EVN/JIVE Technical developments

Arpad Szomoru, JIVE

Correlator upgrades

- New(ish) data output platform
  - Solaris AMD server with large raid array
  - Fully interchangeable with control computers
  - Re-circulation enabled correlator code; system now runs at 64 BOCFs
- Re-circulation
  - Has been demonstrated to work
- Terminal servers installed on Mark5 and PCInt cluster
- Improved system redundancy, disaster control

- Legacy hardware has been remarkably stable over past year
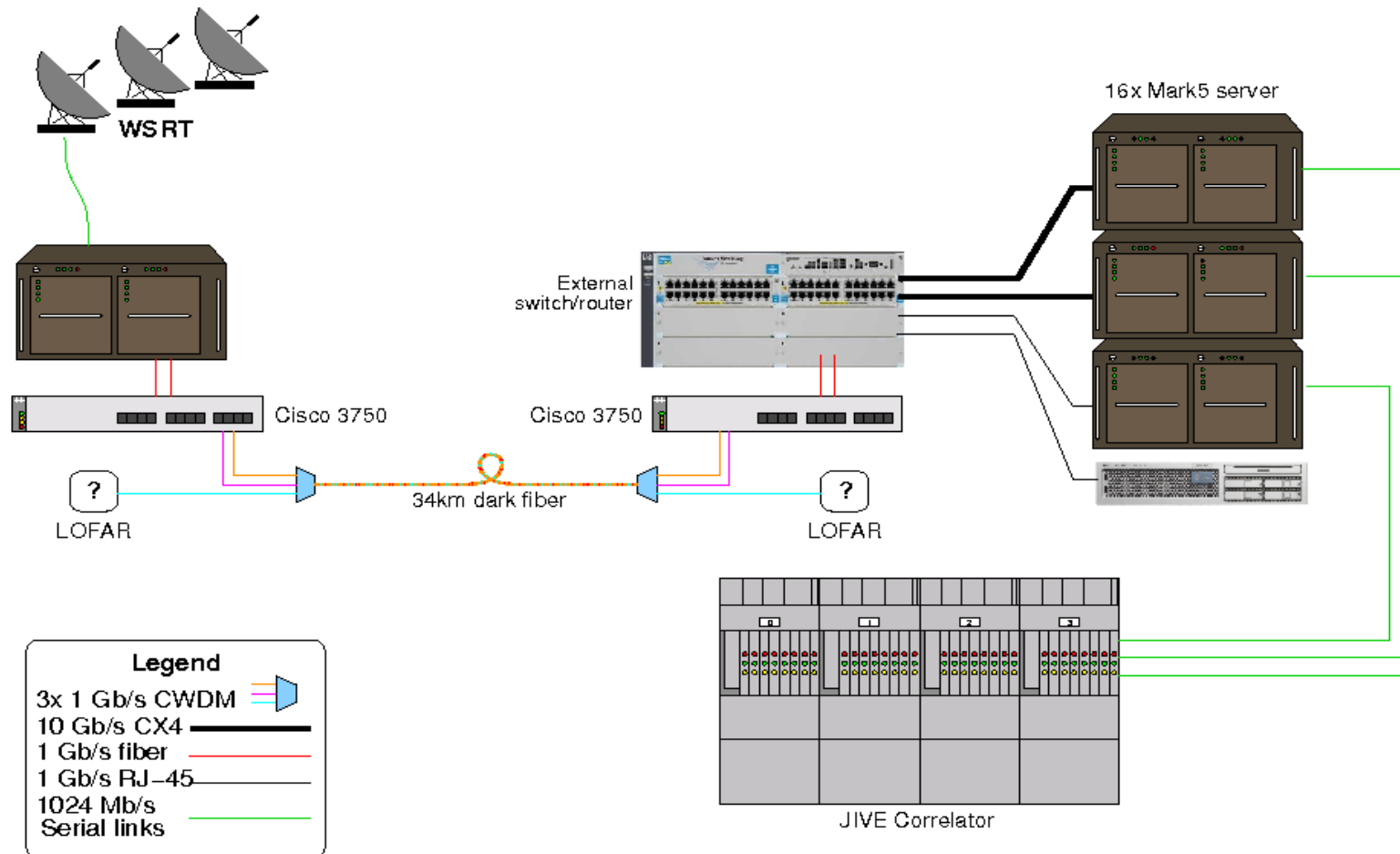
Mark5 status at JIVE

