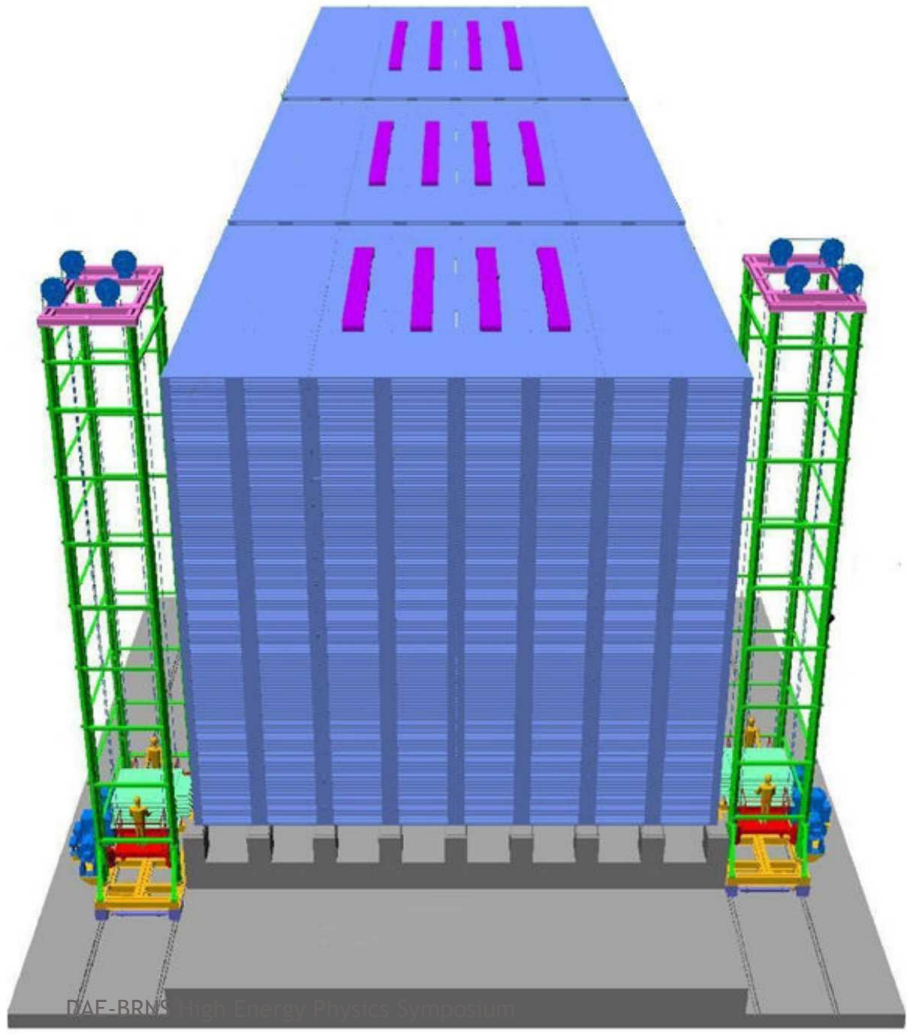
Electronics and DAQ for the magnetized mini-ICAL detector at IICHEP

Mandar Saraf, TIFR, Mumbai

On Behalf of the INO Electronics Team

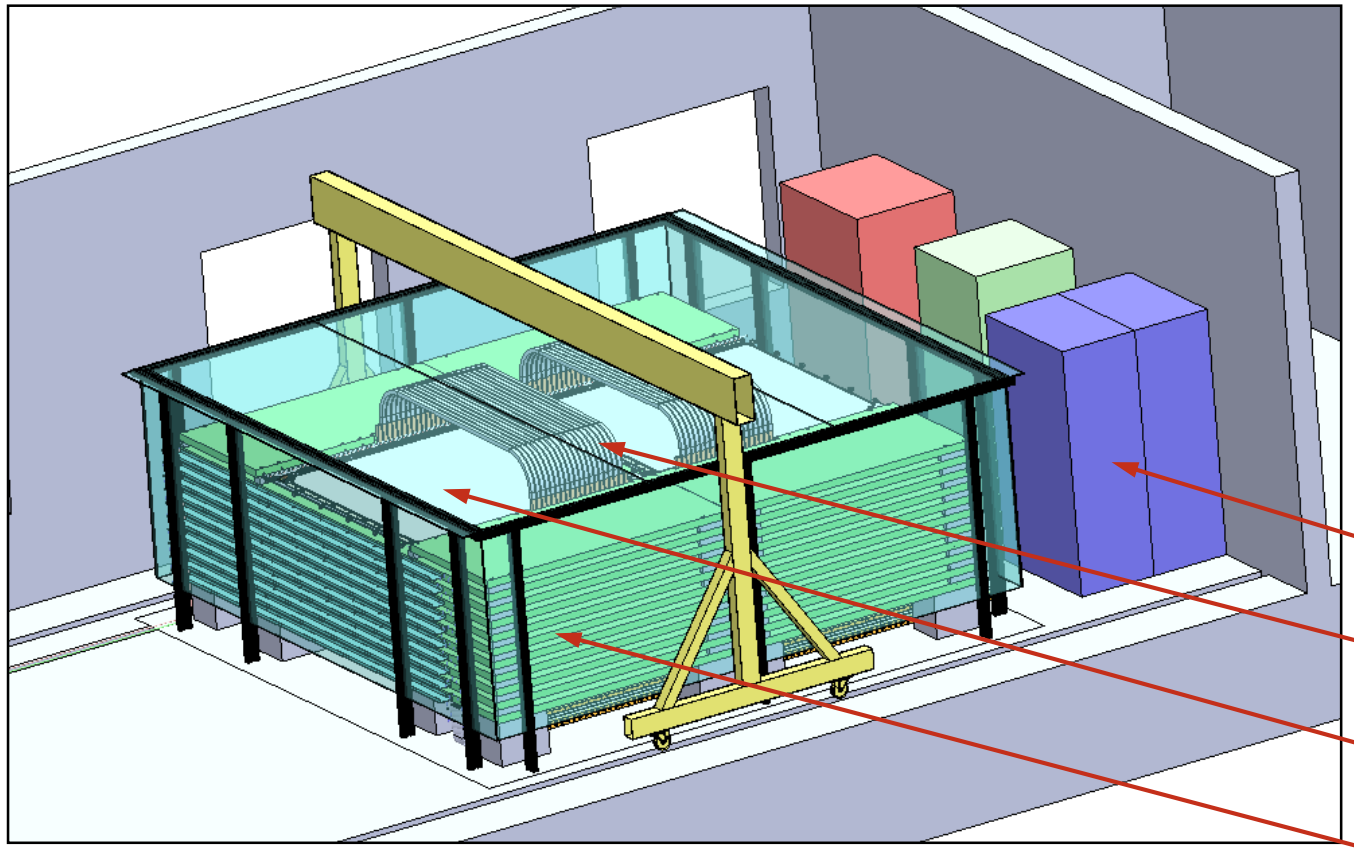
INO ICAL Detector



No of Modules	3
No. of Layers/Module	150
No. of RPCs/Layer/Module	64
No. of ½ Roads/Layer/Module	8
No. of RPC units	28800
No. of readout strips	3.7M

Drawing Courtesy Piyush Verma

MiniICAL Detector with Veto Scintillators



No of Modules	1
No. of Layers/Module	10
No. of RPCs/Layer	2
No. of ½ Roads/Layer	2
No. of RPC units	20
No. of readout strips	2560

Drawing Courtesy Piyush Verma

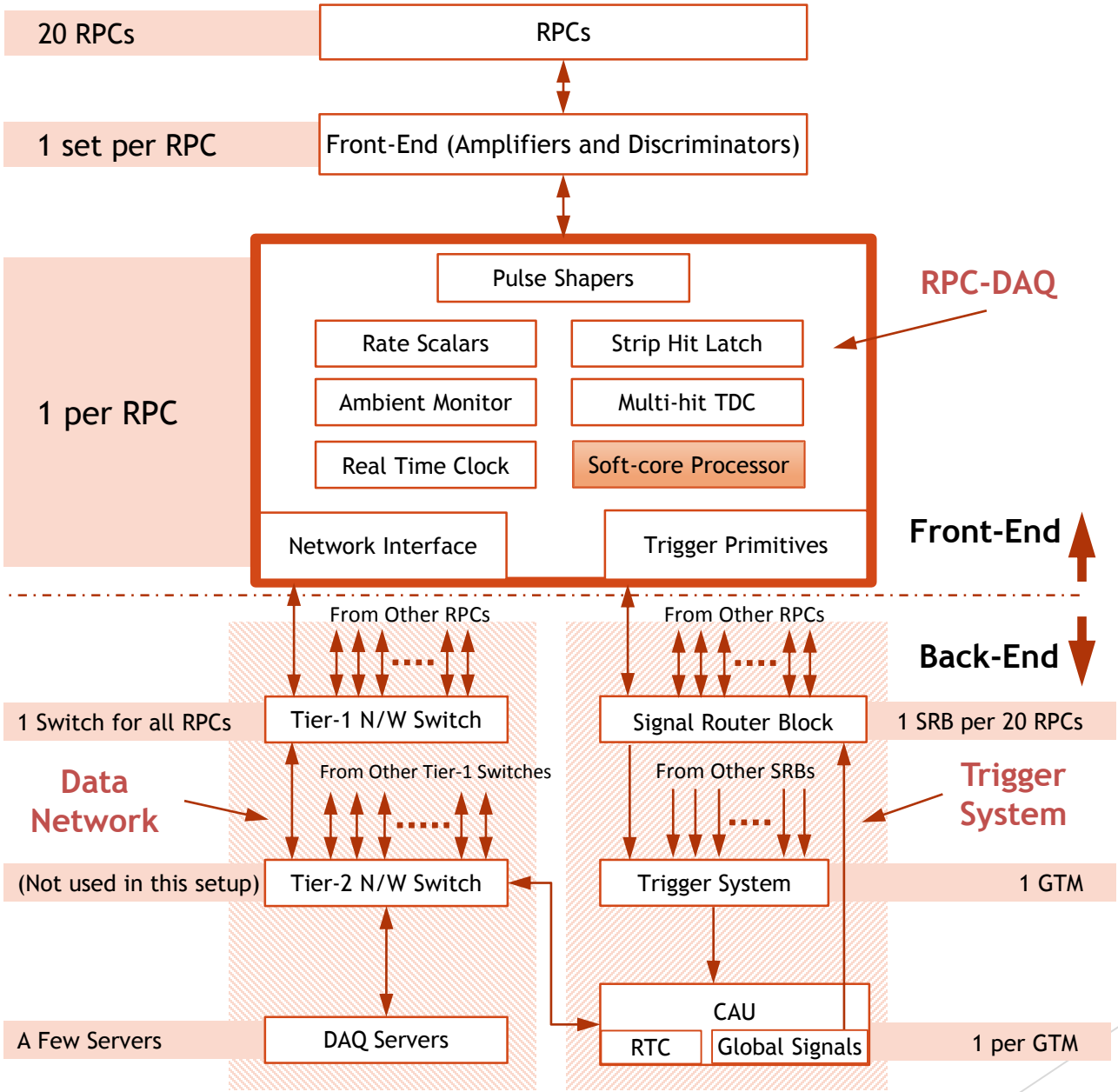
Flow of the Talk

- Prototyping the ICAL Baseline Electronics
- ICAL DAq Architecture
- RPC-Tray Assembly
- Front-End System
  - Analog Front-End
  - Digital Front-End
- Back-End System
  - Trigger Generation
  - Calibration System
  - Back-end Software
  - Power Supplies
- Results

