

# Update on backgrounds at FCCee-91

(some to be shown at FCC workshop next week)

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



# Recent changes in FCCee

- updated design of MDI region

- new machine optics:

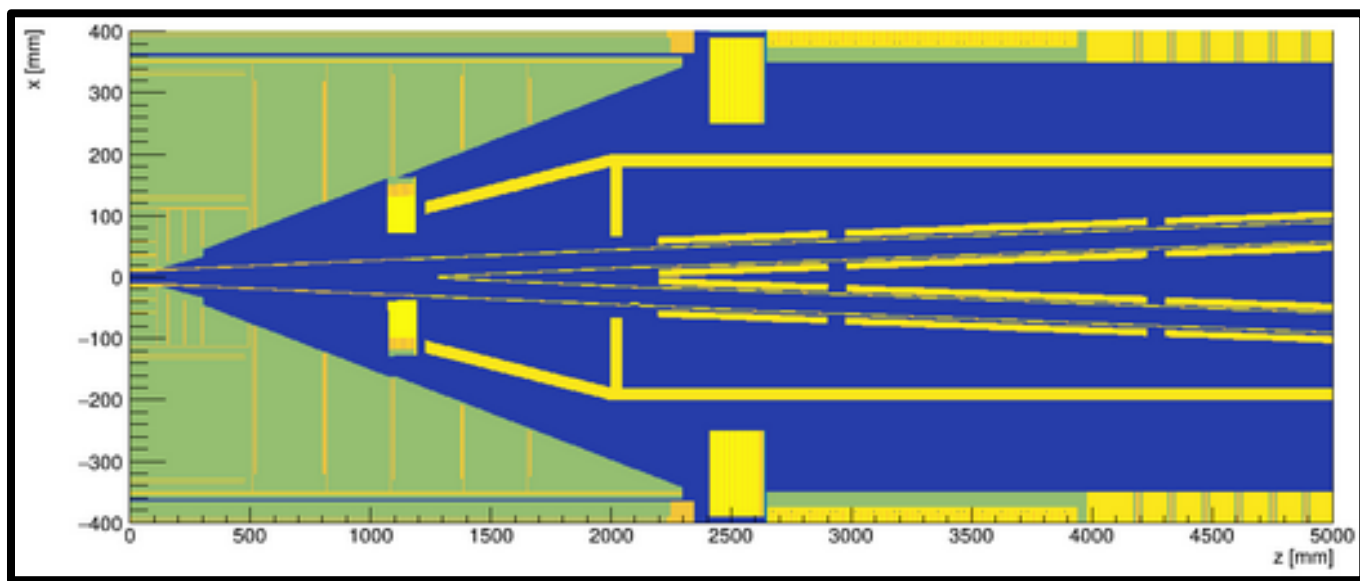
  - GHC (Global Hybrid Chromaticity Correction) → LCC (Local Chromatic Correction)

  - some changes in ring geometry and beam parameters

    - new estimates of backgrounds

# MDI in simulation model

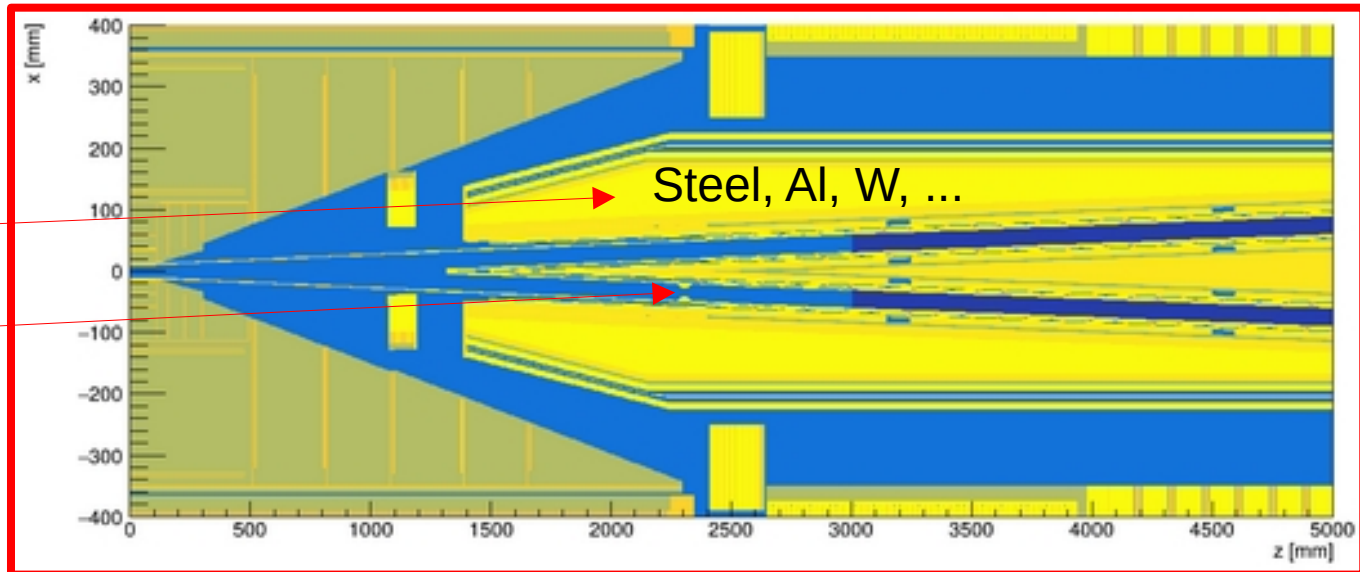
previous CAD-based model  
MDI\_o1\_CADBased\_v01



