Laboratoire d'Annecy-le-Vieux
de Physique des Particules

Impact of the various HCAL mechanical design on its physics performance (first look)

Jan BLAHA

Micromegas Physics Meeting, 23 March 2010, LAPP

In2p

Objective

Find the optimal mechanical design for HCAL which takes into account engineering as well as physics aspects

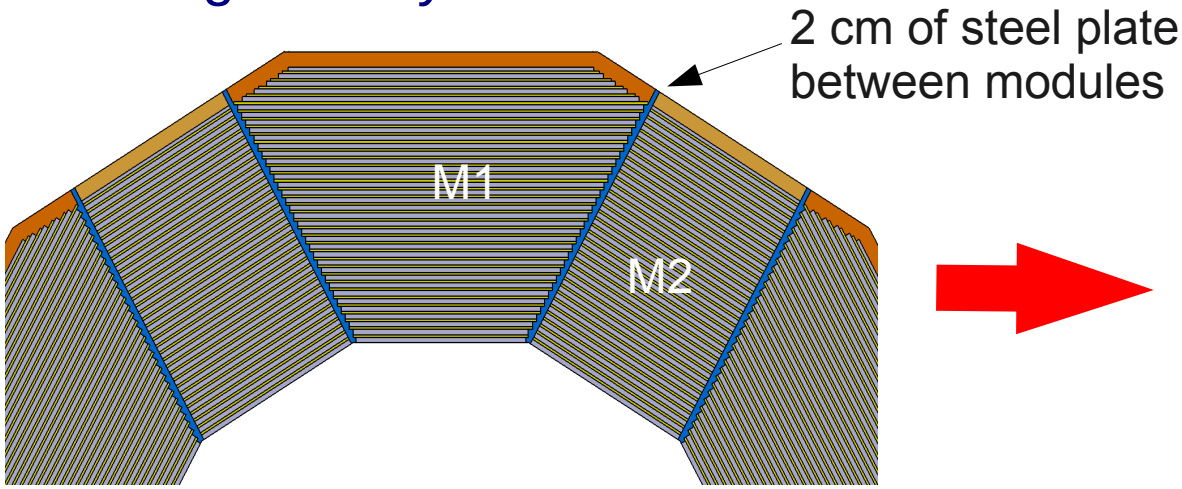
Evaluate the impact of various HCAL mechanical design on its physics performance

Study is focused on hadronic showers behavior close to the boundary between two HCAL modules for

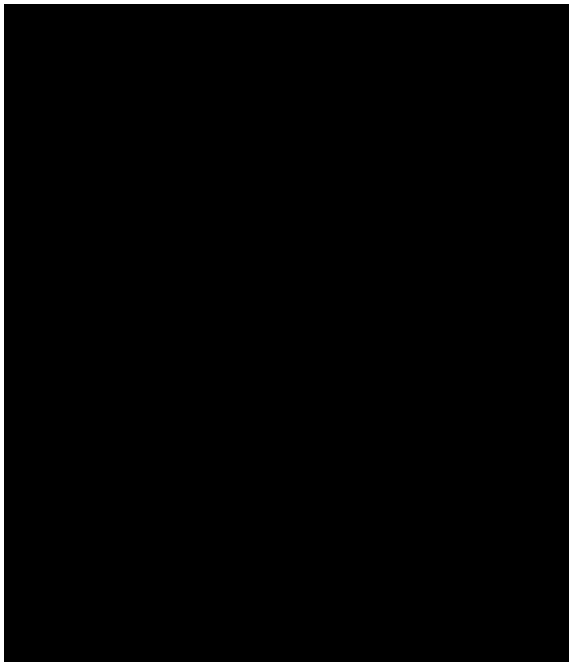
- projective and non-projective geometry
- with and without supporting plate

Considered geometries

SiD LoI geometry



2 HCAL Modules



Geometries:

- sid2Modules_FeAbs_NoFeP (ref. geometry without supp. plate)
- sid2Modules_FeAbs_1cmFeP (1cm supporting plate)
- sid2Modules_FeAbs_2cmFeP (2cm supporting plate)
- sid2Modules_FeAbs_2cmFeP_WE - (2cm supporting plate and ECAL)

N.B. Detectors have double SiD depth (80 layers). Analysis has been performed for both 40 and 80 layers detectors

Considered geometries

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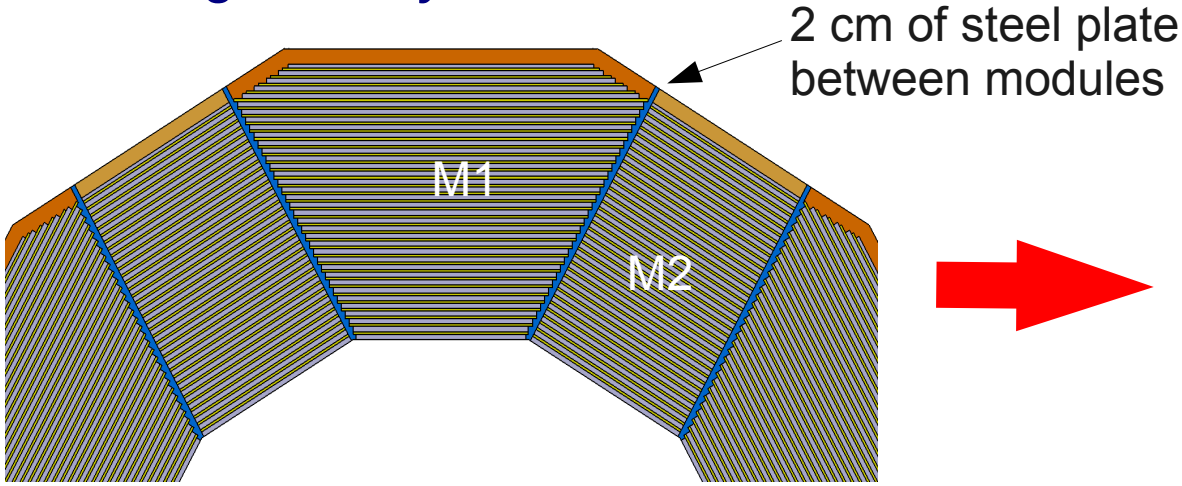

