Presentation of Pisa group

BULLKID-DM kick-off meeting

LNGS, 19-20 March 2024

Donato Nicolò

Università di Pisa & INFN

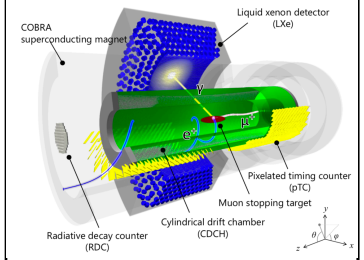
The group

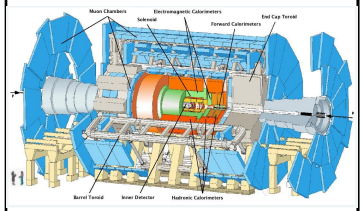
- Paolo Azzurri
- Paolo Dal Bo
- Mario De Lucia
- Eugenia Giorgi
- Gianluca Lamanna
- Tommaso Lari
- Donato Nicolò
- Federico Paolucci
- Elena Pedreschi
- Claudio Puglia
- Chiara Roda
- Stefano Roddaro
- Giovanni Signorelli
- Franco Spinella
- Andrea Tartari

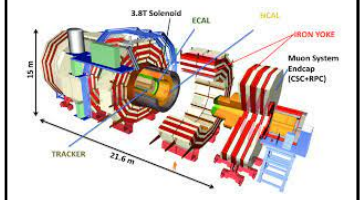
8 academic/research + 4 technology staff + 3 PhD students

Research interest and activity

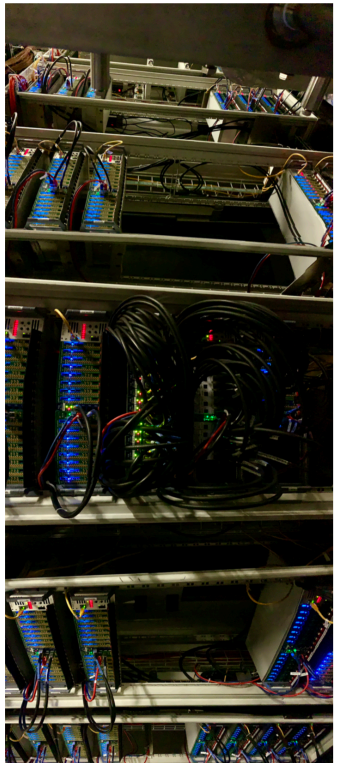
Detection techniques in high energy physics



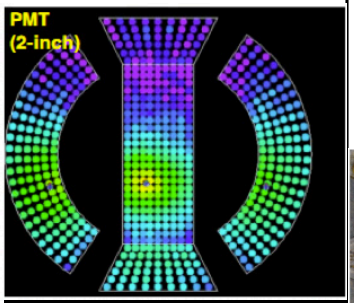


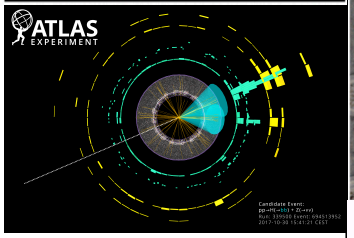


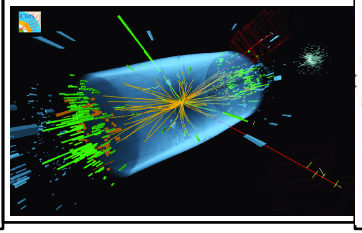
Trigger electronics and data acquisition



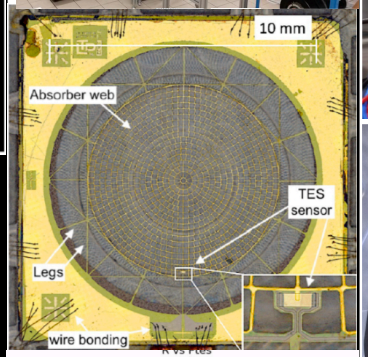
Detector simulation and event reconstruction

