THE CLAS12 RICH

An International Collaboration coordinated by

INFN (Italy), JLab (USA), Argonne National Lab (USA), Duquesne University (USA), University of Connectticut (USA), Kyungpook National University (Republic of Korea), J. Gutenberg Universitat Mainz (Germany), Universidad Tecnica Federico Santa Maria (Chile), University of Glasgow (UK).
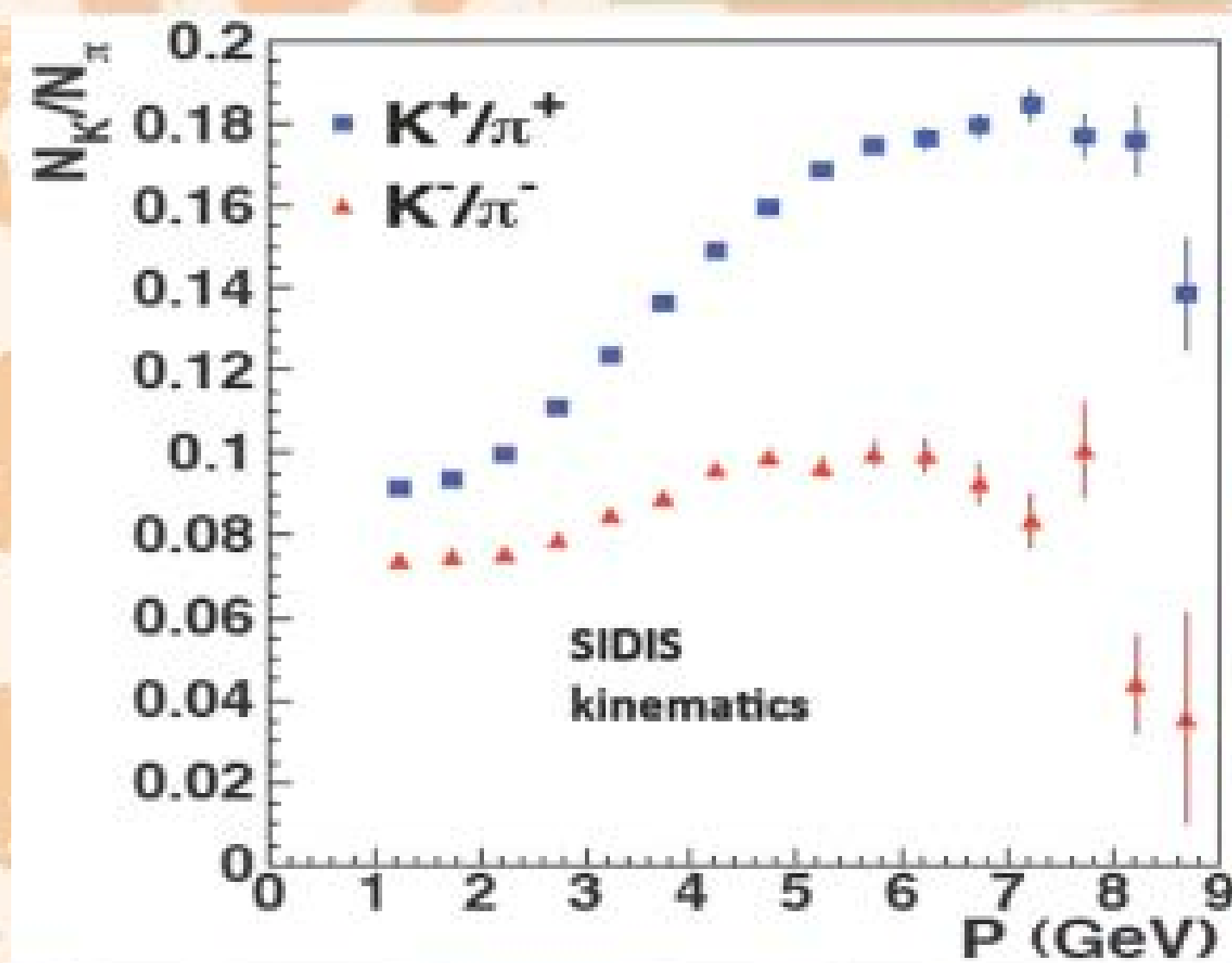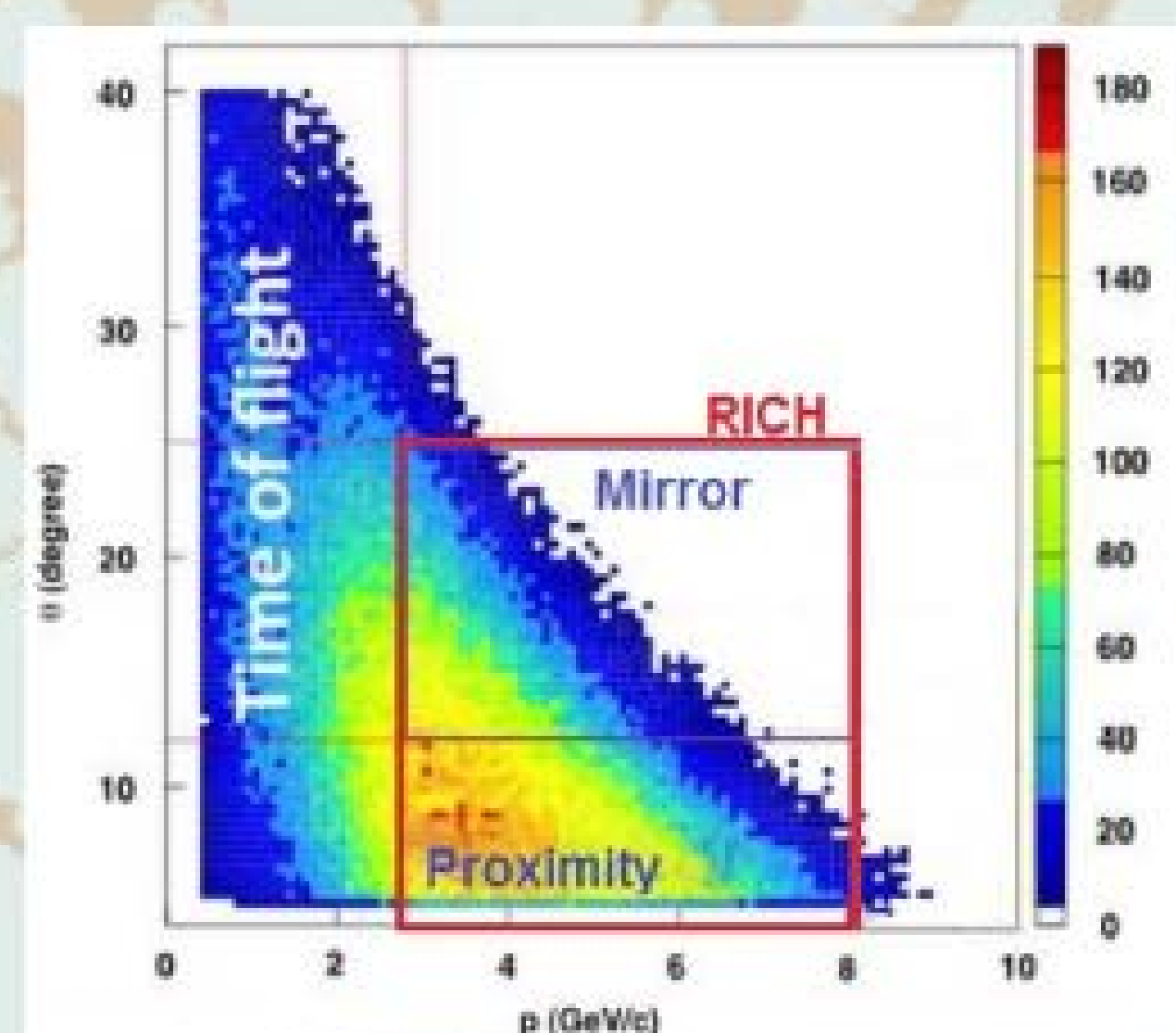
The Ring Imaging Cherenkov detector (RICH) is designed to improve CLAS12 particle identification in the momentum range 3-8 GeV/c

