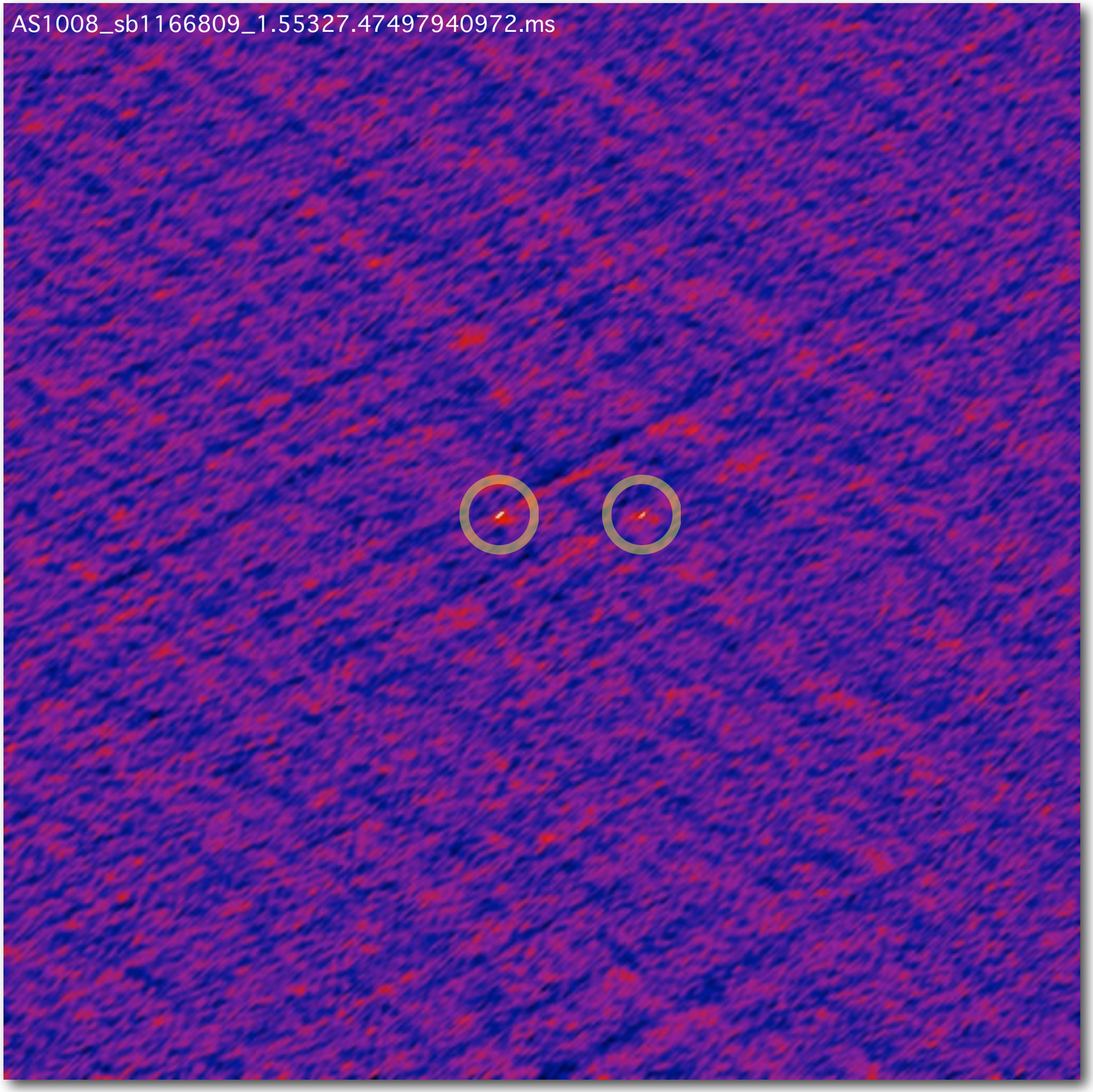
Smirnov, A&A, 572, 107, 2011
Noordam & Smirnov, ApJ, 524, 61, 2011

Solve for differential gains with MeqTrees, subtract model and image residuals



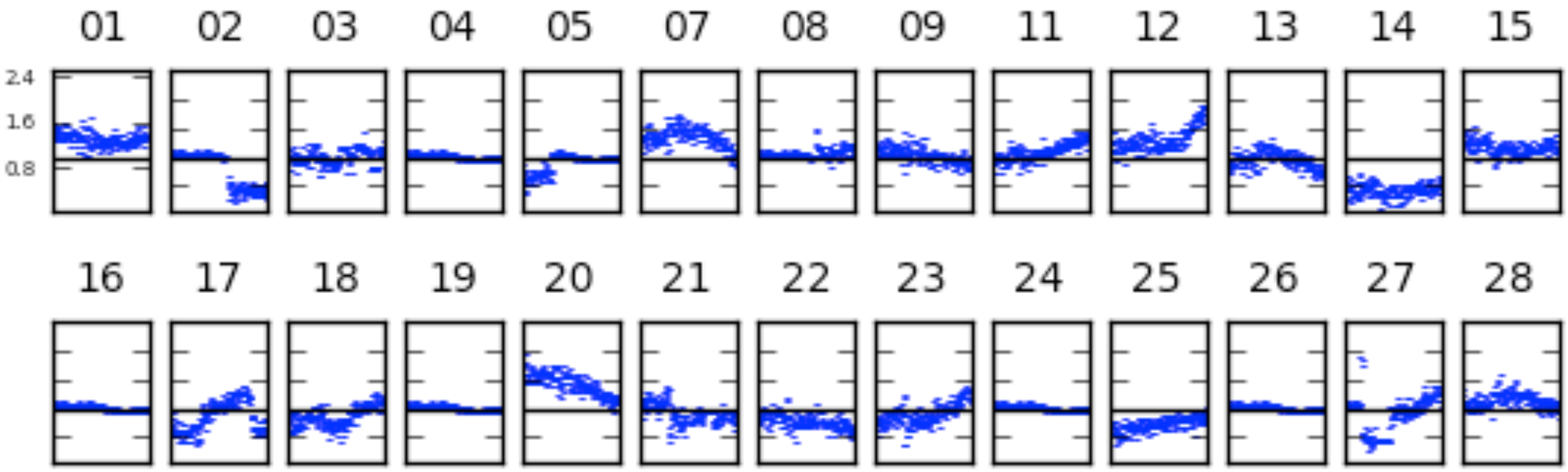
Smirnov, A&A, 572, 107, 2011
Noordam & Smirnov, ApJ, 524, 61, 2011

