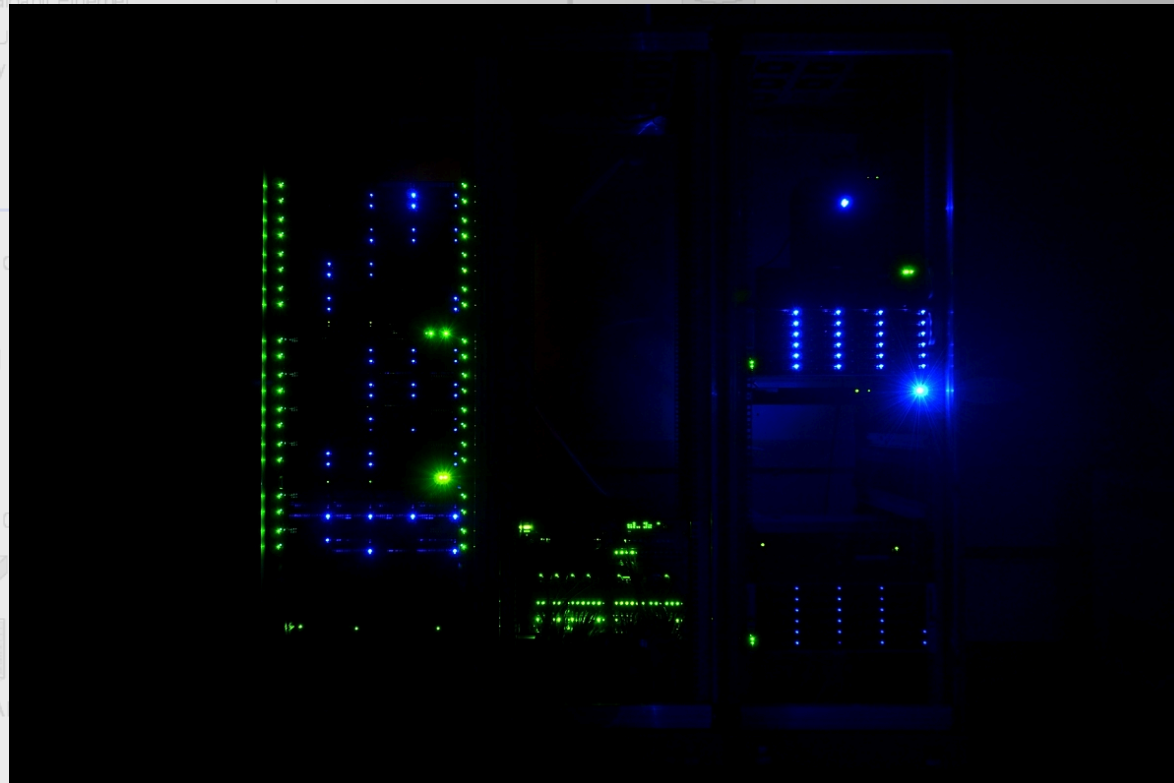


# Technical Operations and R&D at JIVE



Arpad Szomoru, JIVE

# Mark5, SUs, MarkIV correlator

- Mark5, general
  - New Linux kernel + newest SdK would break e-VLBI
  - Has been investigated by Paul Boven
    - Fixed by Conduant
  - Still some minor issues with SdK9.4
  - Finally upgrade to non-antique Linux version! (Wheezy)
- Mark5B/C
  - 2 units permanently converted to B
  - 1 extra unit currently B+, 6 C units in place
  - 1 C unit on loan to Yebes
  - 1 C unit on loan to Torun for DBBC verification
- MkIV Correlator
  - Gone!
  - Correlator boards sent to Hawaii



# Jive5AB

- Jive5ab has taken over most operational VLBI in EVN
  - No major show stoppers, mishaps
- Much development ongoing