KAON IDENTIFICATION

A good PID is mandatory for four already approved experiments

π/K production rate ~ 10
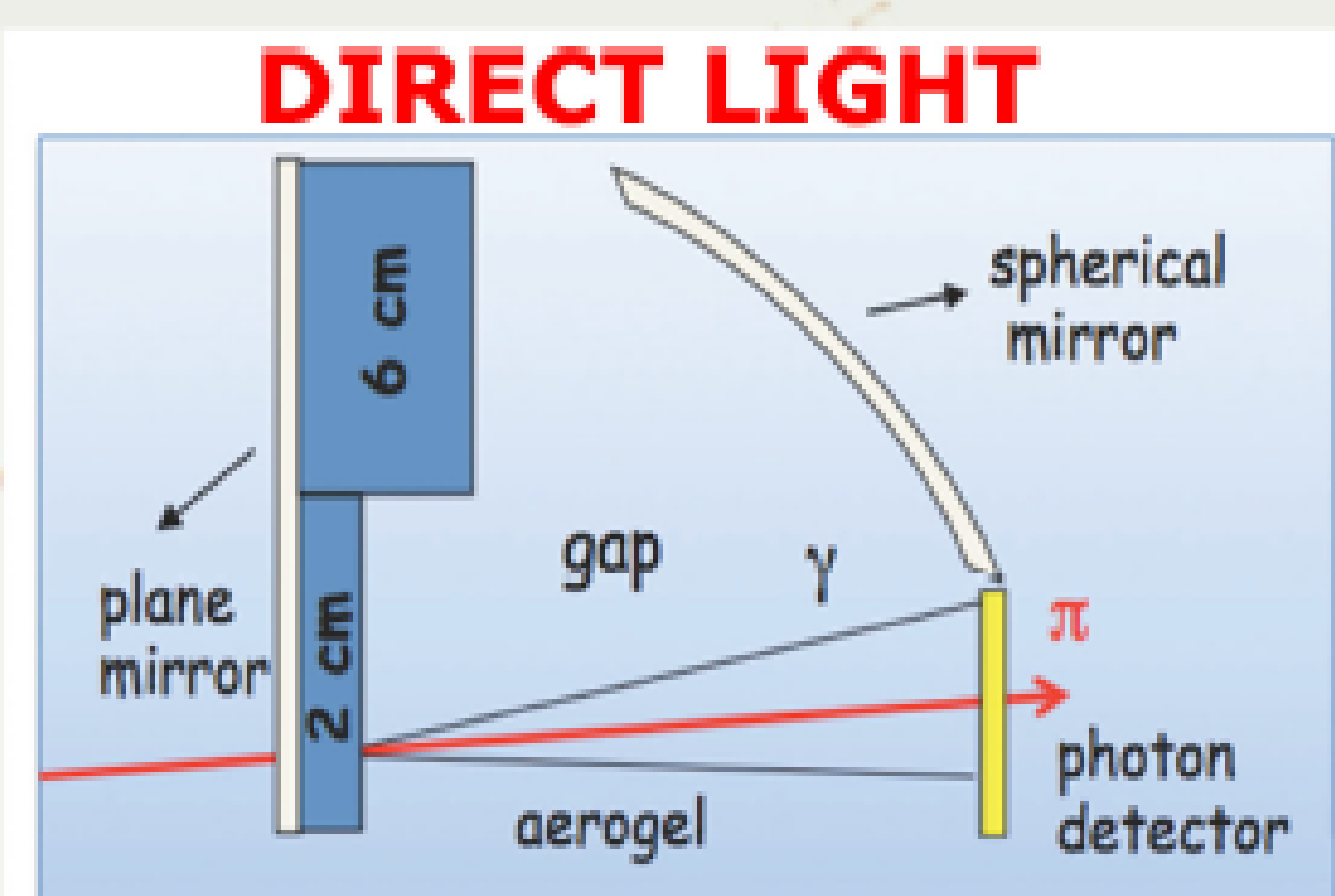
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π/K rejection power > 500