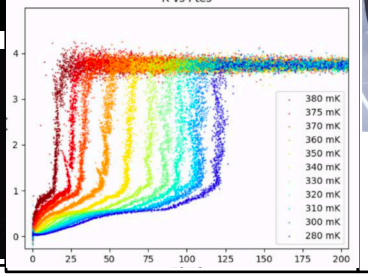




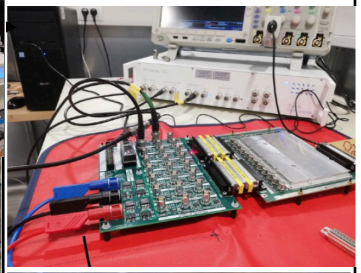


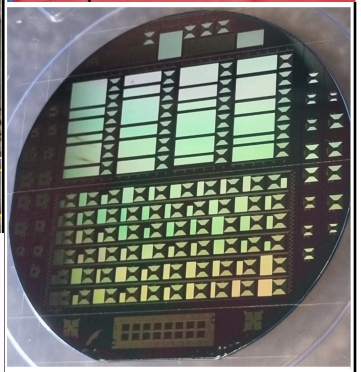
Cryogenics for Cosmology





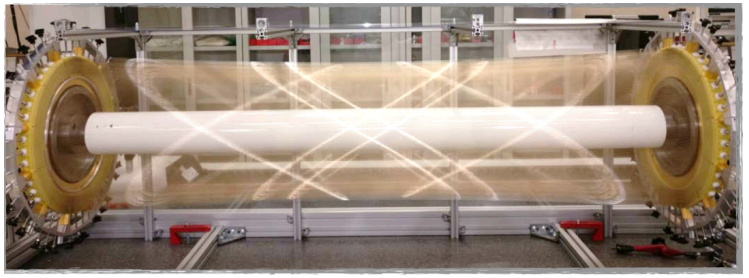
FDM readout electronics

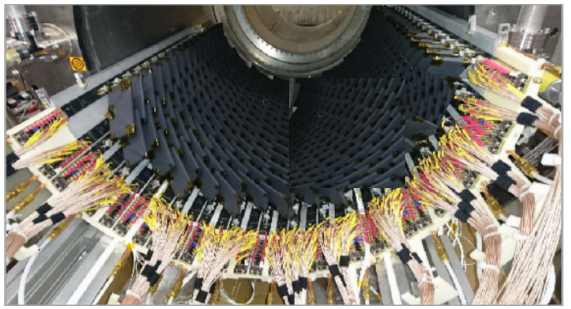


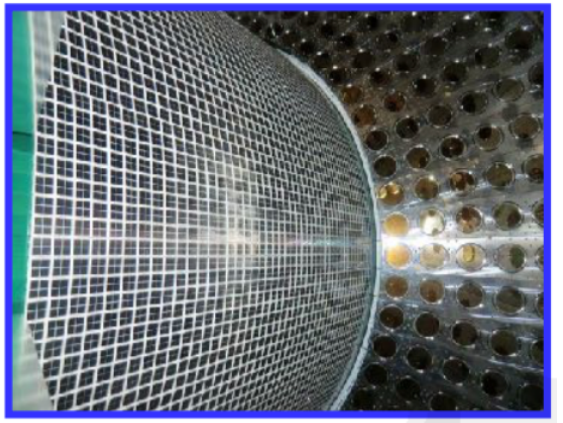


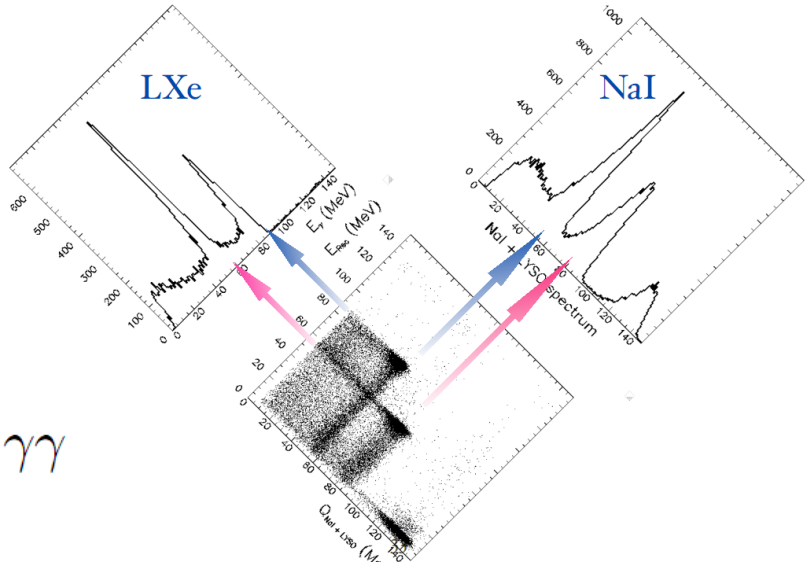
Detection techniques (1)

- Ionization/scintillation detectors
