



RadioNET FP7: Multi-UniBoard Applications

UniBoard Face-to-face Meeting, Bordeaux, 12-13 October 2010

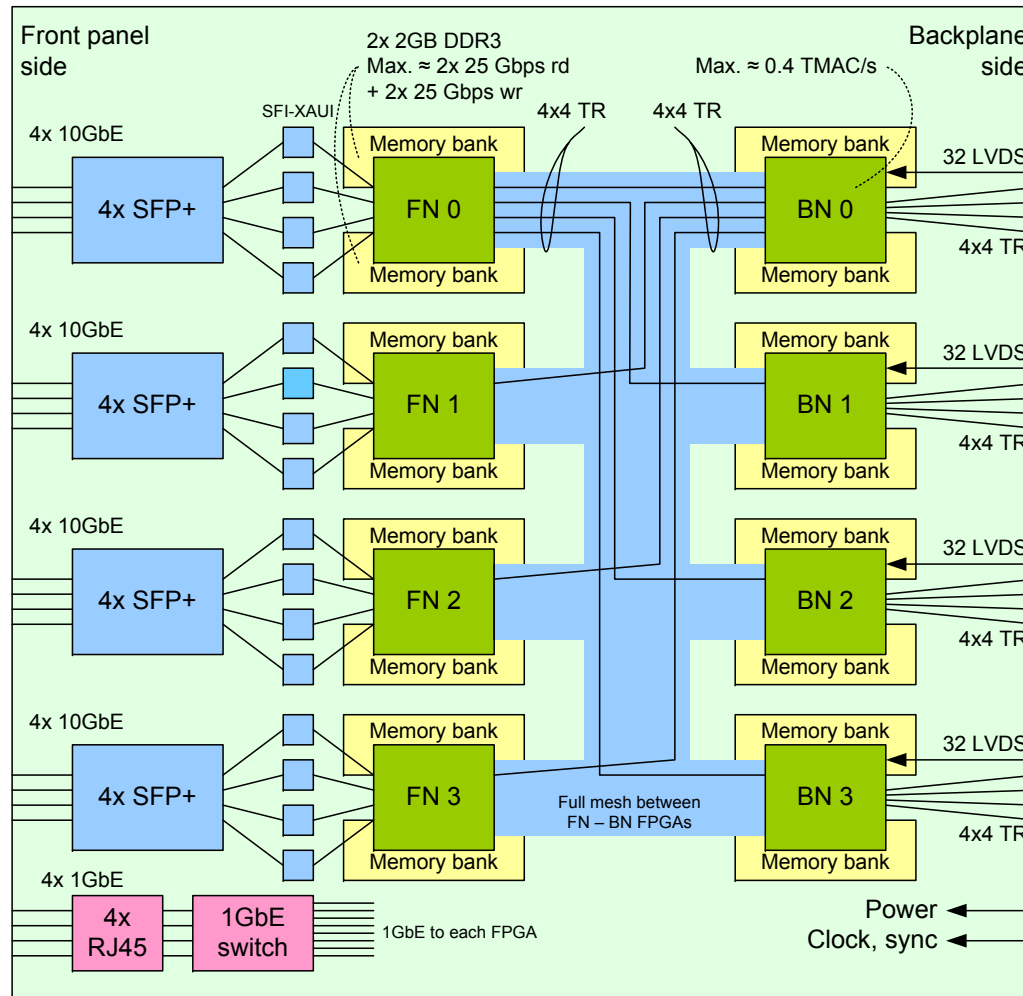
• Eric Kooistra

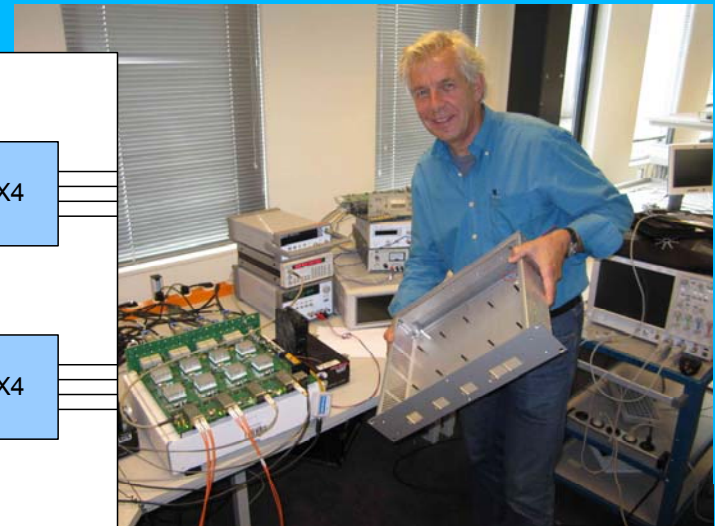
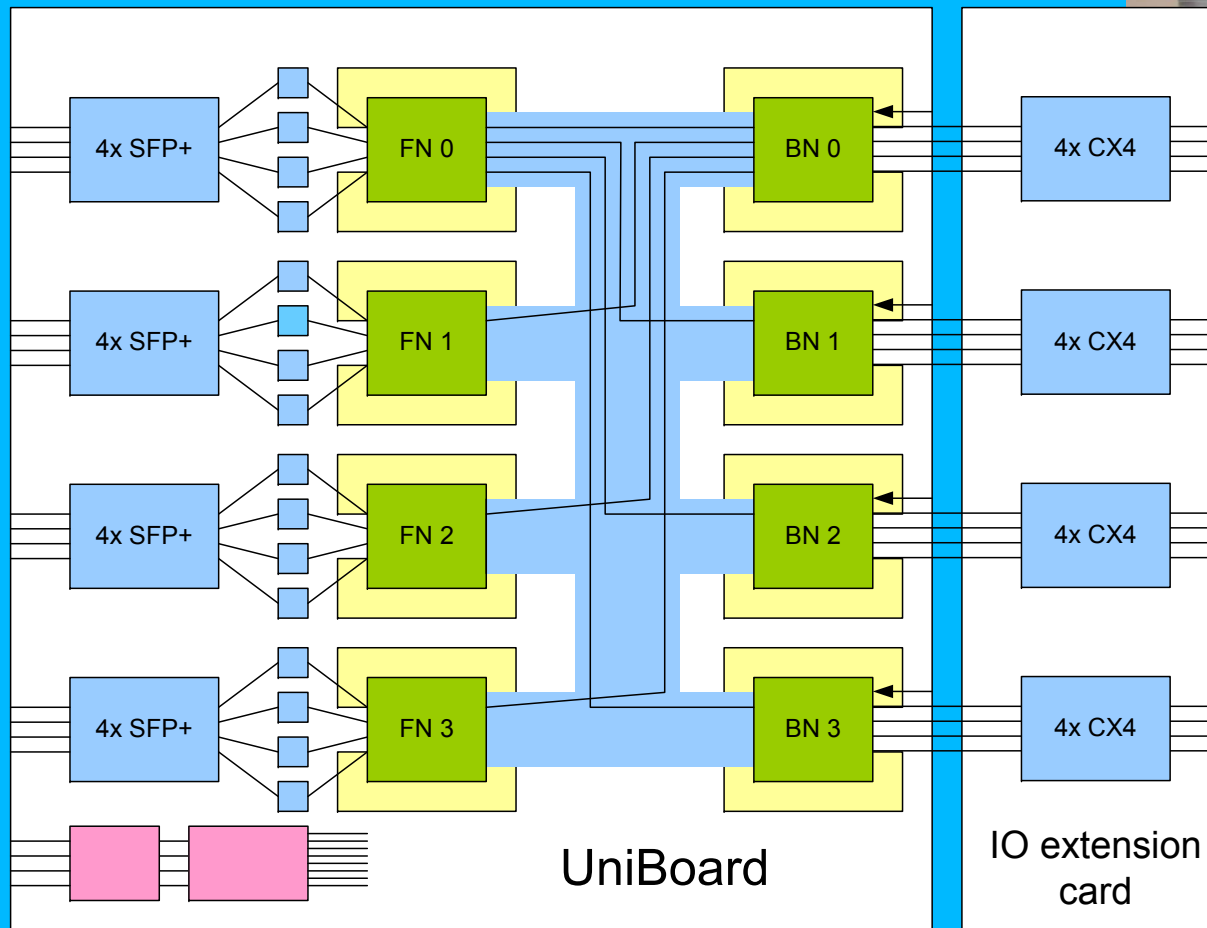


