Dual-Readout Calorimeter Prototype Update

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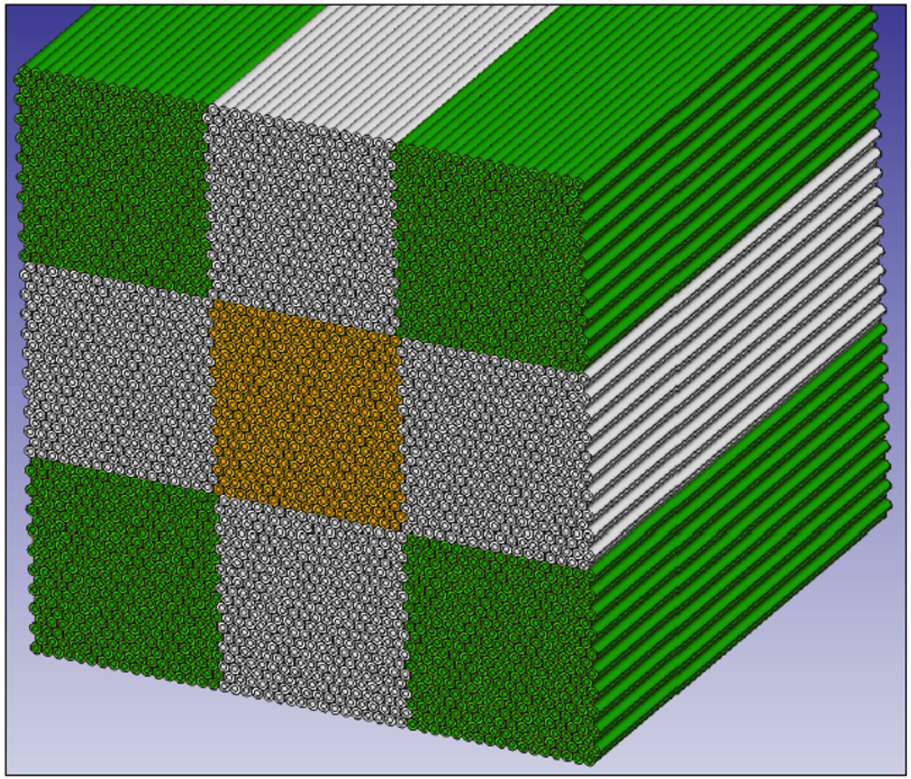
on behalf of the Dual-Readout calorimeter group
July, 15th 2020

Recap “Em-scale” module



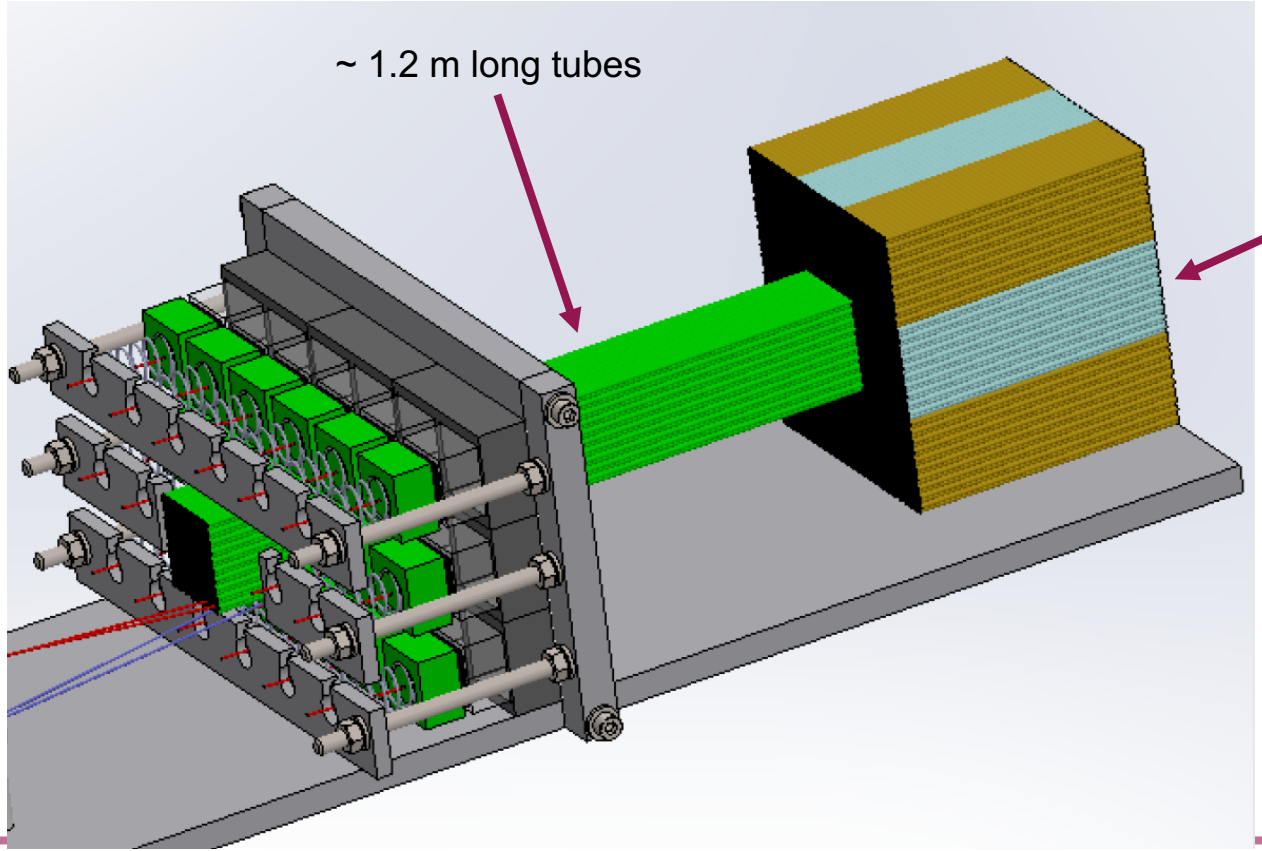
10x10 cm^2 divided in 9 towers, 1m long
16x20 capillary each (160 C + 160 S)