  - drift chambers → magnetic spectrometers
  - organic scintillators (liquid, plastic)
    → timing, time of flight, trigger
  - liquid noble gases (LXe, LAr)
    → VUV fluorescence for timing, calorimetry





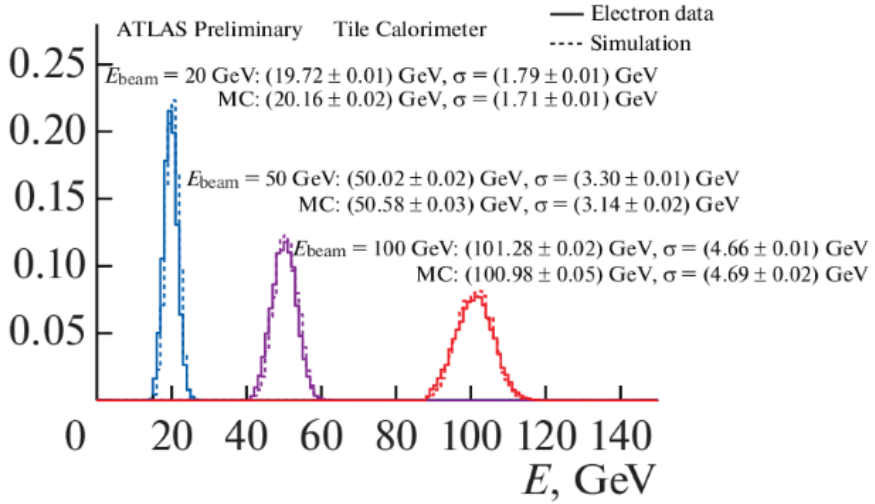


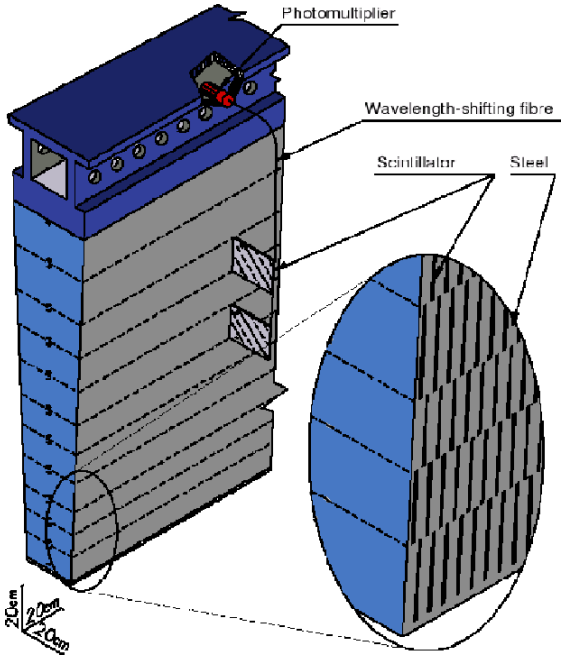


$$\pi^- p \rightarrow \pi^0 n$$
$$\pi^0 \rightarrow \gamma\gamma$$

Detection techniques (2)

