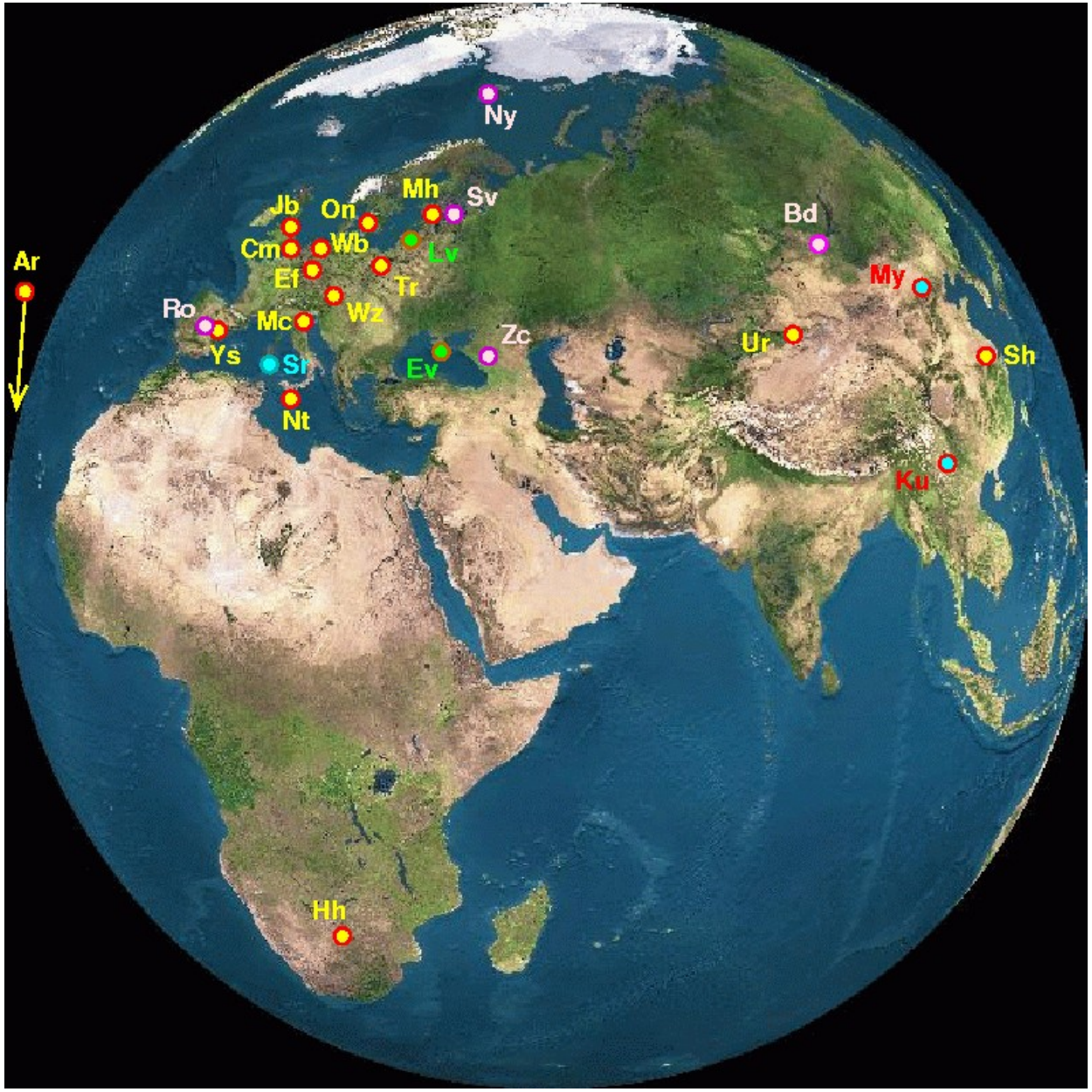
Recent Results from the EVN MkIV Data Processor at JIVE

Bob Campbell, JIVE

- Operations and PI Interaction
  - Pre-observation / Pre-correlation
  - Post-correlation
- The Correlator
  - Capacities & Tips
  - Astronomical Capabilities

