DHH news

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7-th Belle II VXD Workshop and 18-th International Workshop on DEPFET Detectors and Applications

Prague, January 21-23 of 2015

Overview

- Final DHE/DHC production
- DHP-DHE Optical data interface
- Impact of optical interface on system
- Summary

DHE/DHC production

DHE/DHC V3.2

- One Infiniband connector exchanged by RJ45
- Current source integrated in PCB
- Changed layout of JTAG signals to overcome loading stability problems
- Changed layout of DC-DC converter to comply with recommendations
- DHP power monitor changed to pure differential

Production of 73 modules have been submitted in December 2014

- 55 DHE/DHC for Belle II
- 18 DHE/DHC for photon factory

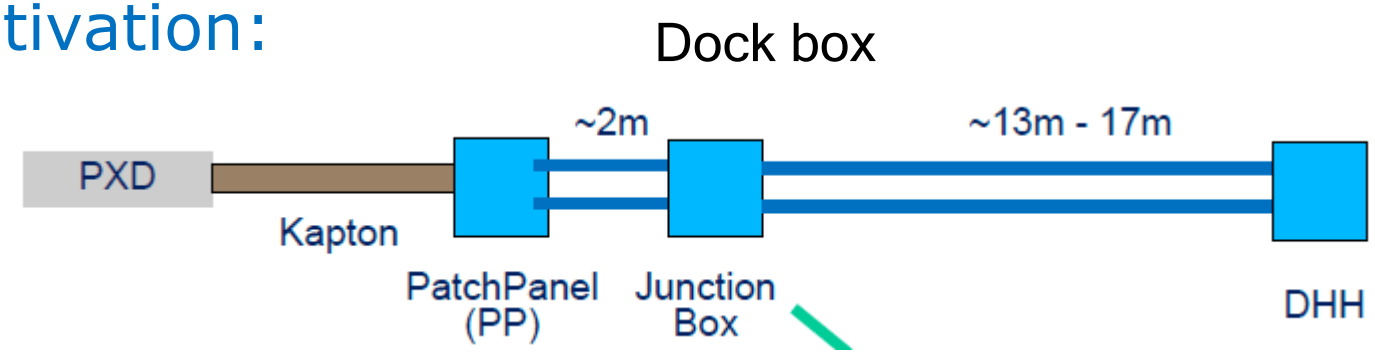
Belle II requires 48 DHE/DHC modules => 7 spare modules

18 DHE/DHC modules will be shipped to Japan beginning of February

ATCA carrier cards are still to be produced

Optical transmitters

Motivation:

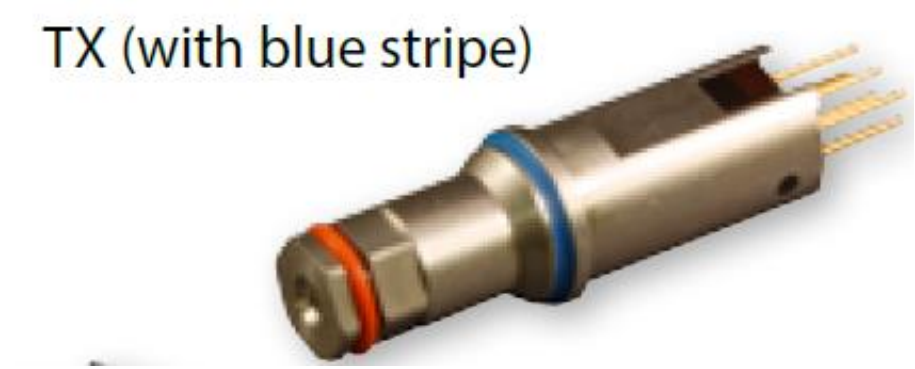


- 4 links 1.5Gbps
- Long transmission lines with variable and different properties lead to impedance discontinuity
- Frequency dependent signal attenuation due ohm resistance
- Signal distortion , unstable links

Proposal : install optical transmitters in Dock box and exchange Infiniband cable by optical fibers and RJ45 cable

Considered optical transmitted

Glenair 050-301
850 nm, 100Mbps-4.5 Gbps
Power consumption 300mW/channel
Size 20x10x10 mm