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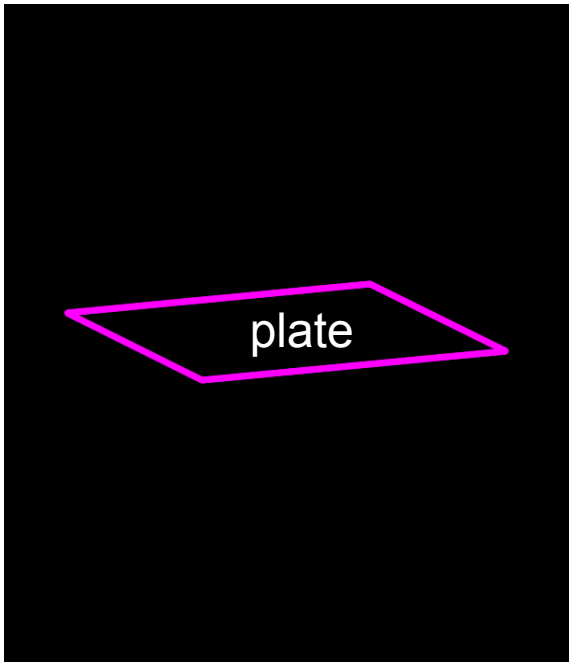

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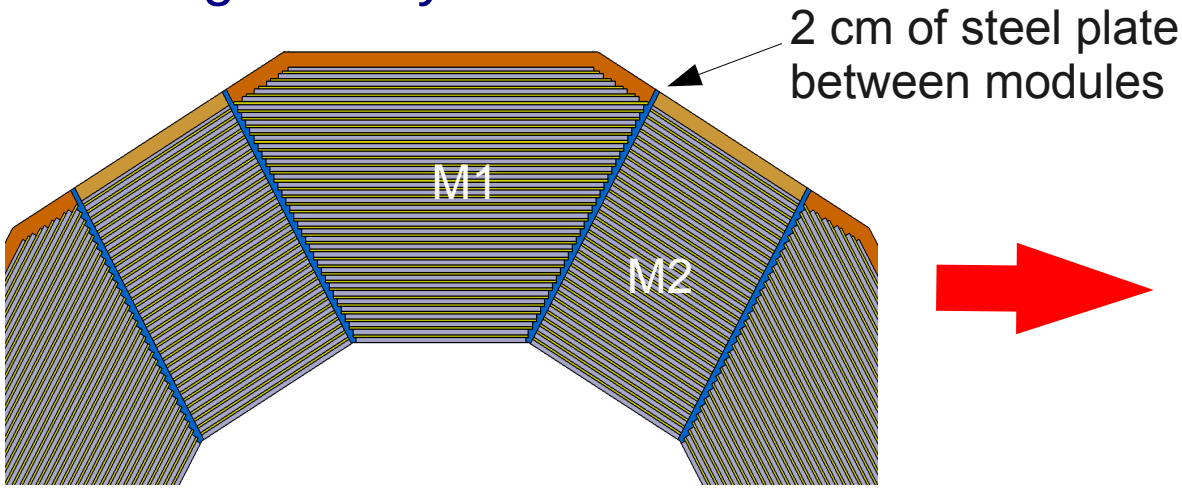

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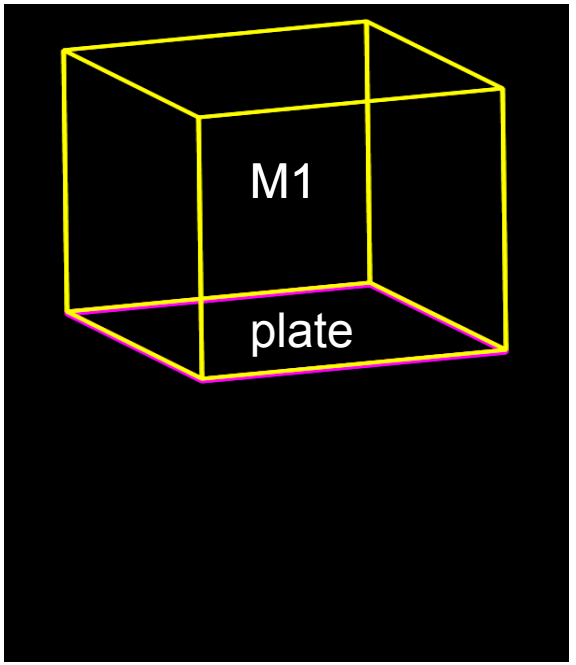

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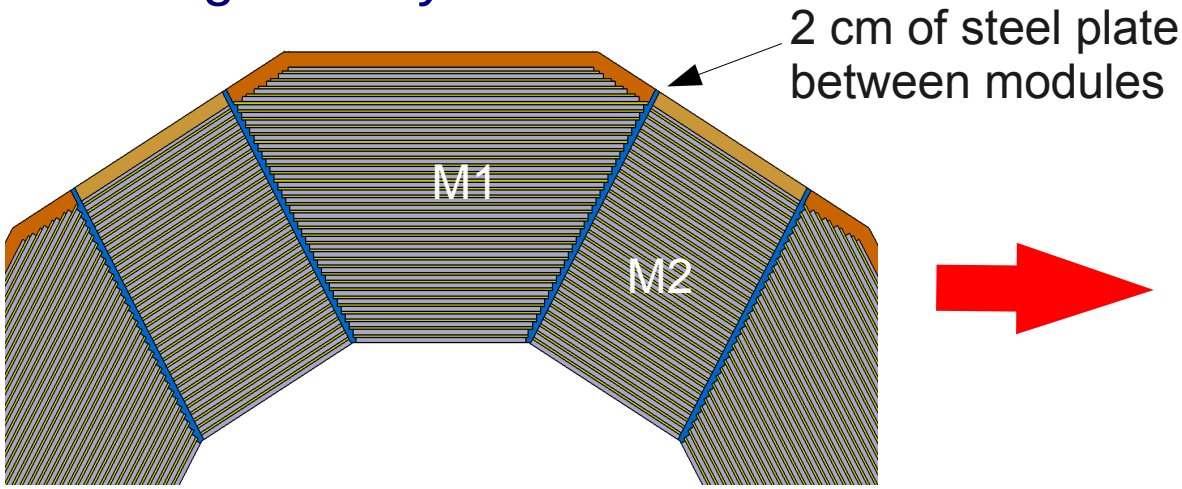