The EVN


Ny
Mh
Sv
Jb
On
Cm
Wb
Lv
Ef
Tr
Wz
Ar
Ro
Mc
Ys
Sf
Nt
Ev
Zc
Bd
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Ur
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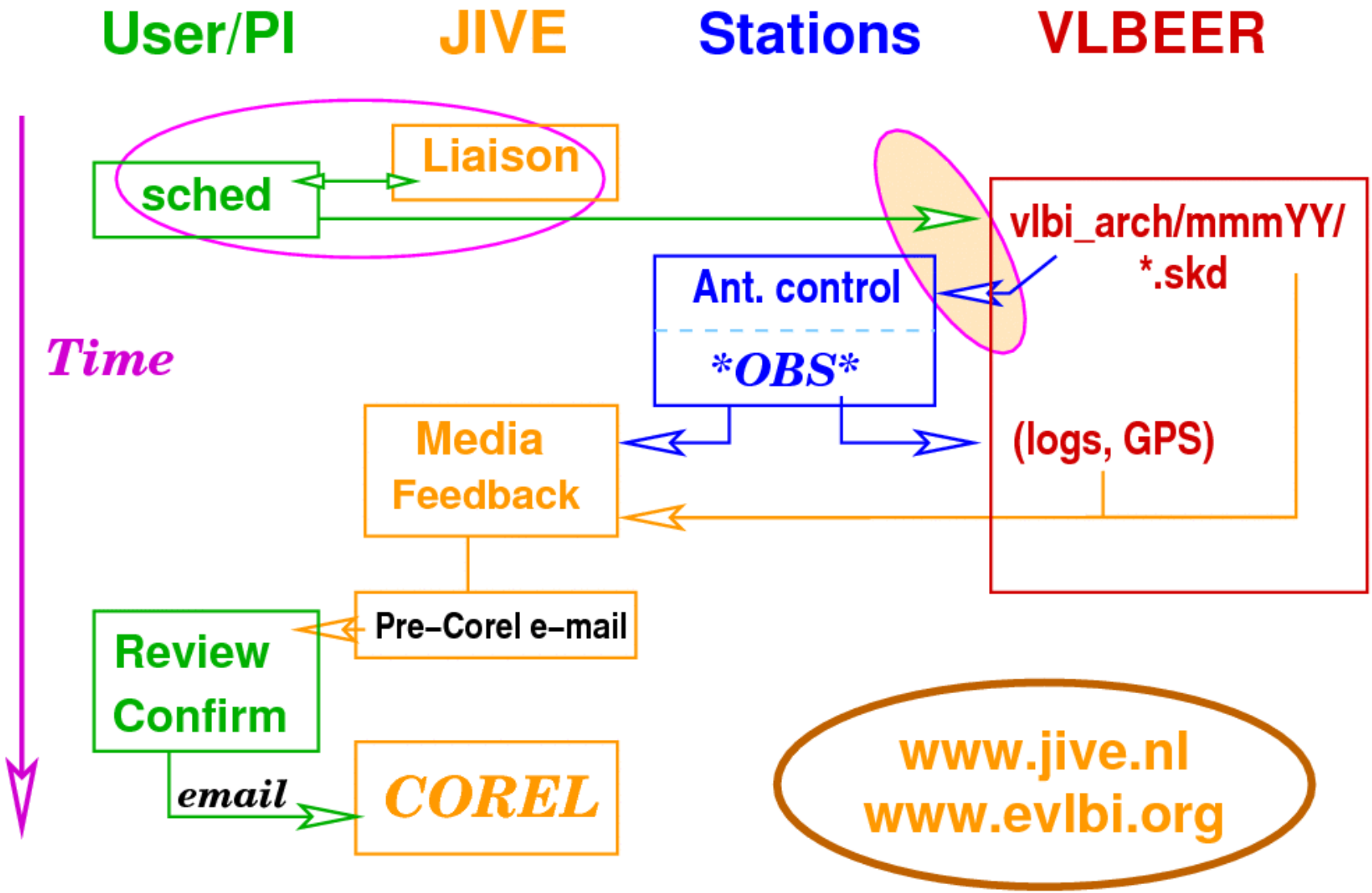
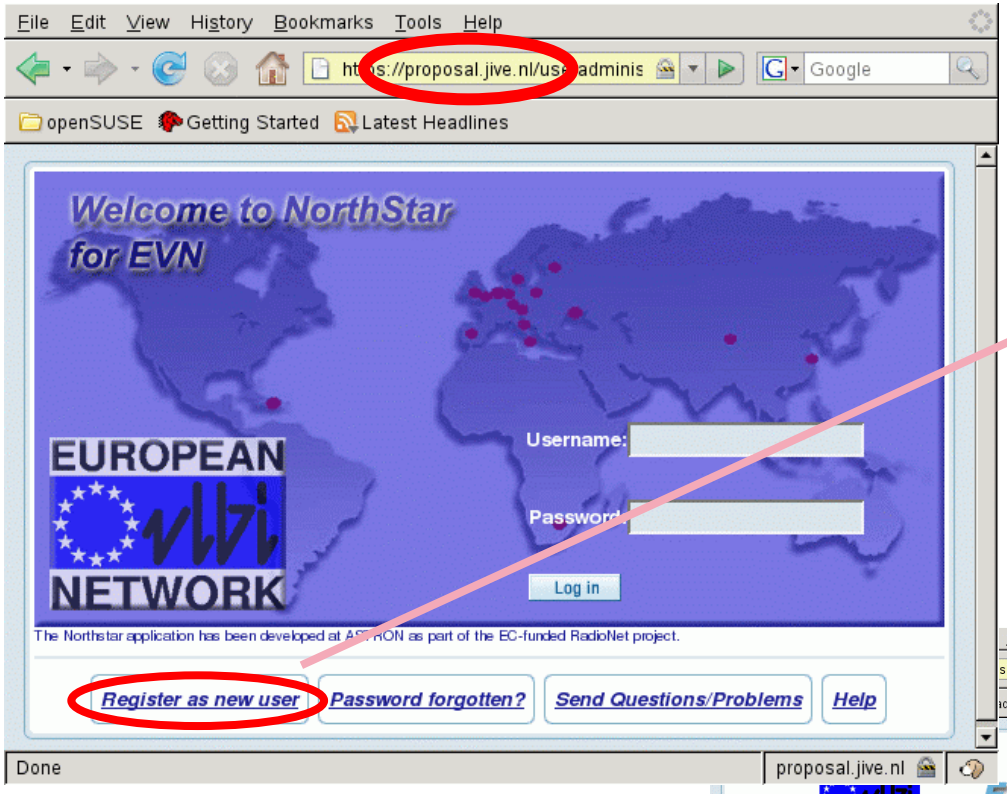
Ku
Hh

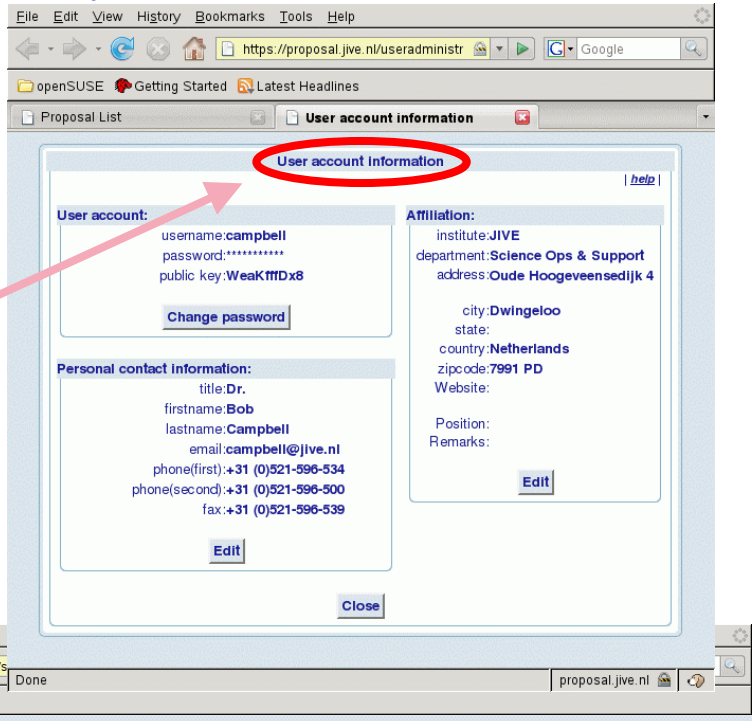
AVIAPTNR
EVN
OS 641
OS 376
HOT

Ops Flowchart (<=Correlation)