- Mark5A
  - Upgrade of hardware (motherboards, memory, power supplies) completed Mark5A+
  - Debian Sarge on several units
  - Will convert all units to Debian Etch, switch to SDK8
- Mark5A+
  - Upgrade of Mark5A, enables play-back of Mark5B data on Mark5A units
  - Used at JIVE with Yebes, Effelsberg and Westerbork TADUmax data
  - And on converted Australian LBADR data
- Mark5B
  - On and off several units converted from A to B at JIVE (depending on production correlation needs)
  - Function well, but very little actual data to play back...
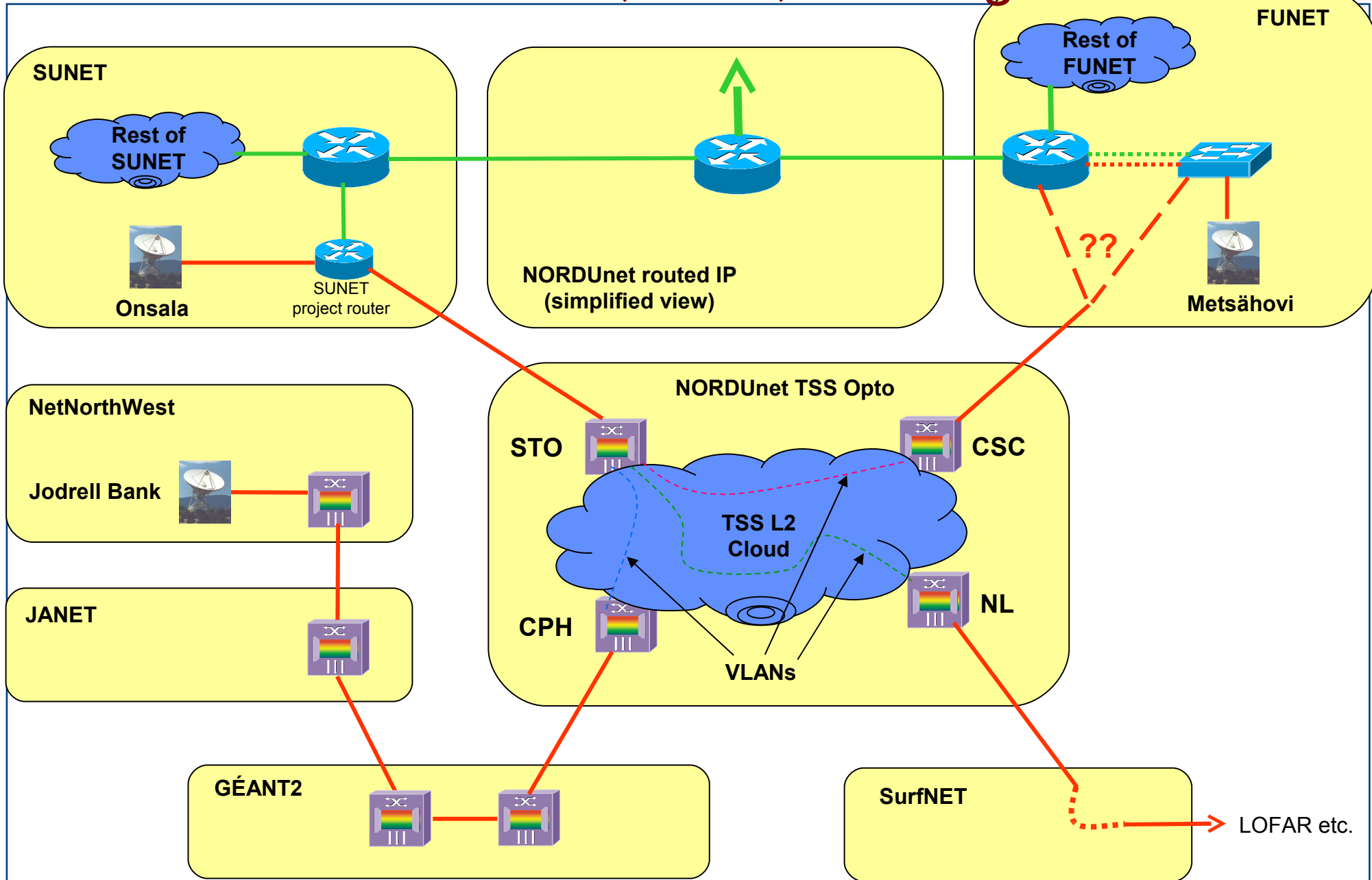
Network status

- Internal network
    - All internal JIVE and e-VLBI traffic now through own router
    - (nearly) all bugs in router firmware have been fixed by HP!