new CAD-based model  
MDI\_o1\_CADBased\_v02

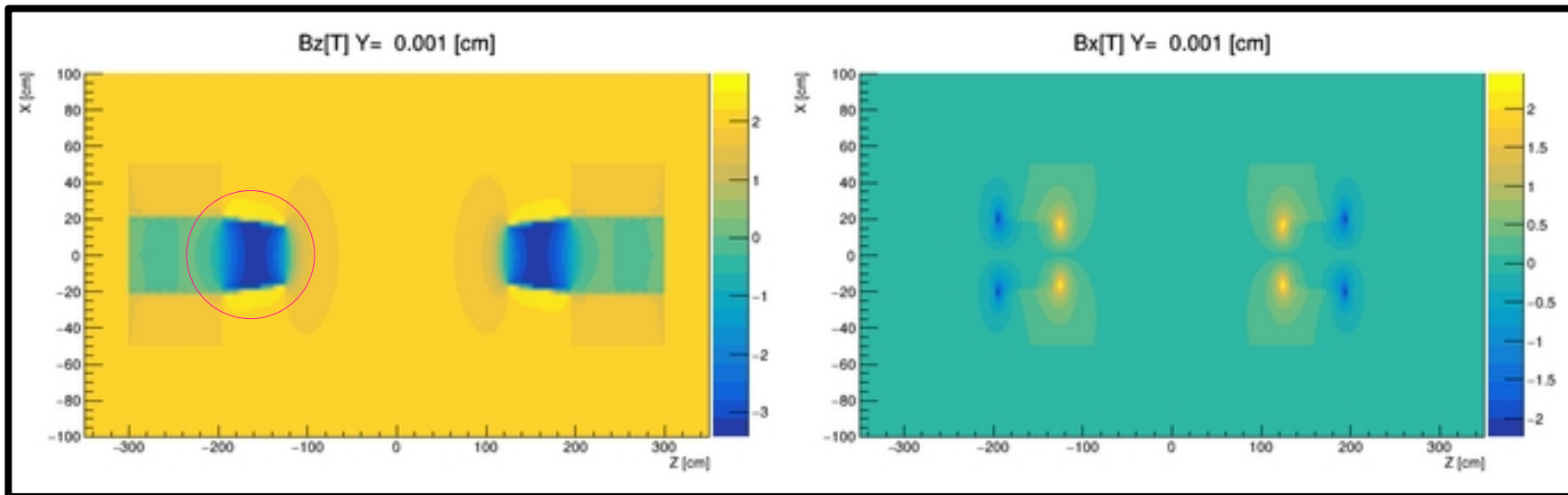
Cryostat full of material

SR masks

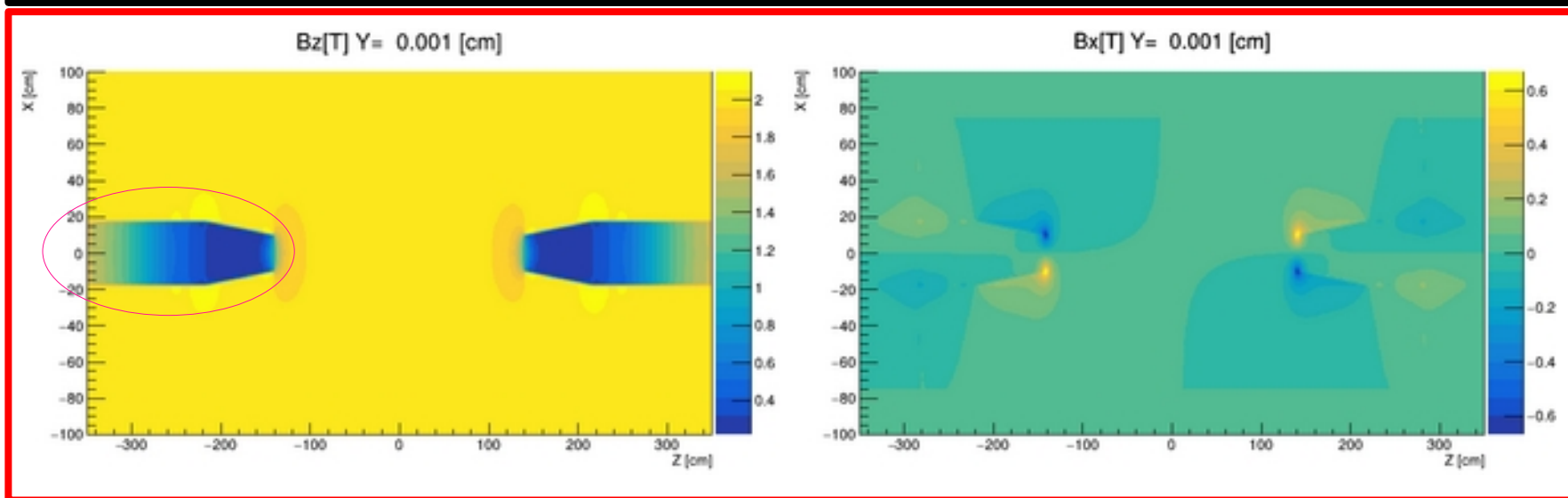


# B-field

