

Front-end electronics for the free-running DAQ-SPD

Front-end electronics of the detectors has to meet the requirements of a free-running DAQ

General FEE requirements from the DAQ system:

- Self-triggered (*trigger-less*) FEE operation
- Digitizing on-board
- Zero suppression
- Large memory to store the data accumulated in a time slice
- Timestamp included in the output format

Compatibility with DAQ (AMBER)

- Optic output
- Protocols: S-link, Aurora, UCF
- White Rabbit input

DAQ hardware

Near detector

Mechanics:

- **374** Front End Concentrators - VME 6U double width 12 inputs, 1 outputs
- **43** VME crates, 0.5kW → **9-10** racks
- Option with ATCA crates < 20

Cables:

- From detectors to DAQ: **4436** optic links
- From DAQ to control room: **374** optic links (double), max **480** links
- For single fiber cables full diameter about **200**mm
- For a multi-fiber cables (12,24) full diameter about **160**mm

In barrack

3 VME crates (1kW)

20 DAQ computers (1kW) → 3-4 racks



Migration to ATCA (Igor Konorov 08-02-2021)

ATCA Carrier Card :

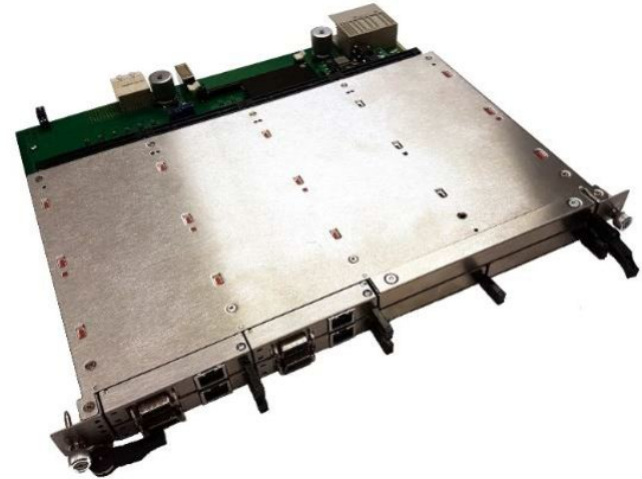
- 4 DHmx/DHsw modules
- 4 Optical interface AMC cards
- 16 links between A B connectors