- New stations
    - Effelsberg, Yebes, Hart, TIGO

- Full 1024 Mbps becoming possible
    - Wb: two lightpaths, channel bonding
    - Ef and On: 10 and 4 Gbps connections for e-LOFAR
    - Jb: 2 lightpaths already available
    - Tr: 10-G equipment in place

Full 1024 Mbps from Westerbork

e–VLBI at 1024Mb/s from WSRT to JIVE

WSRT

16x Mark5 server

External switch/router

Cisco 3750   Cisco 3750

? LOFAR   34km dark fiber   ? LOFAR

Legend
3x 1 Gb/s CWDM
10 Gb/s CX4
1 Gb/s fiber
1 Gb/s RJ–45
1024 Mb/s
Serial links

JIVE Correlator

Onsala to Manchester, JIVE, Groningen

SUNET
Rest of SUNET
Onsala
SUNET project router

NORDUnet routed IP (simplified view)

FUNET
Rest of FUNET
Metsähovi

NetNorthWest
Jodrell Bank

JANET

NORDUnet TSS Opto
STO
CSC
TSS L2 Cloud
CPH
NL
VLANs

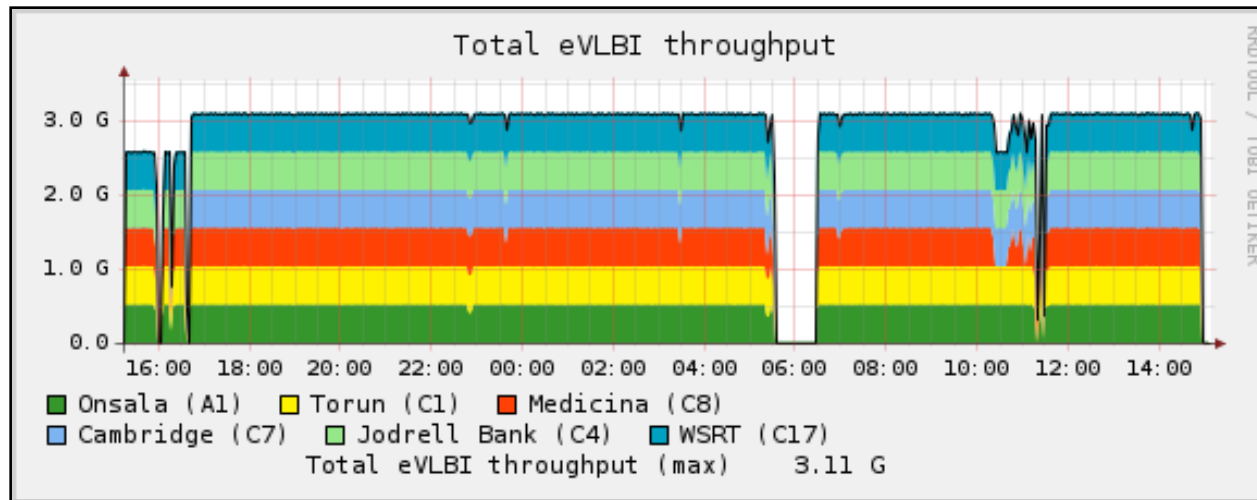**GÉANT2**

SurfNET
LOFAR etc.

??

and beyond Europe

Long distance connections

- Ar back in e-EVN, 512 Mbps fringes two weeks ago
- But time restrictions for high bandwidth transfer
- Sh: available, in principle, at 512 Mbps
- Hh: first fringes this year, 1-Gbps connection to Johannesburg, but price of connectivity to Europe prohibitive
- Situation should improve next year
- Tc: fringes as well, but limitation of S-American network not likely to improve soon
- Oz: still one lightpath in place
- Kashima, Urumqi, VERA next?

