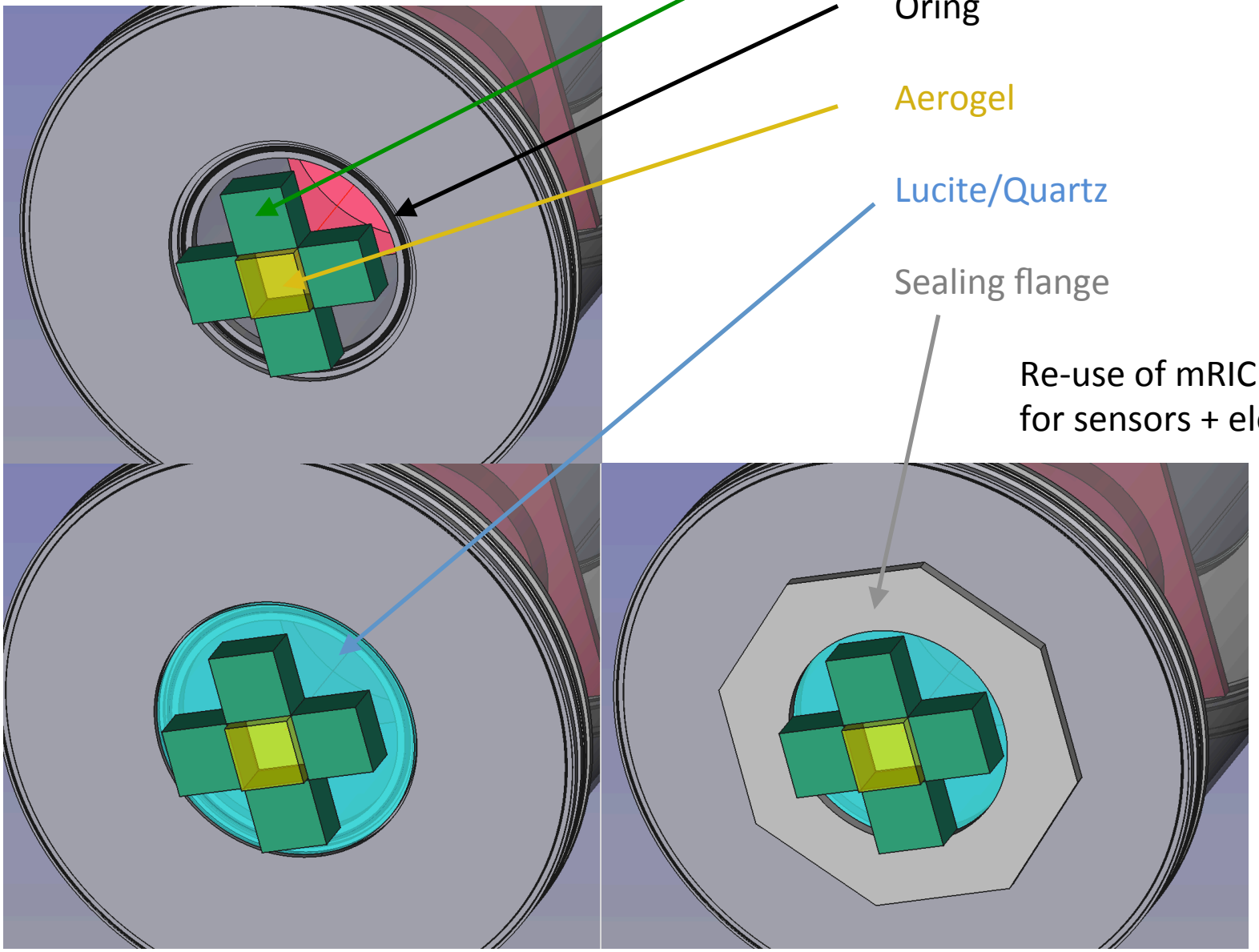
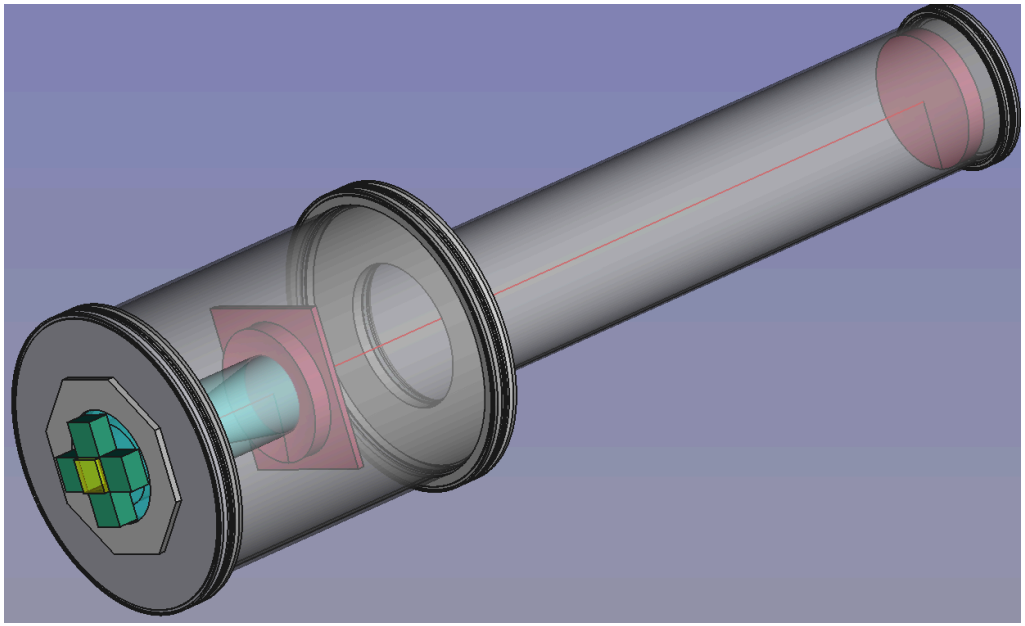
DRICH PROTOTYPE



