

KAT-7 and MeerKAT VLBI

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KAT-7



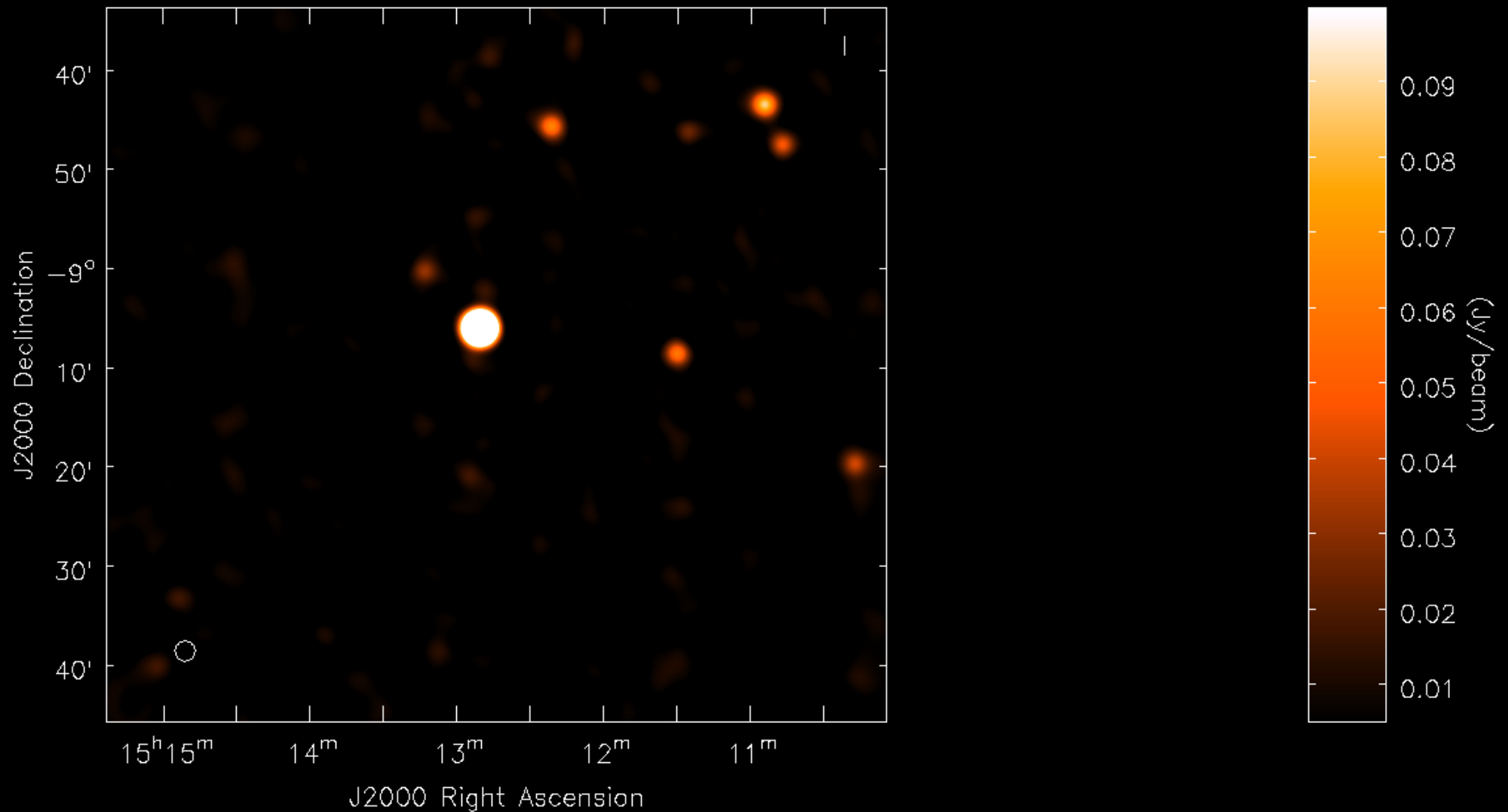
KAT-7

Alive and well!

