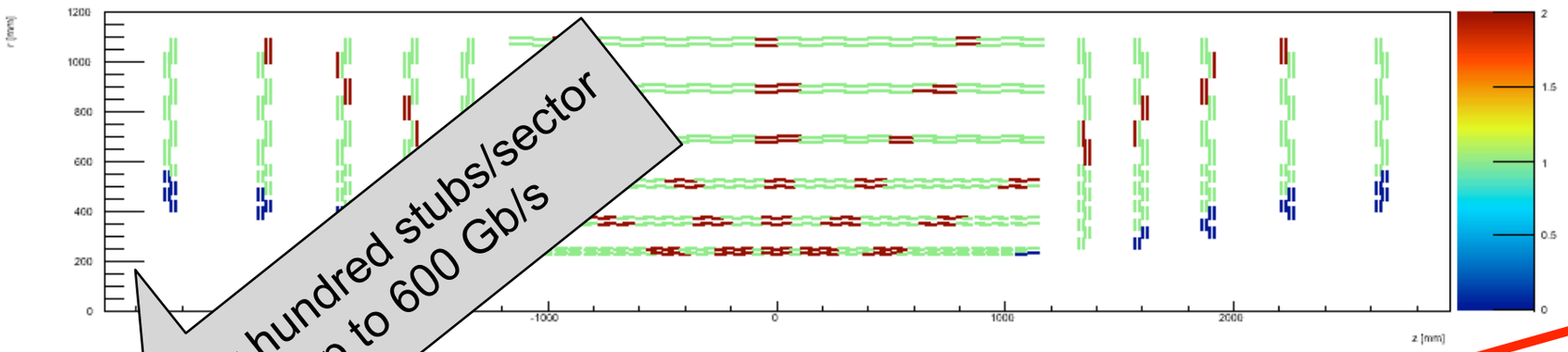
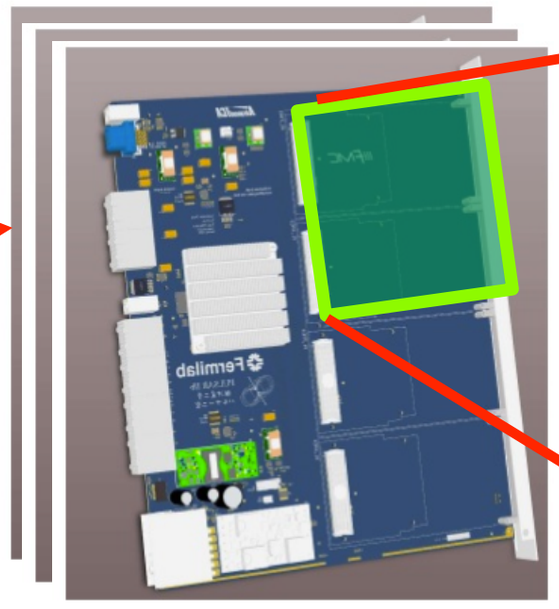
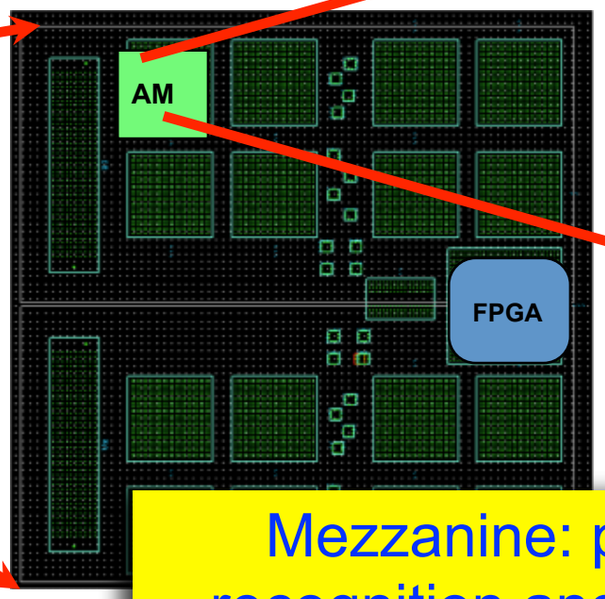
L1 Track finding concept