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

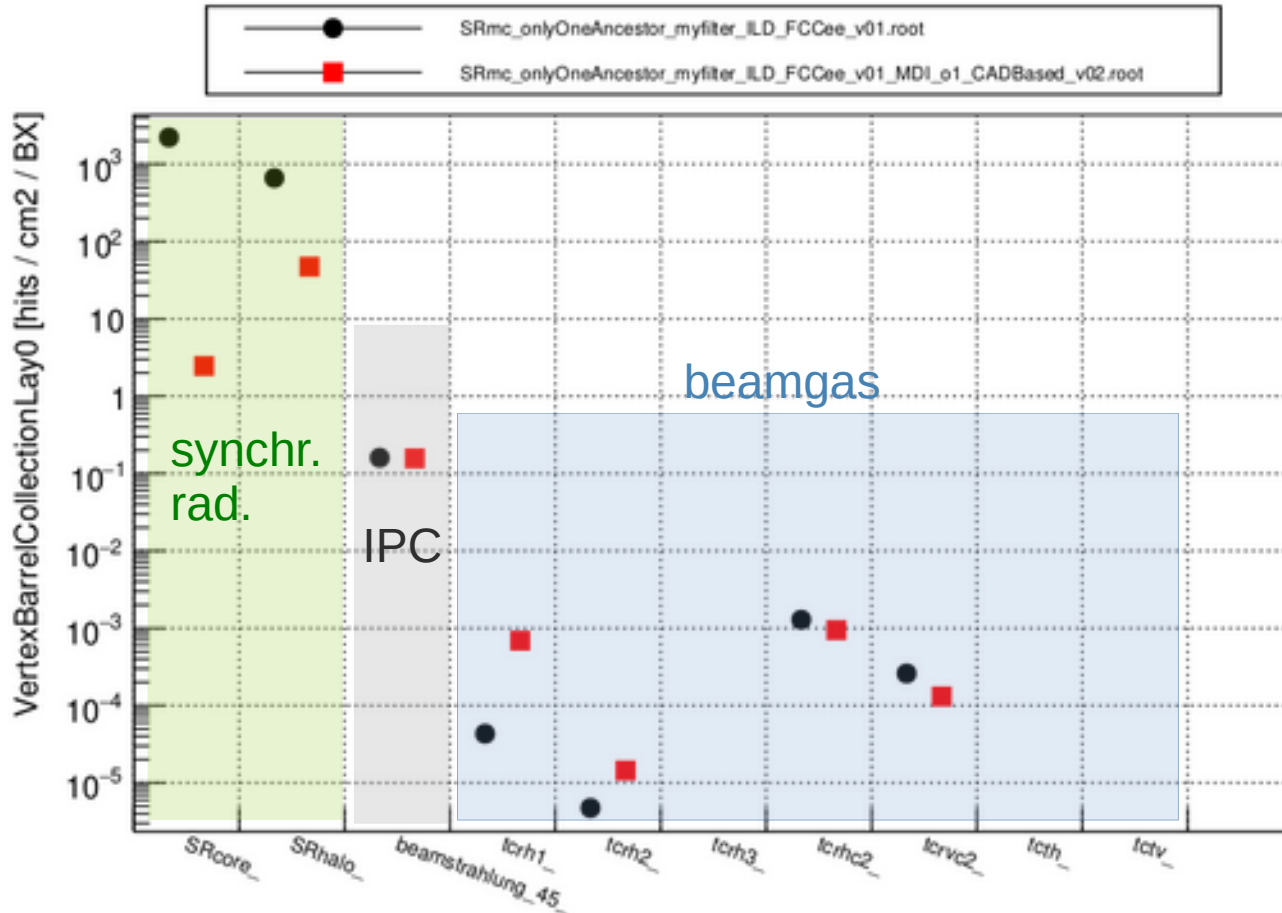
- IPC (Incoherent Pair Creation = beamstrahlung)
- SR (synchrotron radiation from “core” or “halo” of beam)
- beam gas

