# EMCAL Simulations

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3rd March 2016

# EMCAL implementation

- Added simplistic implementation
  - Both in standalone example and under FCCSW
  - LAr/Lead calorimeter with simple “onion” geometry (absorber-active layers)
  - Very simplistic cryostat implemented (Aluminium slab)
  - FCCSW implementation via standard DD4Hep machinery, parameters to be set in FCChh_Ecal.xml
- Next
  - Improve description to allow simulating Si/W calorimeter (i.e. no cryostat etc.)
  - Work on sensitive detectors (mostly on FCCSW side)
  - Implement EndCaps

# Magnetic field

- First implementation of a Field tool
  - Both on standalone example and on FCCSW
- Constant 6 T field to start with
  - Good enough for calorimeter studies
- FCCSW implementation creating problems with Fast Simulation example
  - Under investigation, apparently a G4 bug/feature?
- Field map implementation as a next step
  - Tried Zbynek’s class to read in the field in the standalone example, some problems to be ironed out
  - Decide on a MagFieldSvc on the FCCSW side
- Optimization work needed to improve on G4 simulation performance

# Detector dimensions

- Dimensions of the barrel
  - Inner tracker: $0.04 < r < 2.5$ m
  - EMCAL: $2.6 < r < 3.5$ m
    - LAr technology: 10 cm for cryostat on both sides
      Calorimeter volume $2.7 < r < 3.4$ m (33 $X_0$, 1.6 $\lambda$)
      (Might be a bit optimistic)
  - HCAL: $3.6 < r < 6.0$ m
    - Tile technology: 18 cm for support
      Calorimeter volume $3.6 < r < 5.8$ m (10 $\lambda$)

# EMCAL studies

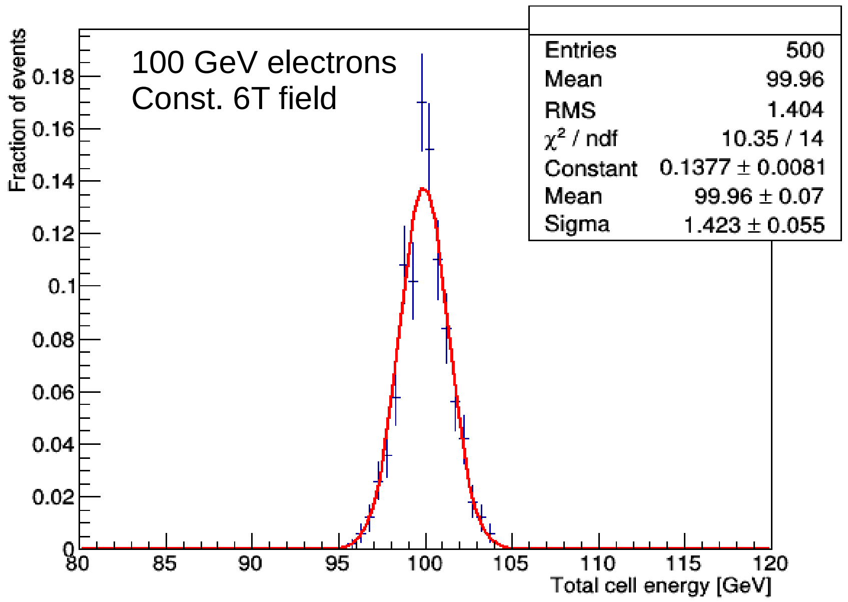
- Goal: Optimize the detector design for the FCC conditions
  - Study different materials (LAr/Lead, Si/W)
  - Optimal detector segmentation
- First tests with LAr/Lead detector in standalone example
  - Segmentation in radial direction: 5 mm absorber + 5 mm LAr
  - Constant magnetic field of 6 T
  - Simulations with beams of single particles at fixed angle ($\eta$=0.25)