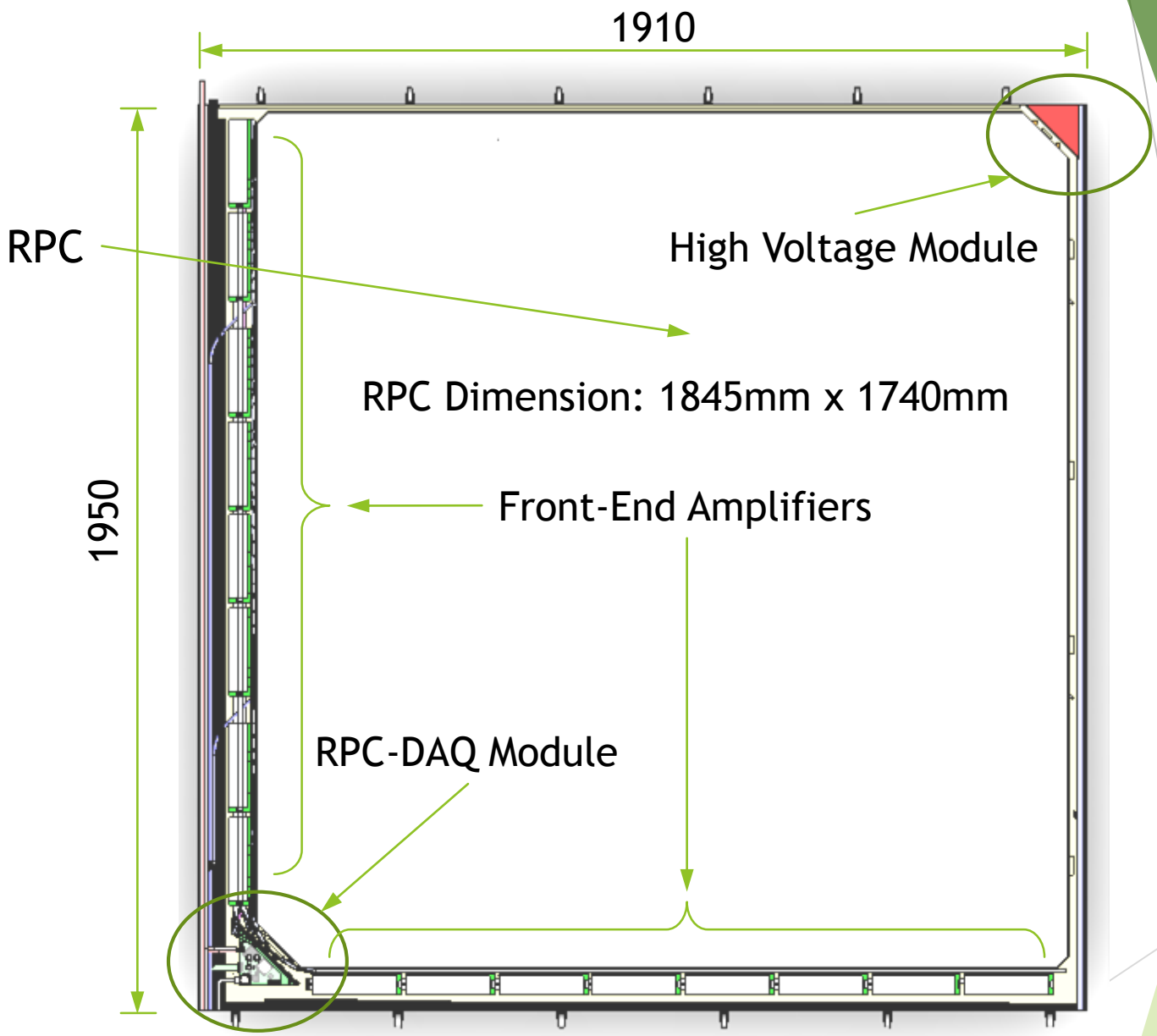
Prototyping the INO ICAL Baseline Electronics and Back-End Software

- The Baseline Electronics for ICAL has been designed and implemented
- It is getting thoroughly tested on real RPC detector stack
- The Mini-ICAL is presently running with 10 RPC detectors
- This magnetised 10 layered 2m x 2m RPC stack is the most appropriate detector to test the Baseline Electronics

ICAL DAQ Architecture



RPC Tray Assembly



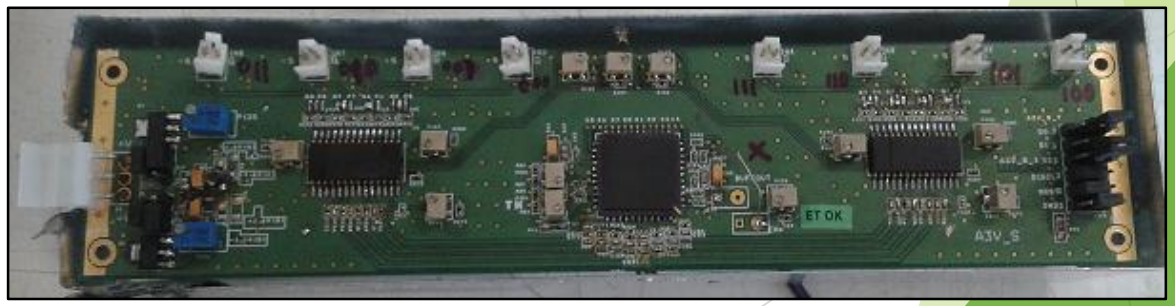
Analog Front-End: NINO and Anusparsh-III

NINO: Installed in 9 layers

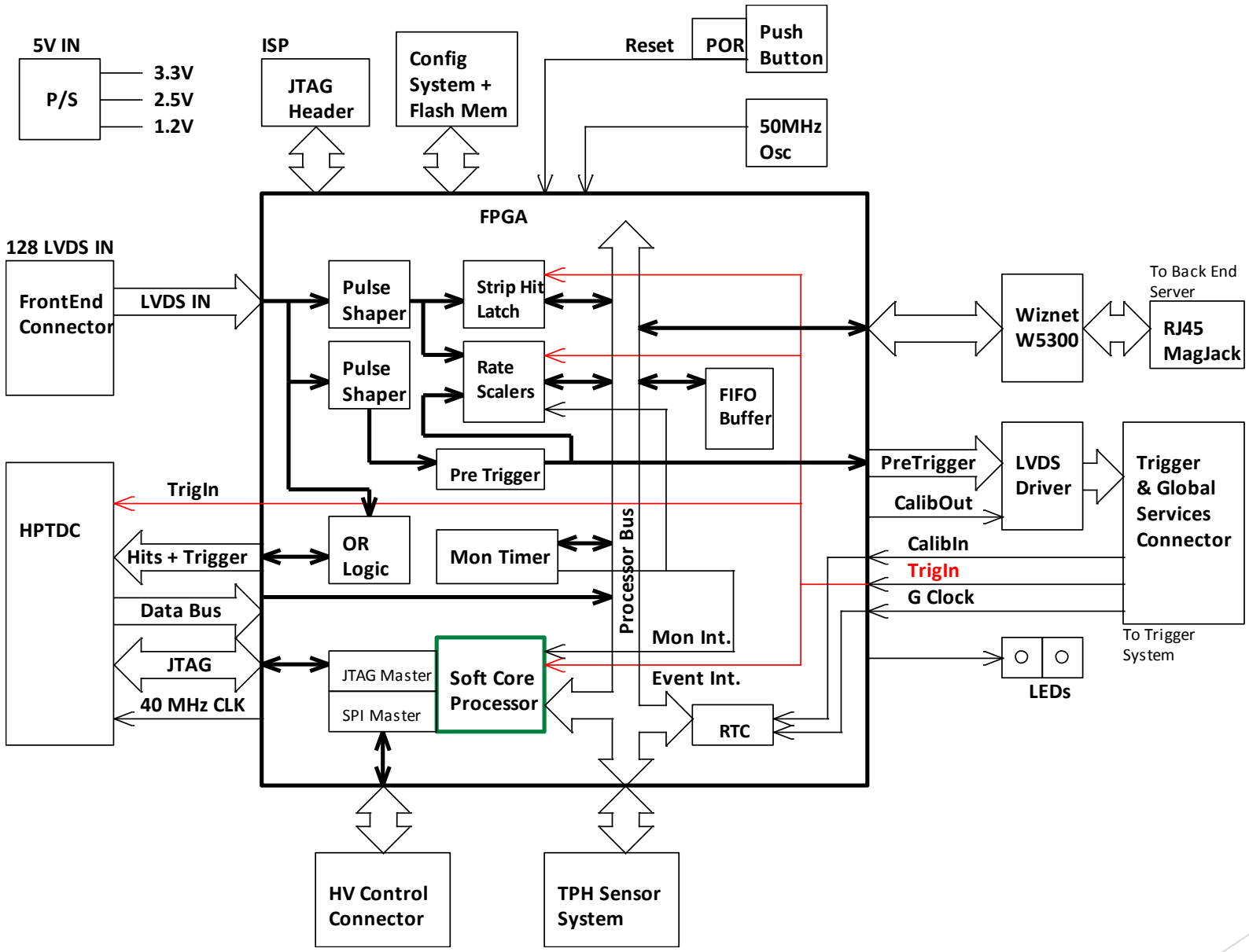
- 8 Channel preamplifier board.
- Common threshold control for all channels.
- Size of Board is 200 mm x 23 mm
- LVDS Outputs
- Power consumption 70 mW/ch