- 7 x 12m dishes
- 1200-1950 MHz
- 400 MHz sampled band
- 7 cold feeds ($T_{\text{sys}} \sim 30\text{K}$)
- correlator (wide-band mode), CAM, data capture and processing
- Routine commissioning operations
- Full remote operations routinely exercised

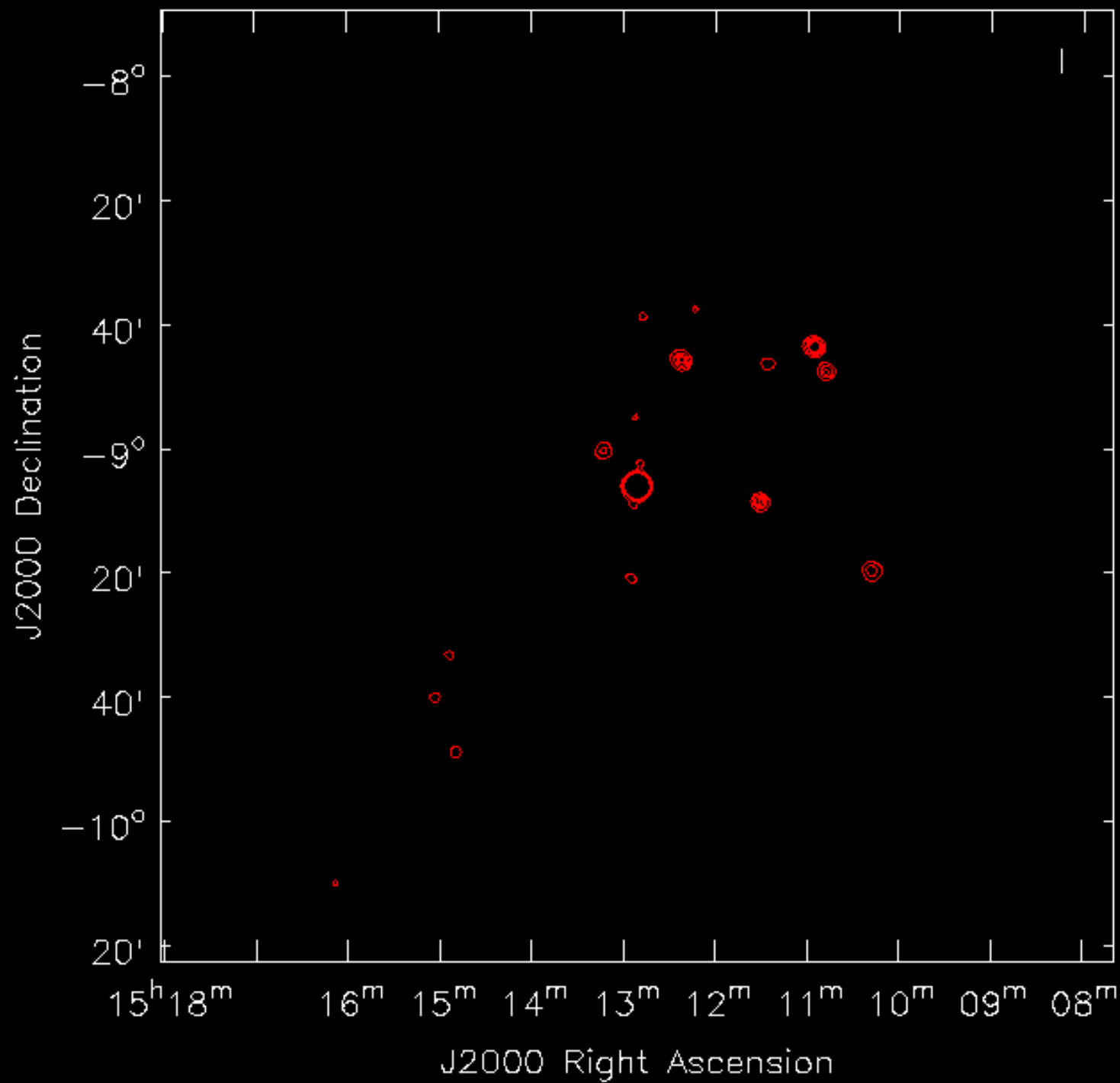
Moving towards science...