Re-use of mRICH concepts
for sensors + electronics

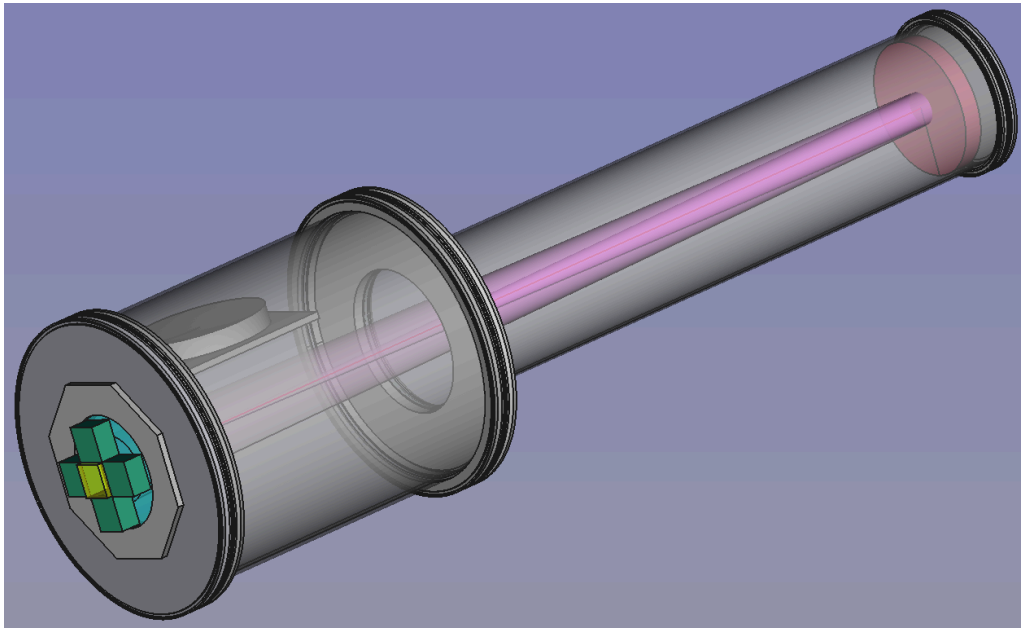
DRICH PROTOTYPE



Two radiators with almost overlapping rings
(to optimize the active area)

Configuration 1:

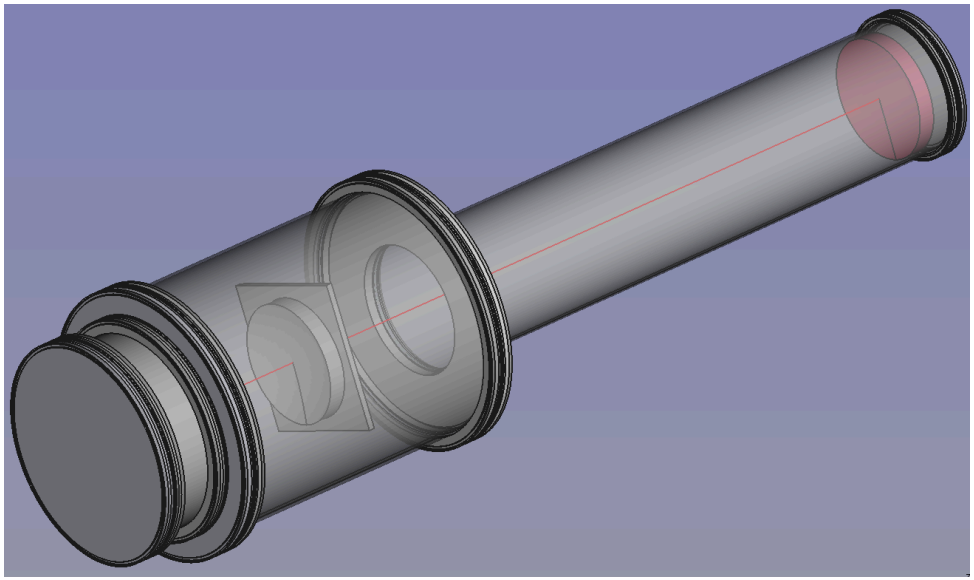
Aerogel ring



Configuration 2:

Gas (freon) ring

DRICH PROTOTYPE



Configuration 3:

Gas exchange / Vacuum

Cost estimates

Vacuum chamber (minimal elements, no mechanical processing):

