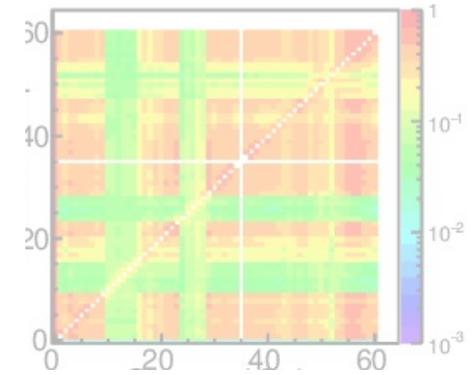
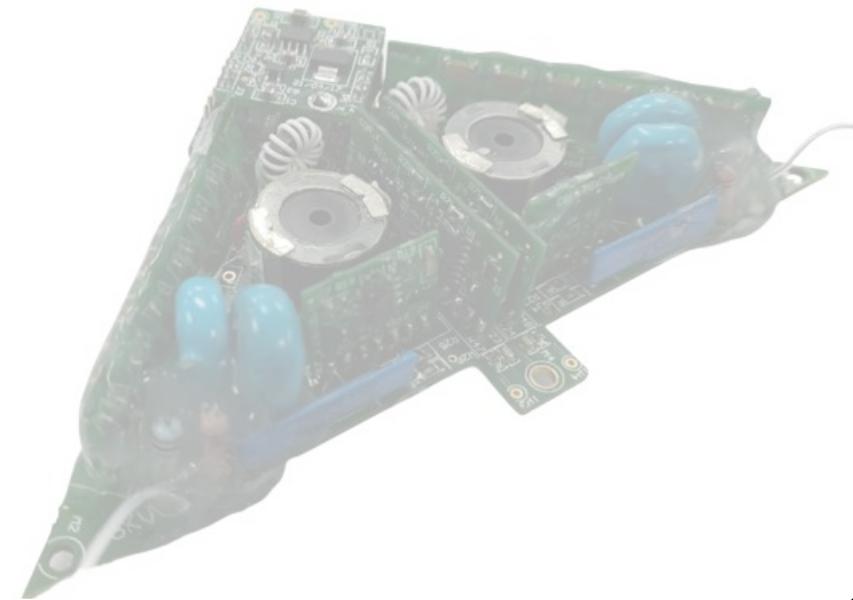
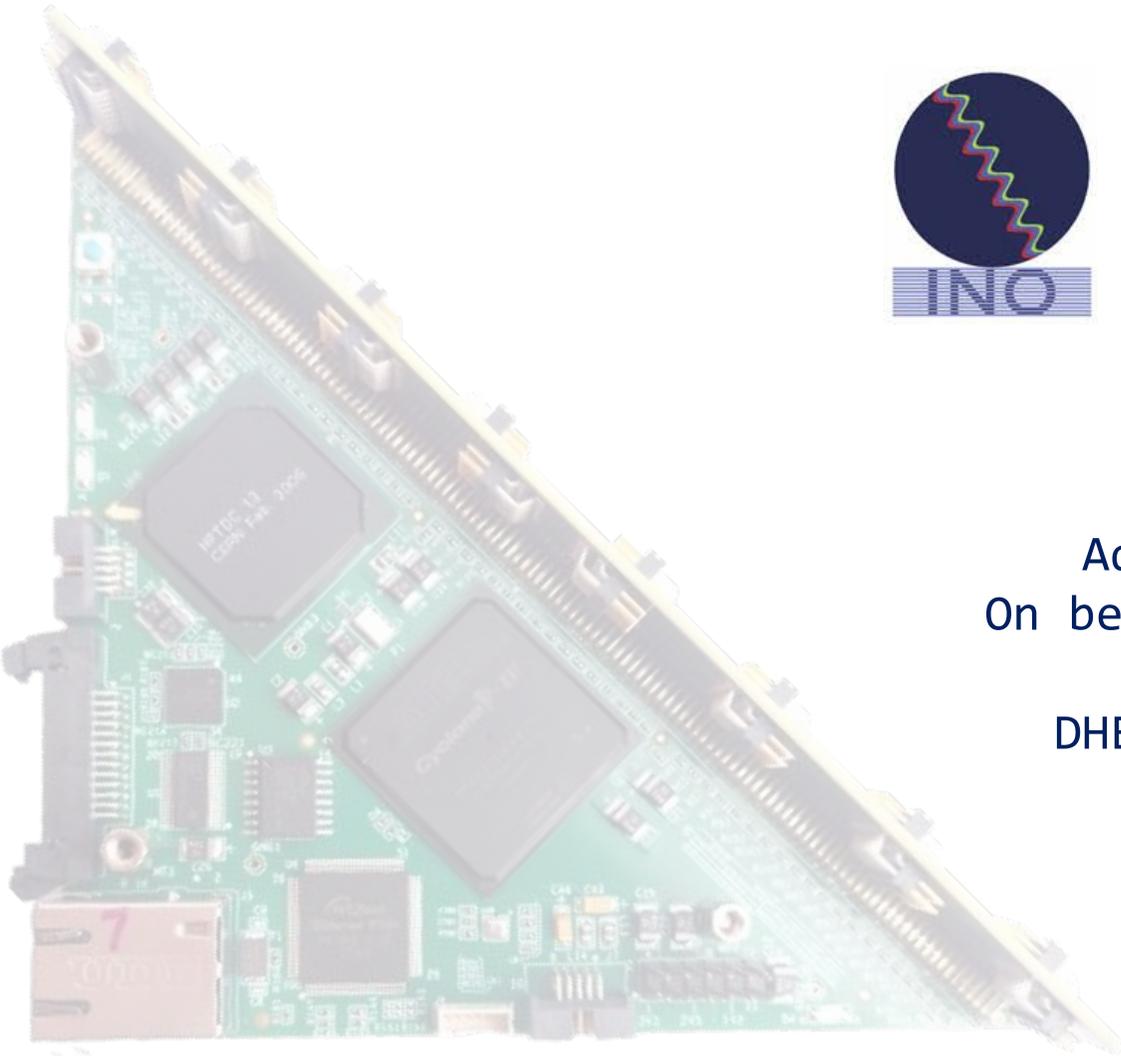


# Troubleshooting Of RPC-DAQ and Noise Studies



Aditya Deodhar  
On behalf of INO team

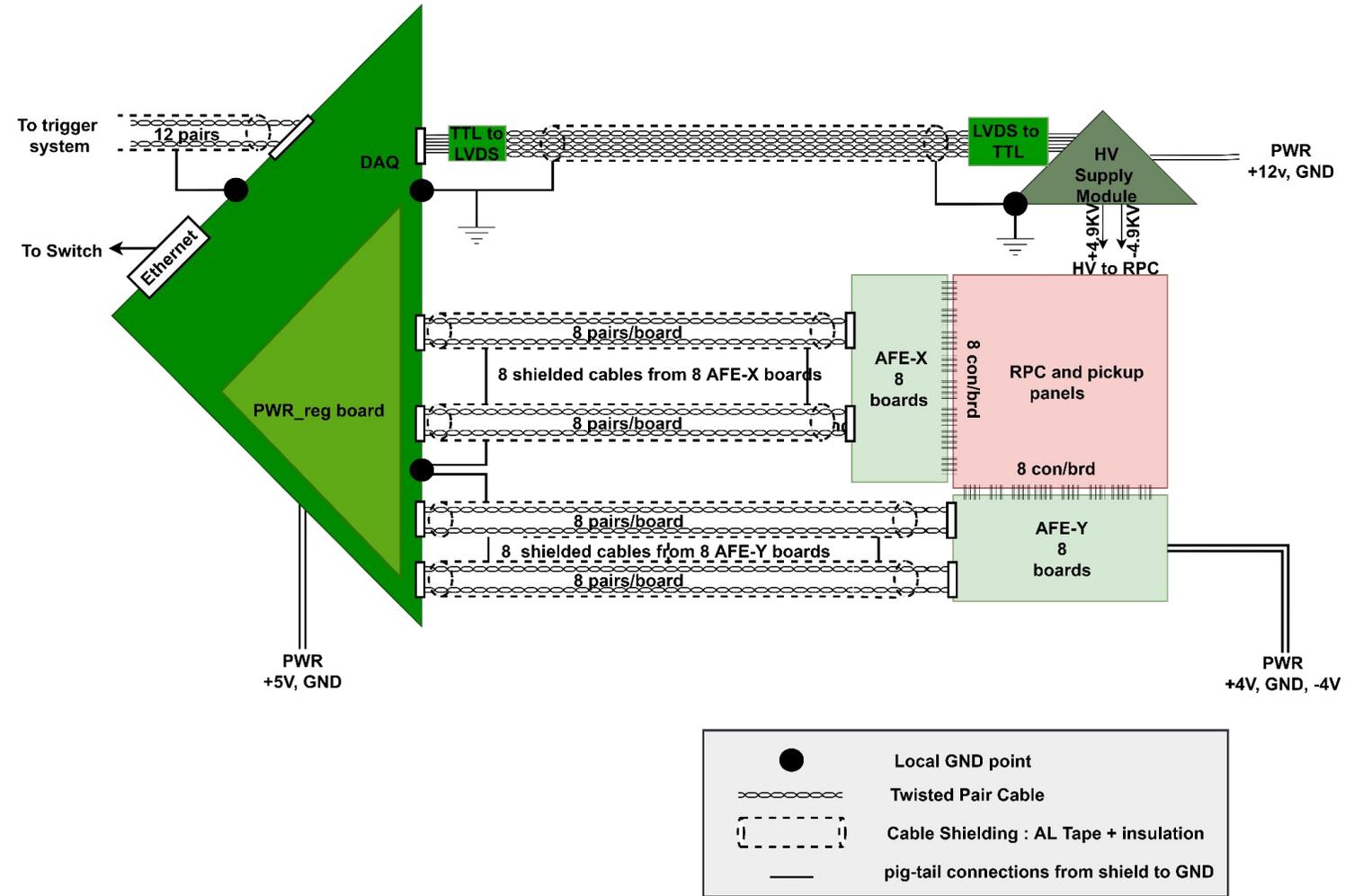
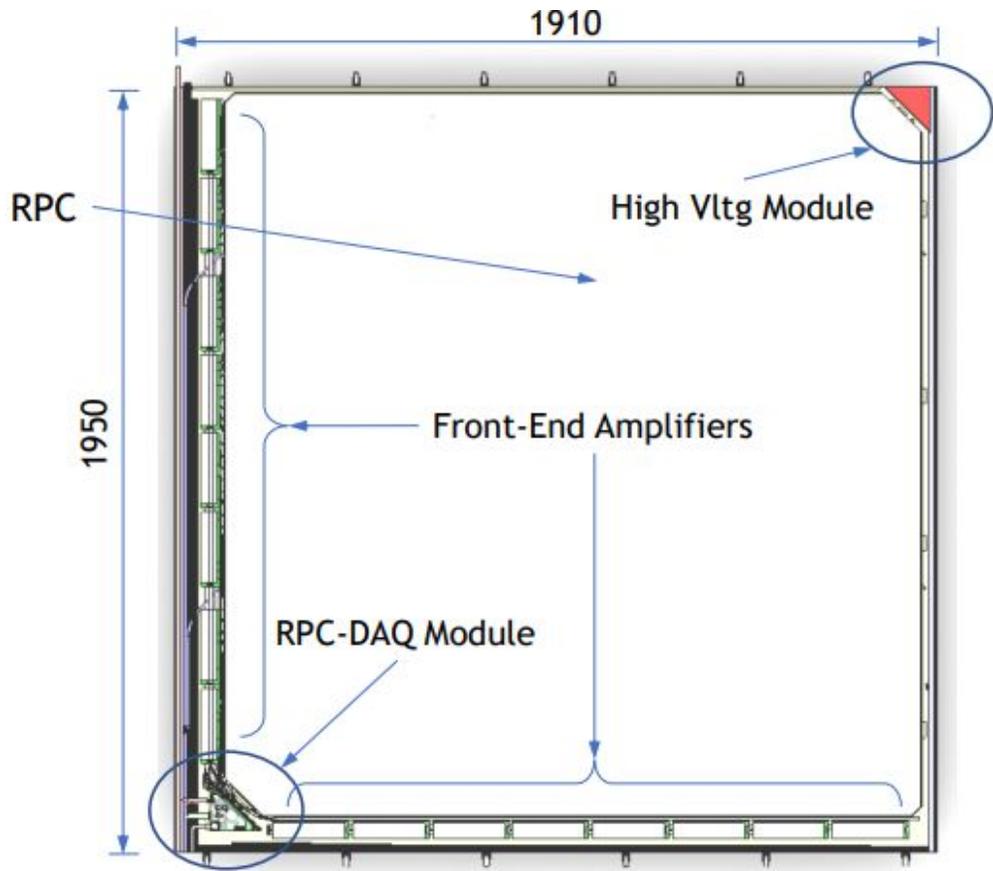
DHEP Annual Meet  
May-2022