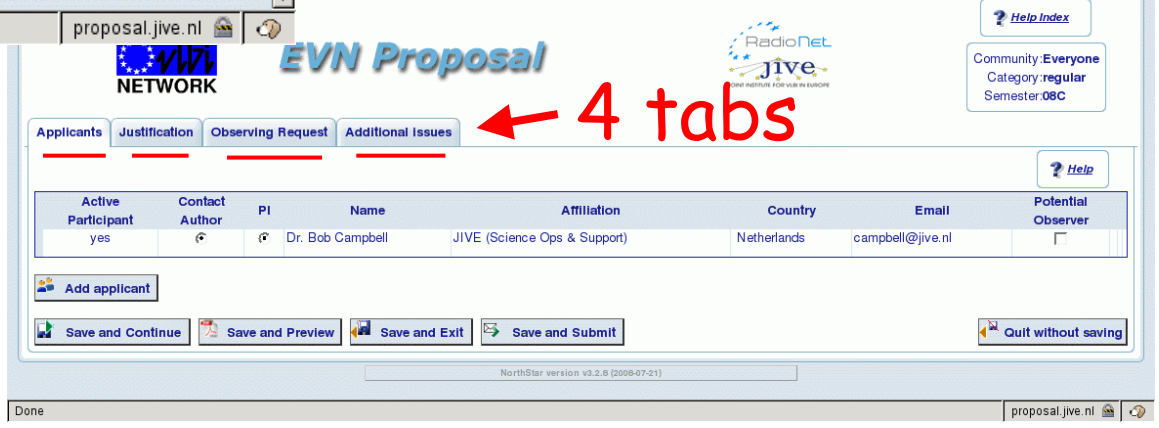


Web-based EVN Proposal Tool

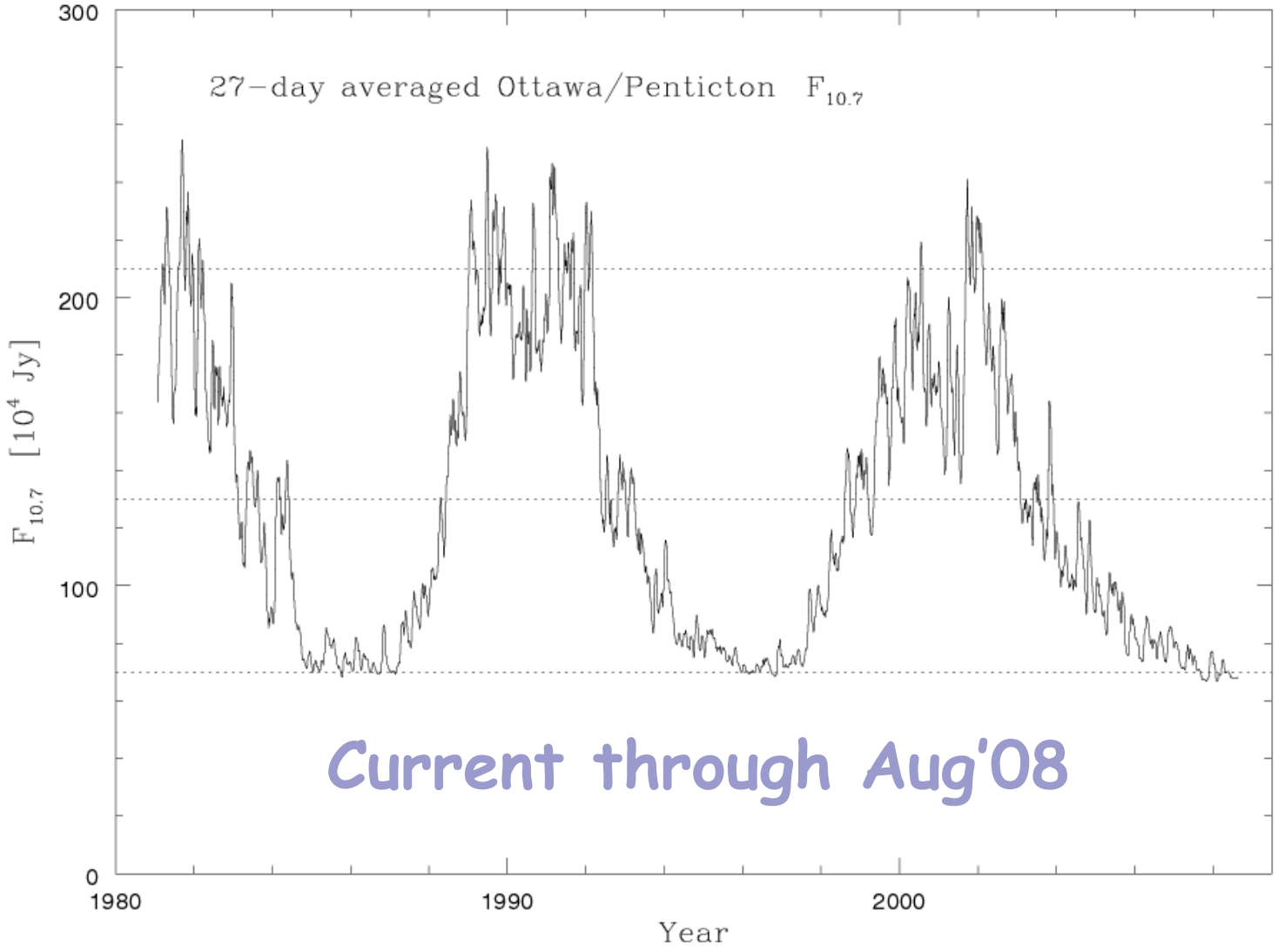




"NorthStar"

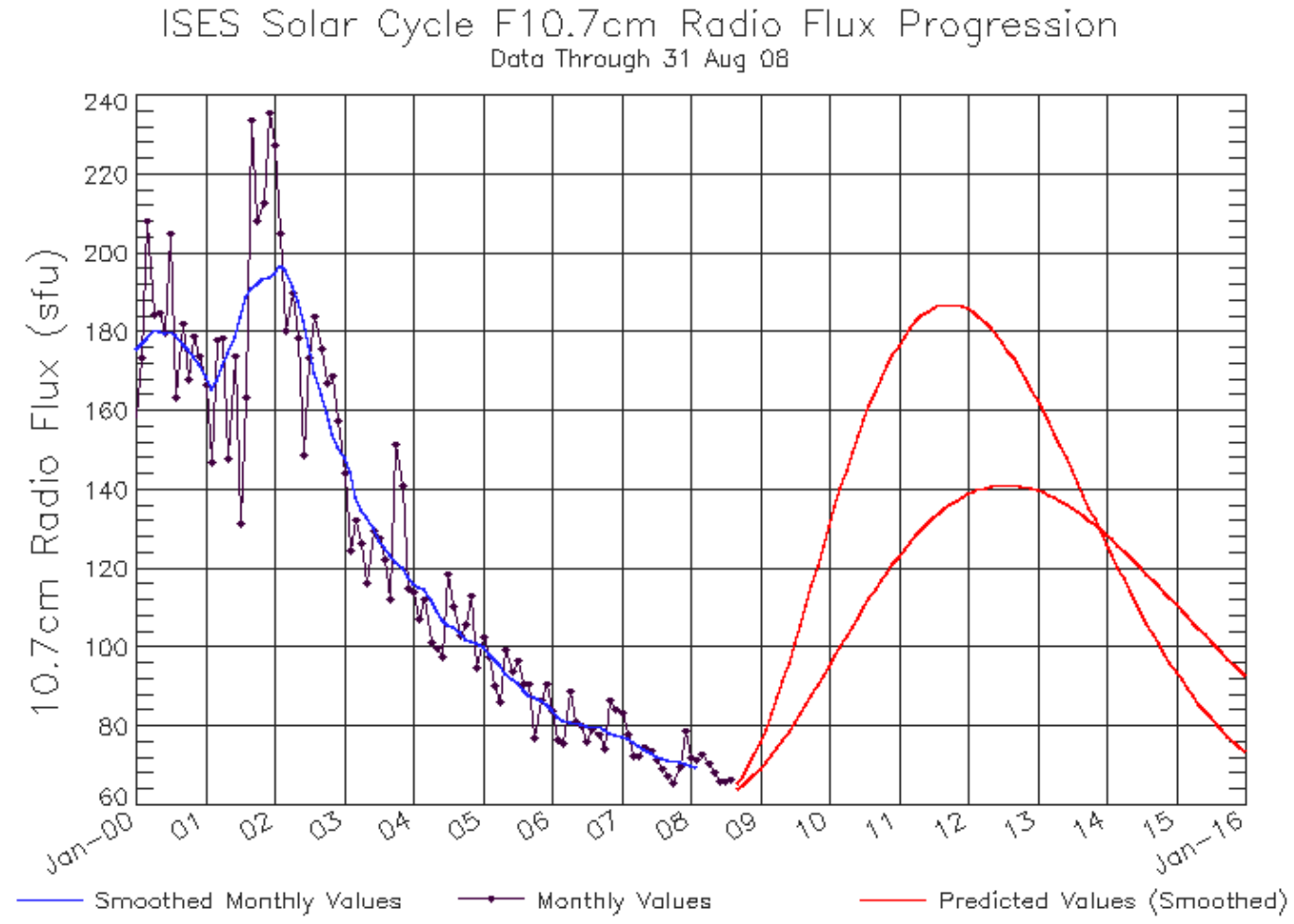


Still time for L-band phase-ref…



Current solar-min conditions continue to linger, but the upswing to the next solar-max shouldn't be too far off into the future

