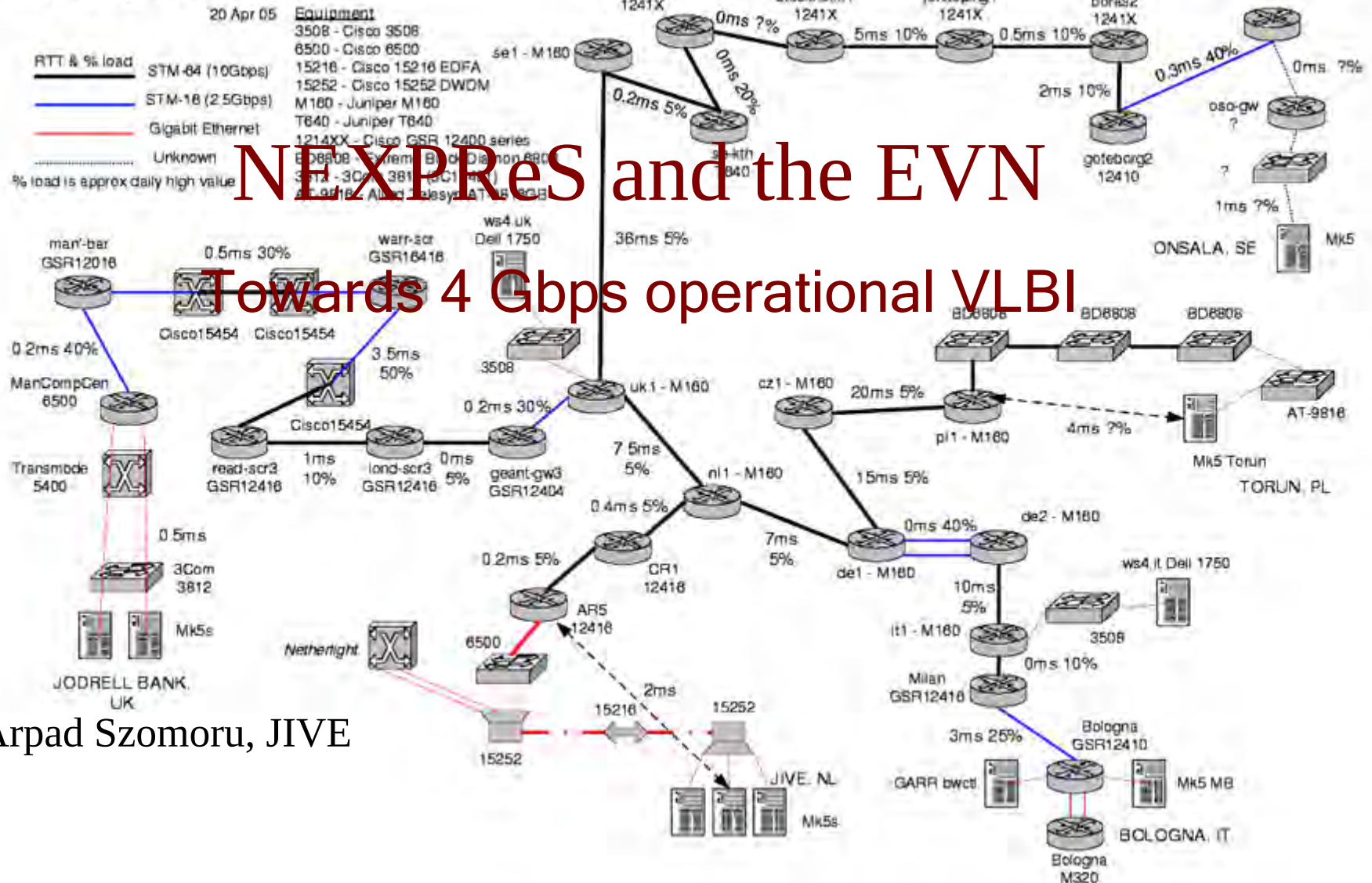


Routes across GEANT used by eVLBI MkVs



Arpad Szomoru, JIVE

- Overview of NEXPreS
 - Rationale, structure
 - Several talks on specific aspects later on during workshop
- Status of Work Packages 7 and 5
- Towards 4Gbps VLBI operations



*Novel EXplorations Pushing Robust e-VLBI
Services*

- Works great!
 - Stable, robust connectivity
 - Big telescopes, long baselines at full 102
 - Enabling new science, increasing demand
- But, limitations remain...
 - Some (important) telescopes will not (ever?) be able to join
 - KVAZAR, Urumqi, global baselines with VLBA...
 - No such thing as a perfect system/hardware, failures do occur
 - Re-correlation with different parameters currently impossible
 - Higher bandwidth/data rates becoming available, crucial for science
 - Need to accommodate 2, 4, 10? Gbps per telescope
 - 4 Gbps dBBCs being rolled out in EVN
 - 100 Gbps technology on its way