Solve for differential gains with MeqTrees, subtract model and image residuals

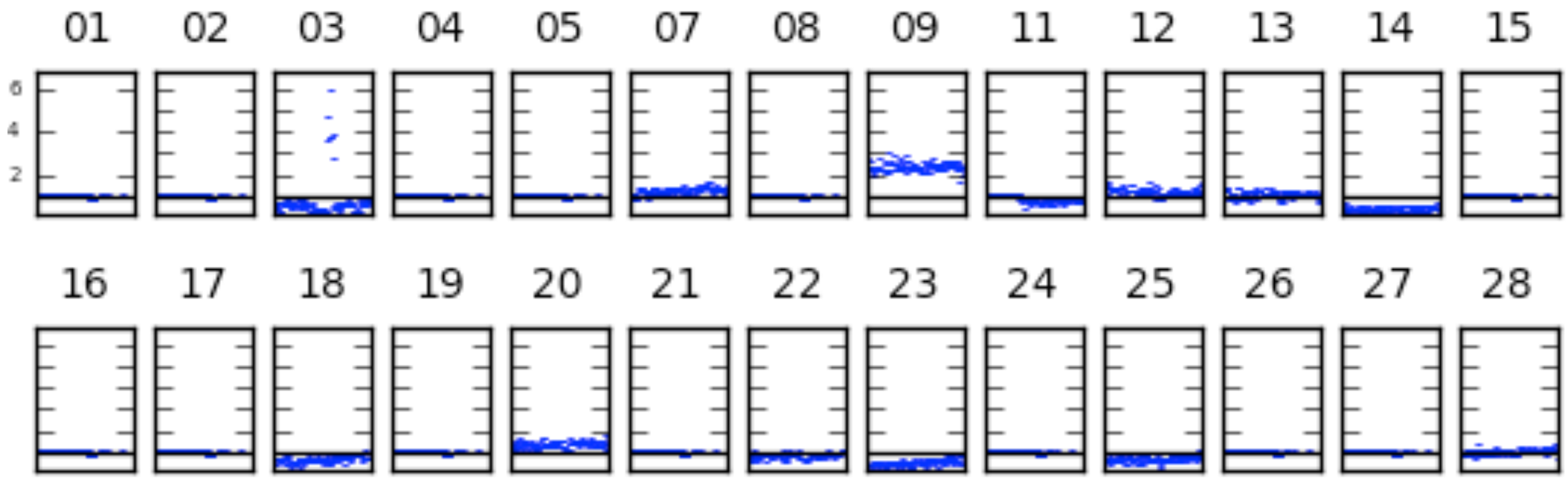


Smirnov, A&A, 572, 107, 2011
Noordam & Smirnov, ApJ, 524, 61, 2011

dE solutions per antenna

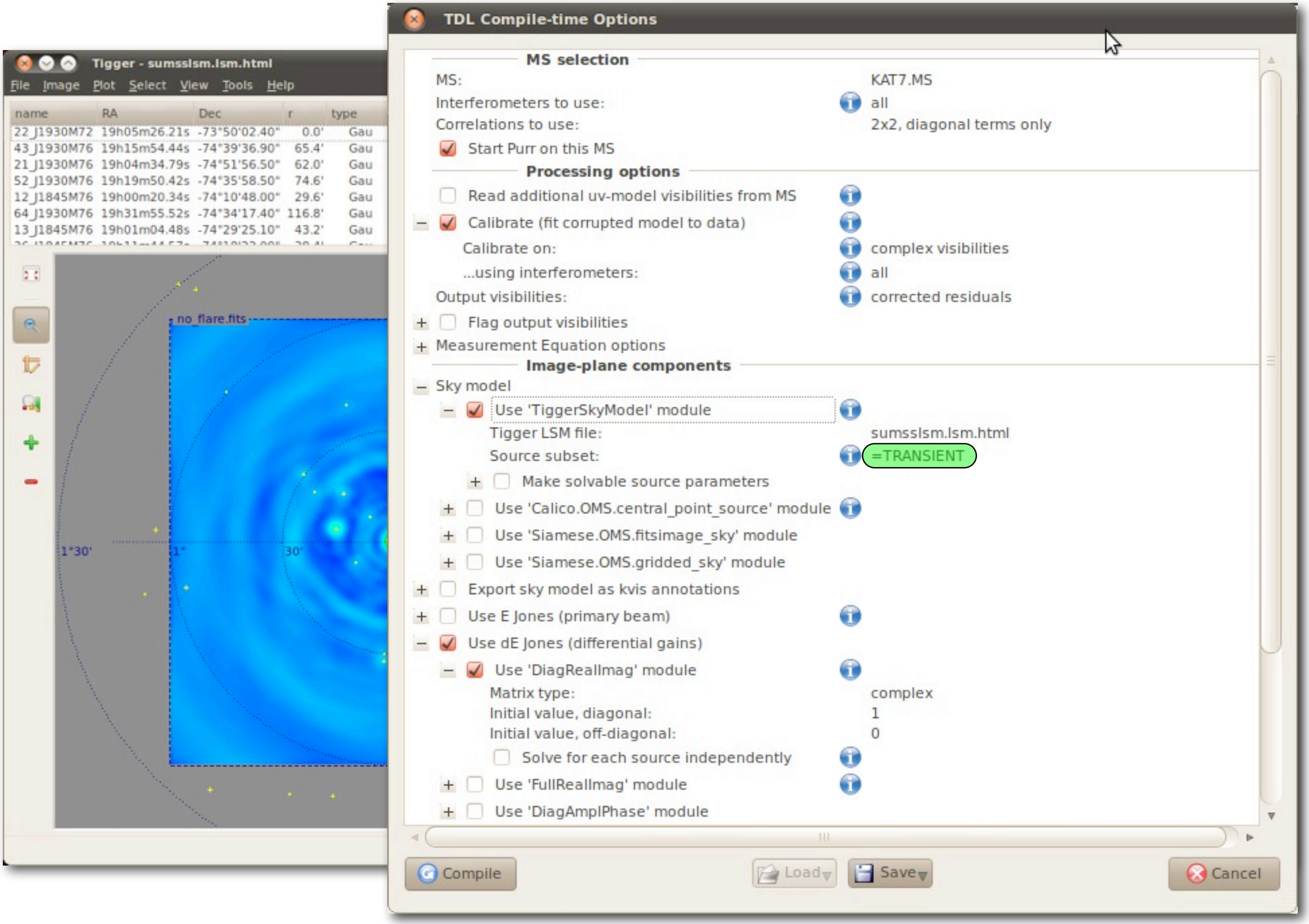


55329_55327_CONCAT.ms



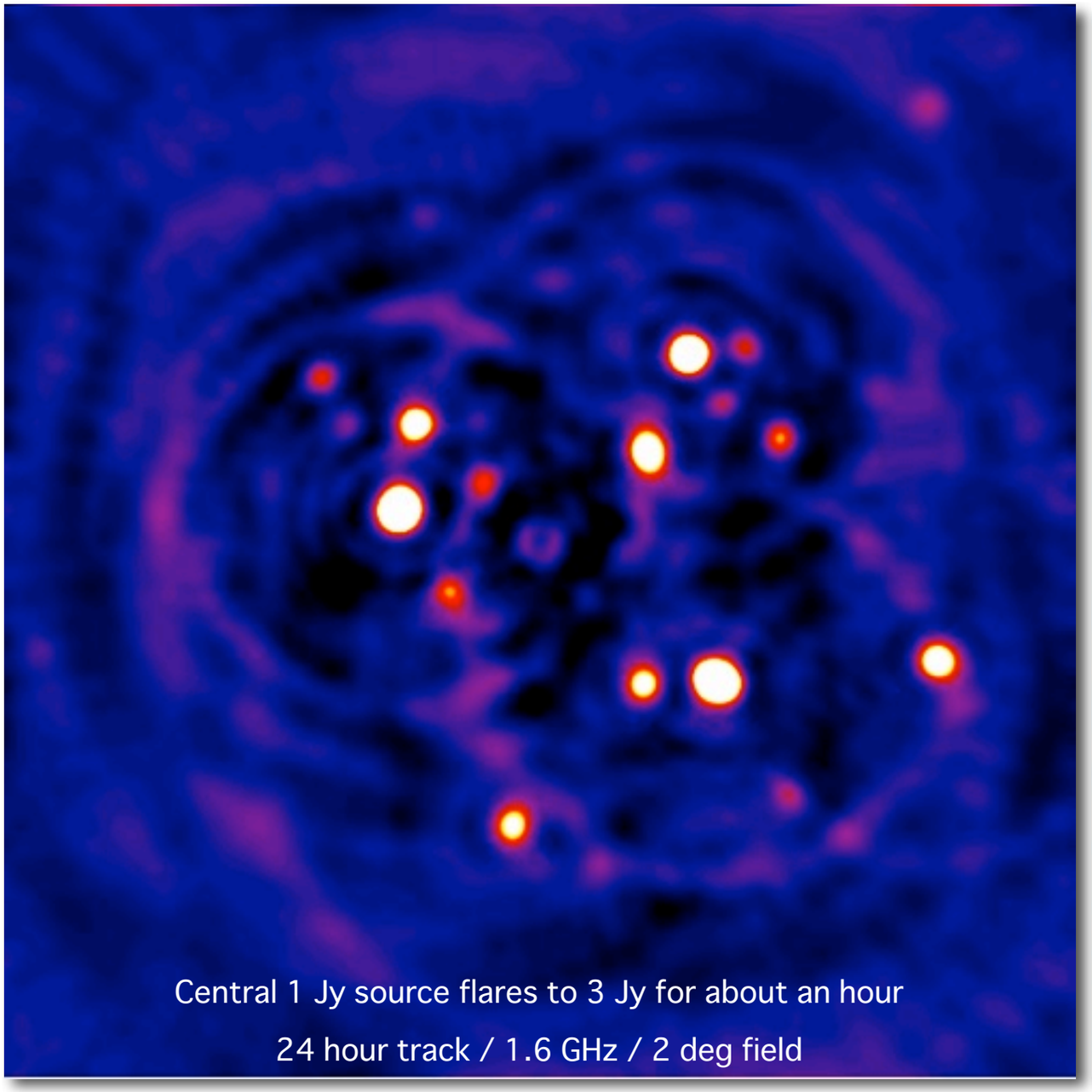
AS1008_sb1166809_1.55311.49789672454.ms.SPLIT.WHDF1.ms

