Proposed updates to Mokka ECAL driver

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adding 2 features to Mokka ECAL driver:

- layer-by-layer configuration of silicon / scintillator readout layers
    presently pairs of layers have same technology

- Scalable endcap geometry

Layer configuration of hybrid ECAL

Presently the active material of layers (silicon sensors / scintillator strips) is constrained to be the same in the two layers within an alvoelus

Controlled by model parameter, e.g.:

30 silicon layers = 15 x "0"
/Mokka/init/globalModelParameter Ecal_Sc_Si_mix 000000000000000

30 scintillator layers (x, y) = 15 x "3"
/Mokka/init/globalModelParameter Ecal_Sc_Si_mix 333333333333333

2 silicon layers, 4 scintillator layers:
/Mokka/init/globalModelParameter Ecal_Sc_Si_mix 033

This limits the hybrid ECAL designs which can be studied

I have added the possibility to do a layer-by-layer configuration
mixing silicon and scintillator within the same alveolus

Added new codes "5" -> "8"

code	1st layer of pair	2nd layer
0	silicon	silicon
1	Sc strip (along X)	Sc strip (along X)
2	Sc strip (along Z)	Sc strip (along Z)
3	Sc strip (along X)	Sc strip (along Z)
4	Sc strip (along Z)	Sc strip (along X)
5	silicon	Sc strip (along X)
6	silicon	Sc strip (along Z)
7	Sc strip (along X)	silicon
8	Sc strip (along Z)	silicon

"Sc strip (along Z)" means a scintillator strip,
whose long axis is transverse to the slab direction
i.e. along Z direction in the barrel

Scalable endcap geometry

In the barrel, the width of an alveolus (and therefore of a detector slab) is determined by:

length of the barrel
number of barrel modules
number of alveola per module
thickness of carbon fibre support walls, etc

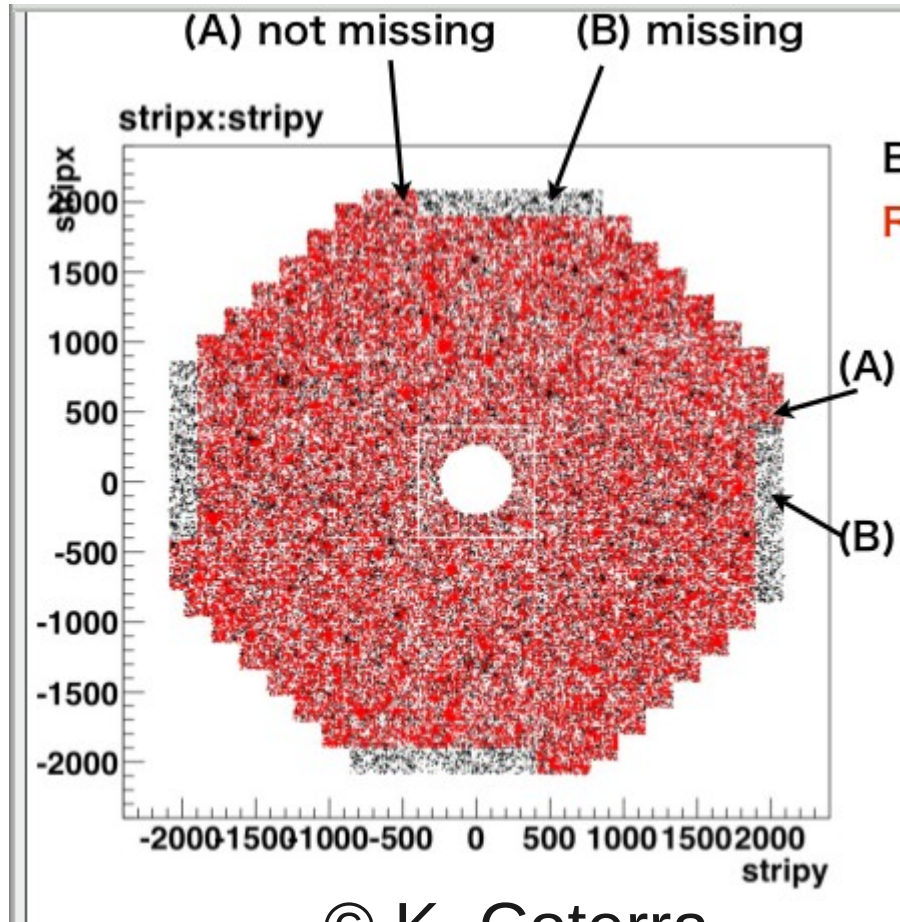endcap size determined by outer radius of barrel ECAL

endcap alveola constrained to have same width as those in barrel

no guarantee that integer number of alveola fit exactly into endcap envelope
    in general there is an uninstrumented region

