



MicroTCA Application: Real Time Event Building and FIONA

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This Talk

1. Completed Work
 - CAPTAN mTCA
2. Current Work
 - FIONA
3. Future Work
 - CMS Upgrades?
4. xTCA Impressions

First DIG xTCA Project

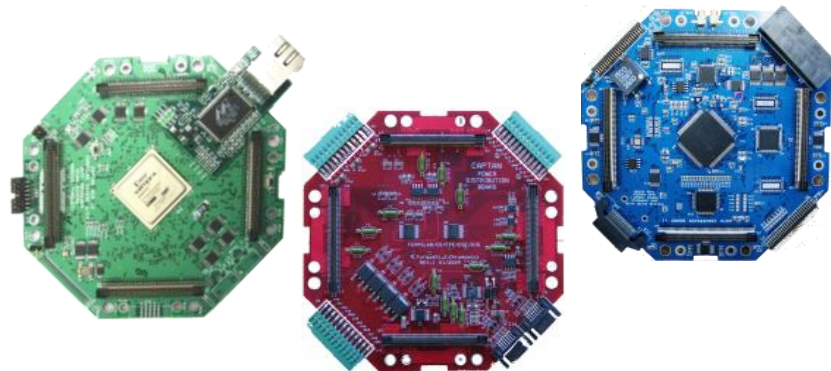
- Goals:
 - Gain experience designing boards in the xTCA form factor.
 - Strive to meet complete mTCA specification.
 - Minimize points of failure.

CAPTAN AMC



Why CAPTAN

- **CAPTAN** - Compact And Programmable daTa Acquisition Node
 - Simple, flexible, scalable data acquisition solution developed by DIG. The user can stack the foundation boards in different combinations to give unique functionality.
 - We had FPGA boards on hand.
 - Reuse of CAPTAN allows the AMC to be simple and avoid errors.