Solving for the ‘variable’ sources in our simulations



Solving for the ‘variable’ sources in our simulations

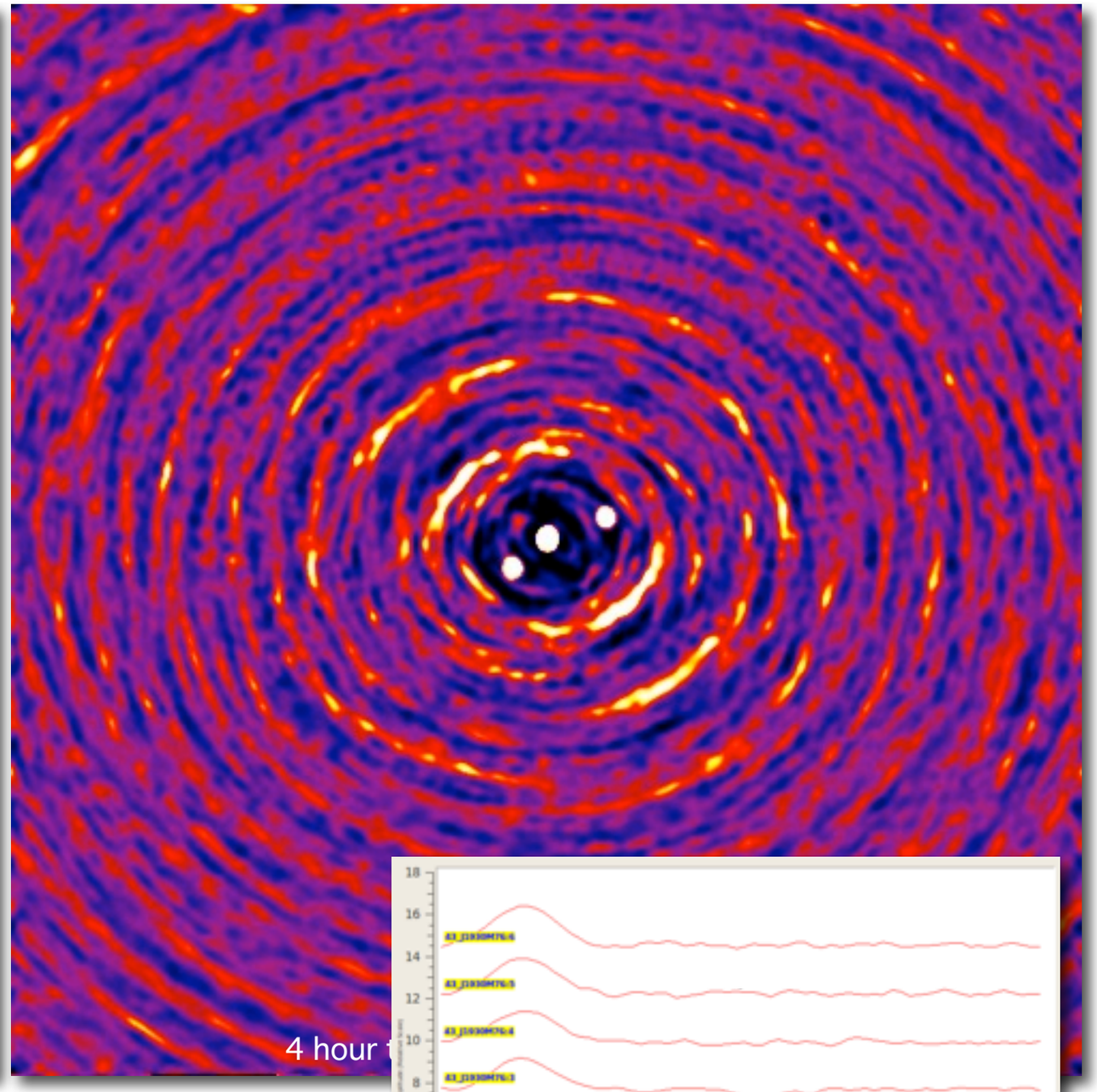
MeqTrees KAT-7 simulation



Central 1 Jy source flares to 3 Jy for about an hour

24 hour track / 1.6 GHz / 2 deg field

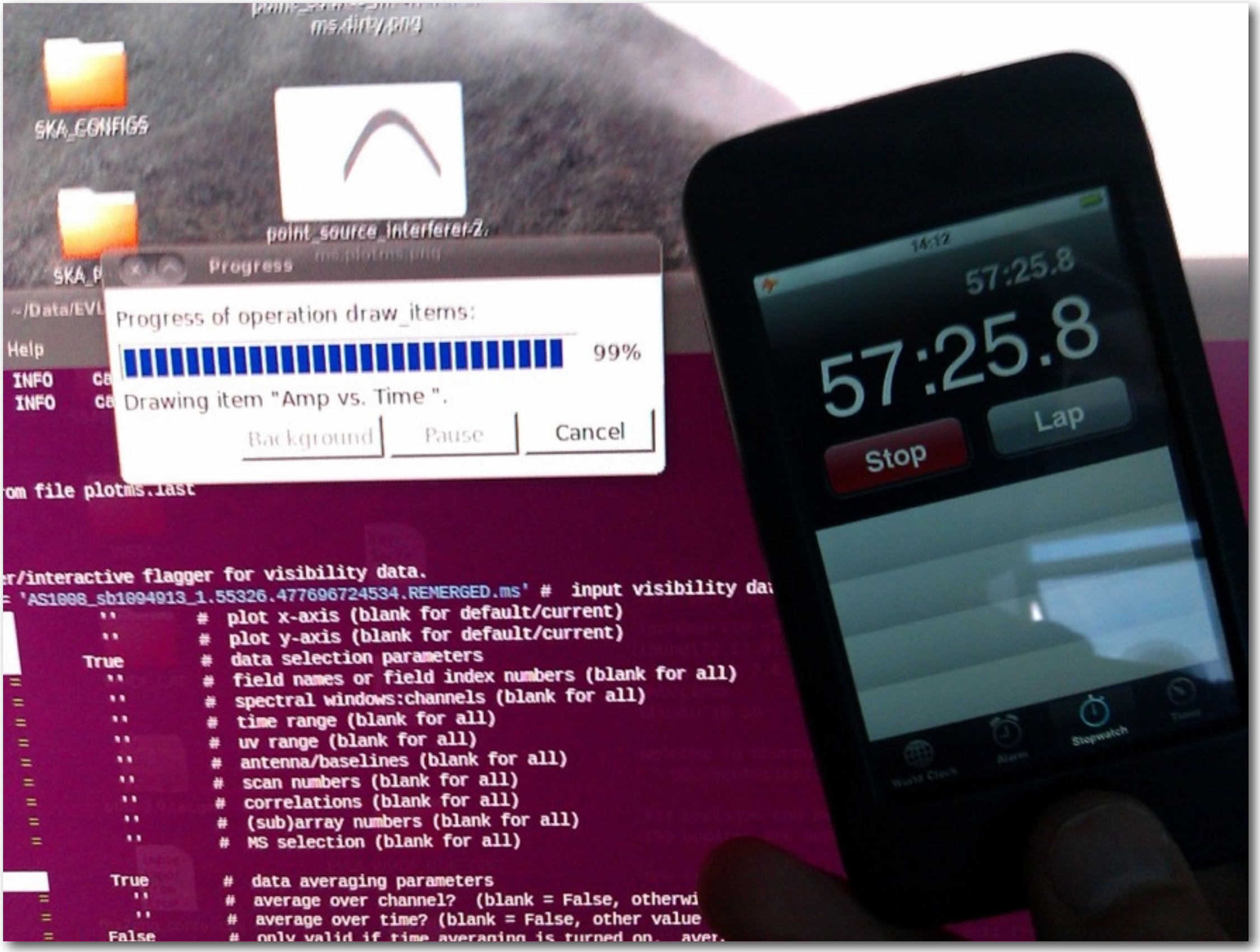
OeRC SKA AA simulation (Dulwich, Mort, Salvini)