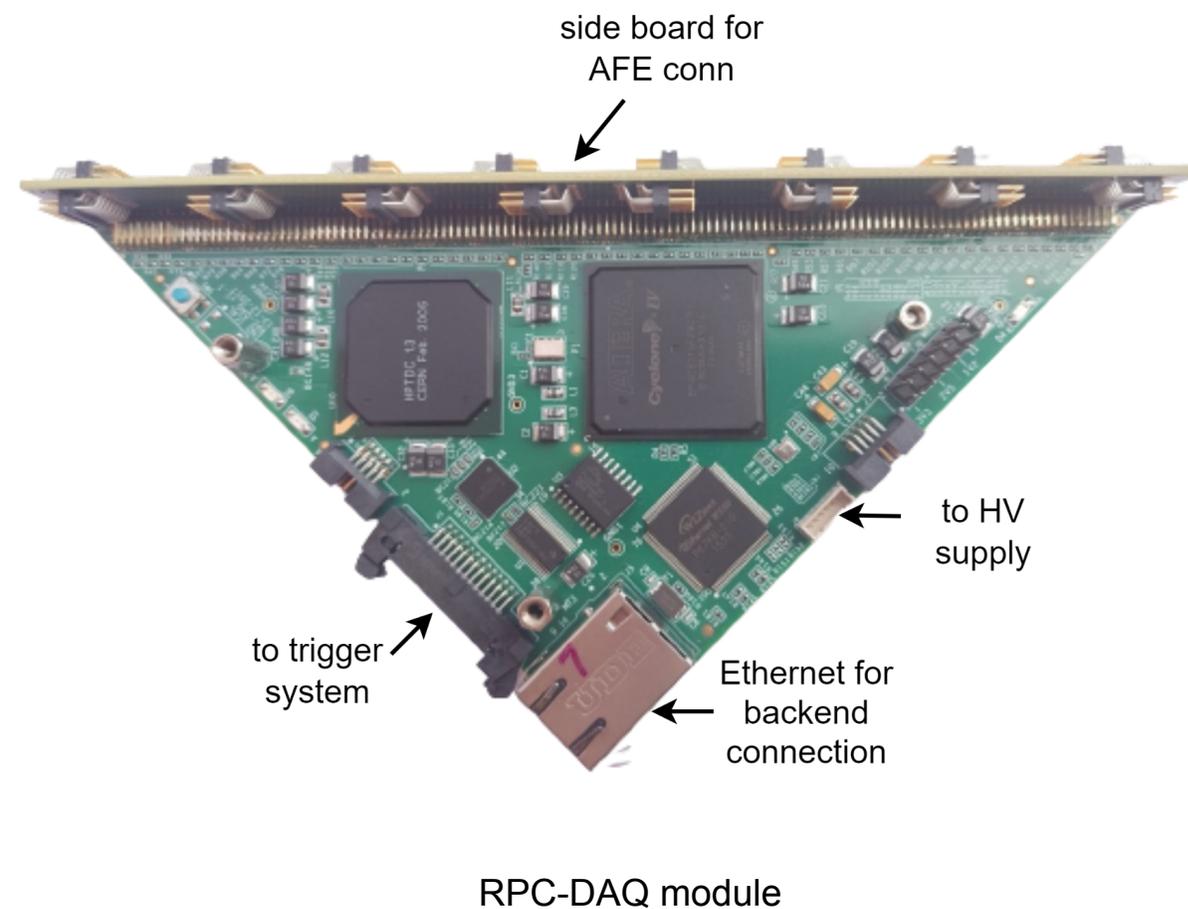
- RPC-Tray and Electrical connections
- RPC-DAQ Troubleshooting and Upgrades
- Ground Loops
- TTL signal pickup and LVDS solution
- Shielding and Grounding
- Noise Mitigation Techniques



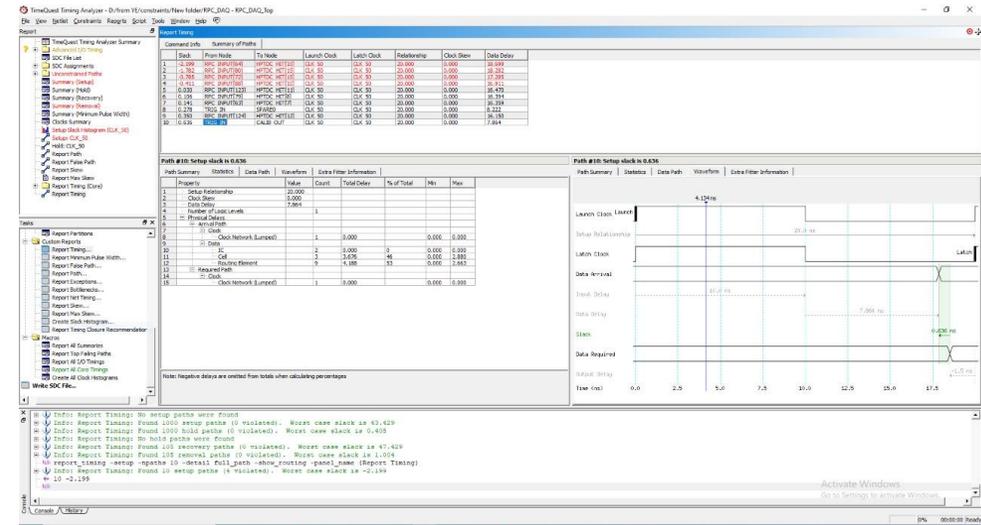
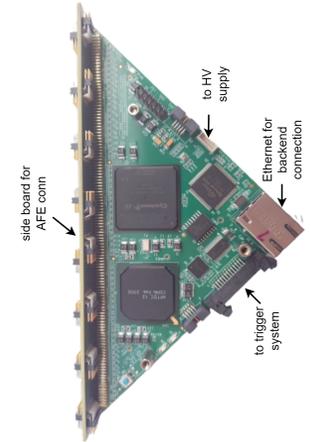
