Bug found after meeting : these slides have updated plots!

Update on backgrounds at FCCee-91

(some to be shown at FCC workshop next week)

Daniel Jeans, KEK @ ILD sw/ana meeting, 3rd June 2026

updated 4th June

Recent changes in FCCee

- updated design of MDI region

- new machine optics:

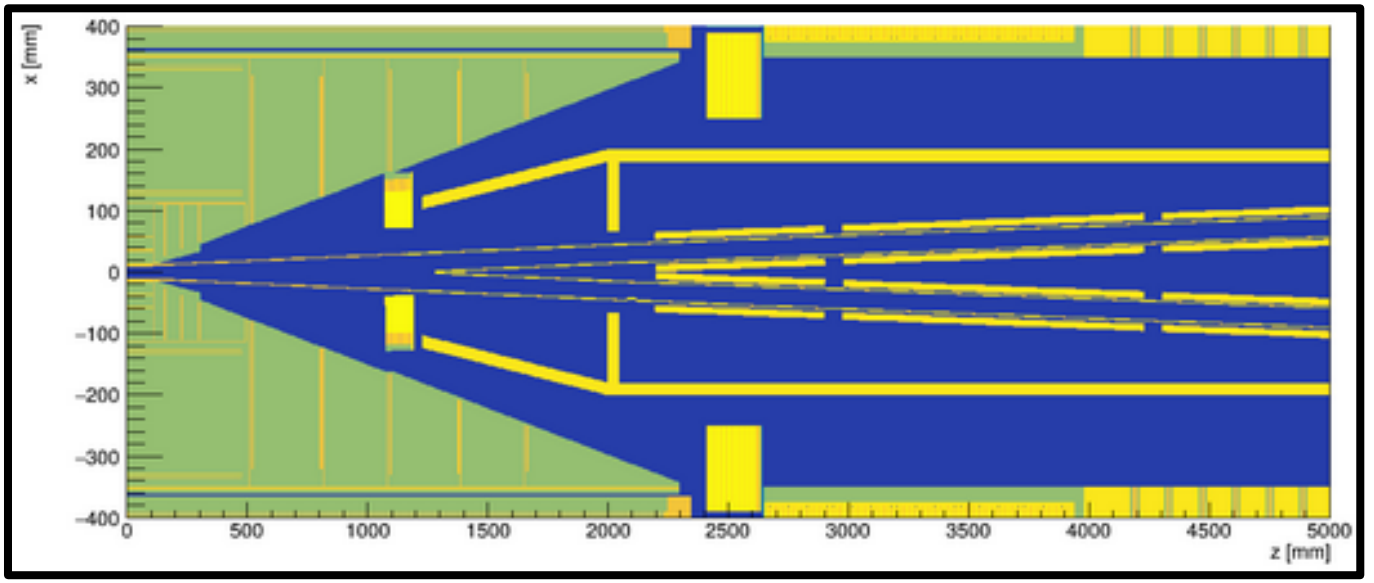
  GHC (Global Hybrid Chromaticity Correction) → LCC (Local Chromatic Correction)

  some changes in ring geometry and beam parameters

  → new estimates of backgrounds

MDI in simulation model

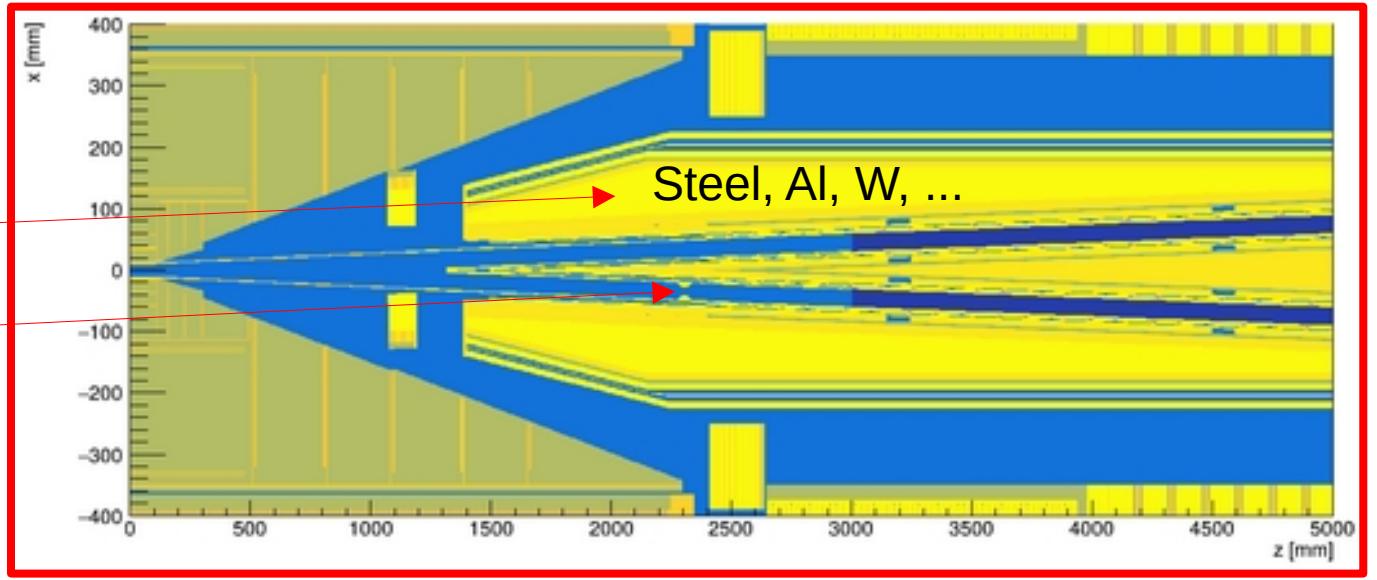
previous CAD-based model
MDI_o1_CADBased_v01