Anusparsh-III: Installed in 1 Layer

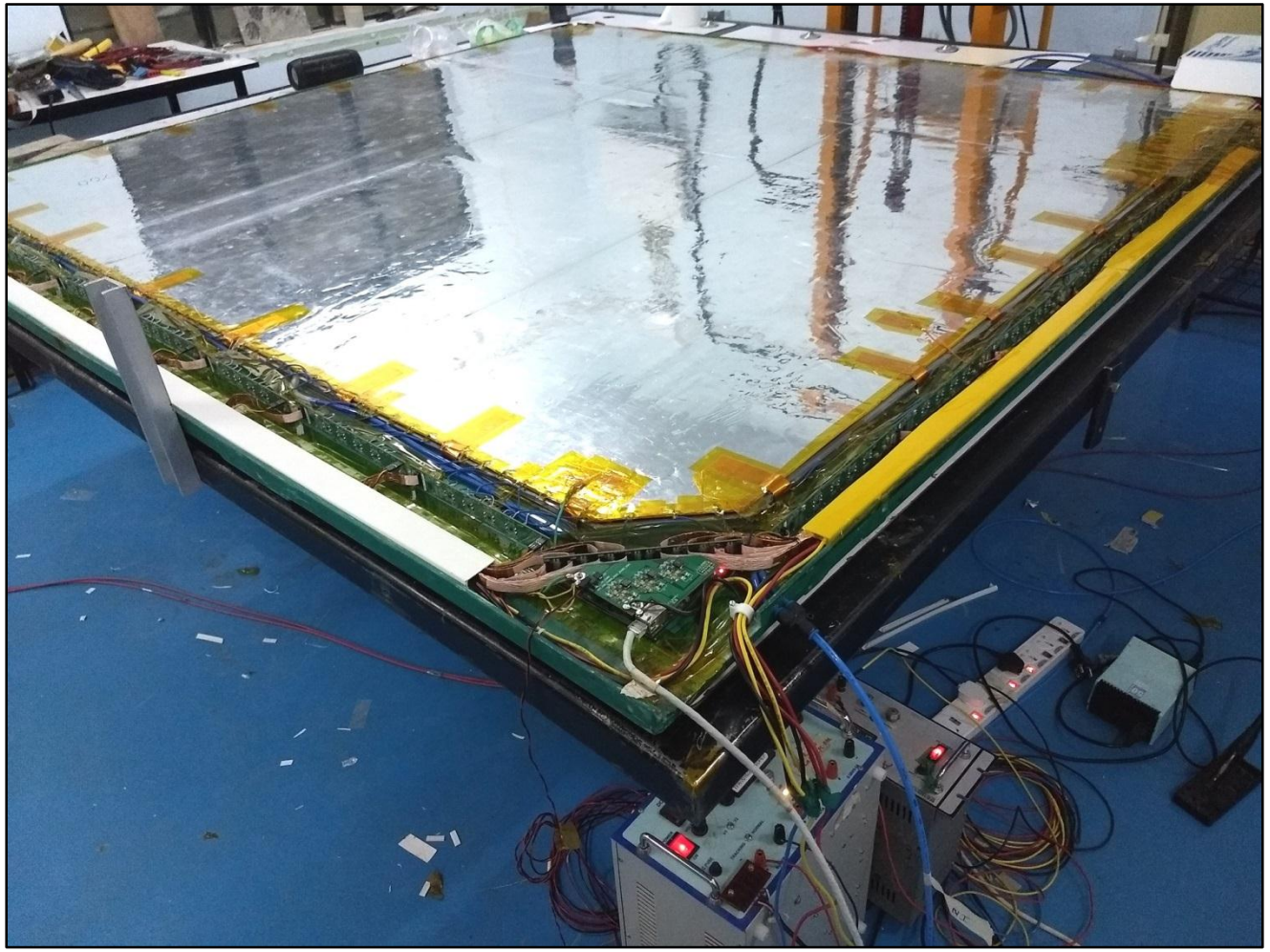
- 8 Channel preamplifier board
- Size of Board is 200 mm x 45 mm
- LVDS Outputs + 1 Multiplexed Analog output
- Power consumption 32 mW/ch