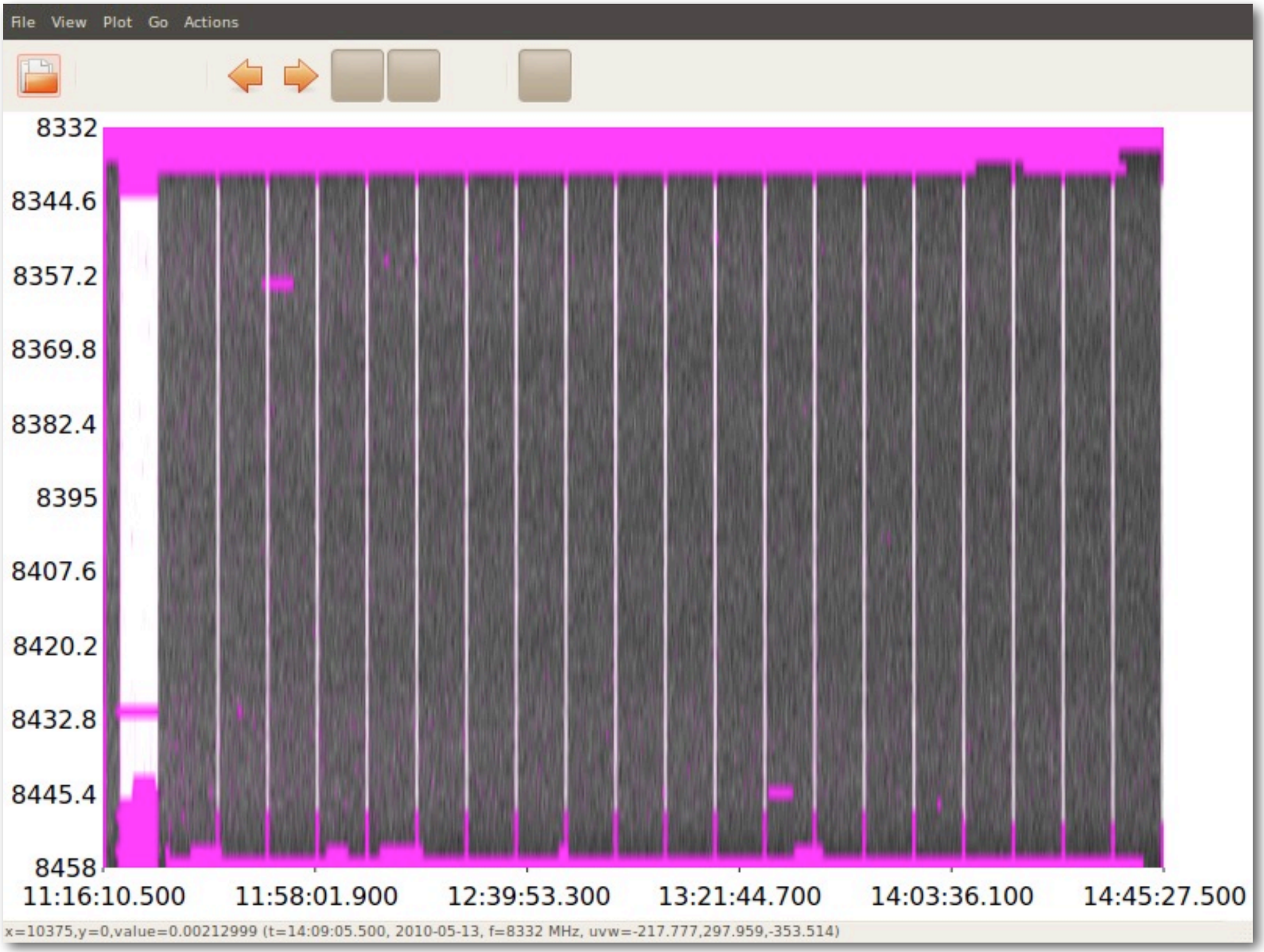
4 hour t

Automating everything

Flagging full spectral resolution data

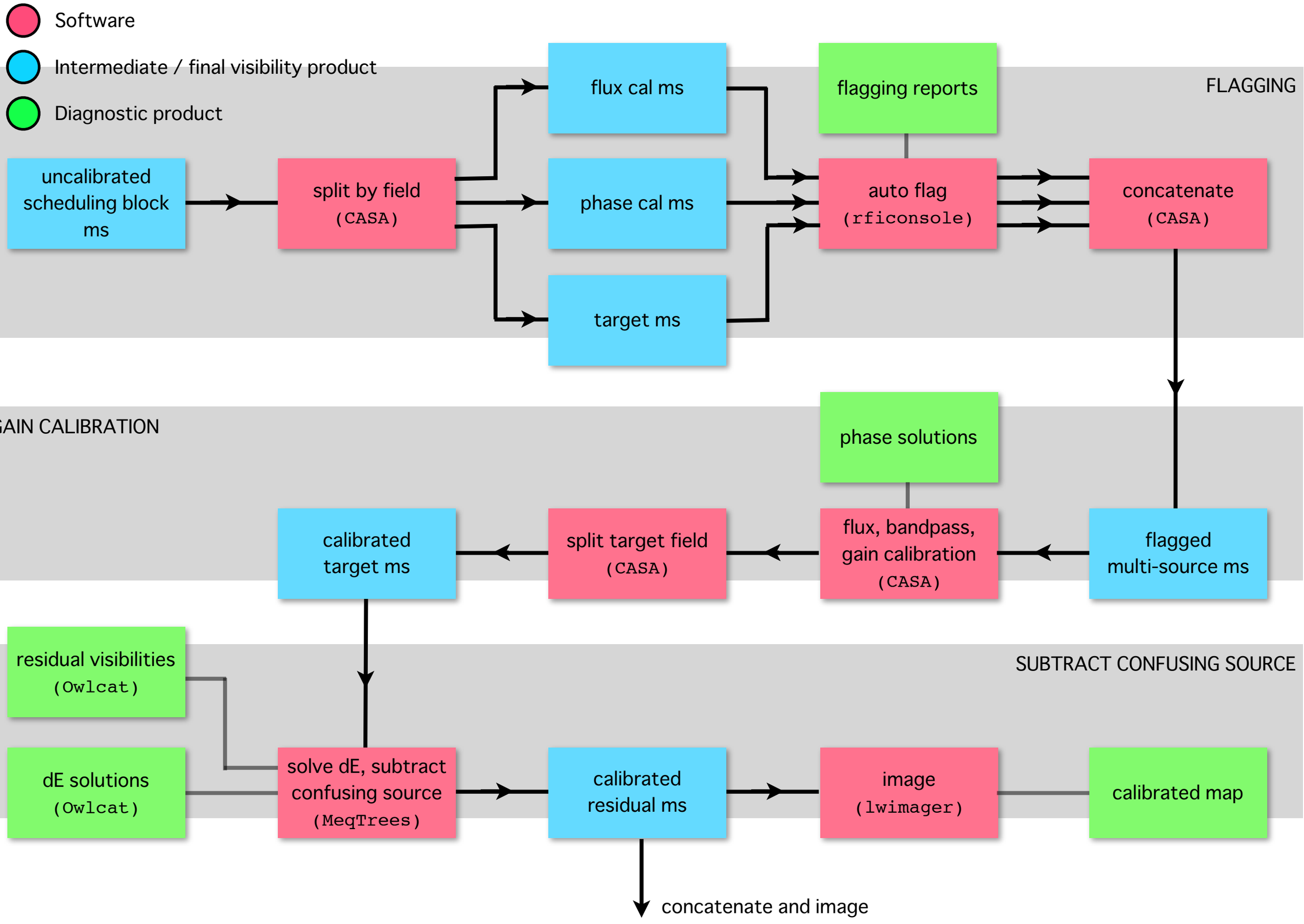