Capillary:
2mm outer diameter, 1mm inner diameter
Material: brass CuZn37

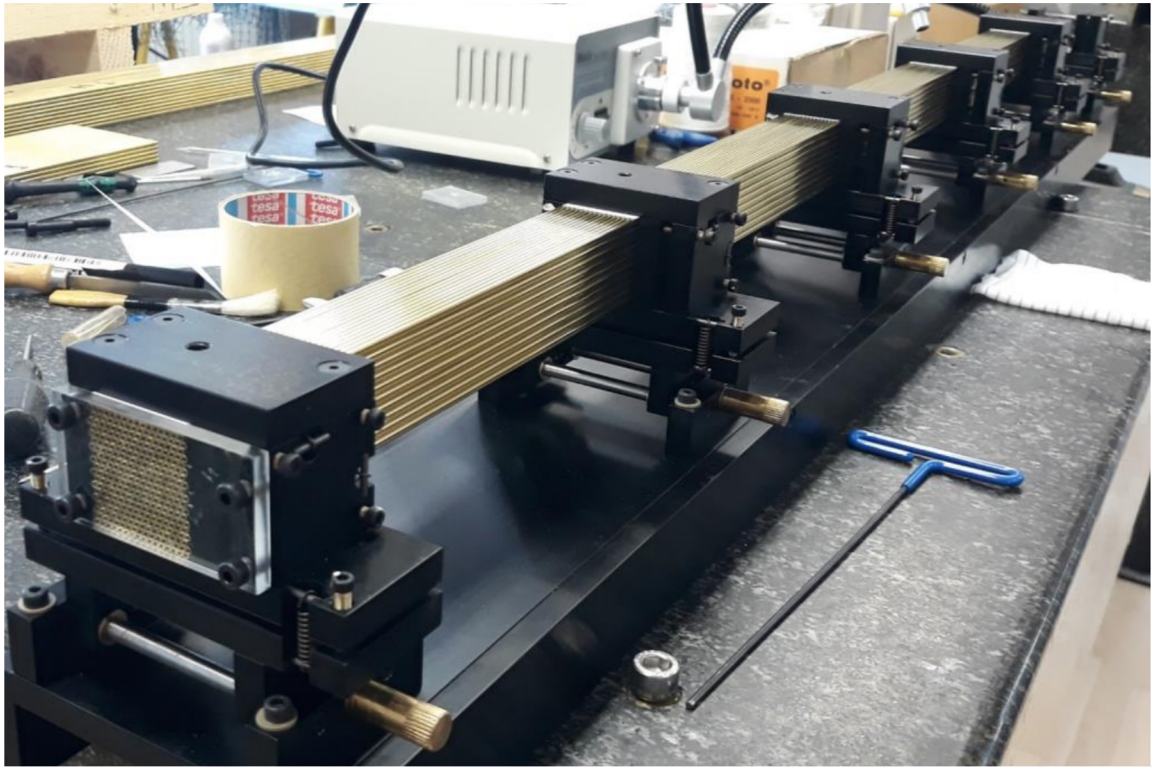
Readout:

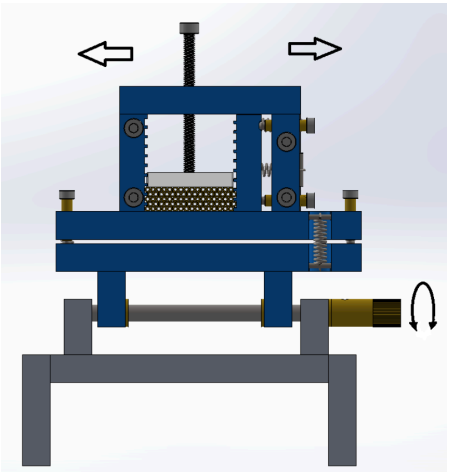
- 1 central tower readout by SiPMs
- 8 surrounding towers readout by PMTs (à la RD_52)

Calorimeter structure



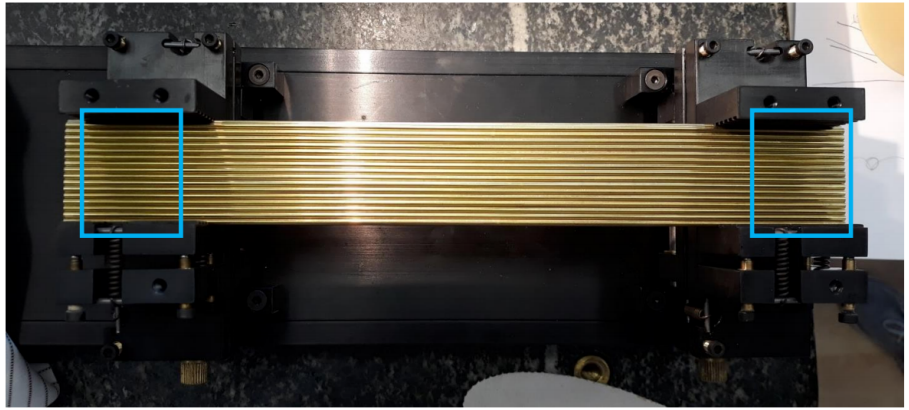
Assembly system





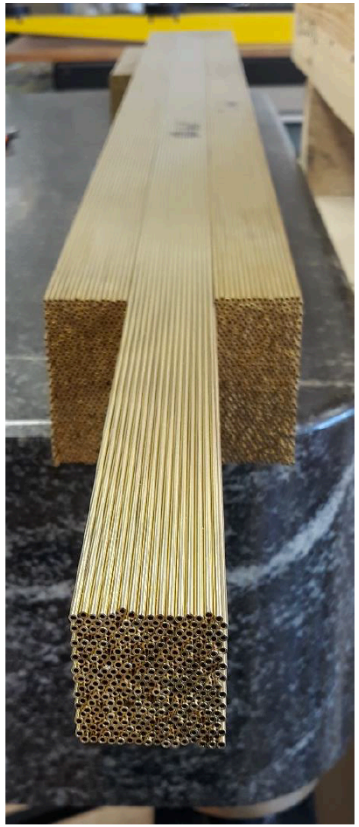
6 adjustable stands for packing capillaries to correct position. Alignment of stations through micrometric screws