Predictions for next Solar Cycle

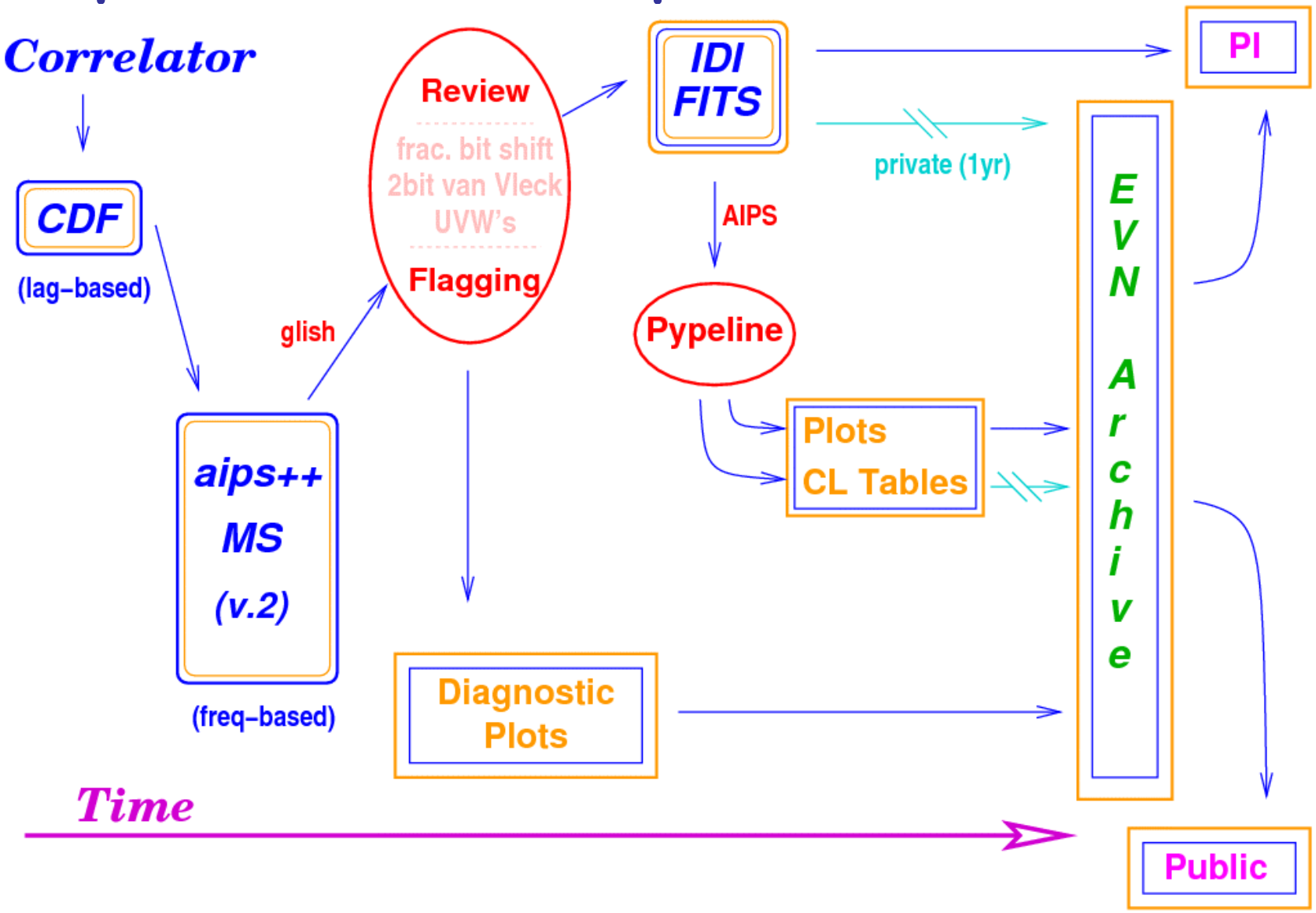


Smoothing = 13-month

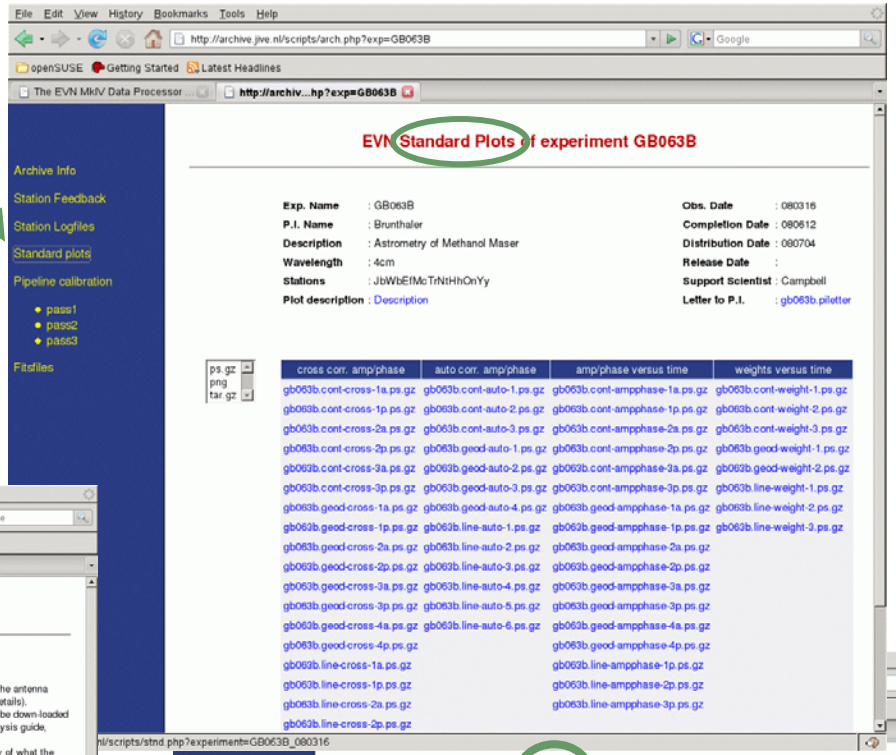
April'07 pred: expected the solar min. at March'08.

