

CERN beam test for the ALLEGRO TileCal-like HCAL

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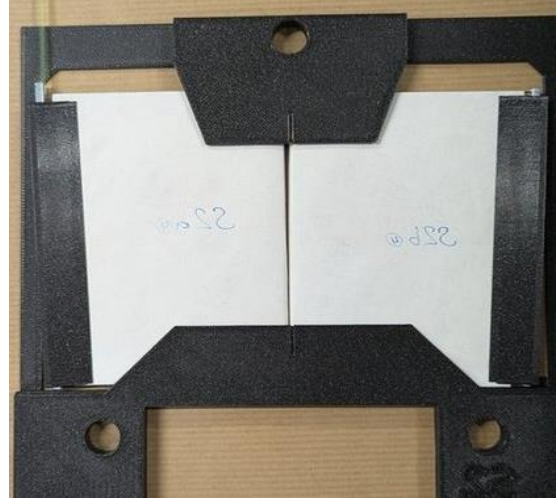
CERN Stacks

- Measure the light yield of the tile+ fibre system.
- Study dynamic range of 25 μ m individual SiPMs.
- Measure the shower development in a stack of steel and tiles of variable length.

- The stack is composed by ATLAS TileCal scintillating tiles + 1.39X₀ steel plates.
- The readout of the tiles is done with wavelength shifting (WLS) fibers Y11.
- Custom 3D-printed optical couples the fibers to the SiPMs (Hamamatsu S13360-1350).
- CAEN A5250 Pin Header Adapter interfacing the SiPMs.
- CAEN FERS1 (A5202) acquisition system.