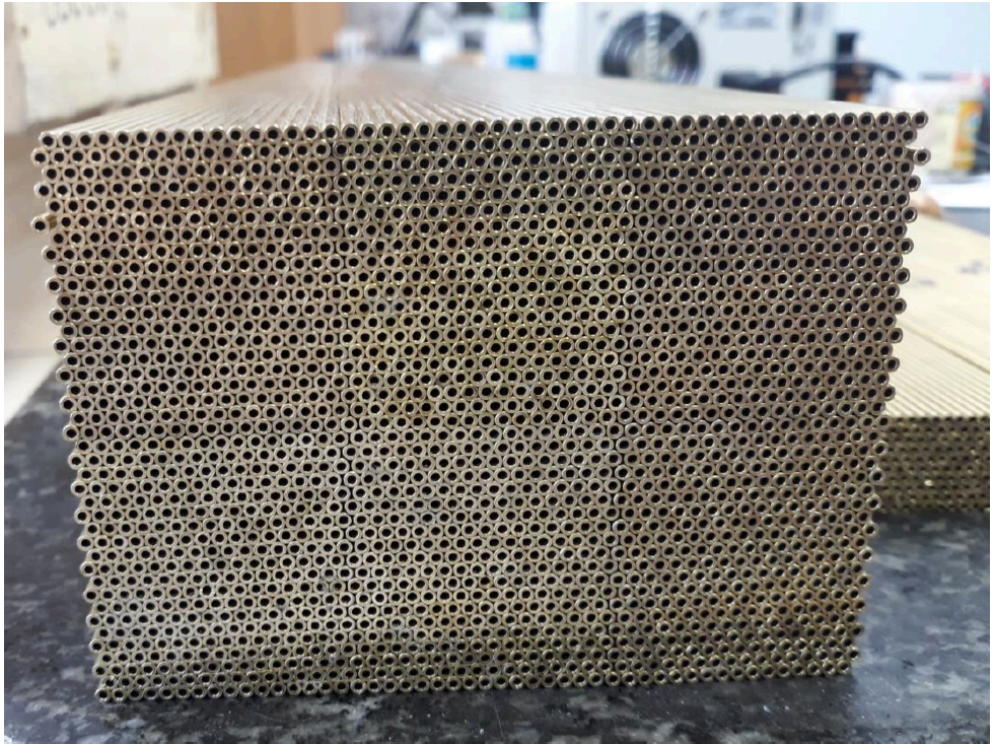
Construction Method



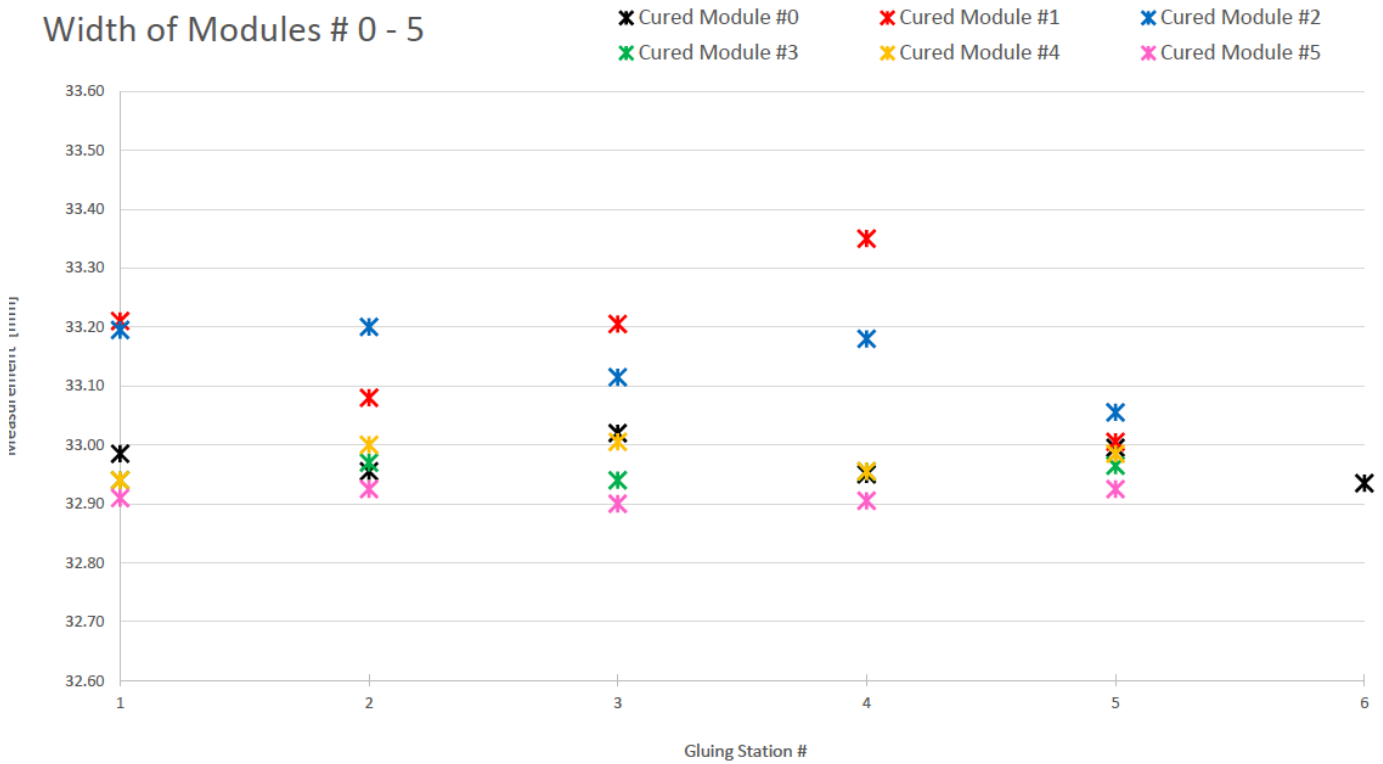
- Capillaries are positioned layer by layer
- Dry run with all tubes for each tower (~3x3 cm^2) is performed and measurements are checked
- If all ok, capillaries removed and repositioned distributing glue at each layer
- Full tower left to cure overnight
- Measurement (external dimensions) done after removal from assembly stations