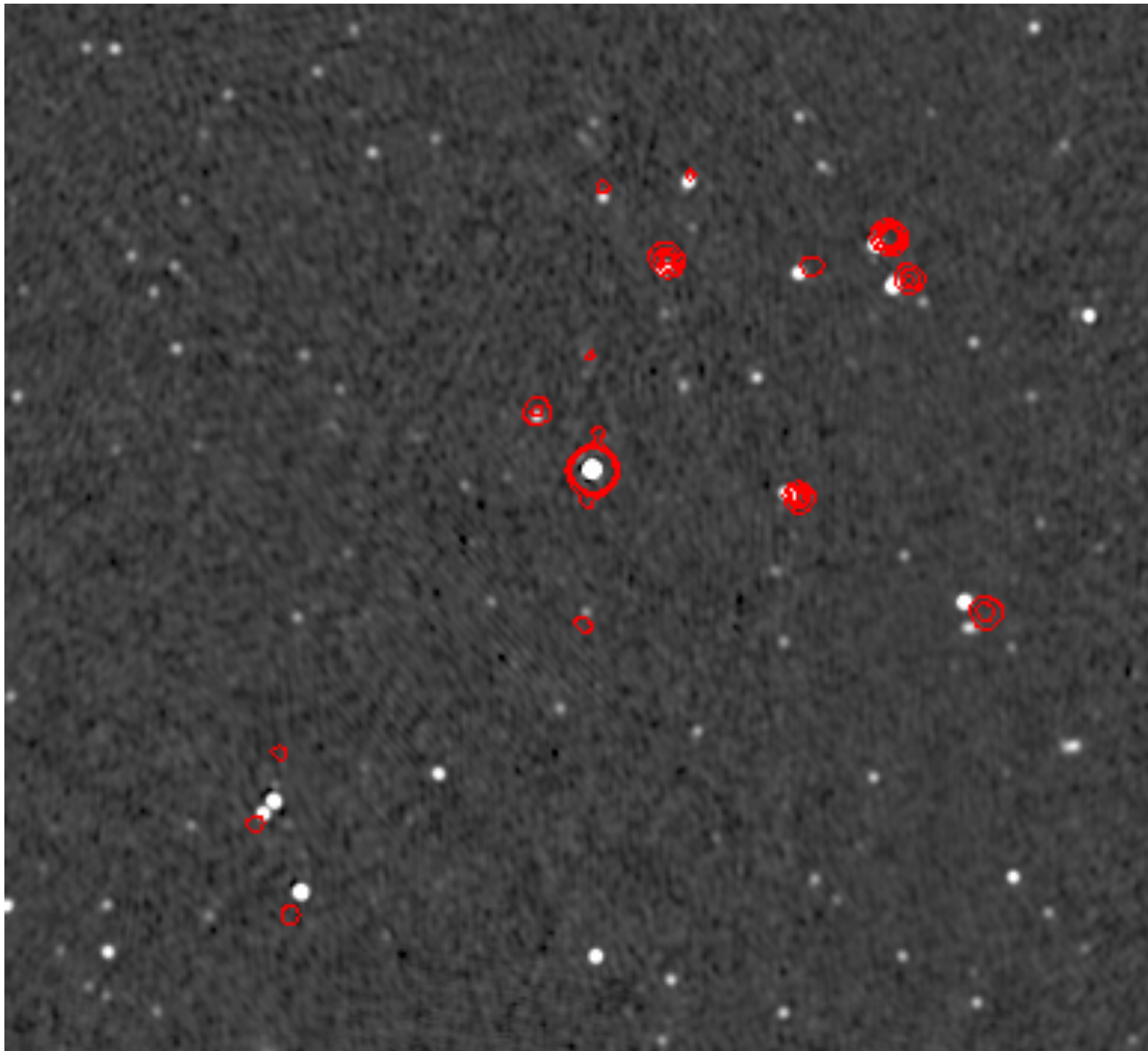
Blazar observations



pks 1510-089 (1 degree field) – credits Simon Ratcliffe & Ludwig Schwardt

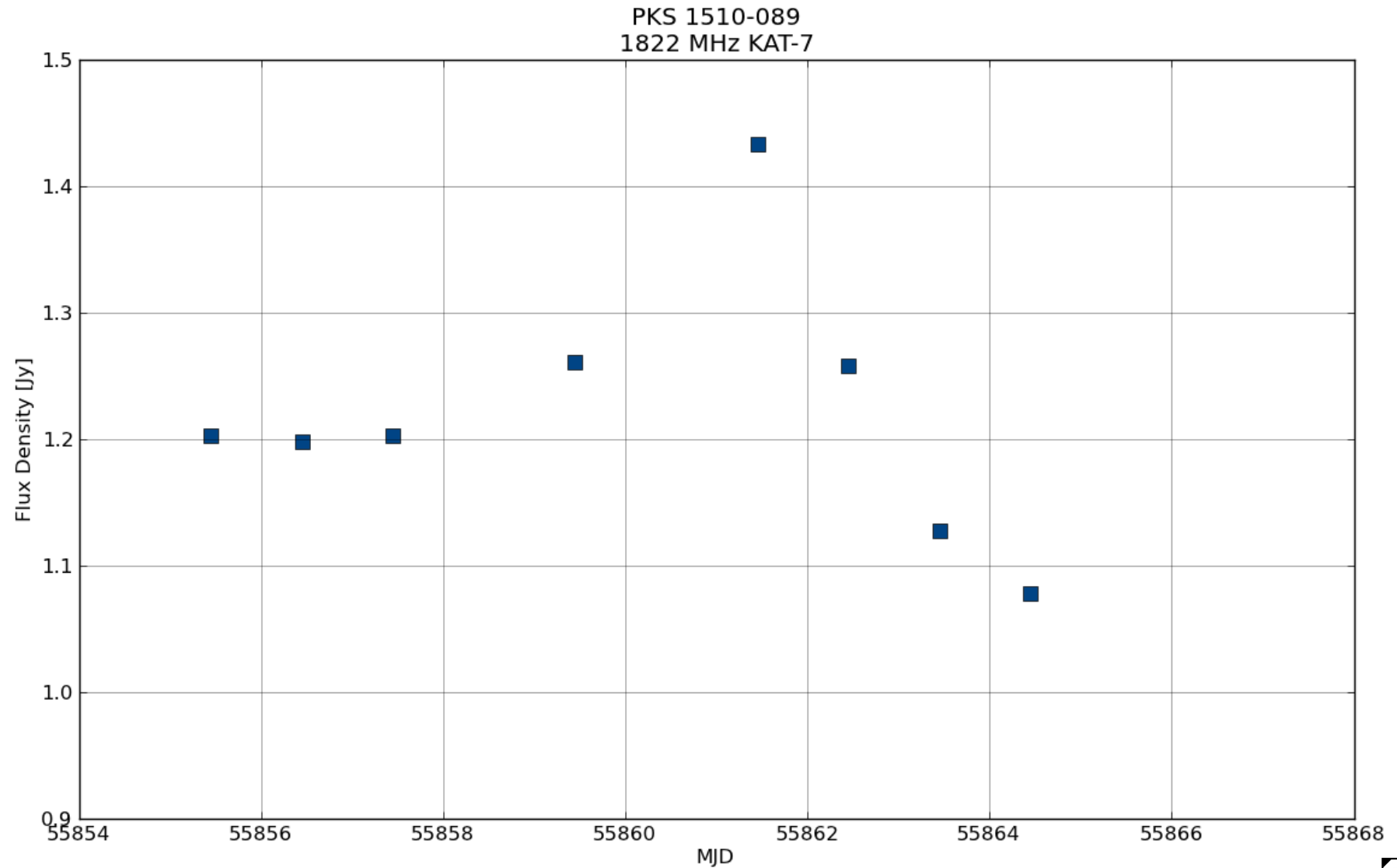
pks 1510-089
15 mJy contour





pks 1510-089 :
KAT-7 15 mJy
contour overlaid
on NVSS

KAT-7 L-band Light Curve



credit Simon Ratcliffe et al.