The RICH is necessary for the PID in the momentum range 3-8 GeV/c

The Time Of Flight provides π/K separation up to 3GeV/c

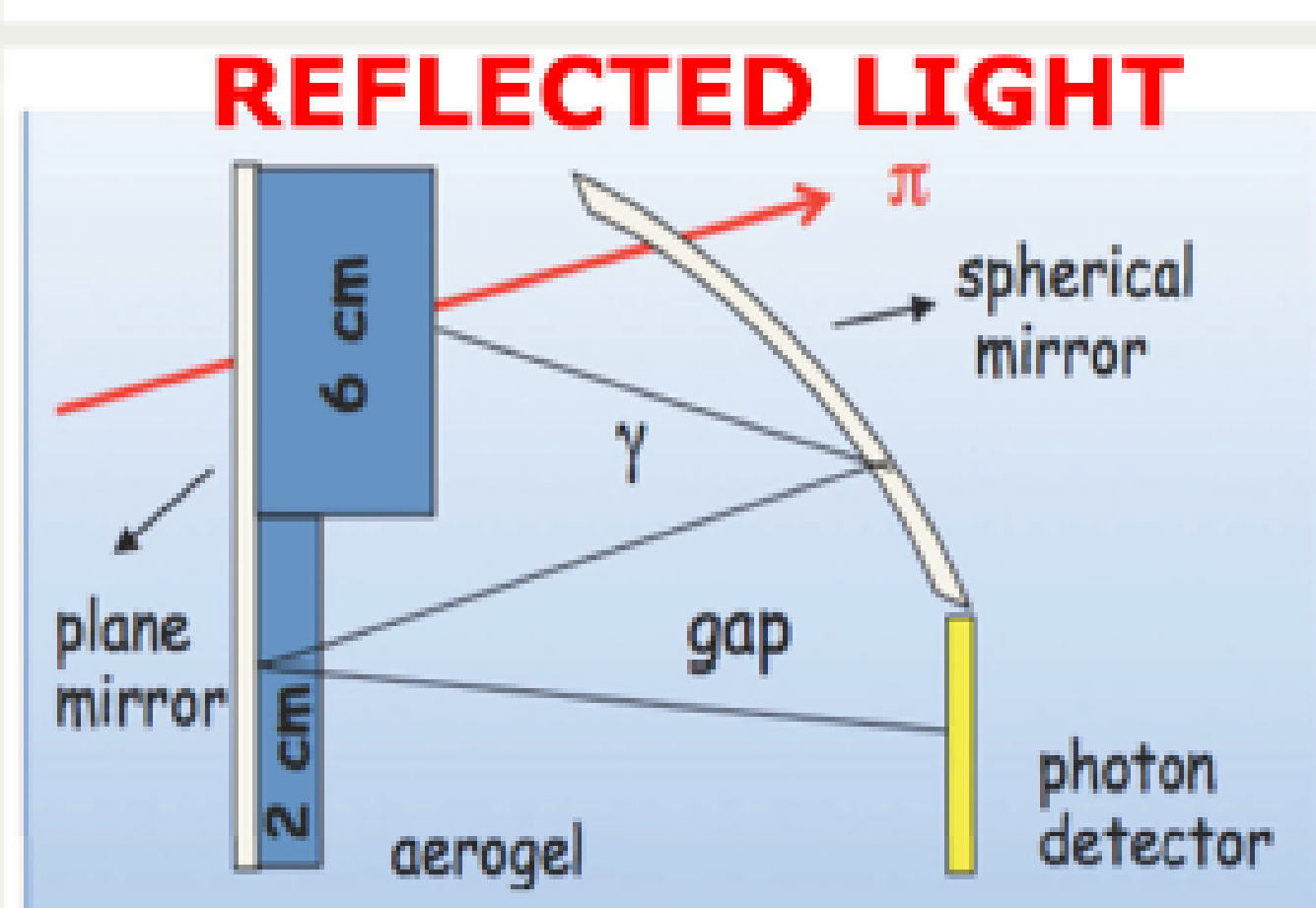Threshold Cherenkov counters provide PID above 8 GeV/c