Novel EXplorations Pushing Robust e-VLBI Services

Correlate in real time what you can
Correlate later what you need

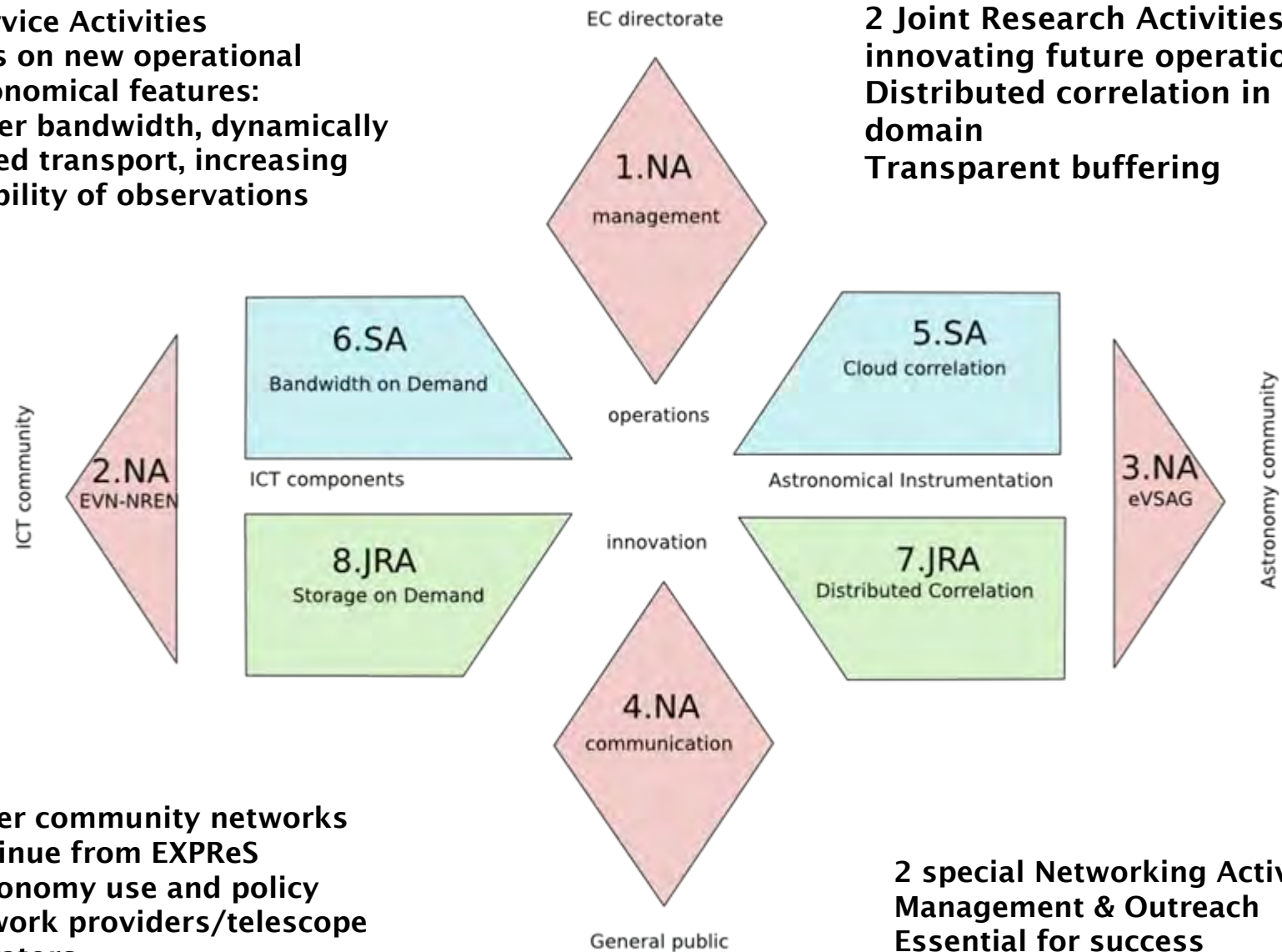
NEXPreS: EXPreS follow-up

- Project has started July 1, 2010
- 15 partners (cf. 19 in EXPreS)
 - Good mix from astronomy-networking-HPC communities
 - High level of partner-contributed effort
- Main objective: introduce transparent caching
 - Bring increased sensitivity, flexibility and robustness of real-time VLBI to all EVN experiments
 - Deploy a high-speed, flexible caching system
 - allow transparent re-transmissions and/or re-correlation
 - Remove distinction between VLBI and e-VLBI operations
 - Continue collaboration with NRENs
 - Explore common technology questions with LOFAR, SKA
 - Prepare the EVN for higher bandwidths to come
- Continuity for e-VLBI operations

NEXPreS structure

2 Service Activities
focus on new operational
astronomical features:
Higher bandwidth, dynamically
cached transport, increasing
flexibility of observations

2 Joint Research Activities aiming at
innovating future operations
Distributed correlation in astronomy
domain
Transparent buffering



2 user community networks
continue from EXPreS
Astronomy use and policy
Network providers/telescope
operators

2 special Networking Activities
Management & Outreach
Essential for success

- WP6: High bandwidth on demand (presentation Boven)
 - Permanent, static links are very convenient, but under-used, and limited to 1Gbps
 - Integrate e-VLBI with existing BoD techniques
 - Investigate on-demand access for large archives
 - Establish international multi-Gbps on-demand services
 - Keen interest in networking community, not all NRENs in agreement
- WP8: FlexBuff (presentation Salminen)
 - Develop buffering solutions capable of multi-Gbps simultaneous I/O streaming
 - Investigate use of LTAs, allocation of resources