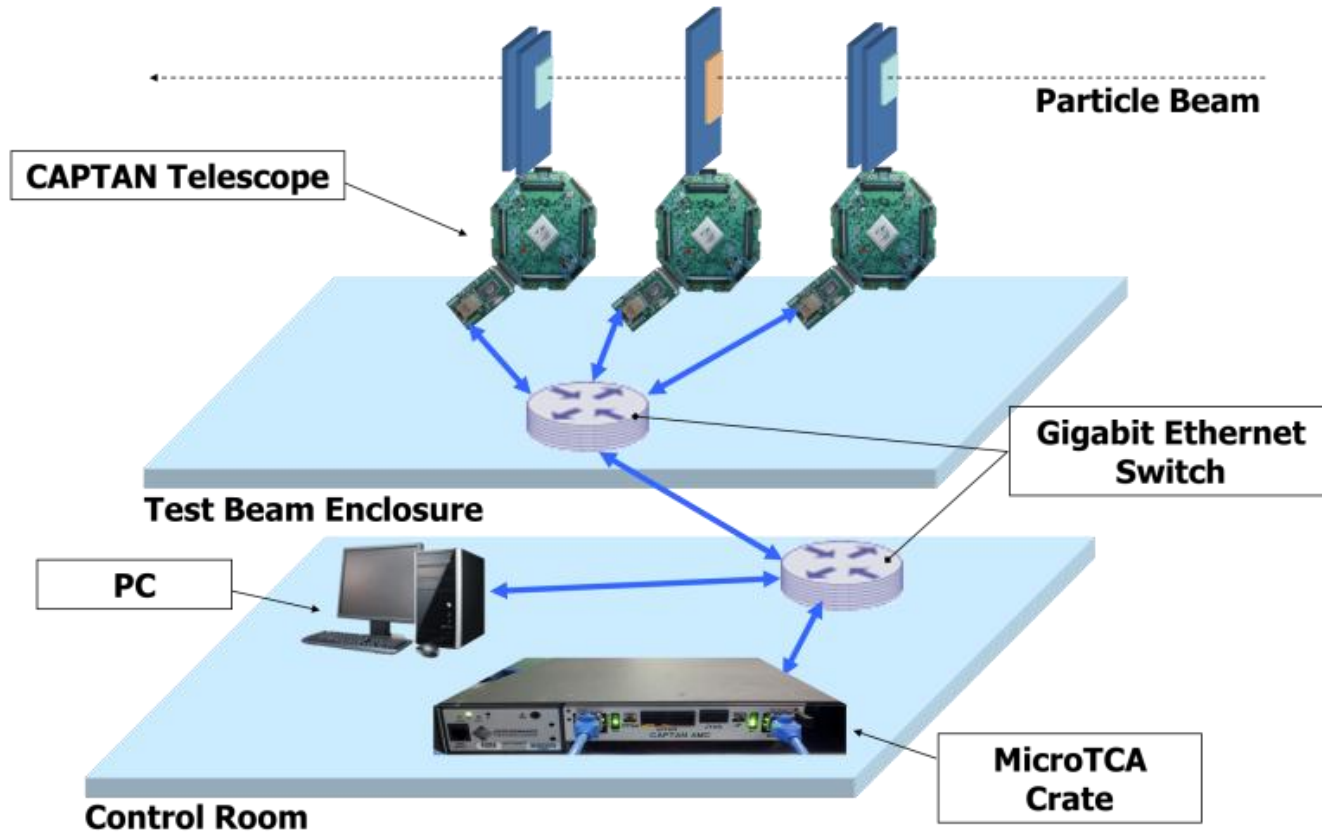


CAPTAN AMC Features

- Passive AMC
- MMC from pluggable Olimex LPC-H2148
 - NXP ARM 7, 60 MHz, 42 KB RAM
- Logic and memory from pluggable CAPTAN
 - Xilinx Virtex-4
 - 162 KB RAM
 - 400 MHz fabric
 - 2 x Full-Duplex GbE



Test Beam Application: Real-Time Event Assembly



FTBF Pixel Telescope

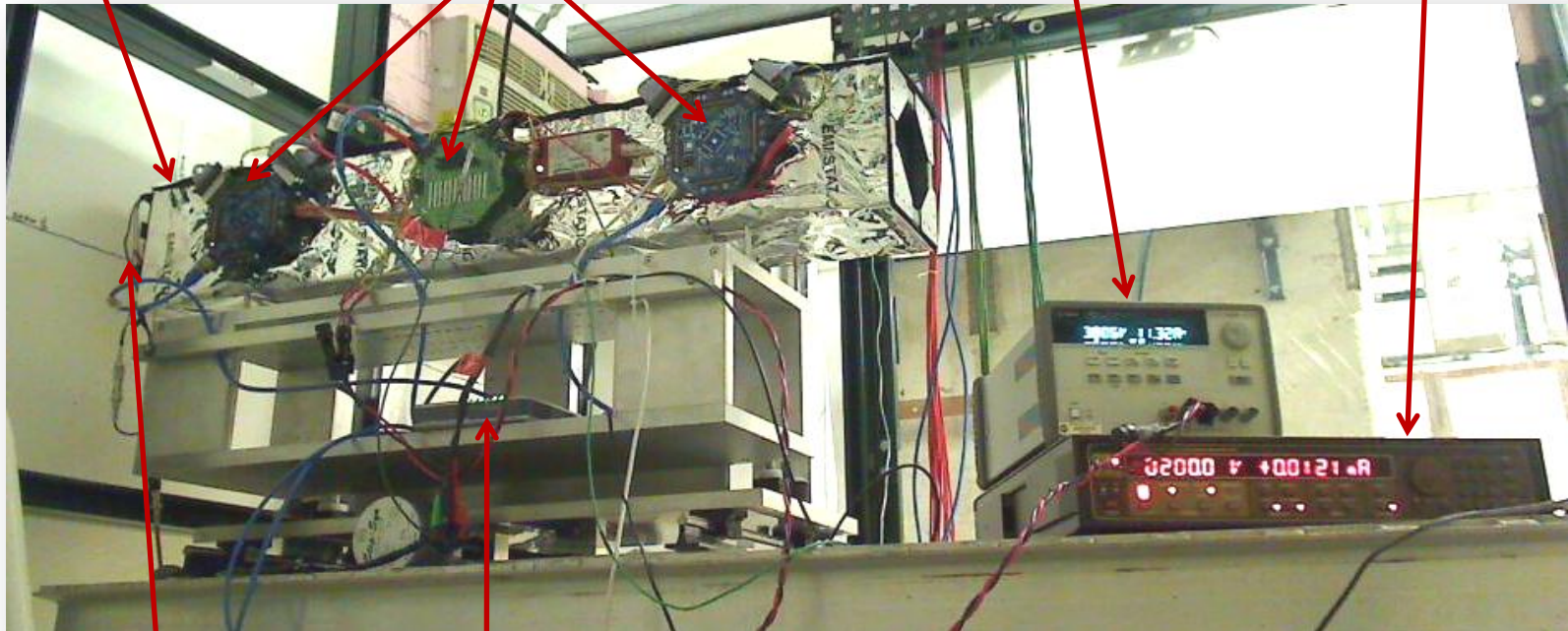
The CAPTAN pixel telescope is 8 silicon pixel planes leftover from CMS, with space for 2 DUTs in the middle. Pixel size is $100\ \mu\text{m} \times 150\ \mu\text{m}$. Projected track resolution on DUT is 6-10 μm . Data acquisition with the CAPTAN system.

