Mu3e experiment - filter farm and camera alignment system

By

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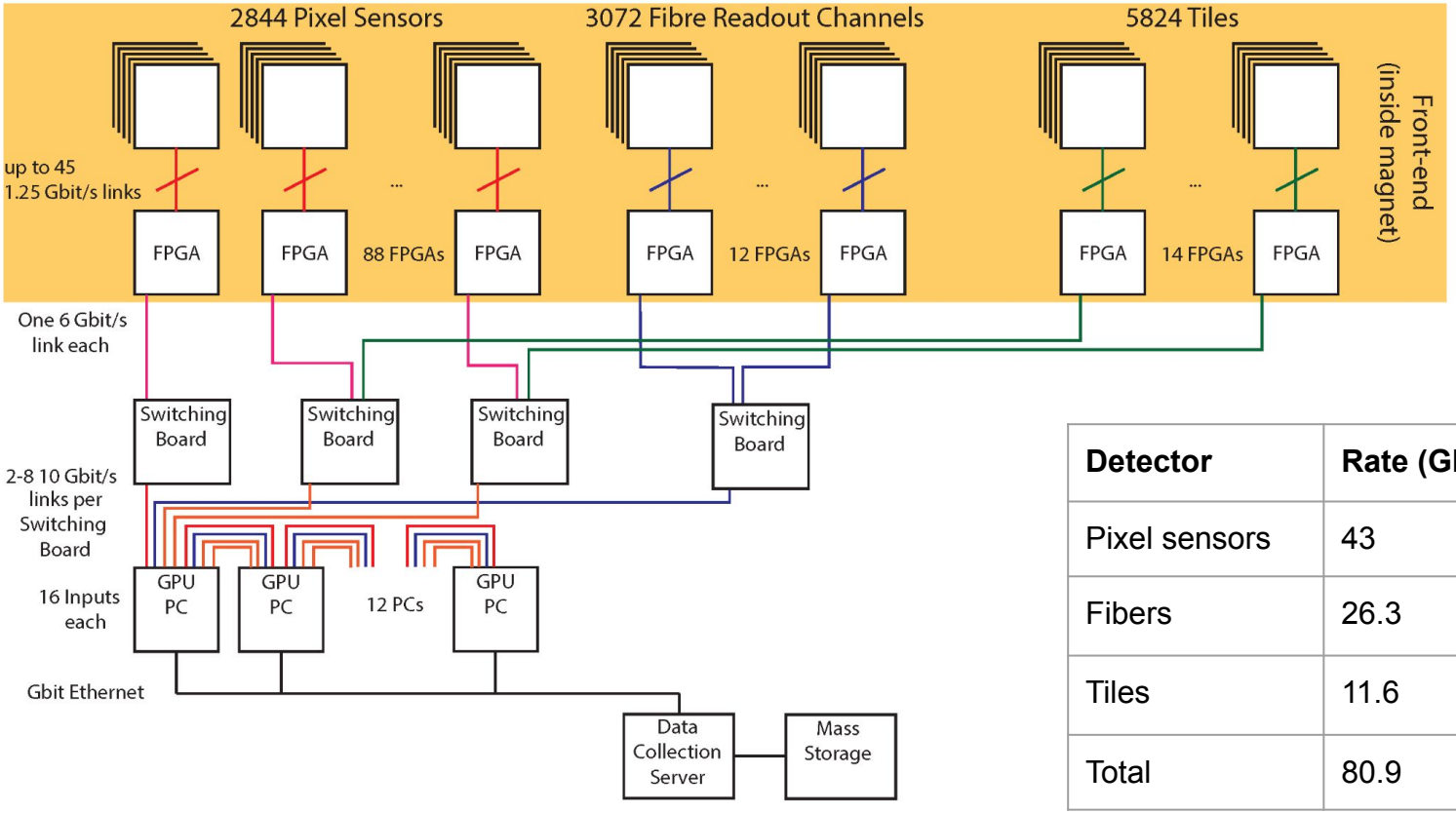
Overview

