Detector-1 configuration quick overview

M. Casarsa[(a)], C. Giraldin[(b,c)], D. Lucchesi[(b,c)], L. Palombini[(b,c)], L. Sestini[(c)], D. Zuliani[(b,c)]

[(a)] *INFN-Trieste, Italy,* [(b)] *University of Padova, Italy,* [(c)] *INFN-Padova, Italy*

IMCC Detector and MDI Workshop
CERN, June 25-26, 2024

Co-funded by the European Union
G.A. No. 101094300 and 101004730

Goal

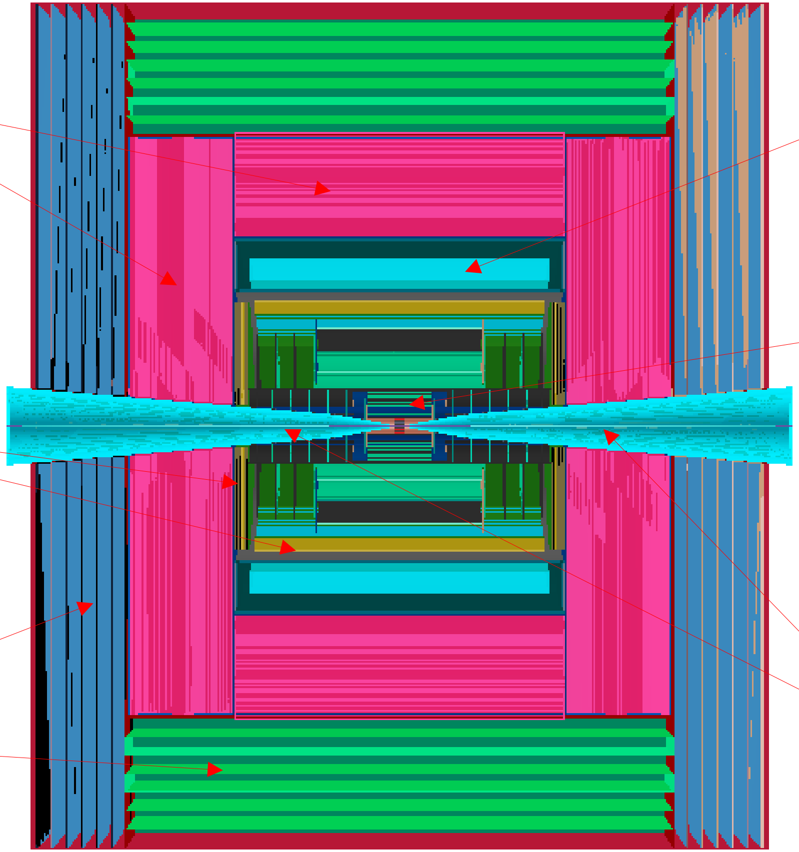
- We want to design a detector capable of reconstructing a broad range of event typologies with the highest efficiency and the highest precision:
  - low-energy physics processes (from standard model) with forward-boosted physics objects of hundreds of GeVs;
  - high-energy physics processes (possibly form new physics) with central physics objects of order of TeVs;
  - less conventional experimental signatures, like disappearing tracks, displaced leptons, displaced photons or jets ... ;

  within the constraints imposed by the background conditions and the machine design.