(dimensions of ILD_01_v05 happen to give very small dead region)

Determined by barrel length

In general case, uninstrumented area likely

Endcap radius determined by barrel radius
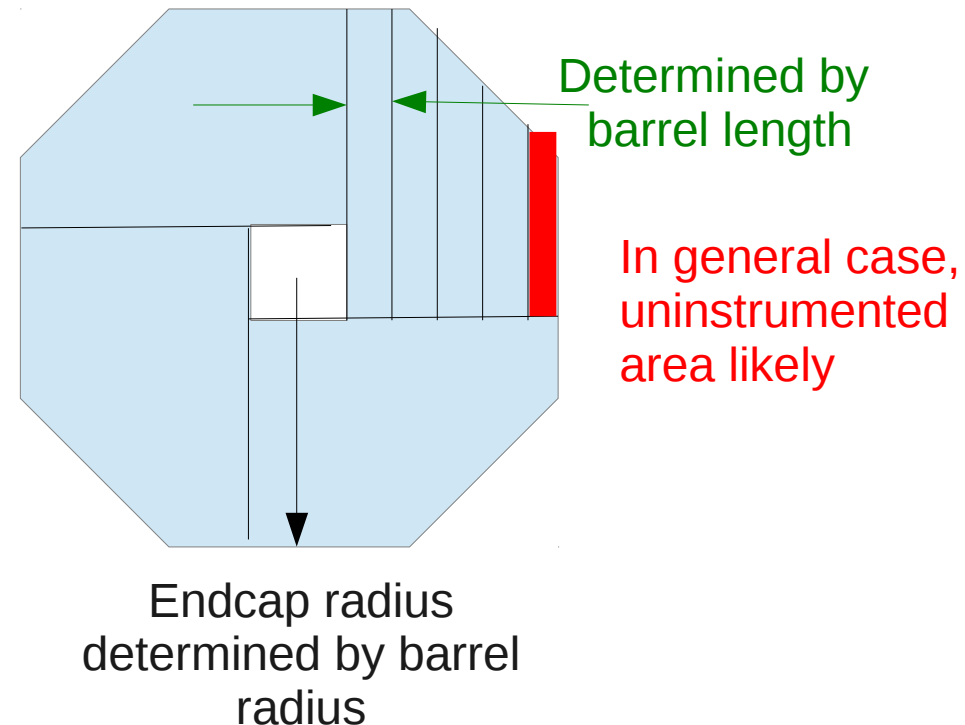
Can be large effects in scintillator, non-standard silicon ECAL geometries