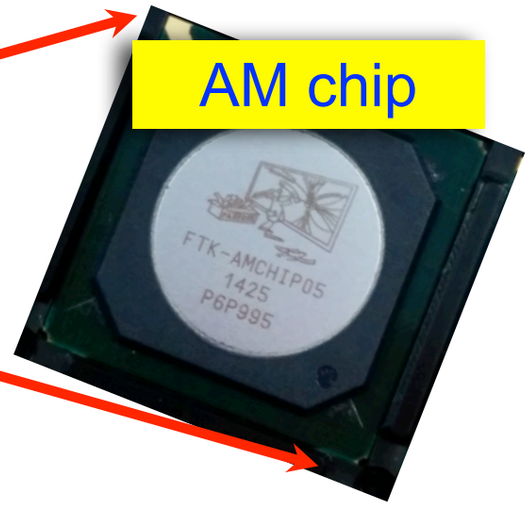


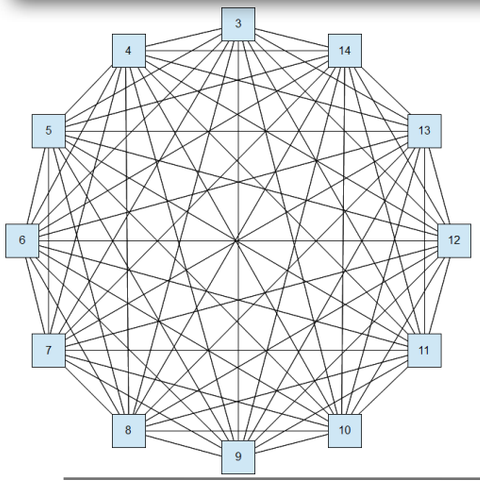
40-100 G full mesh ATCA shelf





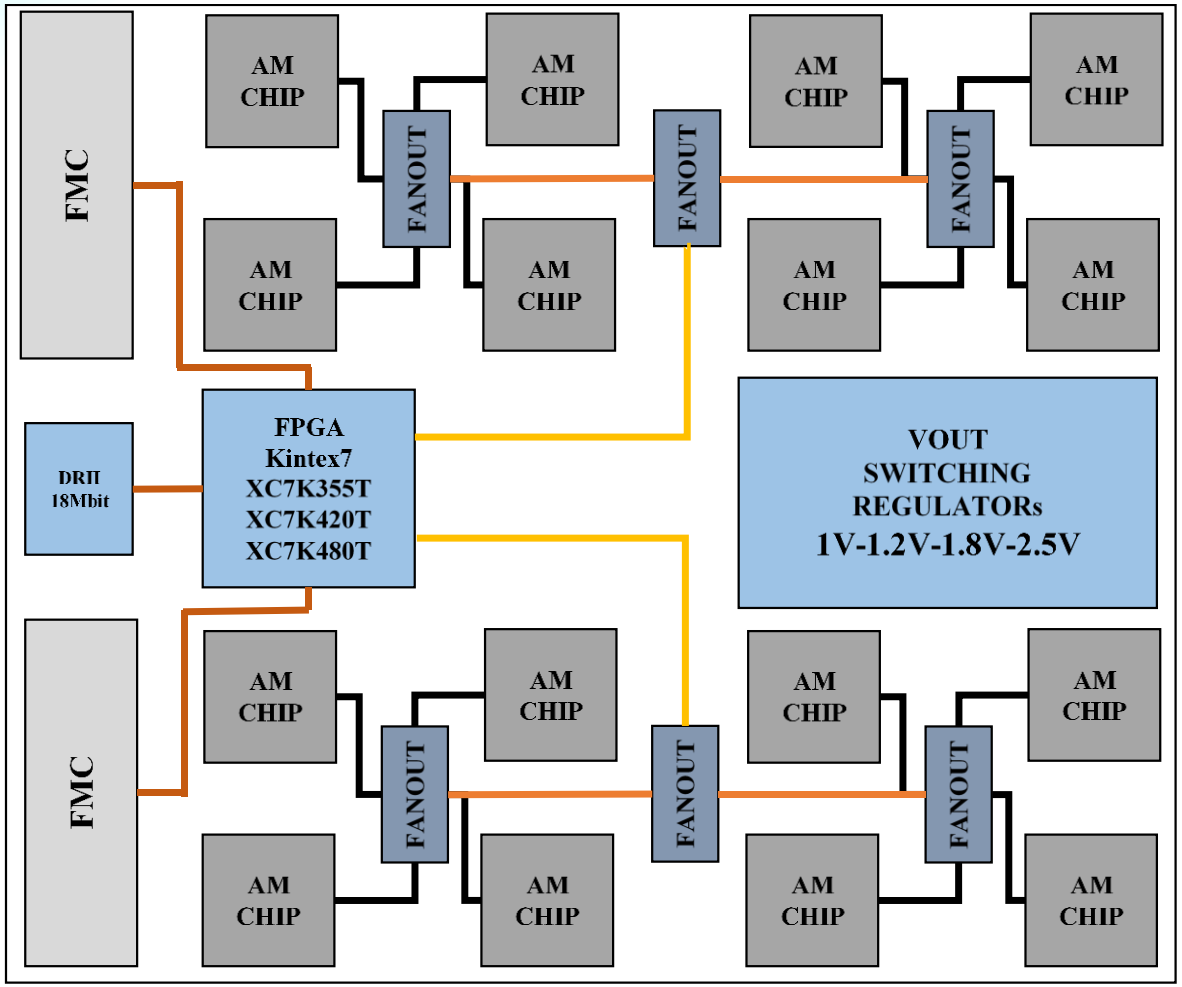
Mezzanine: pattern recognition and track fit





