

CRU

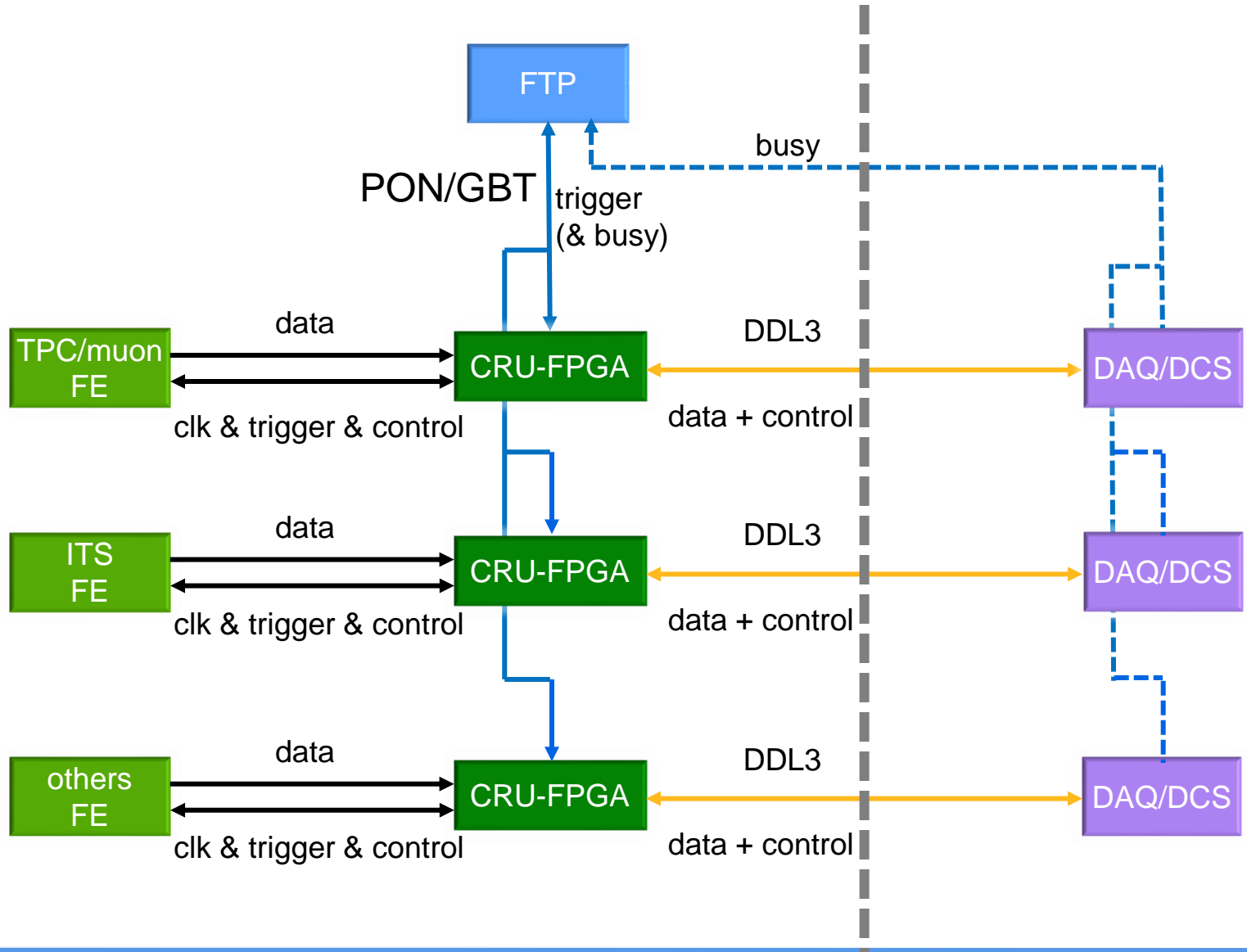
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Common read-out (CRU)