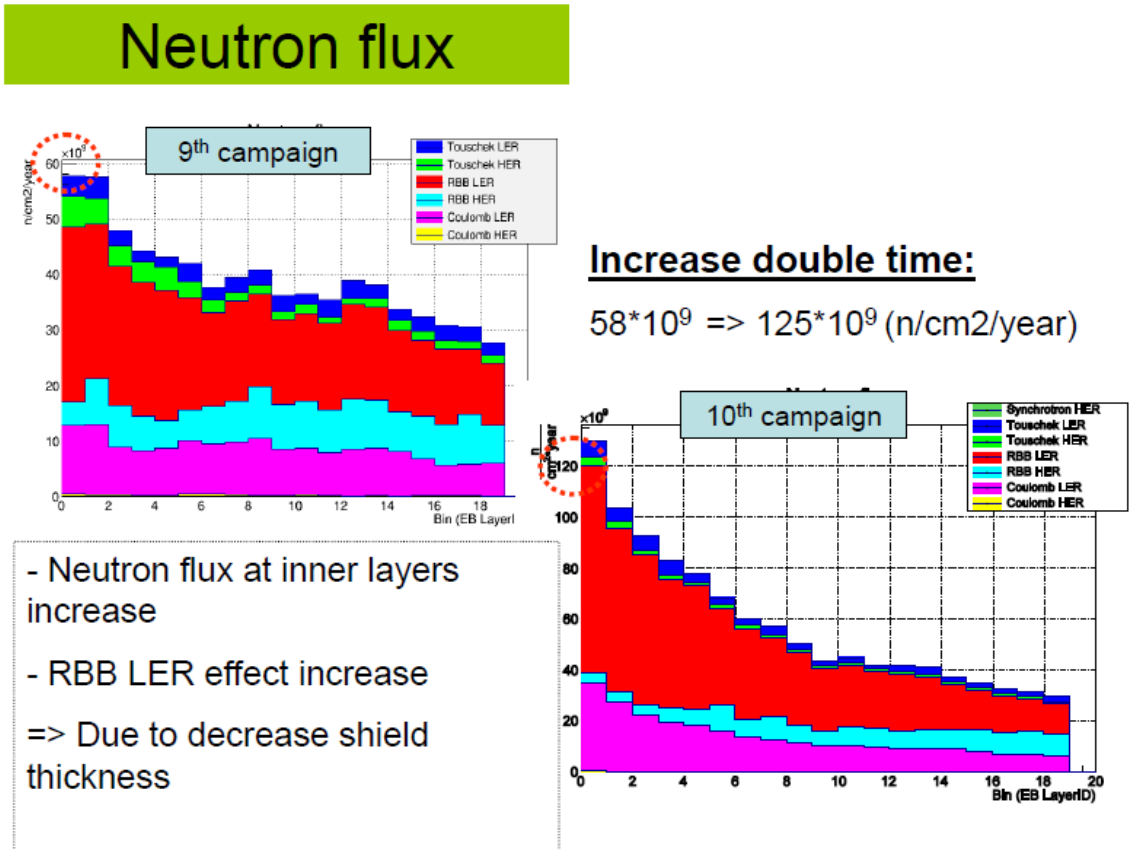


Avago AFBR-811 TX
12 channels, 850 nm, 10Gbps
Power consumption 100 mW/channel
Size 22x19x15 mm

Radiation condition in dock ?

- Simulation for CDC shown by Dong Van Thanh

  Neutron flux1.25 10^{11} cm^{-2} $year^{-1}$, Total dose 80Gy/year



Markus Friedl, interpolation from Belle to Belle II => 250 kRad

Publications

1. IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 60, NO. 4, AUGUST 2013

High Dose Gamma Irradiation of Lasers and p-i-n Photodiodes for HL-LHC Data Transmission Applications

Source Co60. Irradiation with 100kGy, 1Mgy

Conclusion : no significant effect on performance of devices

Devices wer not powered during irradiation

2 IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 58, NO. 6, DECEMBER 2011

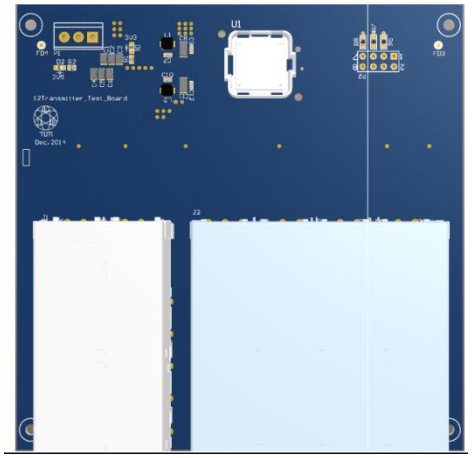
TROSKA *et al.*: RADIATION DAMAGE STUDIES OF LASERS AND PHOTODIODES