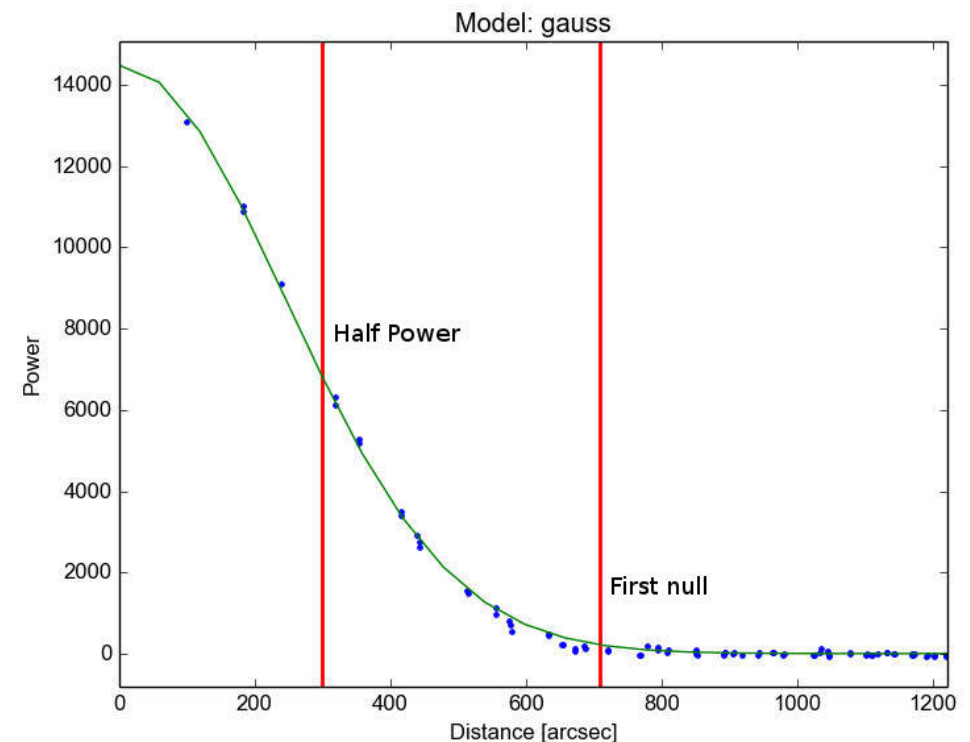
# e-status

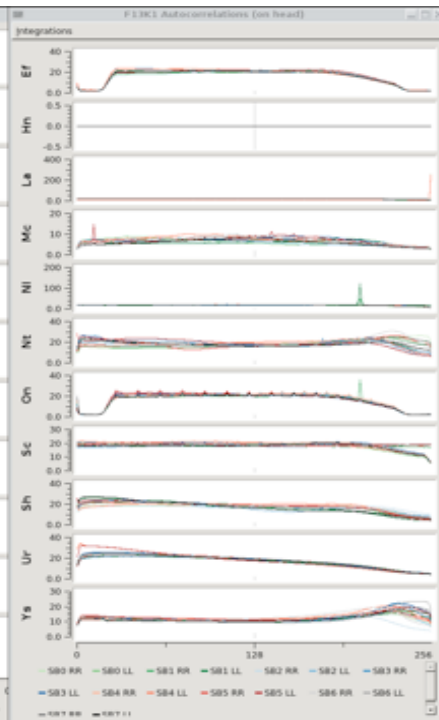
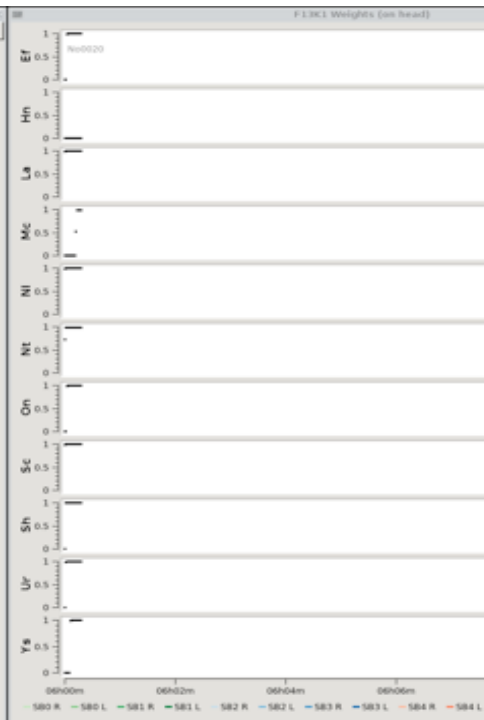
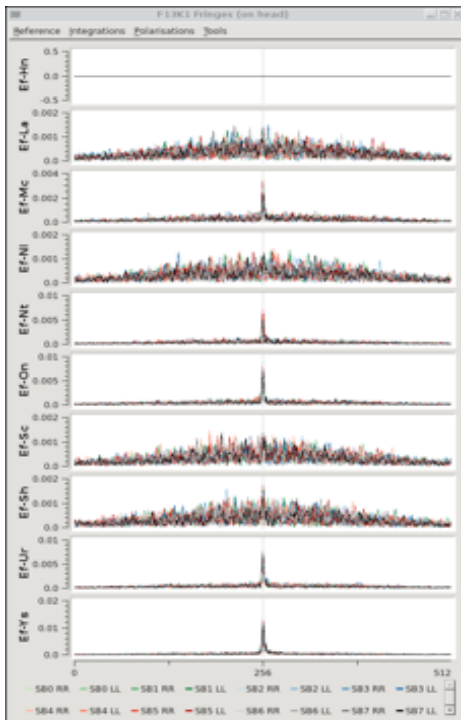
- Full 1024 Mbps available from most stations
  - Ef, On, Nt, Mh, Hh, Tr, Ys using DBBCs operationally
  - Mc doing tests
  - Jb received DBBC
- Channel dropping possible when needed (except Ar)
- Ar still at 512 Mbps
- Irbene: full EVN member in 2015?
- Still attempting to bring e-Merlin back into array

# SFXC Correlator

- Used for all EVN operations, both recorded and real-time:
  - e-VLBI with 13 stations at 1024 Mbps
- Coherent de-dispersion
- Multiple phase centers in real time!
- Primary beam shape determination:

- Beams from Ef, On, Bd, Sv, Ys
- Single map from Tr
- More needed!