Present status





Preliminary qualification



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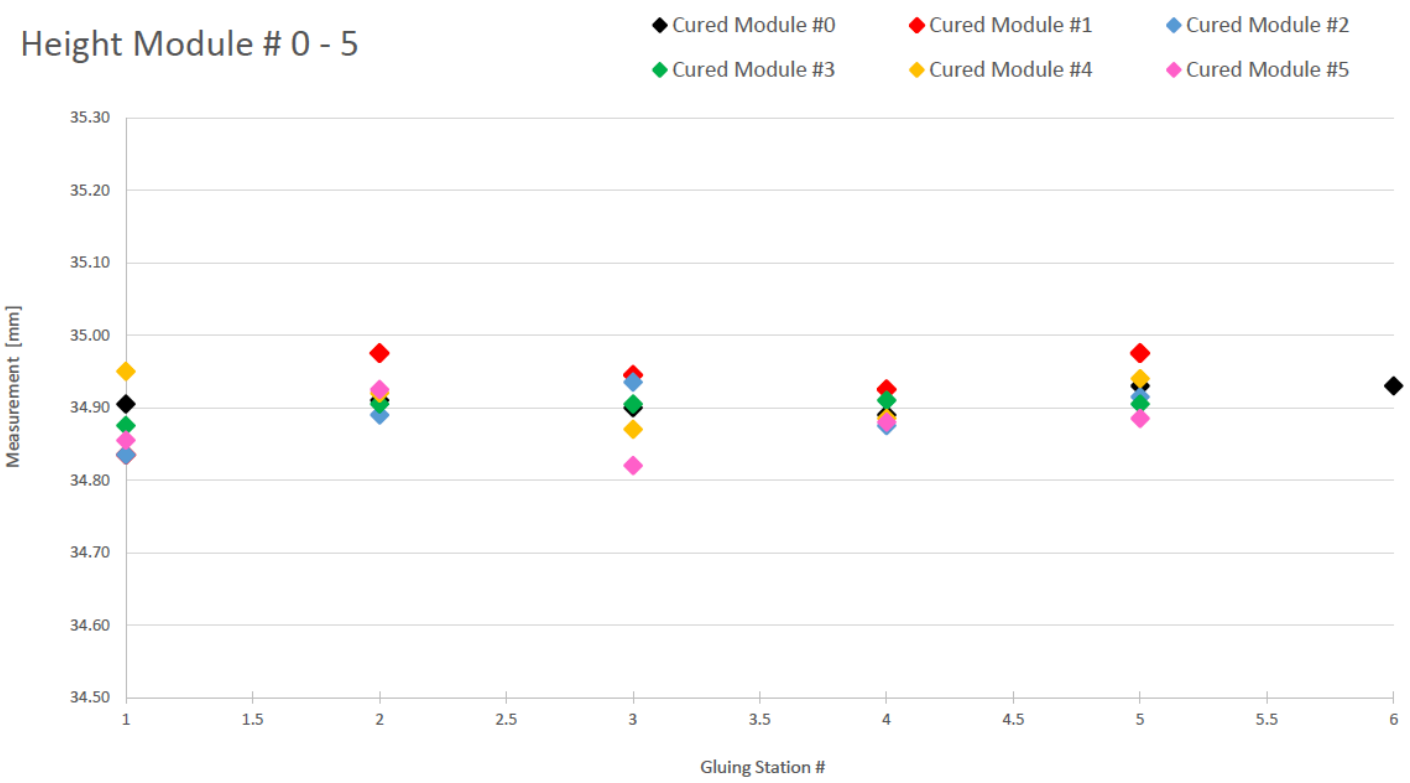
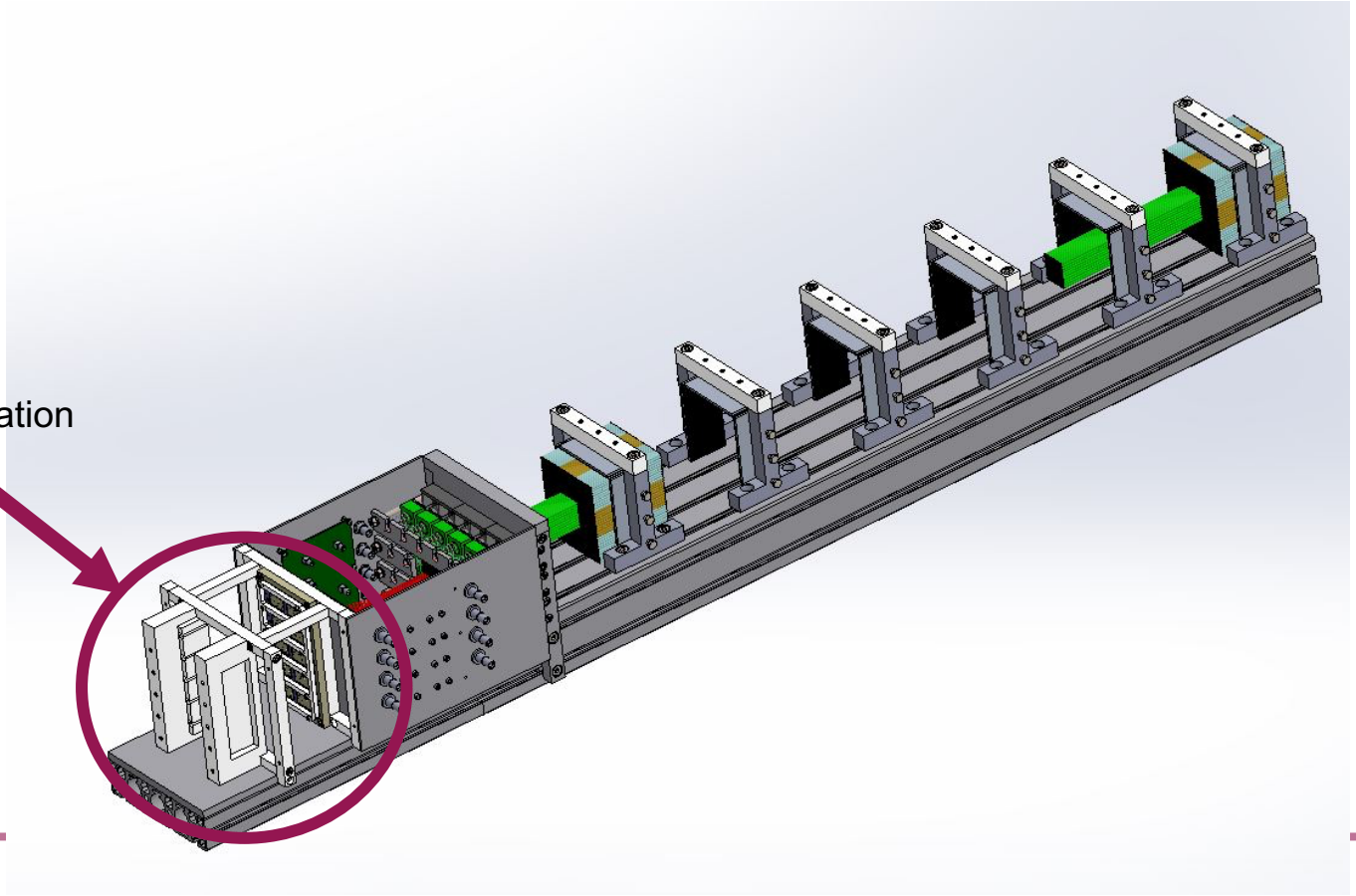
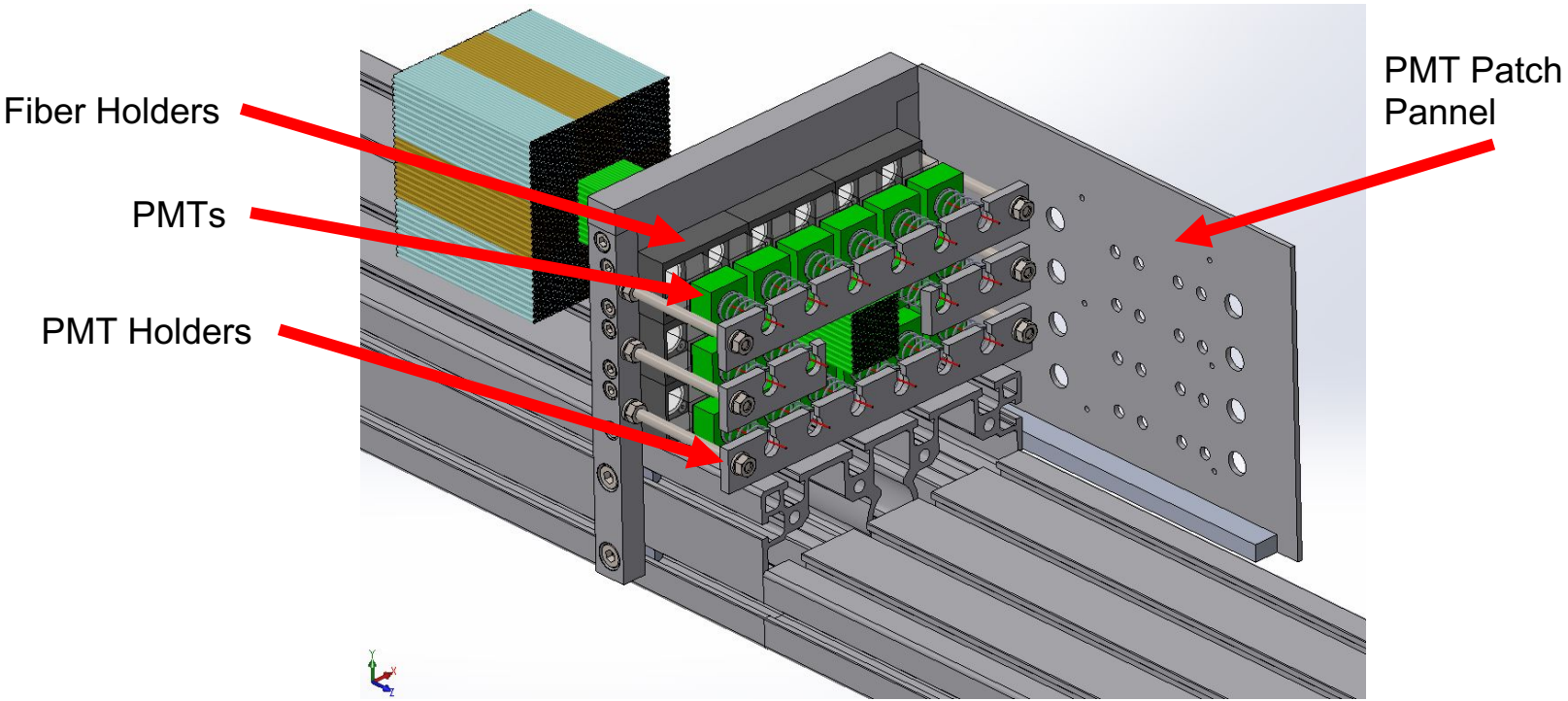