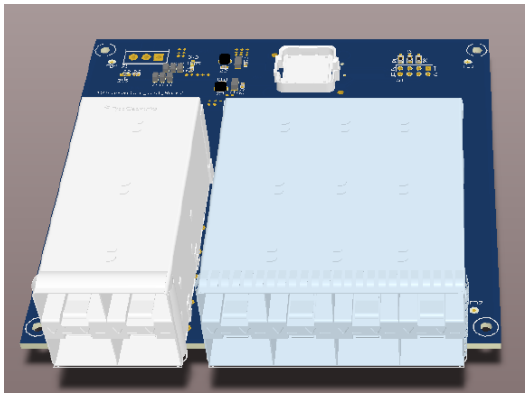
Irradiation by 20 MeV Neutrons

Degradation effect can be seen with neutron fluences of10^{15} cm^{-2}

Preparation for irradiation

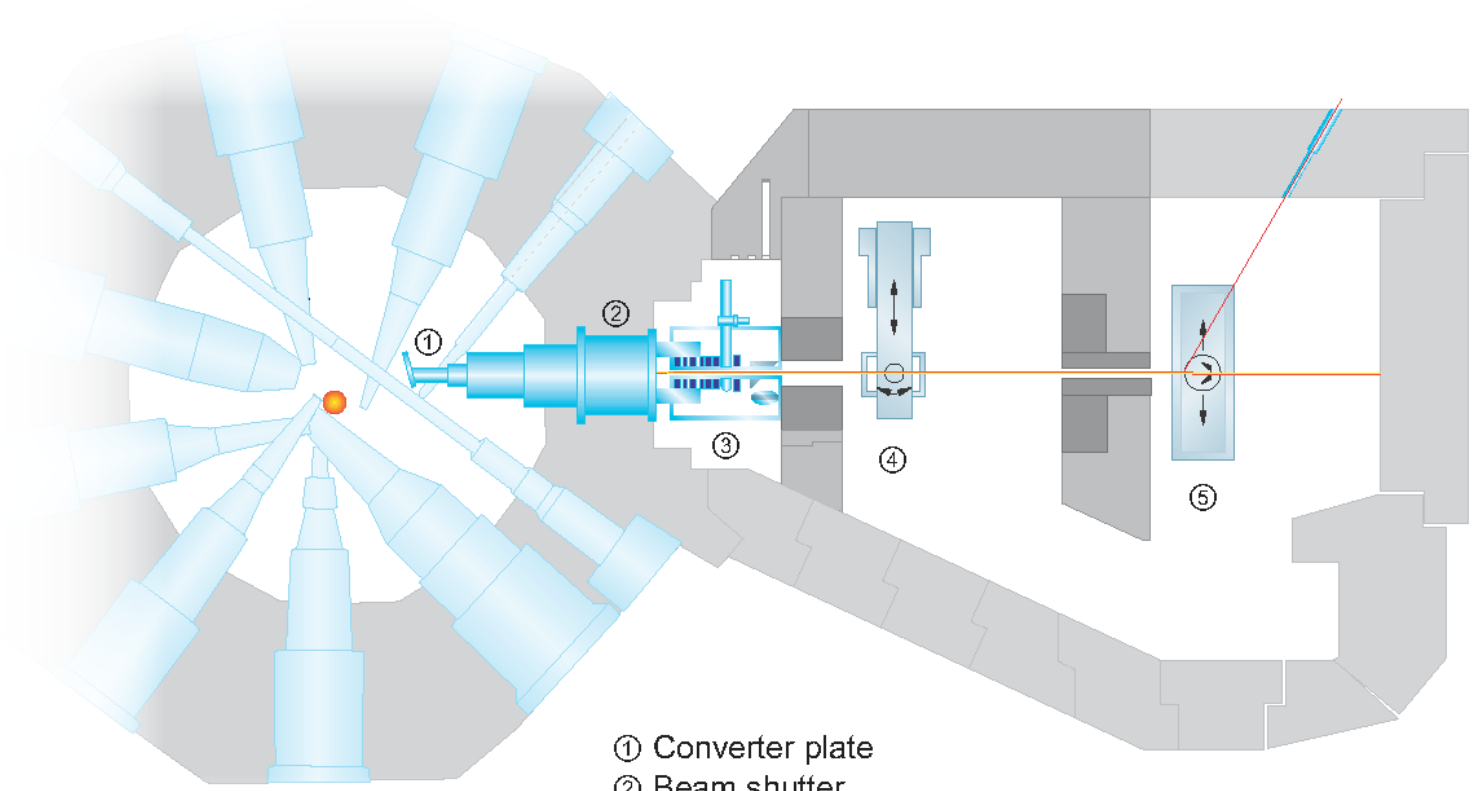
- Neutron irradiation in FRM2 in Munich
- Co60 source available at Giessen, 2 Gy/minute
- Test board for AFBR811 assembled