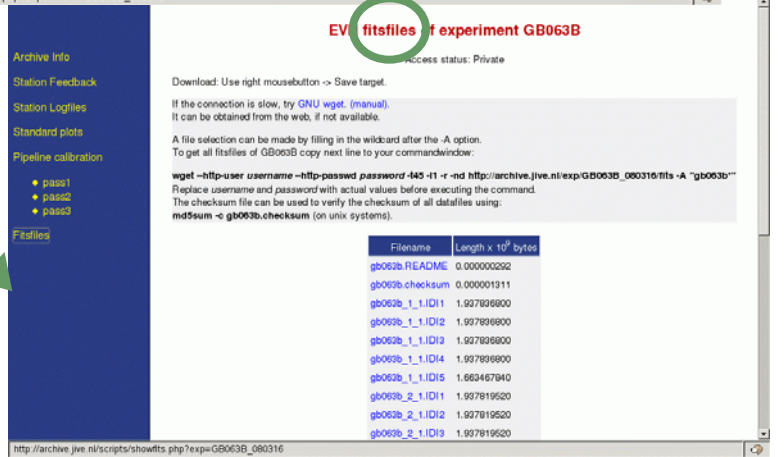
ref: Space Weather Prediction Center, via www.sec.noaa.gov

Ops Flowchart (post-Correlation)



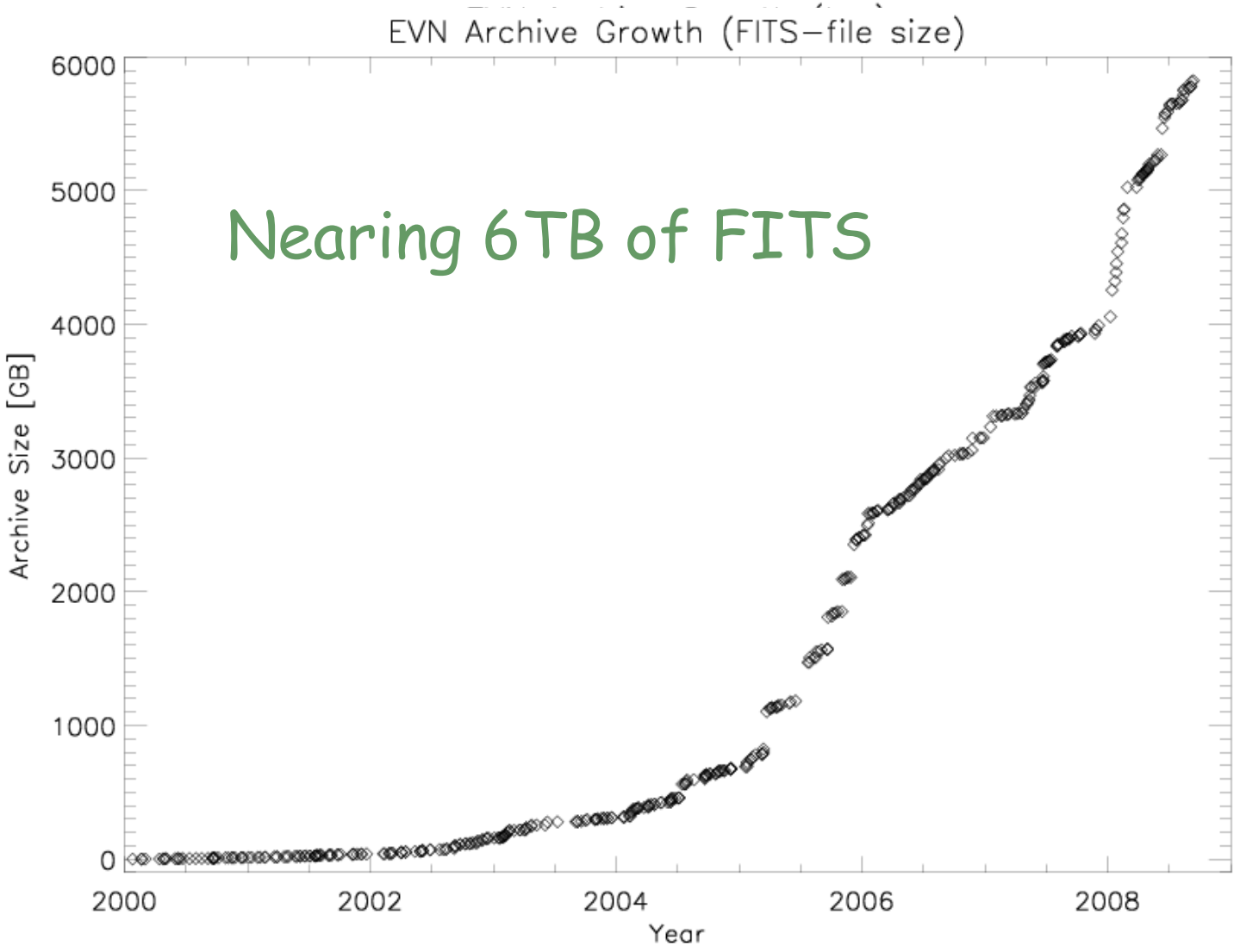
EVN Archive





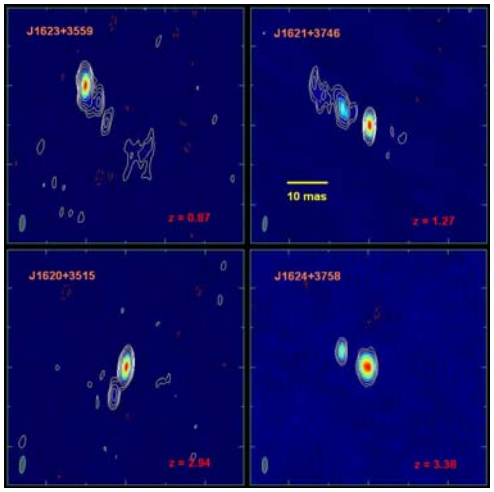
FITS,
Pipeline,
Plots,
Feedback

EVN Archive Growth

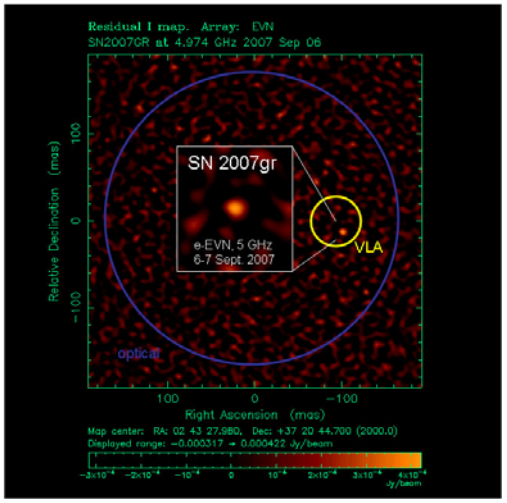


Nearing 6TB of FITS

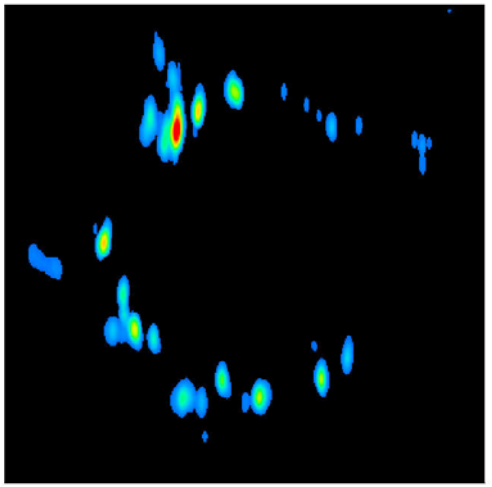
EVN Image Gallery (5 most recent)