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:**

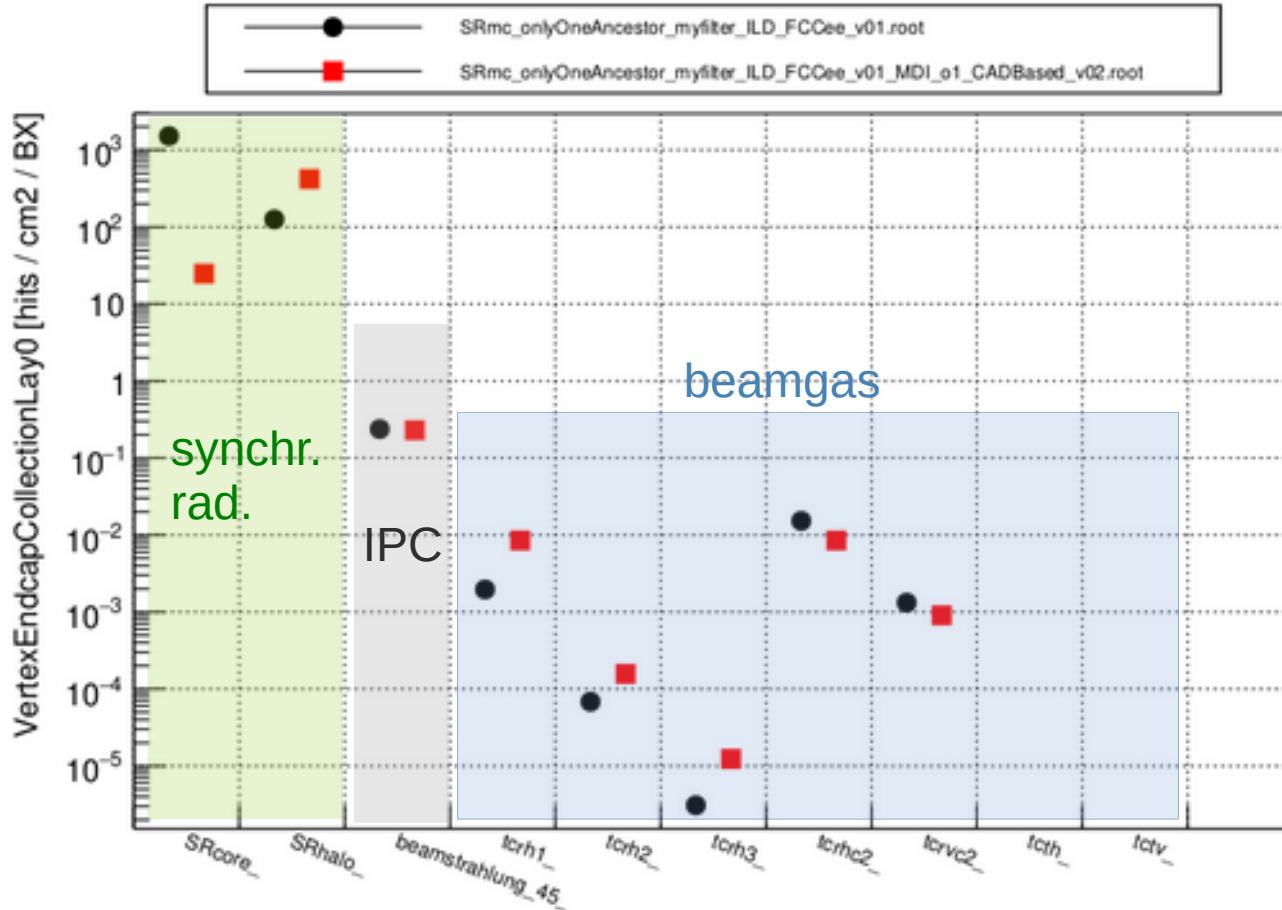
**SR background (core)**  
reduces by ~1000

**SR background (halo)**  
reduces by ~10

No effect on **IPC** (beamstrahlung)