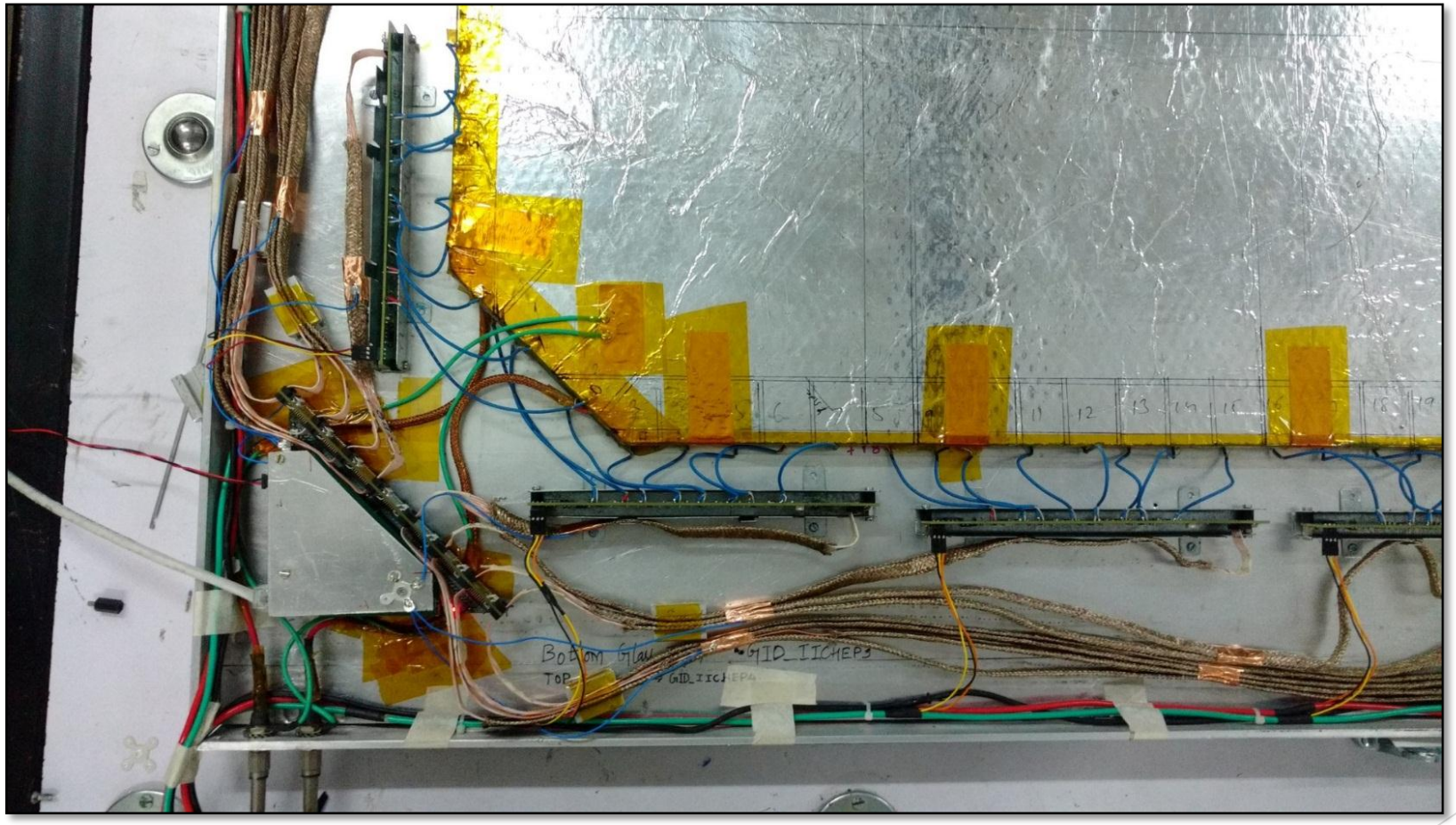
Digital Front End - the RPC-DAQ



RPC-Tray Assembly



RPC-Tray Assembly



The Mini-ICAL Detector

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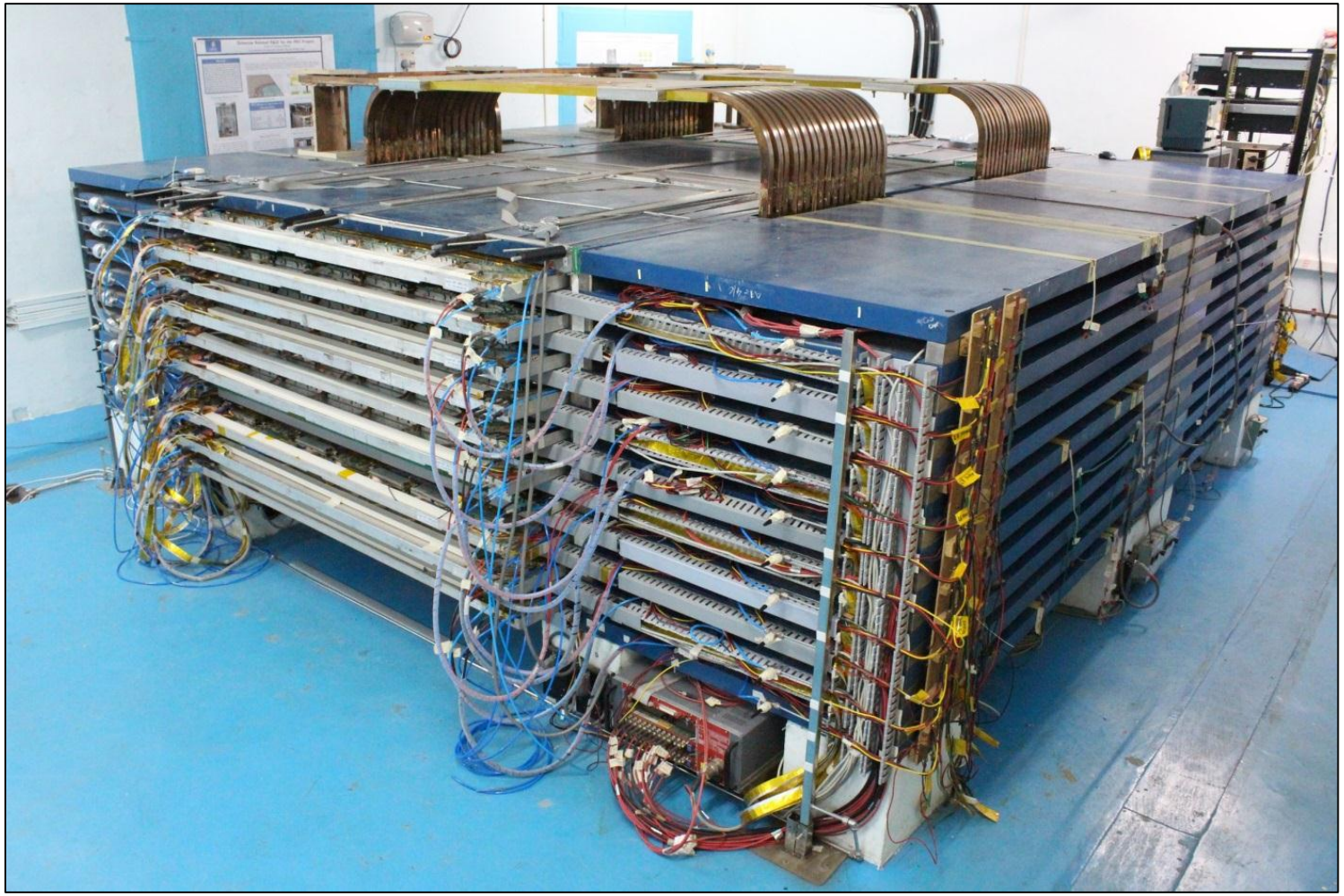
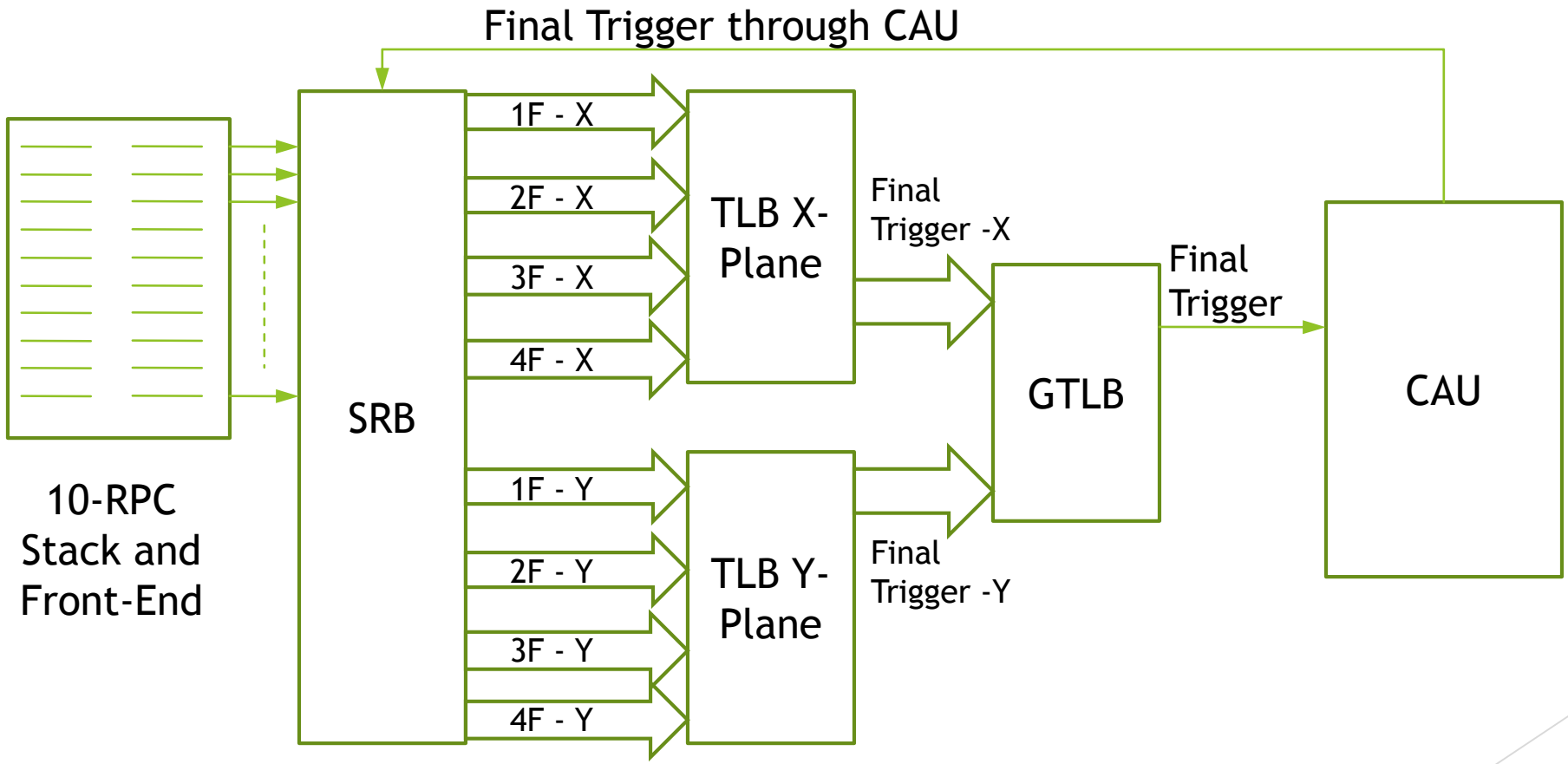
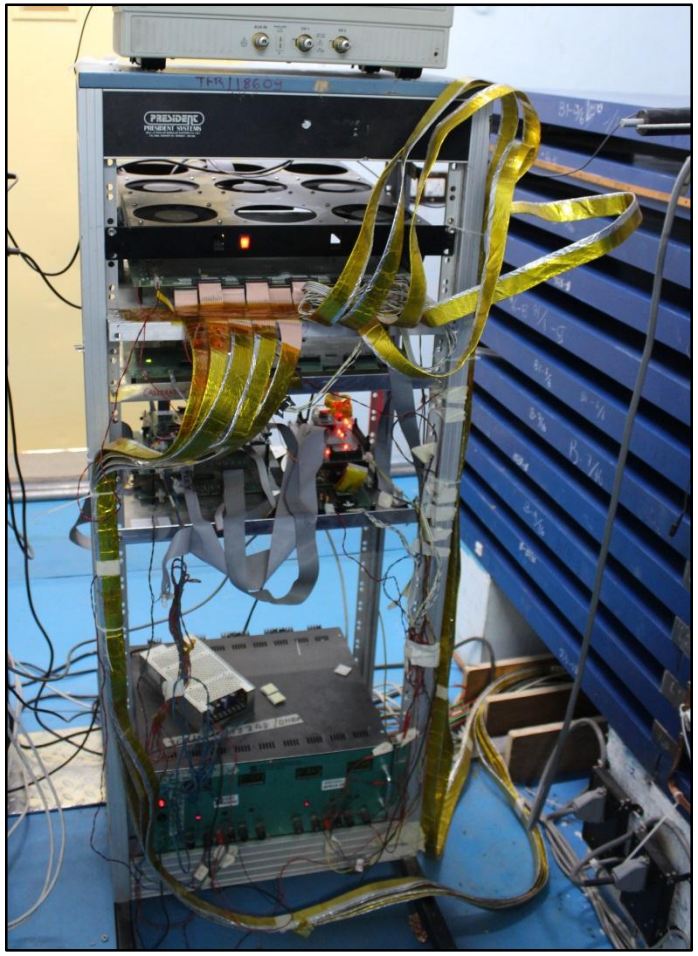