- PCB for Glenair TX will be produced in February

FRM 2 NECTAR neutron source



① Converter plate
② Beam shutter
③ Filters
④ Medical treatment station
⑤ Sample table NECTAR

FRM 2 NECTAR neutron source

Application

- Radiography and tomography using fission neutrons

Neutron spectrum

- Fission spectrum Mean energy: 1.8 MeV
- Flux: $8.7 \cdot 10^{5}$ $cm^{-2}s^{-1}$ – $4.7 \cdot 10^{7}$ $cm^{-2}s^{-1}$ (depends on filter used)
- Best L/D: 233 ± 16 (with collimator, measured)

Sample space

- Max. 80 cm × 80 cm × 80 cm
- Max. 400 kg
- Sample environments easily attachable (e. g. pressure cells)

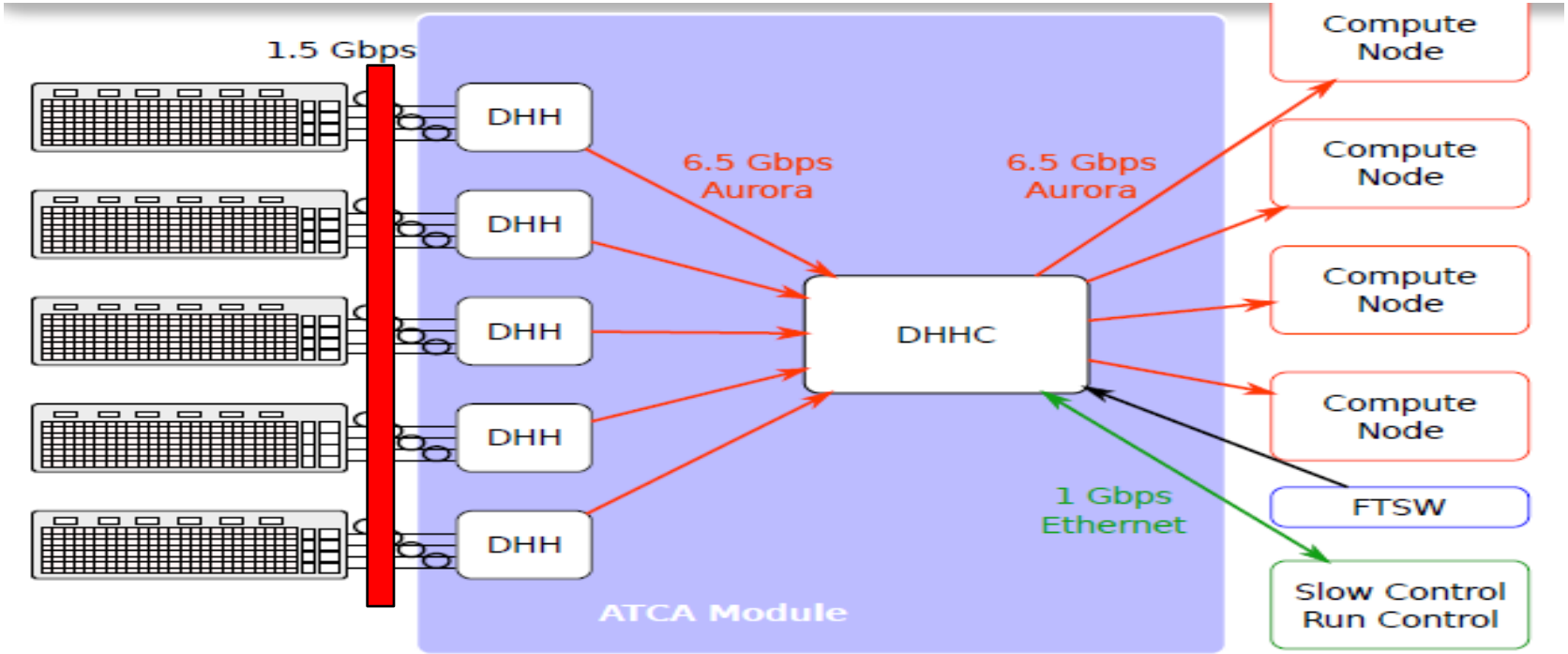
Irradiation procedure with neutrons