THE HYBRID GEOMETRY

The RICH exploits an innovative hybrid design to reduce cost and material budget

DIRECT LIGHT

Forward angles θ<13° and momenta 3-8 GeV/c
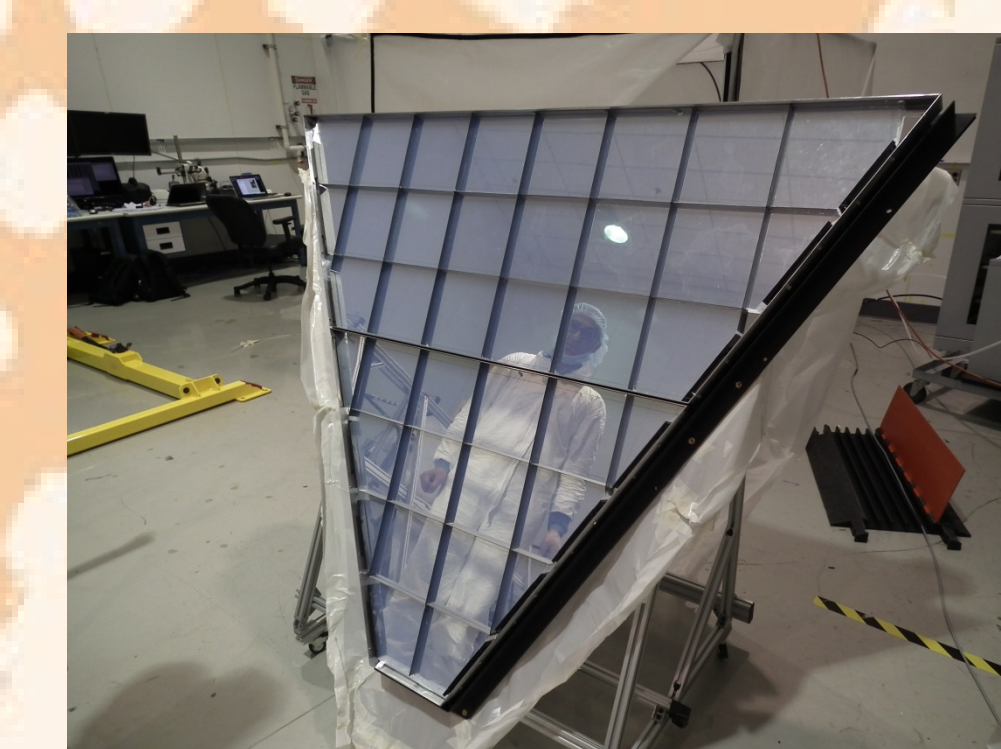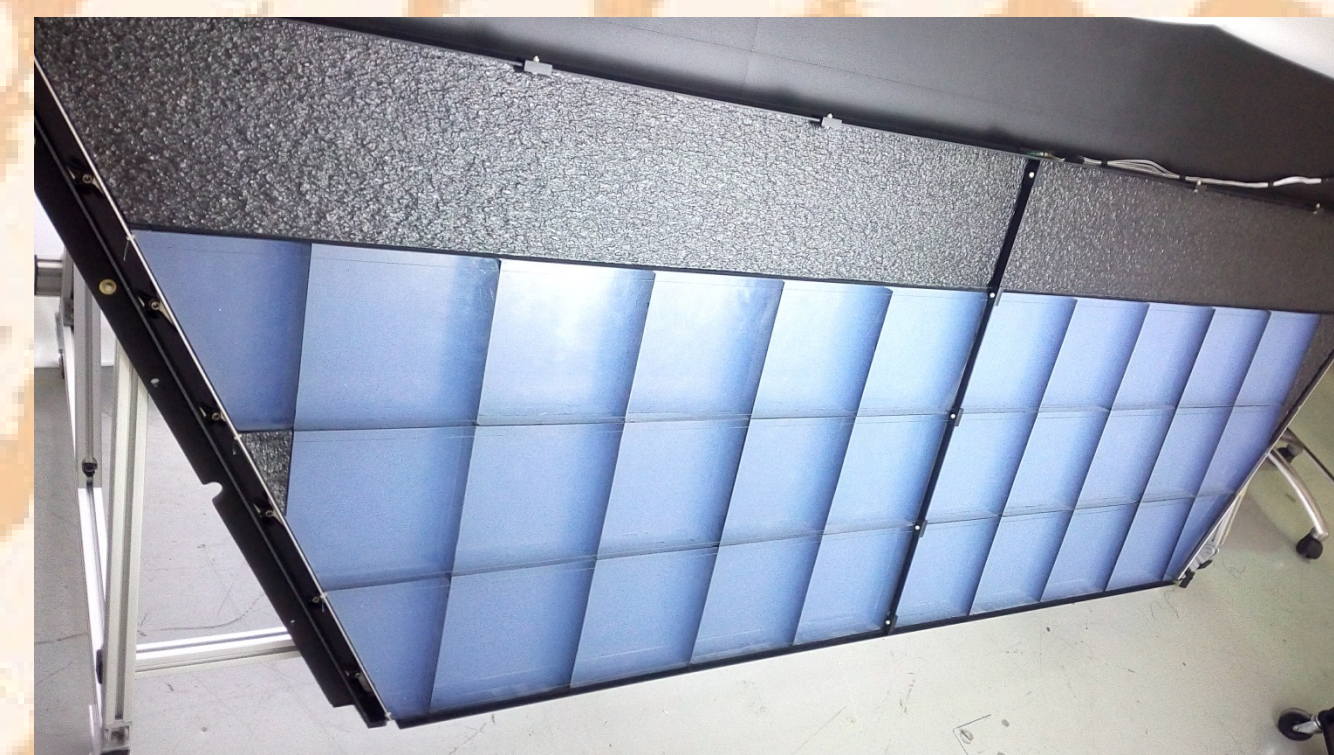
- Direct Cherenkov light detection