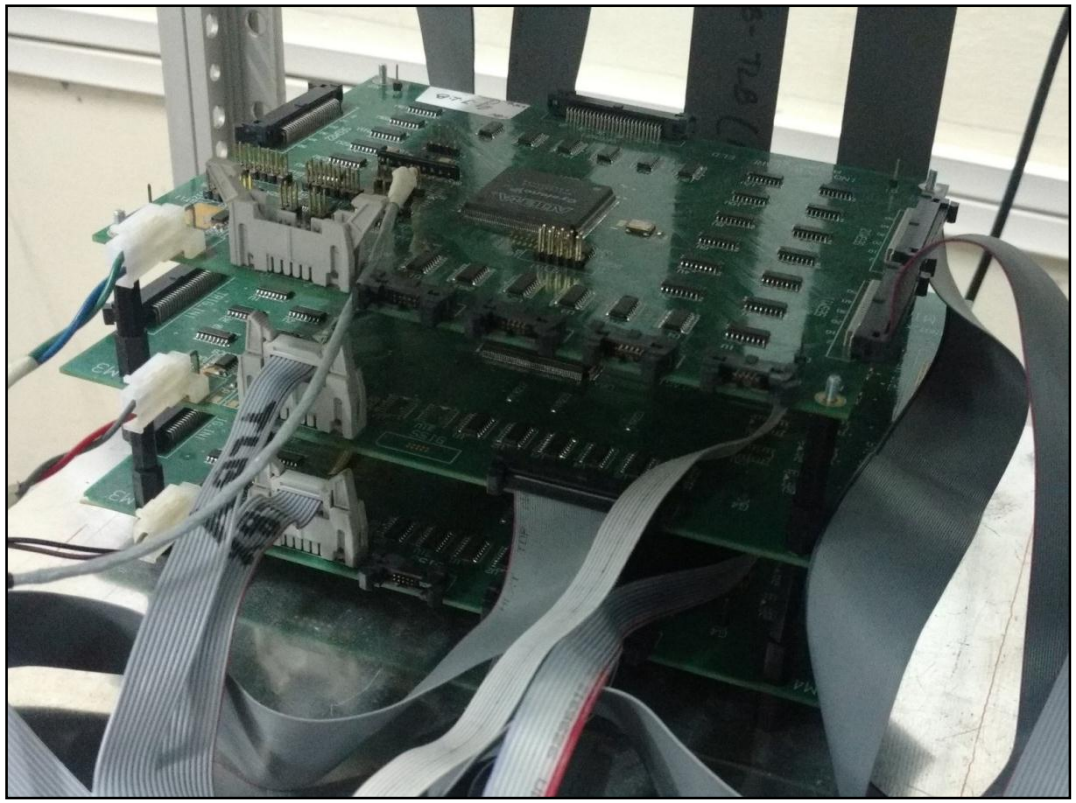
The Trigger System for mini-ICAL



Dev. of Trigger Gen for mini-ICAL – Shib Shankar

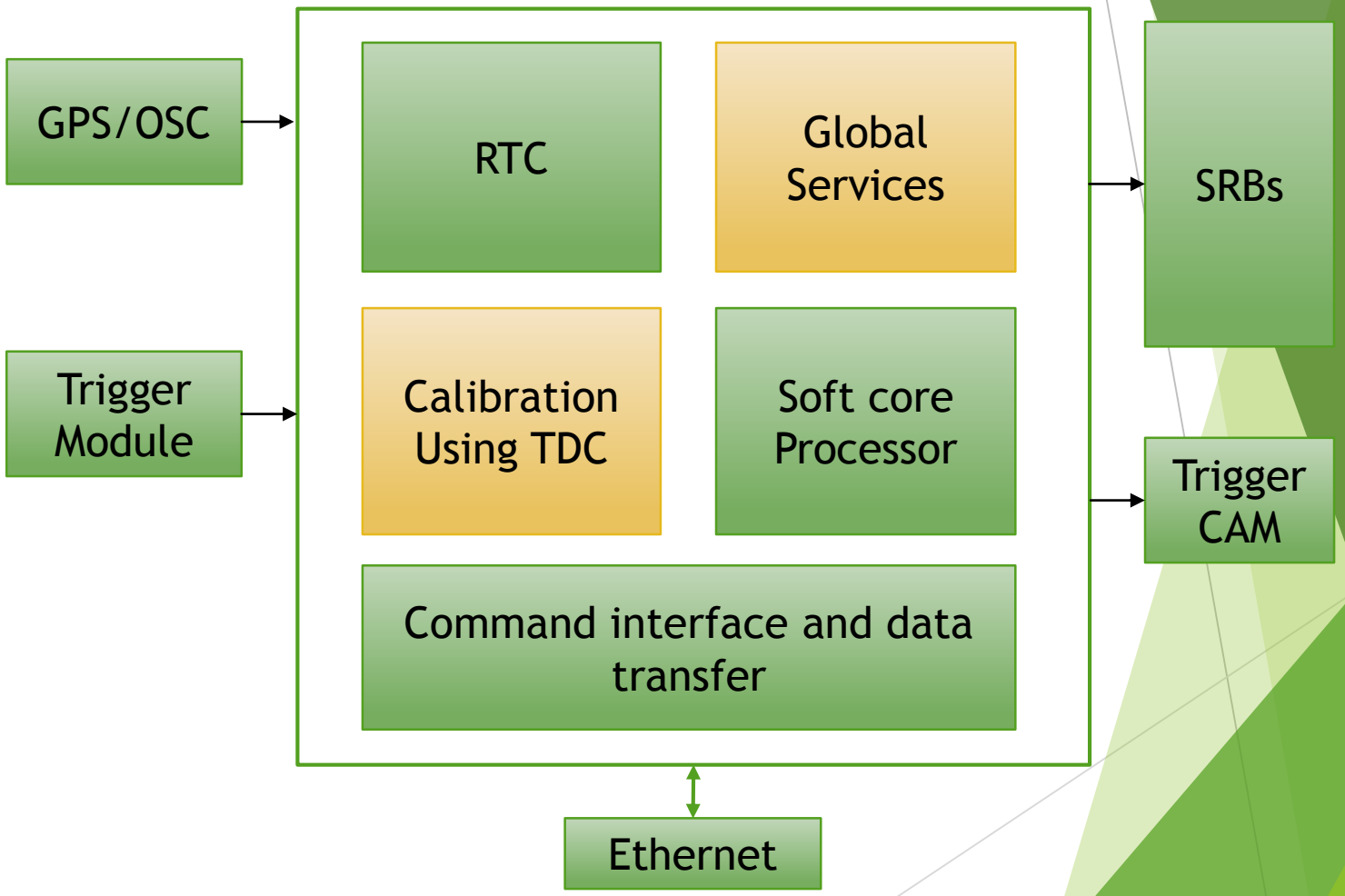
The mini-ICAL Trigger System





CALIBRATION & AUXILIARY UNIT

- Calibrate trigger delay paths for timing data
- Master Time keeper
- Synchronise RTCs across all RPC-DAQs
- Source of all Global services: Global Clock, PPS, Trigger

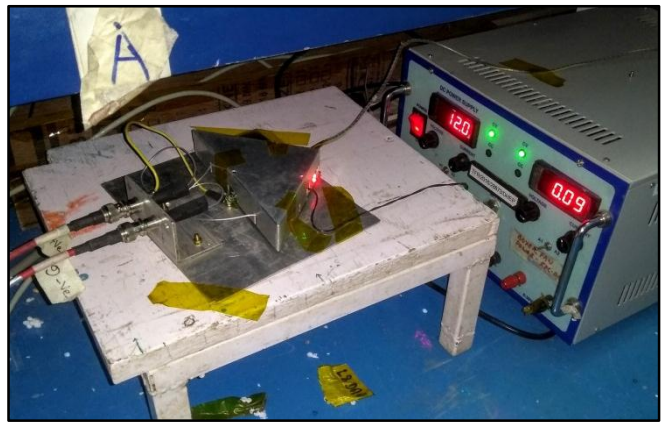


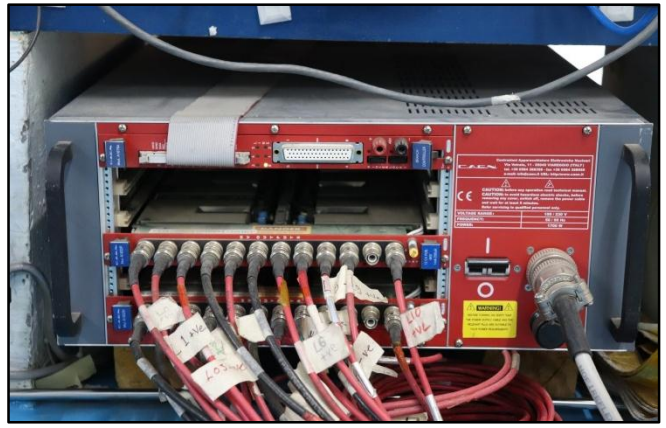
Powering up the RPCs and the DAQ

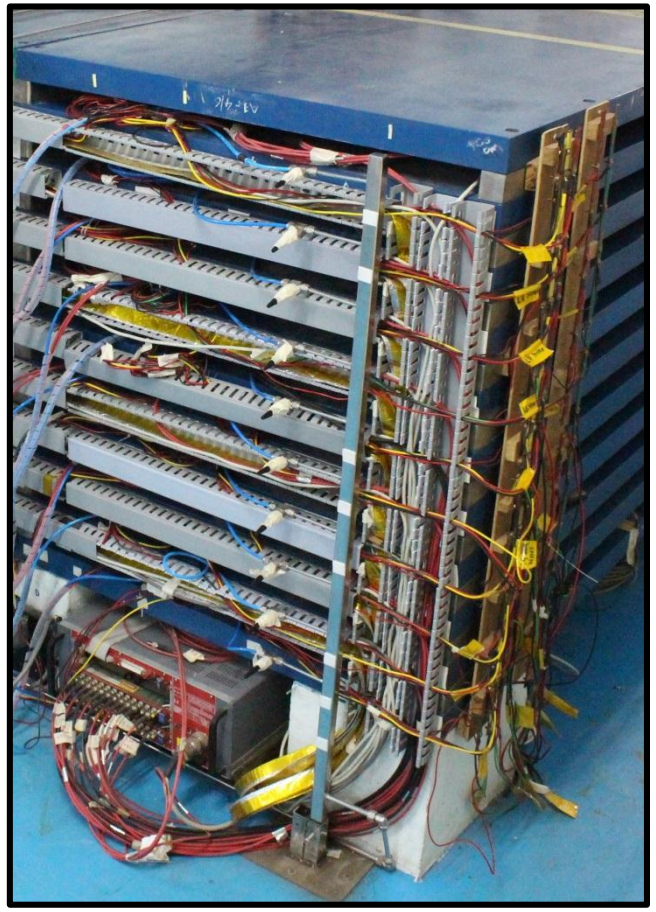
- RPCs are biased to ±4900V using CAEN's SY2527 Multichannel Power Supply System with the 1832 P and N HV modules
- Also 1 layer RPC is being biased with HV module developed by BARC. Eventually all layers would go on these home made modules

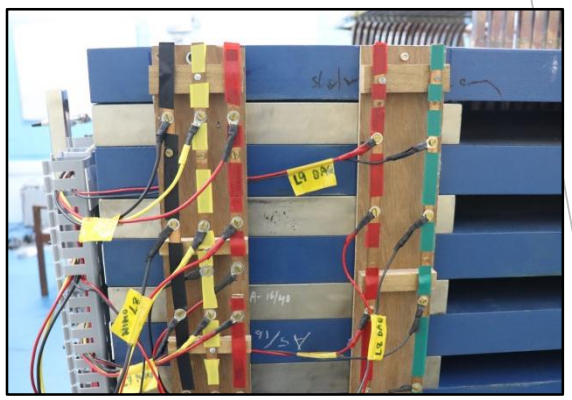
- The Front-End electronics is powered by CAEN's EASY 3000 System with 3 Mod. A3025 Power Supply Boards