Current status

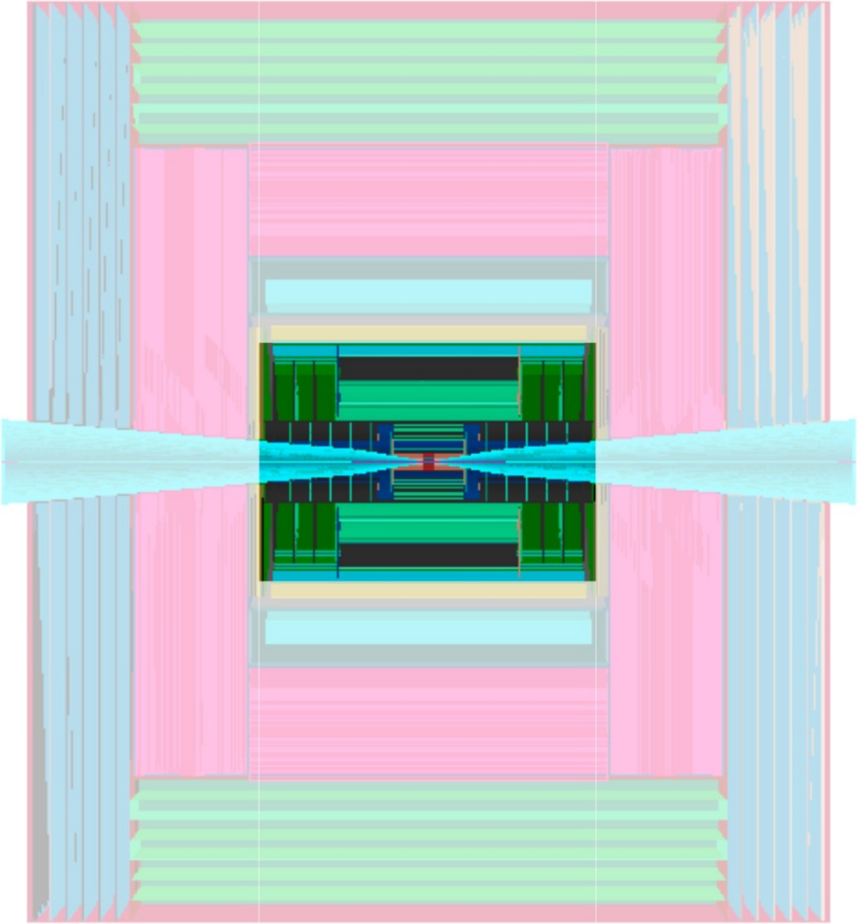
- The many lessons learned from the full simulation studies at 3 TeV are serving as a guideline for the design of the detector for collisions at 10 TeV. The 3 TeV detector represents the starting point.
- We have determined the global detector layout.
- There is a lot of work in progress to define the details and specifications of the various subdetectors.
- More details will be provided in this afternoon session.

Detector concept for $\sqrt{s}$ = 10 TeV



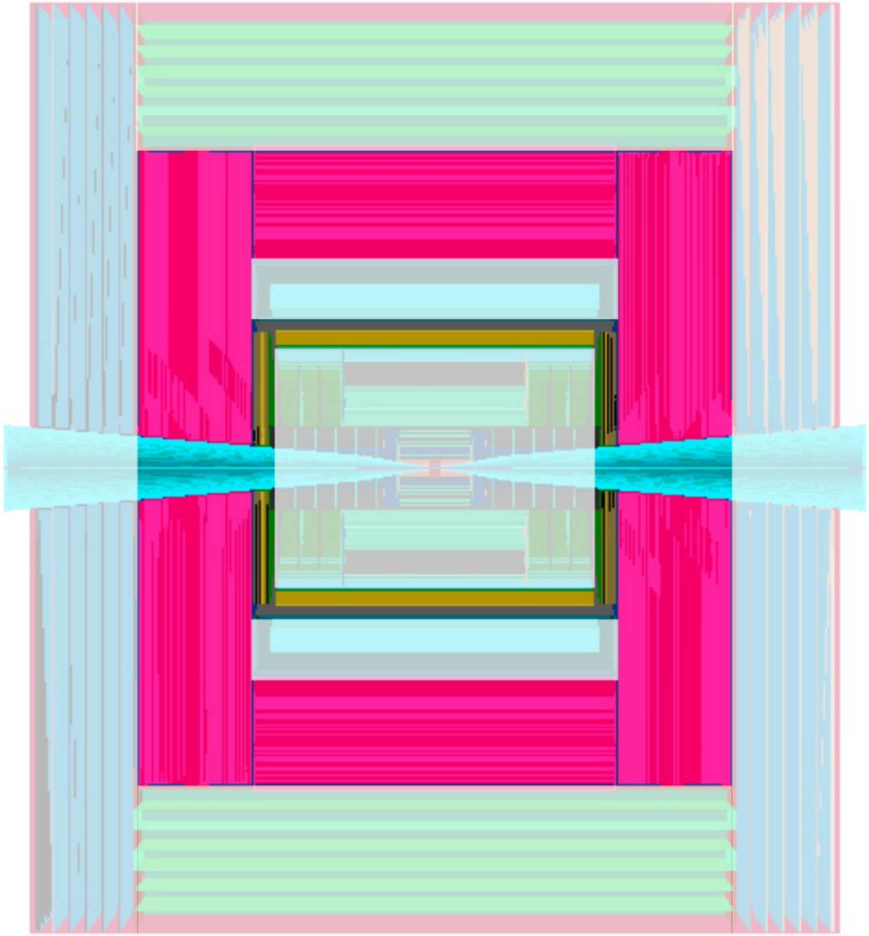
The MUSIC detector (Muon Smasher for Interesting Collisions).