WP 7: Computing in a shared infrastructure

- Partners: PSNC, OSO, VENT, JIVE
- and Curtin through CSIRO for global correlation
- Create an automated, distributed correlator using the global, shared infrastructure of the EVN and its global partners in order to
 - Make use of otherwise unused telescope time
 - Surveys
 - Astrometric monitoring programmes
 - Targets of Opportunity
- Realizing that resources are scarce (staff time, disk pool, correlator time)

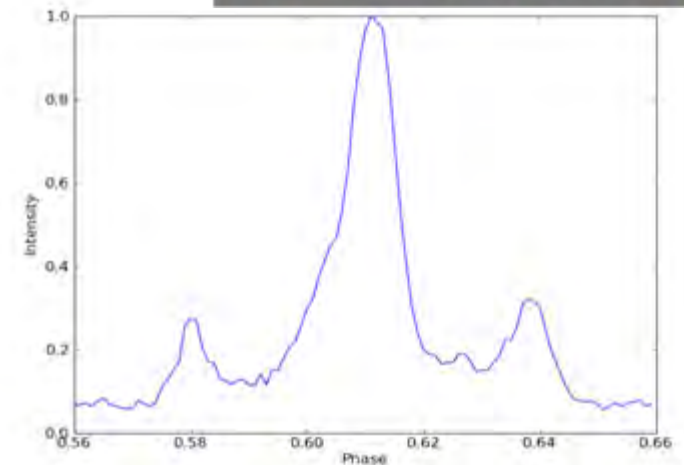
Data from 2008 NME C band 10 stations

WP 7: principles

- e-VLBI: no impact on disk resources
 - Software correlation: no impact on hardware correlator reduced need for correlator operators
 - Workflow Manager: limit impact on telescope operators
 - Distributed computing: pool resources for larger observations
 - Innovative observation strategies: triggers that automatically interrupt background observations
-
- Strong dependence on SFXC capabilities

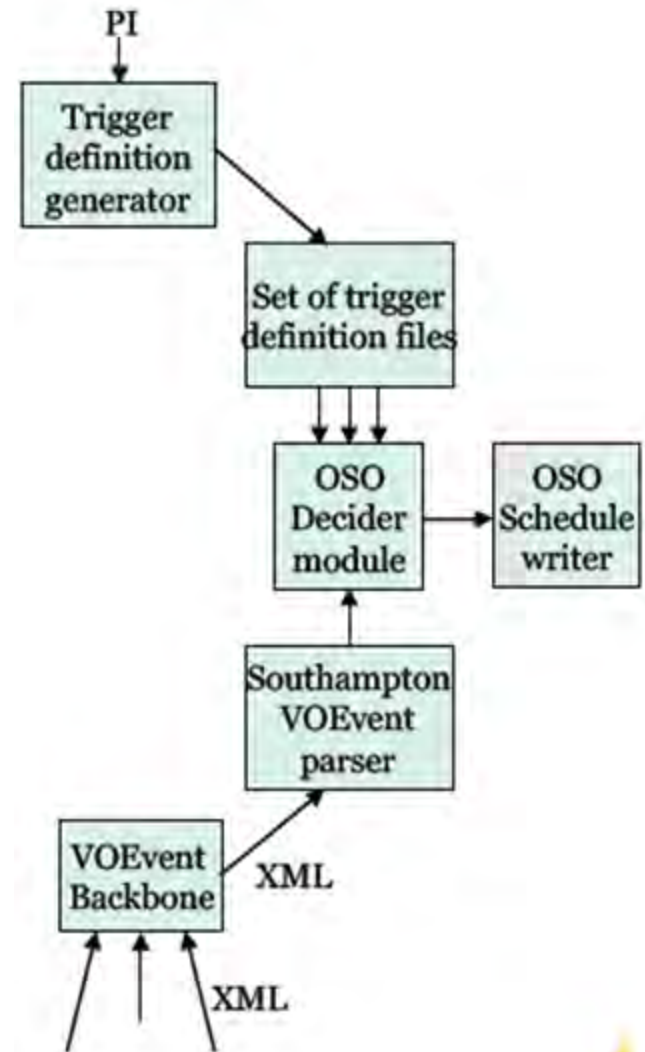
Data from 2008 NME C band 10 stations

- Developed at JIVE
 - First used for Huygens descent on Titan
- Multiple phase centers
- Pulsar gating/binning
- Phasing up of EVN
- Windowing functions: Rectangular, Hann, Hamming, Cosine
- Space Science features:
 - Improved delay tracking for high spectral resolution
 - Near-field model (Dmitry Duv)
- Operational tools
 - weight display, fringe display, clock search tool
- All disk-based VLBI now correlated on SFXC
 - e-VLBI to follow shortly