Control code improvements

- Correlator:

  - General speedup of correlator control code

  - Re-connecting of individual stations without job re-start

  - Significant increase of robustness and reliability

  - Has made e-VLBI a one-person operation at correlator

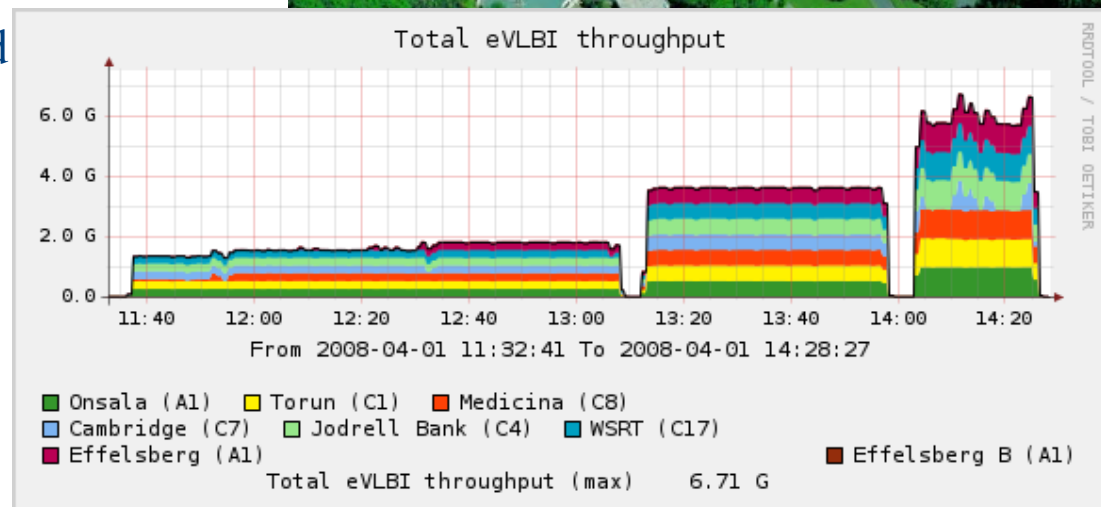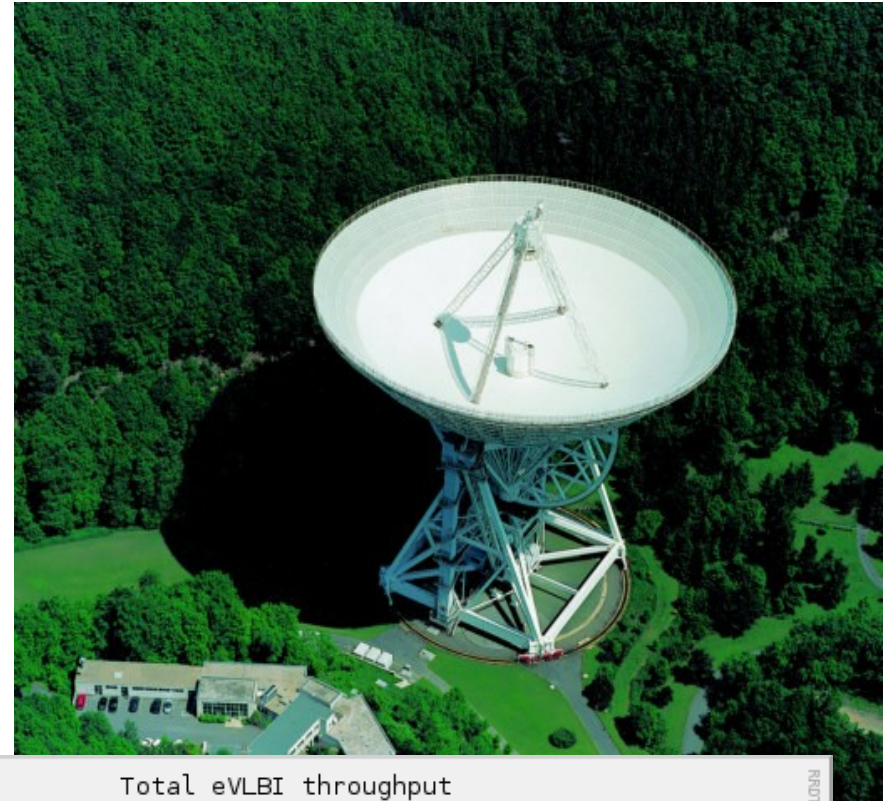 - Led to record length unattended correlation jobs (both e and non-e)

QuickTime™ and a
Cinepak decompressor
are needed to see this picture.