First KAT-7 VLBI

- KAT-7: a single 12 m dish used
- Uncooled receiver (at that stage)
- Roach board plus custom PC-based raw data recorder (full-band and DDC sub-bands)
- GPS disciplined Rb oscillator
- Full 400 MHz band recorded between 1614 and 2014 MHz (single linear pol)
- HartRAO: 26 m dish
- Cooled receiver
- Mark5A VLBI data recorder
- Hydrogen maser
- 16 sub-bands of 16 MHz in dual pol (circular pol)



- Source 3C273
- Baseline approx 900 km
- Comms via skype chat
- Observations over half an hour on 23 Nov 2010
- Data to disk, shipped to Cape Town for processing (thin pipe at that stage)

VLBI baseline



CT Team plus PC Data Recorder



30 TB Data Recorder plus GPUs



Python Correlation

- Hart: 1696 – 1712 MHz band was used in fringe test. Data extracted from the Mark5A format using some (Walter Briskin) DiFX utilities and extra C code.
- KAT: Extracted the same 16 MHz band as Hart data using a software digital downconverter developed for the purpose.
- Fringe stopping software written in python and applied to Hart data (matched to centre frequency and updated over time in small blocks).
- Correlation in python to produce lag plot. A lag plot spike would show correlation power where the signals are correctly time aligned.

First fringe ~ a rare binary event?

