The LOFAR EoR Key Science Project:

Experience, feedback and wishes for the future

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for the LOFAR EoR project team

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Experience with LOFAR (operations)

- Scheduling & Observing: Projects LT5_009 (530h)

Excellent communications with RO staff
Useful & fast feedback: email + on-line 'autoplots'

- Initial data processing (CEP2)

No need for CEP2 processing resources
Still delays in removing data from CEP2 ($\rightarrow$ Dawn , waiting for Dawn $\rightarrow$ SARA)

- Datatransfer, archiving & data access

Direct CEP2 $\rightarrow$ EoR transfer (Dusk and Dawn clusters)

$\rightarrow$ extra work to archive our data (15ch/sb and 2s per) on LTA/(SARA
 (issues with SIPS,   Mehdi Hatef/Jorrit Schaap/Pandey))

Worry: still 300TB of (Cycle0-1) data remaining on LTA/Target node

Current transfer/processing logistics for the EoR project

As of late Nov 2015 we have our new EoR 2.0 (**Dawn**) cluster operational at CIT/Landleven. It is located next to EoR 1.0 (**Dusk, from 2010**) . Dusk and Dawn are connected via a 10Gbps network. About 75% of Dusk will continue to be used.
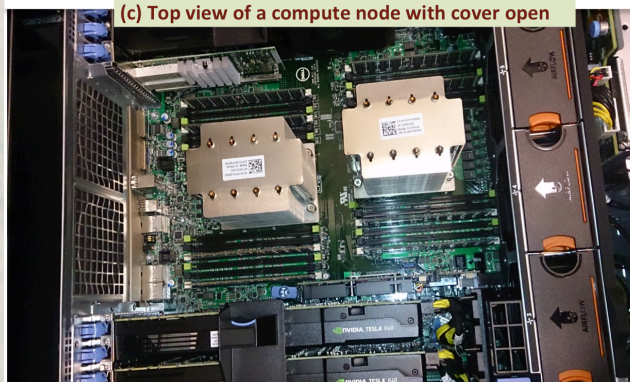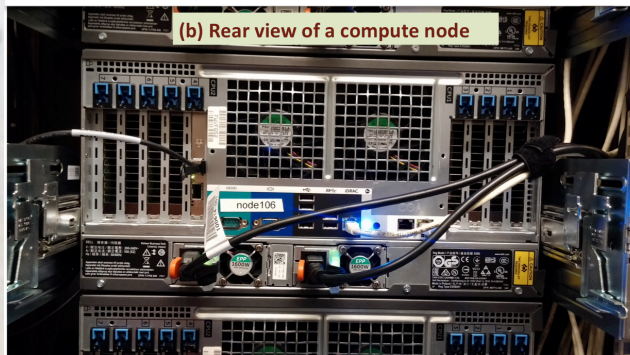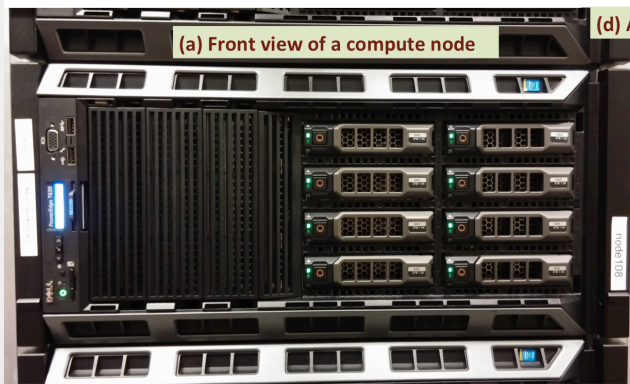
Dawn is now (March 2016) connected to the LOFAR network via (4x)10 Gbps
There are 10 Gbps lines to TARGET, SARA, Julich , Poznan. However, we do NOT have this speed both ways as yet, i.e. it still takes a lot of time to bring data back !

Dawn has a very fast backplane switch allowing 144 signals x 10 Gb/s simultaneously !
All 32 nodes have 48 CPU cores + 4 GPUs and have 128 GB of memory (fast DDR4). Processing power is 550 Tflops (single) and 180 Tflops (double) on the GPUs as well as 26Tflops on the CPU (this is 5-10x faster than Dusk)

Data storage:

All (flagged+4x freq-averaged) 'raw'data (i.e. 15ch/sb and 2s) are/will be stored on the various LTA nodes (SARA, Julich, Poznan). All our intermediate resolution products (3-5ch/sb and 2-4s) can now be stored on our own clusters and storage disks (0.3 TB on Dusk, 1.1 PB on Dawn). In addition we have 0.7 PB storage at ASTRON (a.k.a. LOFARCORE01). There we will also store all images(cubes)

Composite image of elements of the Dawn cluster at CIT Groningen

(a) Front view of a compute node

(b) Rear view of a compute node

(c) Top view of a compute node with cover open

(d) A cluster rack with eight compute nodes

Courtesy Pandey

(e) Network of the Dawn cluster. The 10GbE high speed switch (on top with black and yellow cables), 1GbE login/authentication switch (second from top with white cables) and th 1GbE remote management (iDRAC) switch (third from the top with white cables). The green LEDs indicate active network/transmission. Just below the remote management switch is the Headnode cum software server (blue LEDs) of the cluster. The compute nodes are placed in two racks each on both side of the network rack.

See ASTRON Newsletter Winter 2015/16

Data quality in LT5_009

- Station behaviour: generally good and now include CS013 (8% sensitivity boost for EoR low resolution work) !!
- Occasional dropouts of one station CS003,006,007,101, RS409, RS210, …

- Still significant gain/sensitivity differences between the 48 CS

- Ionospheric stability: much better than in Cycle 3 winter (2014/2015)

- About 33 % of our data have 8-9 international stations

- Some very nice recent datasets with 10 SAPs (NCP) and 20 SAPs (3C196) including one with 12 international stations ! Perhaps more on those on Wednesday !

- In cycle 5 we suffered from RFI which correlates only on core baselines:

Thursday   22 October 2015

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Friday   23 October 2015

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Some wishes/improvements for the future

- More attention for the still significant scatter in CS sensitivity (> factor 1.5) (i.e improved station calibration?)
- Improved delays for CS (which after all is on same clock and very stable)
- R & D work to improve models for the element and station beams
- Fast switching between HBA and LBA (60s → 10s): ionospheric calibration
- Possibility to observe in RCU mode 6 ?
- Attention to RFI threats from DAB+