Pixel Telescope Frame

CAPTAN Stacks

Power Supply

DUT HV Supply

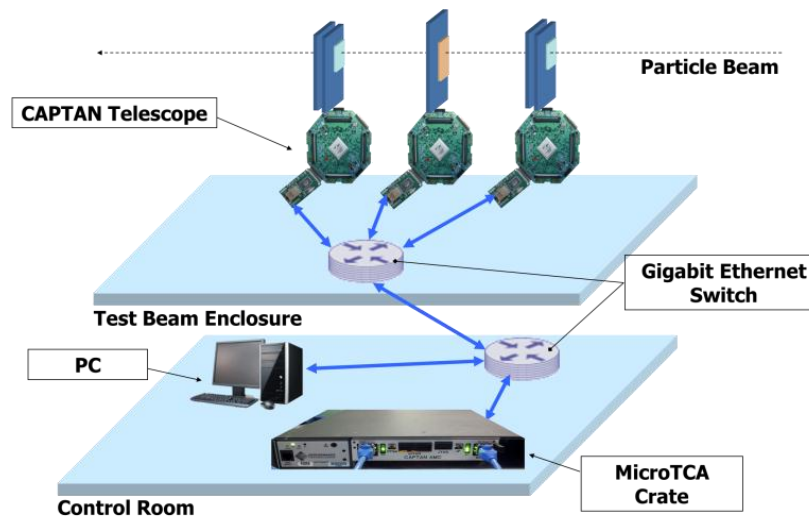


Scintillator

Ethernet Router

Test Beam Outcome

- Successful integration of real-time event assembly, in mTCA form factor, into the T-992 pixel telescope DAQ.



