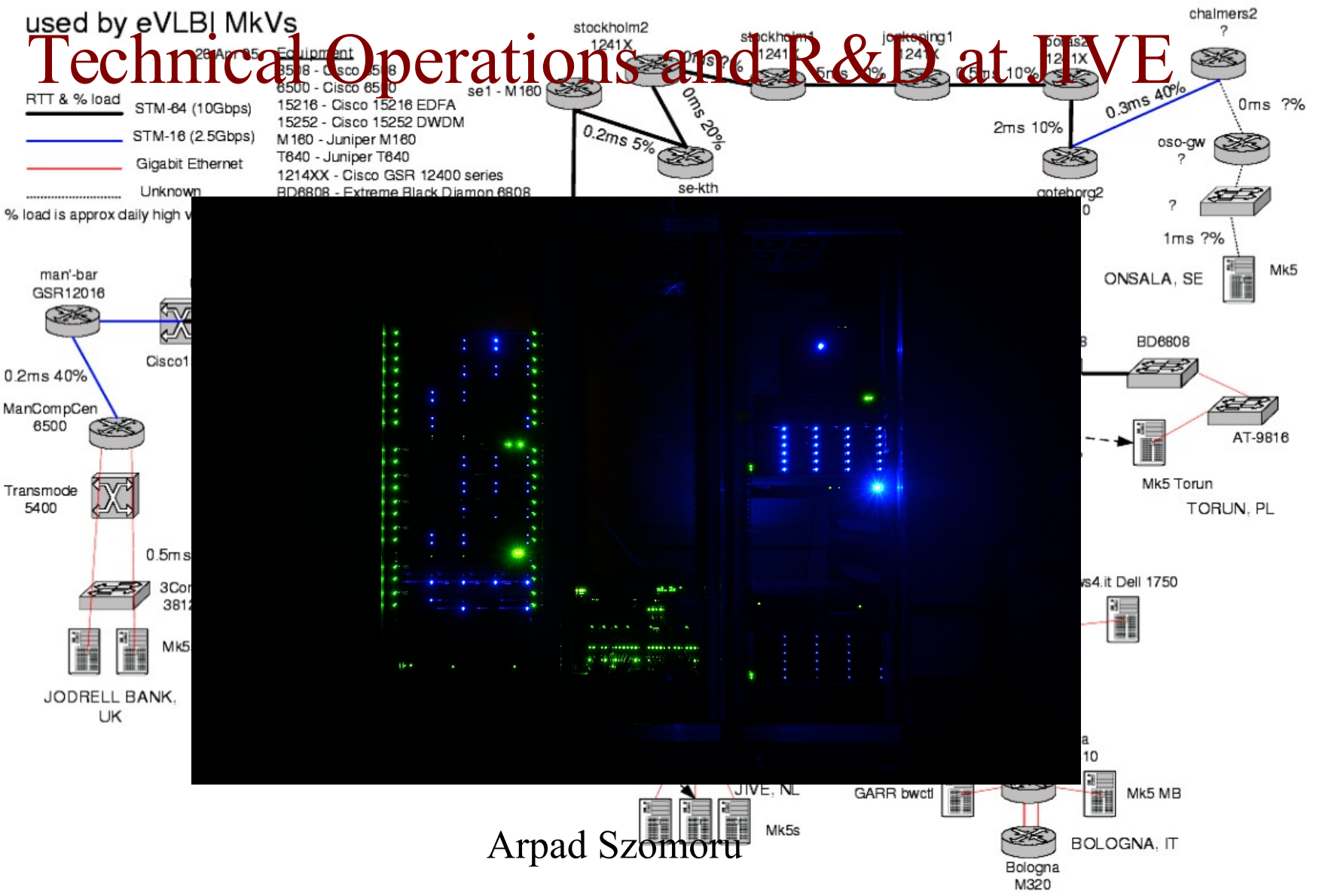
Technical Operations and R&D at JIVE



Arpad Szomoru

What do we do?