- Mori meccanica: 4-5 kEUR
- Allectra: 5 kEUR (single chamber)
- VCS: 3.5 kEUR

Mirrors: Edmund protected Aluminum

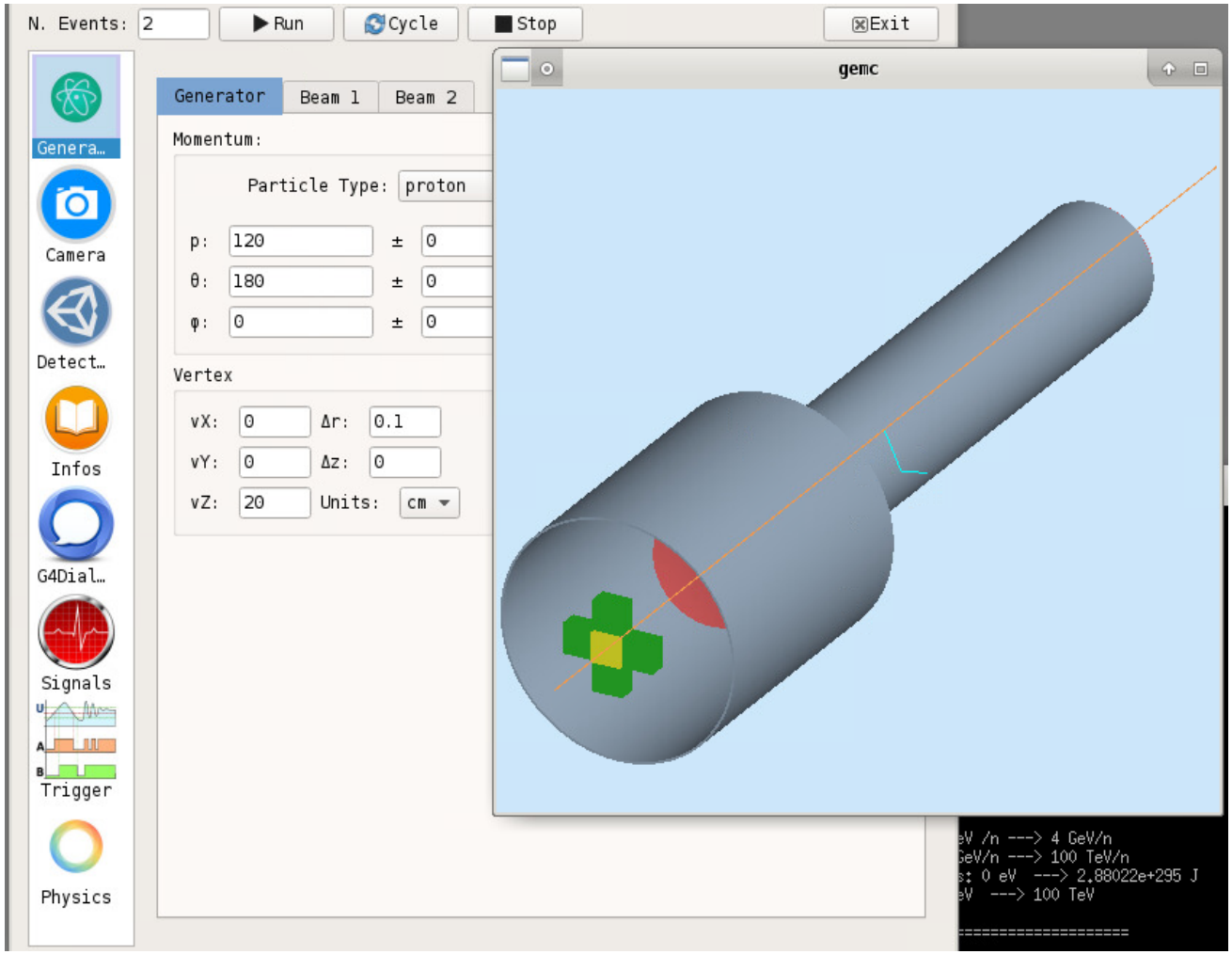
⦸= 6” (~ 150 mm) F=1200 mm 600 $

⦸= 8” (~200 mm) F=1600 mm 830 $ (34 mm thickq8ness)

Support with micrometric screws: 1500- 2000 $

DRICH PROTOTYPE

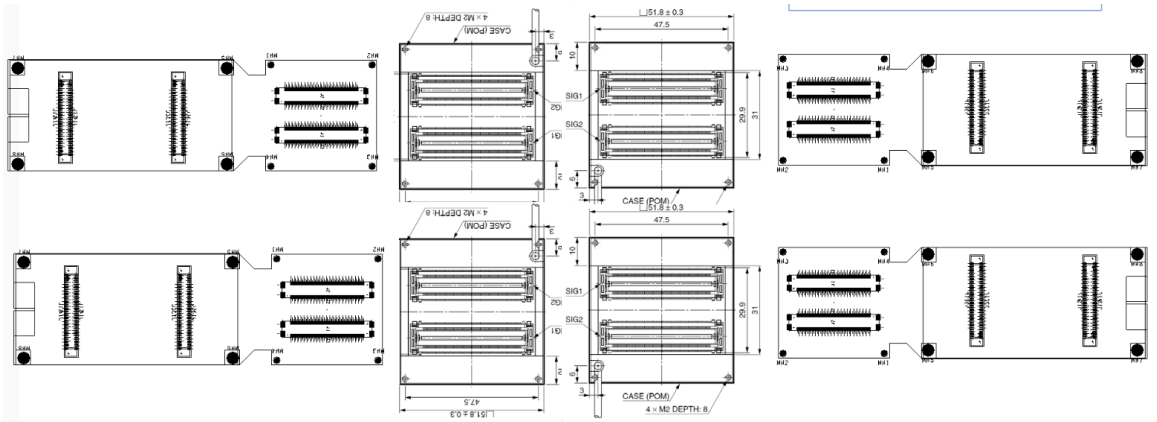
GEMC simulations (docker) with geometry imported from CAD



H13700 READOUT (2018)