**beamgas** negligible

# Vertex endcap : layer 0



**new MDI:**

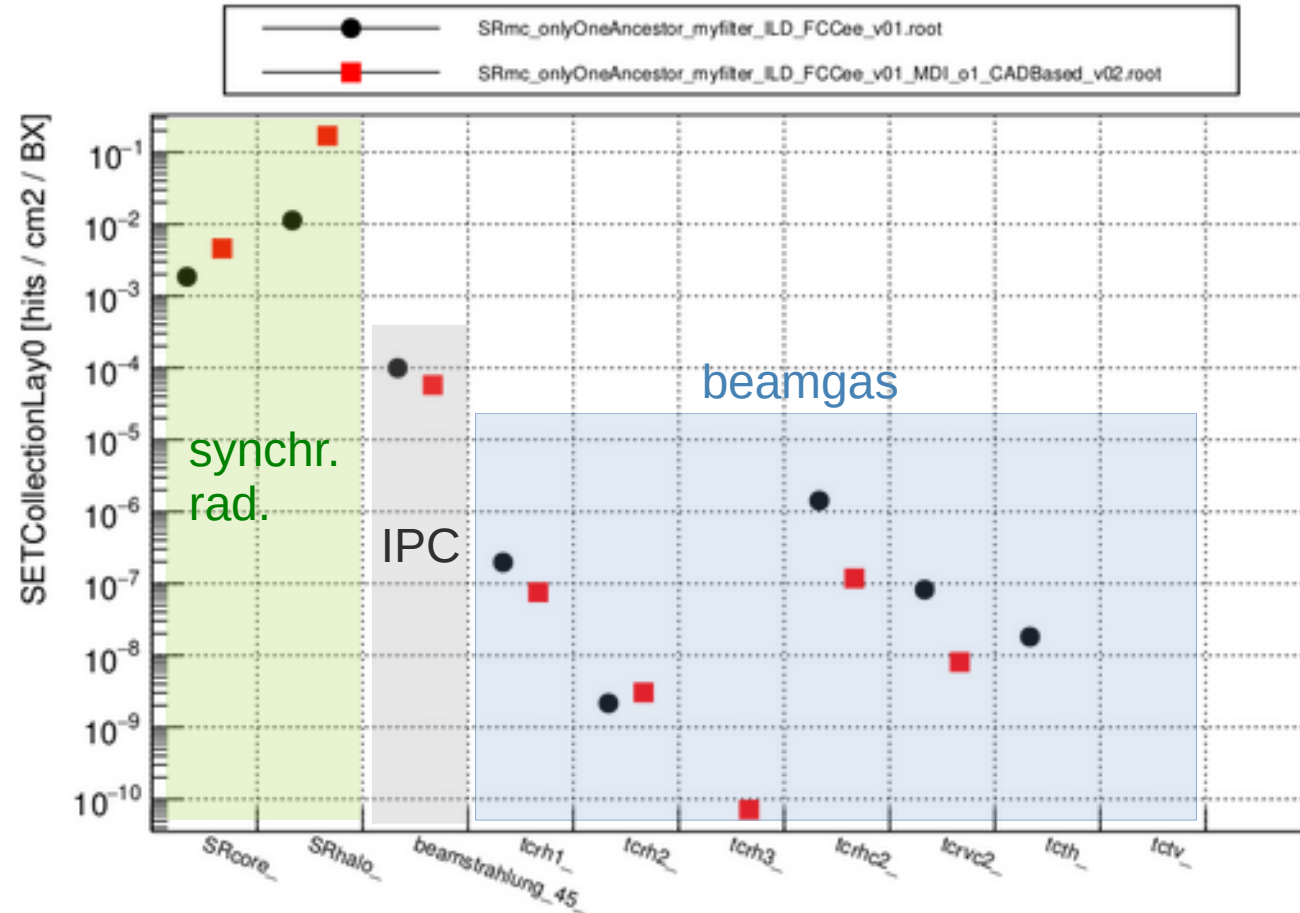
**SR background (core)**  
reduces by ~100

**SR background (halo)**  
increases by ~5

No effect on **IPC**

**beamgas** negligible

# SET layer 0



**new MDI:**

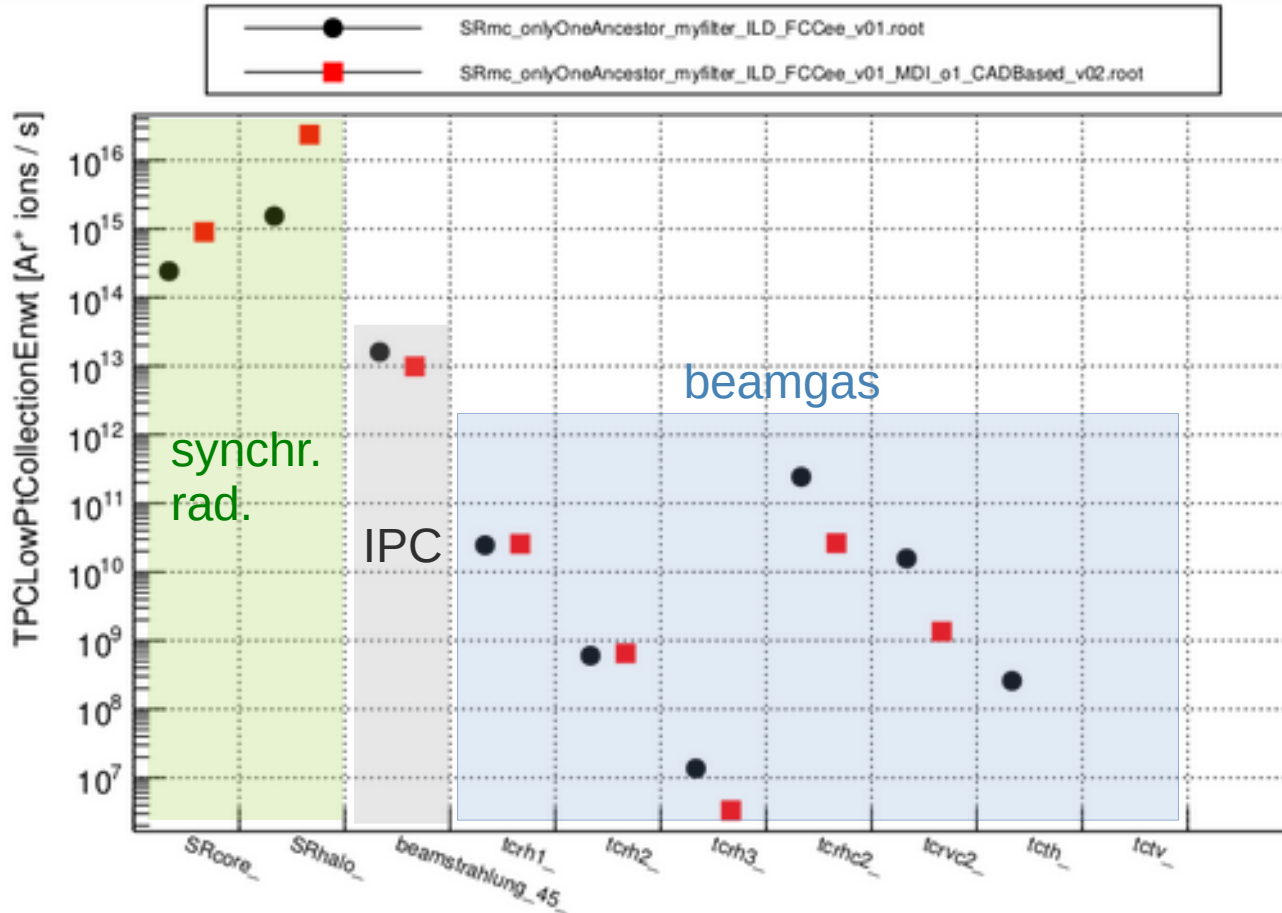
**SR background (core)**  
increases by ~2

