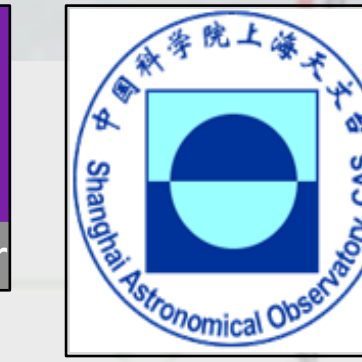


The UniBoard

Generic Hardware for Radio Astronomy Signal Processing

J. E. Hargreaves

Contract nr. 227290



The Project:

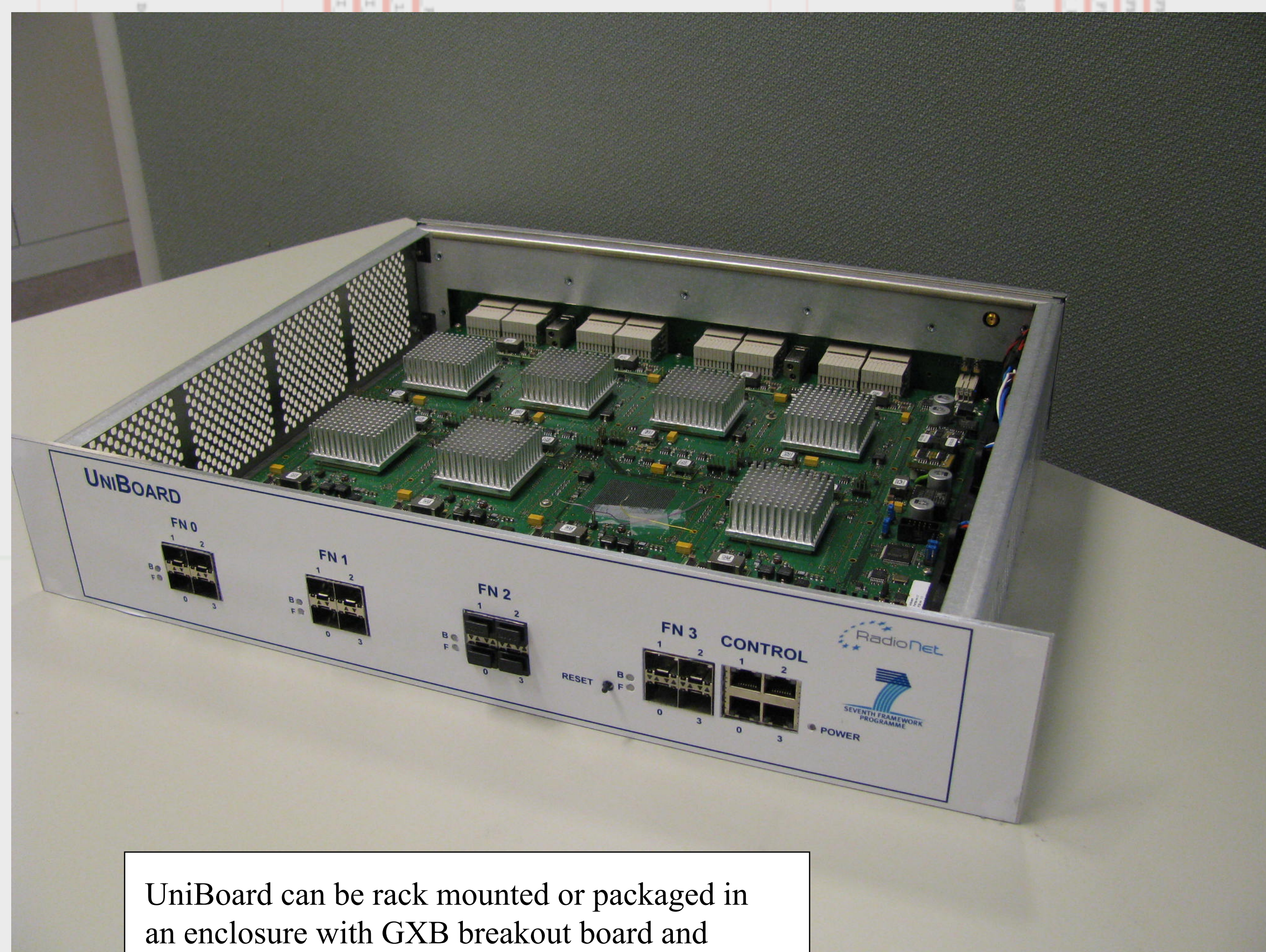
Concentrate as much computing power and I/O as possible on a “reasonably” sized PCB
 Based on state-of-the-art FPGAs for best performance/shortest development time
 Take advantage of expertise at Astron obtained through Lofar development
 Keep board interfaces as generic as possible (1 and 10G Ethernet, DDR3 memory)
 Maximize project-wide re-use and exchange of VHDL code through a shared repository.
 Test bench for SKA instrumentation: several Tflops/board, power efficiency, volume
 3-year project, started January 1 2009, funded by EC and participants (total of 1.4 Meuro)

