Use the H1 SpaCal for LUXE BSM searches?

Hadronic and electromagnetic SpaCal in HERA-West hall (DESY's detector "museum")

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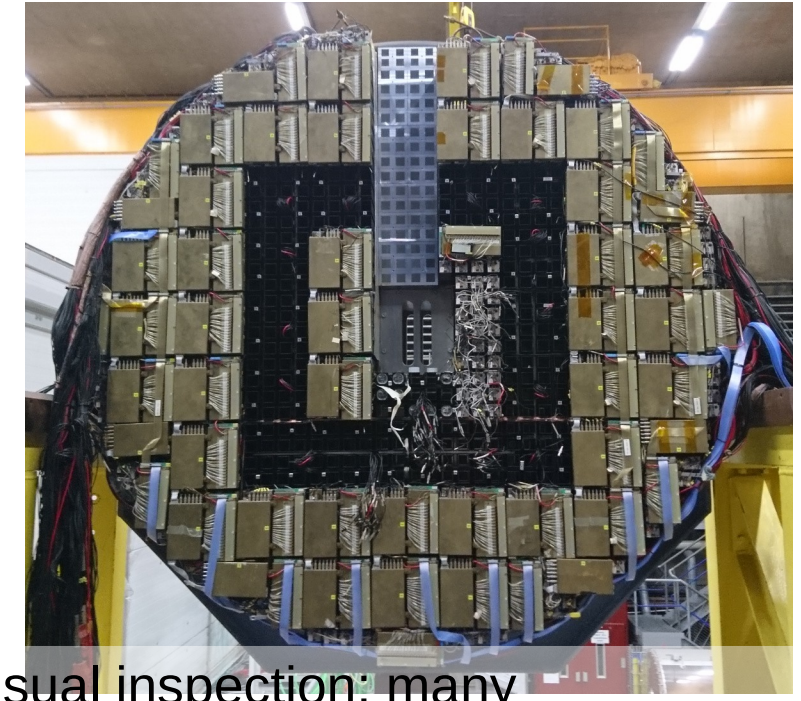
May 2022

The H1 electromagnetic SpaCal

- Spaghetti Calorimeter: scintillating fibres embedded in lead matrix
- Size of cells in (x,y): 4x4 cm
- Total size: 160cm diameter
- About 1600 cells total
- Energy resolution: 7.1%/sqrt(E)+1%
- Moliere Radius: 2.55 cm
- Spatial resolution of clusters:

  At E=5 GeV: σ_{xy}~4mm

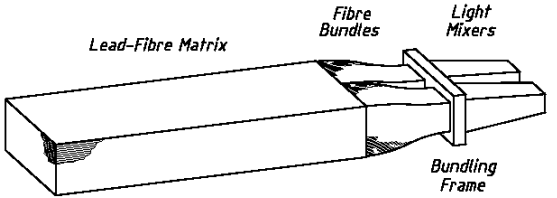


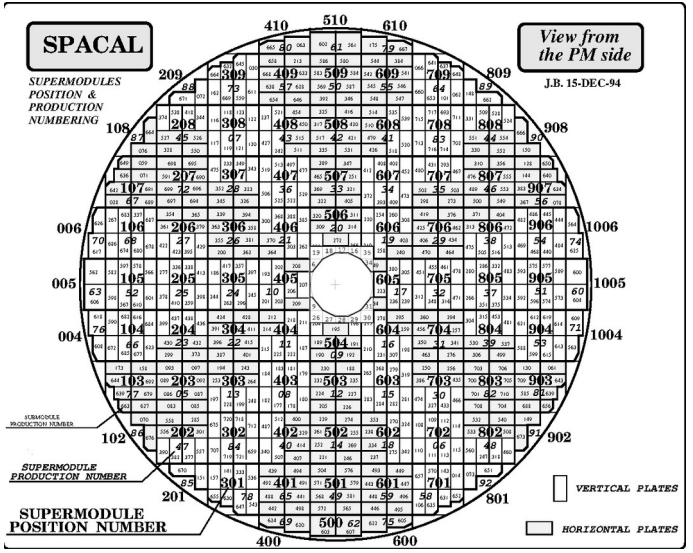
Visual inspection: many photomultipliers have been removed

The H1 electromagnetic SpaCal (2)

- Detector is made of supermodules (pair of 2 cells)
- Detector has a hole of ~20 cm diameter in the middle
- No longitudinal segmentation → difficult to get pointing without installing another detector
- Could try to use transverse shower shape