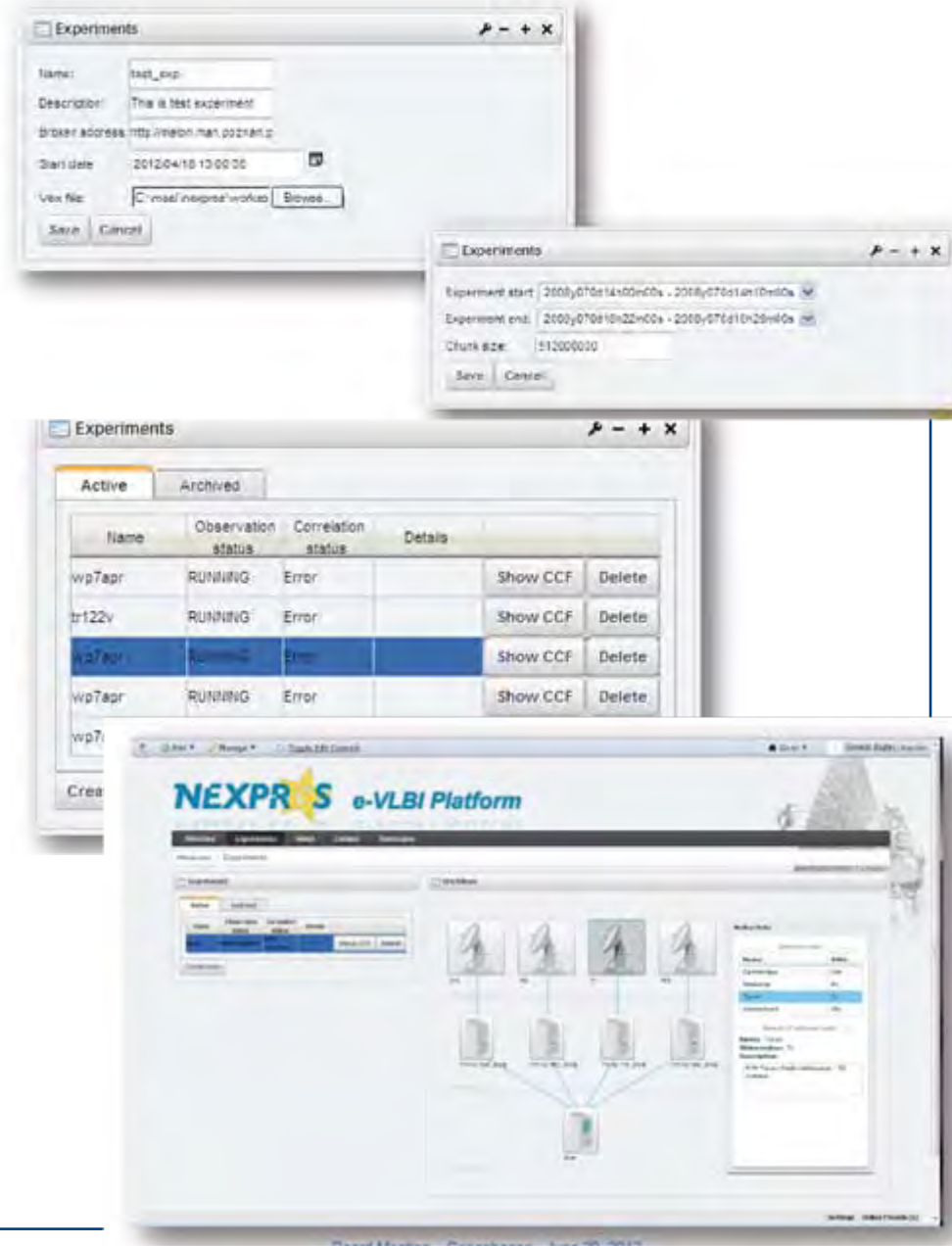
WP 7: software modules (OSO)

- Station module
 - Runs on FS PC, interface between FS and WfM
 - Receives schedules, drudges
 - Start-stop operations
- Decider module
 - Receives VOEvent, compares with trigger definitions
 - Makes decision whether to observe or not, and when
 - Send observation parameters to
- Schedule writer
 - Produces standard VEX file
 - Submits it to WfM



WP 7: Work flow Manager (PSNC)

- Simplifies and enhances work of various actors: PIs, administrators, operators
- Dedicated widgets, called portlets, to create, submit and monitor e-VLBI observation
- Liferay portal
- Authentication and authorization
- Roles, permissions for groups, communities
- Communication between users (alerts, chat, shared documents)



- Partners: AALTO, TUM, MPG, JIVE
- Extend the benefits of real-time e-VLBI to *all* EVN observations
- Transforming the VLBI operational chain
 - scheduling
 - setting up of observations and actual observing
 - buffering, transferring and correlation of the data
- Prepare the EVN for the much higher data rates that are becoming available, both recorded and real-time
- Accommodate bandwidth-on-demand techniques (topic of WP6) in a transparent and efficient way
- Implement monitoring, authorization and remote control (presentations Neidhardt and Ettl)

Data from 2008 NME C band 10 stations

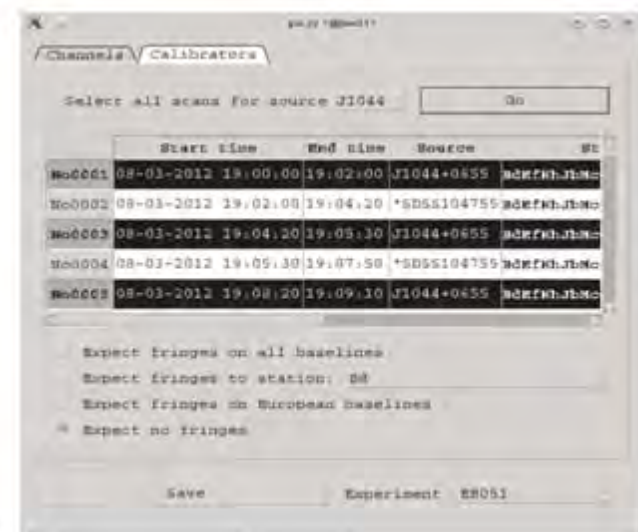
WP 5: Progress at JIVE

- Further increase of functionality of Jive5AB Mark5 (and more) control code (presentation Verkouter)
 - Recently: implementation of full Mark5 command set
- New monitoring and alarm system at JIVE
- Buffering control and administration of multiple copies
 - All based on completely re-designed database structure
- First steps towards automated fringe tests
 - Without disruption of science observations
 - Or human intervention
- First full implementation of disk-less recording – transmitting – correlation