The Hardware:

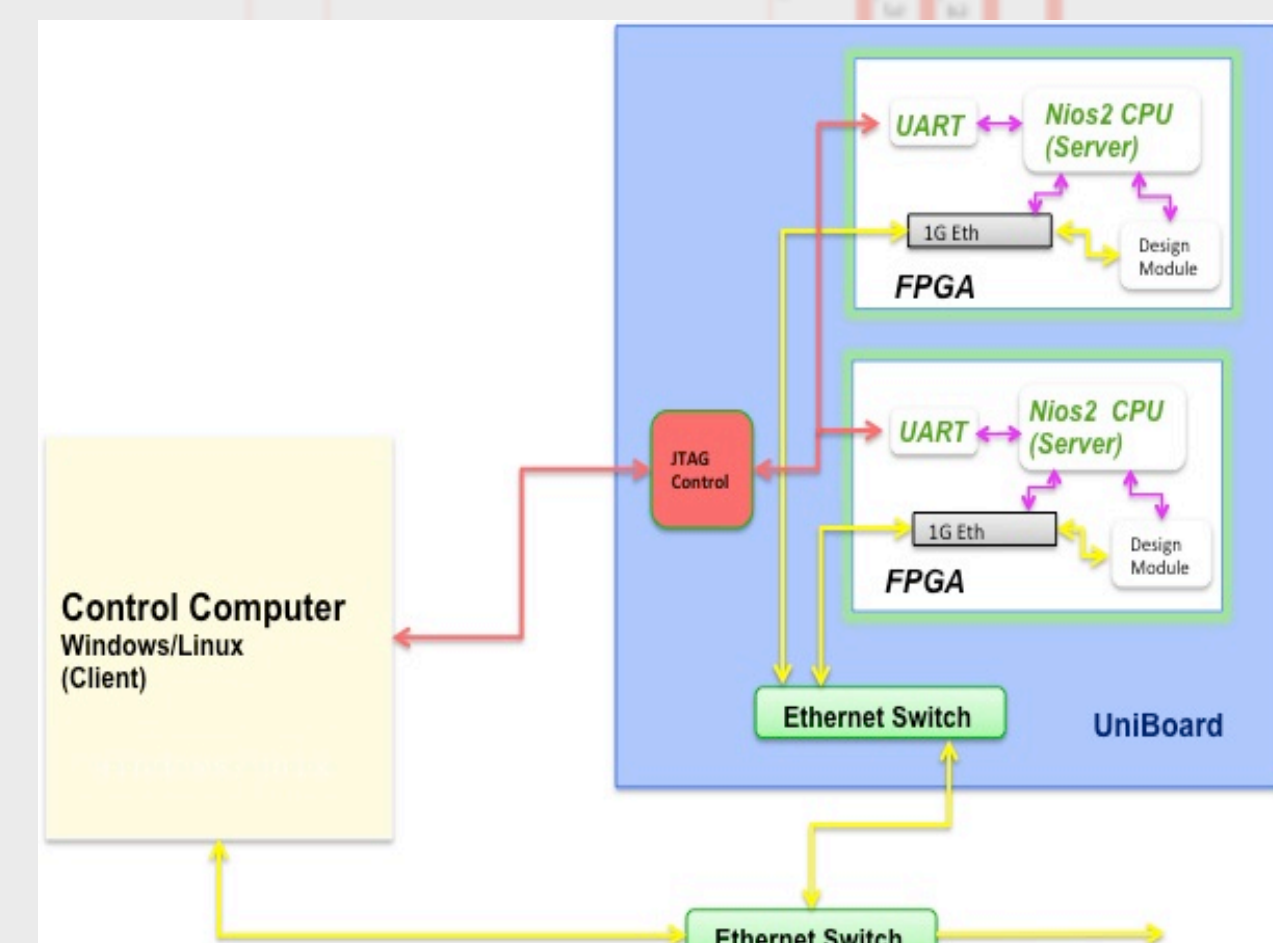
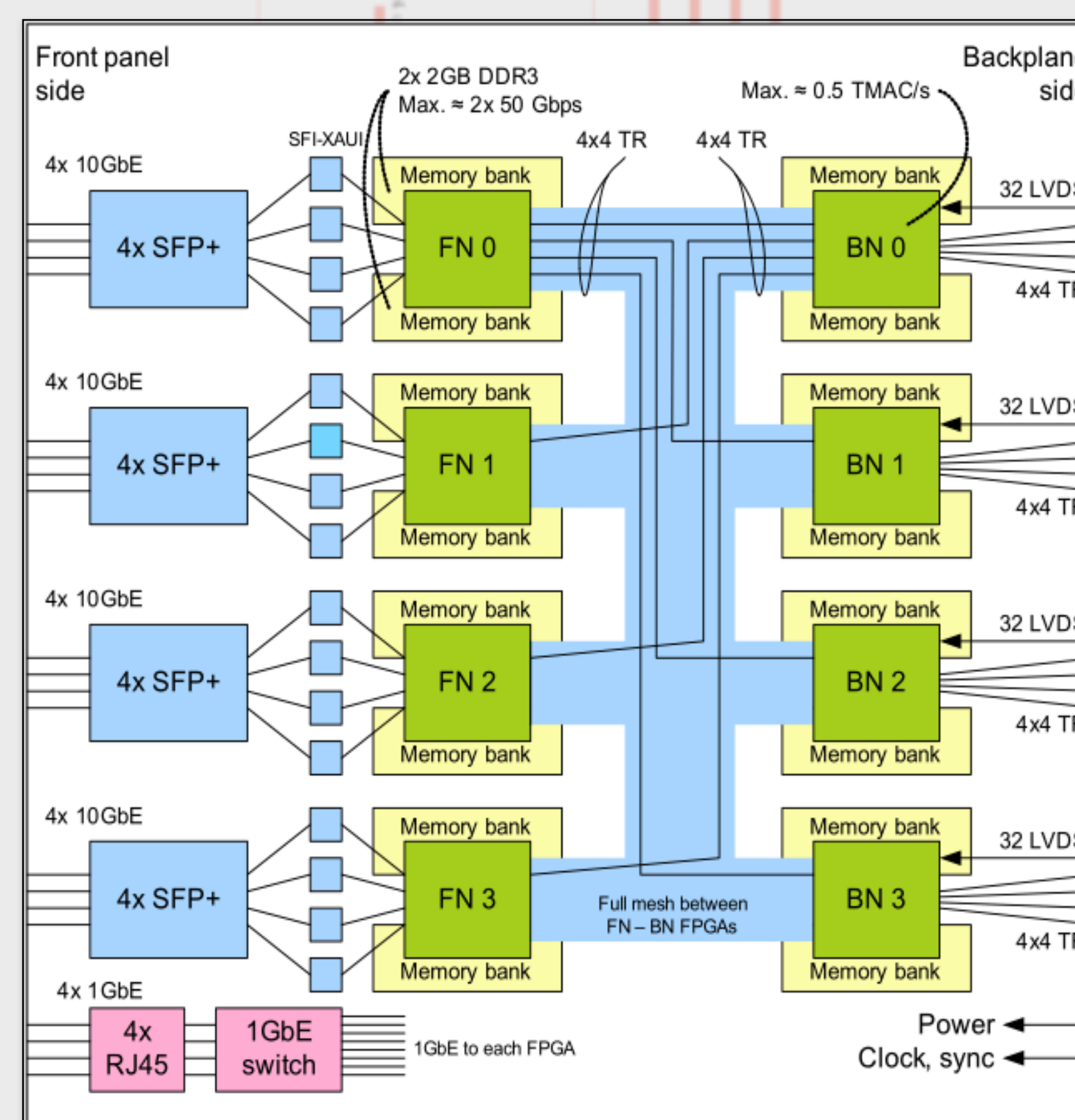
8 Altera Stratix IV 40nm FPGA, type EP4SGX230KF40C2, 1288 multipliers, 1517 pins
 One front node → all back nodes bi-directional mesh
 14 layers
 8 × 2 DDR3 modules
 24 10GbE ports
 1GbE control link to each node
 4 × 32-bit LVDS in
 48V power supply
 Estimated maximum power consumption 280 W