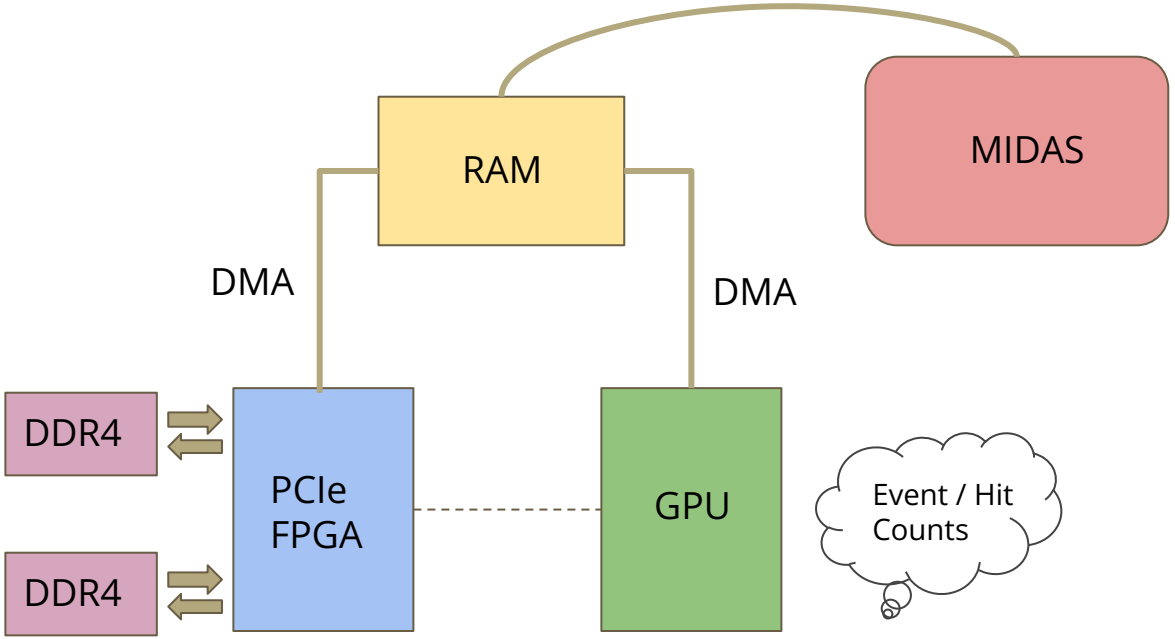
- Data Acquisition System
  - Filter Farm
  - GPU
  - Counting in GPU
- Camera Alignment System
  - Prototype
  - 3D Model
  - Plans for camera alignment system
- Plans for Cosmic Run