CERN S2p: 5 layers plastic + steel plates

CERN S6: 10 layers plastic + steel plates

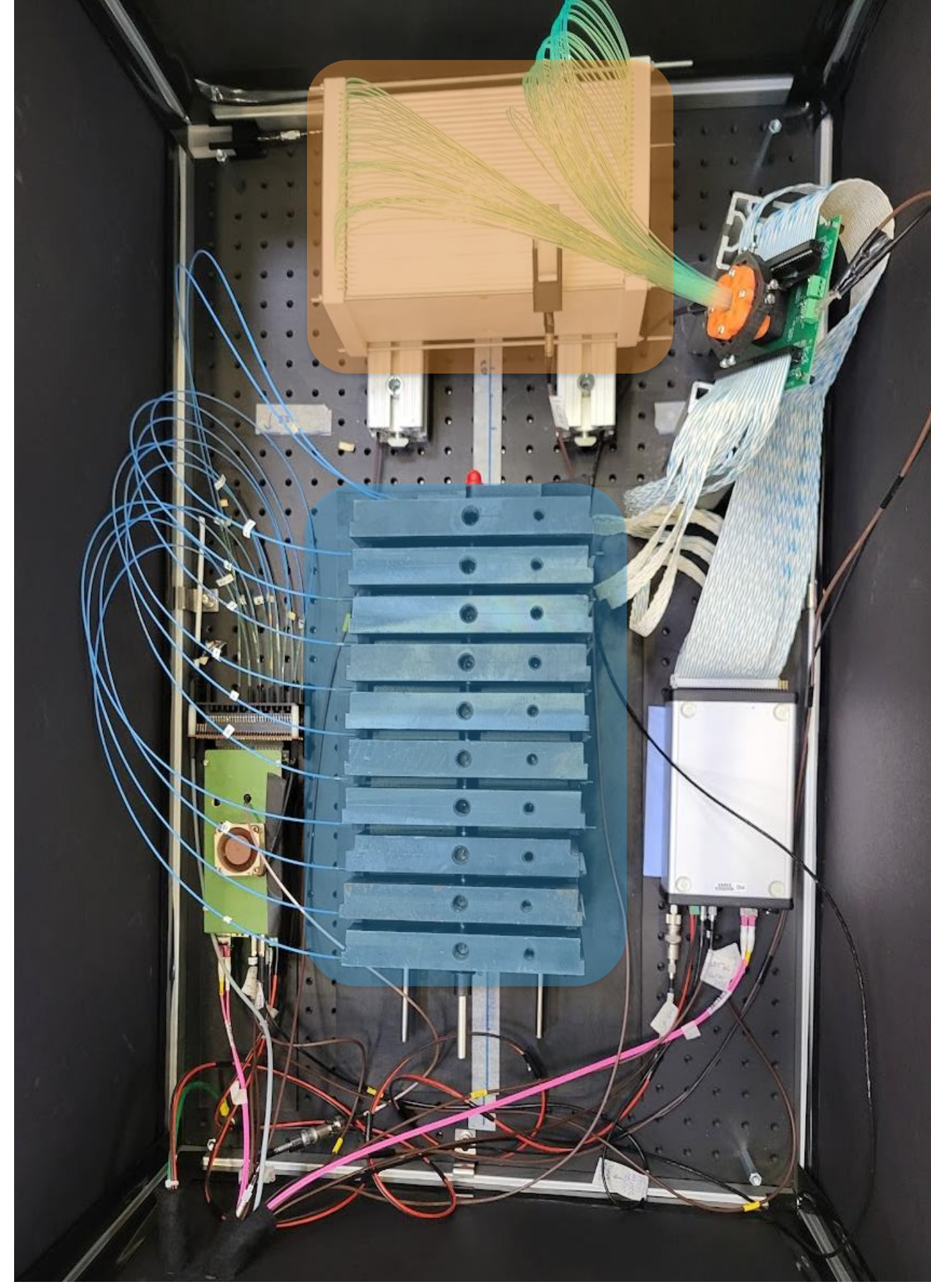


2 tiles next to each other to study cross-talk and shower sharing between tiles



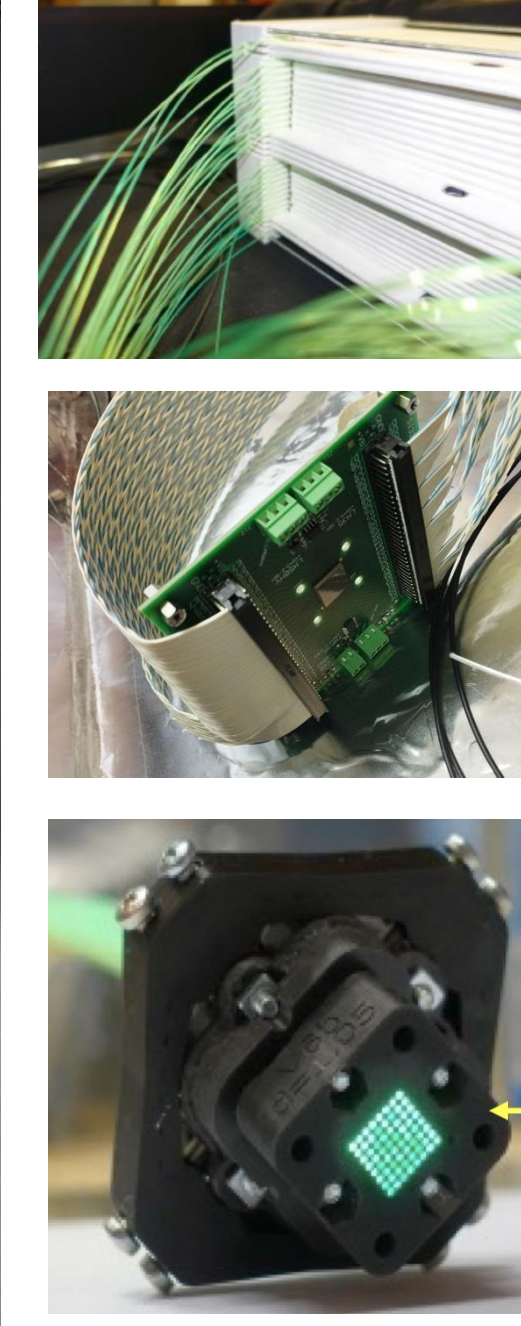
1 larger tile to study longitudinal shower development (13.9X₀ ~ 1.45λ_{int})

Black box



FZU Stack

- Test FERS readout of a large SiPM array.
- Test tile+fibre+SiPM coupling on a large number of identical iterations.
- Measure ionisation energy deposit by different particles at the GeV/c scale.