new CAD-based model
MDI_o1_CADBased_v02

Cryostat full of material

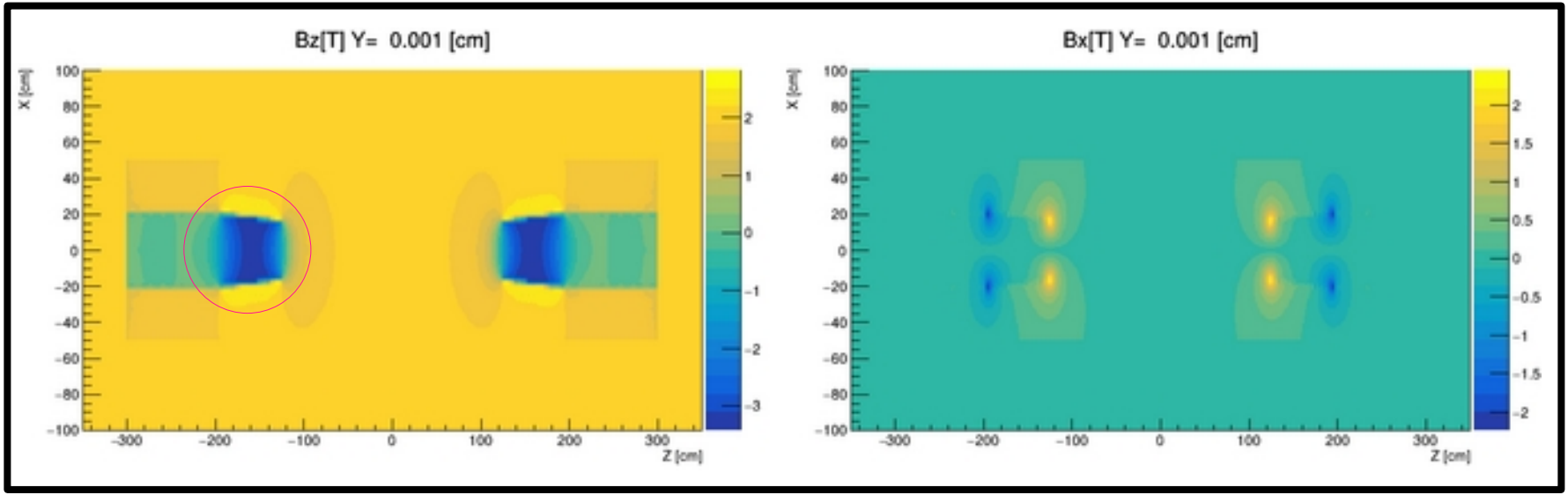
SR masks

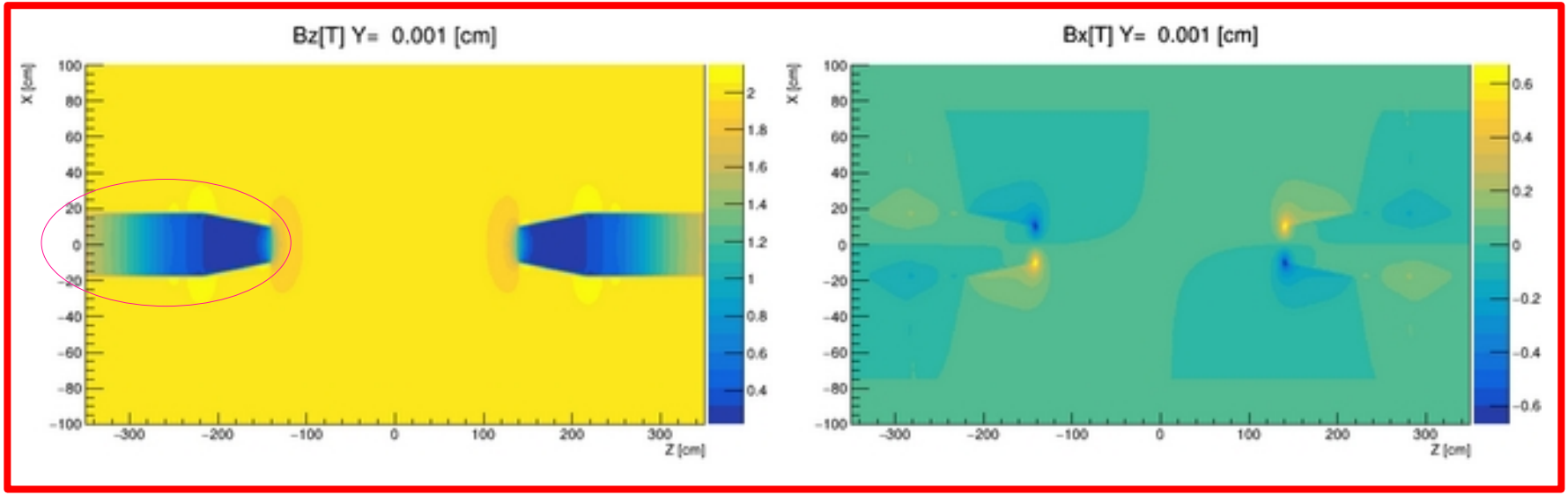


B-field

Strong compensating solenoid now moved outside detector

Screening solenoid remains (but a bit under-strength in the current model)