Full prototype mechanics



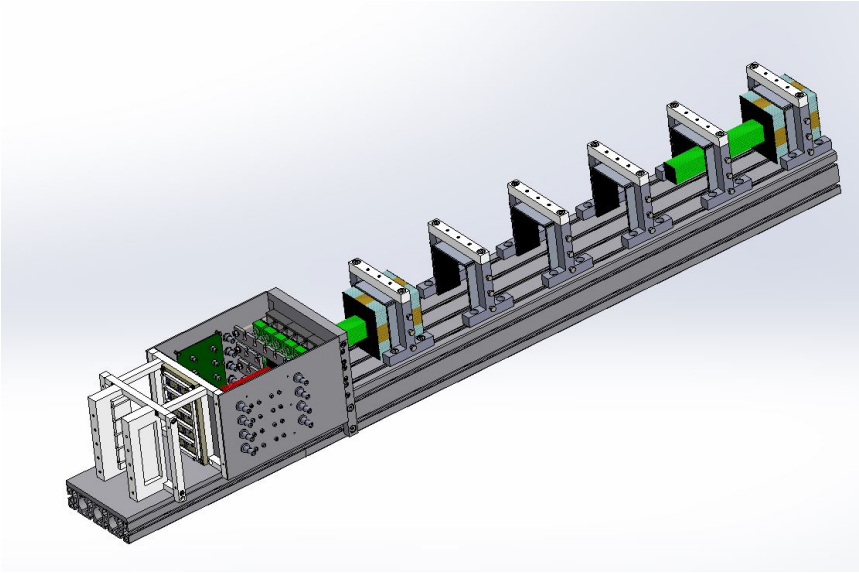
Fiber connection to PMTs



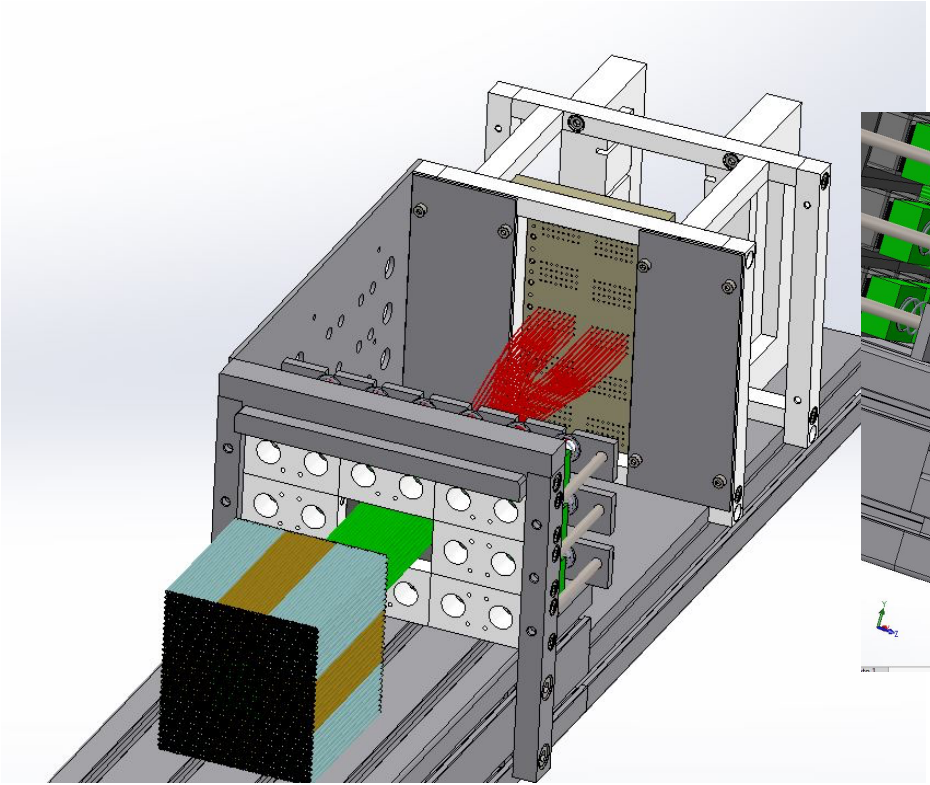
Material prepariation: Status

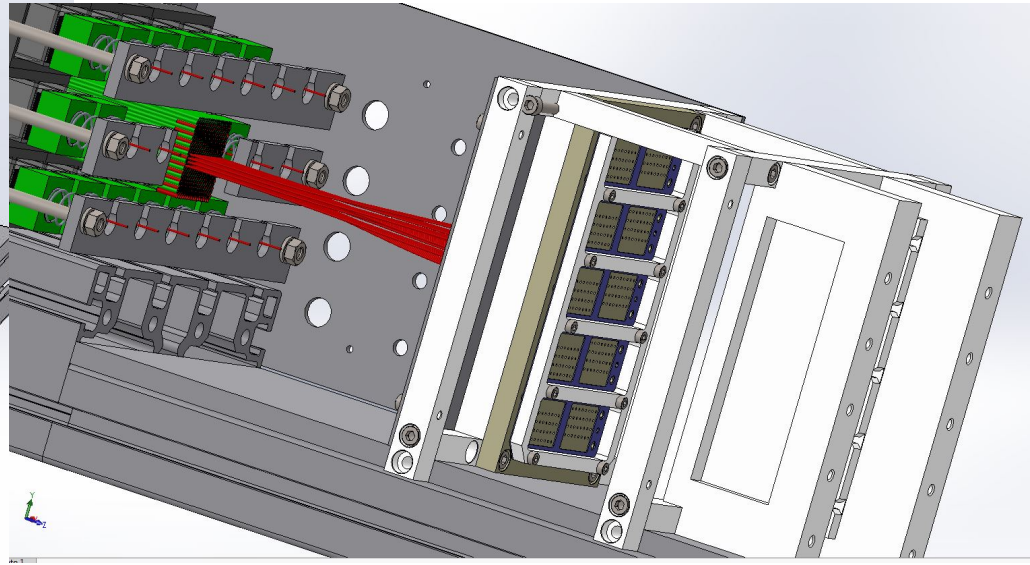
- All the drawings finalized except for FERS board support (ongoing)
- Calorimeter support and light-tight cover : all material procured
- Fiber grouping and PMT holders produced by 3D-printing

- Fibers: all available in Pavia
  - Test stand under preparation
- PMTs: all available in Pavia