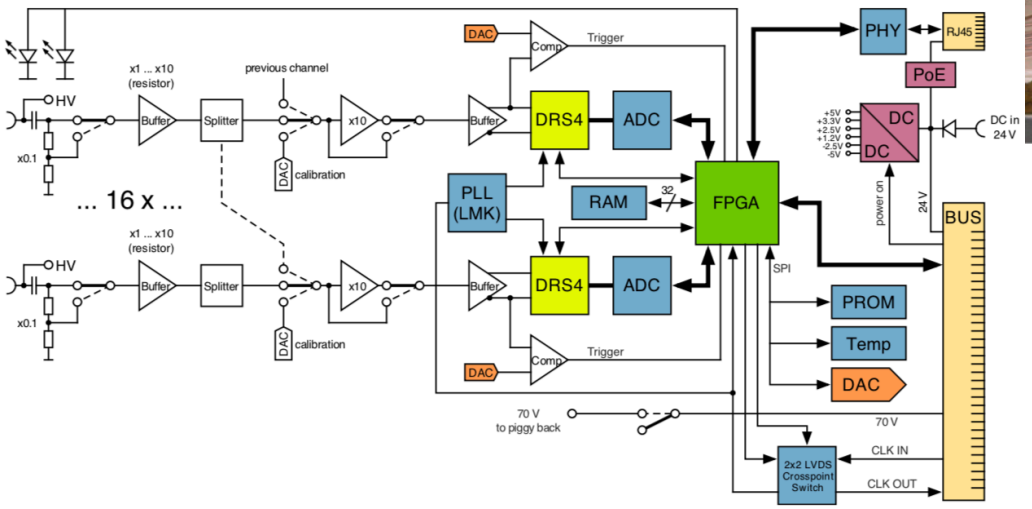
- Ionization/scintillation detectors
  - inorganic crystals (NaI, CsI, LYSO)
    → e.m. calorimetry
  - sandwich/ segmented calorimeters
    → e.m./hadronic calorimetry
    → clustering algorithms for shower sampling/compensation

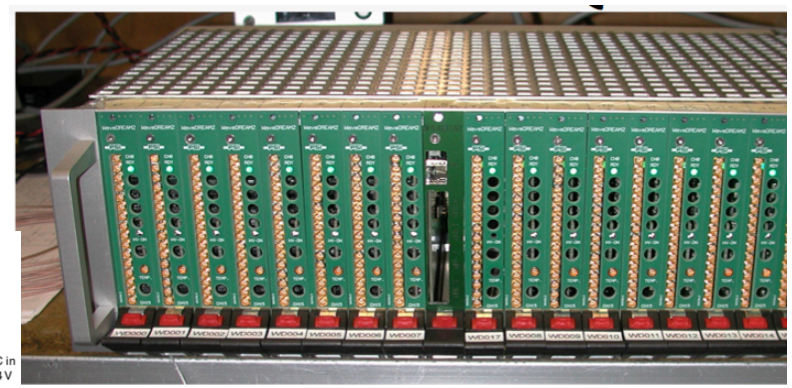




Trigger and DAQ electronics (1)

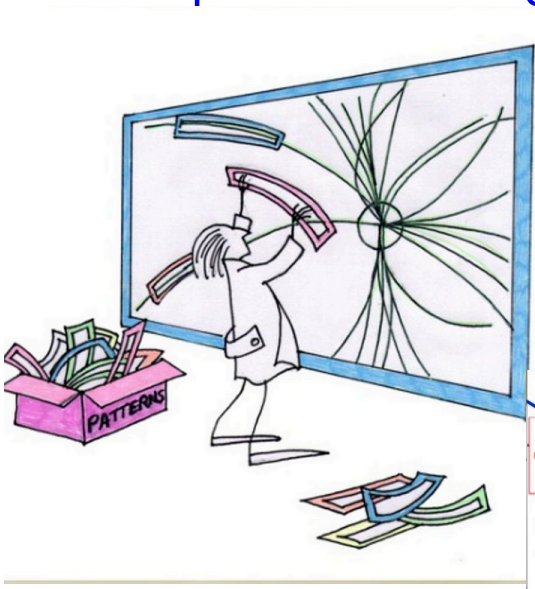
- Custom boards for fast event reconstruction (with DRS chip)
  - front-end high-band (> 500 MHz) for pile-up rejection
  - > 1 GS (programmable) sampling capability
  - FPGA (Kintex-7) reconstruction with ~500 ns latency