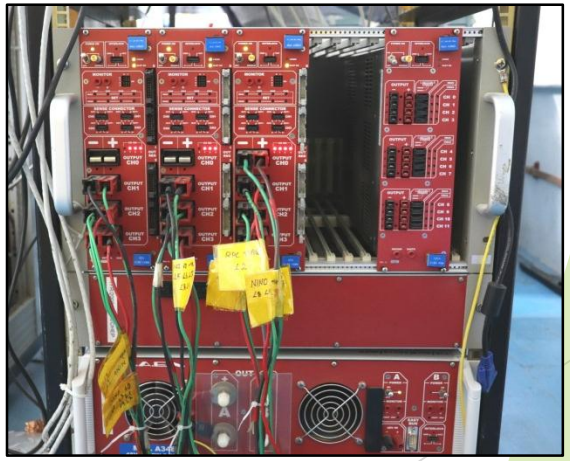
Powering up the RPCs and the DAQ



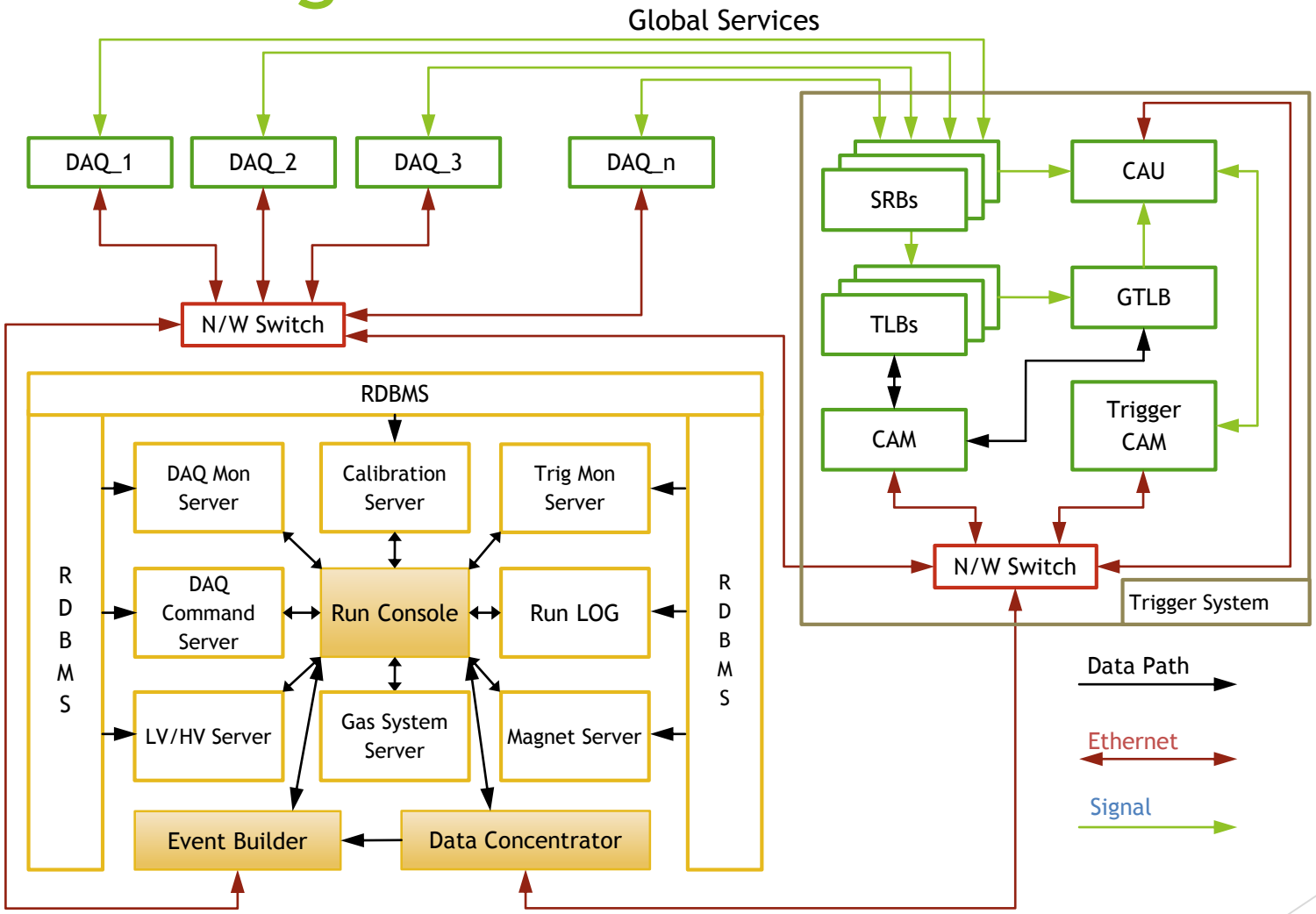






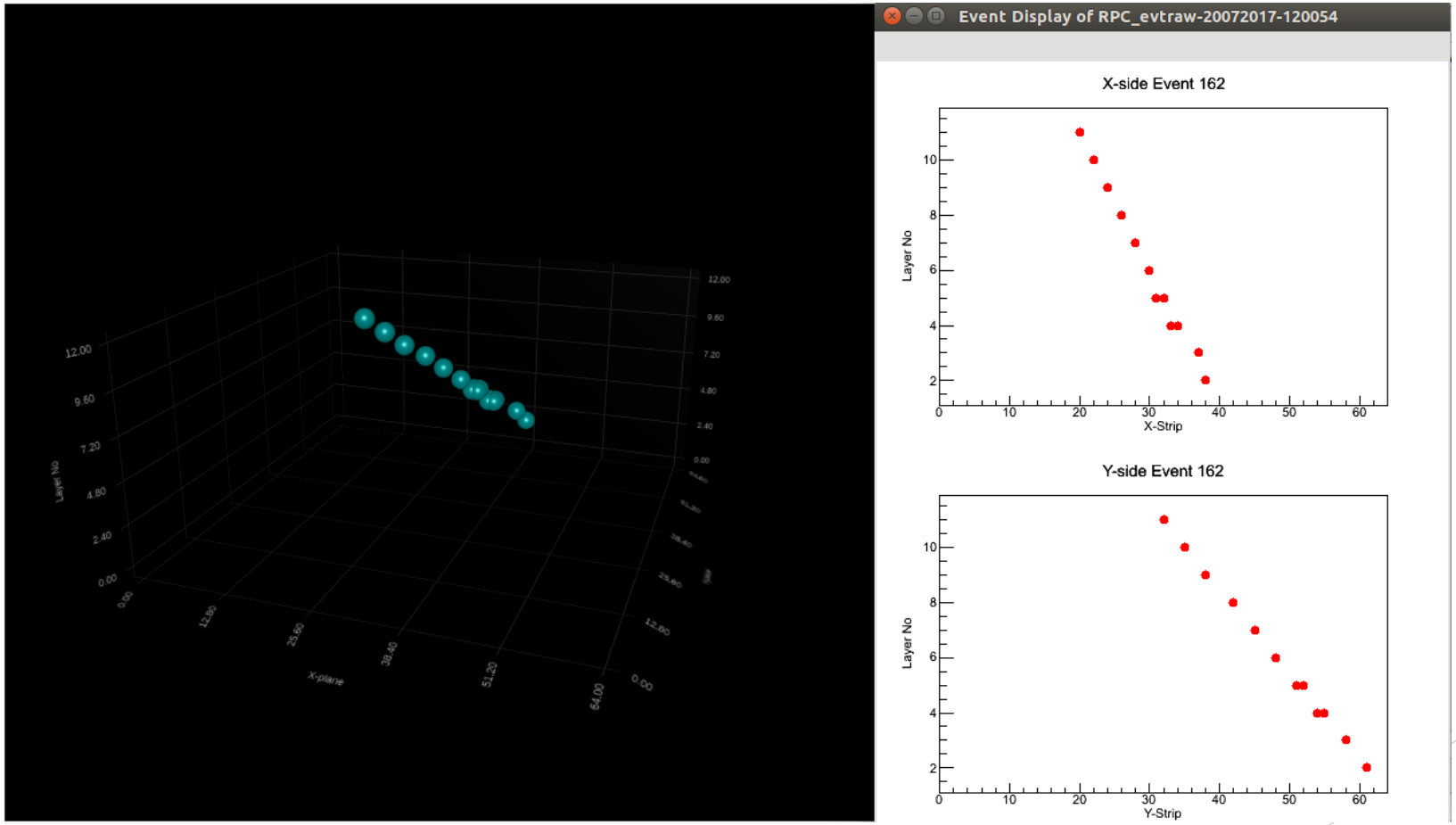


System Integration



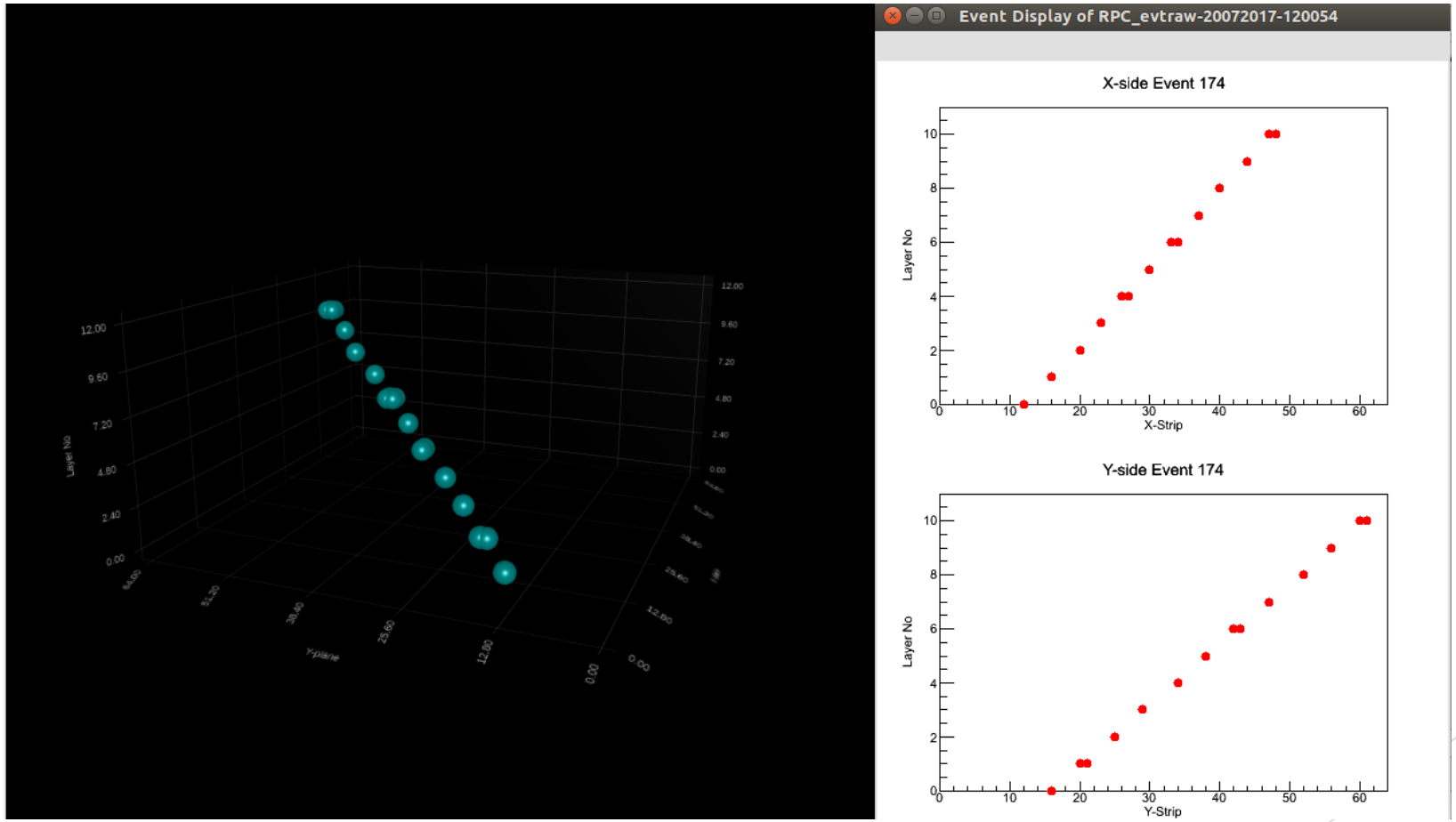
Results: Tracks

Online Track Display



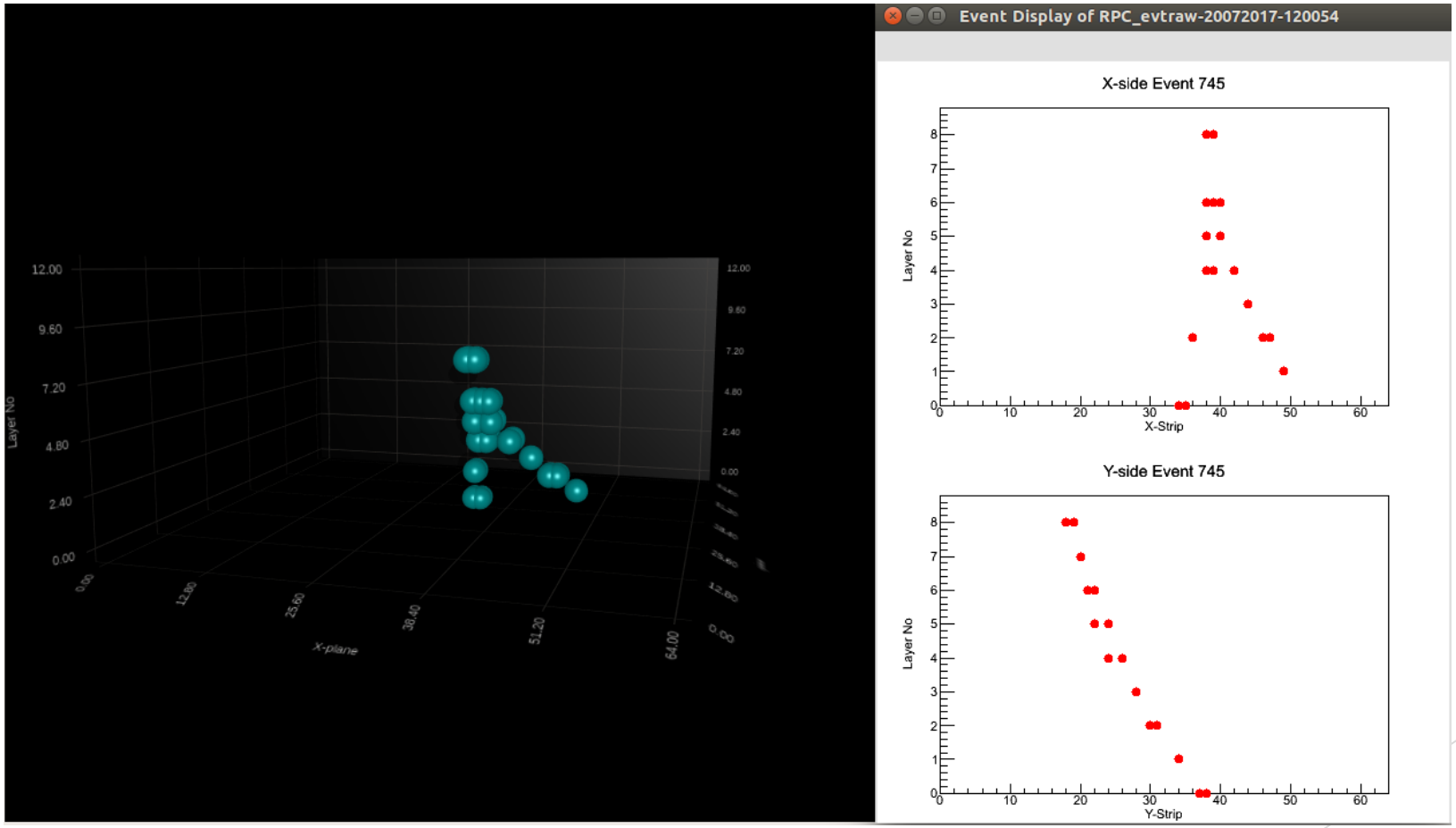