Rear interfaces

- 8 x Ethernet for IPBus
- USB for JTAG
- SFP+ for TCS interface + 1:8 fanout

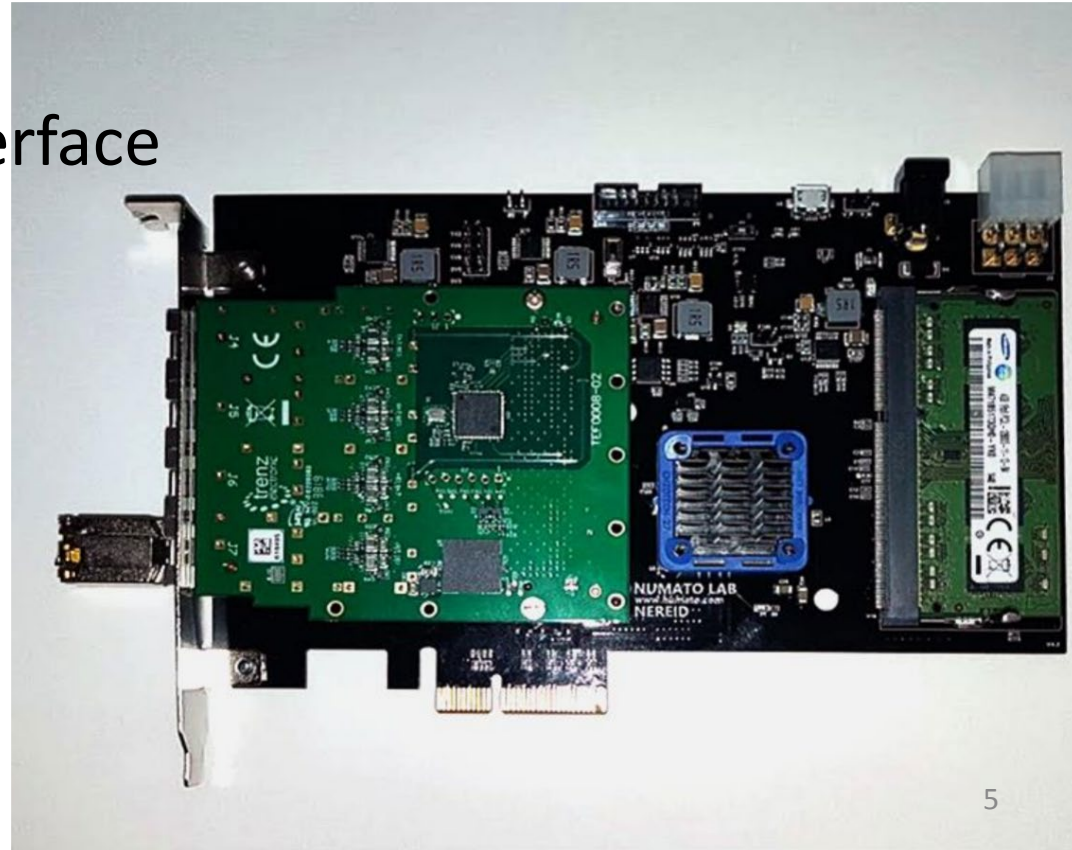
Optical Interface AMC card

- 8 + 4 FireFly Transceivers

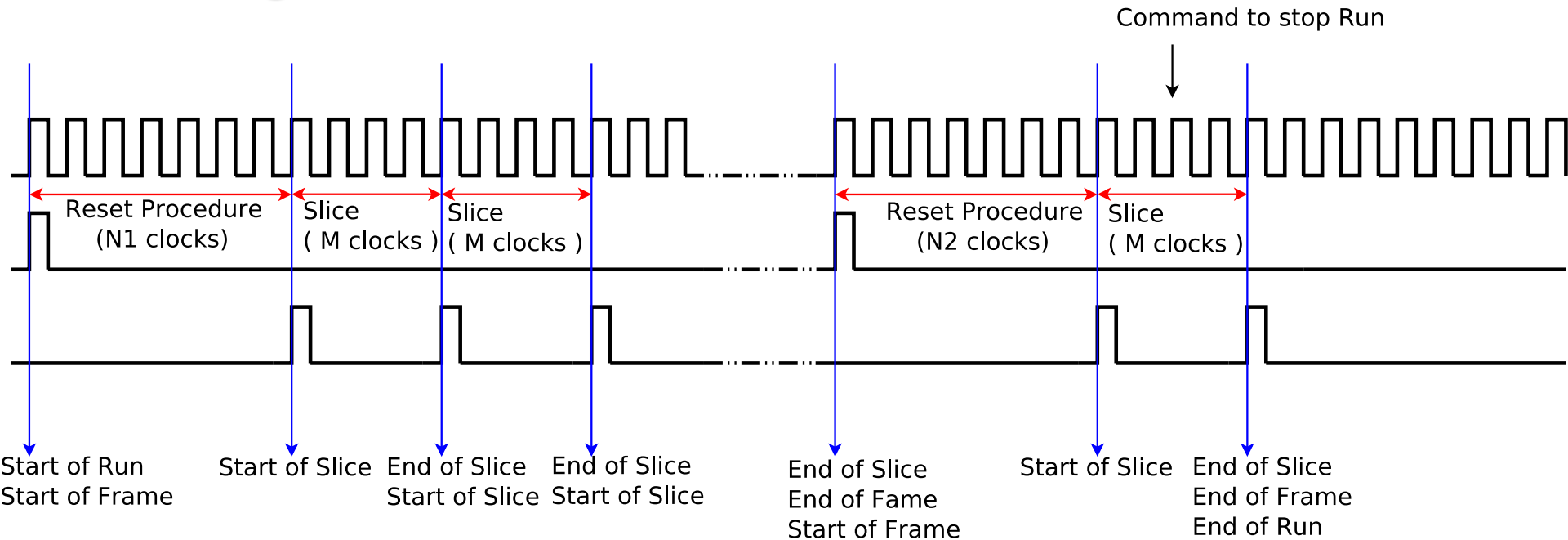


Spillbuffer Hardware / PCI Express buffer

- Based on commercial hardware
 - Nereid Kintex 7 PCI Express
 - Trenz FMC – SFP adapter
- Kintex 7 XC7K160T FBG676
- 4x PCIe-Gen2 interface
- 4 GB DDR3 memory
- No dedicated TCS interface



Time diagrams



$T_{\text{clock}} = 8\text{ns}$ (125 MHz) from White Rabbit;
Reset Procedure $\leq 300\text{ms}$ (depends on electronics);

Slice Number: 24 bits (1 μs - 8.3ms)
Data Size: max 16GB (real size $< 160\text{MB}$ (20GB/s limit));

Frame: starts by Reset procedure, width 16 bits (min: 65ms, max: 549.7s),
Data Size: max 1PB (real size $< 10\text{TB}$ (20GB/s limit))