  → dedicated H1 data analysis could tell us how this performs

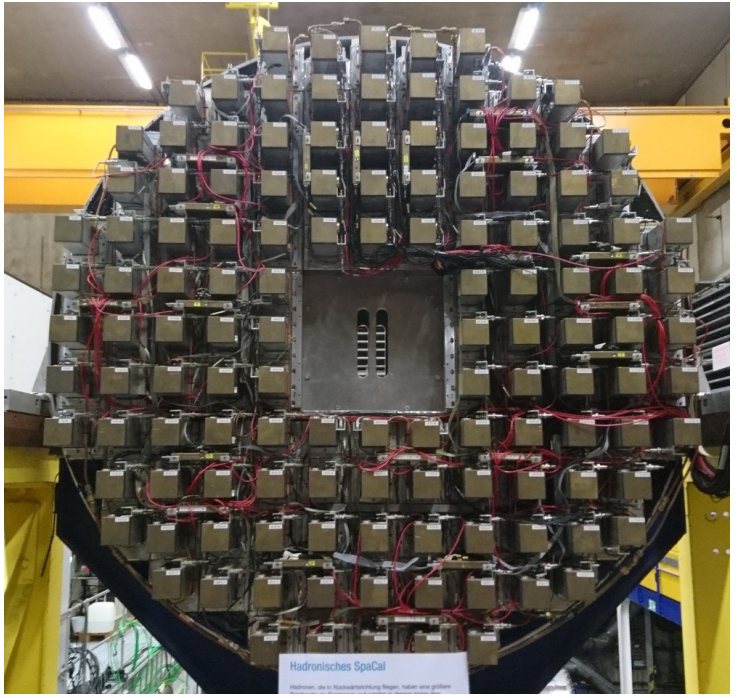




The H1 hadronic SpaCal

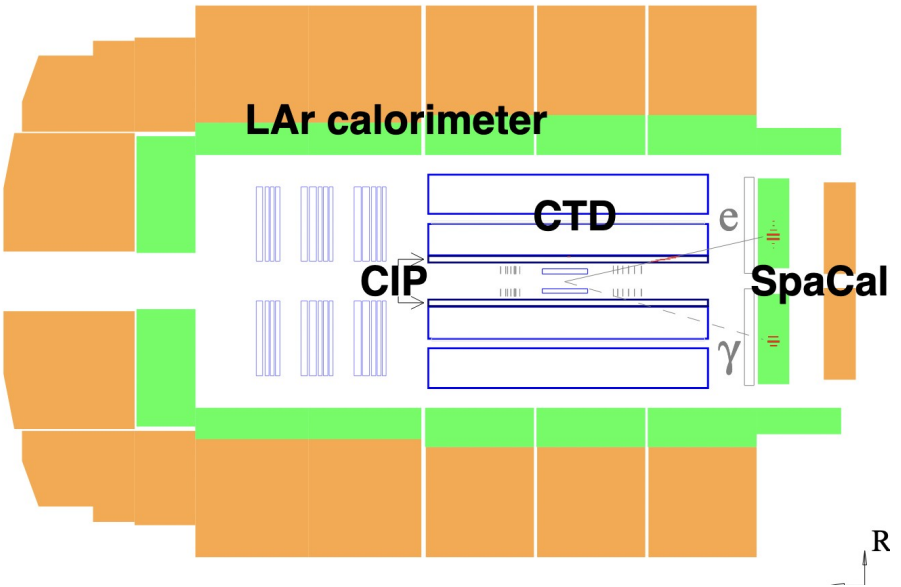
- Also in the West hall
- Similar technology as EM SpaCal, but much larger cells 12x12 cm
- Visual inspection: in better shape than EM SpaCal (no cells were opened)
- Large square hole in the center: 36x36 cm

Reason for large holes in center of EM and had calorimeter: for HERA-II luminosity upgrade, focussing magnets were installed around the beam pipe at the location of the SpaCal



H1 analysis of QED Compton events

- Used to get independent H1 luminosity measurement
- ep → eγp
- Both the electron and the photon are in the SpaCal, back to back
- Very similar topology to our BSM search for two photons
- Can use the electron (with tracker hits) to investigate correlations with photon shower shape



Existing QEDC paper: Eur.Phys.J.C72 (2012) 2163, erratum ibid. C74 (2014) 2733 [arXiv:1205.2448]

Summary

- H1 SpaCal (EM and had) are in the HERA West hall “museum”
- EM SpaCal: cells of size 4x4cm

  energy resolution 7%/sqrt(E), position resol. ~5mm
- Hole with diameter 20cm in the middle and only partially instrumented → need to be refurbished
- Main problem: no longitudinal segmentation → poor pointing capabilities
- Suggestions: use H1 data to quantify how well the vertex can be reconstructed from a dedicated transverse shower shape analysis
- Data sample: QED Compton: electron and photon back-to back in SpaCal