Automatic flagging with rficonsole

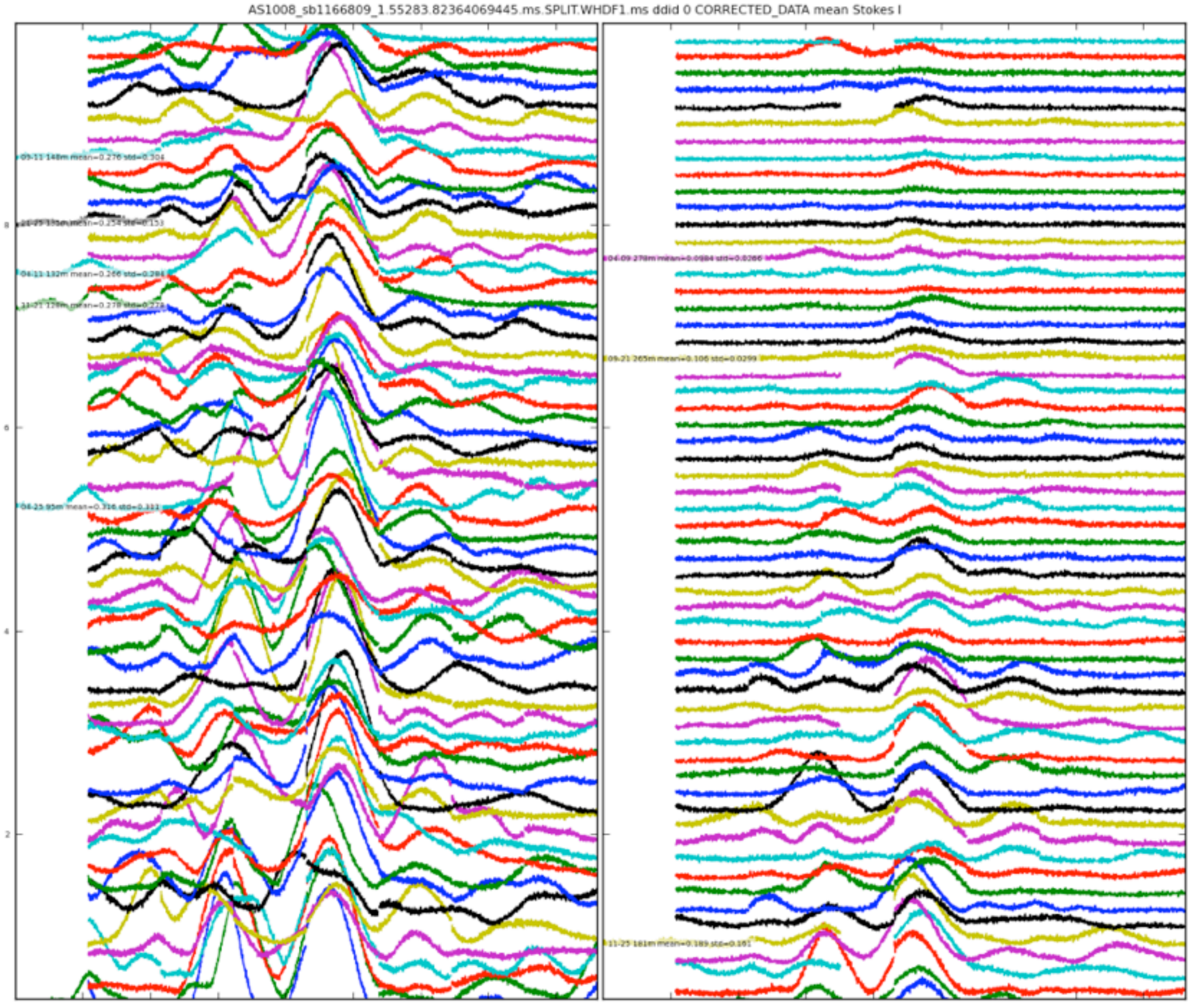


Offringa et al., MNRAS, 405, 155, 2010

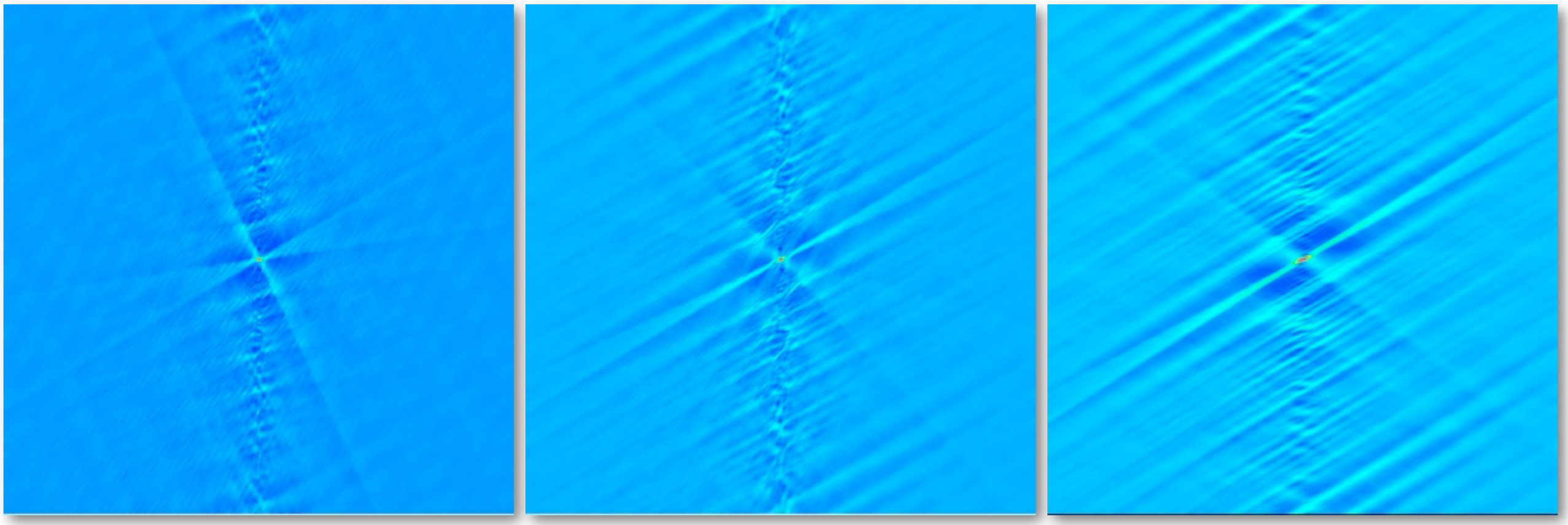