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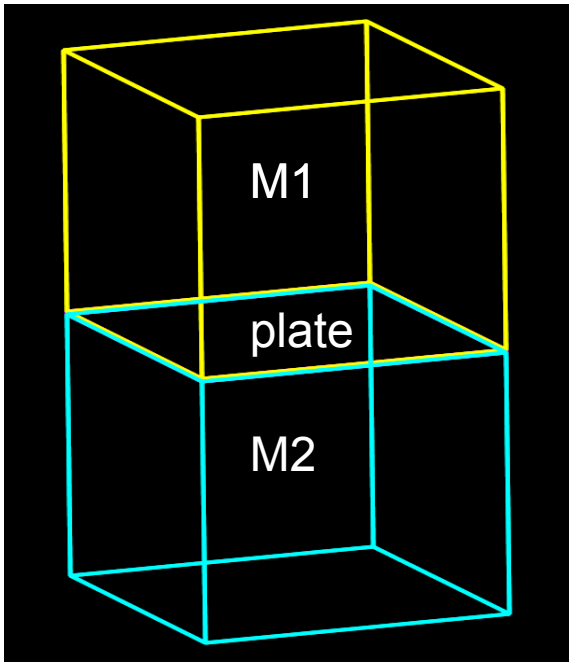

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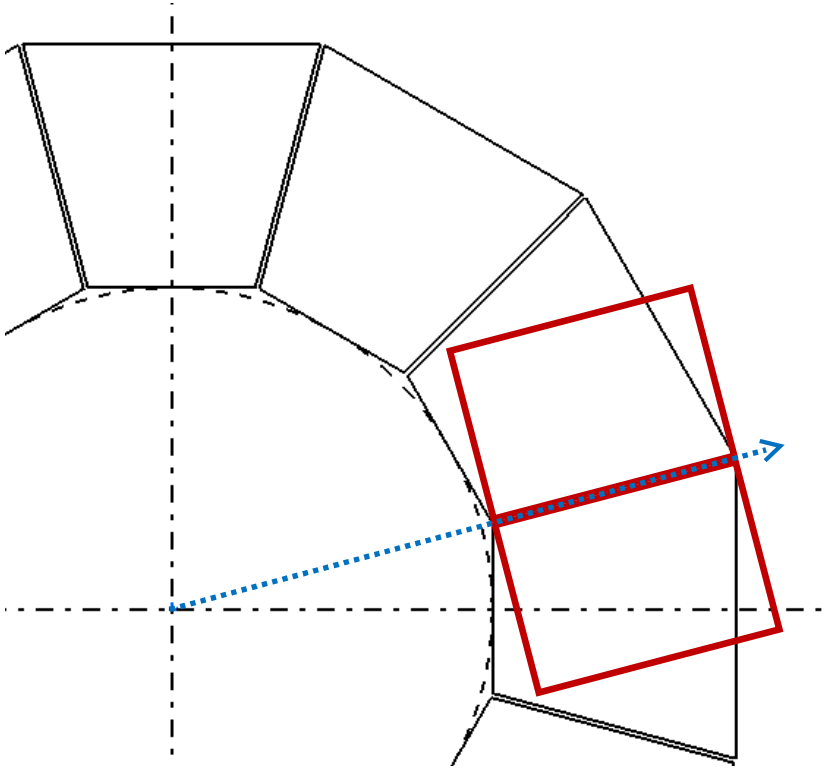
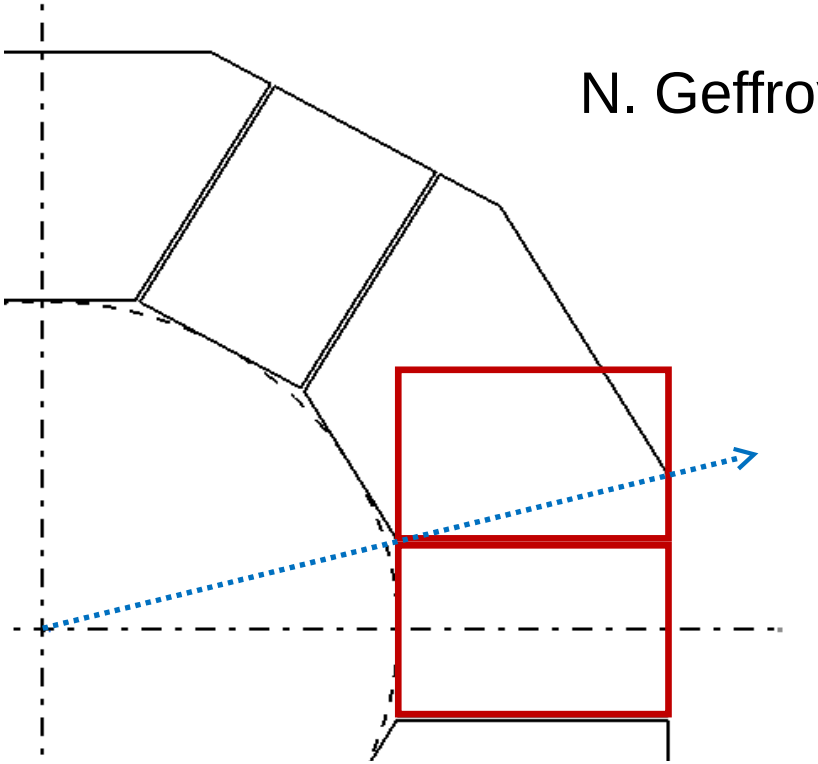
Projective and non-projective geometry