Background samples provided by FCCee MDI group

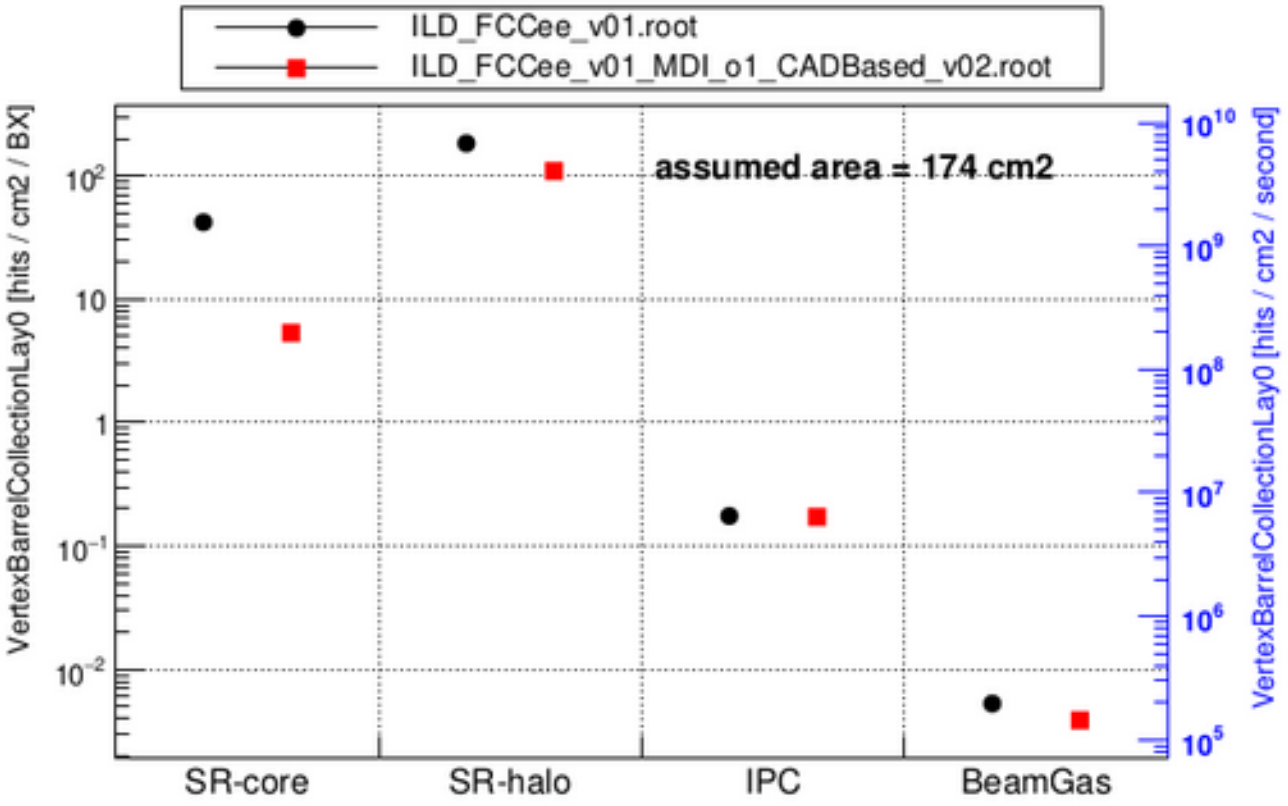
- IPC (Incoherent Pair Creation = beamstrahlung)
- SR (synchrotron radiation from “core” or “halo” of beam)
- beam gas

Simulate in ILD_FCCee_v01 model

compare **OLD** and **NEW** MDI descriptions

for the moment, look only at tracking detectors

Vertex barrel : layer 0



new MDI:

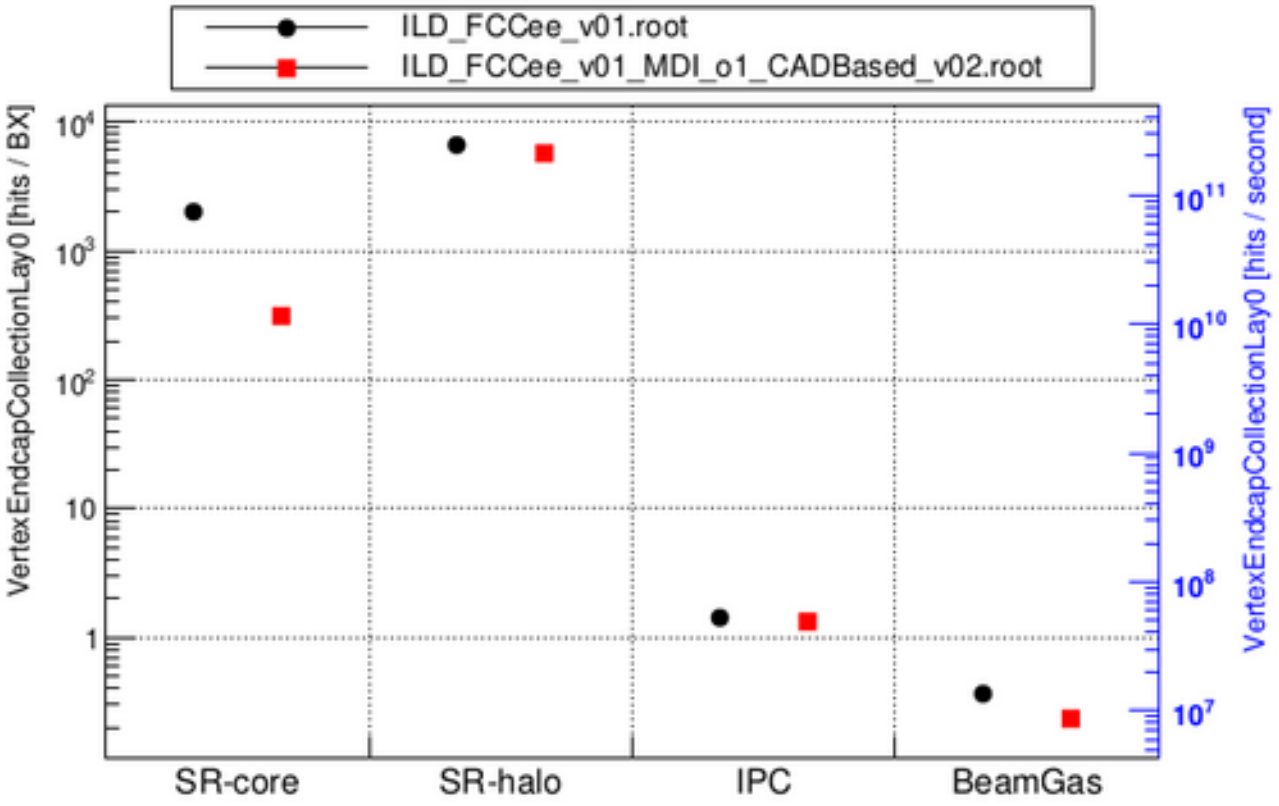
SR background (core)
reduces by ~10

SR background (halo)
reduces by ~2

No effect on **IPC** (beamstrahlung)

beamgas negligible

Vertex endcap : layer 0



new MDI:

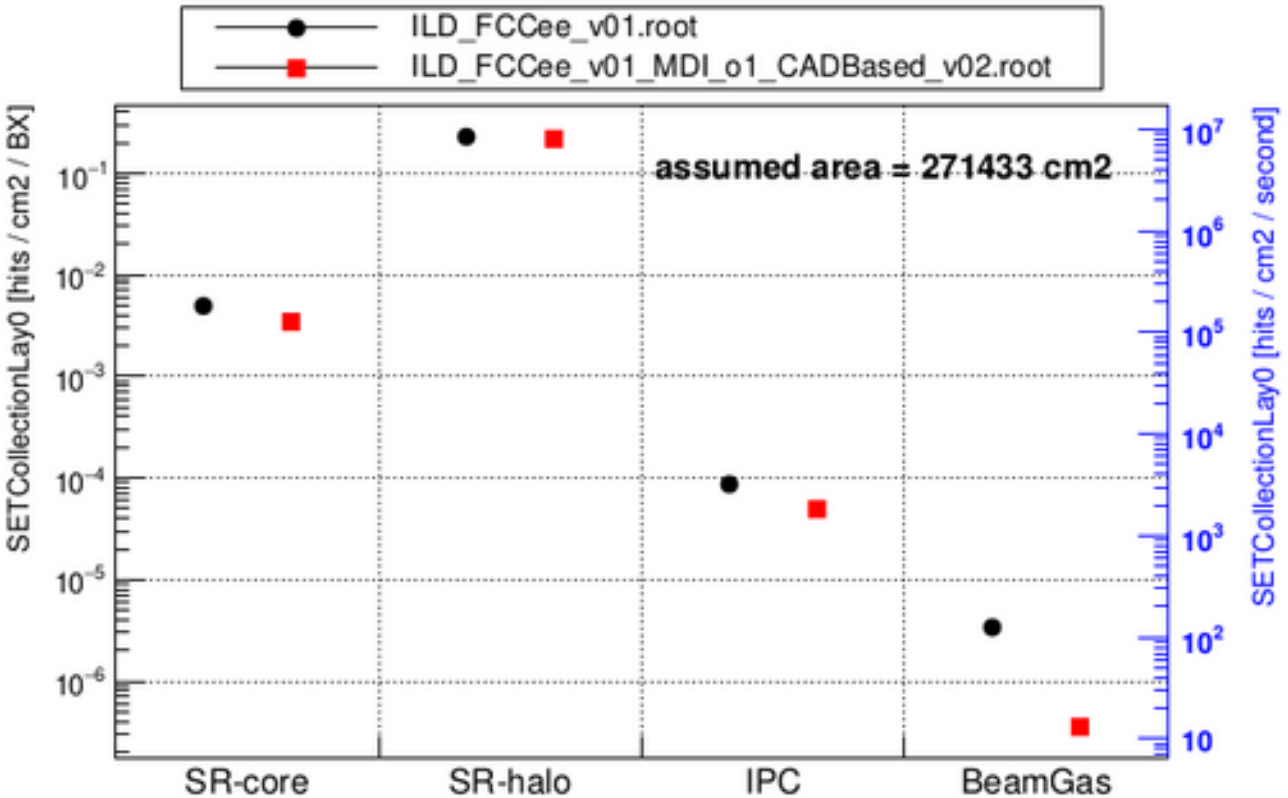
SR background (core)
reduces by ~10

SR background (halo)
~no change

No effect on **IPC**

beamgas negligible

SET layer 0



new MDI:

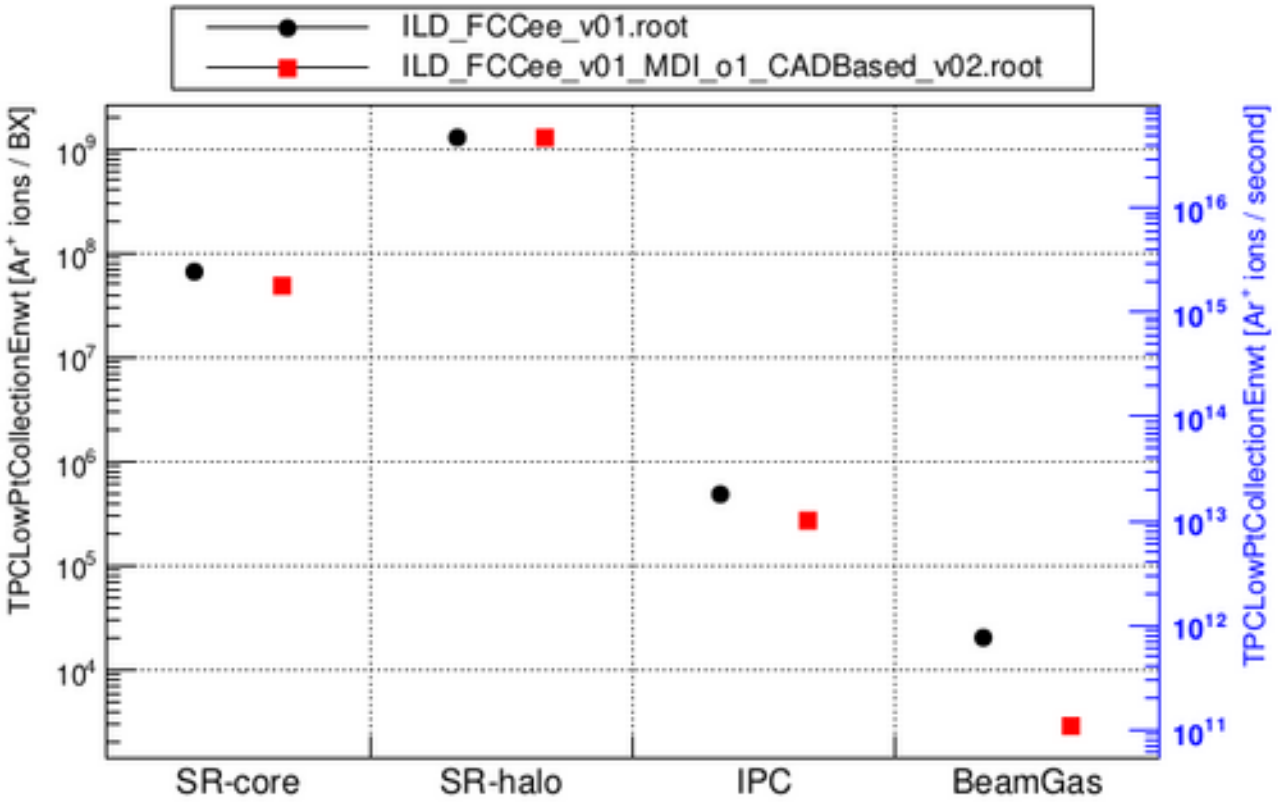
SR background (core)
small decrease

SR background (halo)
no effect

No effect on **IPC**

beamgas negligible

TPC



new MDI:

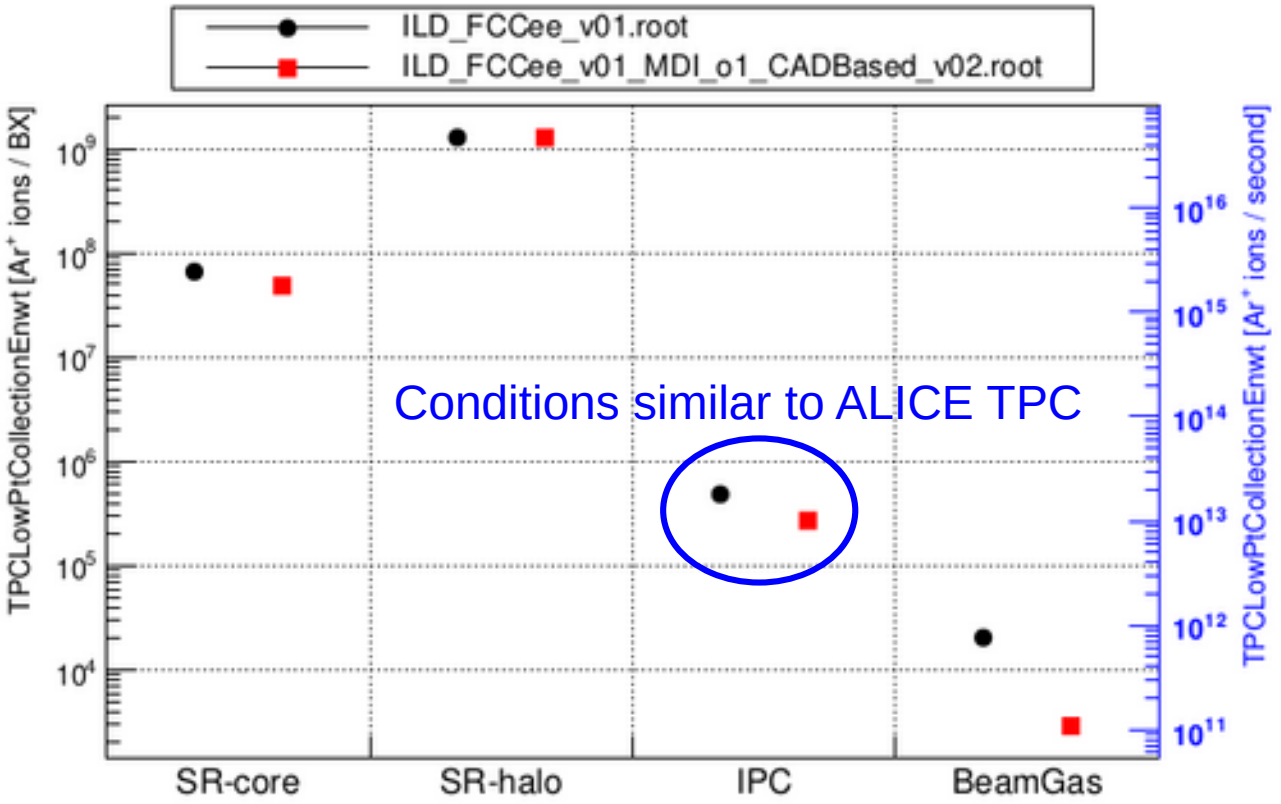
SR background (core)
small decrease

SR background (halo)
unchanged

No effect on **IPC**

beamgas negligible

TPC



new MDI:

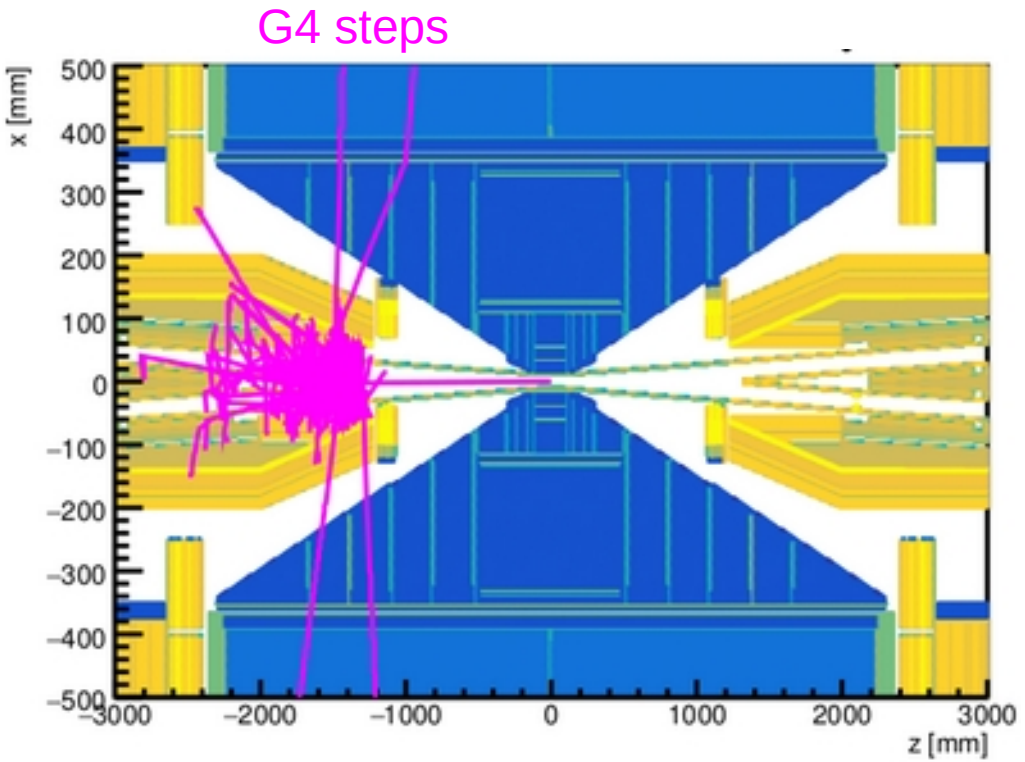
SR background (core)
small decrease

SR background (halo)
unchanged

No effect on **IPC**

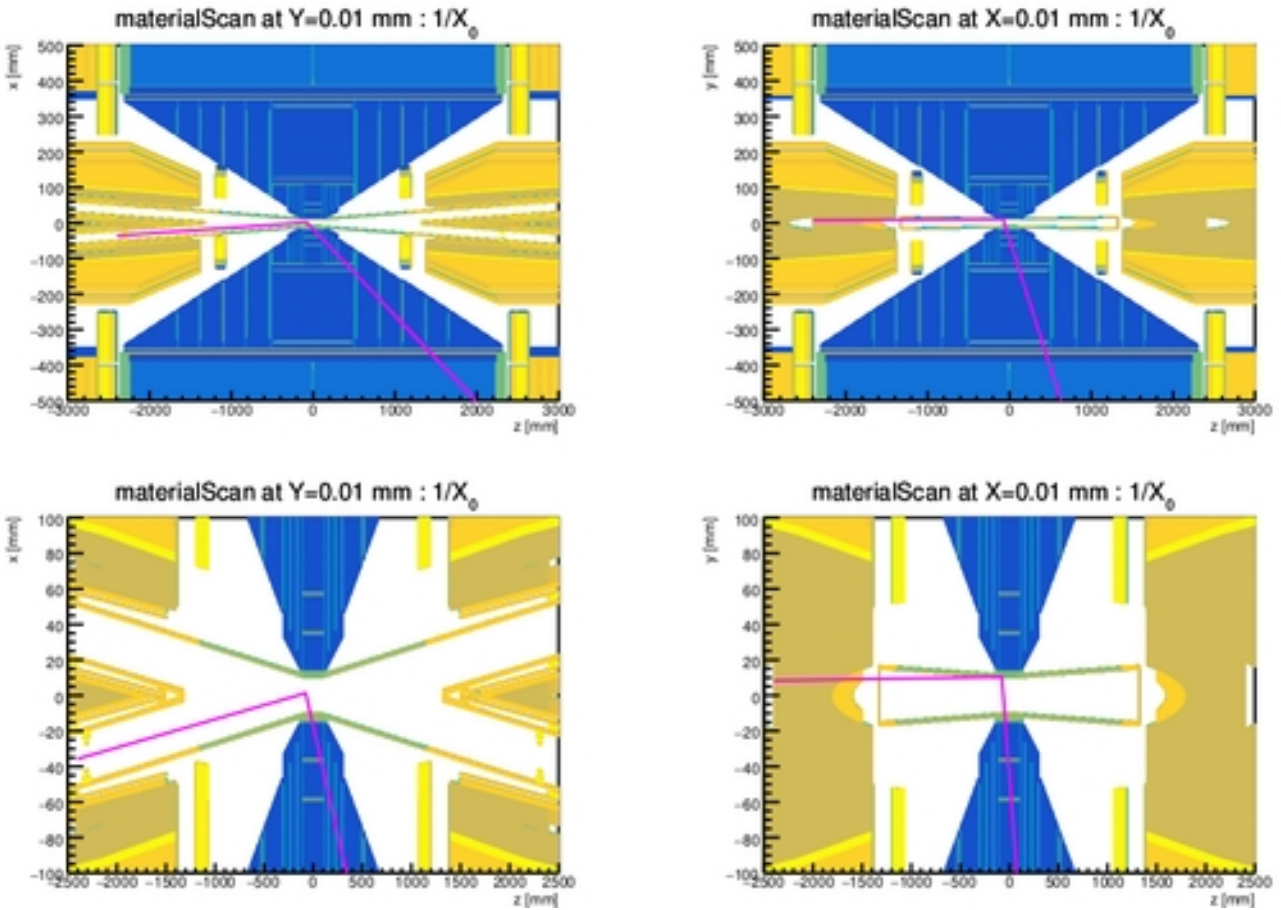
beamgas negligible

How do photons reach the TPC (from IPC) ?



Single initial e- from beamstrahlung
initiates shower near beampipe junction
several photons escape the cryostat to enter the TPC