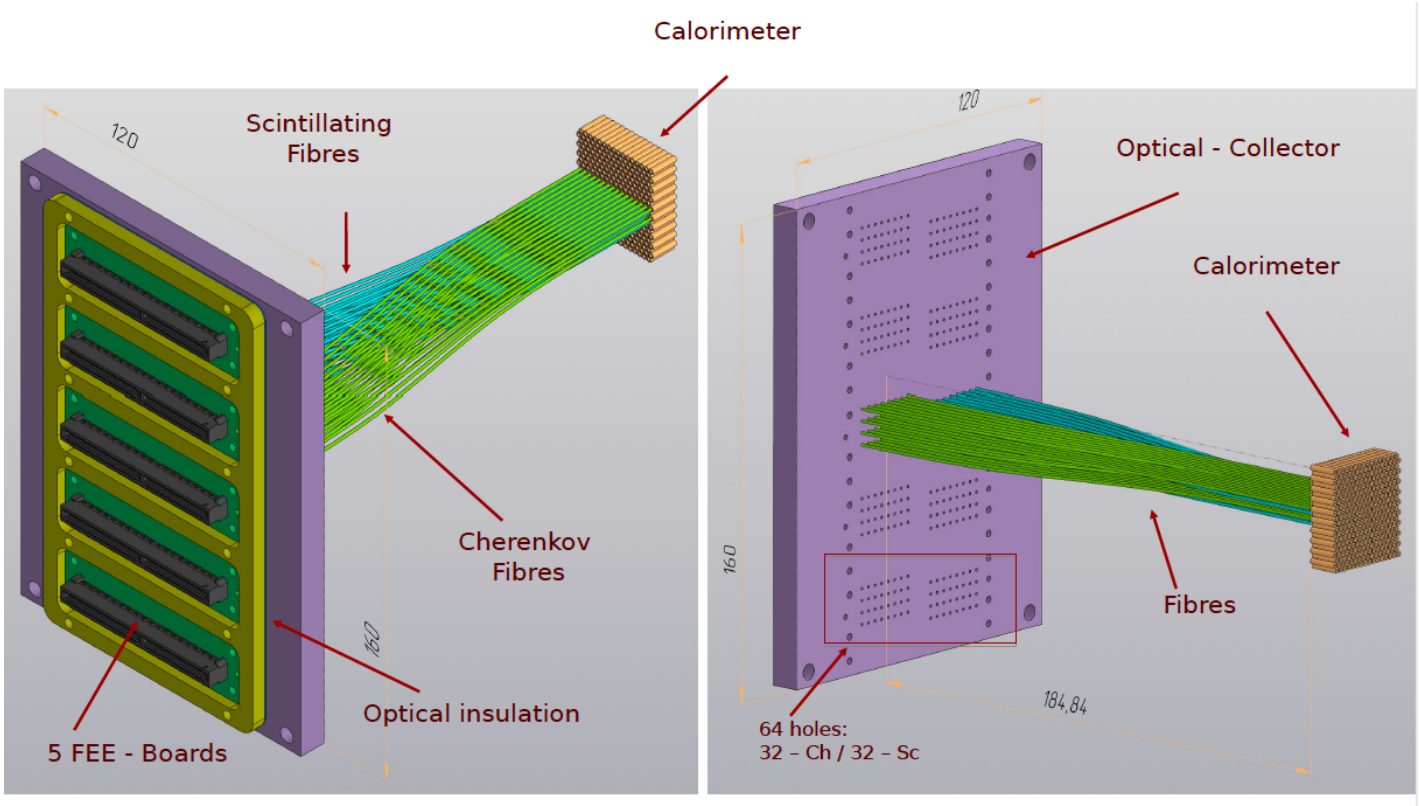


Fiber connection to SiPMs





SiPM Coupling

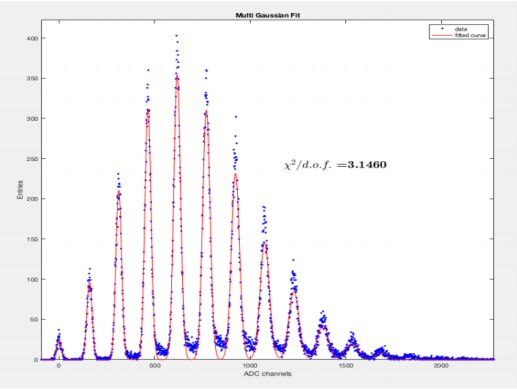


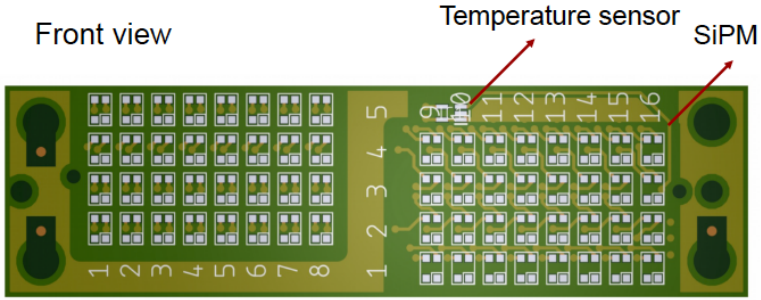
FEE-boards

All boards delivered and electrically qualified

All SiPMs (320 + spares) expected ~ mid July

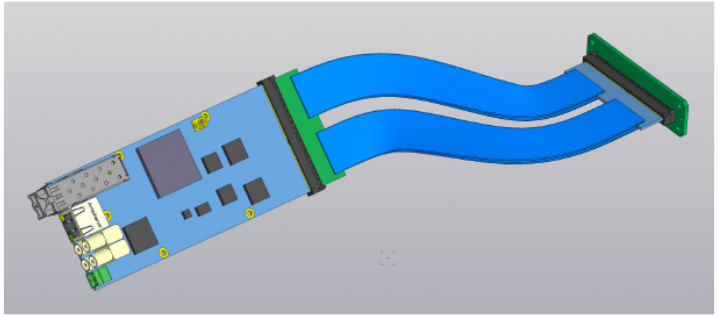
Sensor: S14160-1315PS
Cell size =15μm
Vbias = 42 (≈ 4 V over breakdown)
Signal amplification: 40dB
Measured Xtalk = 2%