Projective geometry



Non-projective geometry



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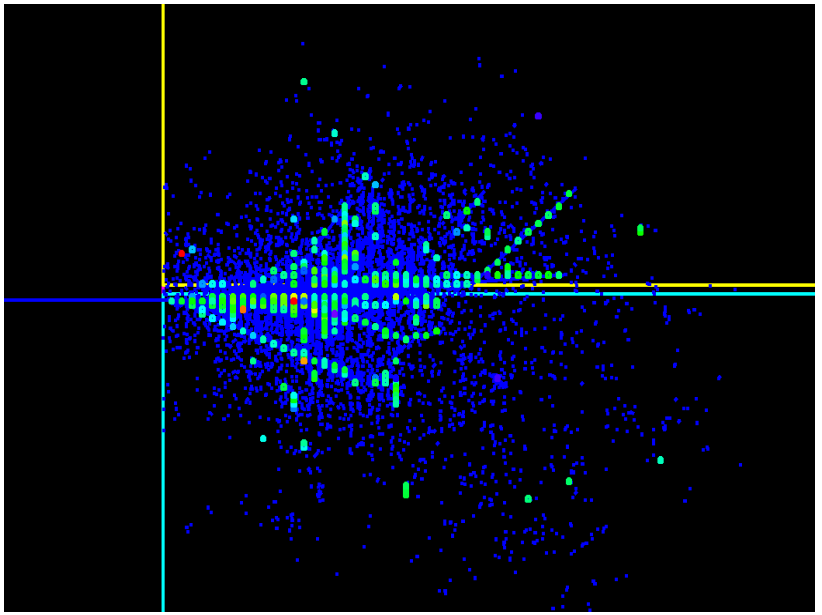
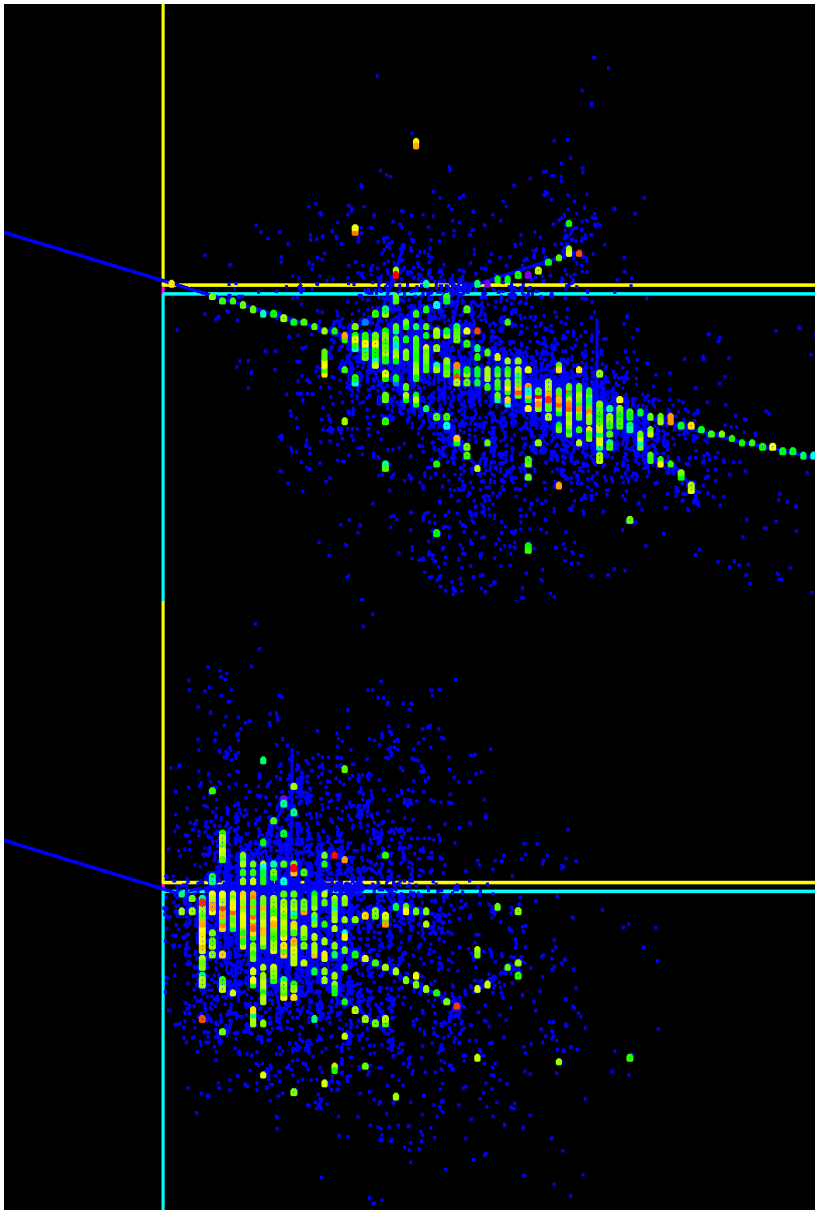
- HCAL SiD baseline geometries:
  - Projective geometry – 12 identical calorimeter modules
  - Non-projective geometry – 6 reqtangular and 6 trapezodial modules
- Two rectangular modules are considered as a good approximation for simulation study

Typical events for 50 GeV pions

Projective geometry



Non-projective geometry



- Particles directed as from the vertex
- Impact area restricted to 5 cm diameter around the boundary at front of the detector
- For each configuration, data have been generated for pion energies between 3 to 200 GeV

Typical events for 50 GeV pions

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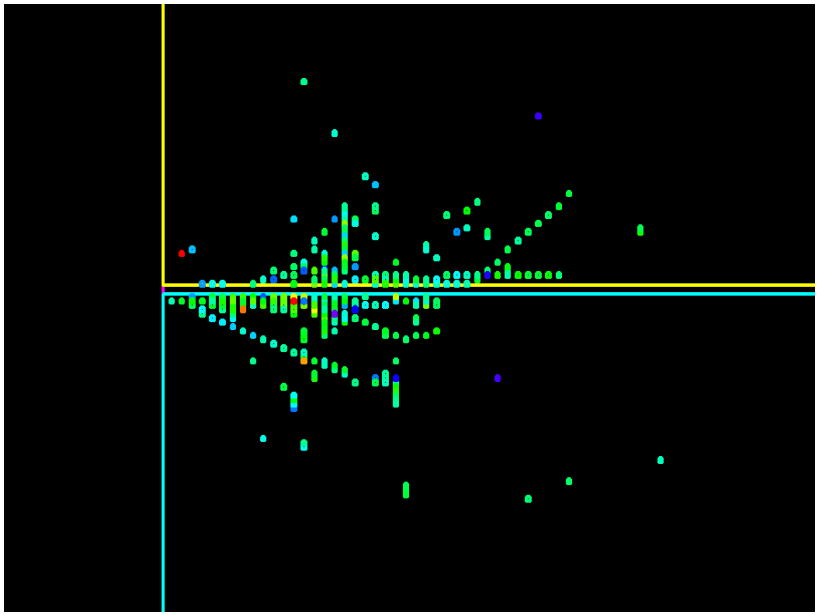
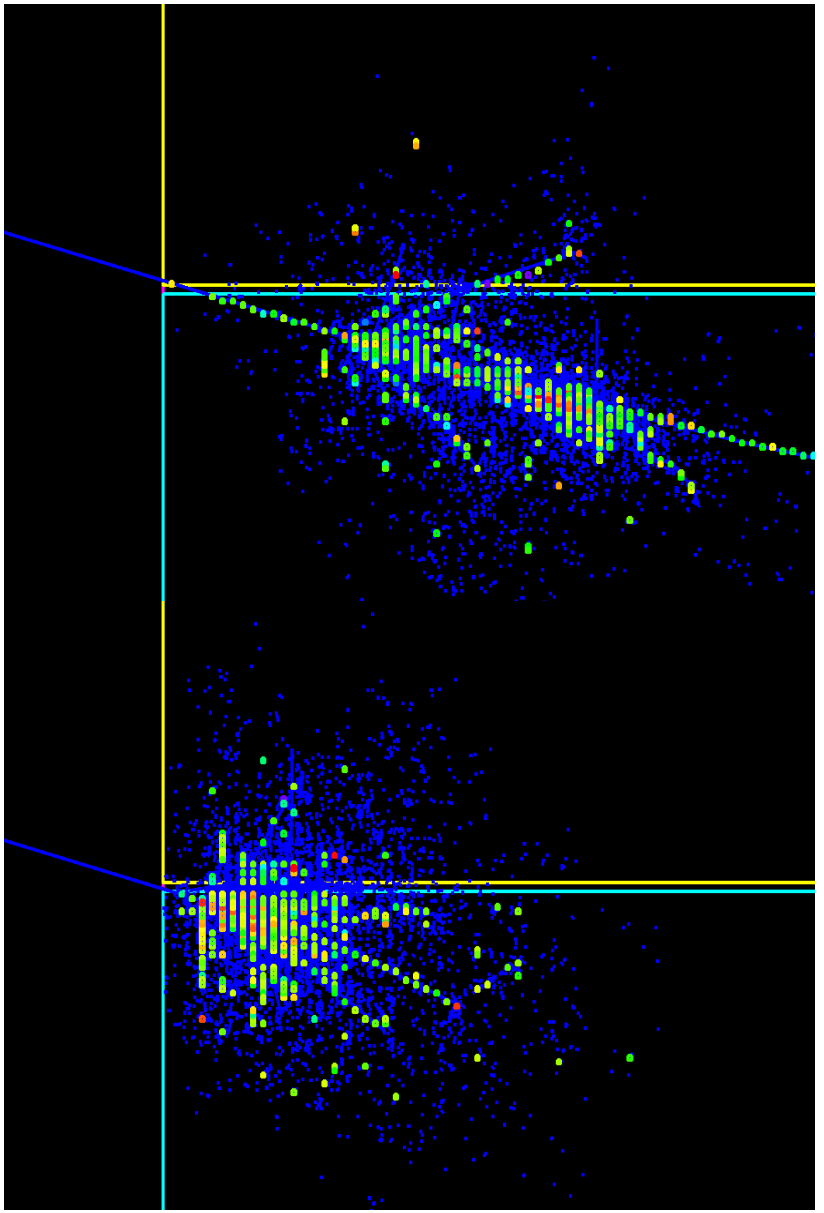