**SR background (halo)**  
increases by ~10

No effect on **IPC**

**beamgas** negligible

# TPC



**new MDI:**

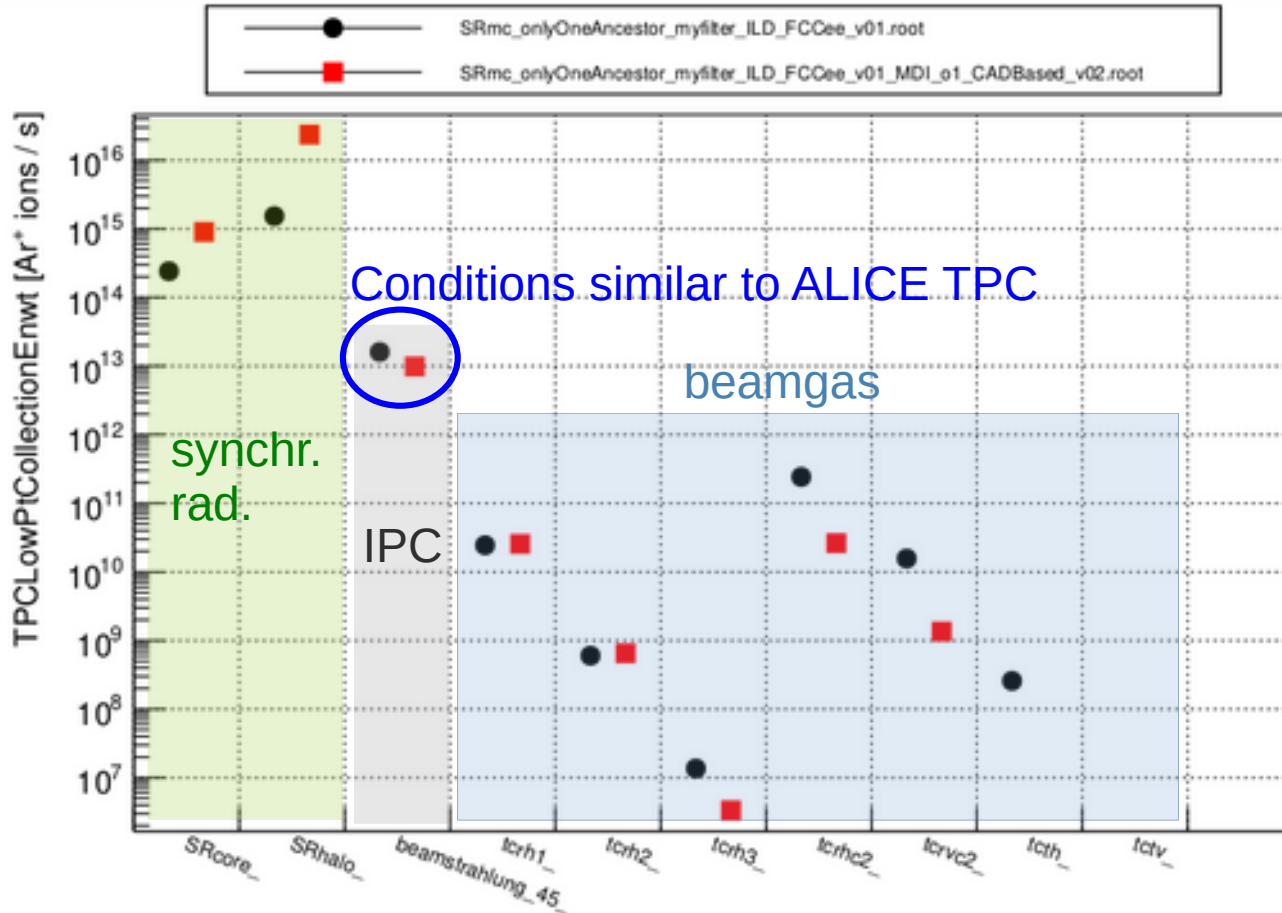
**SR background (core)**  
increases by  $\sim 3$