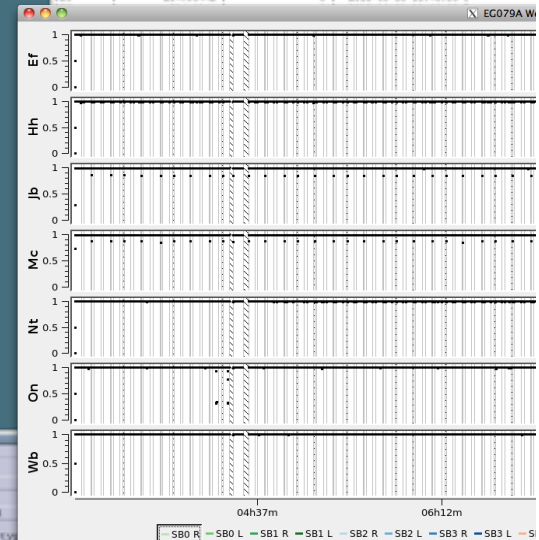


Applications Places System

File Edit View Terminal Help

File: /home/.../P13K1/No0020

File	Size	Permissions	Owner	Group	Created	Modified	Accessed
UR	4,561	-r--r--r--	root	root	2013-09-27 18:21:40	2013-09-30 08:39:57	
UR	4,561	-r--r--r--	root	root	2013-09-30 13:46:50	2013-09-30 13:46:50	
UR	4,622	-r--r--r--	root	root	2013-10-01 11:46:08	2013-10-01 11:46:08	
UR	4,561	-r--r--r--	root	root	2013-10-01 11:56:12	2013-10-01 13:43:31	
UR	4,561	-r--r--r--	root	root	2013-10-01 13:43:31	2013-10-01 13:55:19	
YY	-10,376	-r--r--r--	root	root	2013-09-27 18:21:40	2013-09-30 08:39:57	
YY	-10,376	-r--r--r--	root	root	2013-09-30 13:46:50	2013-09-30 13:46:50	
YY	-10,376	-r--r--r--	root	root	2013-10-01 11:46:08	2013-10-01 11:56:12	
YY	-10,376	-r--r--r--	root	root	2013-10-01 13:43:31	2013-10-01 13:43:31	
YY	10,9699925	-r--r--r--	root	root	2013-10-01 13:55:19	2013-10-01 13:55:19	
2C	214,755	-r--r--r--	root	root	2013-09-27 18:21:40	2013-09-30 08:39:57	
2C	214,90442	-r--r--r--	root	root	2013-09-30 13:46:50	2013-09-30 13:46:50	



Job status (on jaw31)

Job Info

Experiment: P13K1  
Frequency: 2217MHz-2228MHz  
Bandwidth: 16.0MHz, 64.0MHz  
Data rate: 1024Mbps  
Stations: EFHnLaMcNIOnScShUrYs  
P.I.: Bob Campbell

Clock Search

Reference station: EF  
Job start offset (s): 0  
Clock search all scans  
From: 03-10-2013 06:33:24  
To: 03-10-2013 06:38:24  
Clock search interval: 5 minutes  
Set interval to: 5 minutes  
Current status: Finish Abort  
Old job

Last Job	A	B
0		
1	On	MSRT-052
2	La	MSRT-014
3	EF	SHAO-032
4		
5	Ta	JOD-0076
6	Mc	HOB-0058
7	Ur	KAD-1011
8	Hn	SAIC-007
9	NI	MYAL-003
10		
11	Sc	MPF-0103
12	Sh	MSRT-079
13		
14		
15	Ty	MPF-0058
16		
c00		
c01		
c02		
c03		
c04		
c05	Mc	0800-372
c06		

Schedule

Now: 12-06-2013 06:50:00 Time scale: 1 hour

36:00 36:05 36:10 36:15 36:20 36:25 36:30 36:35 36:40 36:45 36:50 36:55

First: No0020  
Current: No0020  
Last: No0026

Configuration

Experiment: P13K1  
Profile: prod  
SELECT data input type: eVLA / Flexbuf (remote) / Flexbuf (local)  
Stations: EF Hn La Mc NI On Sc Sh Ur Ys  
Frequency points: 256 Integration time: 1  
Cross polarizations:   
Channels:

SPIC specifics

Pulsar Binning  
Use node reservation ID:  
Use pre-generated delays:  
Setup station: EF

Start time	End time	Source	Stations	Mode	Status
No0020 12-06-2013 06:20:06	06:22:00	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	Tried
No0021 12-06-2013 06:12:26	06:14:06	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	Tried
No0022 12-06-2013 06:14:26	06:18:36	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0023 12-06-2013 06:18:56	06:23:06	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0024 12-06-2013 06:23:26	06:25:06	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0025 12-06-2013 06:25:26	06:29:36	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0026 12-06-2013 06:29:56	06:34:06	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0027 12-06-2013 06:37:06	06:38:46	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0028 12-06-2013 06:39:06	06:43:16	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0029 12-06-2013 06:43:36	06:47:46	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	
No0030 12-06-2013 06:48:06	06:49:46	J2005+7752	EFHnLaMcNIOnScShUrYs	X5.avn.rdbdd	

Operator: Fans Start Reload from database Save profile Show status Show Log Quit

Progress (on head)

Scan: No0020 Job ID: 7906  
Time: 06:00:19 Subjob ID: 87358  
1%

177 09J28m10s716ms, 00\_start 2013y163006A01m06s000ms, channel 5.10 to correlation node 153  
09J28m11s066ms, 00\_start 2013y163006A01m06s000ms, channel 7.15 to correlation node 160  
09J28m12s296ms, 00\_start 2013y163006A01m06s000ms, channel 12.14 to correlation node 163  
09J28m12s449ms, 00\_start 2013y163006A01m07s000ms, channel 0.3 to correlation node 171