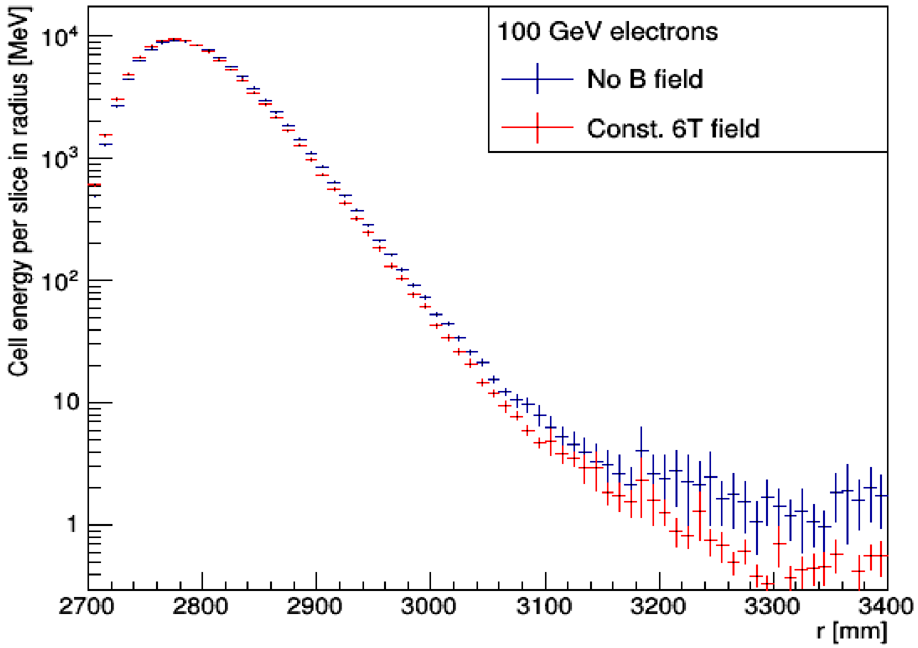
# Electrons in EMCAL

- 100 GeV electron beam
- Conversion factor from hit to cell energy

  no B field: 1/SF = 10.1

  with B field: 1/SF = 9.4

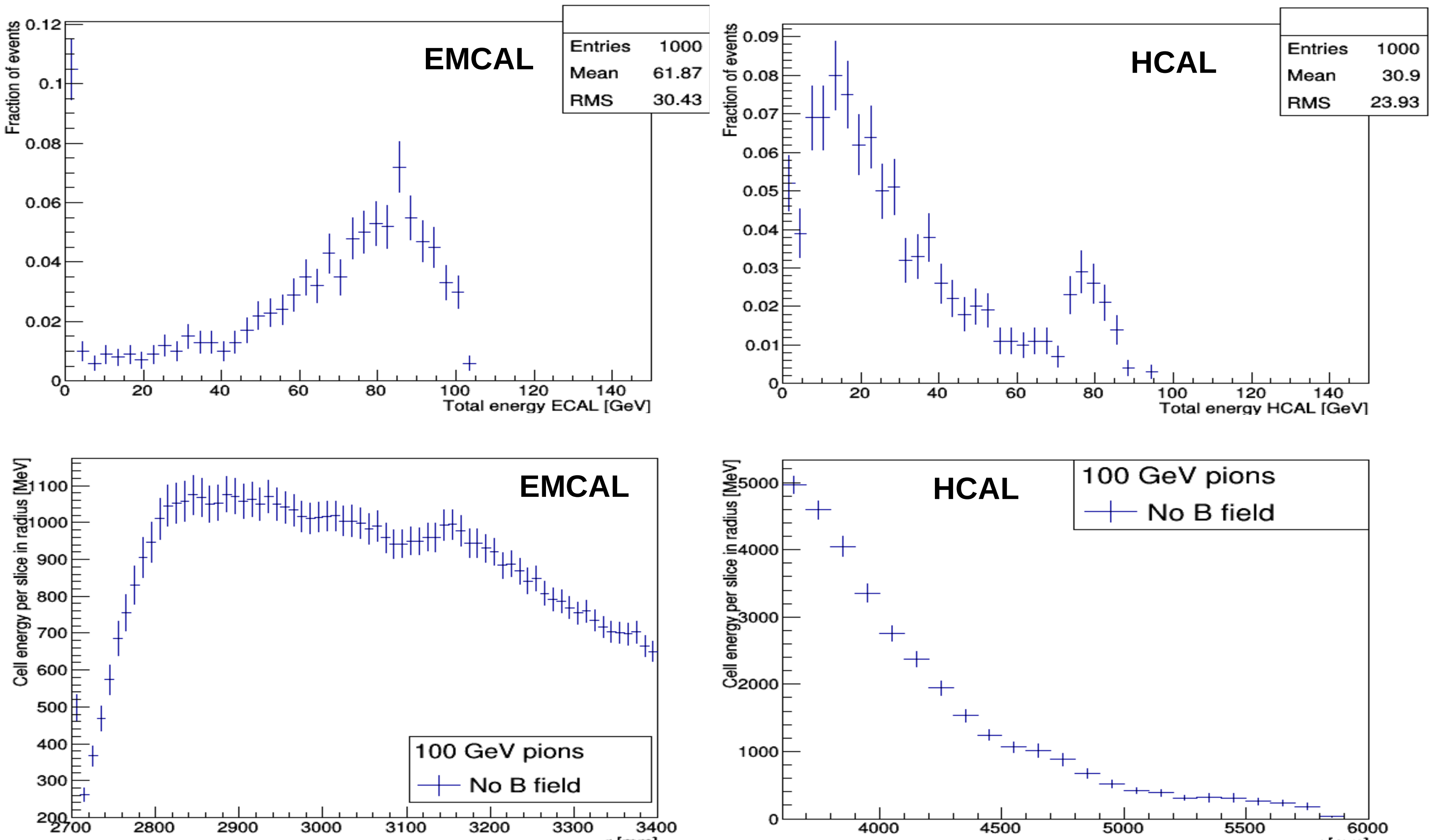



- Plans
  - Calibration hits for more detailed studies
  - Simulations at different energies