- Send data to PRM in each ATCA shelf
  - Data distributed to Pulsar boards in time multiplexed mode
  - Perform pattern recognition using AM chips
  - Track fit with FPGA (PCA, Hough transform, Retina etc)

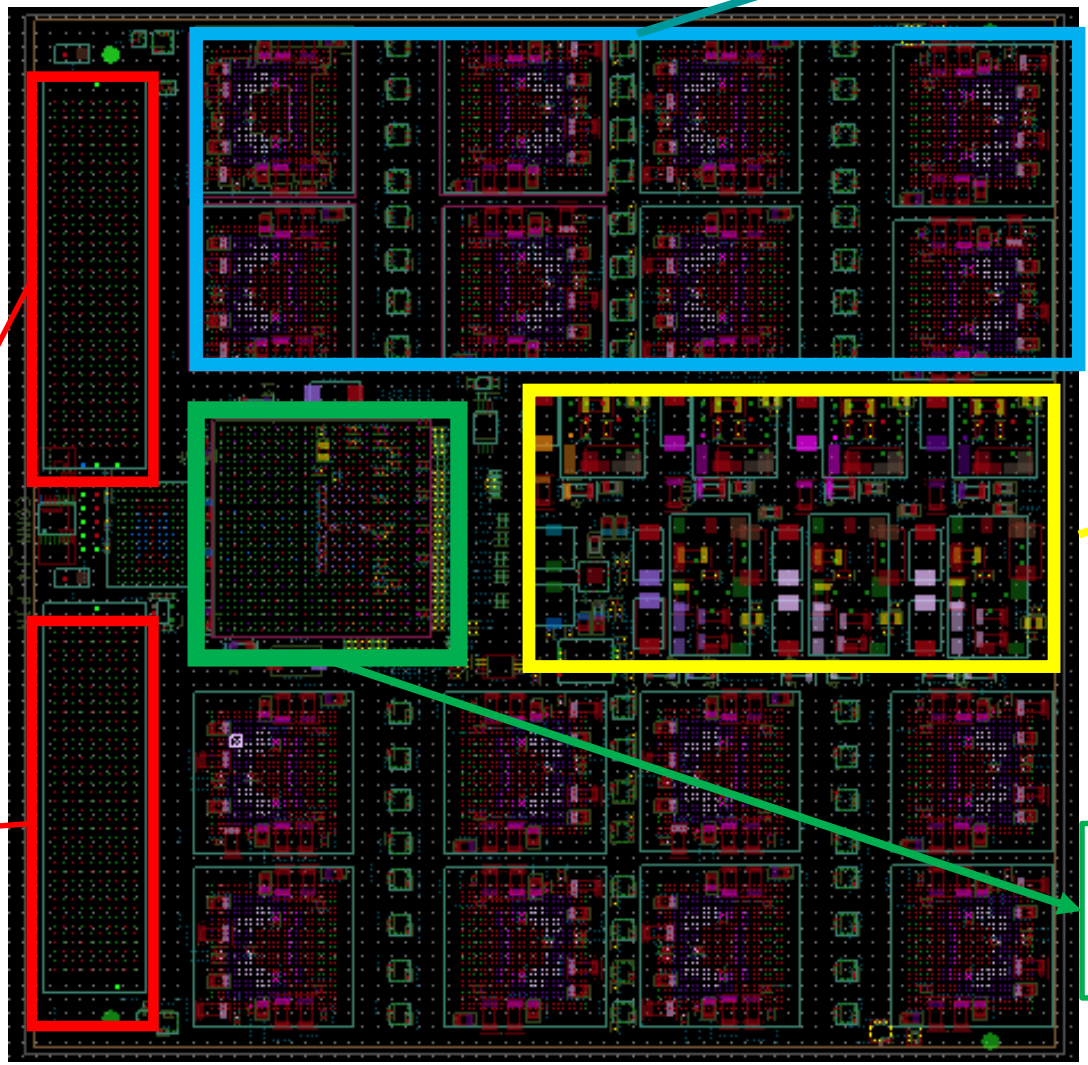
The architecture of PRM