Vertex detector and tracking system



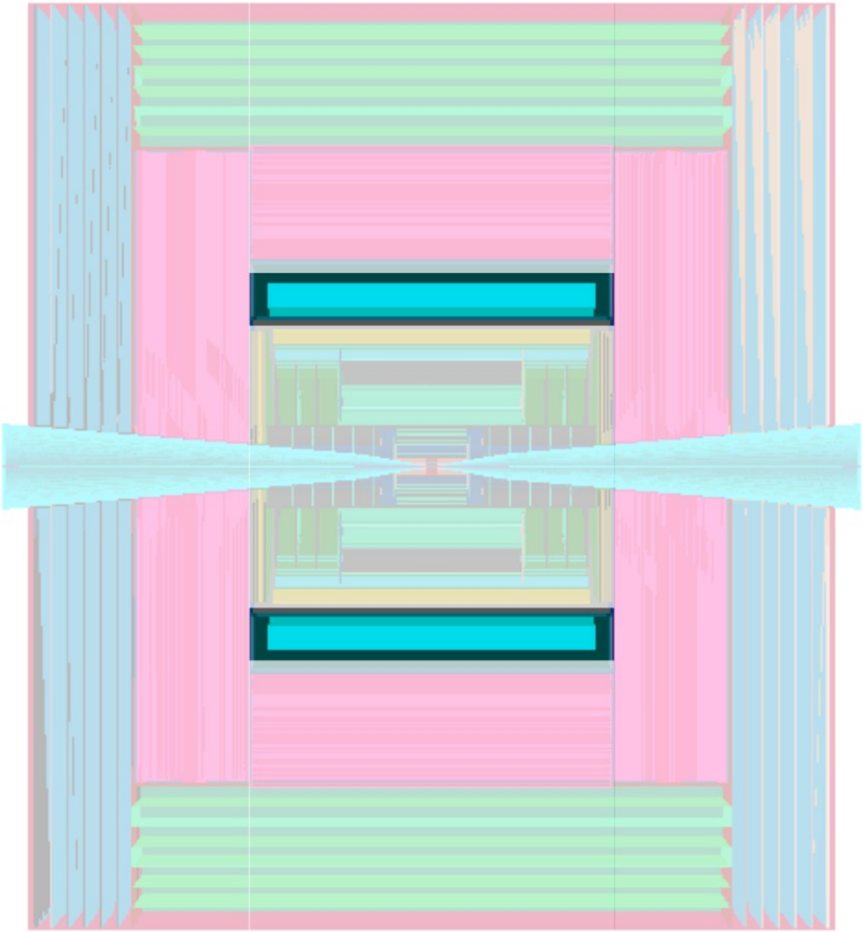
- Full silicon with high granularity and timing capabilities, more stringent requirements for the inner layers:
  - small pixels in the vertex detector;
  - macro-pixels in the inner and outer trackers.
- Layer geometry, position, and layout under optimization.

Calorimeters



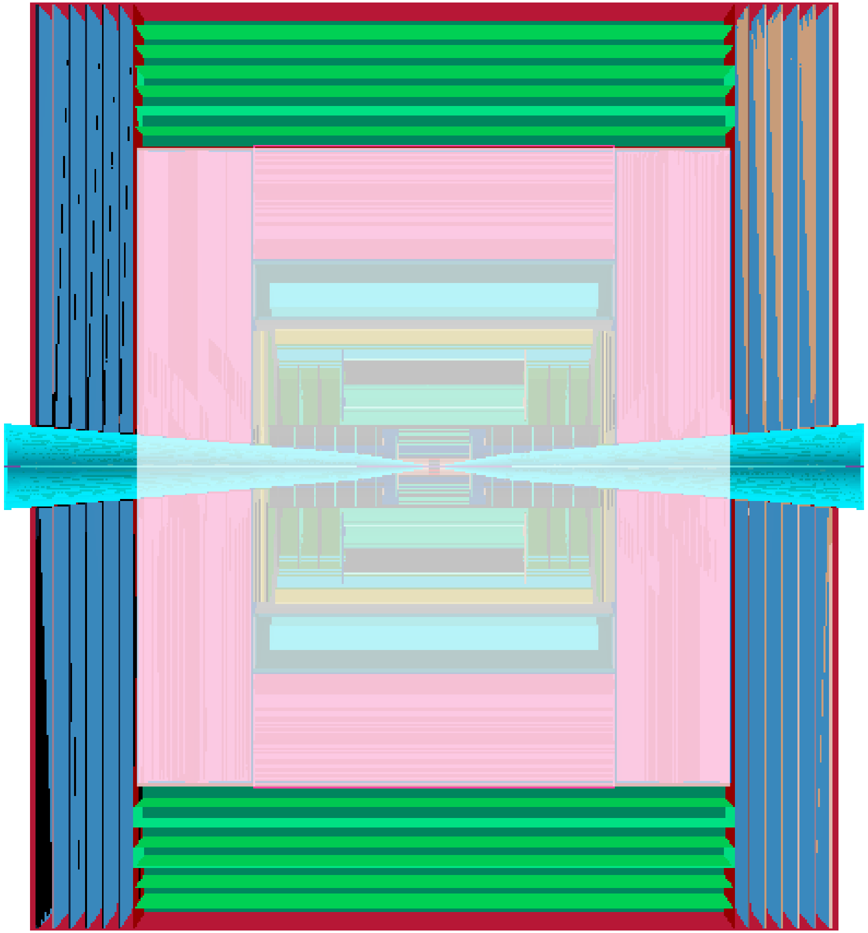
- HCAL;
  - moved outside the superconducting solenoid to allow more room inside the magnet bore for a larger tracker and a deeper ECAL;
  - for the time being, using 3 TeV configuration;
  - considering whether to use iron as an absorber for the B field flux return.
- ECAL:
  - inside the magnet bore to minimize material in front of it;
  - based on the CRILIN technology.