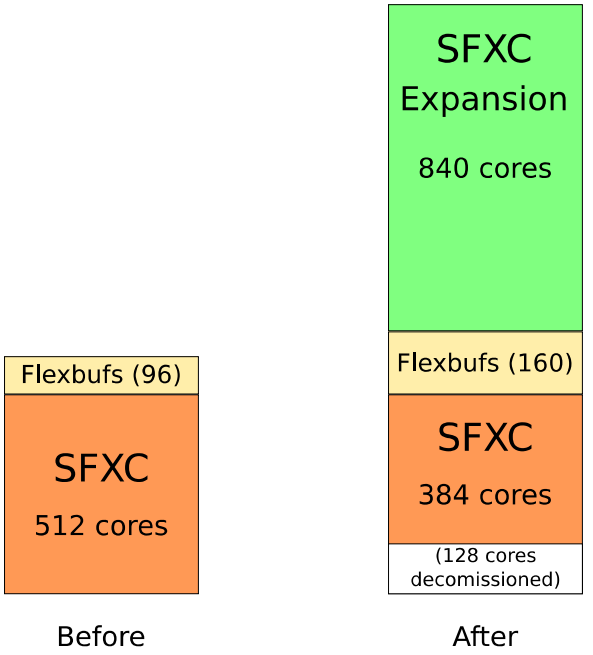
- Correlators
  - More capacity, new telescopes, development of AVN, new features, MeerKAT VLBI
- Data recording/playback/transport
  - Real time/near-real time, higher bandwidths, 2 and 4Gbps
- Automated operations
  - Get rid of disk shipping
  - Monitoring, automated fringe checking
  - Triggered observations, multi-messenger astronomy
  - Fringe checking for BlackHoleCam
- Software
  - User software, VLBI with CASA
  - CASA in Jupyter notebooks, containerisation
  - Simulations for BlackHoleCam
  - SCHED re-factoring
- Time and frequency transfer
  - SAT architect in SaDT consortium
  - Transfer over public networks: demo involving Wb, Dw, LOFAR, SURFNet

JIVE R&D

- Continued development of Jive5AB
  - Talk by Harro Verkouter
- Used expertise for creation of file transfer tool
  - Part of Cleopatra WP in Asterics
- FlexBuff recording expanding
  - Many new machines
  - Aim to move to all-2Gbps recording
    - CBD decision
  - 10 TB disks now in general use
  - SSDs still way too expensive….