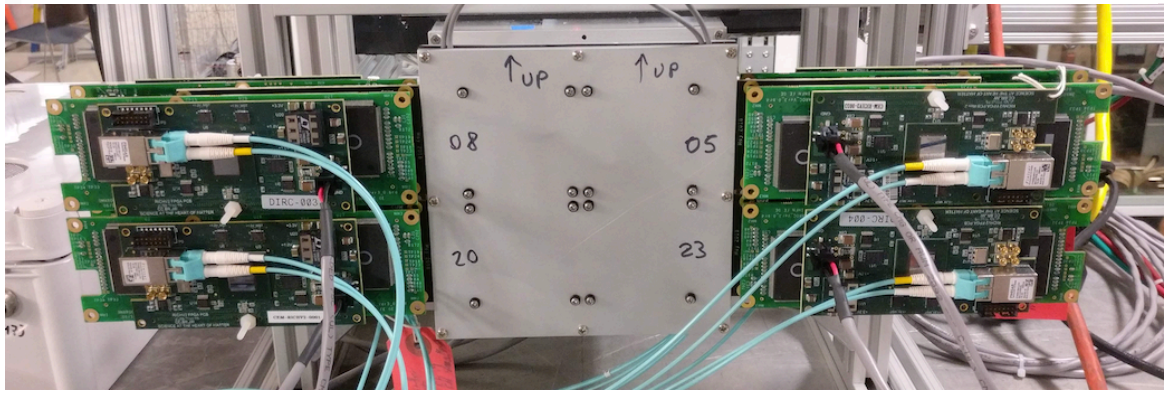
Derived from CLAS12 RICH readout:

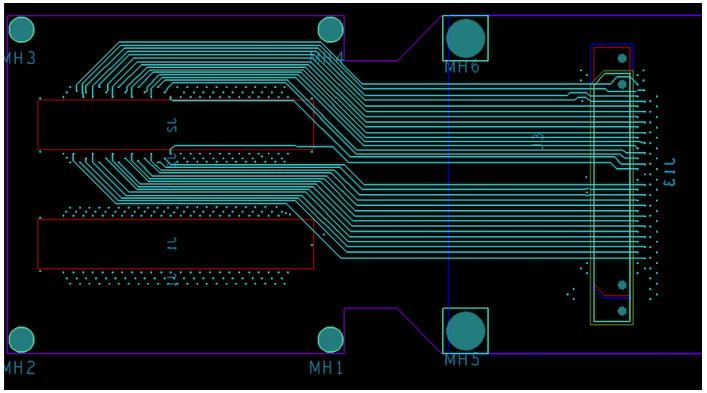
- 1024 channels
- MAROC 64 channel parallel digitalization
- FPGA generated 1 ns timestamp
- DAQ protocol based on VME/VSX SSP



Custom adapter boards

- Compact distribution
- Use of existing MAROC boards
- Light and gas tightness





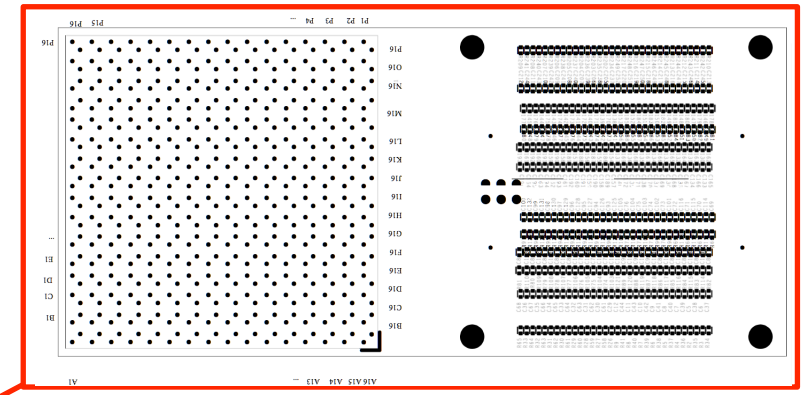
SIPM READOUT (2018)