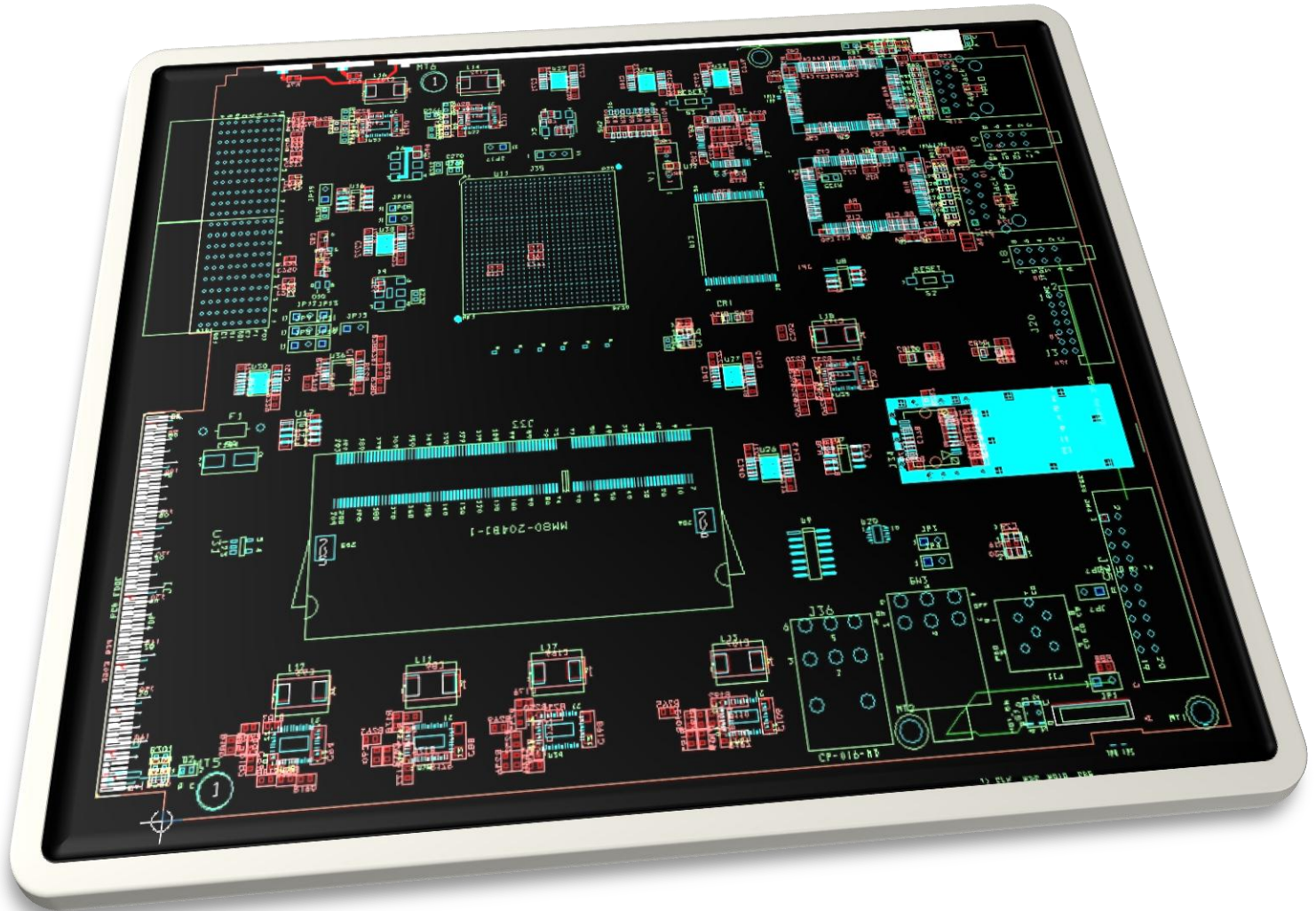
Current Work

- FIONA - Fast Input/Output Networked AMC
- Goals:
 - mTCA.4 RTM experience
 - High speed (~10 Gbps) FPGA TX/RX
 - Explore mTCA.4 backplane and connector speed capabilities
 - Add real-time track generation to event assembly solution

FIONA

- **FPGA: Kintex 7**
 - 2,000 KB RAM, ~800 MHz fabric, 16 GTX transceivers
- **Memory: DDR3 SODIMM**
 - 2 GB RAM @ ~1.3 GHz
- **μRTM rear transition module**
 - 1 SFP+ and 10 TX/RX channels on MiniPods
- **AMC front panel**
 - 1 SFP+ and 2 x GbE (use GbE for FPGA config)
- **Backplane**
 - 10GbE Fat Pipes and GbE to MCH crate position

FIONA

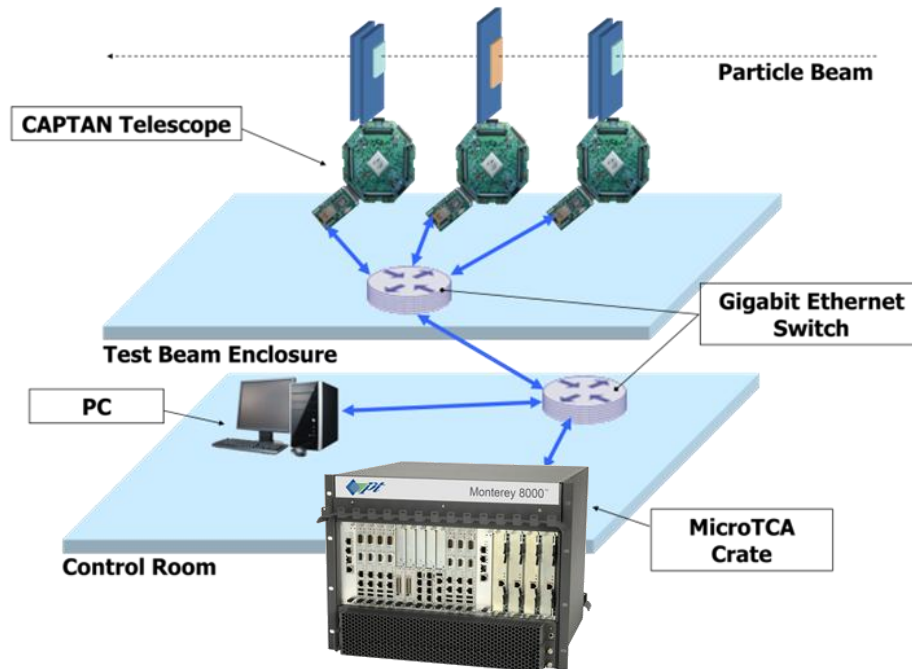


mTCA.4 Crate



FIONA Future Work

- We plan to use 1-3 FIONAs in the mTCA.4 carrier to conduct real-time tracking in a test beam environment.



xTCA Future Work

- Large experiments need DAQ carriers and are considering xTCA over VME.
 - CMS
 - ATLAS
 - LHCb
 - Experiments at DESY
- We want to develop a mTCA-based readout system for a new strips/pixels telescope and leverage the experience to position ourselves for future DAQ opportunities.

xTCA Impressions

- xTCA is a convenient architecture for powering and cooling boards
 - Crates are available, affordable, and scalable
- mTCA backplane has limited utility
 - Few channels between boards
- The full specification is extensive
 - Shelf manager interfacing is involved