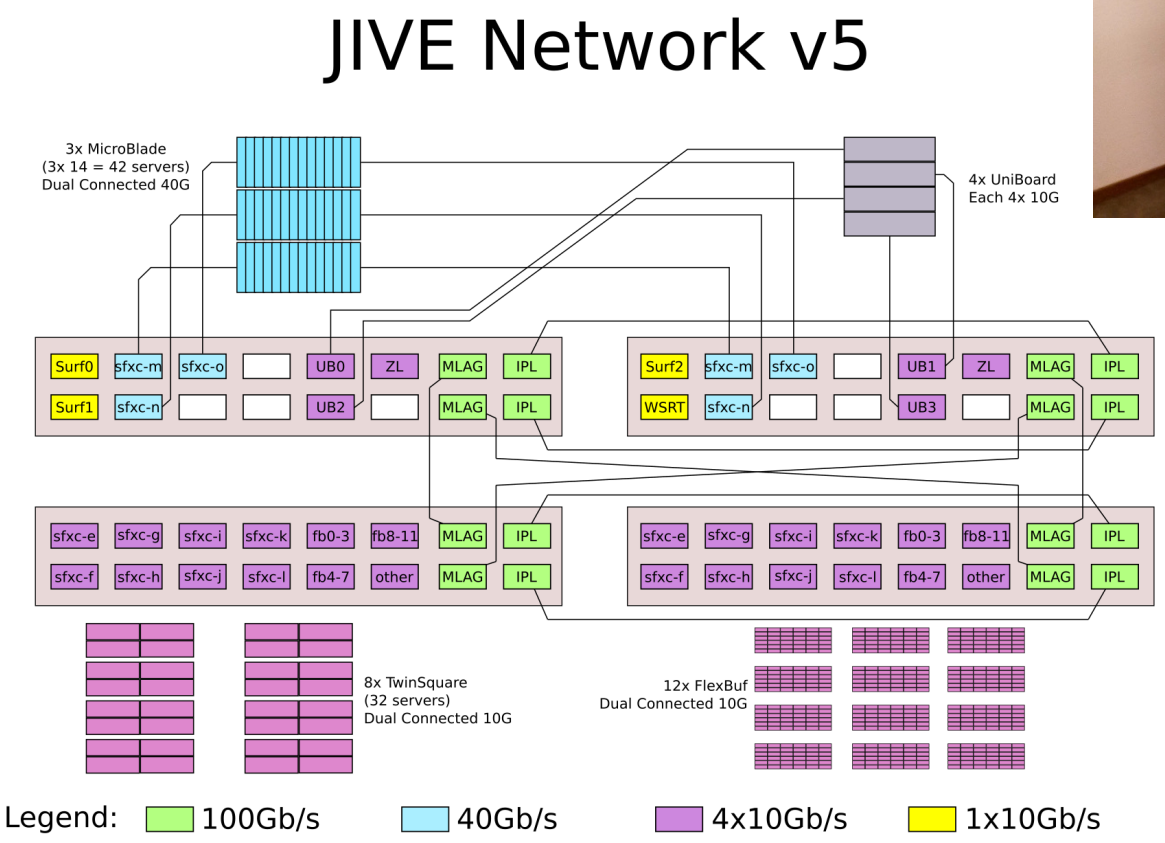
More…

- Massive expansion of SFXC hardware



More…

- Complete overhaul of local network

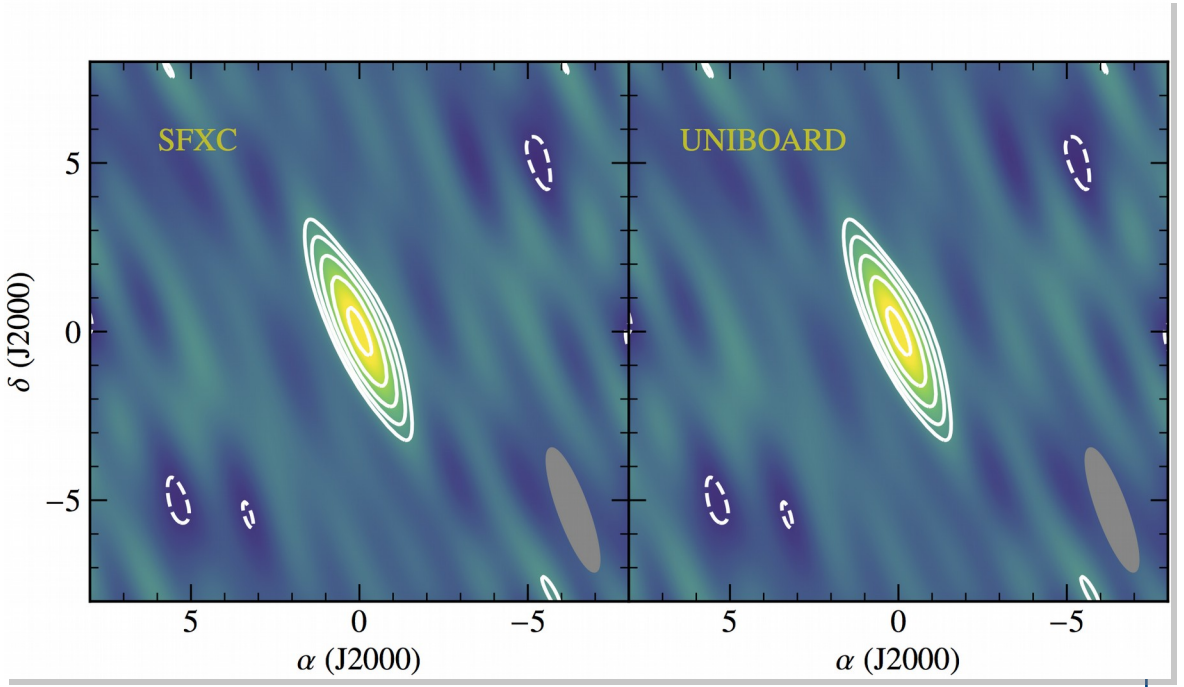


More…

- 2 Gbps e-VLBI operational
  - But what about 4 Gbps…?
- 2 KVAZAR stations recently tested again in e-VLBI mode
  - 1 Gbps per station
  - Although not (yet?) simultaneously
  - And now what?
- E-Merlin stations back in the fold
  - At least kind of
  - 1 bit went up to 2 bits, still some issues
  - But well done anyway!
- But, will e-VLBI with Merlin ever return?