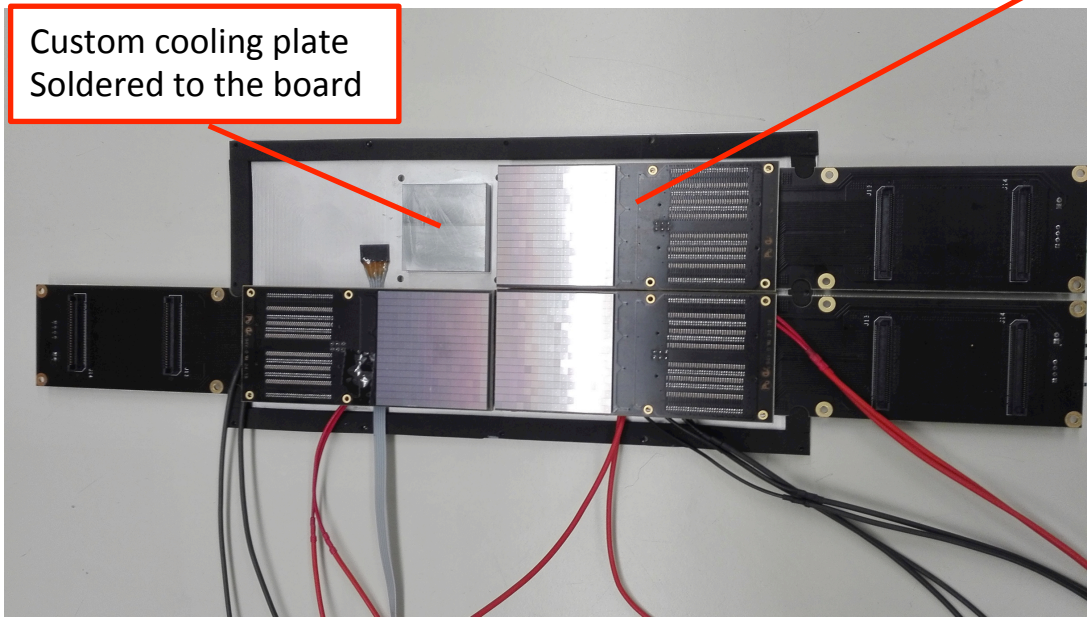
SiPM might offer a cheaper and more efficient solution, expecially in a longer time perspective for other sectors

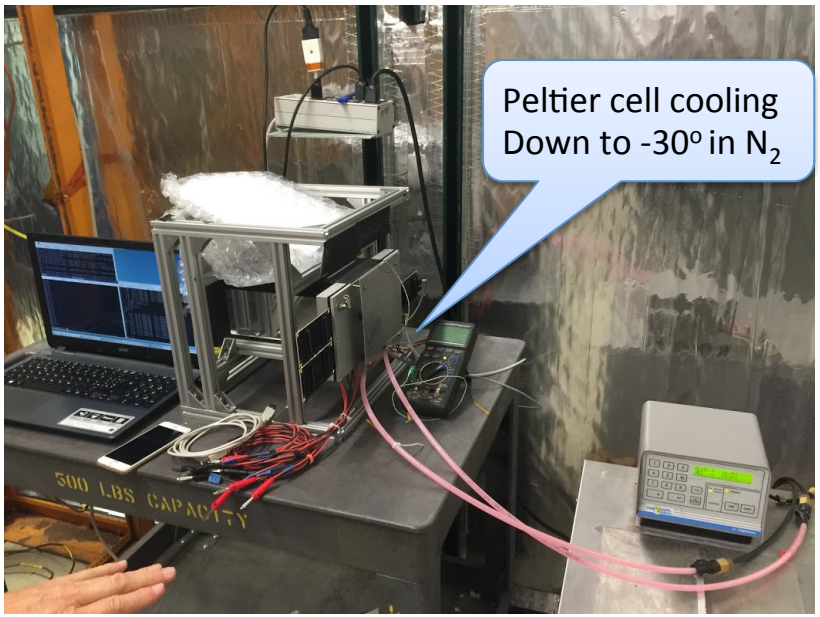
Robust device with low sensitivity to magnetic field
Fast improvement in dark rate and cost
but so far missing radiation hardness