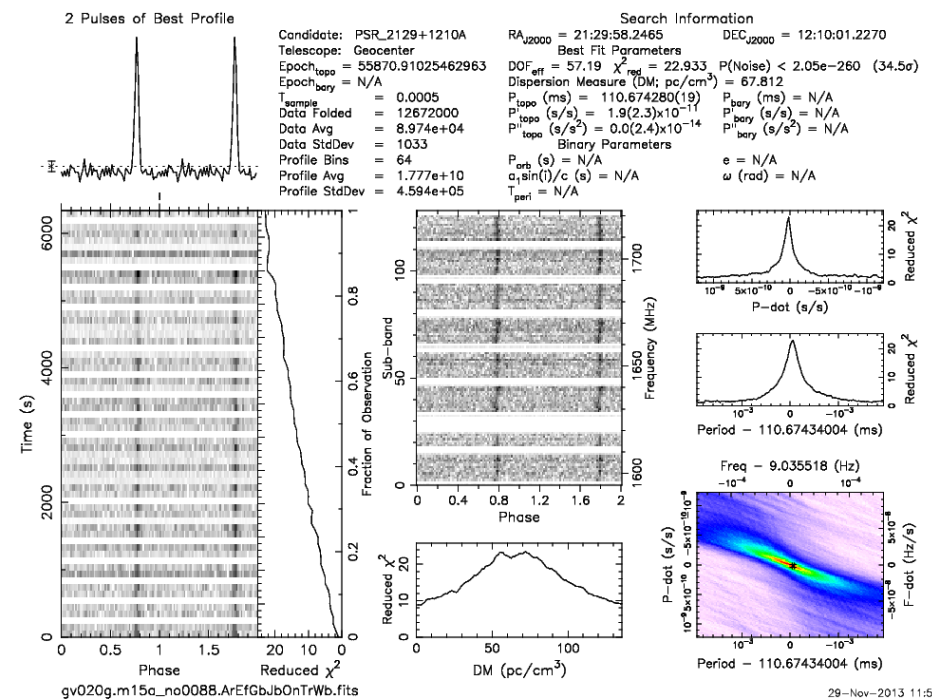
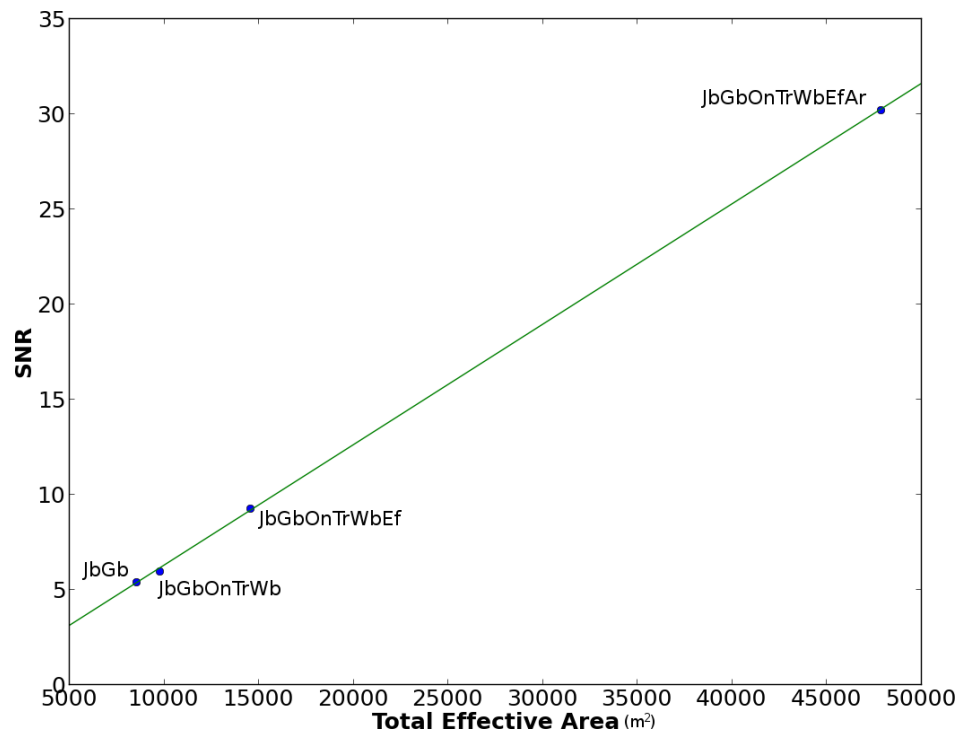
# SFXC Hardware

- 40 nodes; 384 cores  
(Intel Xeon 5500/5600/E5-2600)
- QDR Infiniband interconnect  
(32 Mbit/s)
- 8 nodes with 10 GbE  
(currently limited to 20 Gbit/s total)
- 13 stations @1Gbit/s real-time  
(with cross-polarisations)