Work, work, very VEXing, work, no luck

Hmmm ... vague glimmerings of (mis)understanding.... no luck

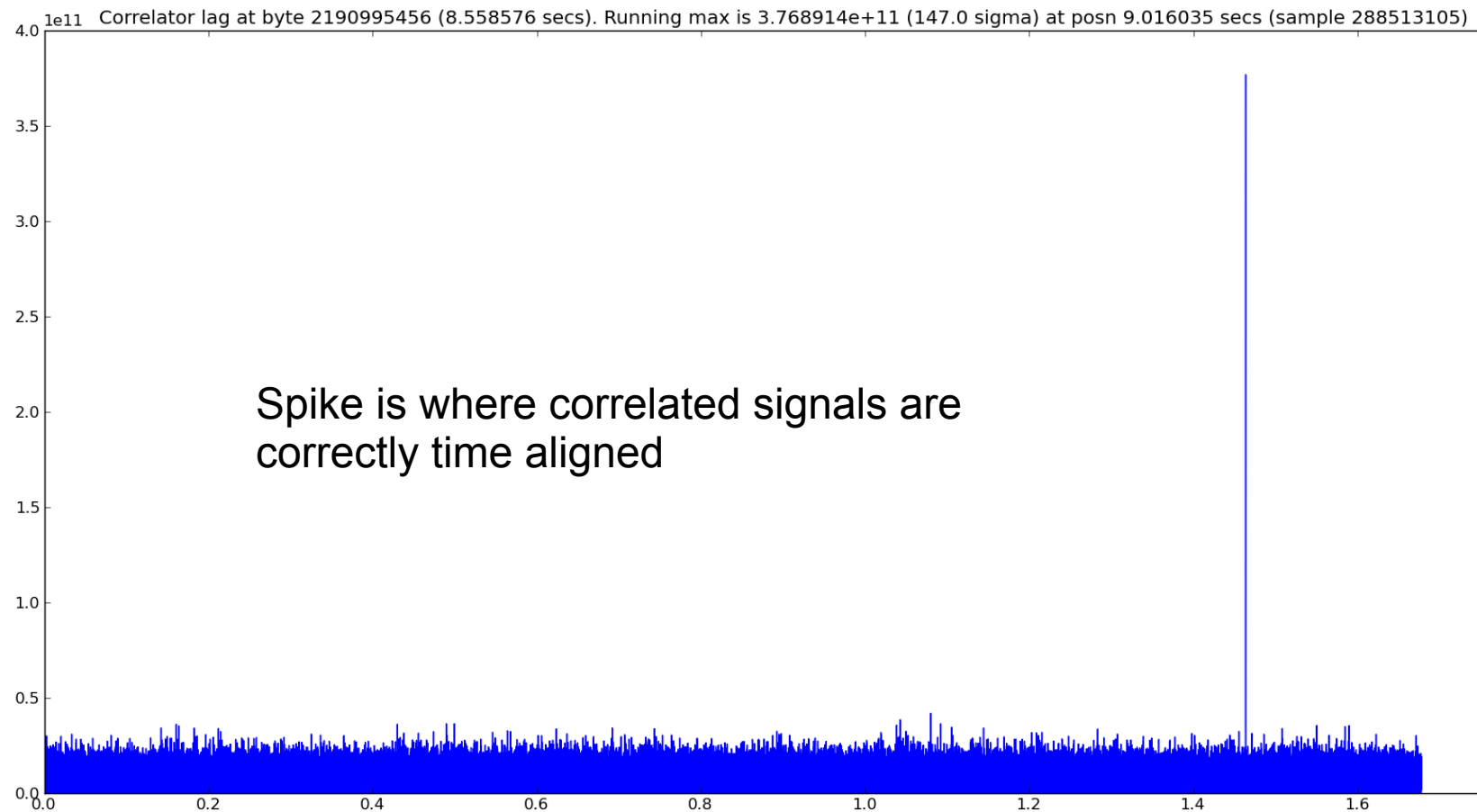
Recode re-check for nth time no luck

Phone a friend ... Jonathan Quick ...

Hmmm How about this tweak AHA!!!

Ah, of course! – hindsight 😊

VLBI Lag Plot



First fringe : stretching belief?

Work-inducing thoughts:

“Success (eventually) on first attempt....no one will believe us. Do we believe us?
Hmm... Had better show fringes using a respectable VLBI correlator”

Work, VDIF, DiFX bleeding edge, work, no luck

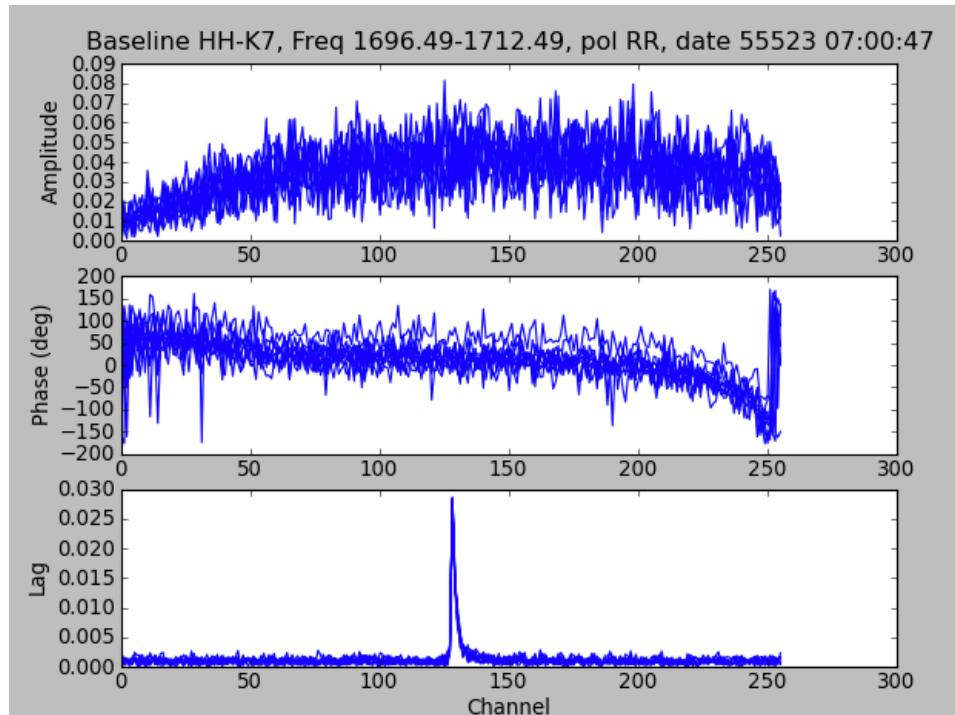
Hmmm ... vague glimmerings of (mis)understanding no luck

etc....