Automated calibration scheme / software inventory: 7 MS test



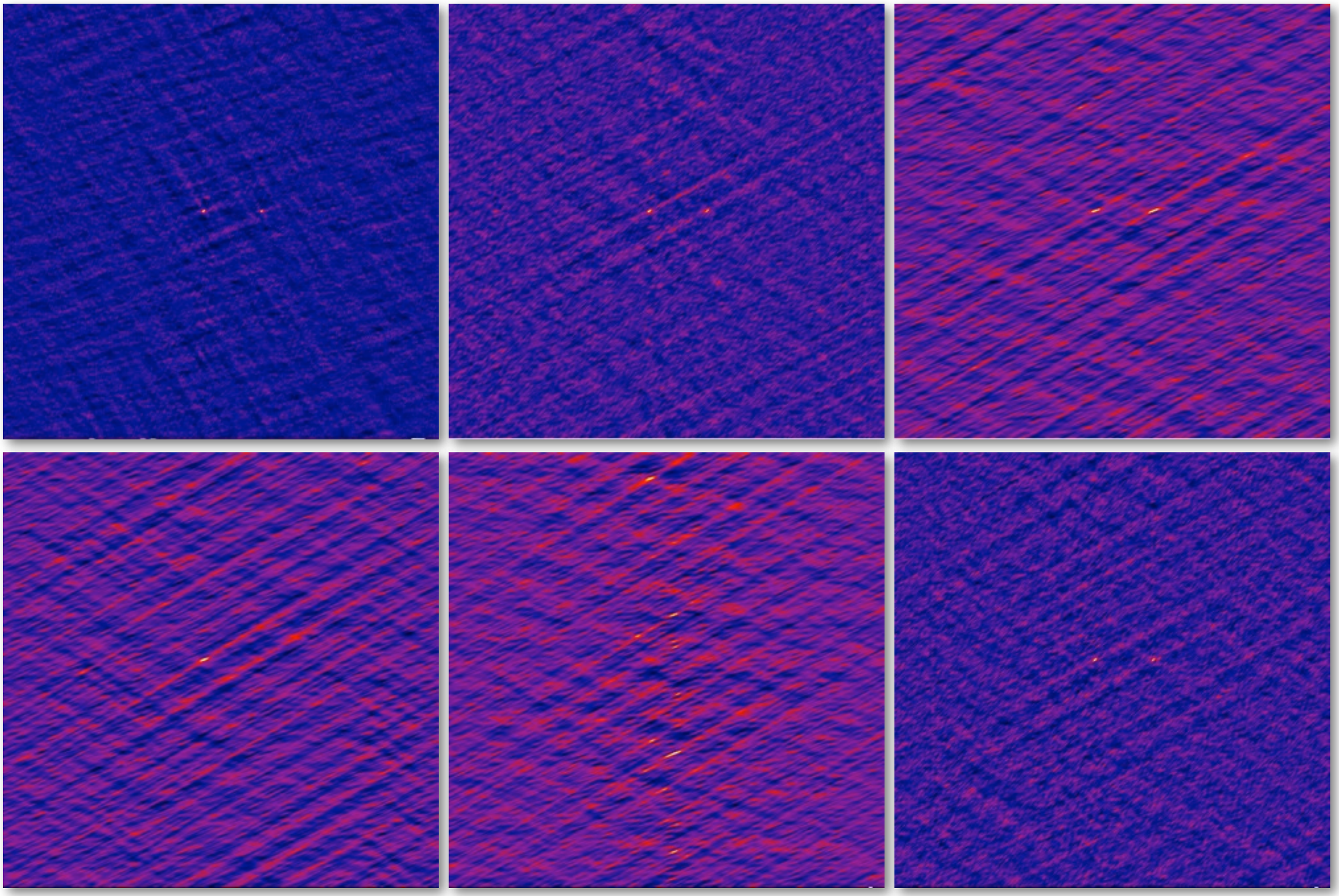
The importance of diagnostic data products: UFOs over New Mexico?