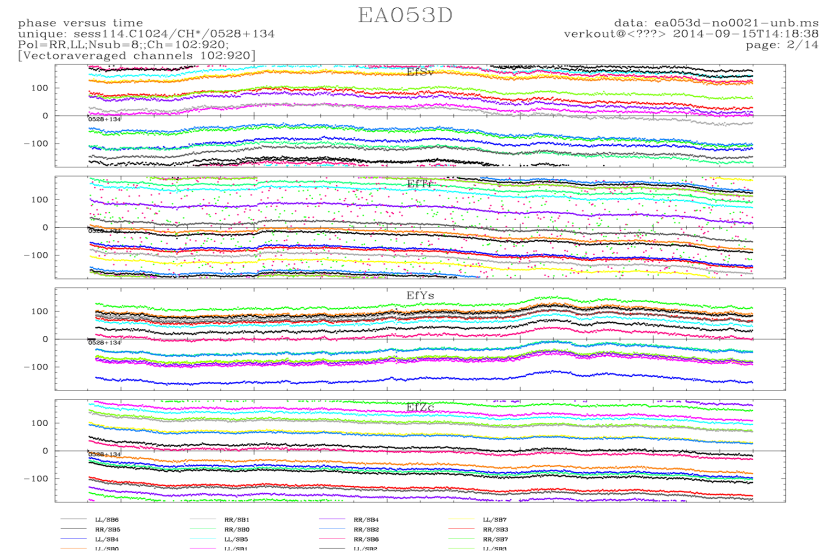
# SFXC Correlator: phasing up the EVN

- Phased array mode
- Coherent summing of signals
- Mult. phase center capability for phased array mode under development
- Implementation at KVN