Challenge: cooling integrated into the sensitive readout

Dedicated board for readout and cooling of a surface Mounting SiPM Matrix

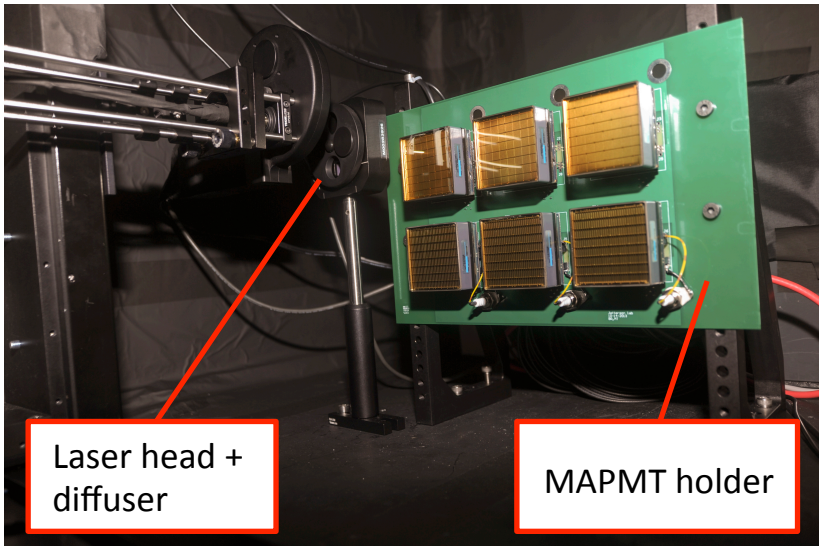






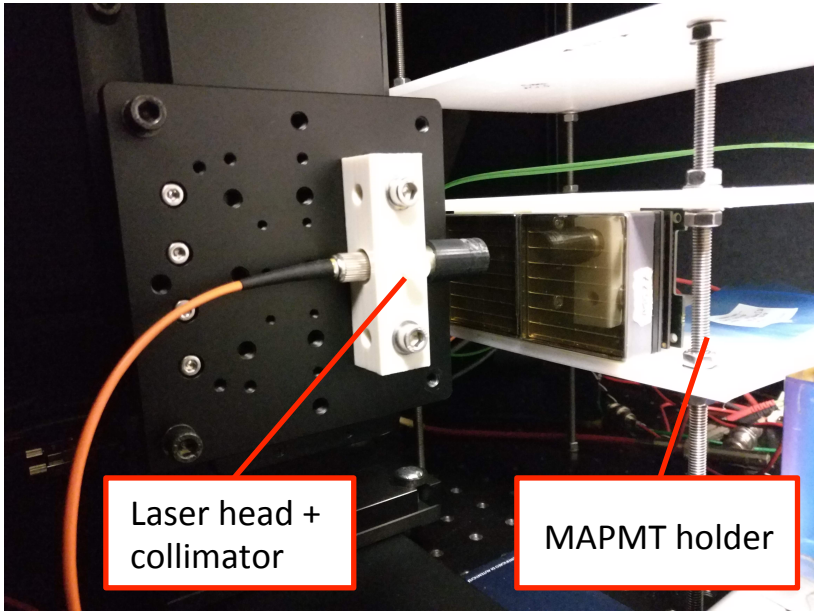
PULSED LASER TEST BENCHES

Detailed characterization
Sensors: gain, efficiency, cross-talk, radiation tolerance
Electronics: gain, cross-talk, thresholds, time resolution



JLab

632 nm picosecond pulsed laser light
Light diffuser to illuminate the whole MAPMT surface
Standardized system with CLAS12 electronics
H8500 6x6 mm^2 pixel sensor so far



INFN

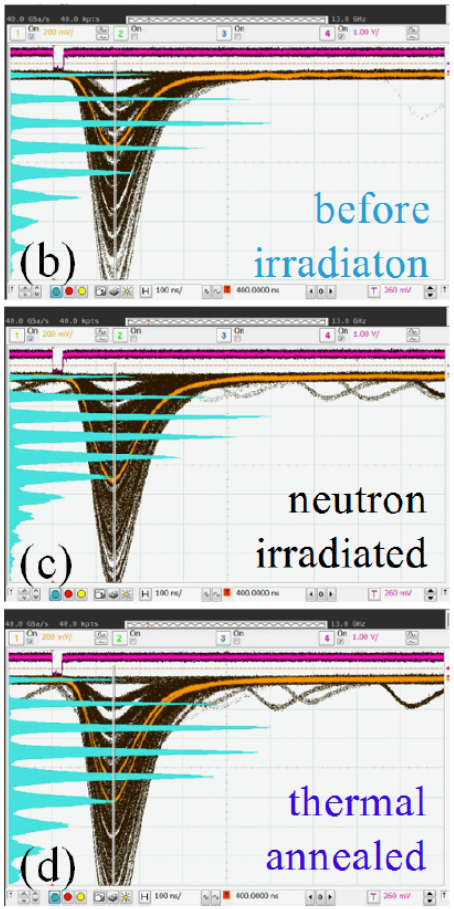
632 nm and 407 nm picosecond pulsed laser light
Light concentrator to scan the pensor surface
Flexible layout supporting various sensors and Front-End electronics