DAQ Readout System



Detector	Rate (Gbit/s)
Pixel sensors	43
Fibers	26.3
Tiles	11.6
Total	80.9

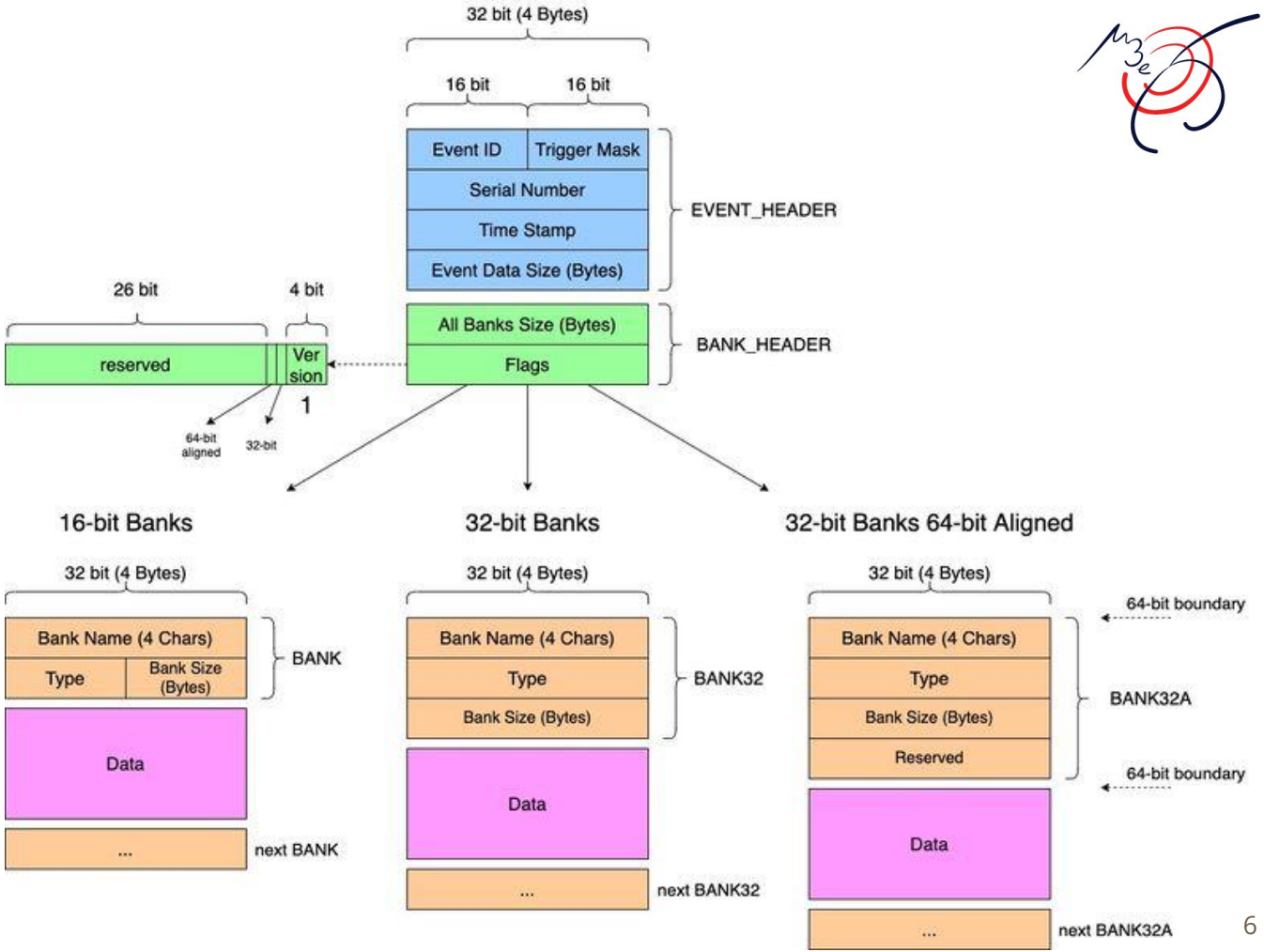
Filter farm



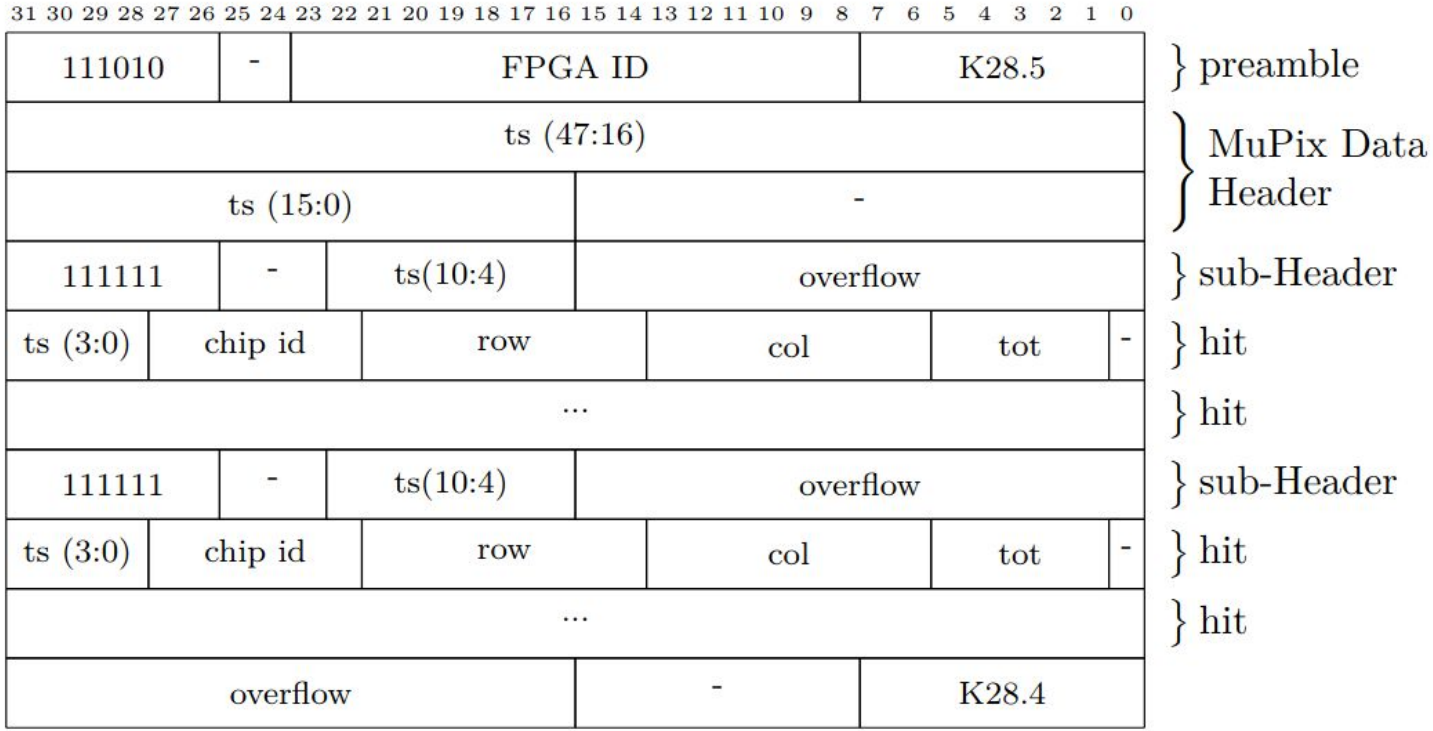
Graphical Processing Unit (GPU)

Specifications	GTX1080Ti
Streaming Multiprocessors (SM)	28
CUDA cores / SM	128
Total CUDA cores	3584
Max. clock frequency	1.6 GHz
Peak compute performance	11 TFLOPs
Memory bandwidth	484 GB/s
Memory bus width	352 bit
Memory capacity	11 GB
Release date	05/2017