1. Multi-UniBoard systems
 - Using switches
 - Using backplane and subracks (NWO-funded ExBox project, JIVE-ASTRON collaboration)
2. APERTIF example for WSRT (NWO-funded project ASTRON):
 - Beamformer
 - Correlator
3. AARTFAAC example (University of Amsterdam-ASTRON collaboration):
 - Correlator for 6 LOFAR core stations

- Architecture uses the independency of:
 - Subbands (different frequencies)
 - Beams (different directions)
- Input processing
 - Filterbank
 - Digital receiver
- Output processing
 - Beamformer (BF)
 - Correlator (FX)
- General digital processing
 - Pulsar processing, RFI mitigation, ...
- Assumption: output load \approx input load

- High level of board integration
- Scalable (1, 2, many)
- Balance of:
 - DSP power (*, +)
 - IO
 - Memory



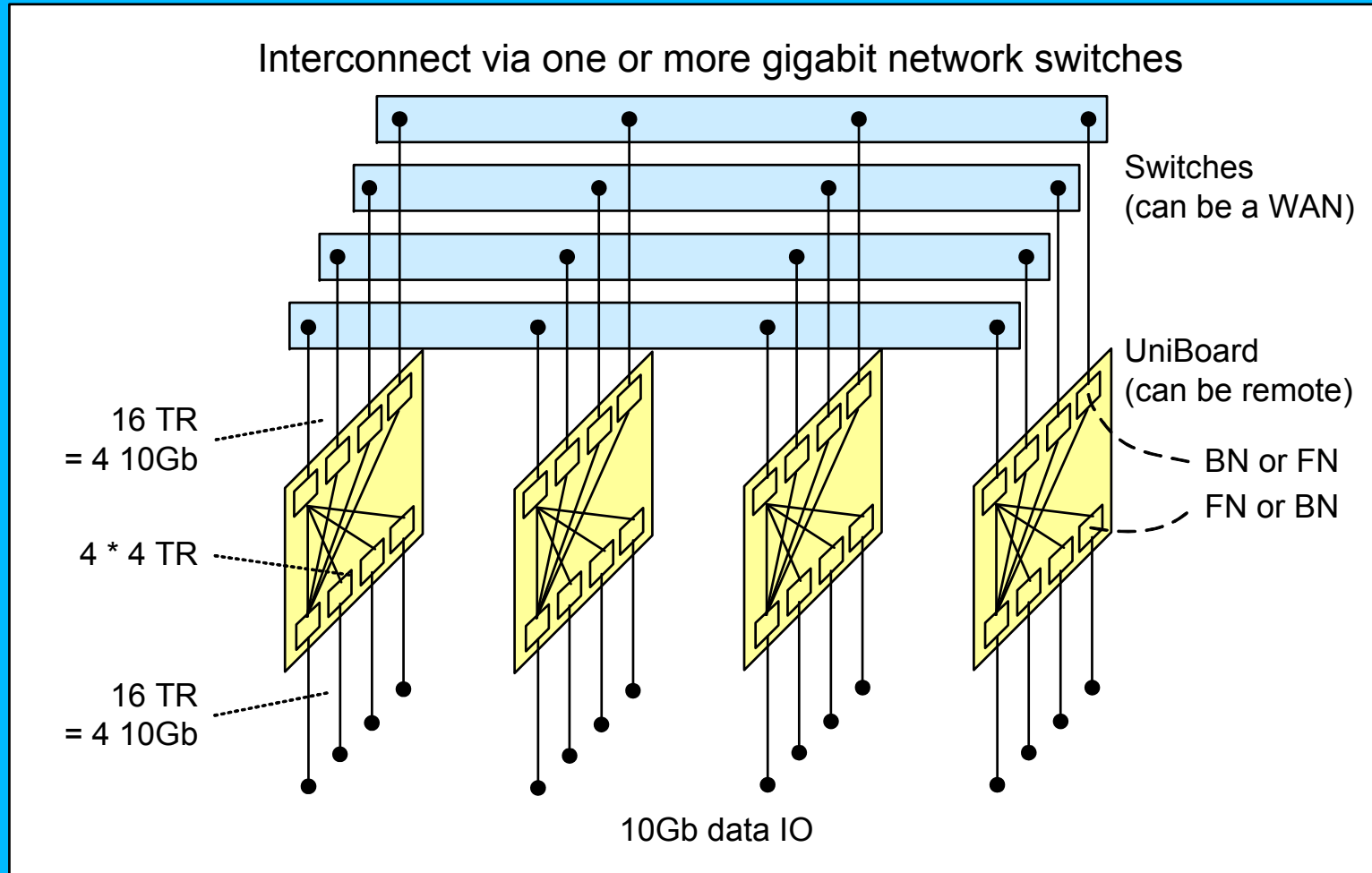


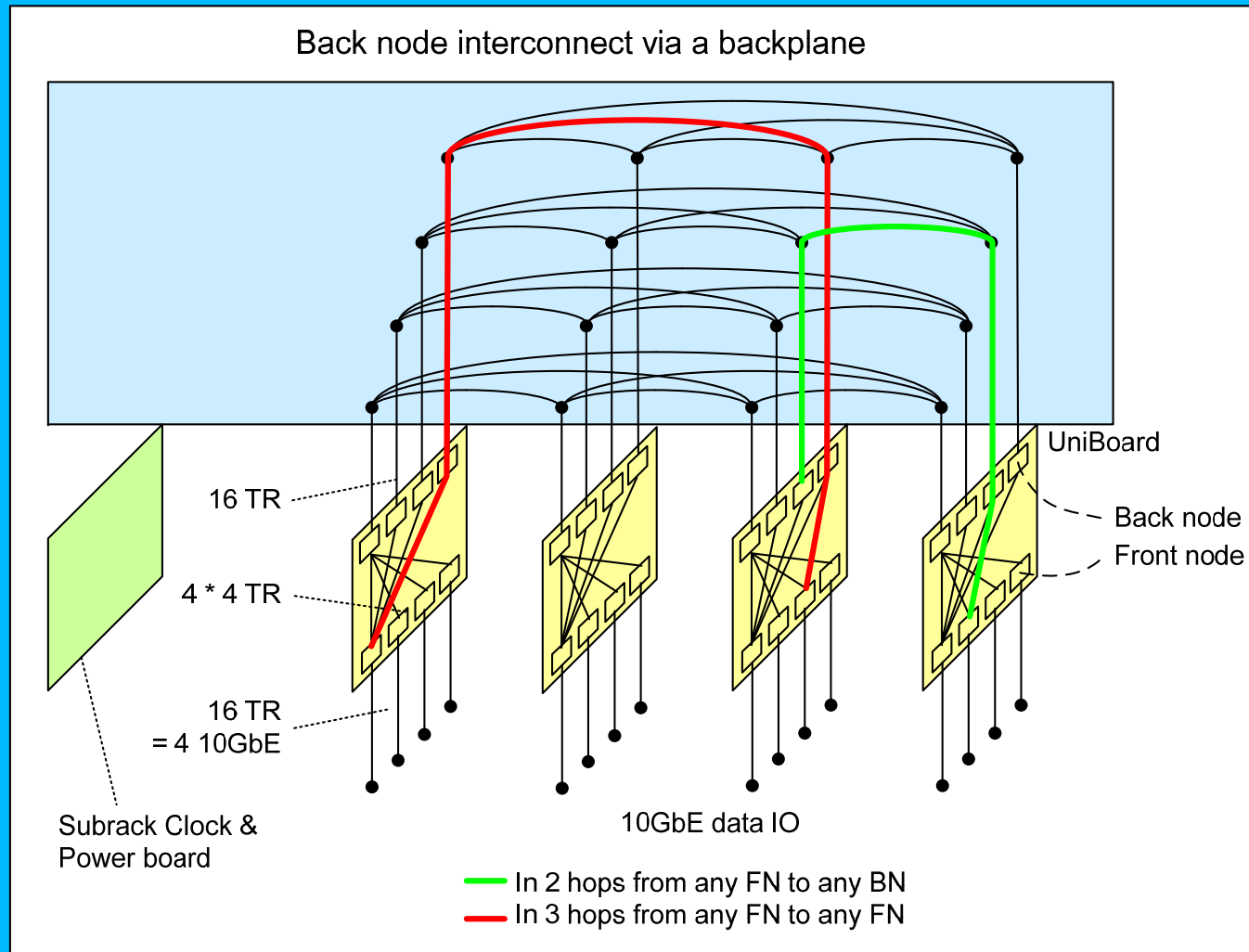