Non-projective geometry



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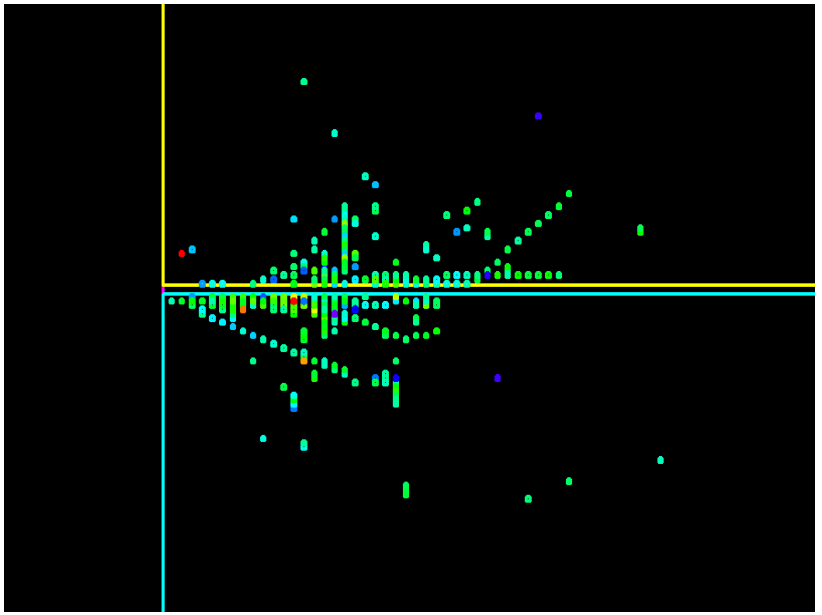

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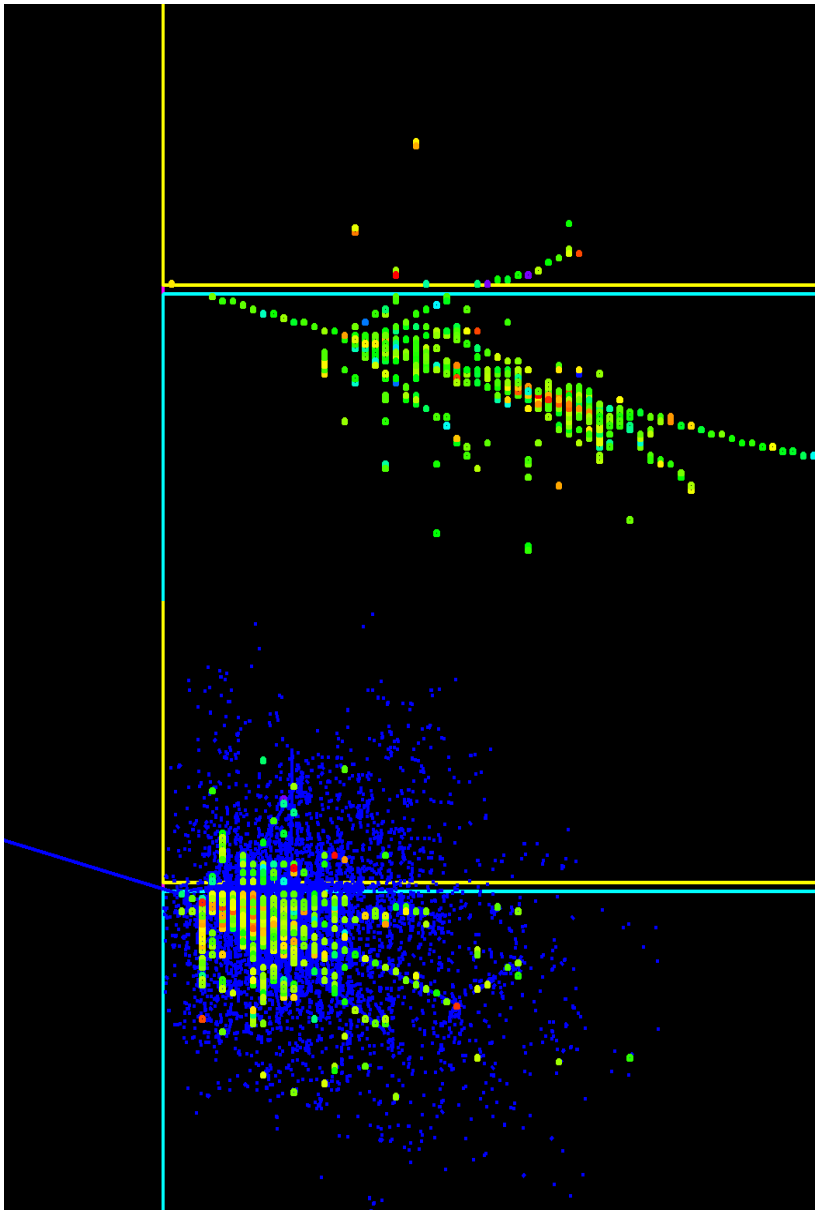