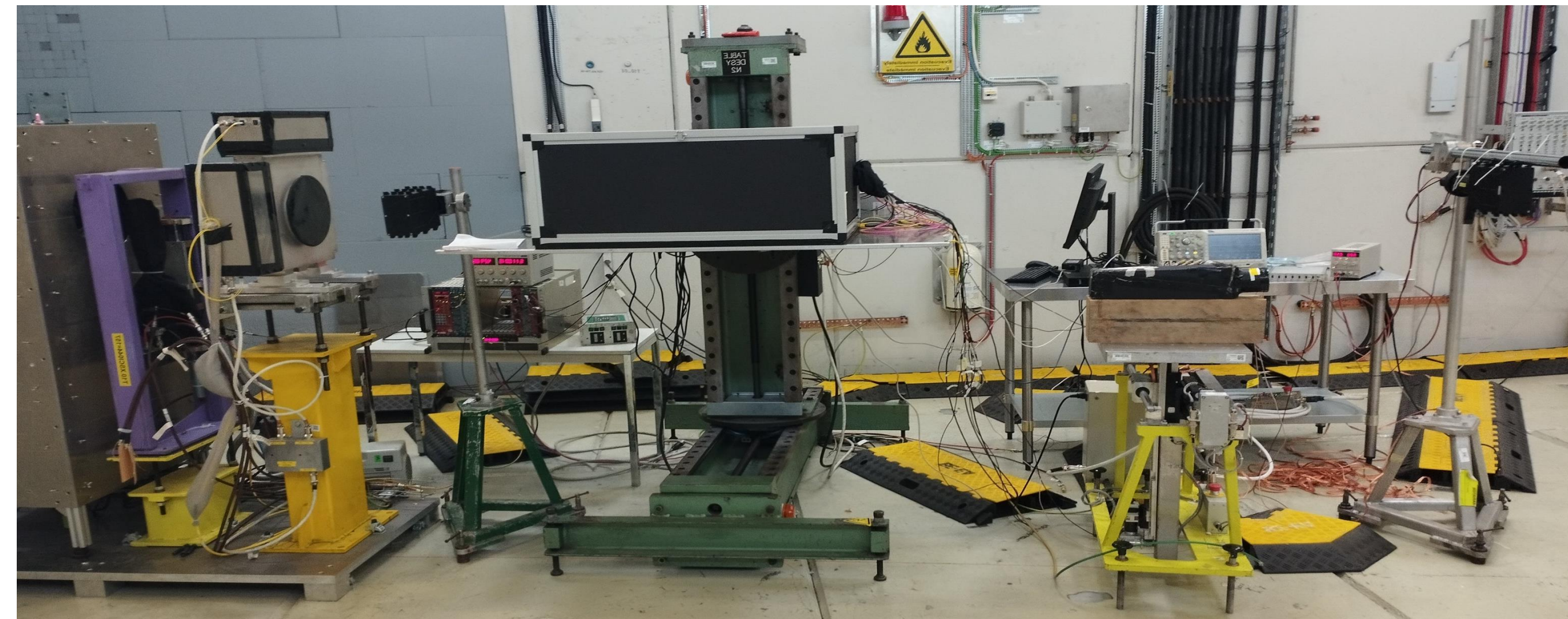
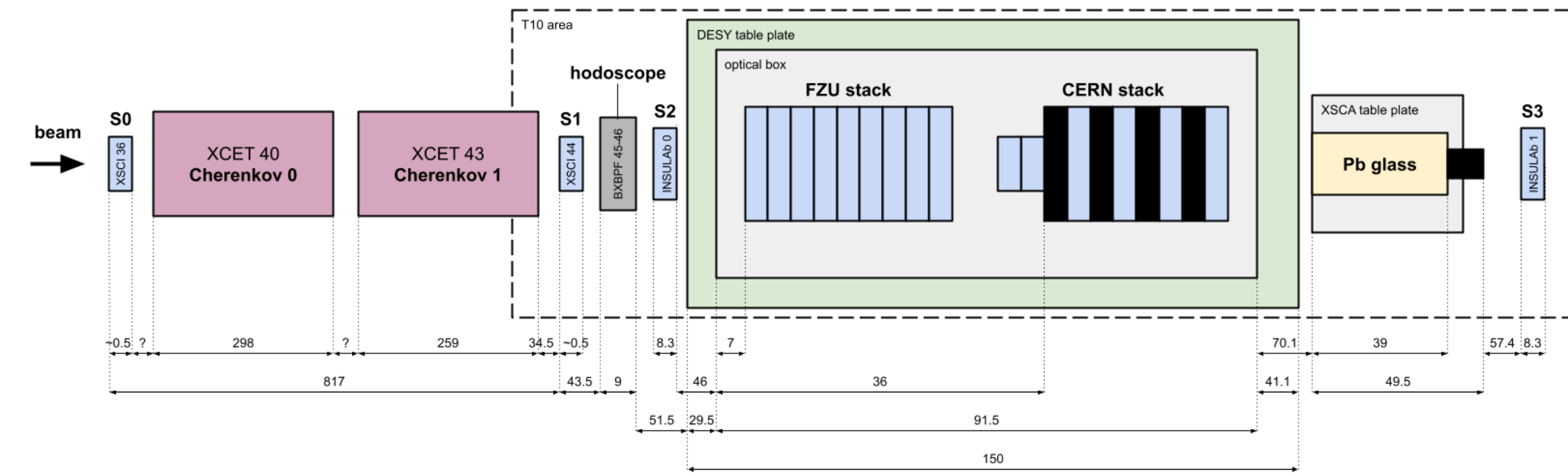