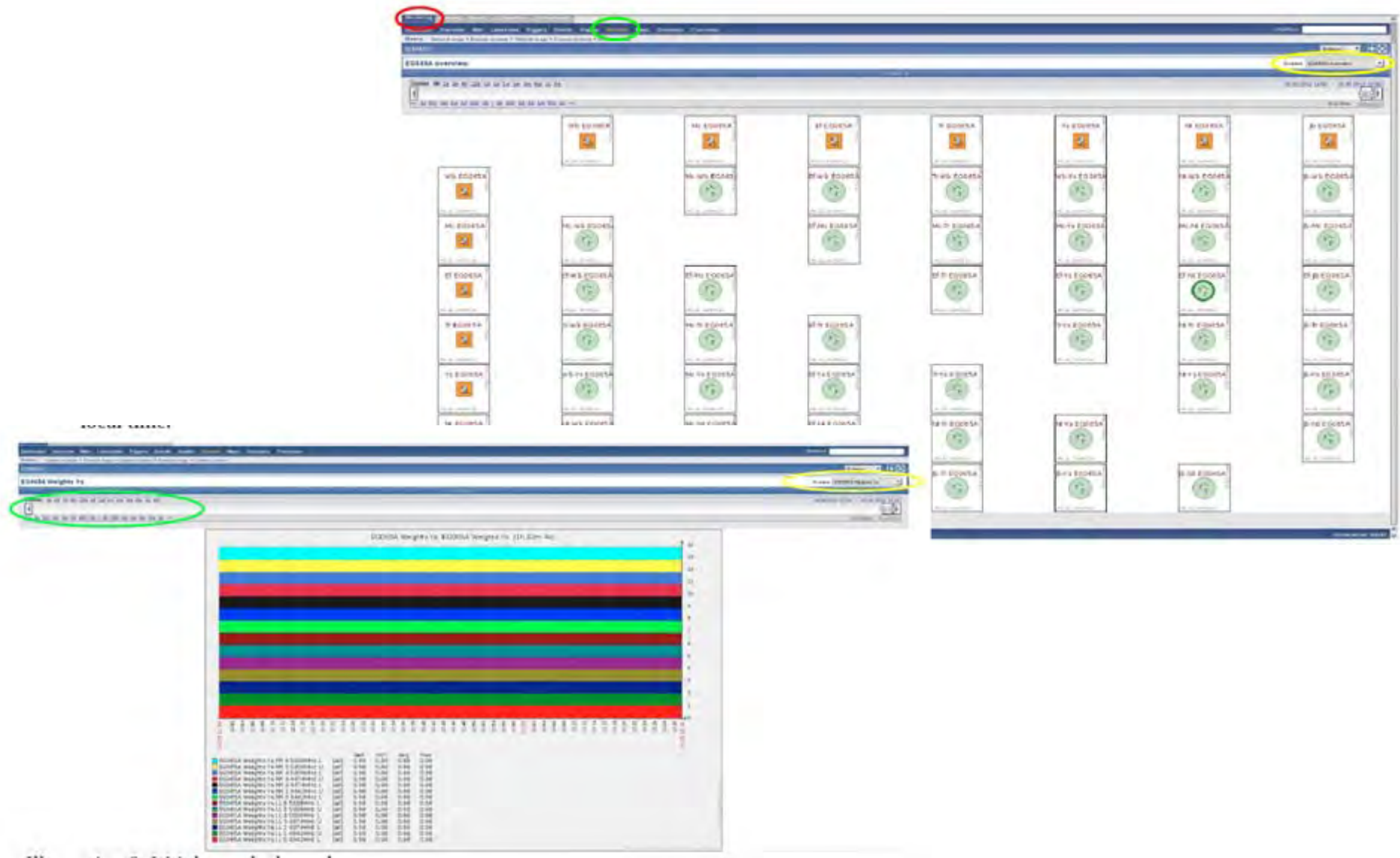
Data from 2008 NME C band 10 stations

Continuous Automated Intelligent Monitoring system

- Based on Zabbix
 - Used for monitoring hardware health of Mark5s, cluster nodes, switches, etc
- Monitors “quality” of fringes of selected calibrators, weights
- Generates warnings via email (or sms)



CAIM: fringe and weight monitoring



- Several deliverables depend on availability and roll-out of 4Gbps-capable equipment
 - Mark5C recorders
 - DBBCs (digital baseband converters)
 - Fila10G boards
 - VDIF support
 - Firm- and software for all of the above
- Towards end of 2011: no indication any of this was happening
 - Mark5C: only 2Gbps
 - DBBC: had only been tested in 1 and 2Gbps mode
 - Only 1 DBBC operational within EVN
 - Fila10G: only Mark5B format, no VDIF support, untested
 - No plans, or available staff, to write additional firmware for Fila10G
 - Production of DBBC and Fila10G delayed
- Things were looking bleak...