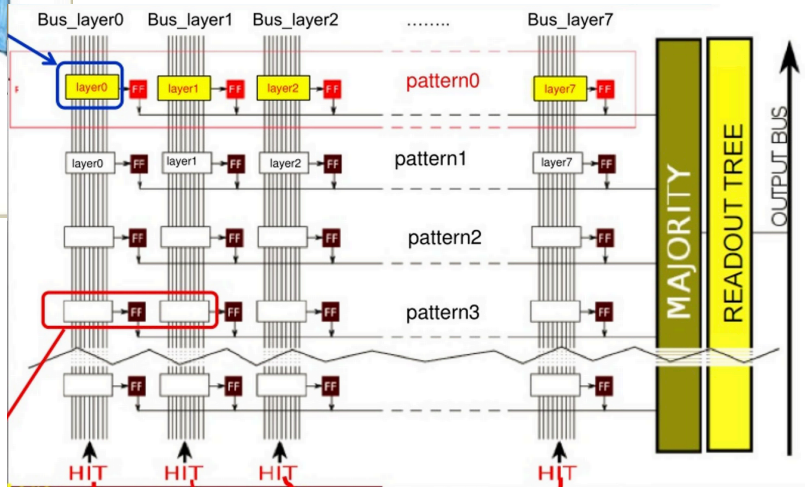


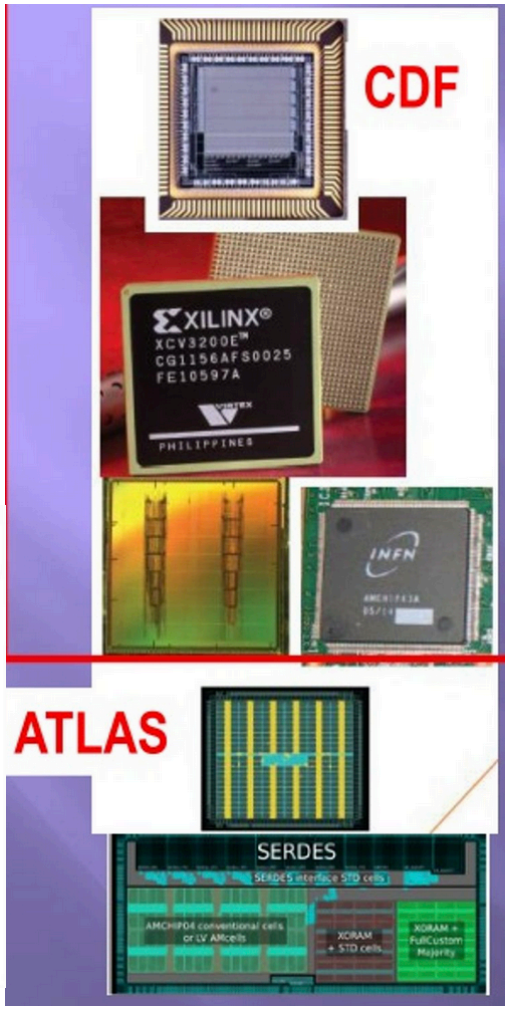


Trigger and DAQ electronics (2)

- Track fitting with associative memory chips
  - parallelized ASIC technology
  - pattern matching/recognition







Cryogenics+FDM

see G. Signorelli's talk