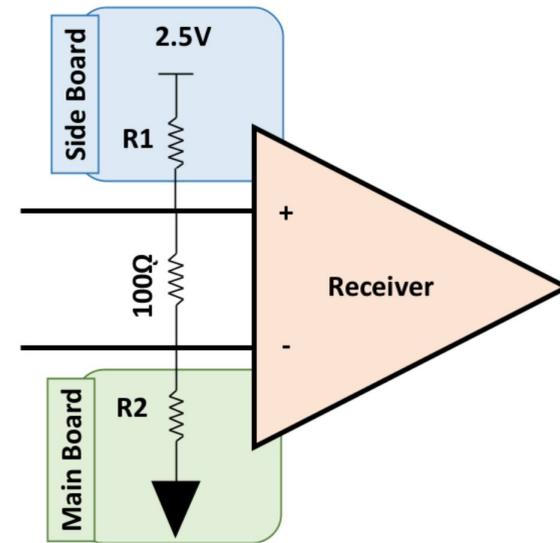
Mini-ICAL detector



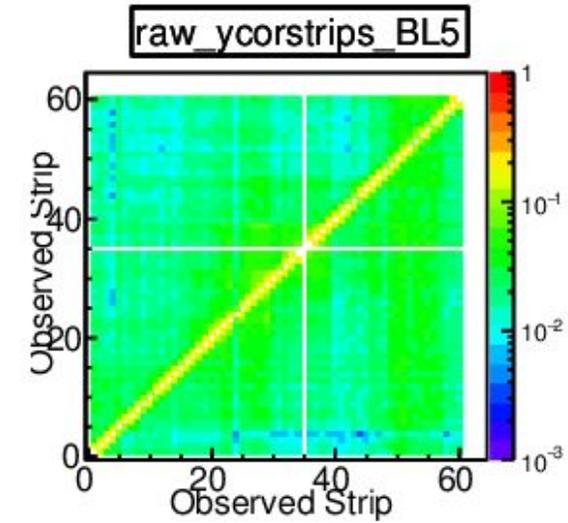
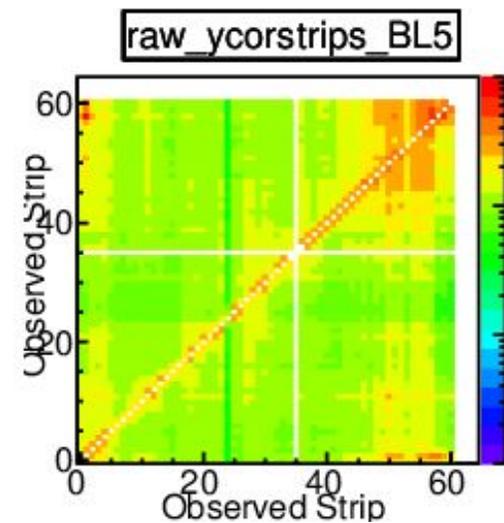
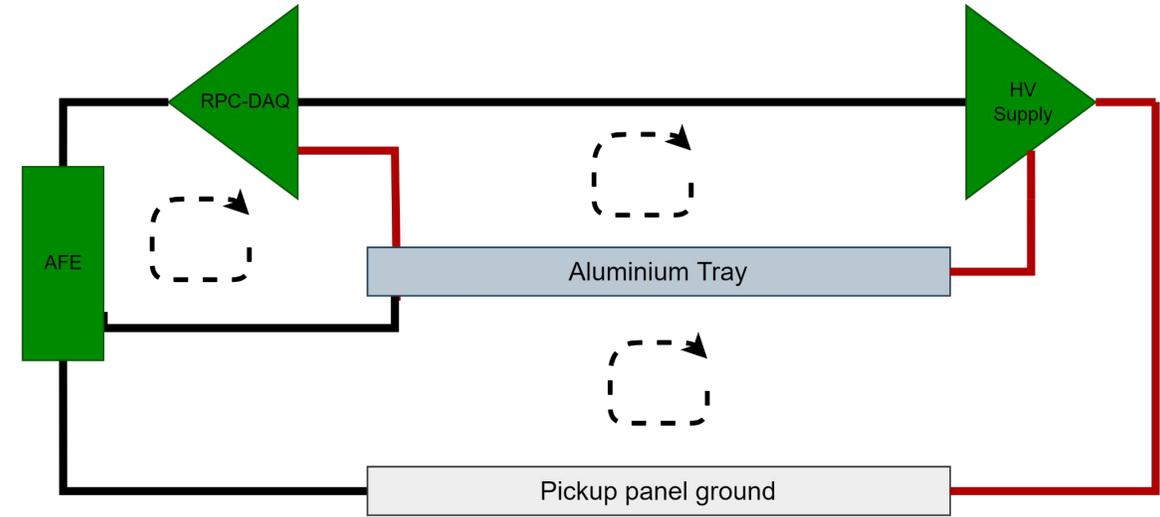
- LVDS Termination Resistance
- Open/faulty LVDS lines from AFE
  - Fail safe using pull-up pull-down
- FPGA pin damage
- Dry solder and noise emission