- Several telecons with EVN TOG officers, designer of DBBC, Haystack engineers
 - Re-affirmation of commitment to work towards higher bandwidth
 - Attempt to speed up development, fix timeline
 - Detached JIVE engineer to Haystack January 2012
- December 2011: discussions with EC officer on deliverable 5.2
 - Demonstrate progress of WP5 through live demo
 - 3 EVN stations (On, Yb, Ef), 4Gbps recording, simultaneous real-time 1Gbps correlation
 - Before end of second period (July 1st 2012)
 - Unfortunately tests had to be done during gaps in block schedule
- Imposed a clear timeline, for all parties involved
- Focus for the effort of several deliverables in WP5

4Gbps recording/1Gbps (or more) real time

- DBBCs in PFB 4Gbps mode: untested
- Yb DBBC sent back to MPG for troubleshooting, no Mark5C at Yb
- On DBBC: clock jumps
- Fila10G cards
 - Only 3 available (4?) available in all of Europe
 - Of which one was sent to Chile...
 - Only ever tested at 2 Gbps
- Mark5C recording at 4 Gbps
 - Never tested in EVN(?)
- Yebes 10G connection not lit yet



Telescopes



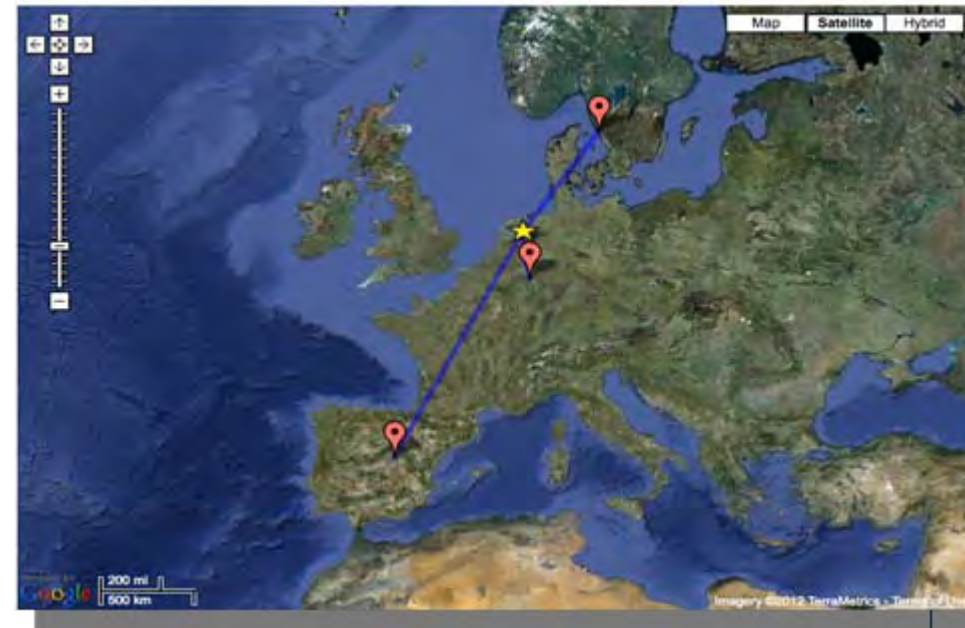
With thanks for the kind cooperation of



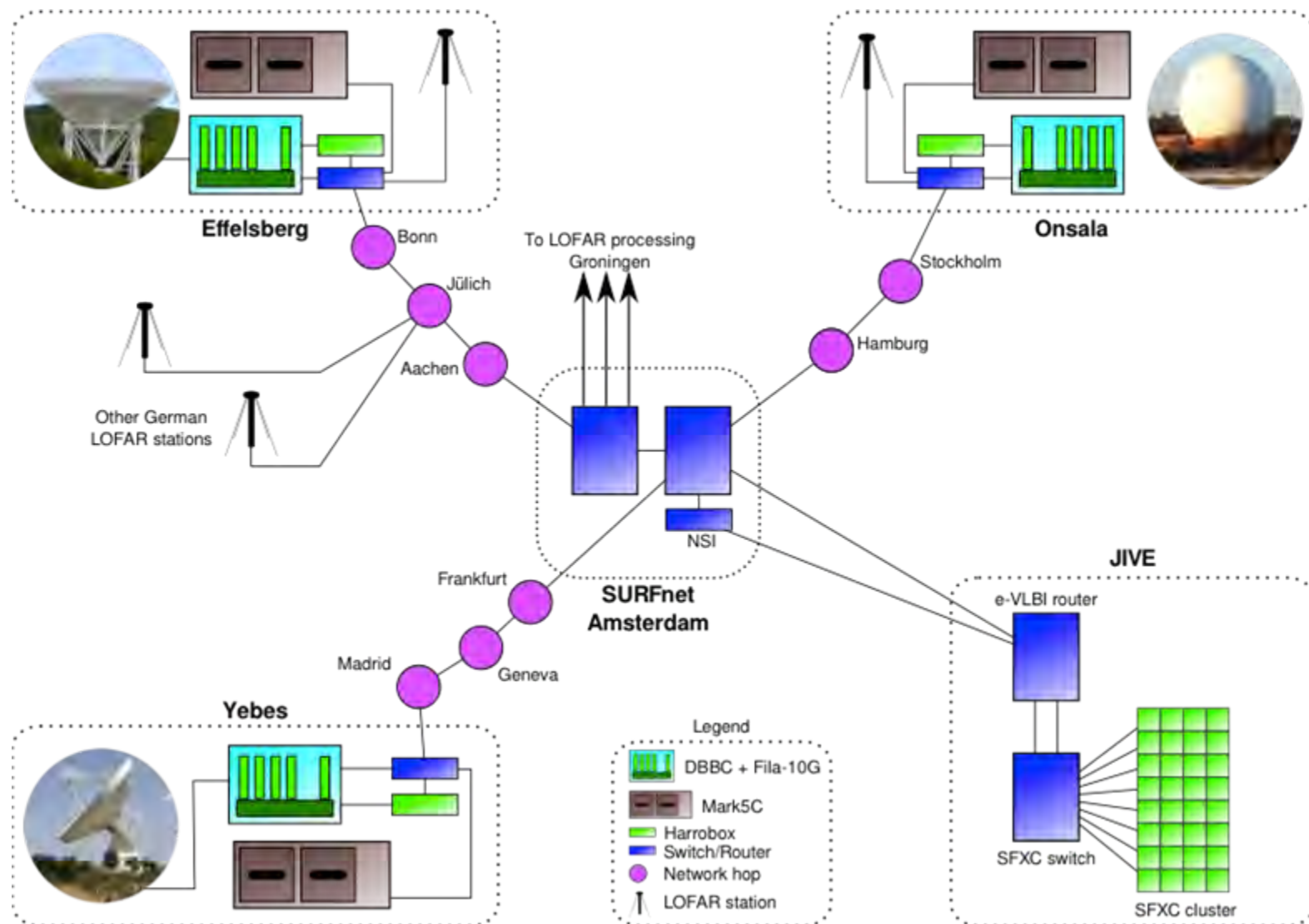
What could possibly go wrong!!!

Lots of activity

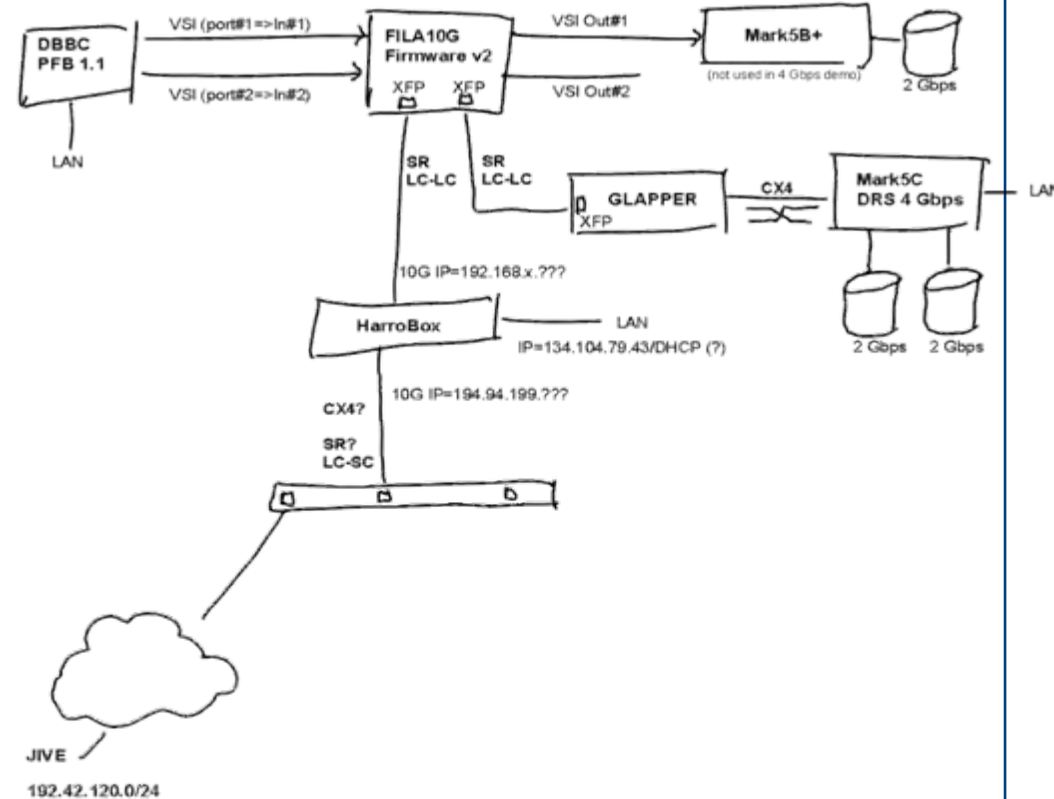
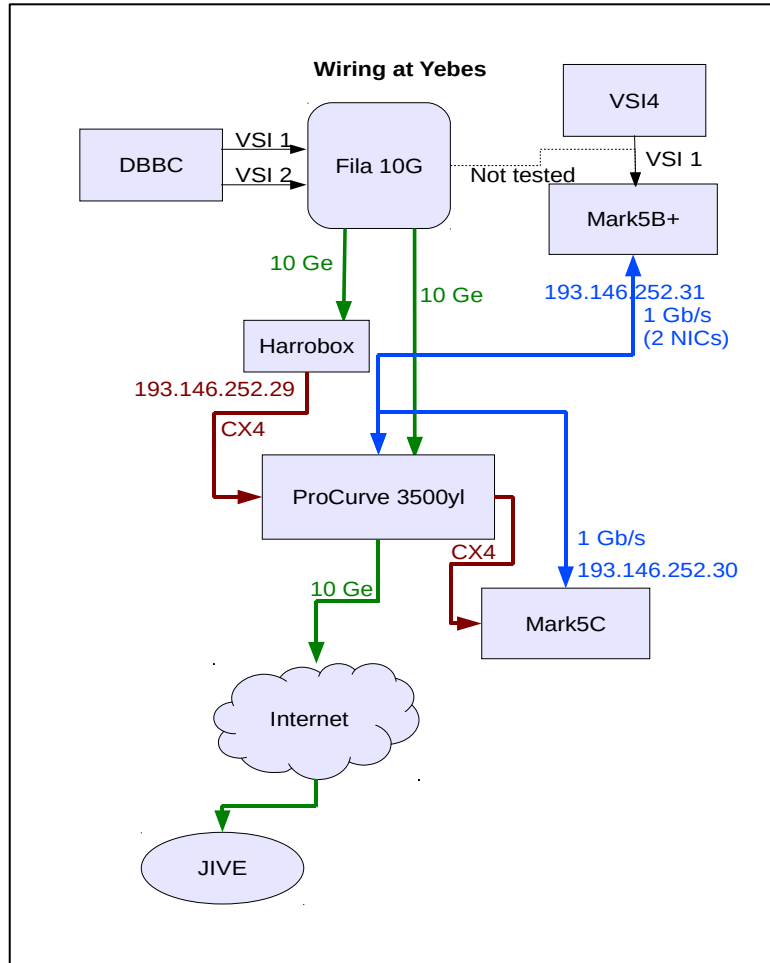
- Countless telecons
- Mark5C shipped from JIVE to Yb
- Fila10G from Chile to Germany in hand luggage (stuck in customs)
- Fila10G for Mh on loan to Yb
- Modules for switches, cables
- Powerful 1U servers with multiple 10G interfaces purchased, shipped to stations, installed (HarroBoxes)
- Software for “chunking” written
- Modifications to SFXC correlator
- *much* testing, bug fixing, new insights
- Excellent way to get many techniques and tools developed in NEXPReS to actually work and work together
- Fantastic support from networks