How do photons reach the TPC? (SR halo)



SR halo: photons scatter off central beampipe

Summary

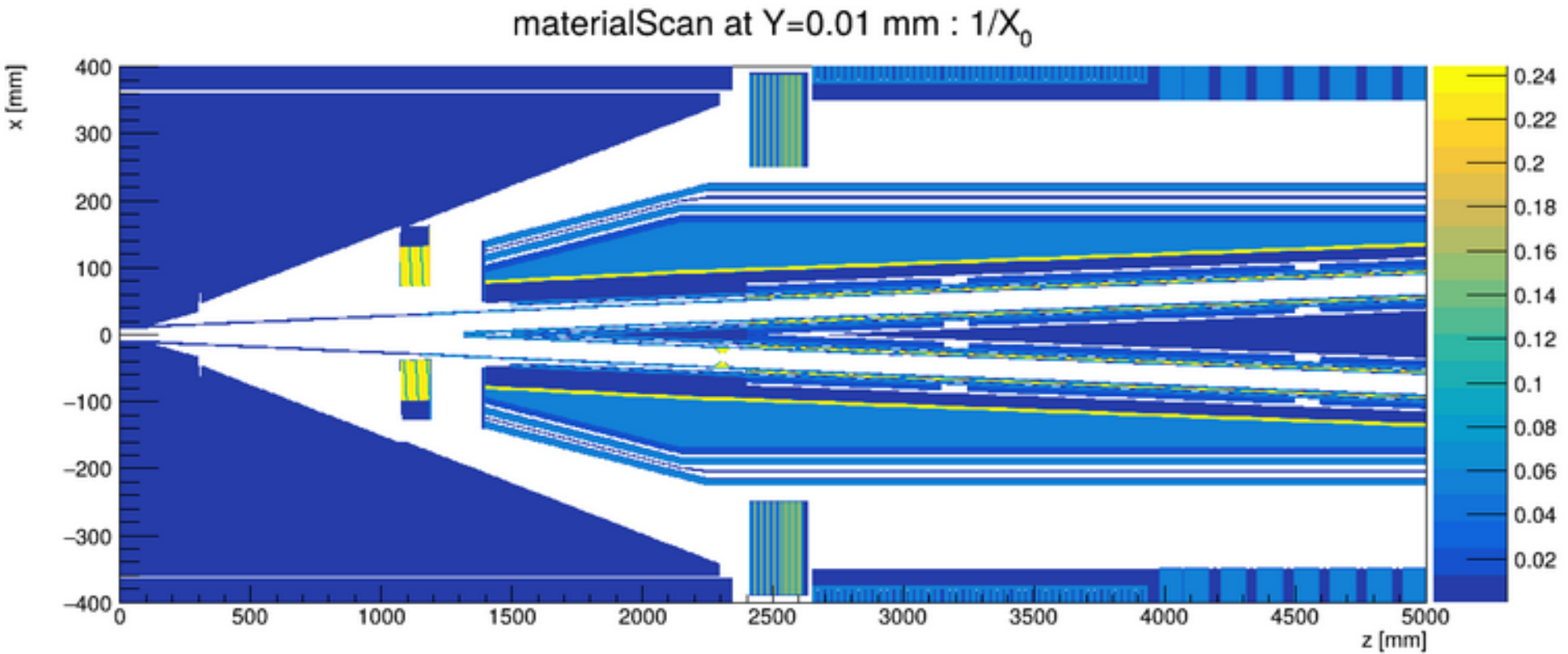
Tracking detector backgrounds dominated by synchrotron radiation
- typically 3 orders higher than IPC/beamstrahlung
- SR photons in the halo scatter off the central beam pipe