# Pion shower

- 100 GeV pions in the EMCAL+HCAL
  - Without magnetic field
- Cell energy at the EMSCALE

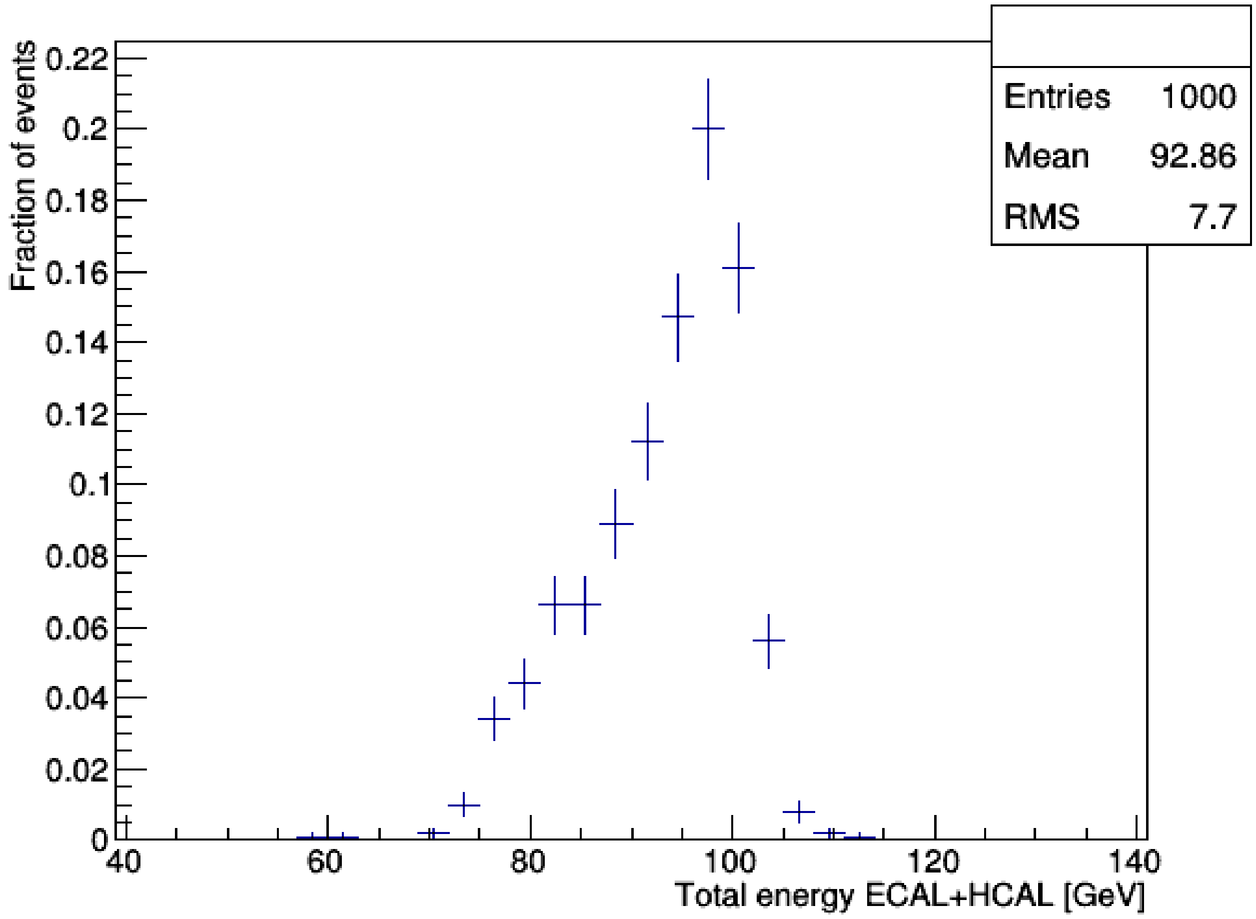


# Conclusions

- First implementation of the EMCAL geometry
  - Tested with beams of single particles
- More to come
  - Endcaps geometry
  - Detailed B field map
  - Implementations in FCCSW (e.g. sensitive detector, calibration hits)
  - Energy resolution studies

# Backup

# Pions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Mean 92.86
RMS 7.7
Fraction of events
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
40
60
80
100
120
140
Total energy ECAL+HCAL [GeV]