DEVOS (Frey) 2007

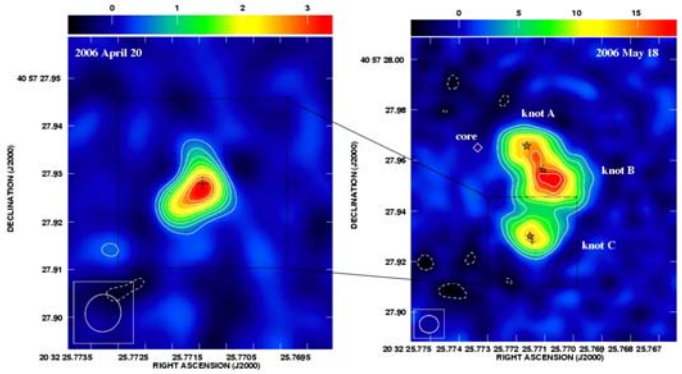


SN2007gr (Paragi, e-) 2007

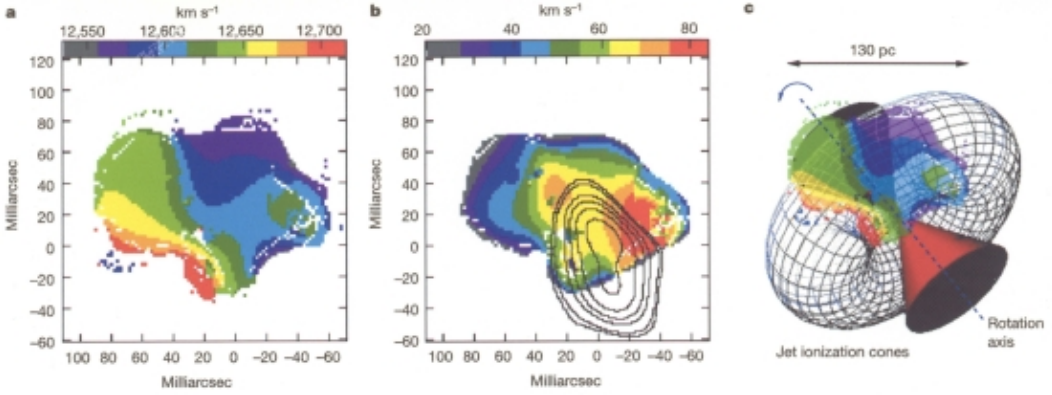


G23.6-0.1 (Bartkiewicz) 2005

Cyg X-3 (Tudose, e-) 2006



Mrk 231 (Kloeckner) 2003



Specific Correlator Capabilities

- Total observed rates up to 1 Gbps
- 1-, 2-bit sampling (e.g., include VLBAs at 512 Mbps in Gbps obs)
- Full-Stokes polarization output
- Up to 2048 frequency points per SB/polarization
- Full-correlator $t_{int} \geq \frac{1}{4}$ sec (half-corr $t_{int} \geq 1/8$ sec)
- Oversampling (2, 4x Nyquist → 500kHz filters)
- >16 stations through multiple passes
- Improved UVWs; 2-bit van Vleck, frac. bit shift comp.
- [illegible]

Not Fully Operational / Testing Underway:

- Recirculation (time-sharing correlator in low-BW obs)

Correlator Capacity (Spectral Resolution)

$$N_{sta}^2 \cdot N_{sb} \cdot N_{pol} \cdot N_{frq} \leq 131072 \cdot \text{Recirc}$$

$N_{sta} = (4,8,12,16)$; $N_{pol} = (1,2,4)$; $N_{chan} \leq 16$; $N_{frqmax} = 2048$

Examples:

5—8 Sta	1 SB	1 Pol	2048 Frq
9—16 Sta	1 SB	1 Pol	512 Frq
9—16 Sta	8 SB	4 Pol	16 Frq

Maximal Spectral Resolution (m/s; N_{frq}=2048)

BW_{sb} [MHz]	$\Delta\nu$ [Hz]	Δv_{1420}	Δv_{1665}	Δv_{6668}	Δv_{22235}
16	7813	1651	1408	351	105
2	977	206	176	44	13
0.5	244	52	44	11	3.3

Recirculation: Recirc ≤ 16MHz/BW_{sb}; N_{frqmax} still 2048

Correlator Output Capacity

Raw output (local validity):

- lag-space correlation functions (32 kB/brd) + headers (16 kB/brd)
- Full-correlator min. t_{int} = 1/4 sec (half-corr. min. t_{int} = 1/8 sec)
  - Max. operational output rate = 6 MB/s

Approximate growth rate of FITS files:

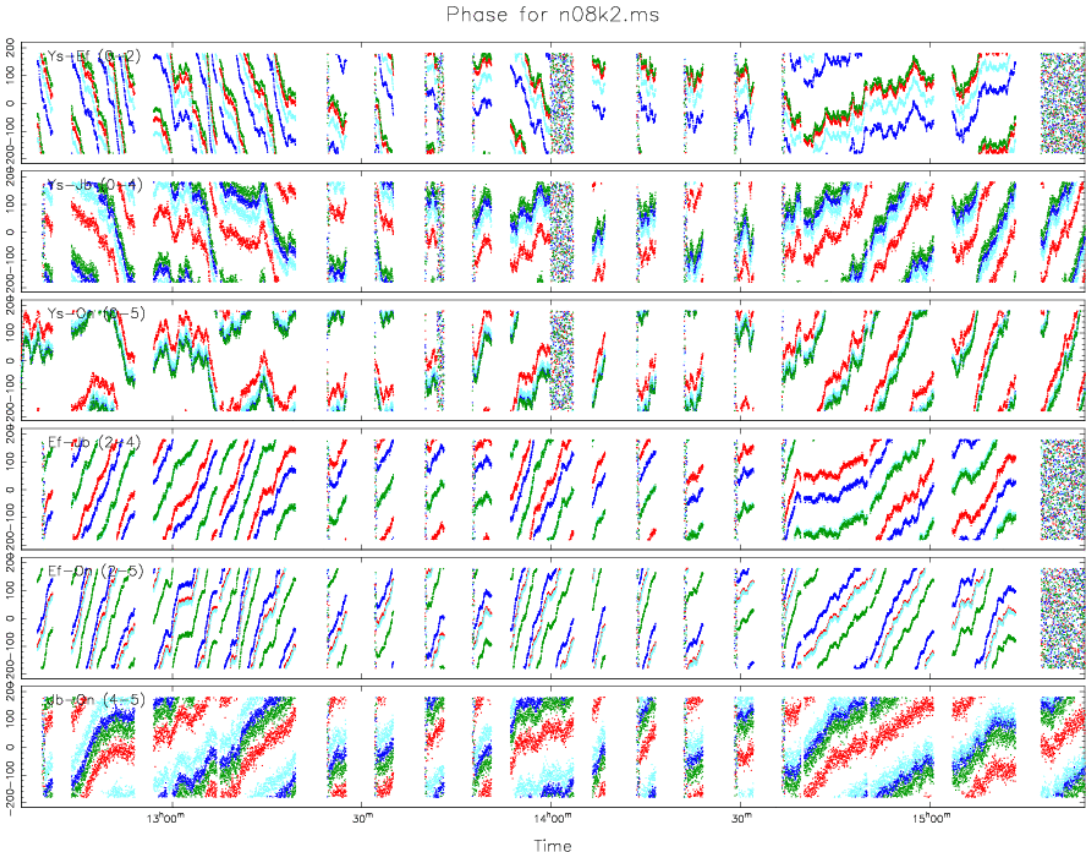
- { $1.75\ \kappa f / t_{int}$ } GB per hour of observation
  - $\kappa \approx 1$—1.7 (fudge-factor for "efficiency" of FITS storage)
  - f = fraction of correltaor used
- **Record for a single experiment: 1028.7 GB**

Recirculation: min. $t_{int} \longrightarrow$ (min. t_{int}) · Recirc

New Stations (Yebes 40m)