Event Counting in GPU

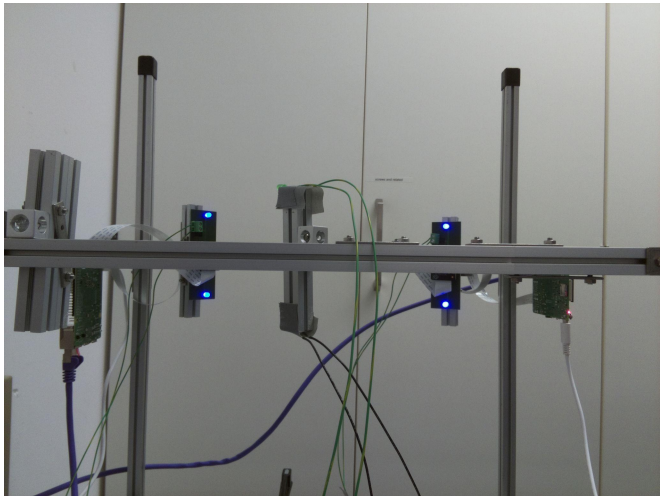


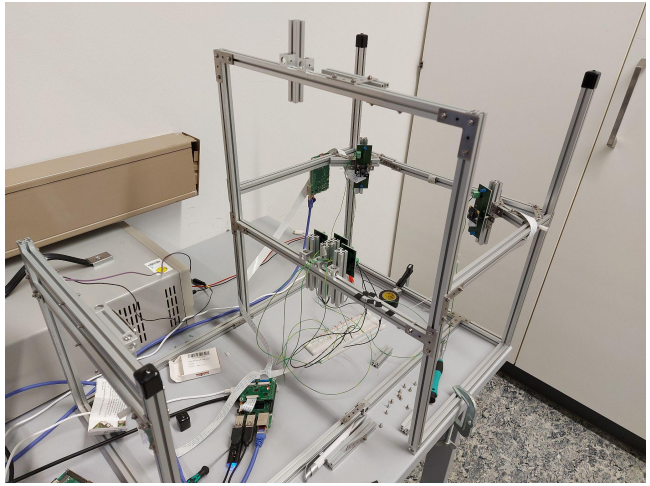
Hit Counting in GPU

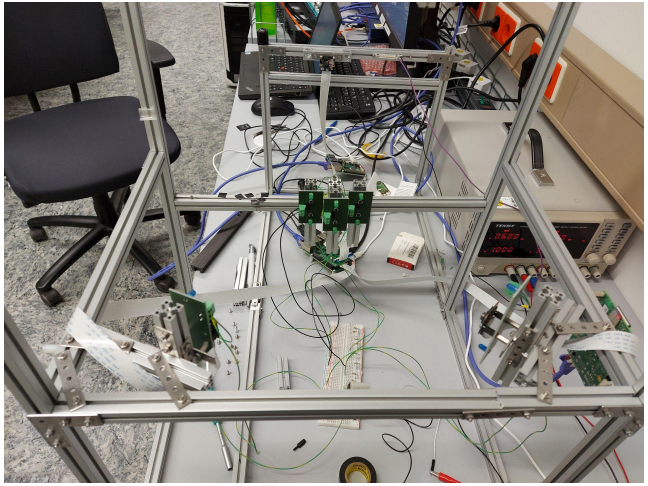


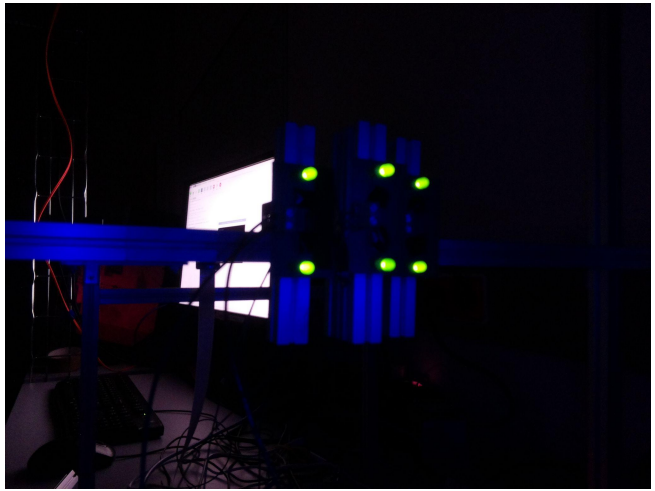
Camera Alignment System

- We gained the information that scintillation fiber detector cannot tolerate Infrared light. Therefore, the LED with wavelengths (845-855 nm) have to be off during data taking.
- An interlock with the power system must be setup together with the camera alignment system such that the camera system turn on only while the data taking is off.
- We can also explore the possibility of trying to capture the misalignment between the position of pixel chips on the detector. It can be done by illuminating the detector surface and recognize each pixel chips with its position from the images.