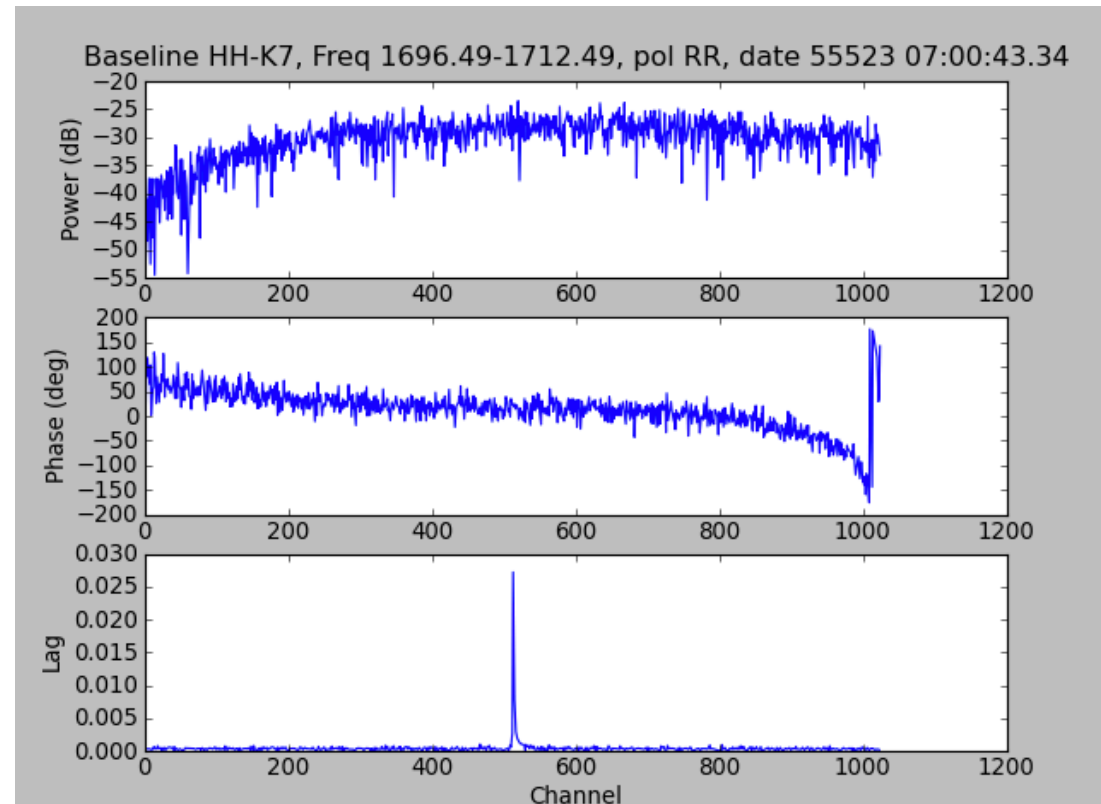
Phone a friend Adam Deller ...

AHA!!

VLBI Lag Plot (DiFX)



9 x 1 sec integration



9 sec integration

VLBI: Next Steps

- KAT-7 Science Verification Programme emerging.... Internal discussions
 - Links delivery of telescope modes (spectral line, beamformer, raw voltage capture) with science ideas
 - Programme for KAT-7, but aimed at learning for MeerKAT
 - To start involving large survey teams with engineering/commissioning
- By March 2012 (provisional):
 - Dual pol raw voltage capture (with VDIF support)
 - More VLBI with HartRAO (DiFX correlator)
- By June 2012 (provisional):
 - Beam-formed mode available on KAT-7
 - eVLBI test with HartRAO
- From July 2012 (provisional):
 - Regular eVLBI (EVN and LBA)
- Expect (e)VLBI programme to continue into MeerKAT as it comes online



Questions?