Superconducting solenoid



- Smaller radius compared to the 3 TeV detector, but also smaller length.
- Magnetic field value to be decided (4-5 T).

Muon detectors



- Muon chambers in the outer part.
- Using 3 TeV configuration for the time being.
- If HCAL absorber is used for the B flux return, the iron yoke may be removed.

Backup

Detector concept for √s = 3 TeV

hadronic calorimeter

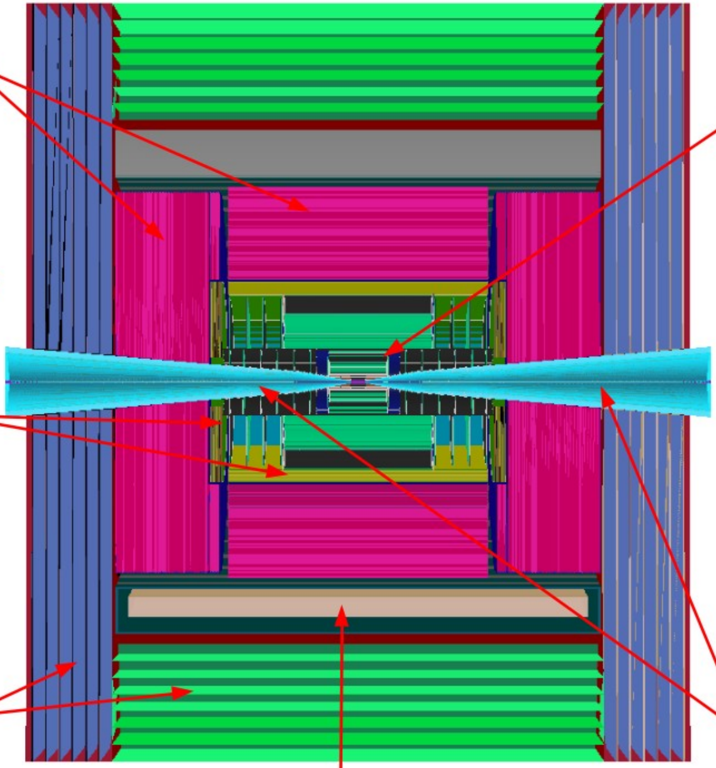
- 60 layers of 19-mm steel absorber + plastic scintillating tiles;
- 30x30 mm^2 cell size;
- 7.5 λ_I.

electromagnetic calorimeter

- 40 layers of 1.9-mm W absorber + silicon pad sensors;
- 5x5 mm^2 cell granularity;
- 22 X_0 + 1 λ_I.

muon detectors

- 7-barrel, 6-endcap RPC layers interleaved in the magnet's iron yoke;
- 30x30 mm^2 cell size.



superconducting solenoid (3.57T)

tracking system

- Vertex Detector:
  - double-sensor layers (4 barrel cylinders and 4+4 endcap disks);
  - 25x25 μm^2 pixel Si sensors.
- Inner Tracker:
  - 3 barrel layers and 7+7 endcap disks;
  - 50 μm x 1 mm macro-pixel Si sensors.
- Outer Tracker:
  - 3 barrel layers and 4+4 endcap disks;
  - 50 μm x 10 mm micro-strip Si sensors.

shielding nozzles

- Tungsten cones + borated polyethylene cladding.