REFLECTED LIGHT

Larger angles 13°<θ<25° and momenta 3-6 GeV/c

- Focusing mirrors
- Double passage of photons through the thin aerogel

AEROGEL RADIATOR

Only option in the momentum range
- Large single brick area: 20cmx20cm
- Refractive index: n=1.05
- Emitted photons: visible & UV region

HAMAMATSU H12700 & H8500 MA-PMTs

First detector using Hamamatsu H12700

- Single photon sensitivity
- Pixel size: 5.8mm
- Packing fraction: 89%
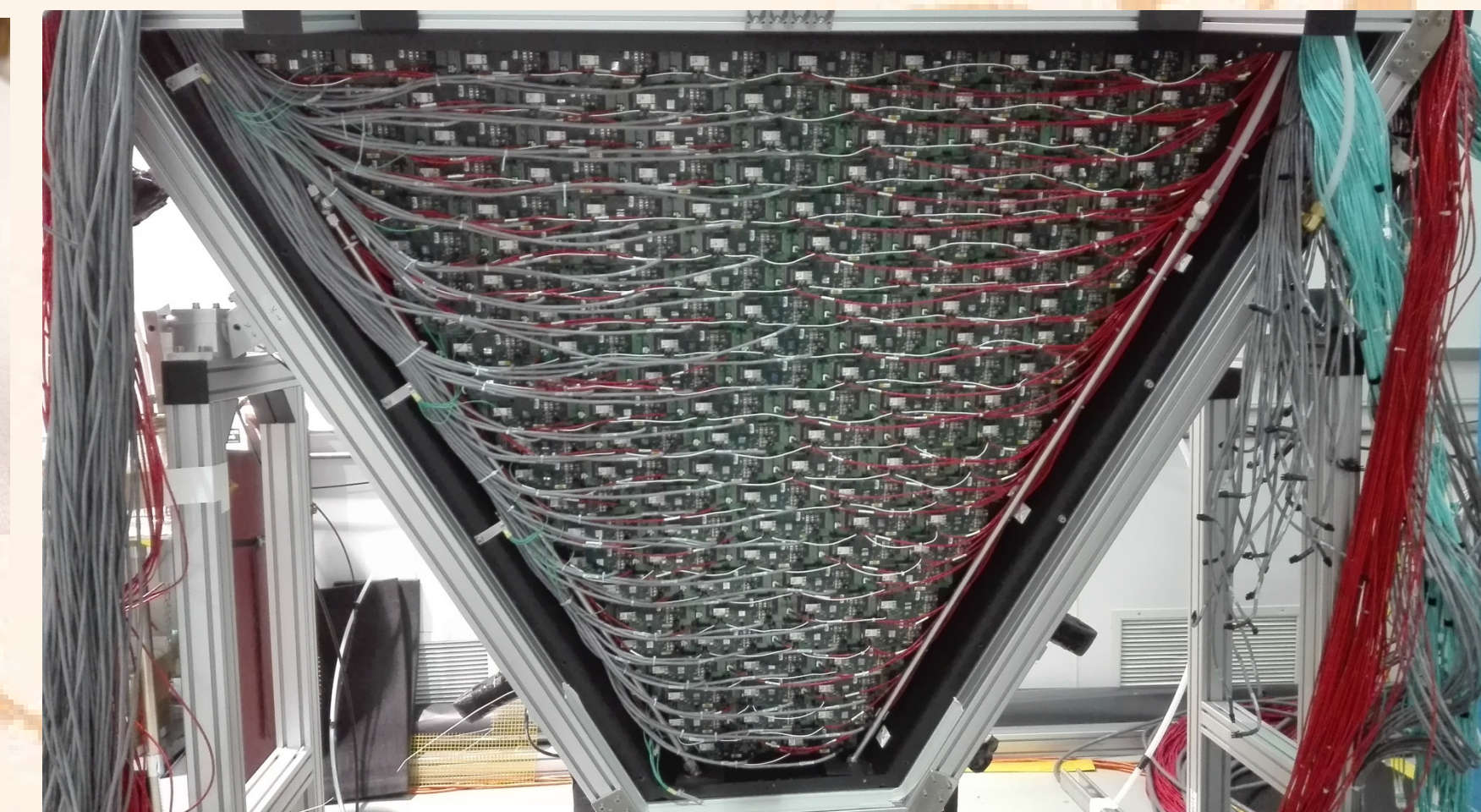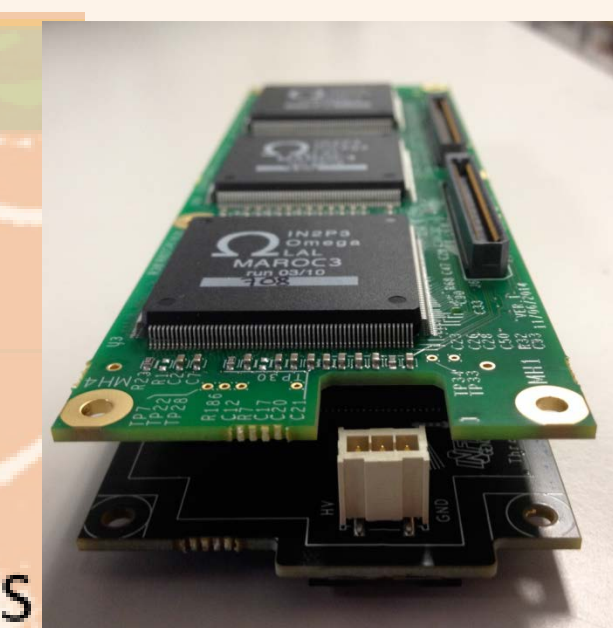- Maximum quantum efficency in visibile range.