SIPM RADIATION TOLERANCE

T. Tsang et al.
JINST 11 (2016) P12002

I. Balossino et al.
NIMA 876 (2017) 89

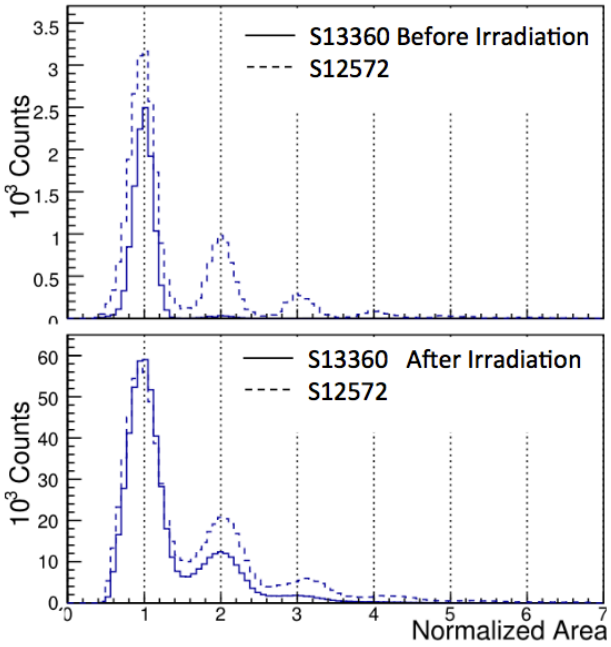
Paolo Carniti
@ RICH 2018



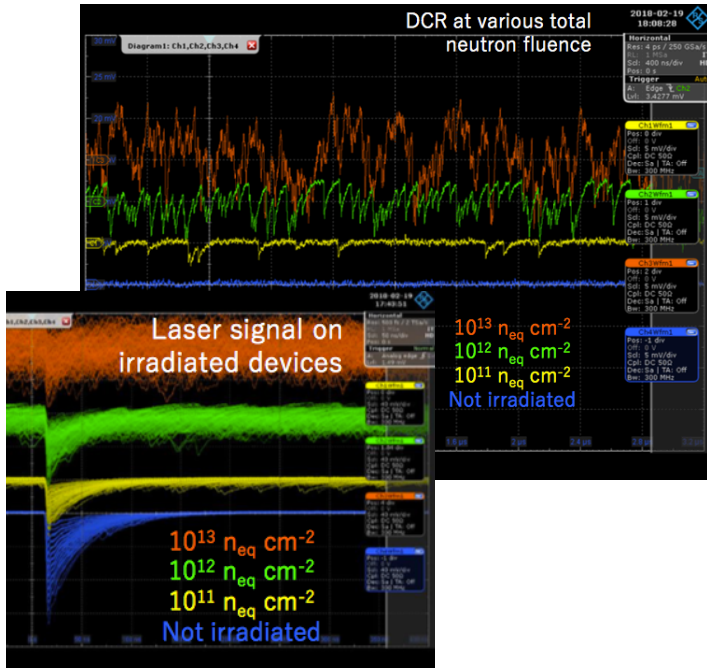
T= 84 K
10^9 n_{eq} cm^2
Annealing at 250 °C

Single-photon capability after irradiation ?

S12572 standard technology
S13360 trench technology



T= 0 C
few 10^9 n_{eq} cm^2



SiPM: Hamamatsu S13360-1350CS (50 µm cells)

Temperature: –30 °C

Bias: V_{BR} + 1.5 V