- SEU probability measurement ?
  - Expected neutron flux 10^4 cm^{-2} s^{-1}
  - Start measurements with fluxes 10^6 cm^{-2} s^{-1} down to nominal

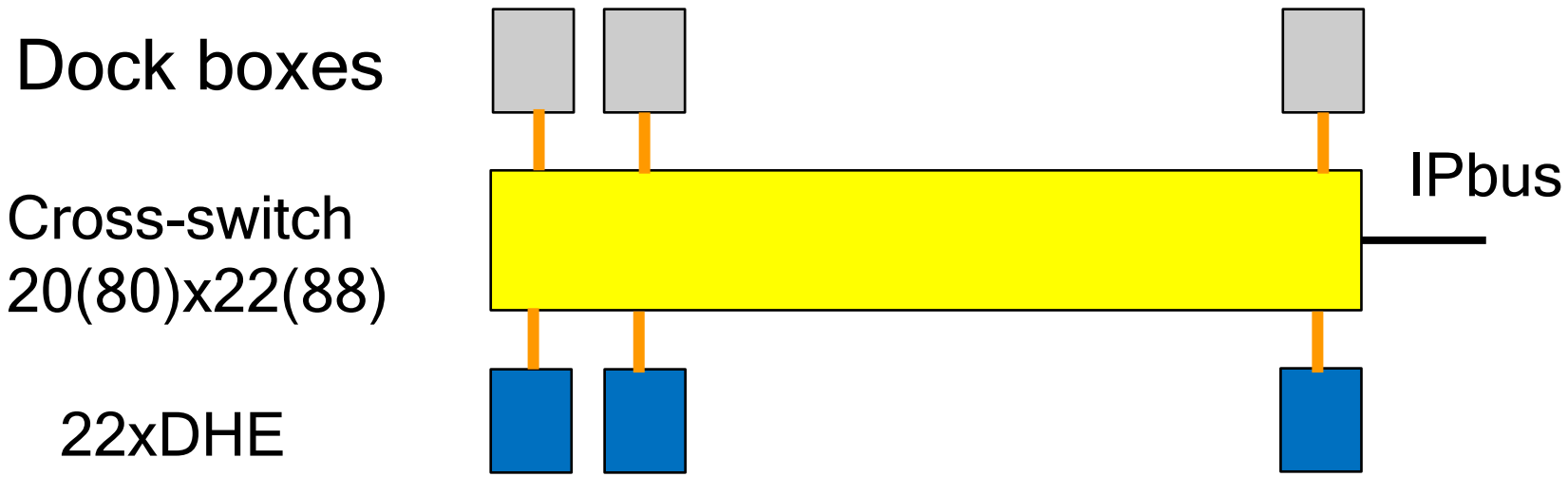
- Qualification for radiation damages
  - Repeated cycles of irradiation (one year equivalent) followed by performance measurements

Impact on the system

- Space in dock box – no problem for both types of transmitters
- Additional power lines 3.3V and 2.5V
- I2C interface to control and configure optical transmitters
- Cabling: Infiniband cable => RJ45 and optical fibre cable
  - Change of interface with DHE
  - New interface module to be developed