Results: Tracks

Online Track Display

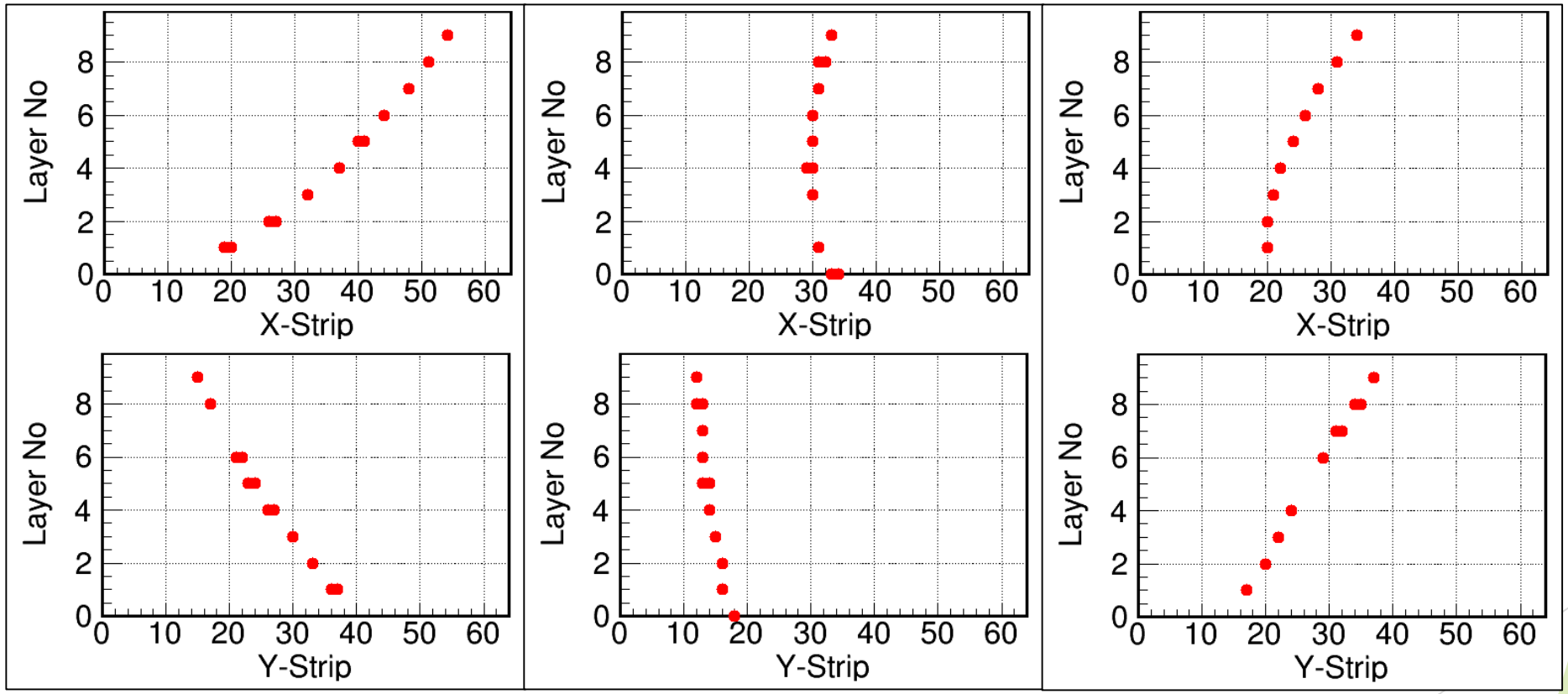


Results: Tracks

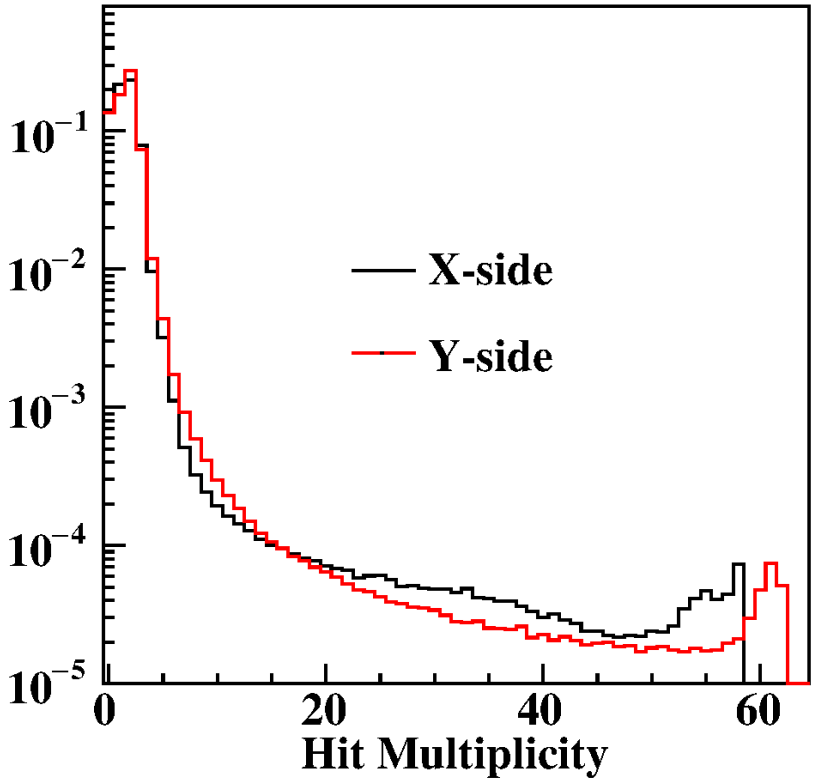
Online Track Display

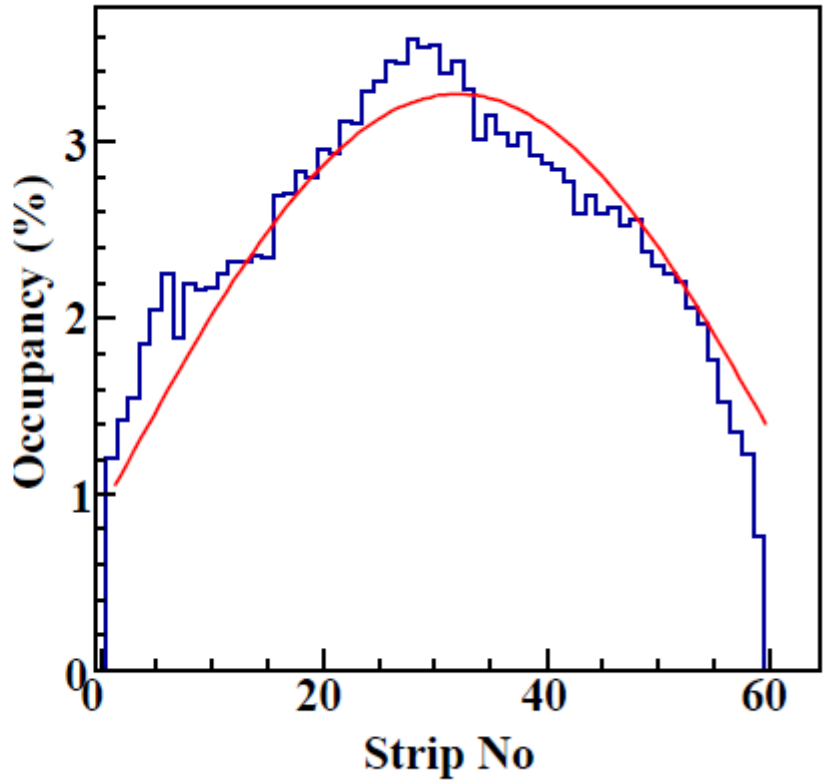


Results: Bent Tracks with the Magnet on

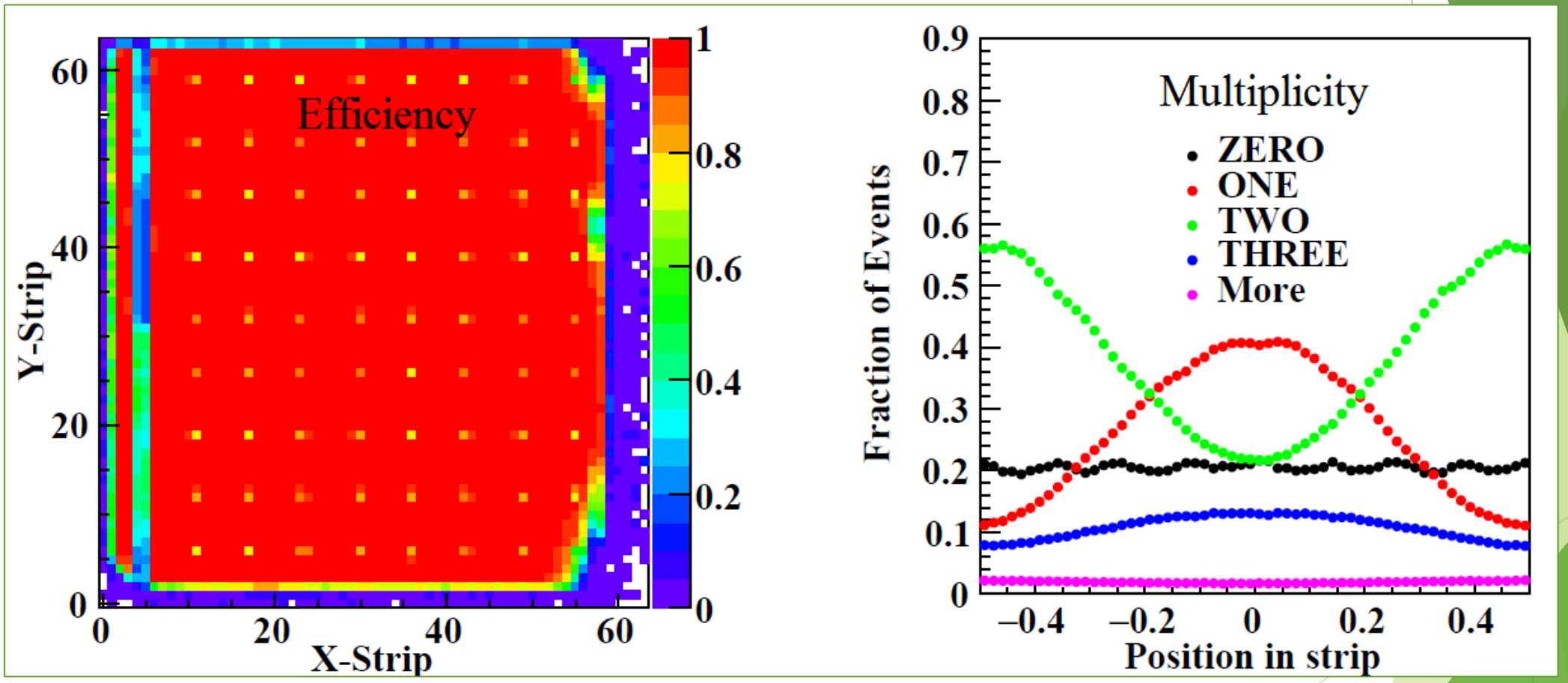