4 Gbps demo

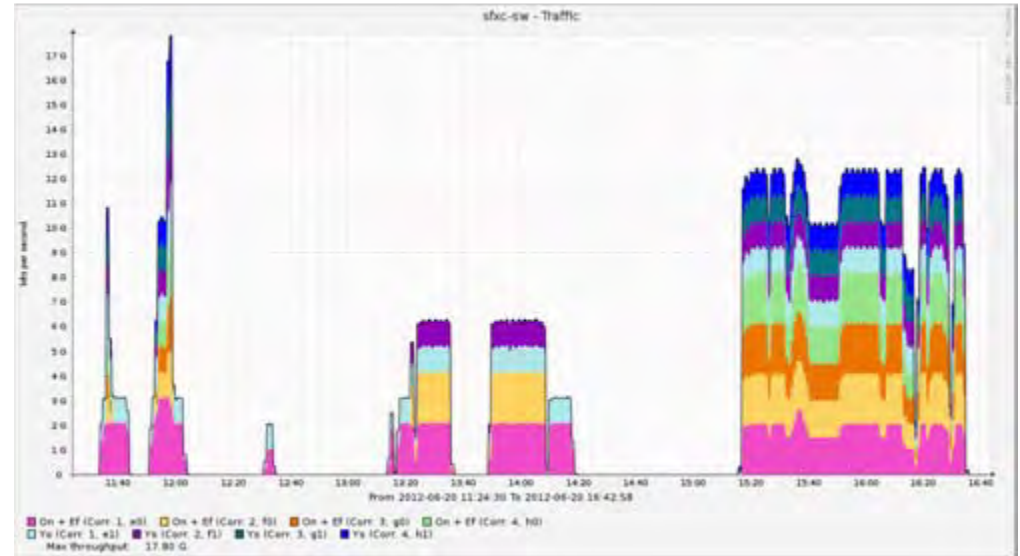


4 Gbps demo: local networking setup



4 Gbps demo: results (June 20)

- Some initial problems
 - Flooding
 - Mark5C configuration
 - Scan length recording issue
 - Some packet loss at Ef
- But, technically everything just worked!!!
- All equipment keeping up
- Networks stable and performing flawlessly
- But..... No fringes
- DBBC configuration, Fila10G time synchronization?
- Completely new equipment, need to learn
- Anyway, EC officer and review panel were well pleased



4 Gbps: the future

- New attempt soon(ish)
- Maybe demo during final review of project (what could possibly etc etc)
- Common LO settings need figuring out
- Idem wrt globals at 2Gbps
- Need all stations to start using DBBC for production, slow process
- Will need more disk packs...
- Even core 4Gbps network of just 5 EVN stations at would probably be very much in demand