- 32 ATLAS TileCal scintillating tiles mounted in a 3D model tile holder.
- WLS fibers Y11 coupled to each side of the tiles (64 fibers).
- 3D printed piece for fiber mounting.
- Readout by a 64-channel SiPM (Hamamatsu S13361-1350NS-08) with an adapter PCB.
- CAEN FERS0 (DT5202) acquisition system.

Testbeam setup

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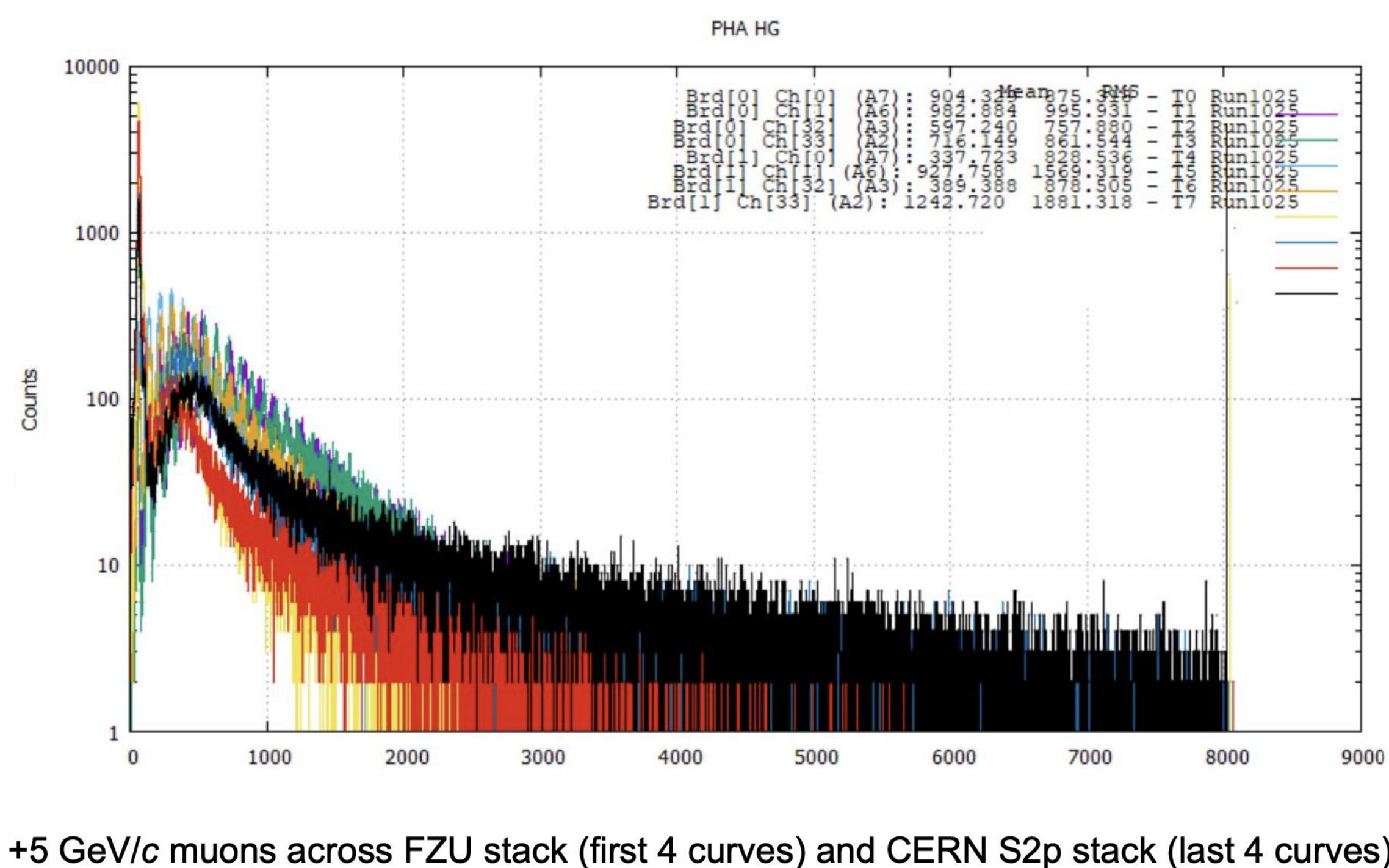
Mixed (e/μ/π/p) beams between 0.5 and 11.5 GeV/c.



- Two beamline scintillating detectors XSCI36(S0) and XSCI44(S1).
- Two Cherenkov threshold counters XCET40 and XCET43.
- Two INSULab pads (S2 and S3).
- A Pb glass + PMT.
- Hodoscope for the beam profile.