**SR background (halo)**  
increases by  $\sim 20$

No effect on **IPC**

**beamgas** negligible

# TPC



**new MDI:**

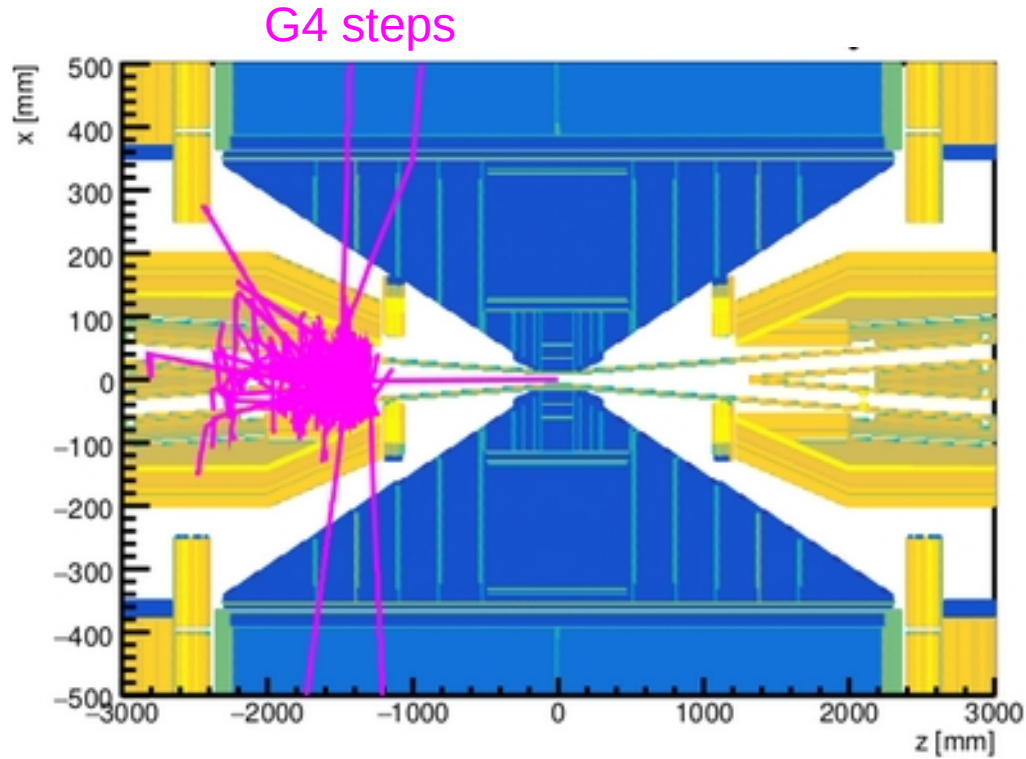
**SR background (core)**  
increases by  $\sim 3$

**SR background (halo)**  
increases by  $\sim 20$

No effect on **IPC**

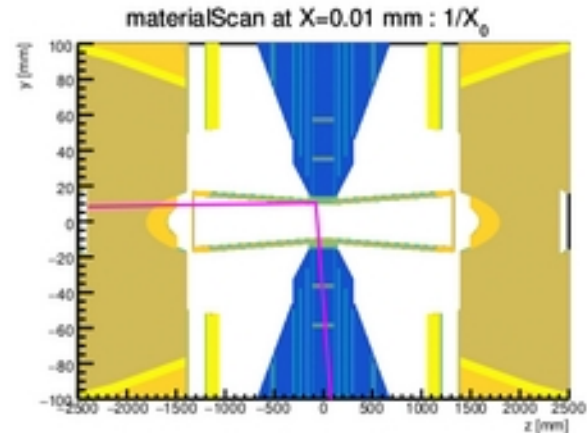
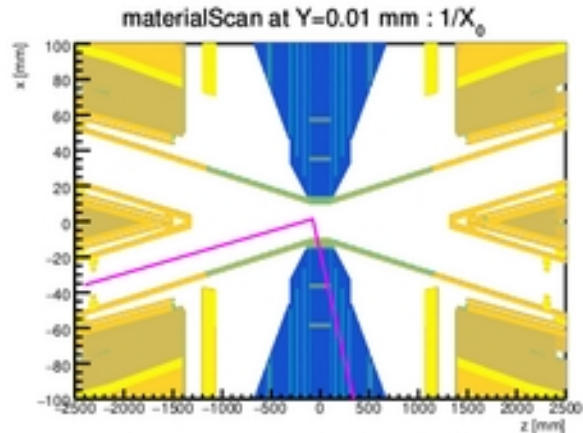
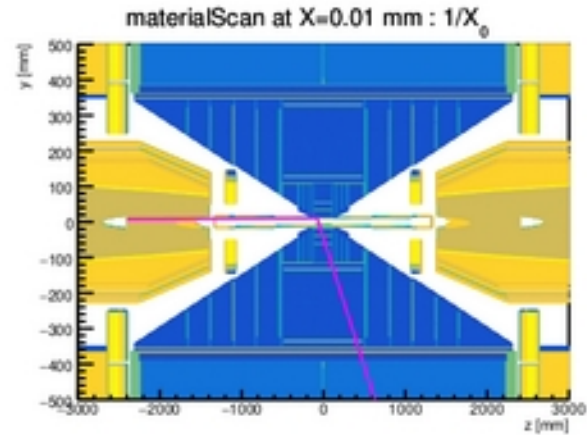
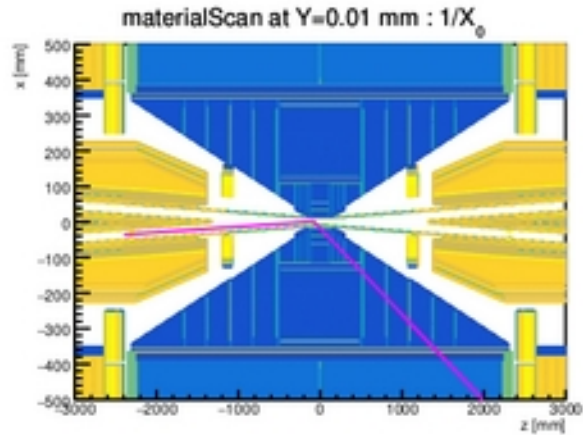
**beamgas** negligible