Interface module



Cross-switch

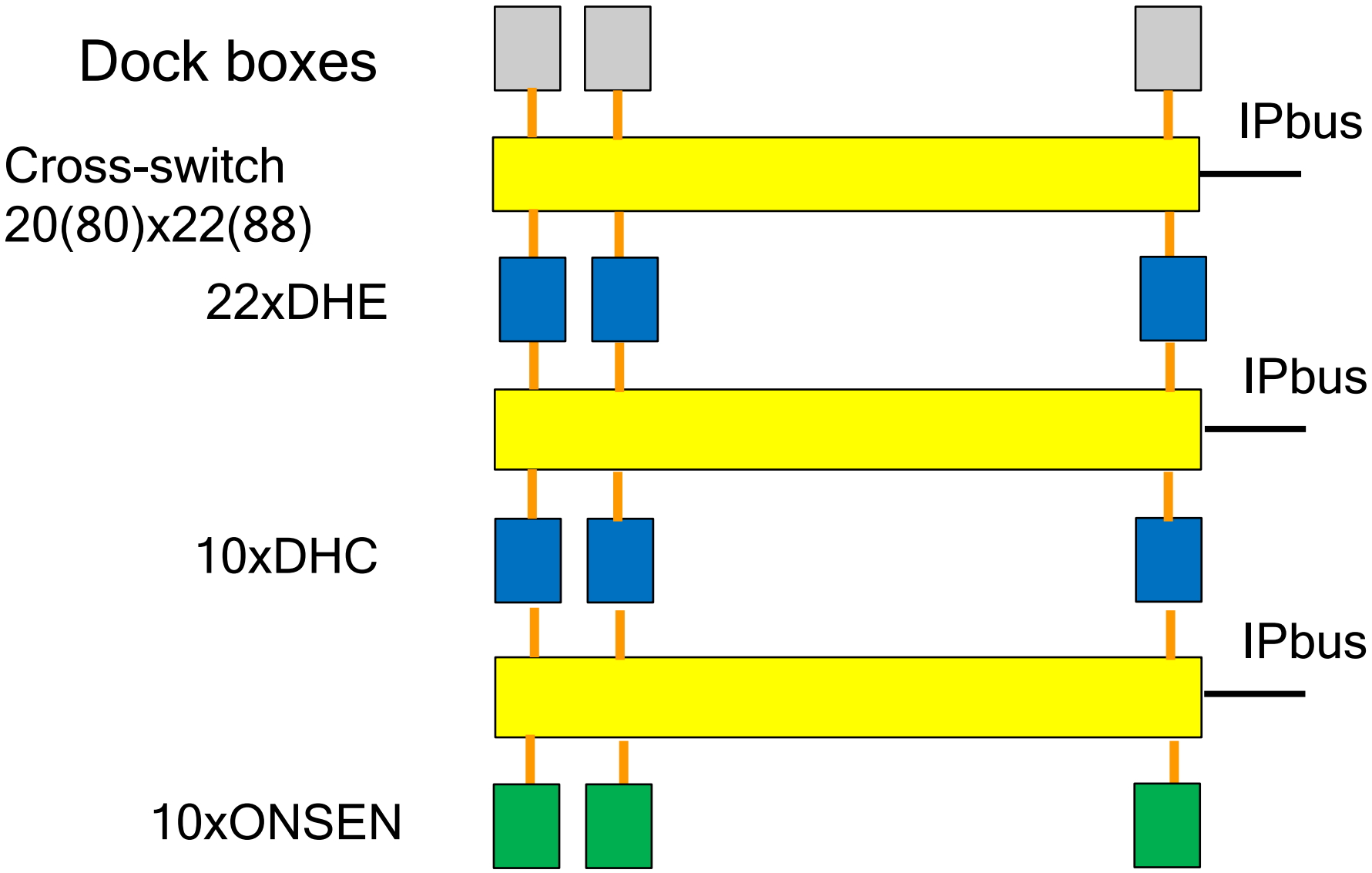
- galvanic isolation (optical receivers + digital isolators + analog isolators)
- High speed (6.5Gbps) cross-switch IC (144x144)
- FPGA as cross-switch for JTAGs

Advantages :

fully configurable interconnection topology

spare modules included in the system

System sketch



Summary

- Production of 55(78) DHE/DHC modules to be completed by end of January
- Irradiation test of optical transmitters with neutrons and gammas in preparation
- New Interface module to be designed
- New Interface module => Cross-Switch
- Cross-Switch can be used to interconnect DHH and ONSEN as well