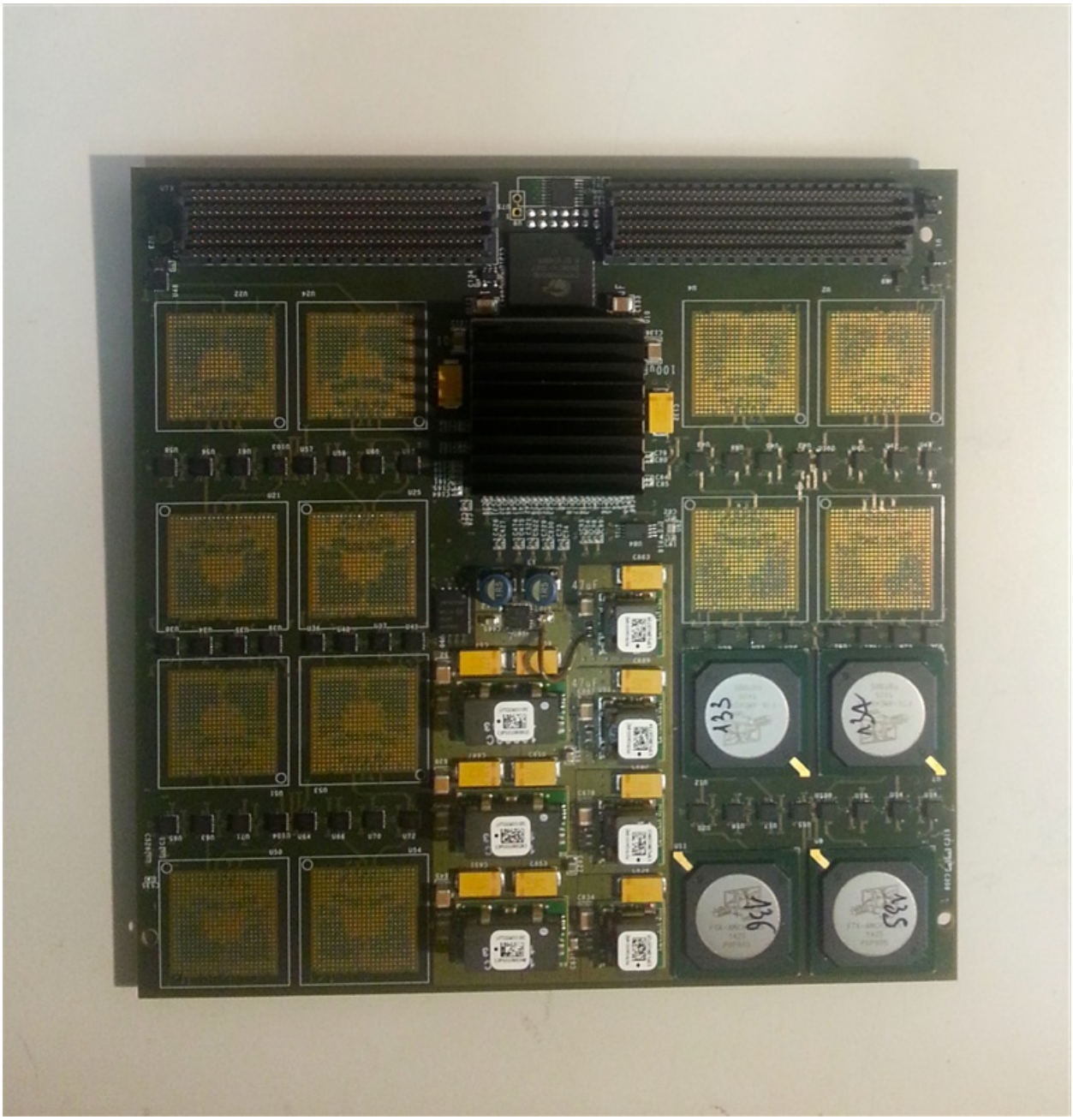


- Double FMC mezzanine 14.9x14.9 cm^2
- Kintex-7 FPGA
- FMC compatible with Pulsar IIB & satisfy the Vita 57.1 standard
- I/O bandwidth for each FMC connector
  - 64Gbps (GTX transceiver)
  - High speed LVDS signal
- DDRII eternal memory
- Support AMchip05/AMchip06