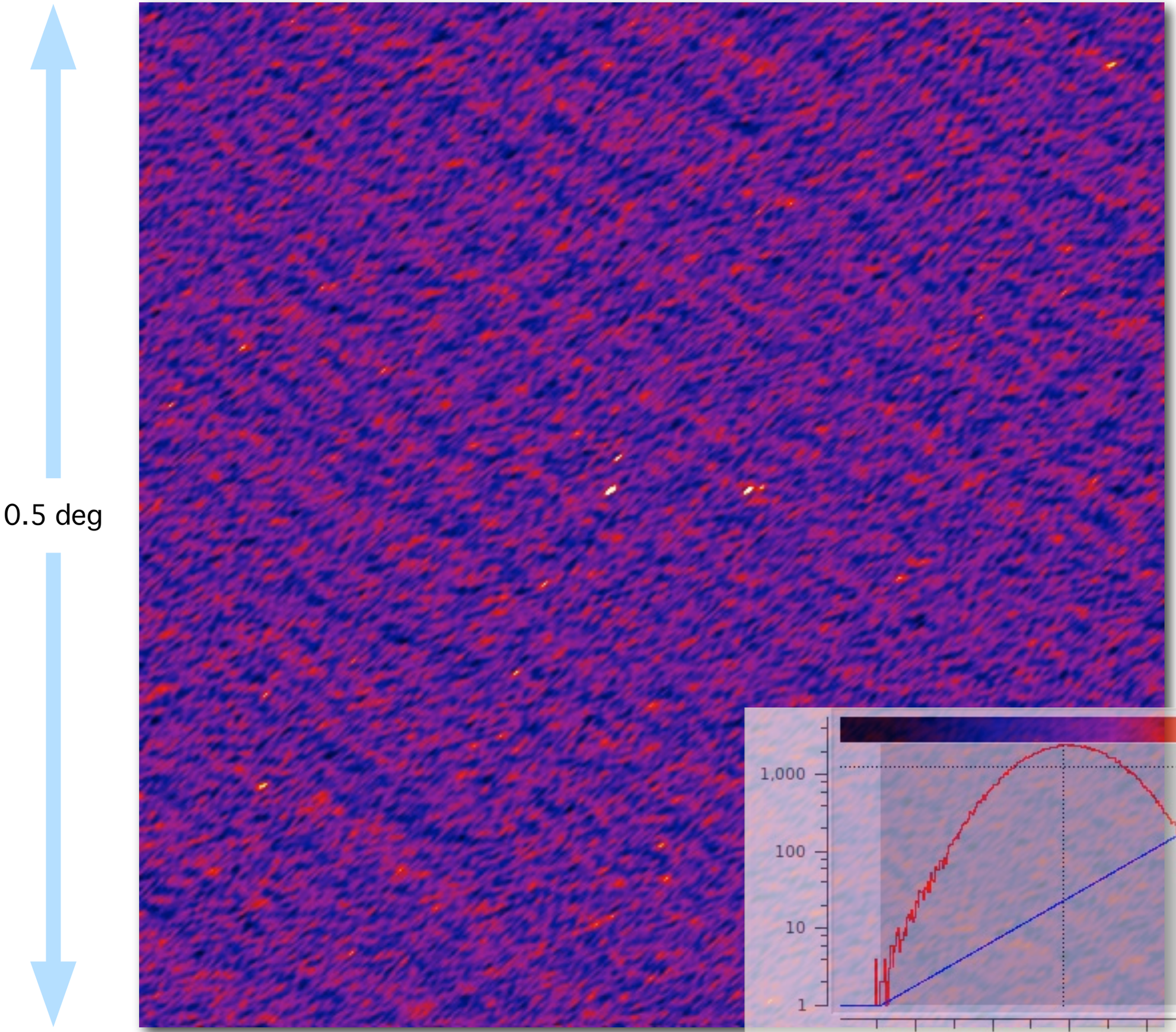
Automatically generate PSF images



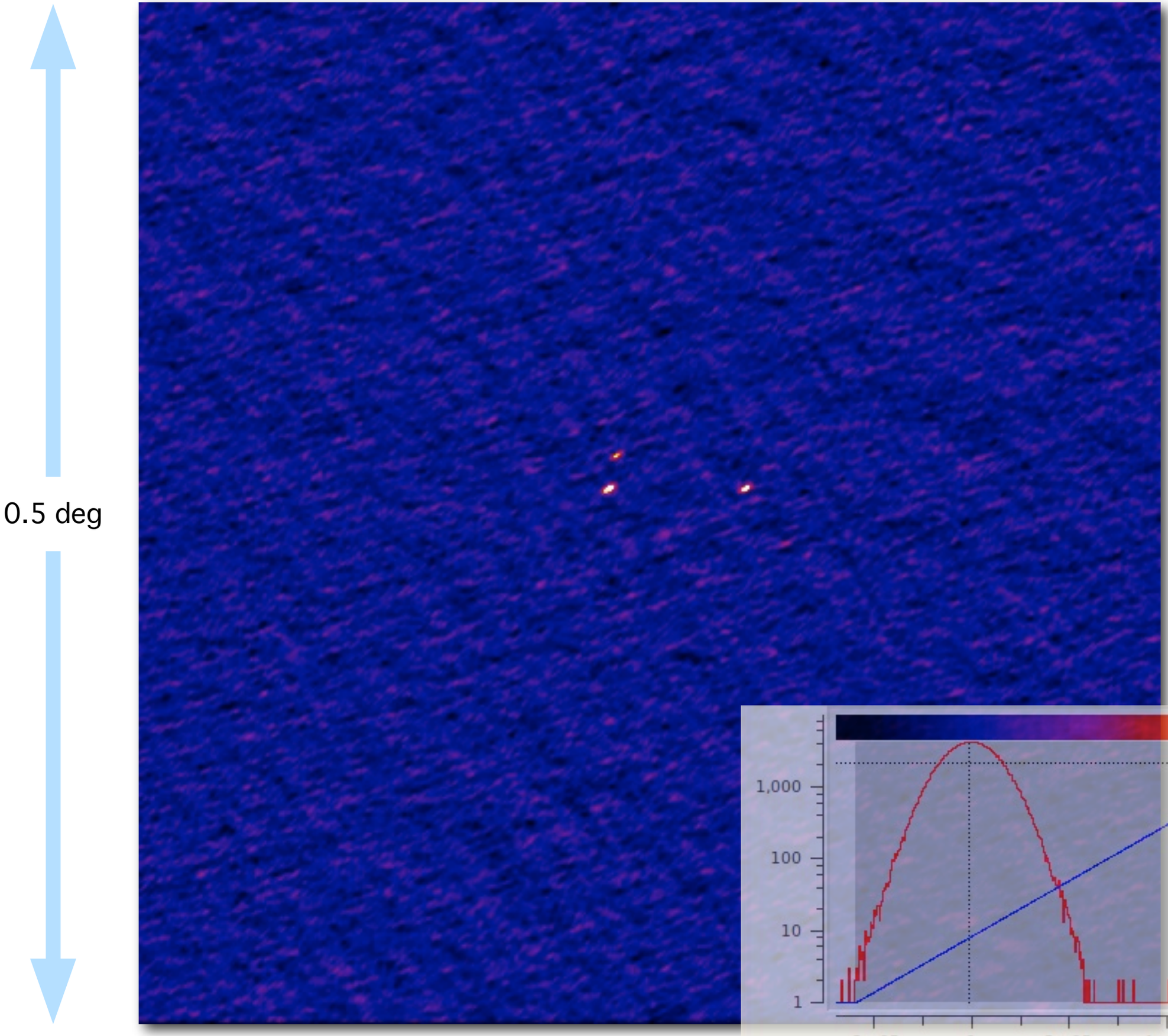
Automatically generate dirty maps



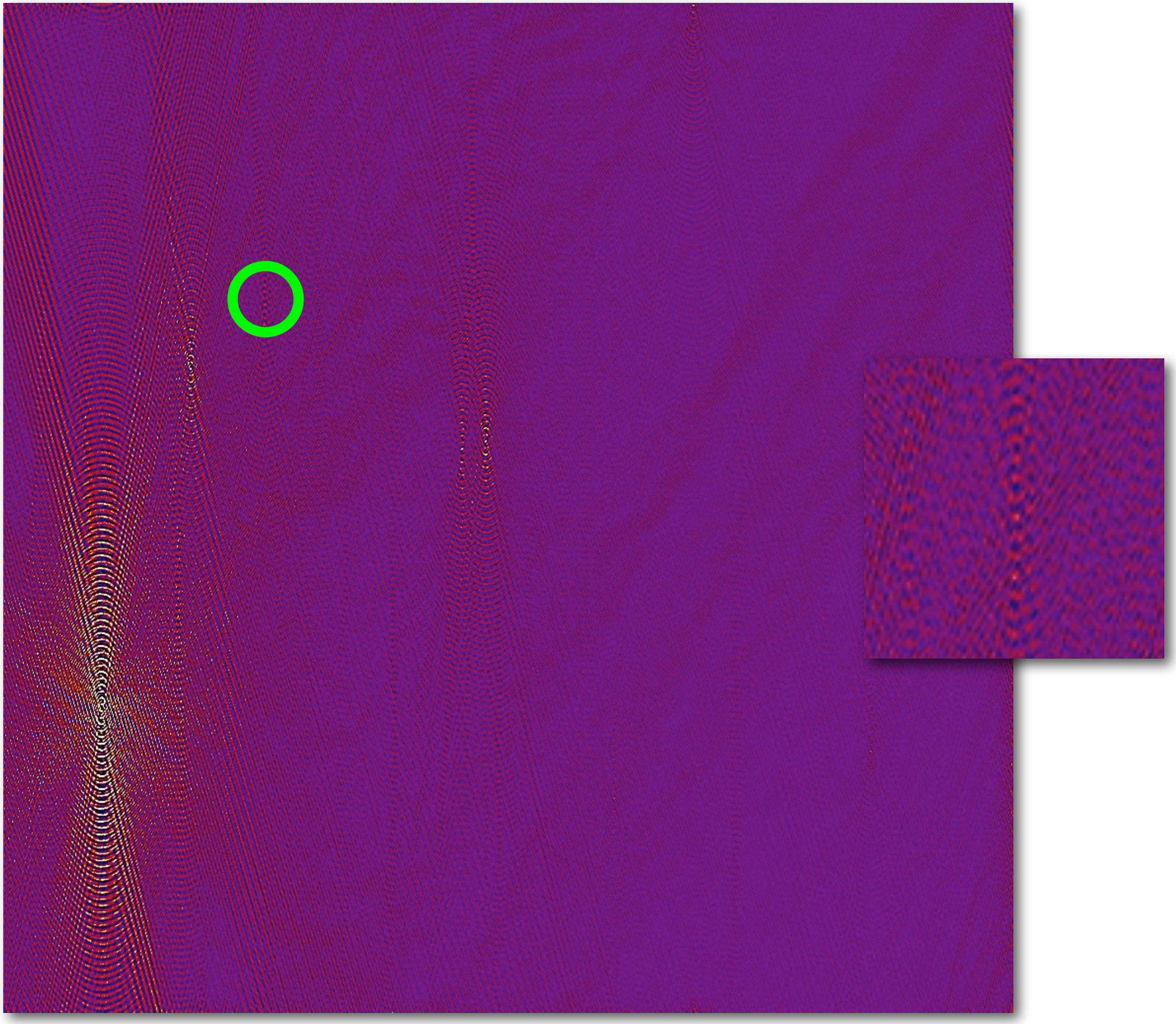
Map from 6 MS × 2 SPW, 13μJy RMS



Less is more: 5 MS × 2 SPW, 6μJy RMS