Phs(t) for 4C39.25 in K-band NME

1st 3: Ys-[Ef,Jb,On]; 2nd 3: {Ef,Jb,On}

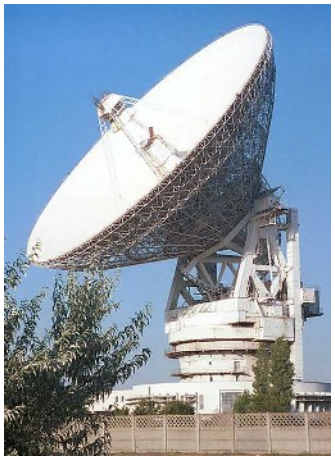


Session 3/2008: also X-band

New Stations (fringe tests since Torun)

Evpatoria (3-4aug06)
C-band @ 256Mbps
(8dual-pol 4-MHz SBs)

Ev-Mc-Wb (1hr per day)



Irbene (13-14nov06)
12GHz (methanol)

Ir-Nt-Tr (1.5hr per day)

New Stations (III)

- QUASAR Stations (upcoming session S/X,C,L)

Svetloe

Zelenchukskaya

Badary

movie: www.ipa.nw.ru/PAGE/ENG/film/film.htm

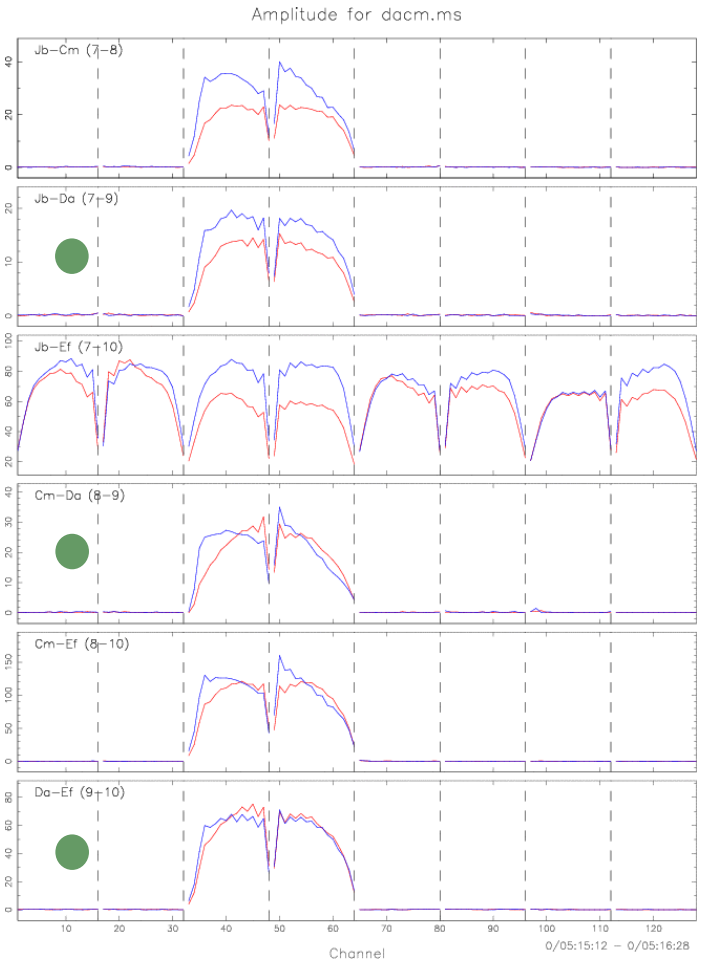
- EVLA & GBT at 5cm (sessions 1/2008, 2/2008)
- Multiple MERLIN out-stations (next slide)

Multiple MERLIN Out-Stations

- Now, 1 Bsln (Jb-Cm) in common to EVN & MERLIN
- Dual-pol: 2 out-stations via Cm (Cm + 1)
- Single-pol: up to 4 out-stations via Cm (Cm + 3)
  - 2 out-stations would have only 1 BBC available each
- Concept of "free subbands"
  - If so, no impact on scheduling
  - If not, "Cm" would need a different, higher-rate schedule
- At Correlation:
  - Multiple N-station Cm pack copied to (N-1) new packs
  - Each additional out-station correlates as a separate station
  - N_{sta} in correlator-capacity equation → (N_{sta} + N - 1)

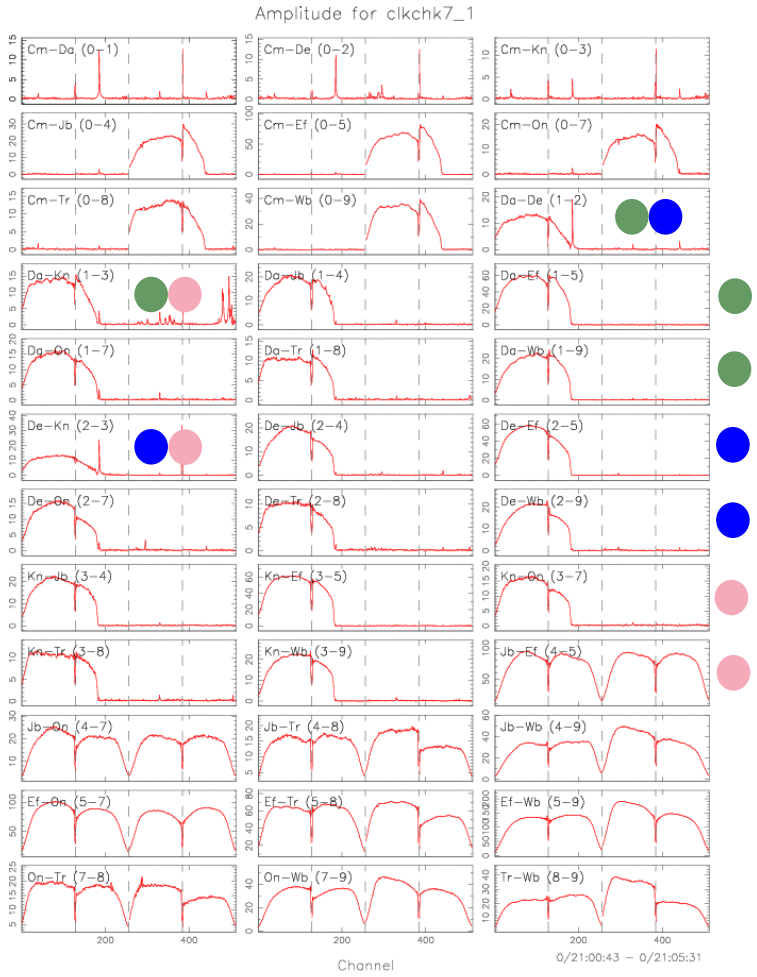
- H0YOEI#D SSOIFD WIRQ#KQGHU#GHYHORSPHQW