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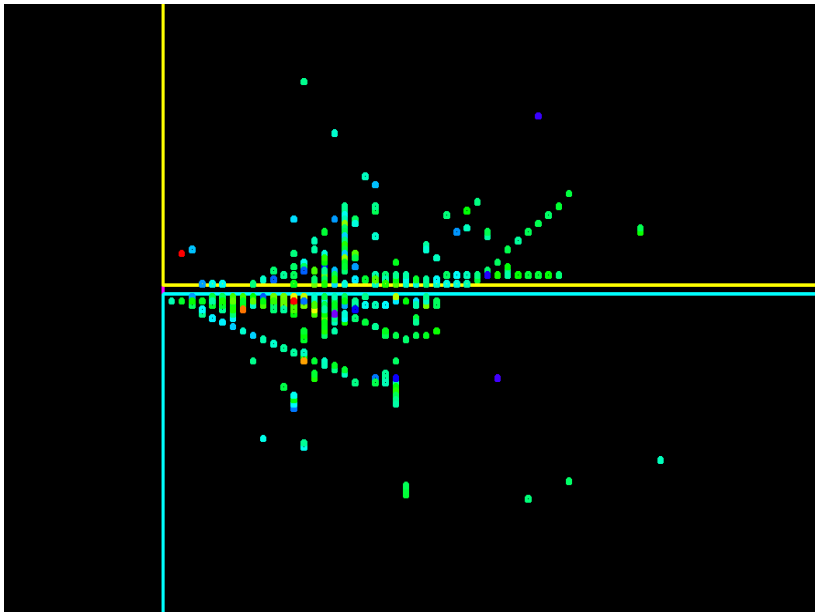

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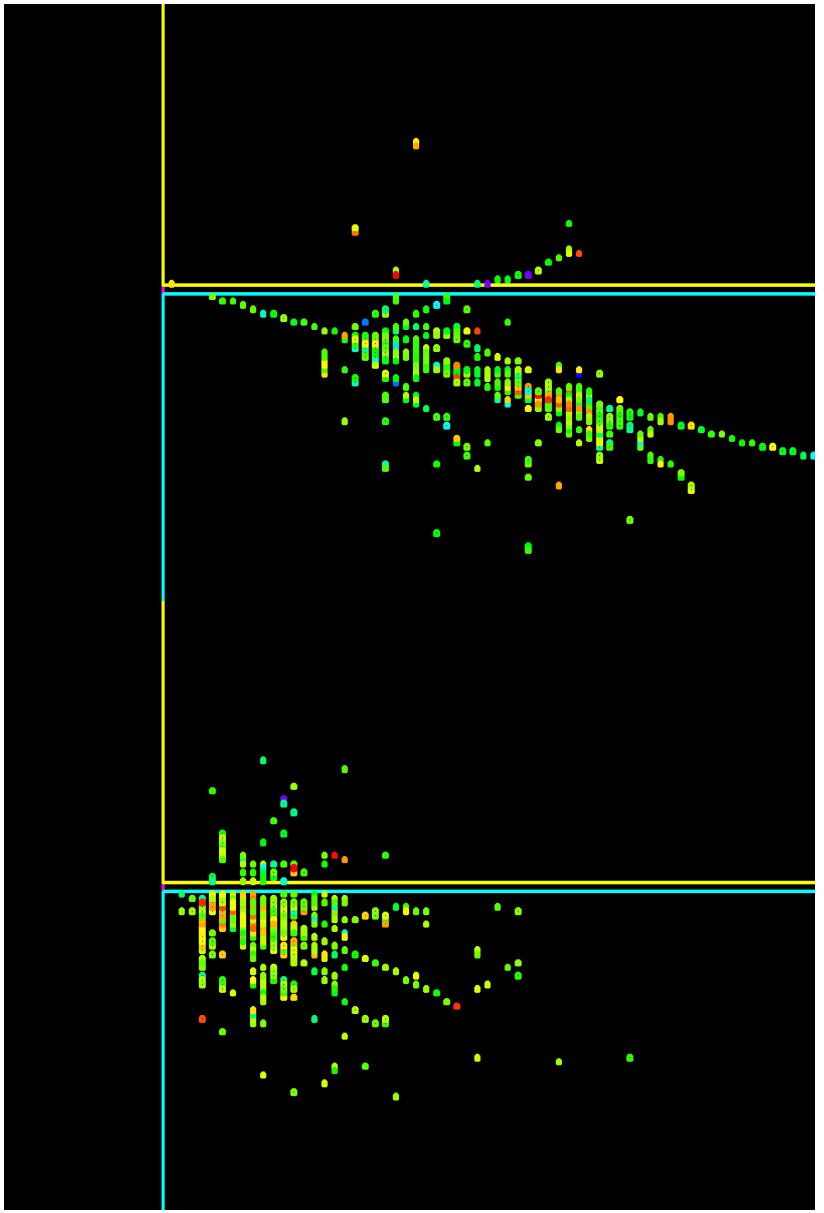