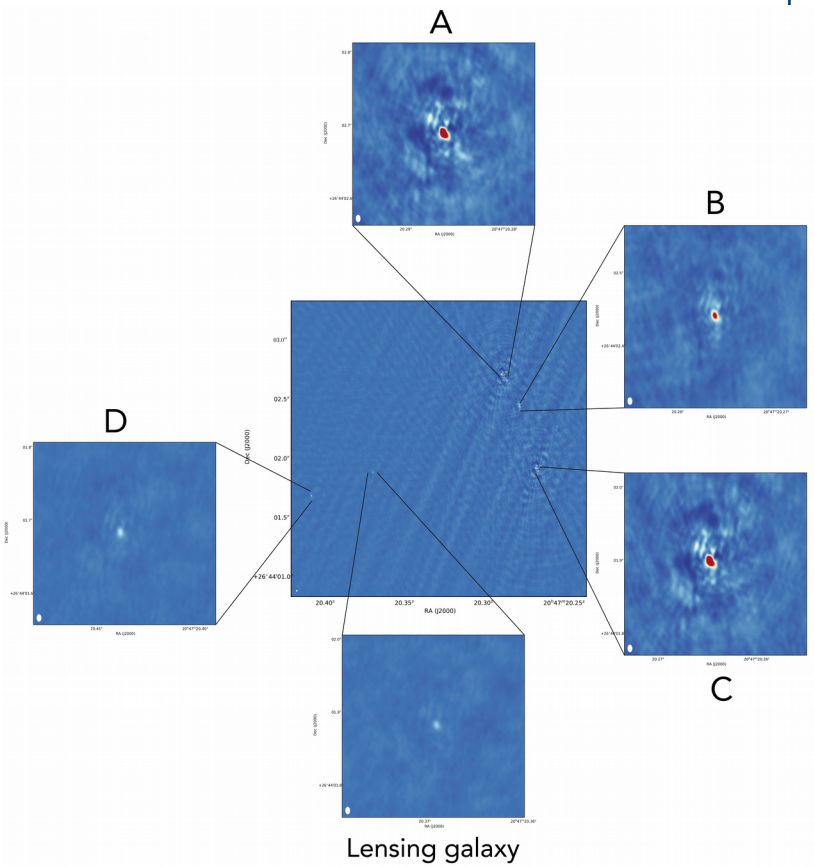
JIVE UniBoard Correlator (JUC)

- JUC tested for e-VLBI
  - Control software re-written, stable
  - Needs Fila10G in corner turning mode
  - Which means small packets of 1000B
    - Maybe 2000
    - Several real-time tests
  - Now testing final problems with DBBC simulator
    - As soon as simulator debugged
  - Per board:
    - 32 stations at 64 MHz
    - Dual pol
  - 4 boards: 16 stations at 4 Gbps
  - Jonathan moved to ASTRON
    - Still 1 day/week at JIVE



R&D User software development

- CASA fringe fitting
  - in RadioNet RINGS
  - Basic version in next (?) CASA release
  - New features in development branch
    - Mainly for BlackHoleCam folks
    - Dispersive fringe fitting for RINGS
    - Needed for BRAND
- Continued support for ParselTongue
- OBELICS work package in ASTERICS
  - Minimize re-calculation when changing parameters during data reduction of large data sets
  - Nice results with CASA in Jupyter
    - Containerised: docker and singularity
  - Generated much interest
  - Demonstration server set up



R&D User software development

- SCHED re-factoring
- Using f2py to create Python main loop
  - All fortran routines appear as Python objects
  - But can add new Python functionality

- VEX2 writer done
- QT and Matplotlib available instead of PGPLOT
- Keyin reader re-written
- Allows the use of a templating language to generate and run KEYIN files

- Now working on a build system
  - Let the whole thing loose on our support scientists

KAT7 VLBI

- KAT7: prototype array for MeerKAT
- Not really maintained anymore, KAT4
- All efforts towards MeerKAT
- Still much interest in VLBI

- Harro has been analysing sample of KAT7 data
  - Pretty clear data is corrupted
  - Not worth trying new observations with KAT7