Total eVLBI throughput

3.0 G		
2.0 G		
1.0 G		
0.0		

16:00 18:00 20:00 22:00 00:00 02:00 04:00 06:00 08:00 10:00 12:00 14:00

RRDTOOL / TOBI OETIKER

■ Onsala (A1) ■ Torun (C1) ■ Medicina (C8)
■ Cambridge (C7) ■ Jodrell Bank (C4) ■ WSRT (C17)
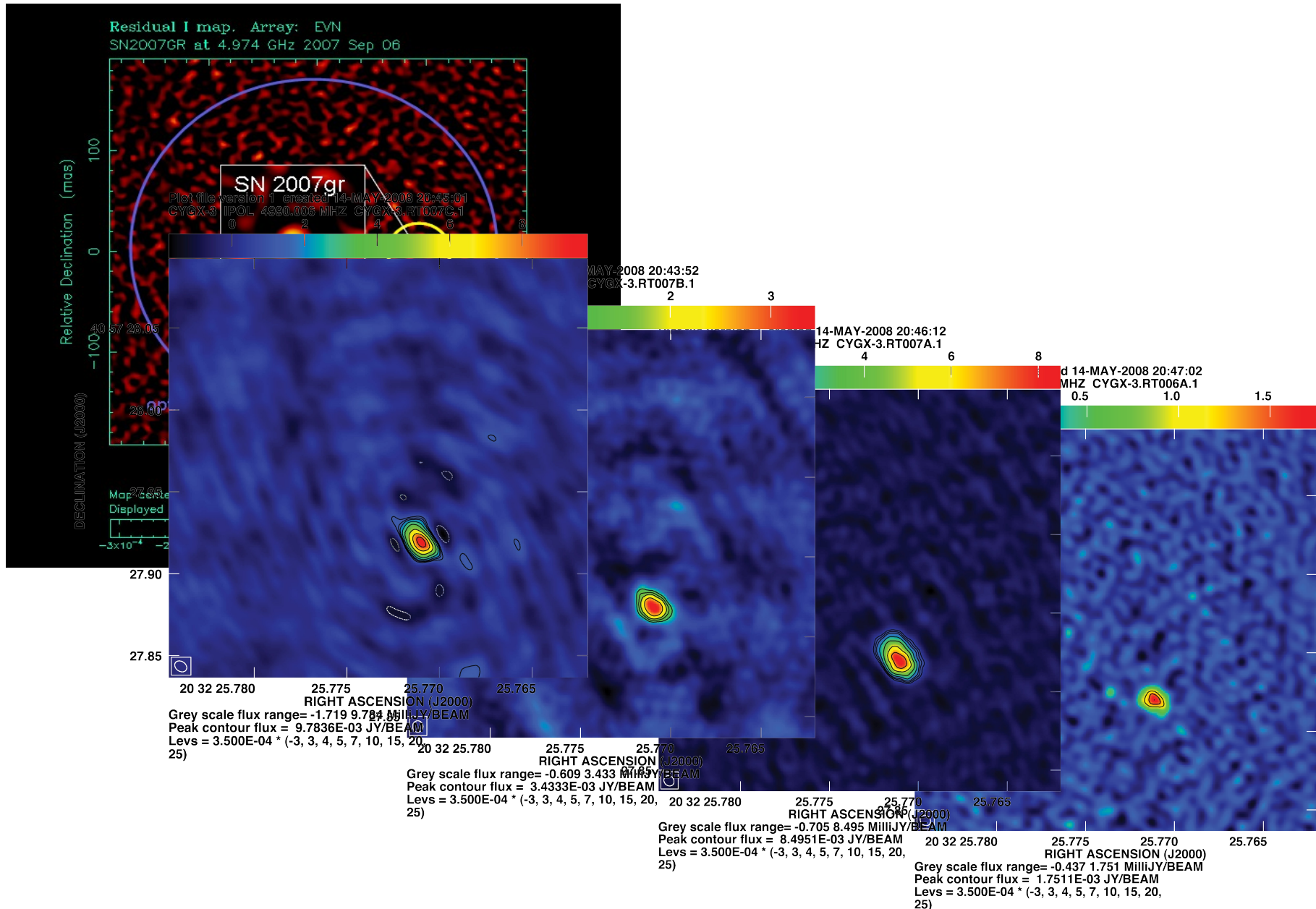Total eVLBI throughput (max)   3.11 G