Layout of the PRM

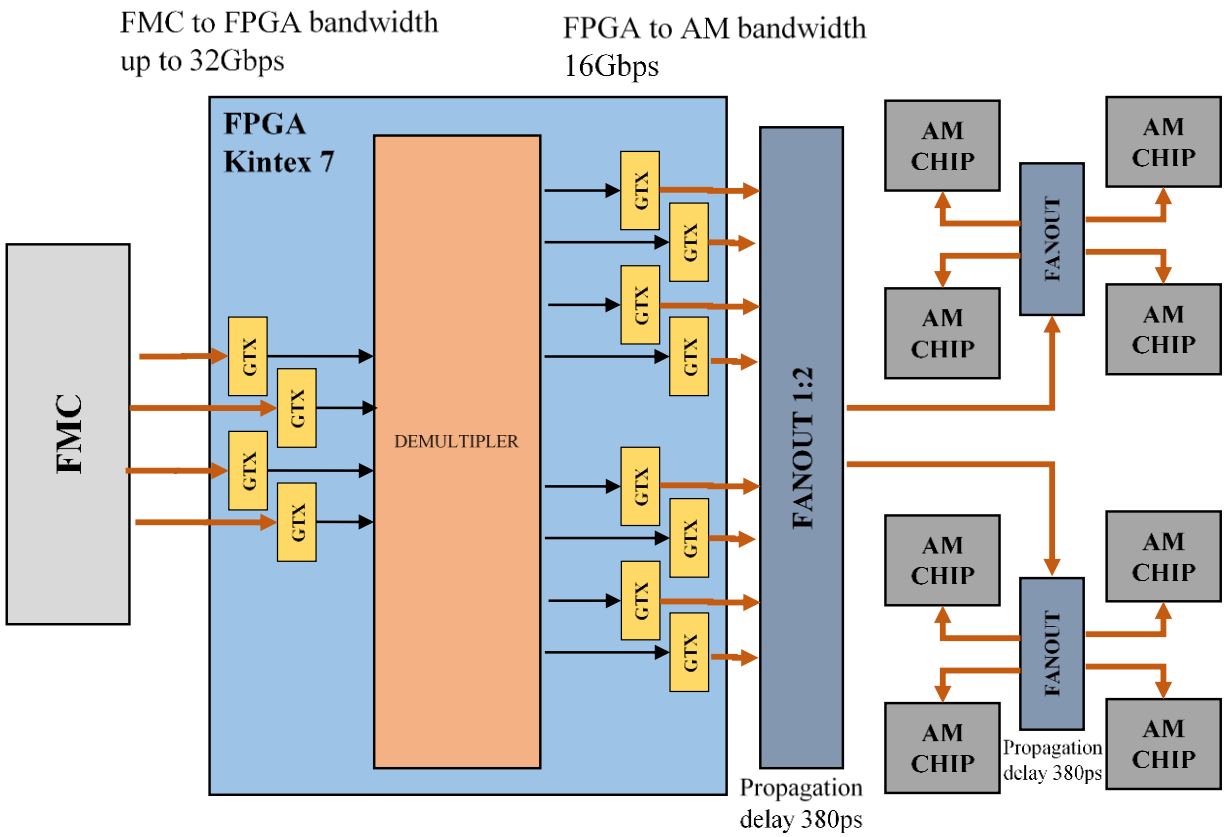
- The layout of the PRM mezzanine





Input data distribution

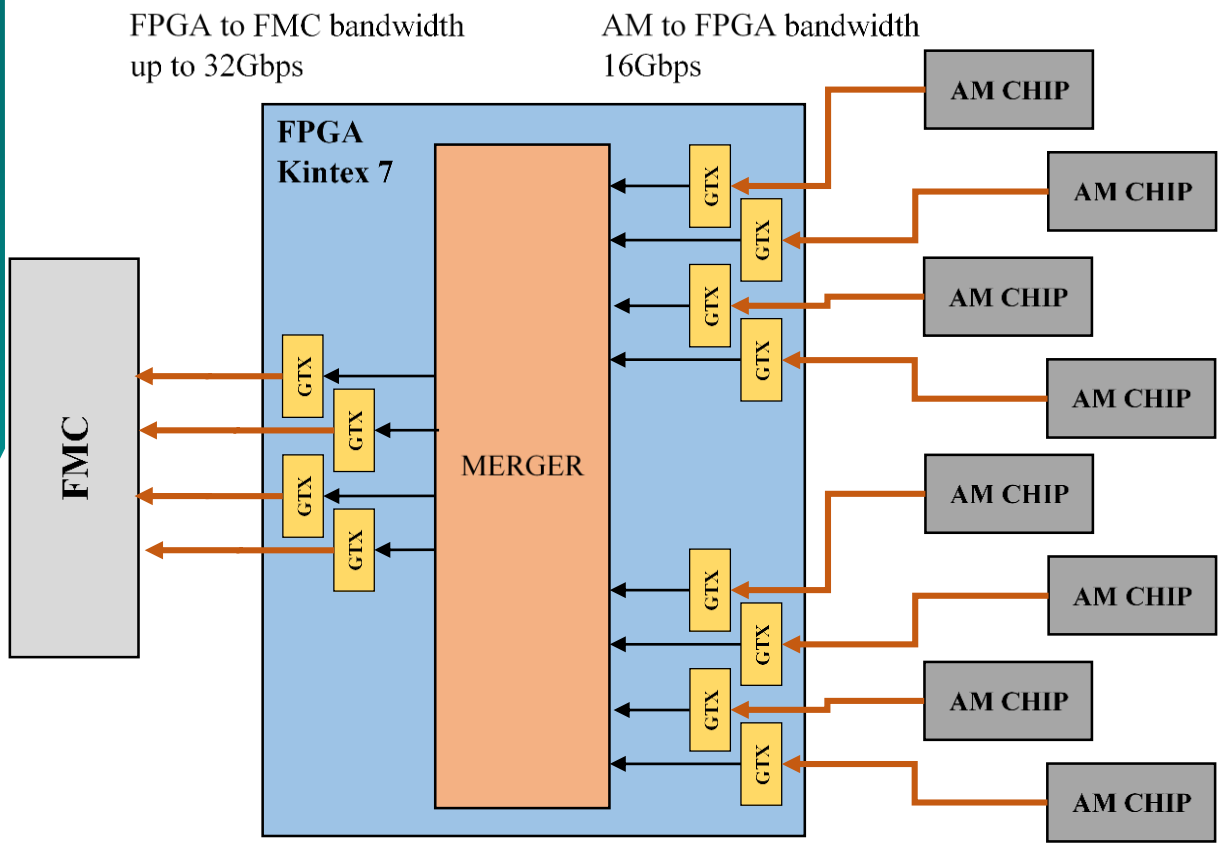
- Half part of the PRM mezzanine



- Each bus to the AM chip has a dedicate transceiver
  - 8 links@2Gbps for serve all the 8 input buses of the AM
- Minimized the latency of connection
  - The Fanout buffer introduces a delay of 380ps
- The total bandwidth to the AMchip after the spitting is 8Amchip with 8links @2Gbps
  - 128Gbps to AM

The output data flow

- The output connection of half mezzanine



- Each output of AM chip is connected to FPGA (**star connection**)
  - 16 links@2Gbps in parallel are connected directly to FPGA
- Minimized the latency of connection
- The latency is due to the deserialization/serialization of output road stream in the FPGA transceiver
- The output bandwidth from FPGA to FMC > to the AM to FPGA input bandwidth
  - No latency introduced by the merger

Pattern Recognition Engine flow

Δt_pattern_reco

Δt_track_fit&cleaning

FPGA

Track fitting starts after one road has been outputted and the rest of the event still in input

Pipelined processing

Roads with associated stubs

stubs Pt Check for each comb

Track fitting stage

Clean up

tracks

Stubs from Pulsar for a given BX and Trigger Tower

Stubs library or Data Organizer

Additional segmentation in z-phi

Super Strip ID of each stub <~100

AM 1

Phi-z segmentation (several AM) reduces I/O time

Unique Roads fired in output
(< ~ tens per BX/AM per trigger tower)

PR time proportional to the hottest number of stubs/layer.