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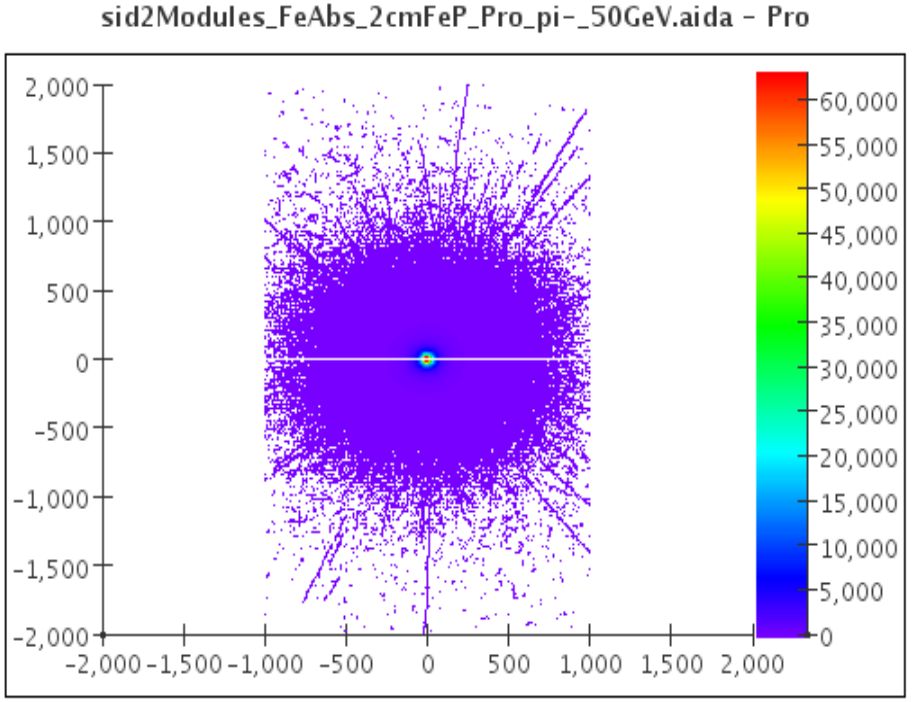
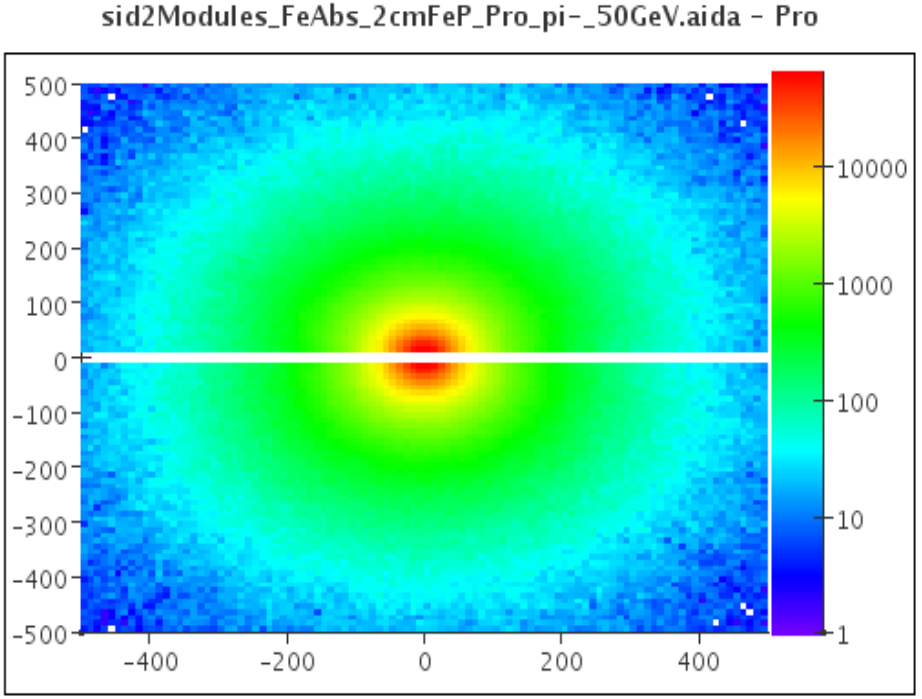
Projective geometry

Number of hits versus cell id number





Configuration:

- 2 cm Fe plate between modules with 80 layers
- 50 GeV pions, 10k events
- 0.5 MIP readout threshold

Non-projective geometry

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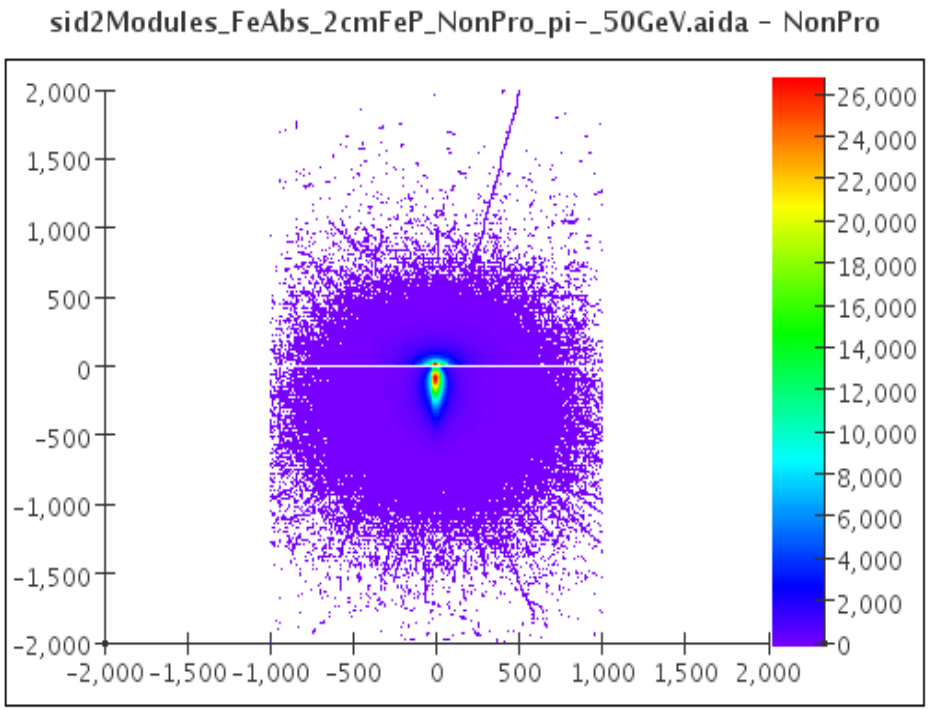