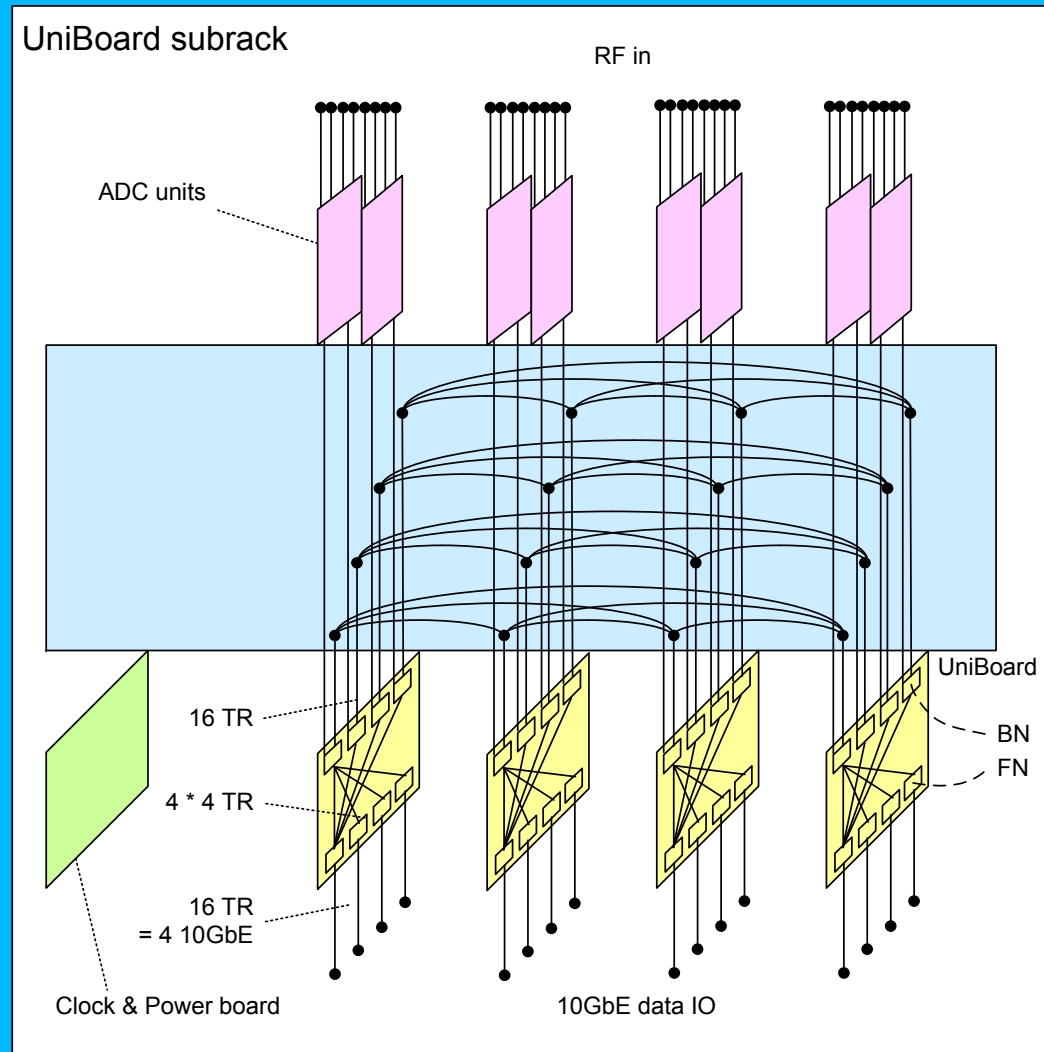
UniBoard IO → semi-full mesh



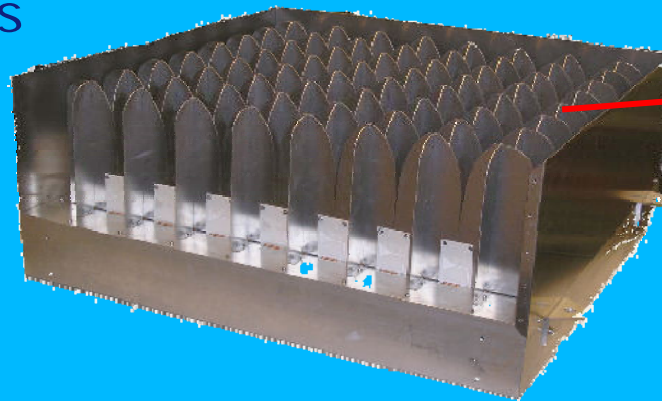
- All interconnect IO is done with gigabit transceivers (TR)
- On board:
 - Each front node (FN) connects to each back node (BN)
 - The FN do not connect to each other
 - The BN do not connect to each other
- Between boards:
 - Various interconnect options via the FN and/or the BN
 - Via backplane:
 - . BN0 connects to all other BN0, but not to BN1,2,3
 - . Idem for BN1, BN2 and BN3
 - . Number of TR per link is 16 / (number of boards-1)

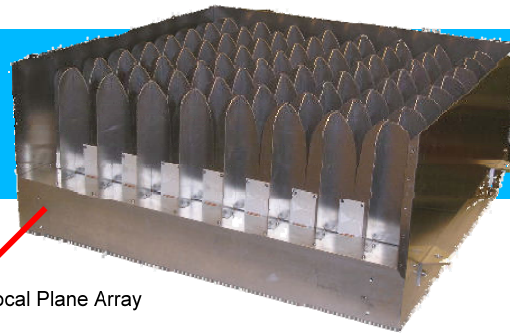






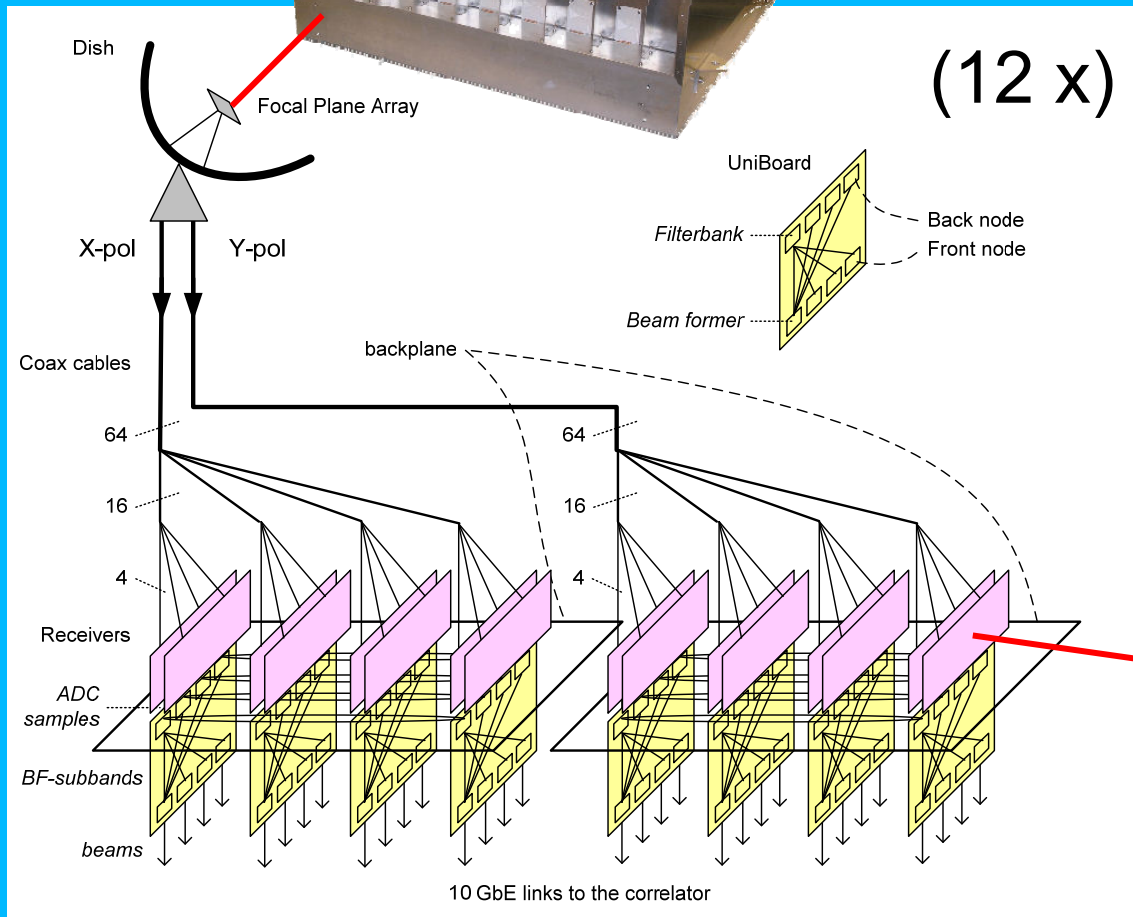
- Focal plane array for 12 of the 25m-dishes of the WSRT
- Input:
 - RF range 1000 – 1750 MHz
 - RF BW 400 MHz
 - 61 signal paths per tile
- Output:
 - Beam BW 300 MHz
 - 37 beams