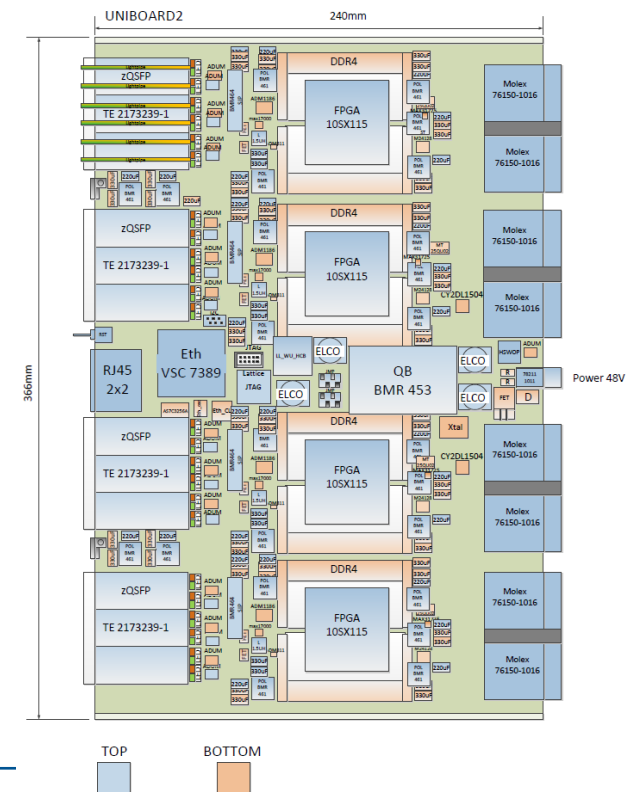




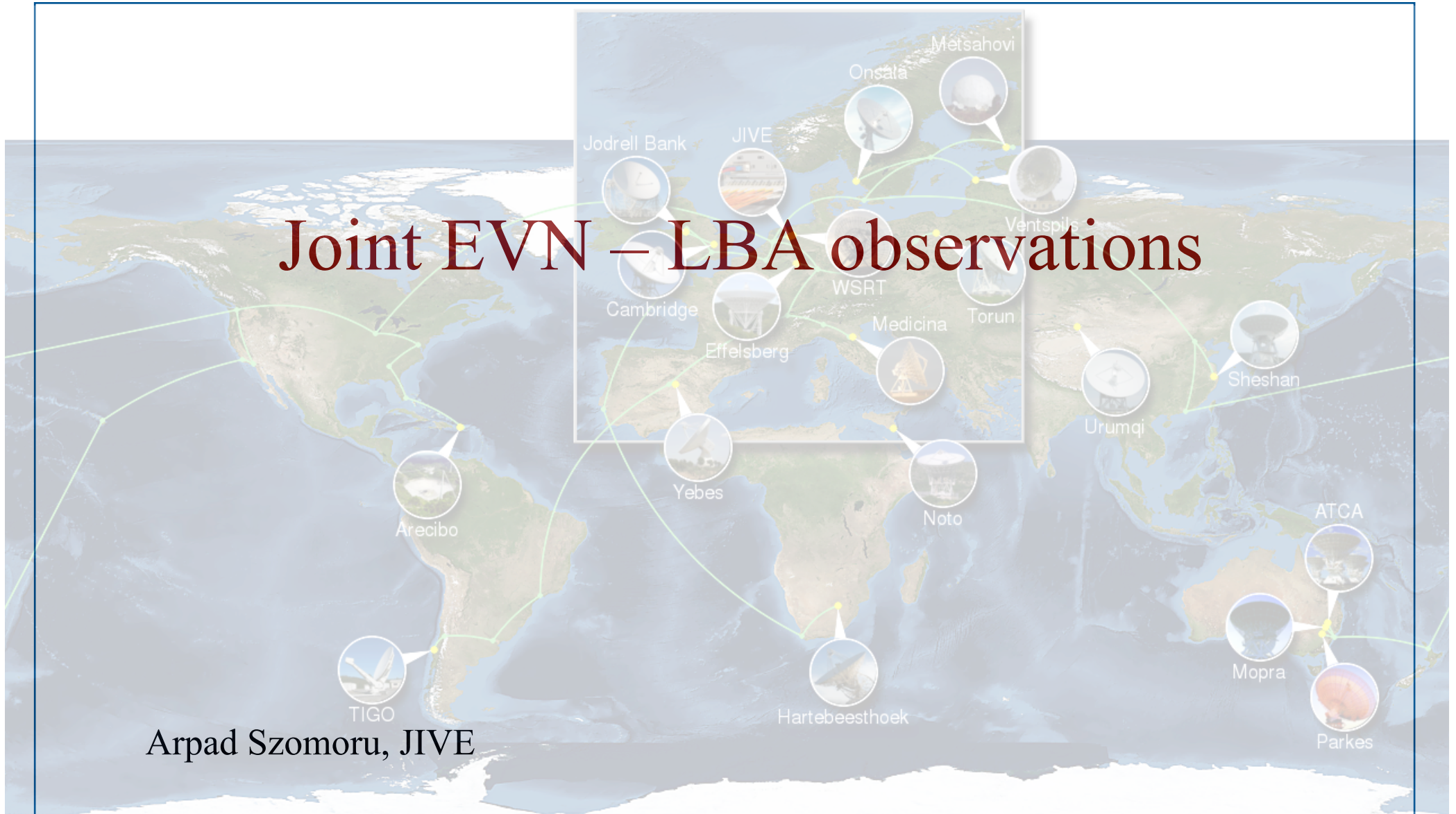
# UniBoard and beyond



- UniBoard-based EVN correlator
  - Can now accept data from Mark5, FlexBuff
  - Interesting problems remain
  - Two UniBoards at JIVE
    - 32 stations at 1 Gbps
    - Or 16 at 2 / 8 at 4
  - Project review took place in September
    - Very positive feedback from panel
- UniBoard<sup>2</sup>
  - Prototype will use 20nm FPGA technology
  - Some (or all?) production boards with 14nm (pin compatible)
  - Main board, optimized for use as AA-low beam former
  - Full mesh, Hybrid Memory Cubes and QSFP+ cages on break-out board
  - Tender has been issued, manufacturer selected



# Joint EVN – LBA observations

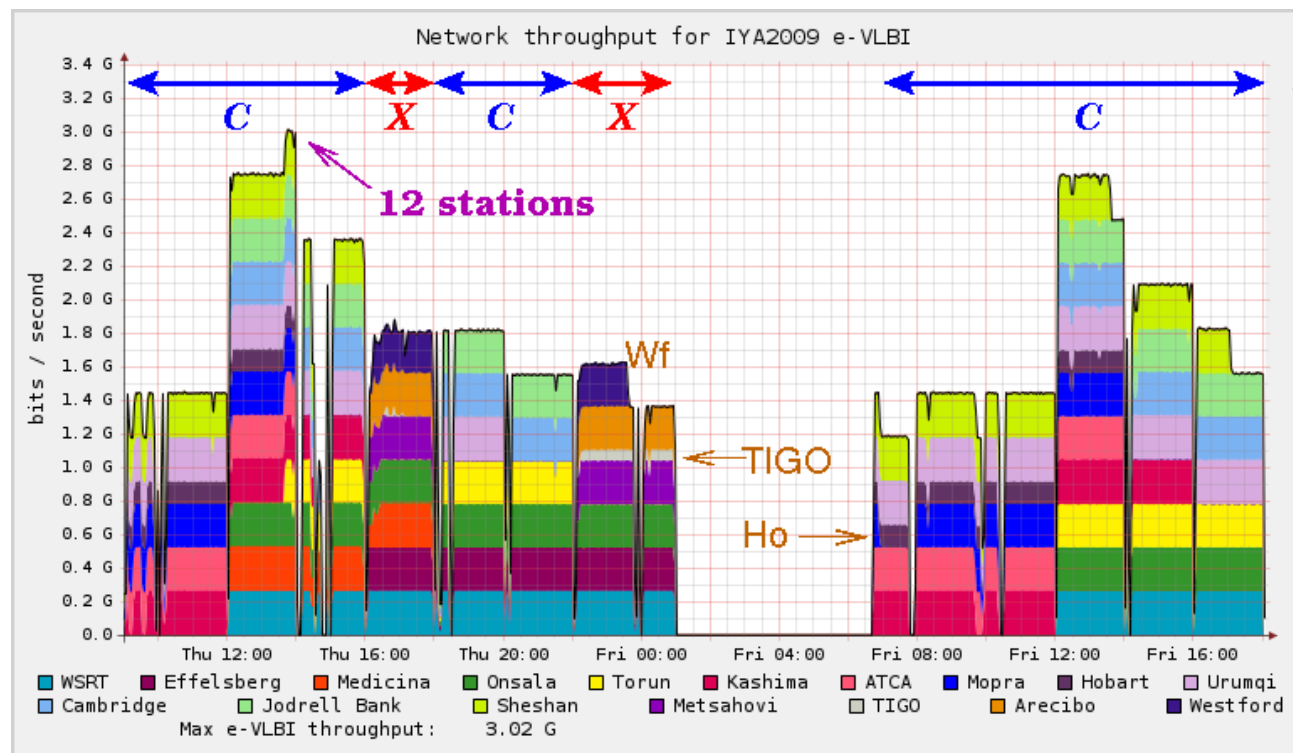


Arpad Szomoru, JIVE

Network status as per 2008-05-02. Image created by Paul Boven -boven@jive.nl-. Satellite image: Blue Marble Next Generation, courtesy of Nasa Visible Earth (visibleearth.nasa.gov).