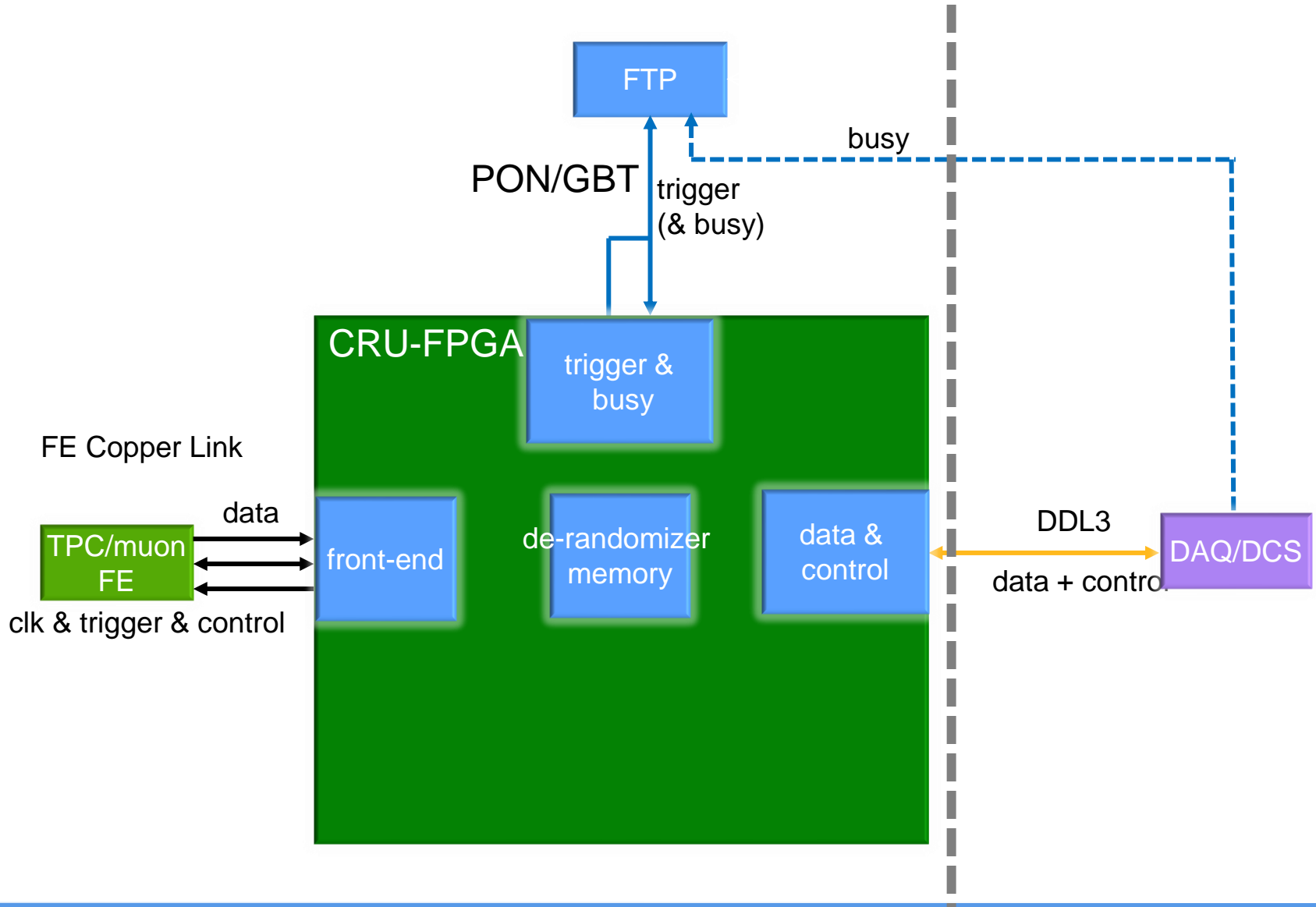
- **ITS**
 - ~3 m from ITS @ up to 1.7 Gbit/s
 - transmission length from ITS to CRU of 3 m max
 - radiation
- **TPC**
 - ~3 m from ITS @ undefined rate, assumption 320 Mbit/s
 - radiation
 - ideally form factor allows to directly plug into front-end card
 - no cabling but not accessible
- **Muon tracker**
 - same read-out ASIC as TPC
 - little radiation
- **TRD**
 - 2 Gbit/s
 - optical
 - multiplexing factor up to 60:1
 - little radiation
- **Muon identifier**

CRU-FPGA





CRU-FPGA





Common read-out (CRU)

- Needs to receive clock, trigger and control signals and distribute to detector with constant latency
- Data path no constant latency needed → no trigger detectors
- Provides ideally a direct interface to the DAQ

qualification steps

- **Radiation qualification:**
 - **FPGA**
 - **external transmission components**
 - **optical & multiplexer (XAUI)**
 - **trigger transmission**
 - **constant latency implementation in chosen FPGA**
 - **size of de-randomizer buffer**
 - **internal / external**
 - **Present PON implementation not radiation tolerant**



Radiation level

- CRU is sitting in radiation:
- for Pb-Pb interaction rate of 100kHz (Nov. and Jan TBs):
 - TPC inner: Hadrons: $10\text{kHz}/\text{cm}^2 \cdot \text{s}^{-1}$, Total Dose 0.4kRad
 - TPC outer: Hadrons: $2.2\text{kHz}/\text{cm}^2 \cdot \text{s}^{-1}$, Total Dose 0.06kRad
 - Scaled from calculations (ALICE₁)
Assumed Pb-Pb multiplicities higher than true ones,
as we now know,
scaled numbers do therefore include a safety factor of 2-3
- Common Readout Unit (CRU) for TPC and ITS sit on Service Support Wheels (SSW)
 - inner radius 80cm, outer radius 250cm
- Specification for CRU
 - 1krad of ionizing dose
 - $10^3 \cdot \text{cm}^{-2} \cdot \text{s}^{-1}$ hadrons
 - $10^3 \cdot \text{cm}^{-2} \cdot \text{s}^{-1} = 3 \cdot 10^{11} \cdot \text{cm}^{-2} \cdot (\text{10 years})^{-1}$