Control code improvements (2)

- Mark5:

  - Re-write of code with rigorous thread control (with help of UMan colleagues)
  - Much improved stability of units
  - New features, such as packet dropping/padding, channel dropping, simultaneous recording and transmitting of data on Mark5A
  - Enabled using available bandwidth to the limit, both on dedicated short- and shared long-haul links
 - Simplicity pays off: trivial to add EVN stations to e-EVN

Total eVLBI throughput

From 2008-04-01 11:32:41 To 2008-04-01 14:28:27

- Onsala (A1) ■ Torun (C1) ■ Medicina (C8)
- Cambridge (C7) ■ Jodrell Bank (C4) ■ WSRT (C17)
- Effelsberg (A1)   ■ Effelsberg B (A1)

Total eVLBI throughput (max)   6.71 G

New modes, feedback and streamlining

Currently under development:

- Fast/adaptive (re-)scheduling (presentation by Des)
  - Transform EVN into a truly flexible instrument
  - Based on automated download and execution of modified observing schedules - possibly on-the-fly
  - Reactions from stations vary from "excellent idea" to "over our dead bodies"
  - But will further improve reliability and responsiveness of EVN
  - Recent test with Tr and Wb

- On-the-fly fringe fitting

- Real-time station-log processing, display of Tsys, status information

- Multiple Merlin stations via one formatter, one link, to multiple Mark5 units at JIVE, using multicast (transfer of two stations sucessful, although only one station produced fringes)

- ## Software correlator developments

  - ### Several bug fixes; phase drift fixed
  - ### Excellent agreement with hardware correlator results
  - ### Web services to interface with workflow manager; grid-based tests soon
  - ### Possibility to create FITS files
  - ### Optimization efforts continue
  - ### Collaboration with AUTOBahn project (bandwidth-on-demand)

  - ### Unfortunately, engineers/postdocs just will not stay put (three persons leaving/having left this year alone)
  - ### Fortunately, new hire per 1st of September (Aard Keimpema)
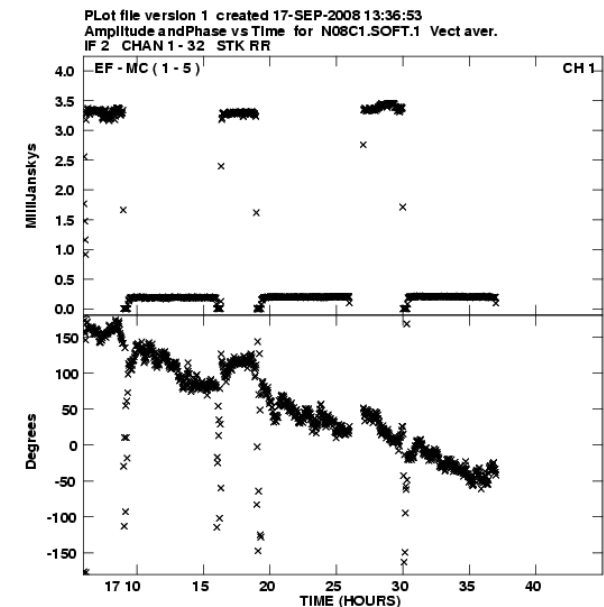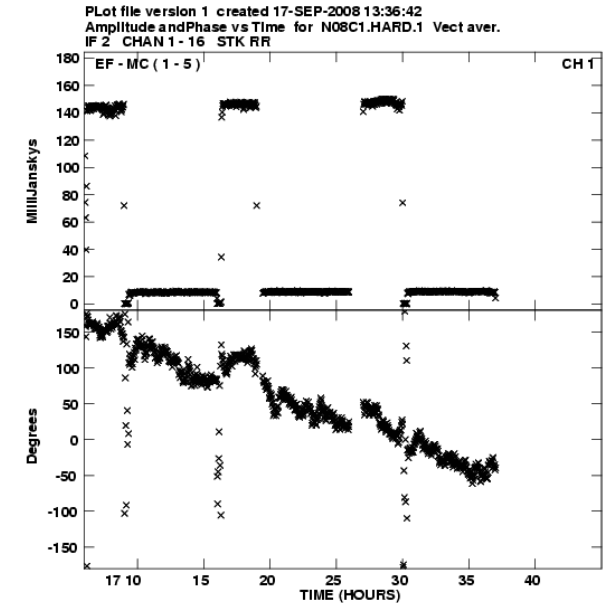
The UniBoard