FRONT-END ELECTRONICS

MAROC3 redout chip:
- 64 Channels
- Digital redout
- Single channel configurability

DAQ Electronics:
- FPGA serving group of G 2/3 MAROCS

A COMPLEX MIRRORS SYSTEM

Used to reduce the instrumented detection area
- 10 CFRP spherical mirrors (R=2.7m)
- 4 frontal planar mirrors
- 7 lateral planar mirrors

Project status

- the assembly of the first RICH module has been completed in November 2017
- the module has been installed in CLAS12 in January 2018
- the module is taking physics data since the beginning of the run group-A
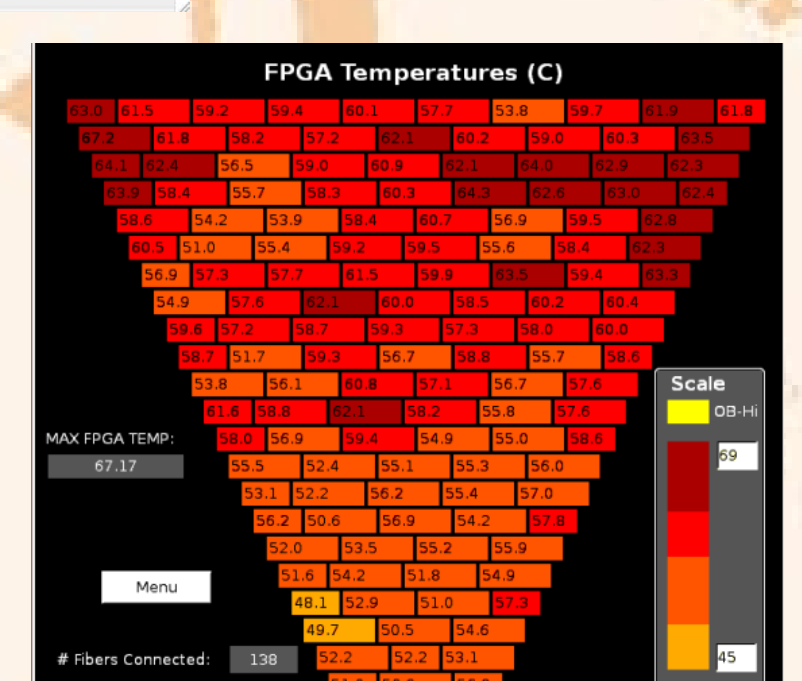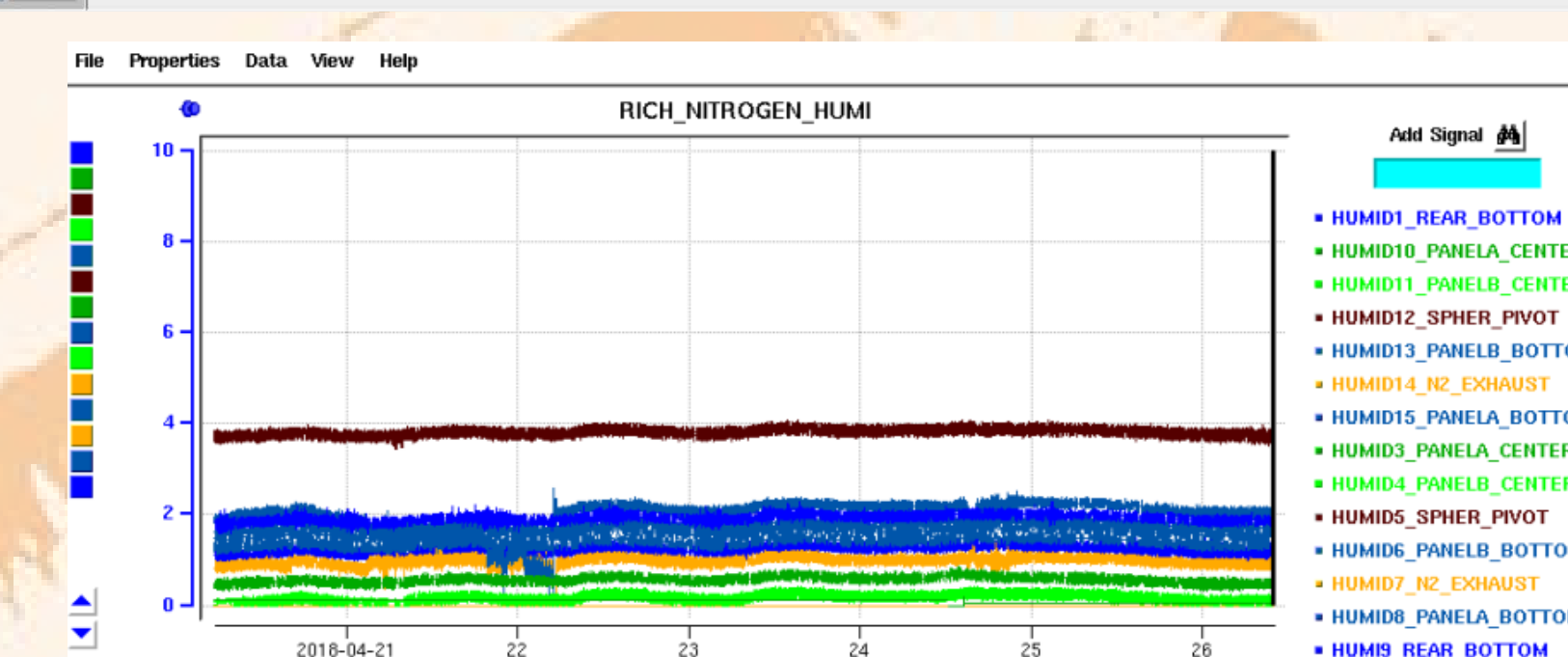