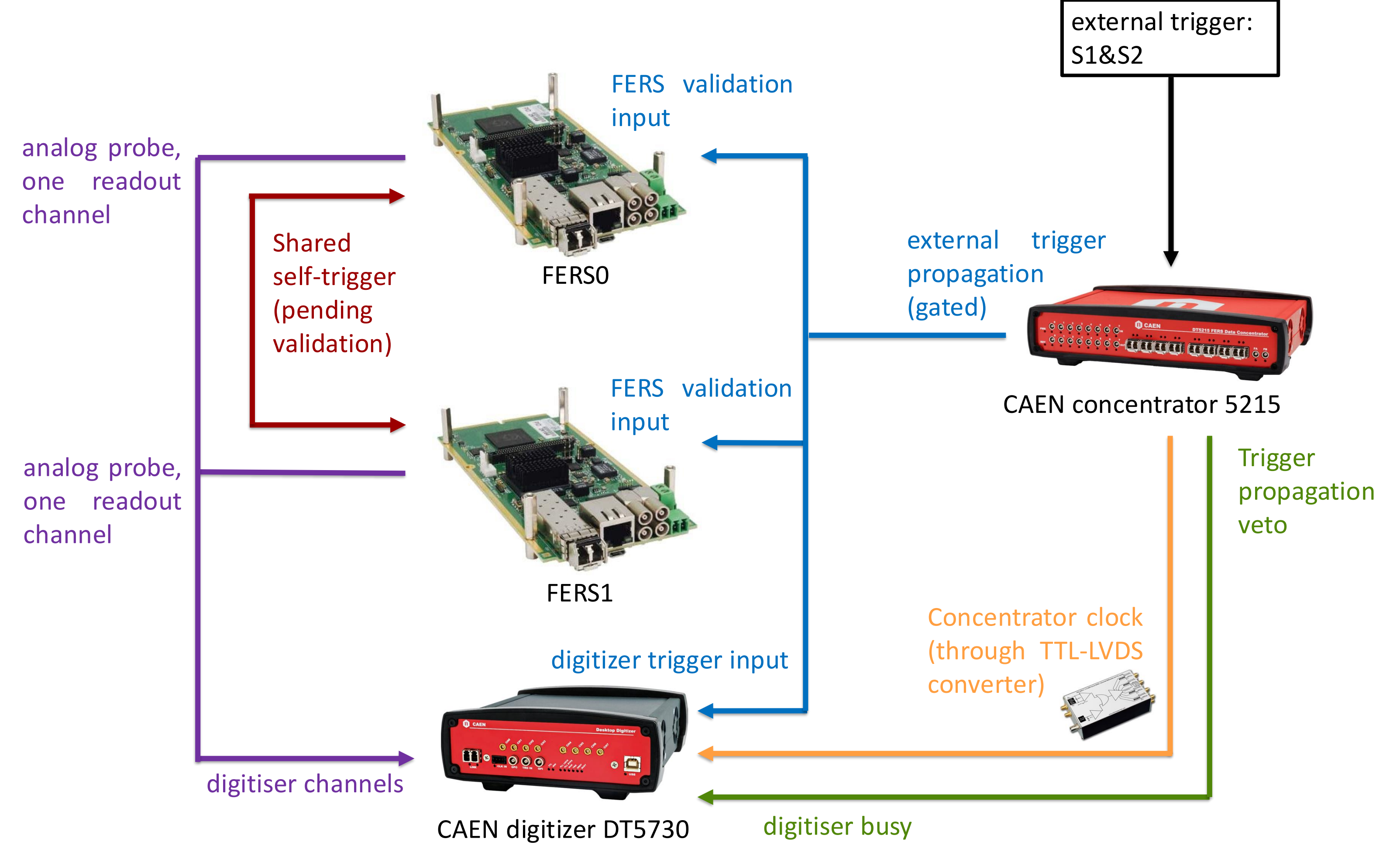
Online monitoring

- Synchronization between digitizer and FERS constantly monitored online to guaranty very good (timestamp-based) alignment of the acquisition.
- Histogram for some recorded channels of each FERS.



+5 GeV/c muons across FZU stack (first 4 curves) and CERN S2p stack (last 4 curves)

Trigger and data acquisition (DAQ)



- The two tile stacks are read out by one FERS each, self trigger made a auto TLOGIC majority of 6 on FZU stack.
- External trigger made with S1 & S2 (validation signal).
- PID system readout by waveform digitiser (independent DAQ):
 - Two Cherenkov threshold counters.
 - Downstream Pb glass and S3 (muon catcher).
- One channel from each FERS board routed to the digitizer for validation of the acquisition.

Preliminary results

- Longitudinal shower profile for CERN S6 stack for different runs increasing thickness of additional steel plates in front of the stacks, to anticipate the shower development.
- PID not included yet.