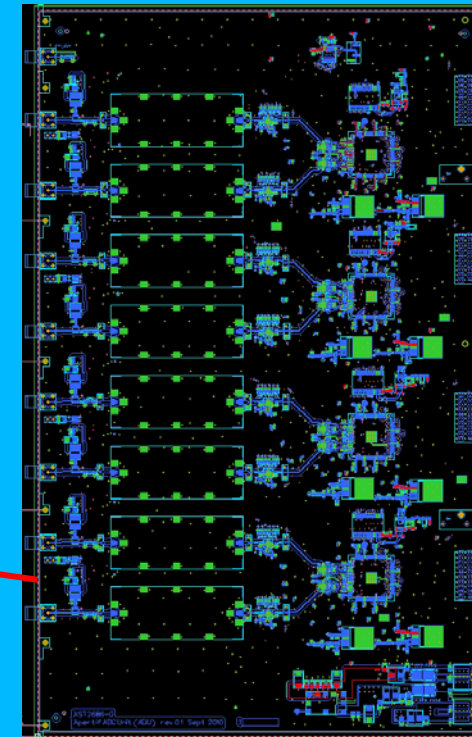


■ Tile

(12 x)

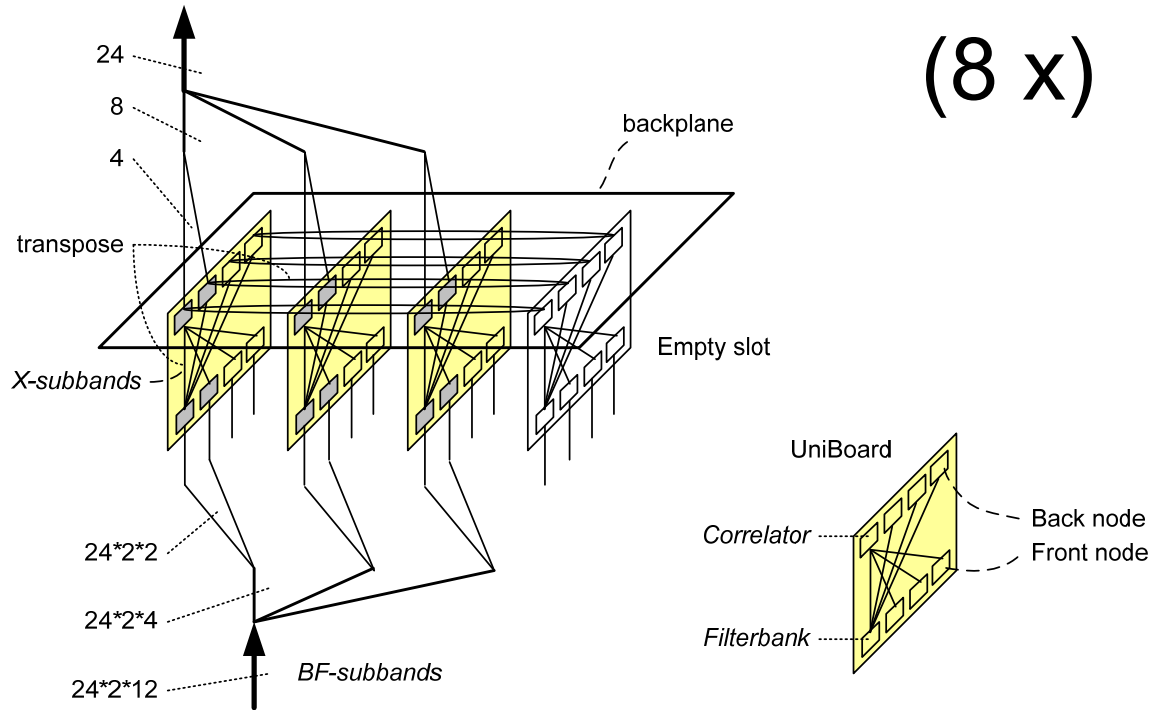


■ ADC unit board



- 11000 visibilities ($=37 * (24 * 25) / 2$)

Full Stokes visibilities of 24 BF-subbands bandwidth and for all beams to the post processing via 1 GbE control links



All beams with each 24 dual pol BF-subbands from 12 telescopes





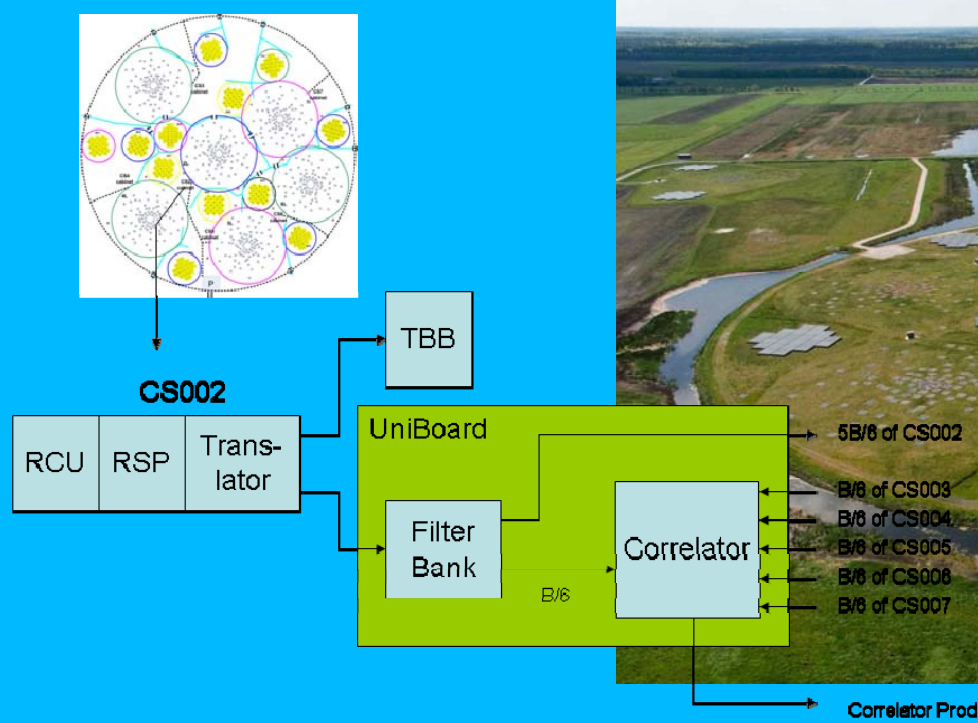
APERTIF for WSRT summary

ASTRON

- APERTIF Beamformer:
 - 96 UniBoards
 - 192 ADC unit boards

- APERTIF Correlator:
 - 24 UniBoards

- Correlator for 6 LOFAR core stations
 - $6 * 96 = 576$ dual-pol antennas, ~ 17.5 MHz BW
 - 12 UniBoards





Application summary

ASTRON

- Single board applications → with XGB in box
- Multi board applications → subracks, via network