- JRA in RadioNet FP7, start Jan 2009
- Funded by EC to ~800k€, comparable matching
- Collaboration between 6 international partners, JIVE leading institute

- FPGA-based computing platform, several applications
  - Digital receiver
  - Pulsar binning machine
  - Correlator (EVN2015, Apertif)

- Single board all-station correlator
- Scalable, distributable
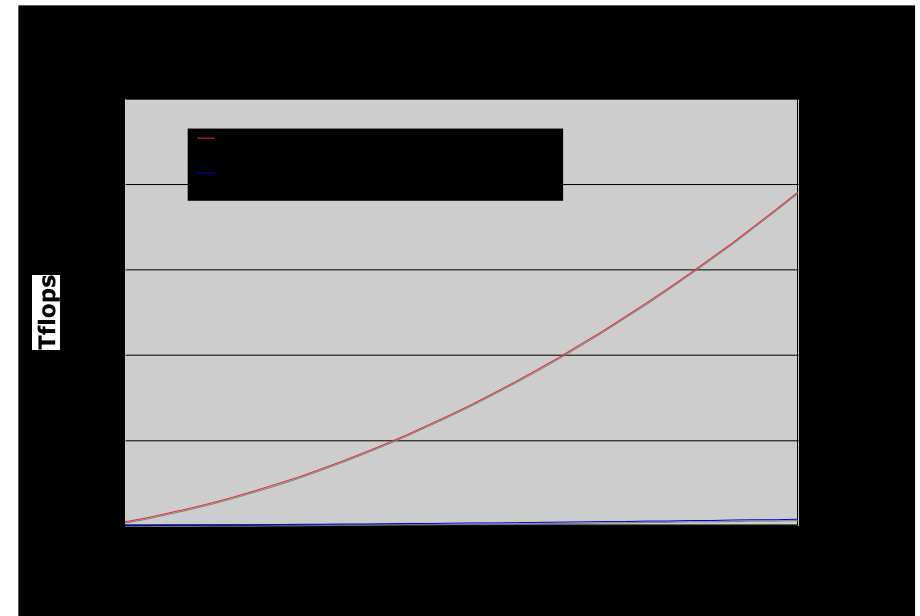
Mark5B (e-)issues

- Mark5A+: works fine with MarkB e- and non-e-VLBI data
  - Demonstrated in EXPReS-OZ e-VLBI demo
  - Yebes, Effelsberg and Westerbork (TADUmax) have produced B-data
  - e-Fringes between A and B at Ef with identical noise source (last April)
  - But.... test two weeks ago with real data gave NO fringes -- synch issues?
- Mark5B, disk-based:
  - Software development mainly done
  - Problems with disk-playback resolved (mysterious missing second..)
  - But hardly any data around
- Mark5B, e-based:
  - Sending side: JIVE-developed code works
  - Domino: e-VLBI enabled, waiting for latest de-bugged code version

- Not a reason not to go ahead with upgrade to B....

What we need from the stations...

- CPU power serious limitation
  - Channel dropping
  - Simultaneous recording/transmitting

- Upgraded Mark5s
  - Dual CPUs
- SMP-enabled kernels (Debian Etch, SDK 8)
  - hyperthreading

- Instant access to logfiles
  - Simple script that copies logfile to f.ex. Mark5 would do
  - No need for access to field system