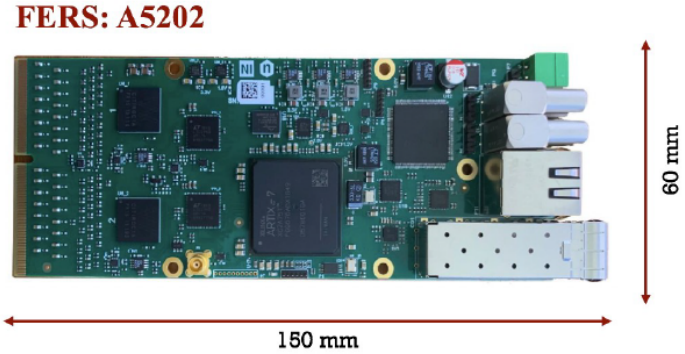


Boards equipped with all components expected ~ early September

FEE-board to FERS cables

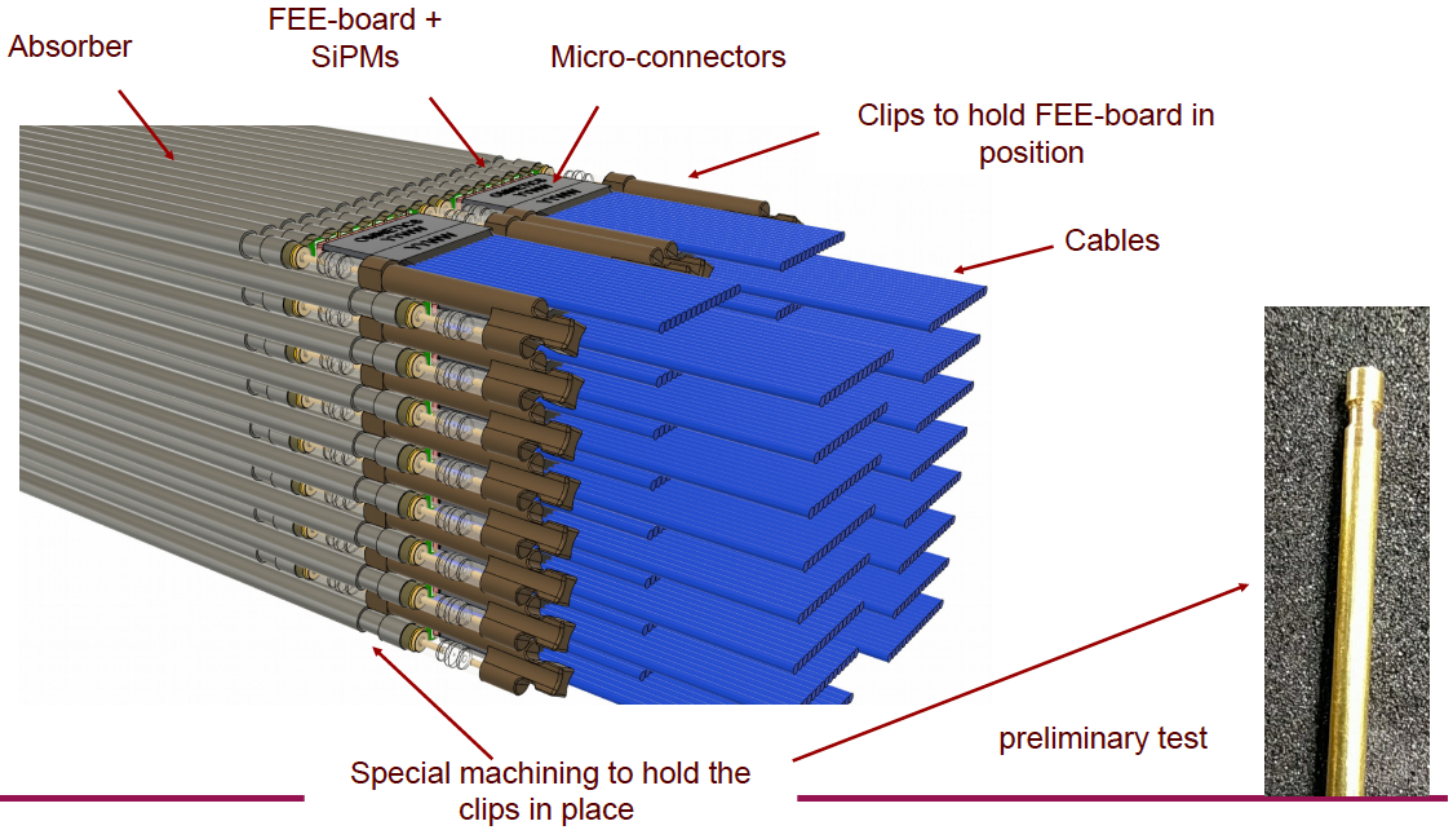


- designed
- will be produced by Samtec
- order to be finalised in next days



- all FERS ordered
- expected ~ early September for final qualification

New concept for a true scalable module



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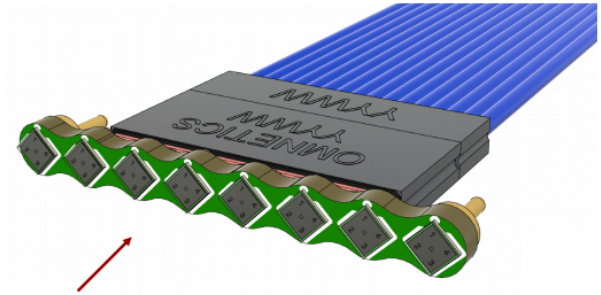
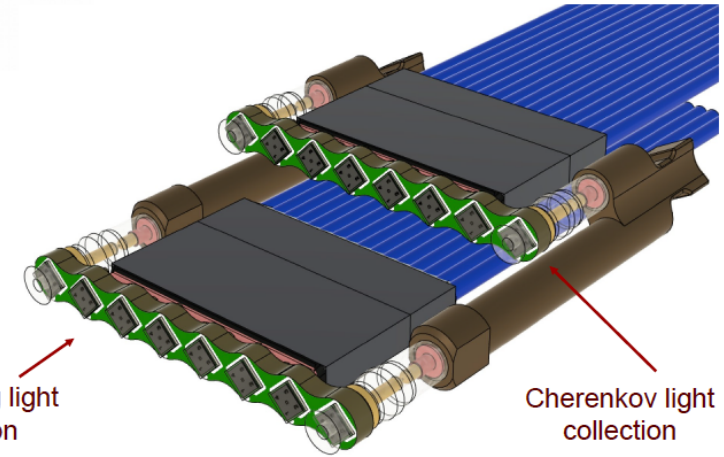


FEE-board + SiPMs
Segmentation optimised to exploit grouping

Pair of FEE-boards joint together with clips



Scintillating light collection

Cherenkov light collection

Schedule

- Three remaining towers will be built in RBI-Zagreb in the next weeks
- Delivery of the mechanically assembled modules to Pavia end of July
- Some measurements and assembly tests will be performed once in Pavia
- Fiber insertion and grouping, connection to light detectors beginning of September
- Module qualification afterwards

- Test beam @Desy was foreseen in November. Proposed to be moved at the beginning of 2021
  - to keep the two-week period foreseen
  - to have more time for module elx qualification

Outlook

- Many funding requests ongoing
  - Submitted INFN call CSN5: (if approved) ~ 900k€ over three years (to be decided end July)
  - Plan B: INFN request in CSN1: RD_FCC, based on IDEA concept
  - AIDA innova (if approved): mainly Post-doc positions
  - S. Korea: large founding over ~5 years (APPROVED)
- Dual-Readout Xtal option under discussion with US colleagues
  - Plan to submit joint LOI to Snowmass process