Multiple MERLIN Out-Stations



RO001B: 512, dual-pol

Cm & Da

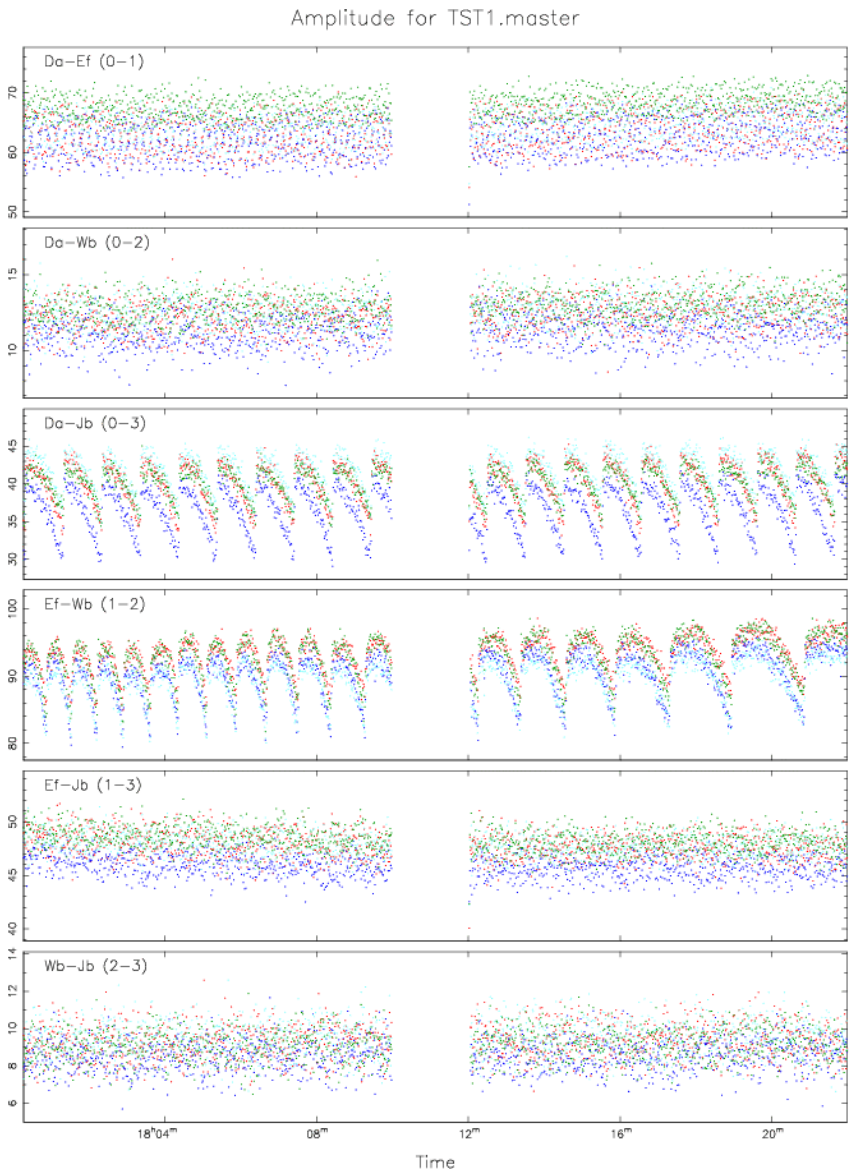


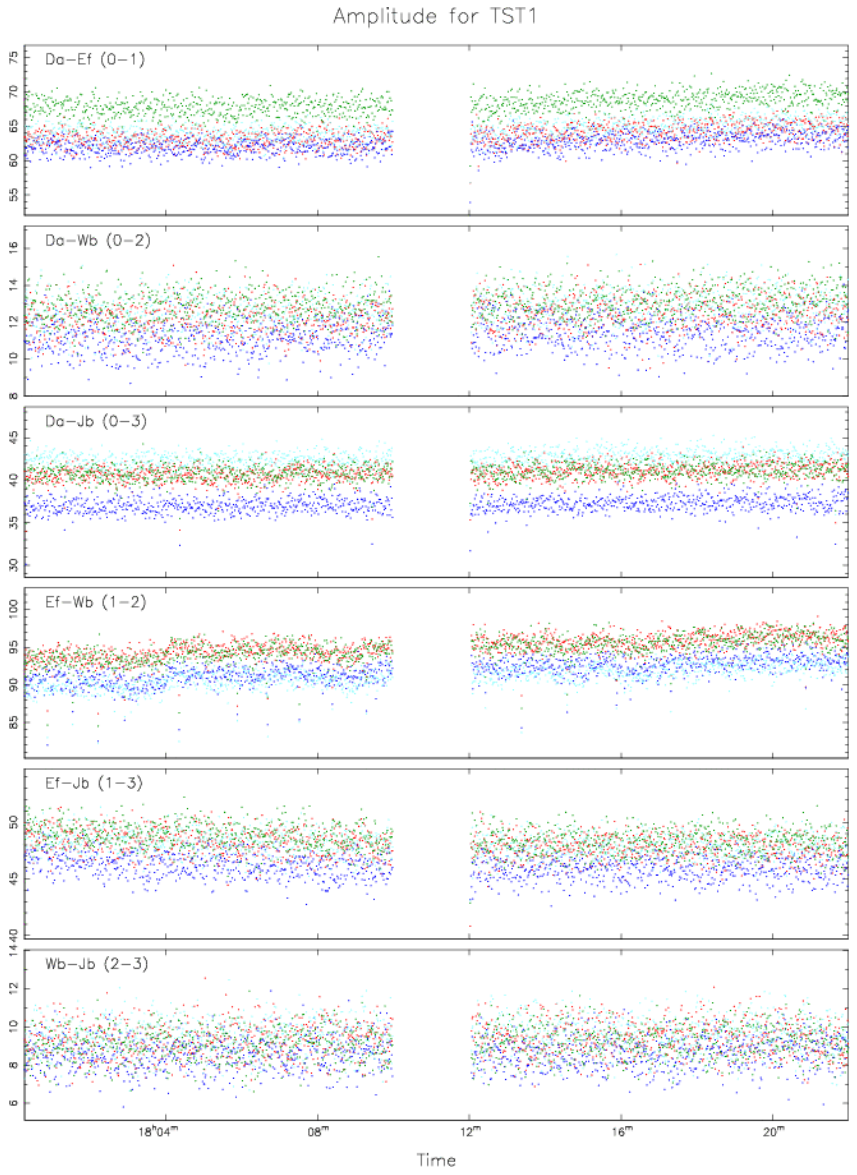
EA038: 128, single-pol

Cm & Da + De + Kn

Data Improvements

- New CALC version (≥Dec'05)
  - IAU200 nutation; ocean loading; direct UVW's
  - Pathway for surface weather → tropo. ZD comput.
- Better UVW's (≥Dec'06)
  - Now taken directly from CALC run (a priori model)
  - UVFIX unnecessary (cf. V.G. from Torun symp.)
- Better fractional-bit shift correction (≥Mar'07)
- AIPS tables issues
  - Apparent positions in SU table improved
  - Polar Motion units in AN table header (UVFIX)





N06M2: before……

& after FBS delay correction

Summary

- PI Support
  - Pro-active liaison; interactive web tools
  - Archive: feedback, standard plots, FITS, pipeline
- Correlator Capabilities
  - <= 2048 freq.pts per SB/pol; 1/4s integrations
  - H0YOEL#FDSDEL0LW\=#HQDEOHV#QHZ#NLQGV#RI#VFLHQFH
- Network Expansion / Data Improvements
  - New stations
  - More MERLIN out-stations
- Future – EVN2015 talk to come

More careful Monte Carlo simulations show:

Successful PI

EVN Symposium

??? you tell me……

(more detailed study required…)

EVN obs:

Archive

FITS data

new PI

a view through the dim mists of Jungian collective unconcious?

PI Archetypes?

Z IQJ G VSHHG#R I#H0YOEL