# Some history

- 32 hour real-time (near-) continuous e-VLBI demo
- Involving telescopes in Australia, Japan, China, Europe, the Americas
- At opening of IYA2009, Paris
- Led to three-epoch observations by Giroletti et al.
- Then, nothing (not known, not supported,....)

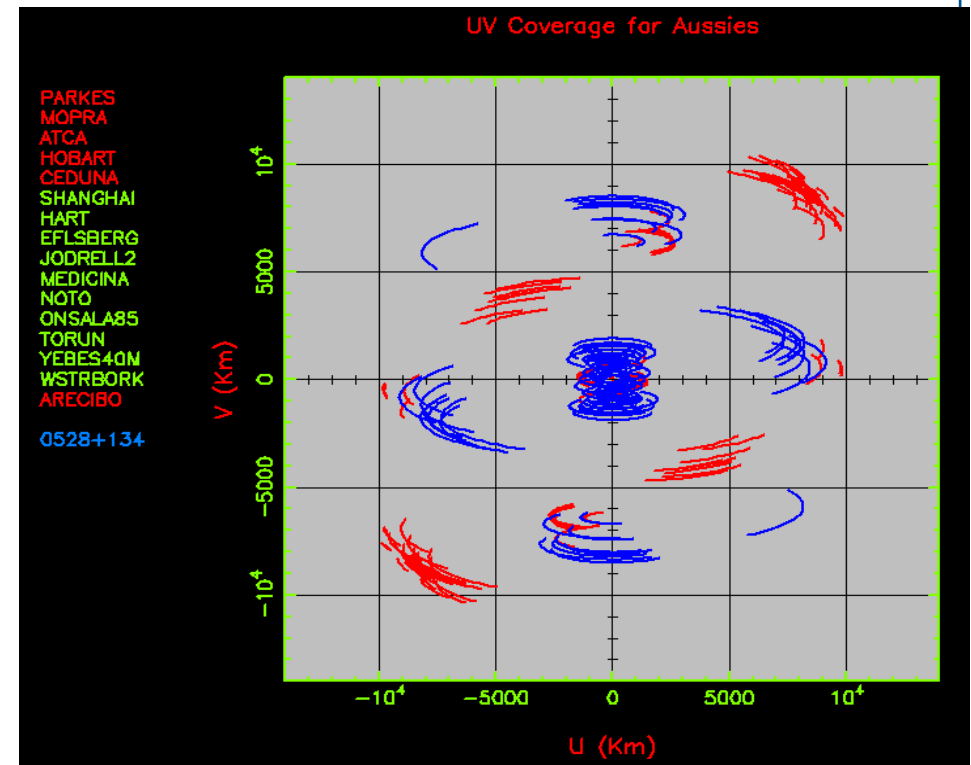
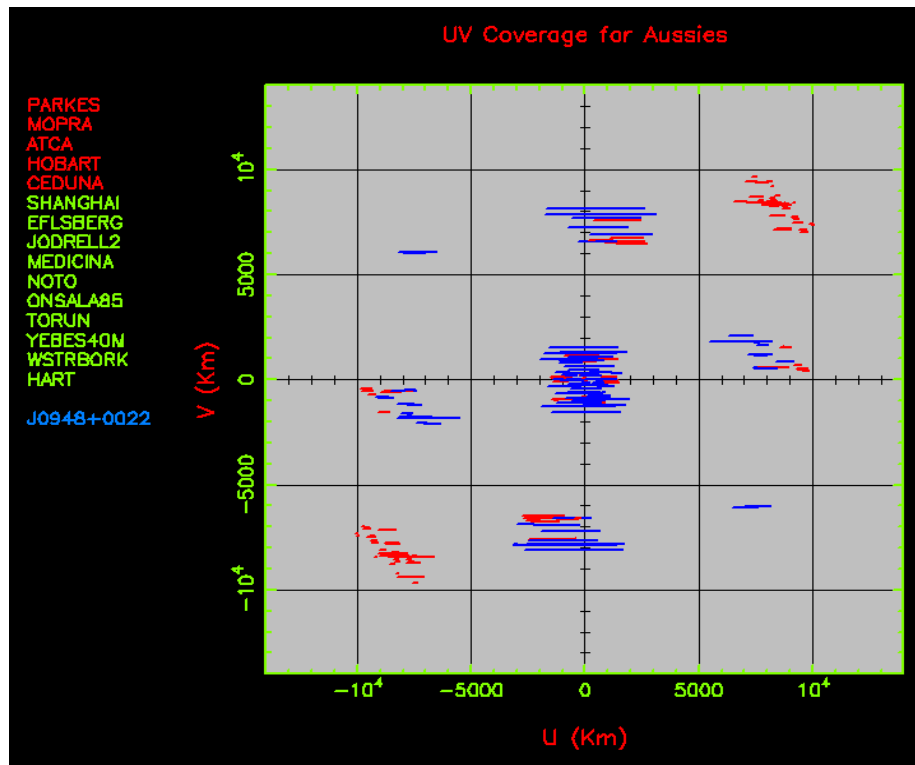