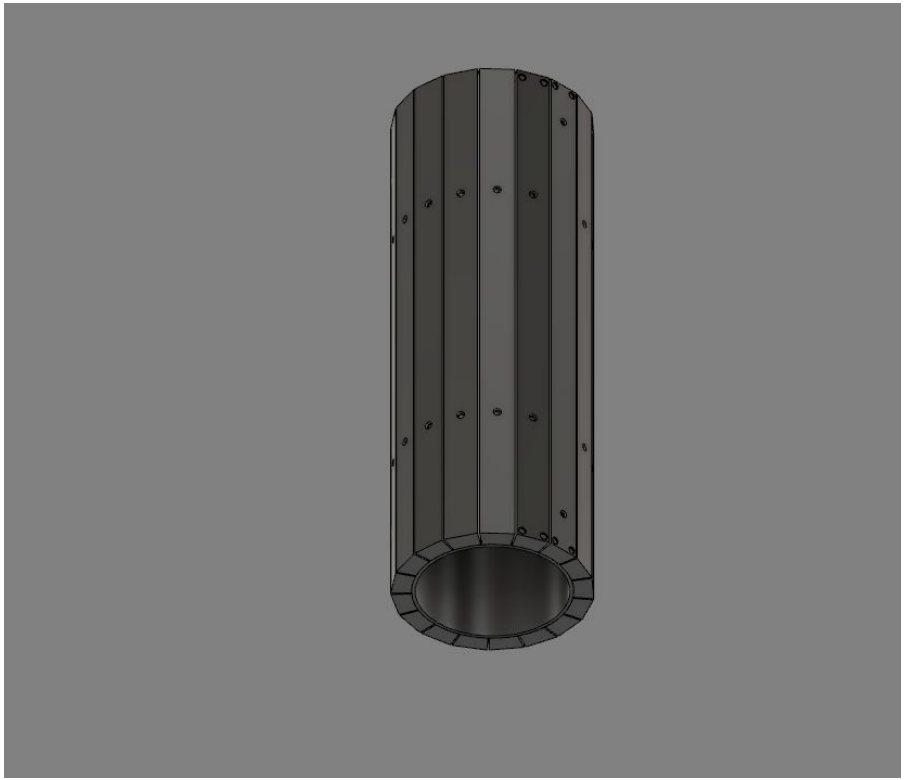






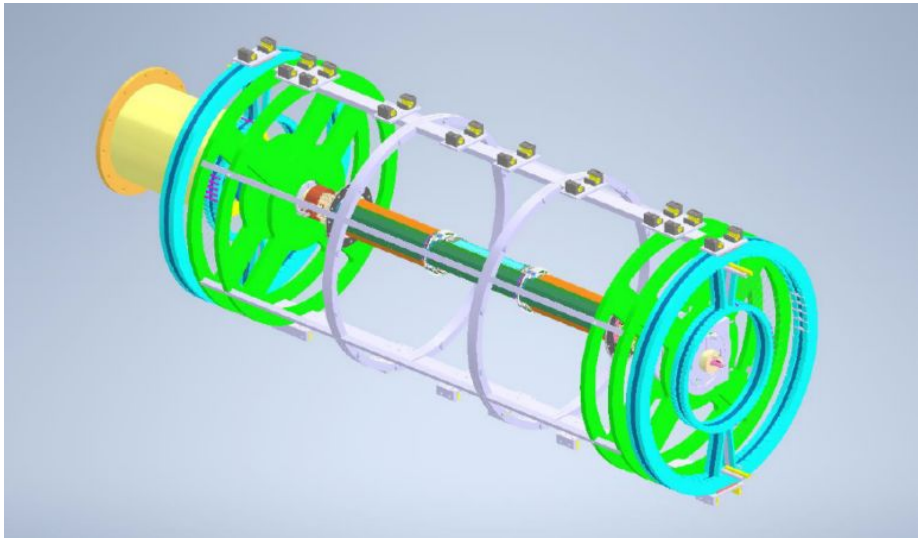


3D Model



Plans for camera alignment system

- The power requirements of the camera system needs to be measured.
- Need to ensure that the camera is able to produce images that shows the distinct feature on the pixel chips.
- Pixel chip position recognition algorithm must be developed and optimized.
- The Raspberry Pi will be replaced by an FPGA dedicated to the purpose of the camera alignment system.



Source: Ref. 5

Plans for Cosmic Run

- Testing of Event/Hits counting in filter farm during cosmic run in April 2022.
- Camera’s field of view from the detector cage will be analysed for blind spots and best orientation as well as combination of cameras will be estimated.
- The distance measuring algorithm will be checked with the actual detector while the data taking is off. It can be further tested if it can find deformations in the geometry of the detector.
- 2m long camera power cables will be tested during the cosmic run.

PhD Requirements:

- I have started the teaching assistantship during the semester break and also for the summer semester F-Praktikum course on Balmer series.

References

1. D. V. Bruch, *Pixel Sensor Evaluation and Online Event Selection for the Mu3e Experiment*, 2017.

2. N. Berger, A. K. Perrevoort (Mu3e Collaboration), *Searching for New Physics with The Mu3e Experiment,* 2019.

Thank You