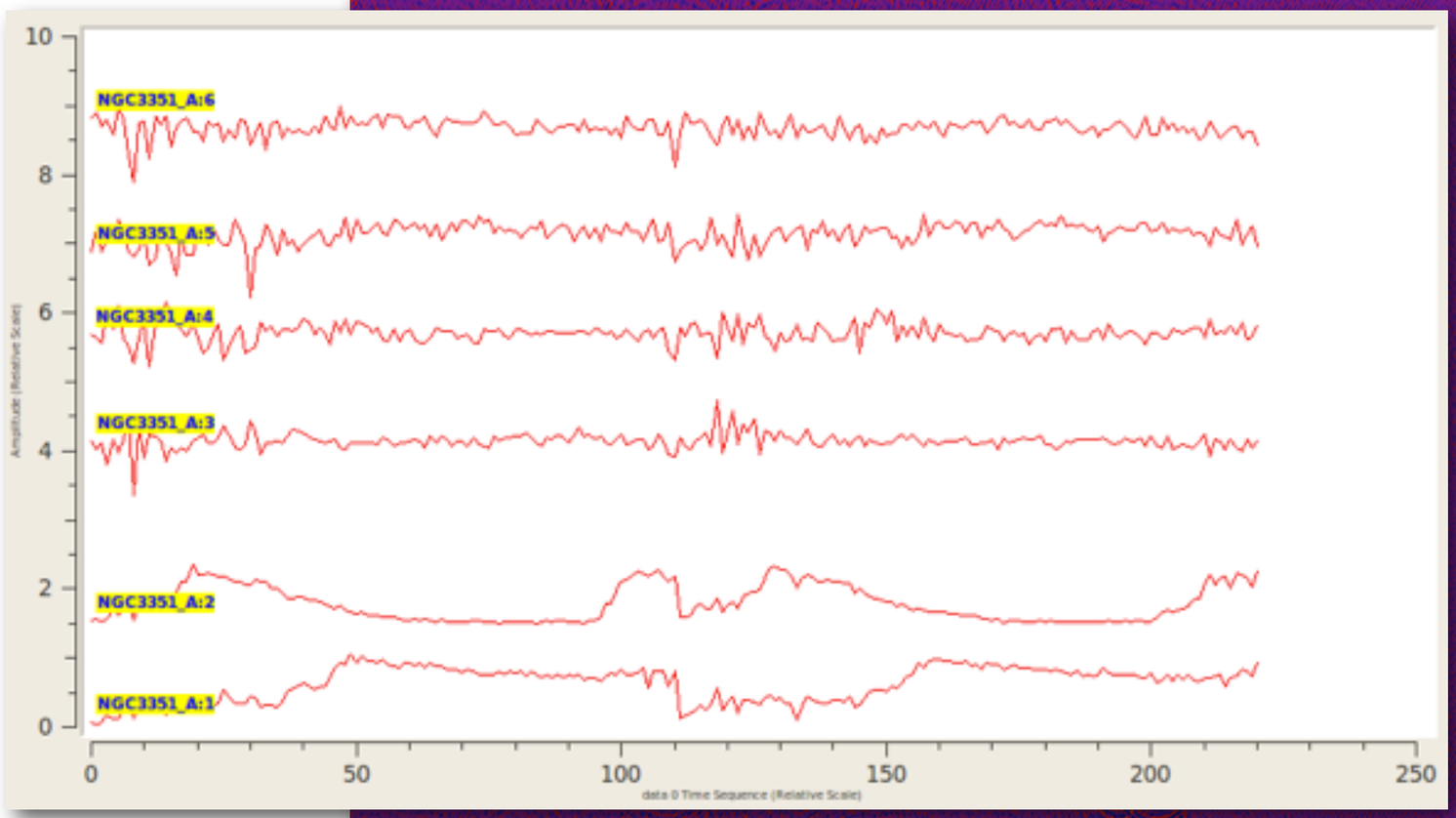


MERLIN observations of NGC3351



Hägele et al., MNRAS, 406, 1675, 2010

MERLIN observations of NGC3351



Hägele et al., MNRAS, 406, 1675, 2010

Wide-band, wide-field e-MERLIN simulation with a toy primary beam model

L-band simulation
512 channels, 1.3 - 1.8 GHz