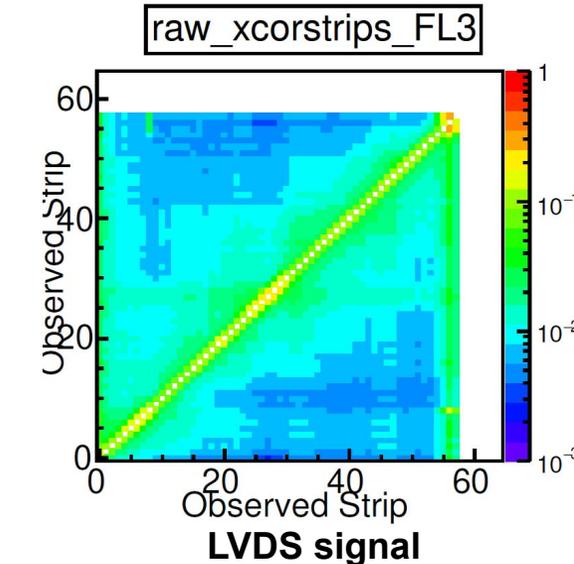
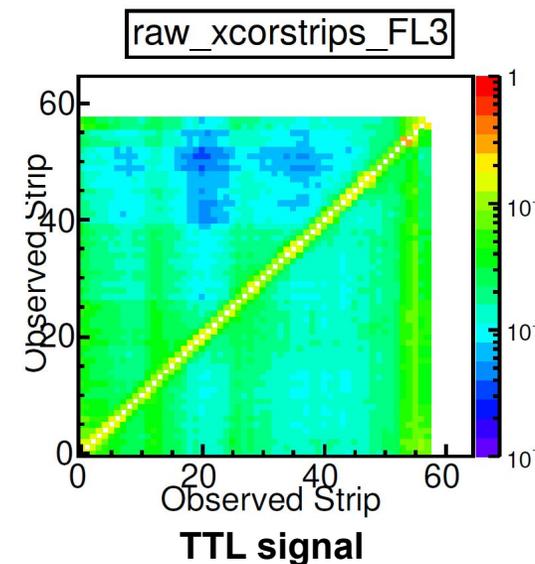
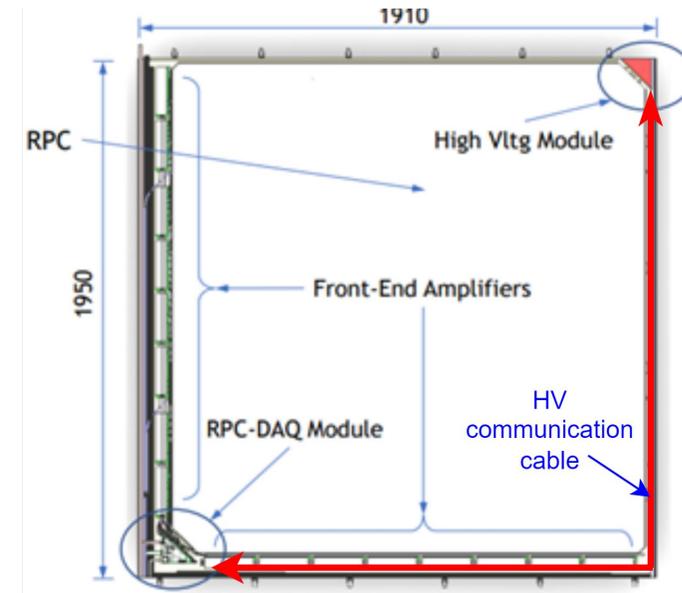
- Upgrades in RPC-DAQ HW
  - SMPS based power board
  - Fail safe Bias resistors for LVDS receiver
  - Better connectors
  - Better connector placement and orientation
  - HPTDC: 20 Channel to 32 Channel