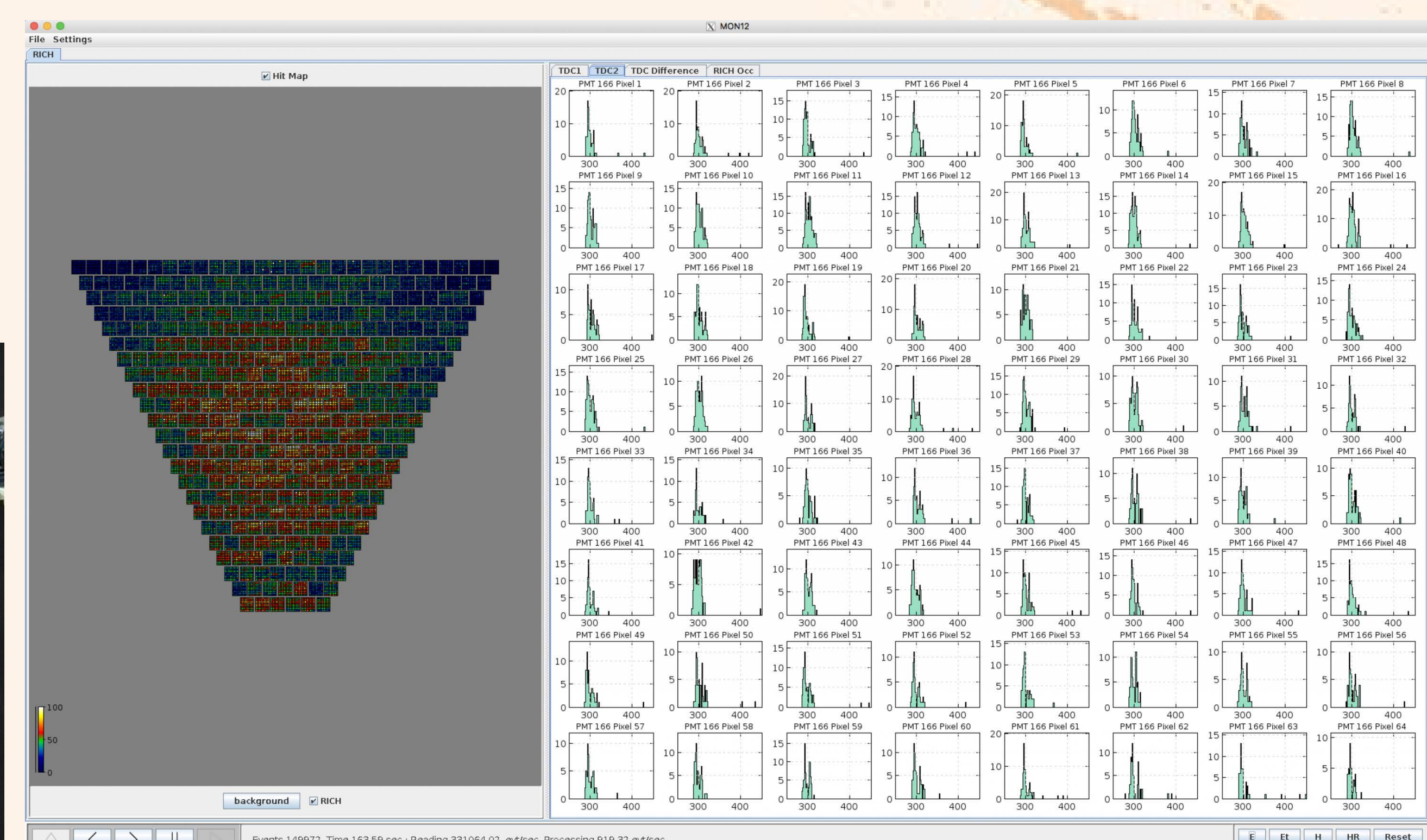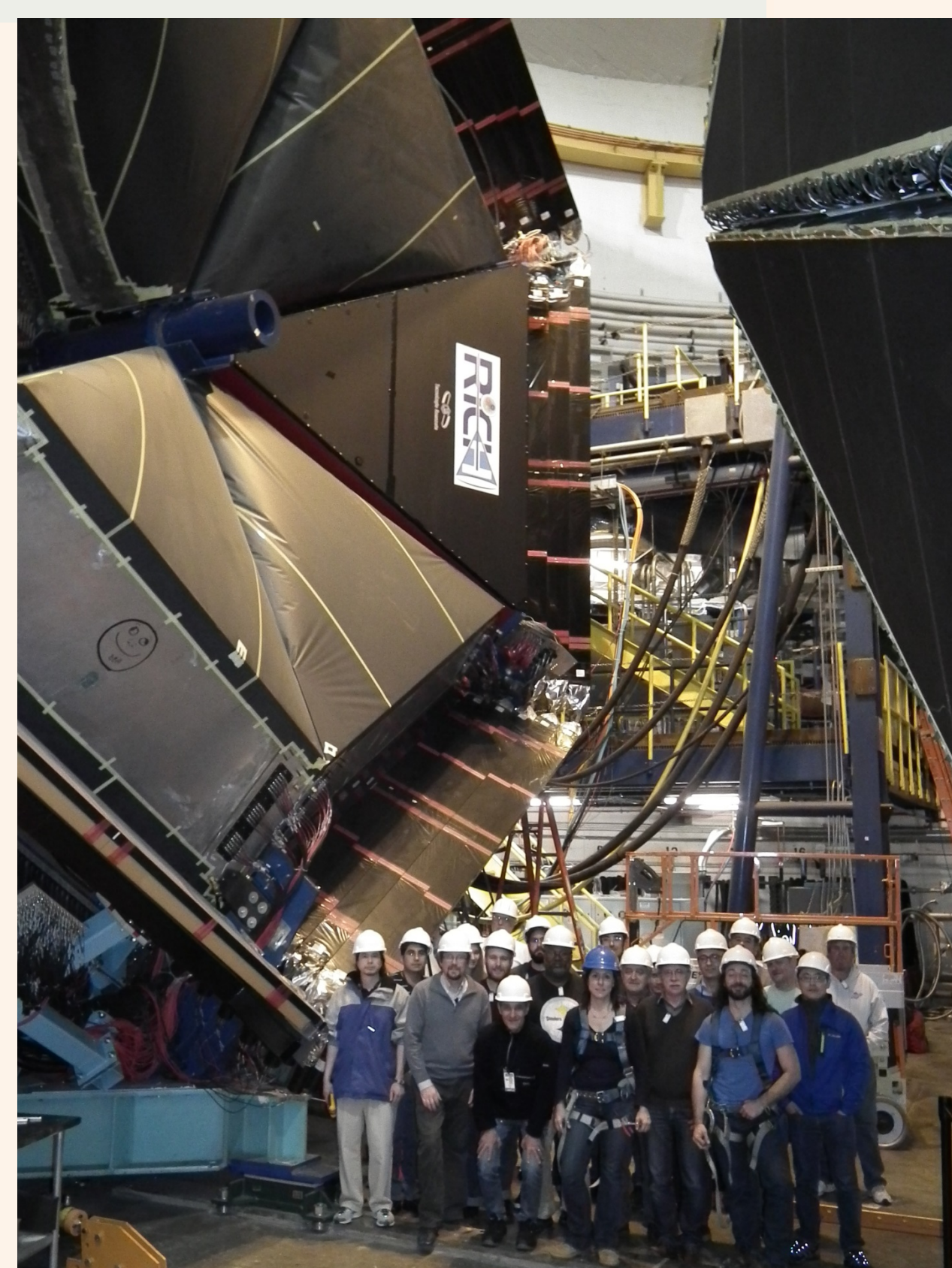
Italian Institutions at JLAB

INFN Bari, Uni & INFN Catania, Uni & INFN Ferrara, Uni & INFN Genova, INFN LNF, Uni & INFN Padova, Uni Roma Sapienza & INFN Roma, ISS & INFN Gruppo Collegato Sanità, Uni & INFN Roma Tor Vergata, Uni Sassari & INFN Cagliari, INFN Torino