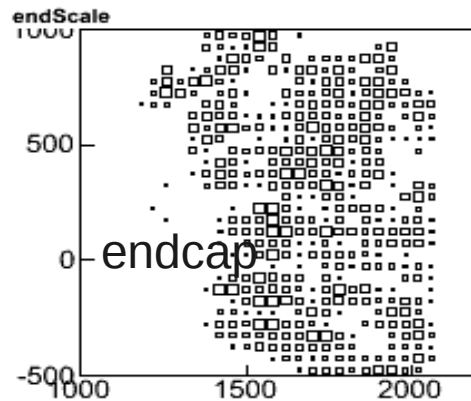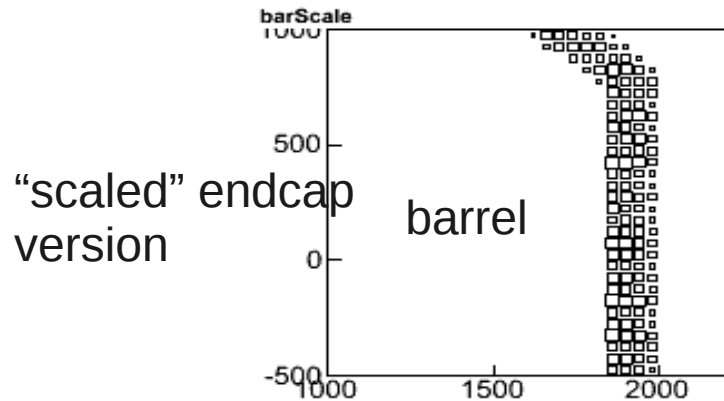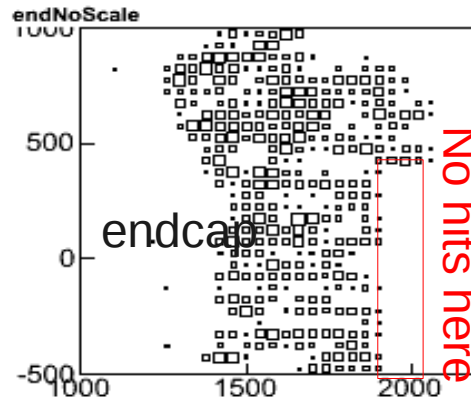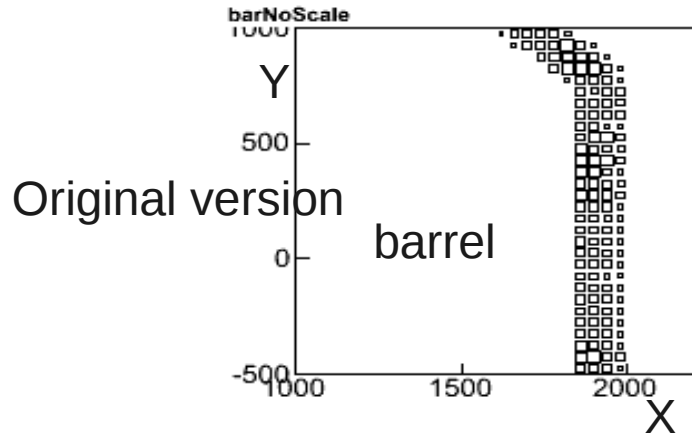To "fix" this feature, redefine width of alveola in endcap

Keep as close as possible to barrel width, while ensuring no dead area

Cell size can be slightly different in endcap and barrel

Redefine according to endcap radius to ensure no uninstrumented region

Endcap radius determined by barrel radius

Original version

barNoScale

Y

500

0

-500
1000   1500   2000
                              X

endNoScale

500

0

-500
1000   1500   2000

endcap

No hits here

"scaled" endcap version

barScale

500

0

-500
1000   1500   2000

barrel

endScale

500

0

-500
1000   1500   2000
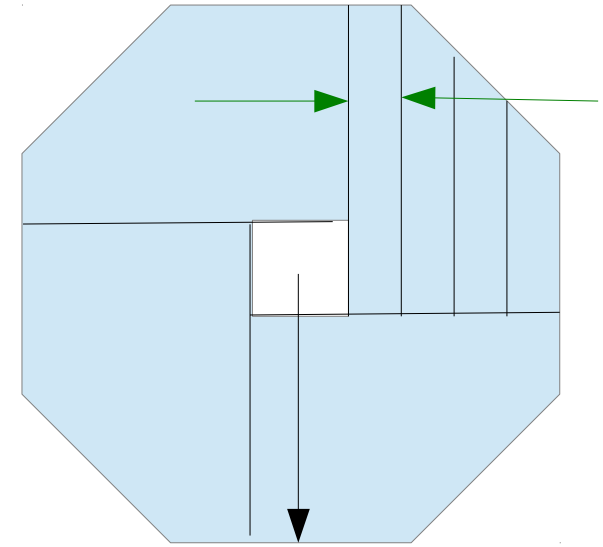
endcap

Muon hit positions

Several of us (Coterra @ Shinshu, Trong-Hieu @ LLR, myself @ Tokyo, students)
     have been using this "patched" version for a month or so,
          no problems reported

I propose to update the official ECAL driver

Requires changes in 2 classes in mokka/source/Geometry/LDC/
     SEcal04.cc, SEcalSD03.cc

Patch to current version?

New version?
     SEcal04.cc -> SEcal05.cc
     SEcalSD03.cc -> SEcalSD04.cc

Do we keep the non-scalable endcap as an option?
     Would require new Mokka model parameter in DB
          (now controlled by hard-coded parameter)