And of course, support for demos

- TERENA 2008:
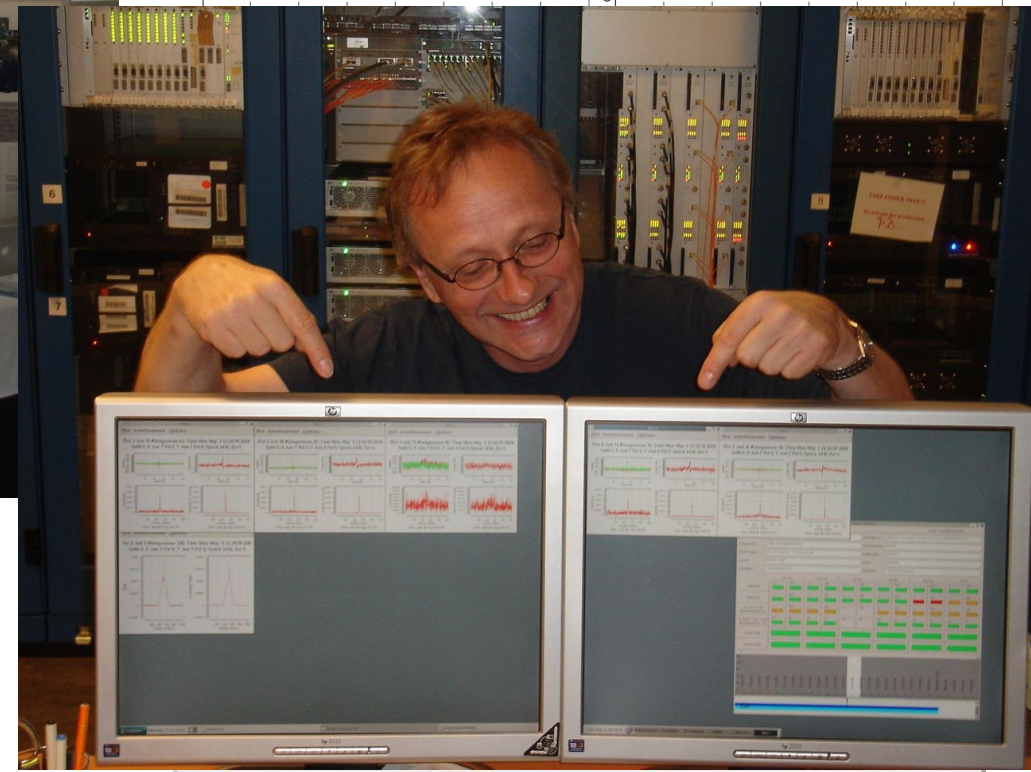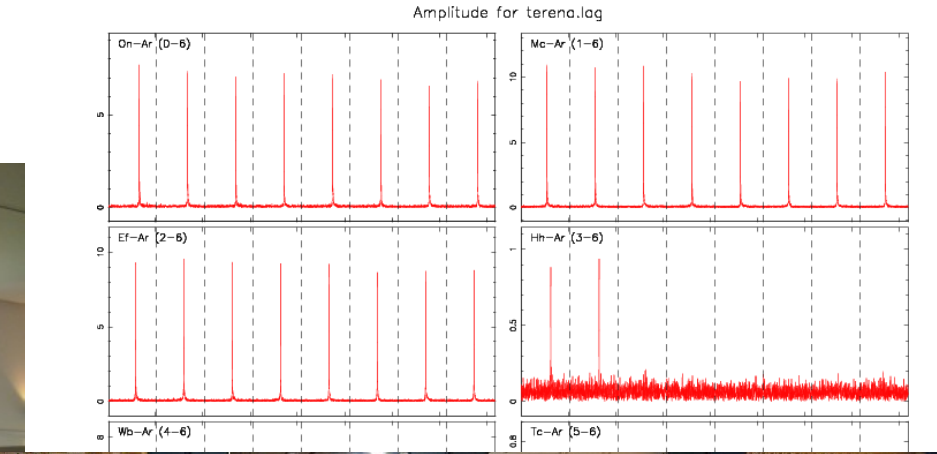
- 4-continent e-VLBI
- 4-continent fringes!
- Mixed-configuration observation

Demonstrations and visibility

- Fantastic way to focus effort
- But can be really disruptive and time-consuming...

The International Year of Astronomy

- The mother of all demos (MOAD) during opening ceremony of IYA, 15-16 January 2009 in Paris

  - 24 hours real-time tracking of one source
  - 6-continent e-VLBI

  - Although we may have to cheat a little

  - Until now, positive responses from Kashima, Oz, Hart, Shanghai, Arecibo; Westford and TIGO still wait for IVS schedule. VLA is unsure
  - Will feature real-time build-up of image (calibration may be a bit doubtful)
  - And educational items like an interactive program to show different results with different telescope configs
  - Remote control of Oz telescopes
  - Suggestions welcome....