The Applications:

Correlators
 Beamformers
 Digital receivers
 Pulsar binning machine
 Pulsar Search
 RFI Mitigation



UniBoard can be rack mounted or packaged in an enclosure with GXB breakout board and forced air cooling as shown.



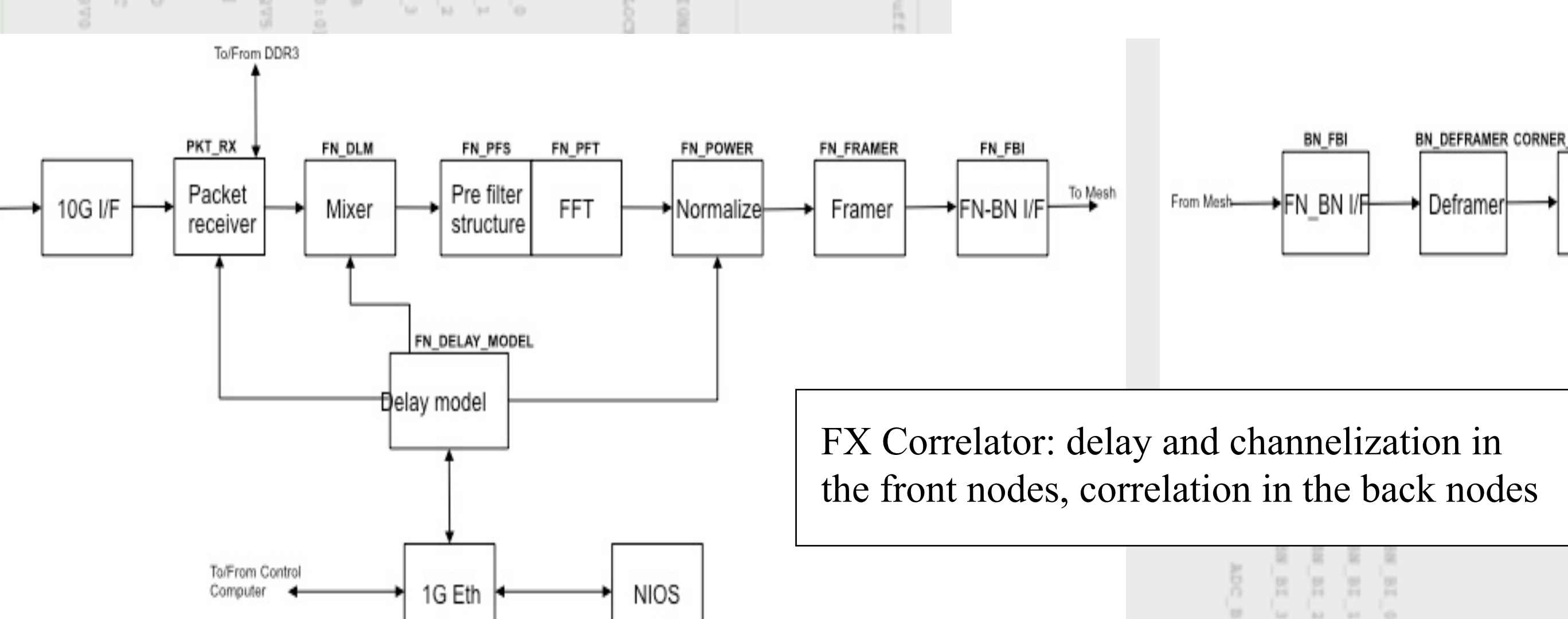
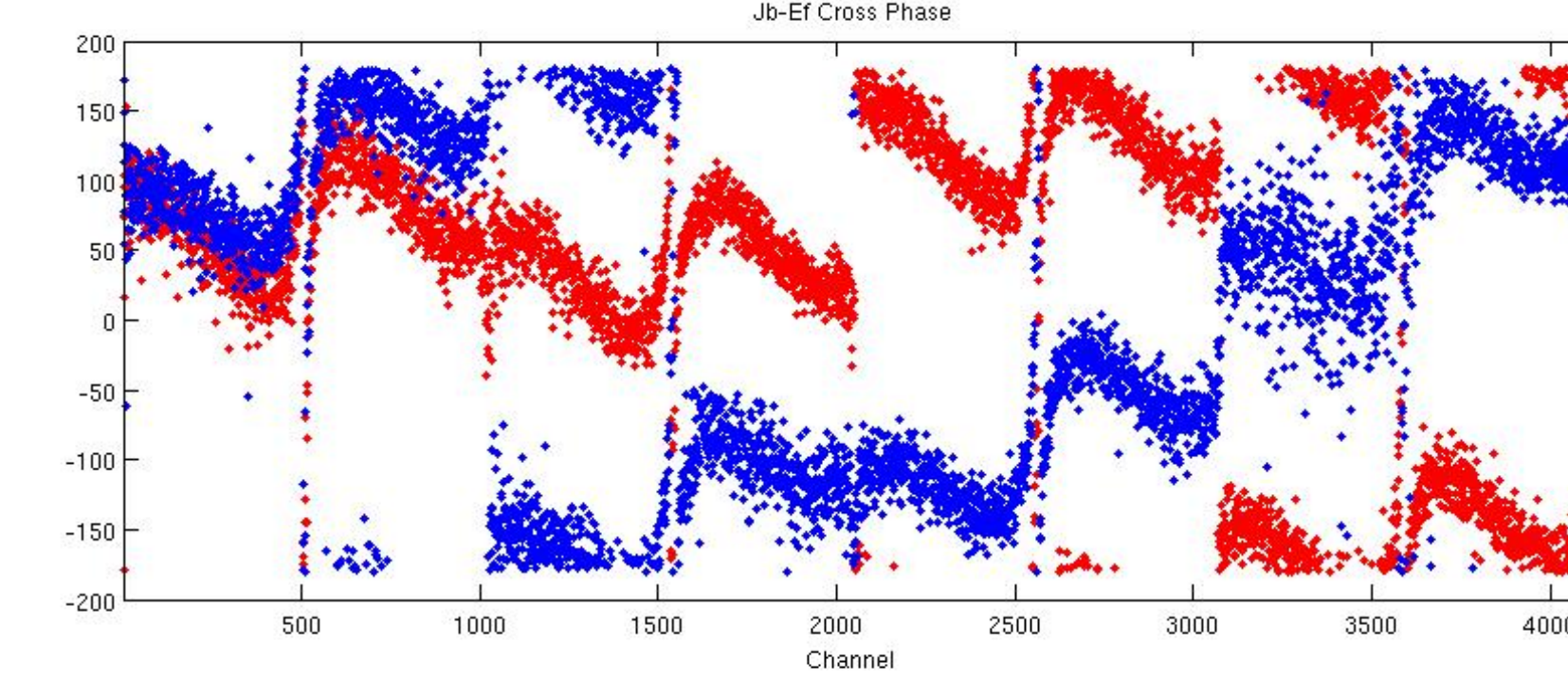
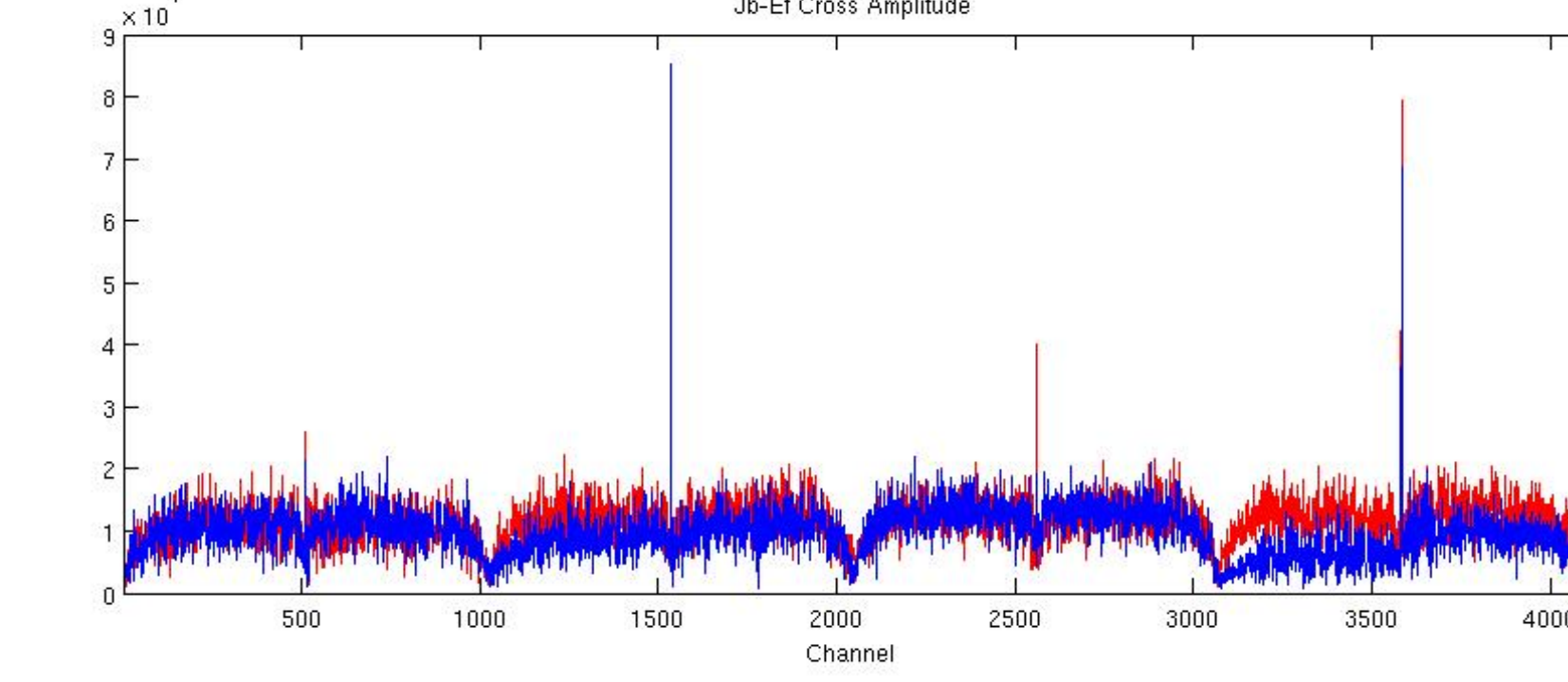
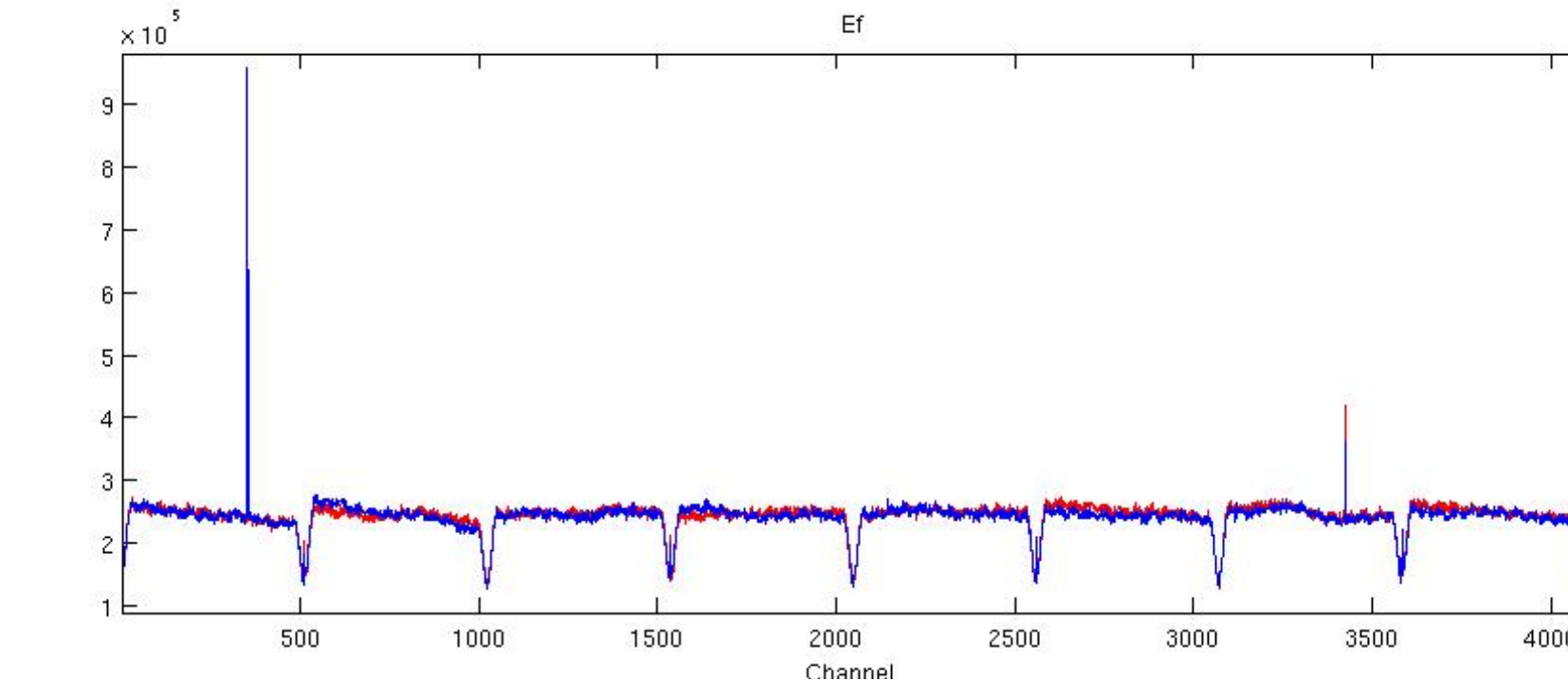
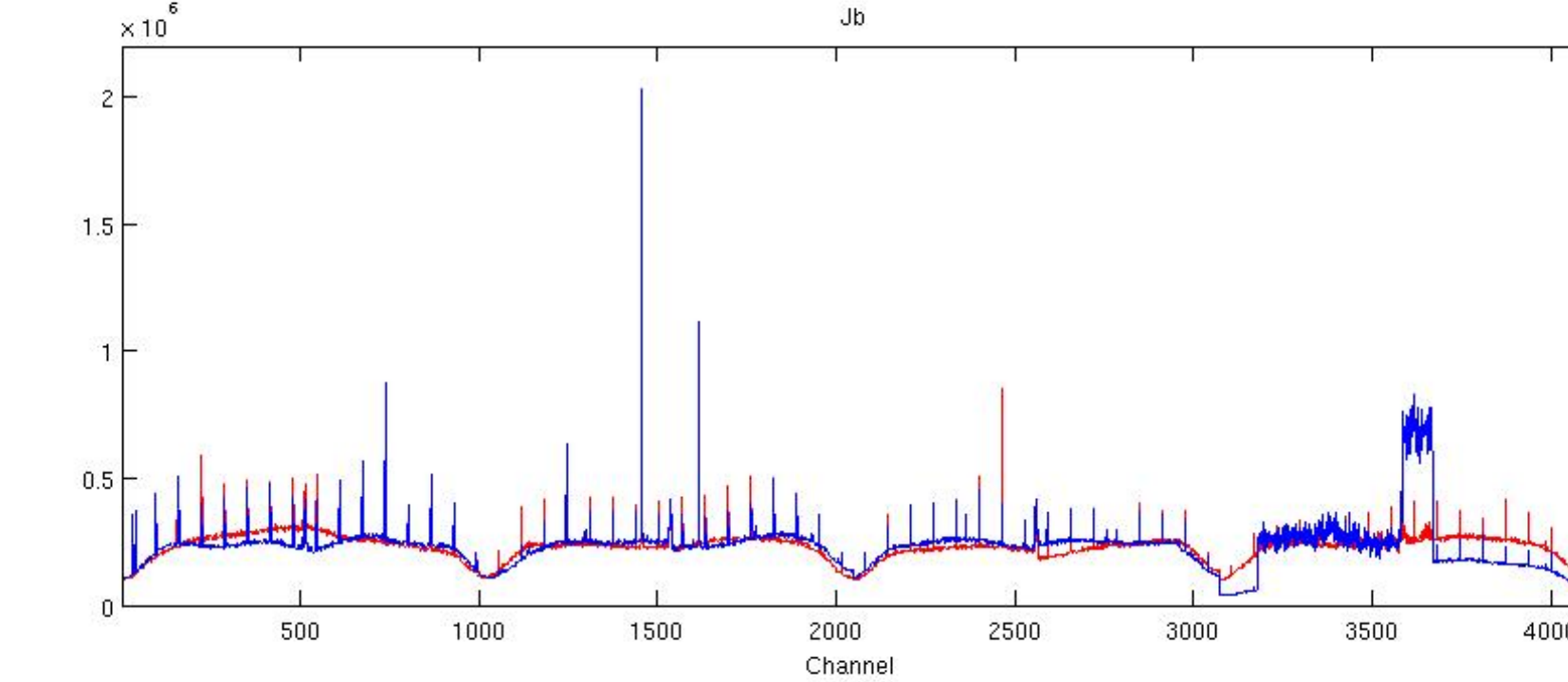
Above: Firmware applications are controlled over a 1GbE link using embedded soft processors in the FPGAs

Left: Block diagram of the UniBoard hardware

EVN Correlator Specifications

Input
 Stations 32
 Polarizations 2
 Resolution 1-8bits
 Format VDIF
 Sub-banding 1,2,4,8,16,32,64MHz
 Total Bandwidth 4096MHz

Processing
 Integration time 22ms – 1s
 Correlation products 2112 full stokes
 Spectral resolution 15kHz



FX Correlator: delay and channelization in the front nodes, correlation in the back nodes

Right: Auto correlation amplitudes (top) and cross correlation amplitude and phase (bottom) for a single baseline, 0.25s integration