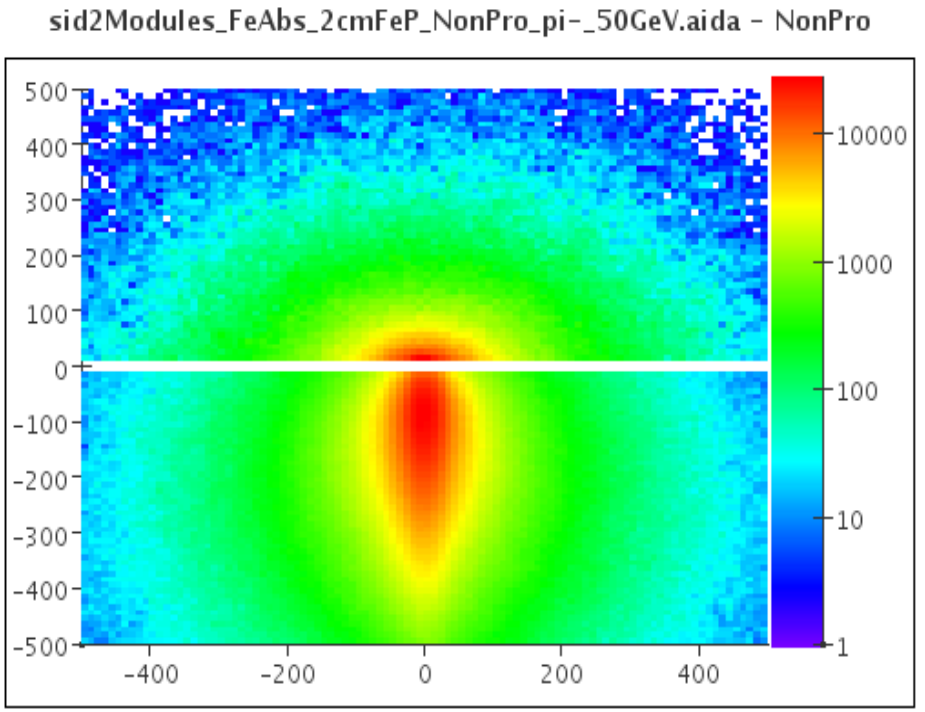

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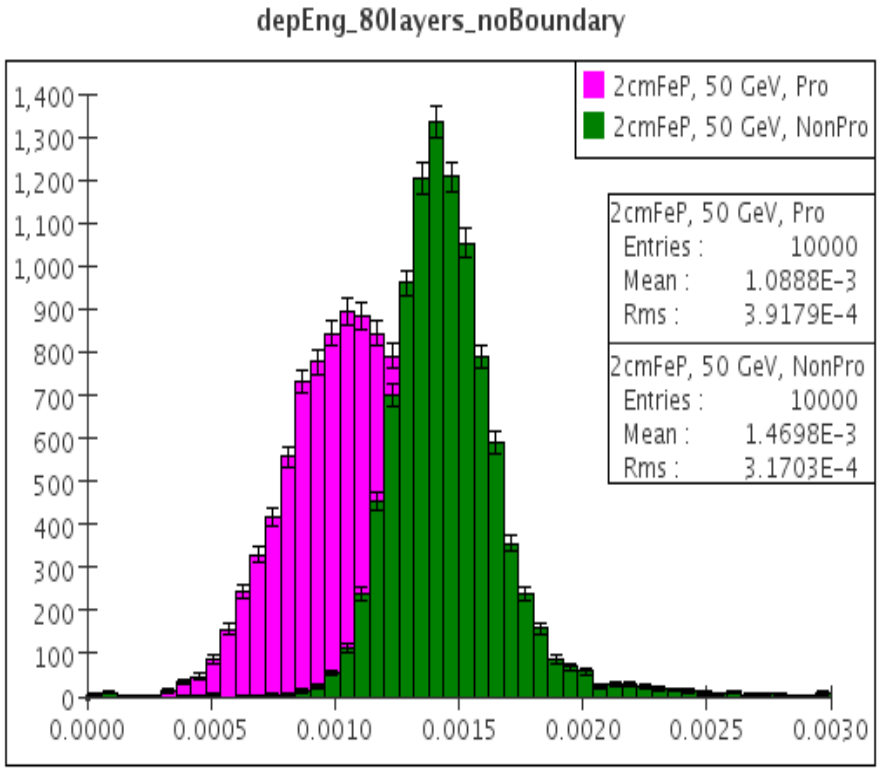
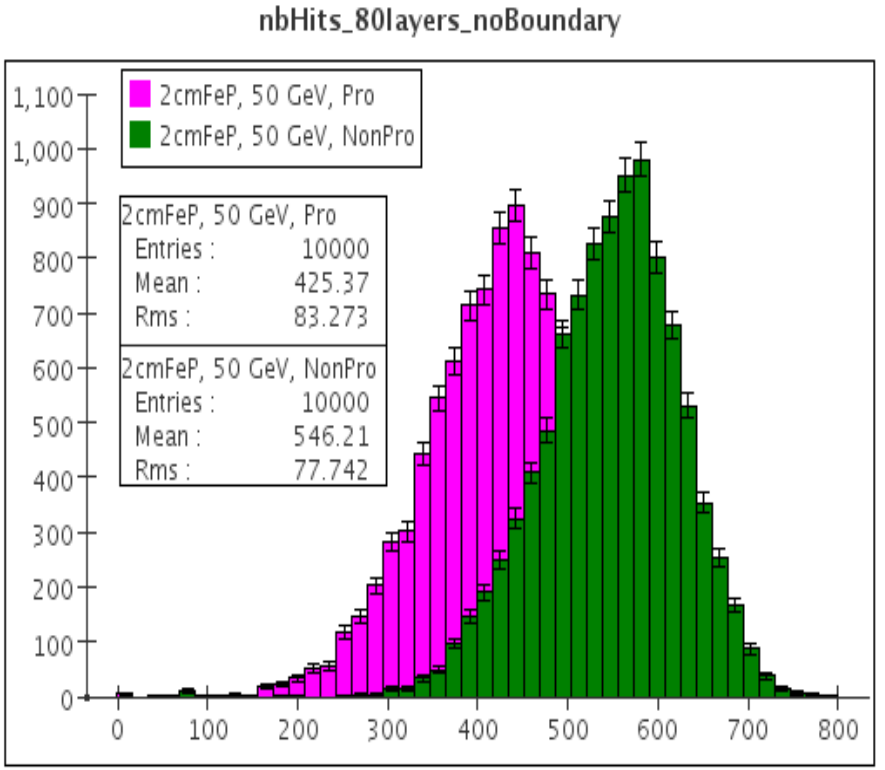
Projective vs non-projective

Deposited energy (GeV)



Number of hits



- More visible energy for non-projective geometry
- Better energy resolution for non-projective geometry

Conclusions and outlook

The first look shows significant difference between projective and non-projective geometry

Next work:

- Study of different boundary configuration
  - with and without supporting plate
  - different size of death zone around modules
  - with and without ECAL module in front of
- Impact of different vertex
- Comparison of projective and non-projective geometry
- Comparison of different readout
- Evaluation over wide energy range