Results: Multiplicity & Occupancy

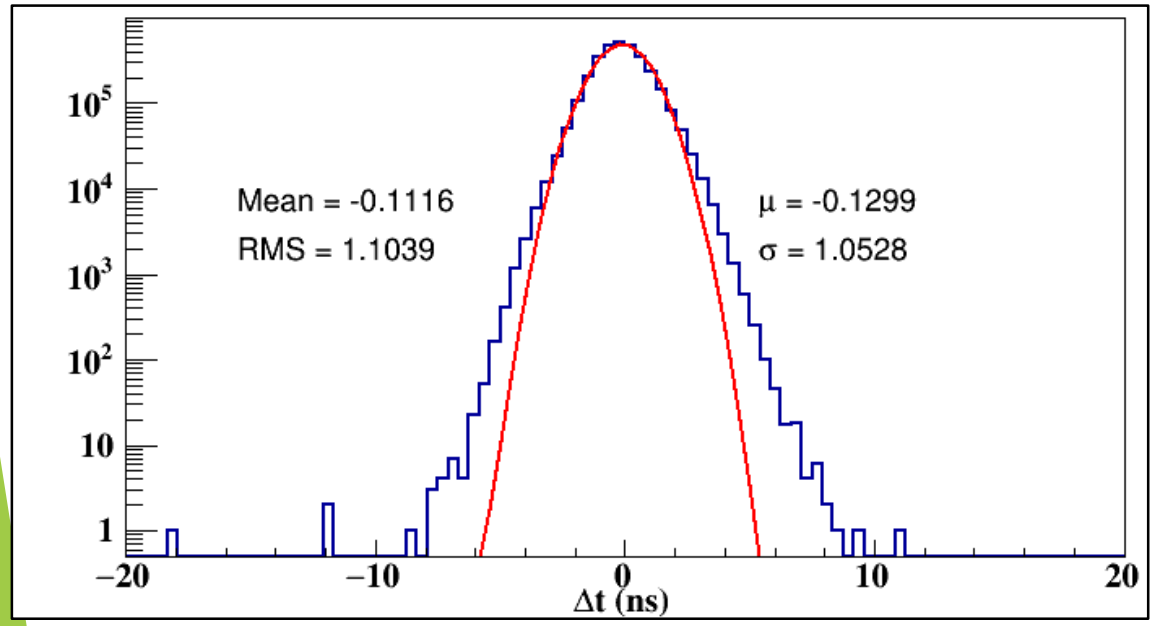




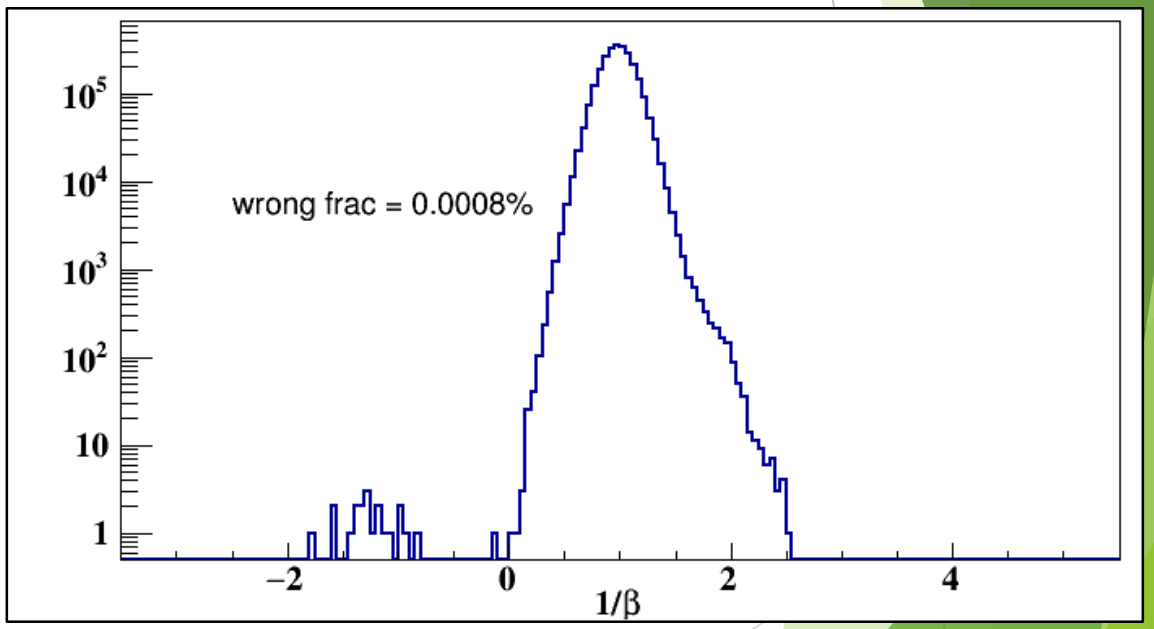
Results: Efficiency & Multiplicity Spread



Results: Timing Data



Timing Resolution



Directionality (β = V/C)

Thank You

On behalf of INO Electronics Team