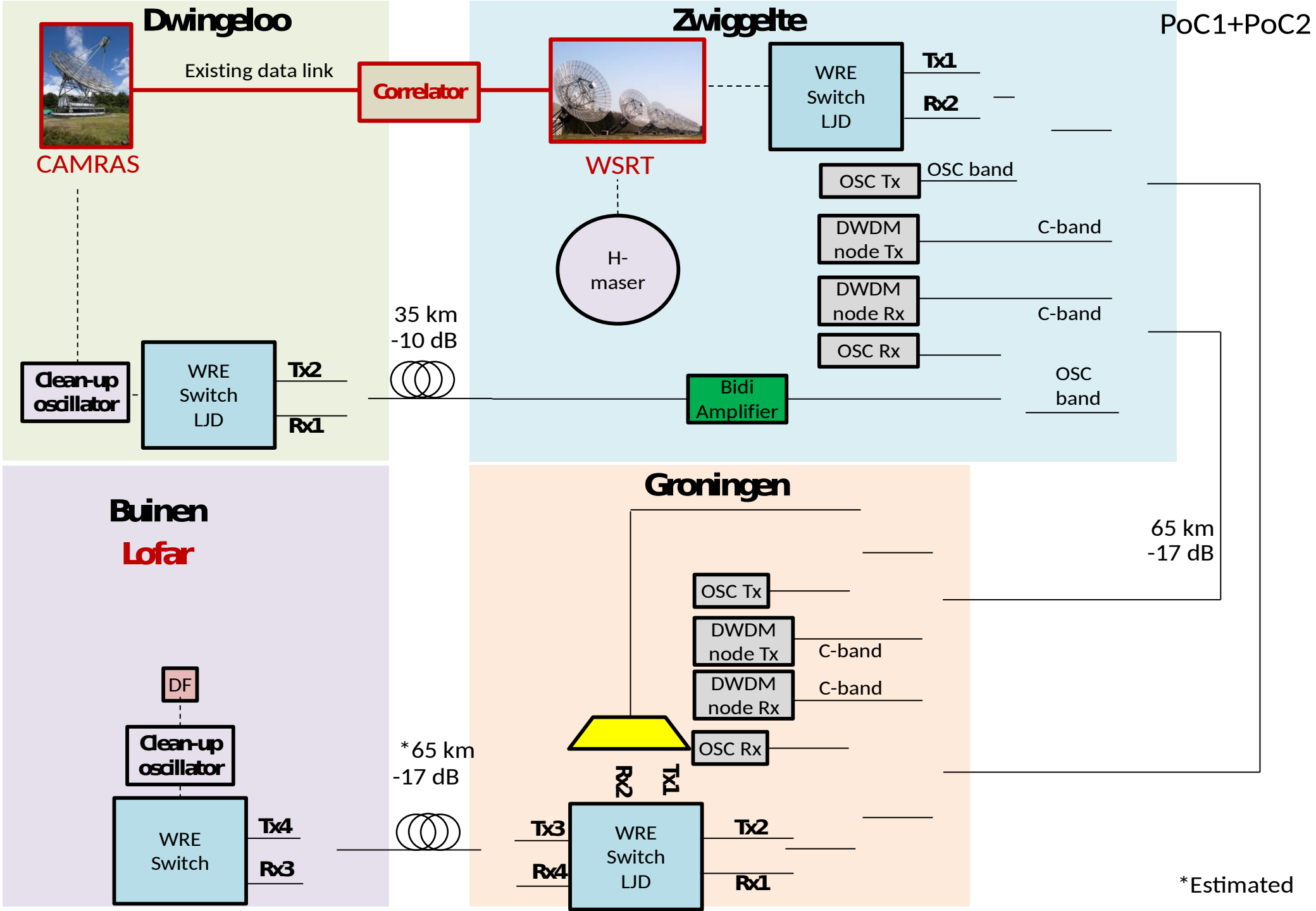
- New attempt, this time several scans with MeerKAT
  - 16 phased up dishes, also single dish
  - During recent NME
  - Now waiting for data to arrive

JIVE

WP5 - CLEOPATRA: Connecting Locations of ESFRI Observatories and Partners in Astronomy for Timing and Real-time Alerts

- Led by JIVE
- Time and frequency transfer
- relaying alerts (warning system for transient events, also in EVN)
- data streaming software (builds on Jive5ab experience)
- advanced scheduling algorithms for complex, large arrays (mainly for SKA, CTA)

- Possible follow-up project: ESCAPE
  - Deals with European Open Science Cloud (EOSC)
  - ASTERICS partners + ESO, CERN, SKA


Dwingeloo
Existing data link
Correlator
Zwiggelte
PoC1+PoC2
CAMRAS
WSRT
WRE Switch LJD
Tx1
Rx2
OSC Tx
OSC band
DWDM node Tx
C-band
DWDM node Rx
C-band
OSC Rx
OSC band
H-maser
35 km
-10 dB
Clean-up oscillator
WRE Switch LJD
Tx2
Rx1
Bidi Amplifier
Buinen
Lofar
Groningen
65 km
-17 dB
OSC Tx
DWDM node Tx
C-band
DWDM node Rx
C-band
OSC Rx
Rx2
Tx1
DF
Clean-up oscillator
*65 km
-17 dB
WRE Switch
Tx4
Rx3
Tx3
Rx4
WRE Switch LJD
Tx2
Rx1
*Estimated