# Why bother?

- NEXPreS has finished
- For time being, no formal collaboration between JIVE + EVN and LBA, CSIRO, AARNET
- New Zealand looking at refurbishing 32m telescope
  - Obviously working together with Australians
  - But how to get them involved in world-wide VLBI?
- SKA looming on horizon, eating up radio astronomy
- VLBI will remain important, considering what baseline design looks like
- But have to showcase this importance
  - Be global, connected, active, transparent
- LBA already observes regularly with some EVN stations

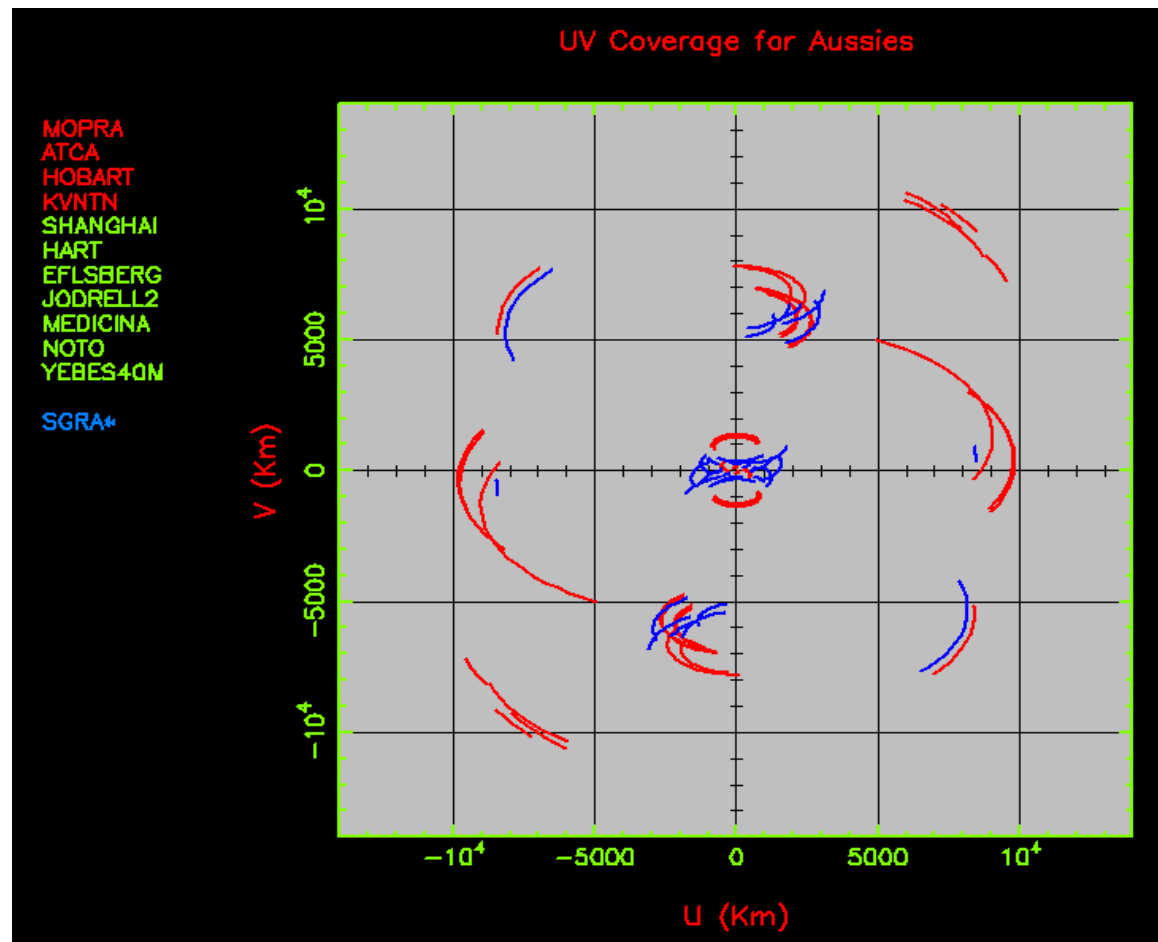
# Science case (?)

- Left: source at Dec 0 (RG001)
  - 17 hours in total
  - Longest N-S and E-W baselines with different telescopes
- Right: source at Dec -10 (now includes Ar)
  - 19 hours in total



# Science case (!)

- SGRA\*
- High frequencies preferred, KVN perfect for this



# And now

- Board approved collaboration
  - In call for proposals
  - Until now, one very good candidate, did not ask for joint observations though
  - Not sufficiently known in community?

# Towards 2 - 4 Gbps operations

Arpad Szomoru, JIVE



# Status

## Current Problems:

- Recording media
- Common LO setting
  - *DDC mode needed!*
- Lack of FS support

## To do:

- Test DDC mode
- Find solution for FS
- Buy FlexBuffs/Mark6
- Test Jive5AB on Mark6
- Aim for 2Gbps for now (VLBA, CDAS, R1002)