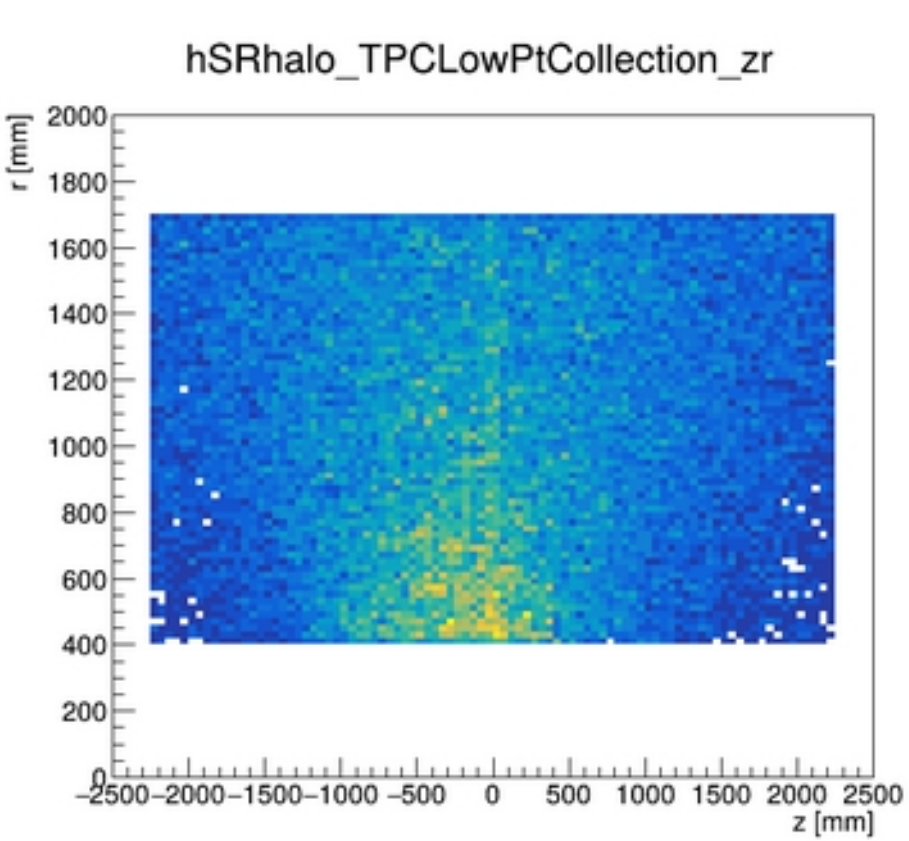
New MDI description
- more realistic, significantly more material
  - no large effect on BGs

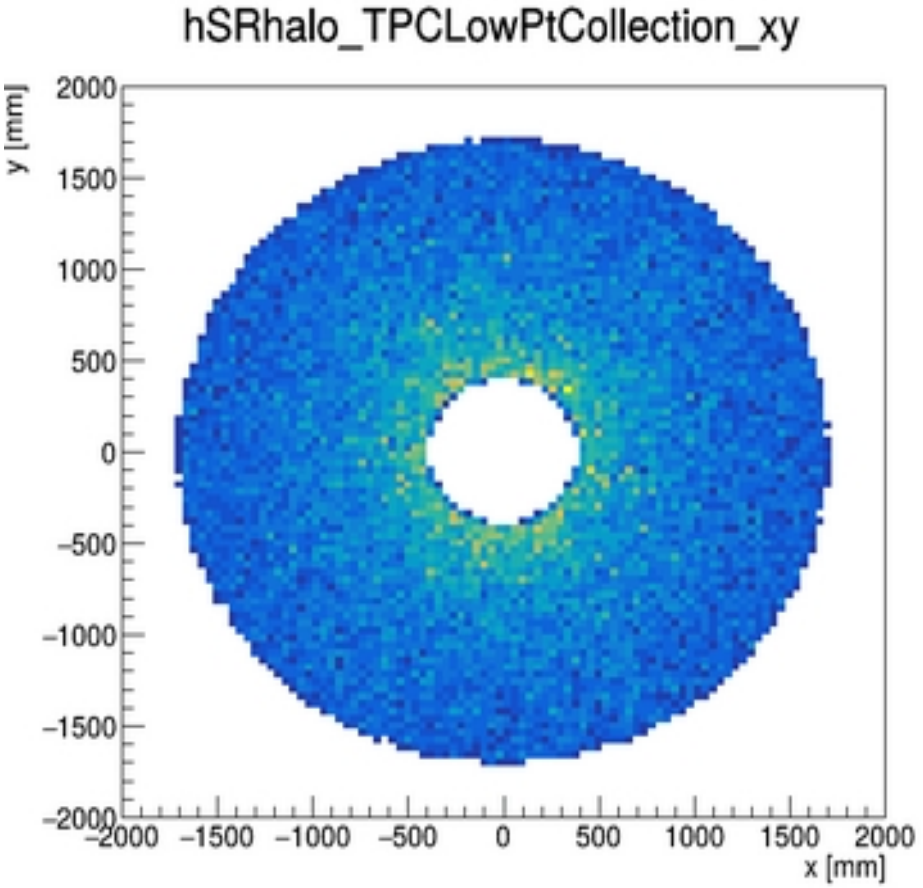
SR will create 3+ orders of magnitude more
- space charge buildup in TPC than @ ALICE...

More investigation needed on if it’s possible to mitigate this

backup


materialScan at Y=0.01 mm : 1/X0
x [mm]
400
300
200
100
0
−100
−200
−300
−400
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
z [mm]
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02


hSRhalo_TPCLowPtCollection_zr
r [mm]
z [mm]
2000
1800
1600
1400
1200
1000
800
600
400
200
0
−2500 −2000 −1500 −1000 −500 0 500 1000 1500 2000 2500


hSRhalo_TPCLowPtCollection_xy
y [mm]
x [mm]
2000
1500
1000
500
0
−500
−1000
−1500
−2000
−2000 −1500 −1000 −500 0 500 1000 1500 2000