  - On board integrated TPH sensor
- Upgrades in RPC-DAQ FW (in progress)
  - FPGA path constraints for AFE signals
  - Timing constraints for trigger path



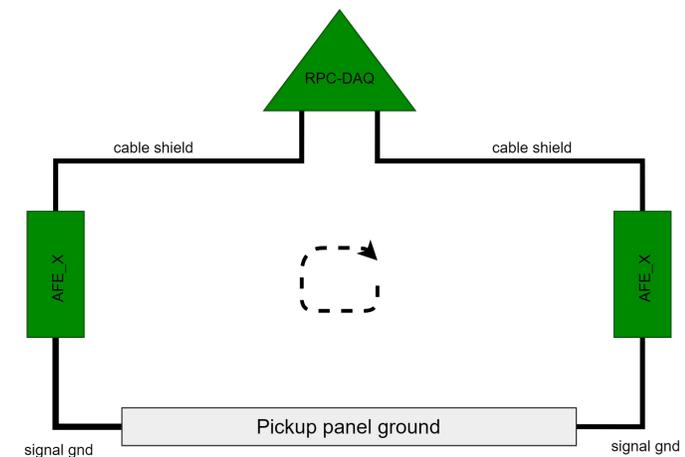
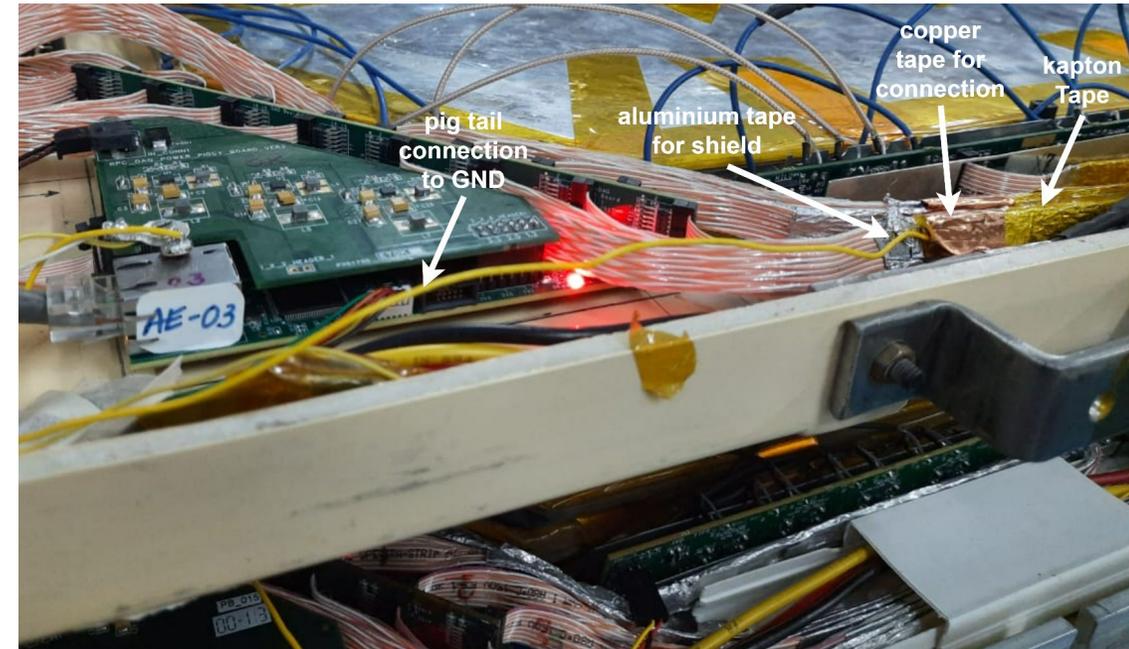
- Ground potential between interconnected modules/circuits differs
- Problems due to Ground loops -
  - unstable circuit reference
  - Switching noise creeps in the AFE analog ground
  - Resulted in correlated noise
- Mitigation Techniques
  - Pick-up plane isolated from HV-supply
  - DAQ, HV grounds isolated from tray



- TTL communication signal and correlated noise
  - Noise through ground/return
  - Increase in plane dependent noise
- SPI over LVDS
  - No ground to ground connection
  - Better shielding (no return path from shield)
  - Significant reduction in correlation noise
  - reduction fold rates



- Every cable on RPC tray is shielded and grounded
  - Aluminium tape wrapped as shield
  - Kapton tape as insulation
- Ideally shields to be grounded on both sides BUT,
  - Shield grounding on AFE side causes Ground loop
  - Significant increase in noise/fold rates



- Cable Shielding and Grounding
- Balanced lines : LVDS transmissions
- Isolation
- Impedance control/matching
- Full RPC-Tray EMI-EMC testing planned





Thank you ...