How do photons reach the TPC (from IPC) ?



Single initial e<sup>-</sup> 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**

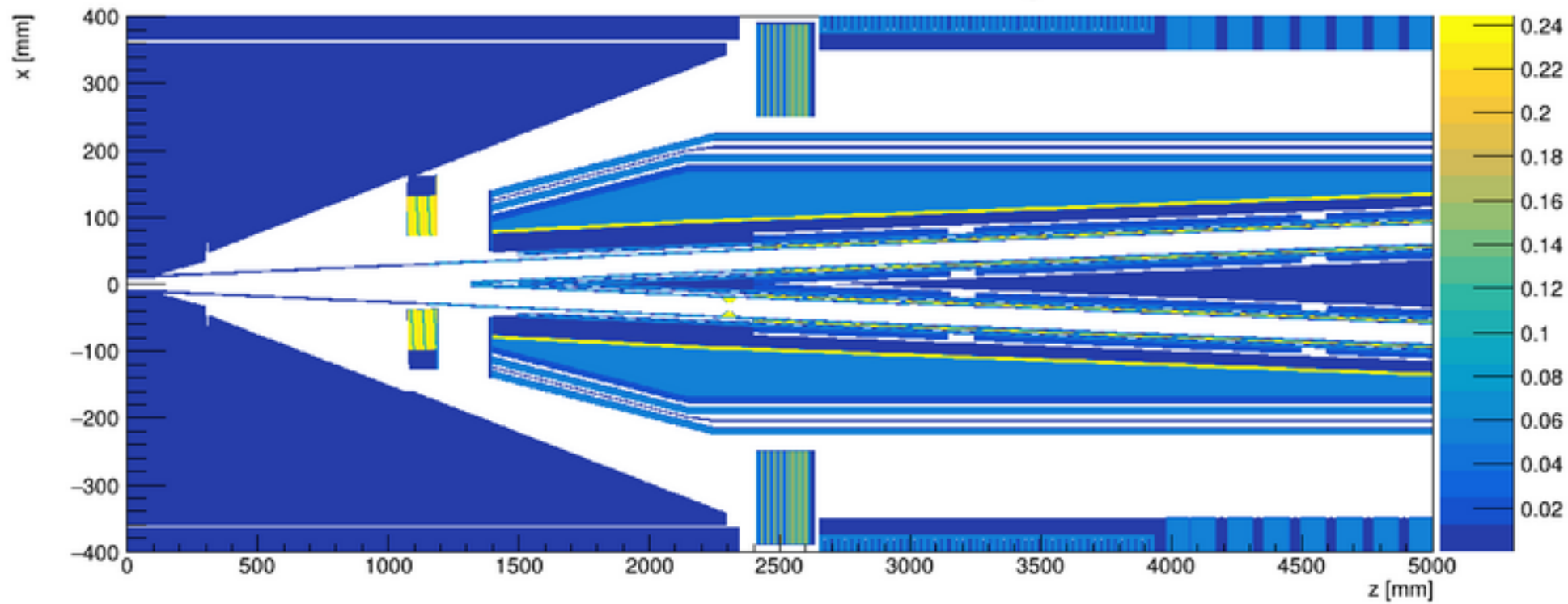
more realistic, significantly more material  
less background for vertex detector  
more background for central tracking

SR will create 2~3+ orders of magnitude more  
space charge buildup in TPC than @ ALICE...

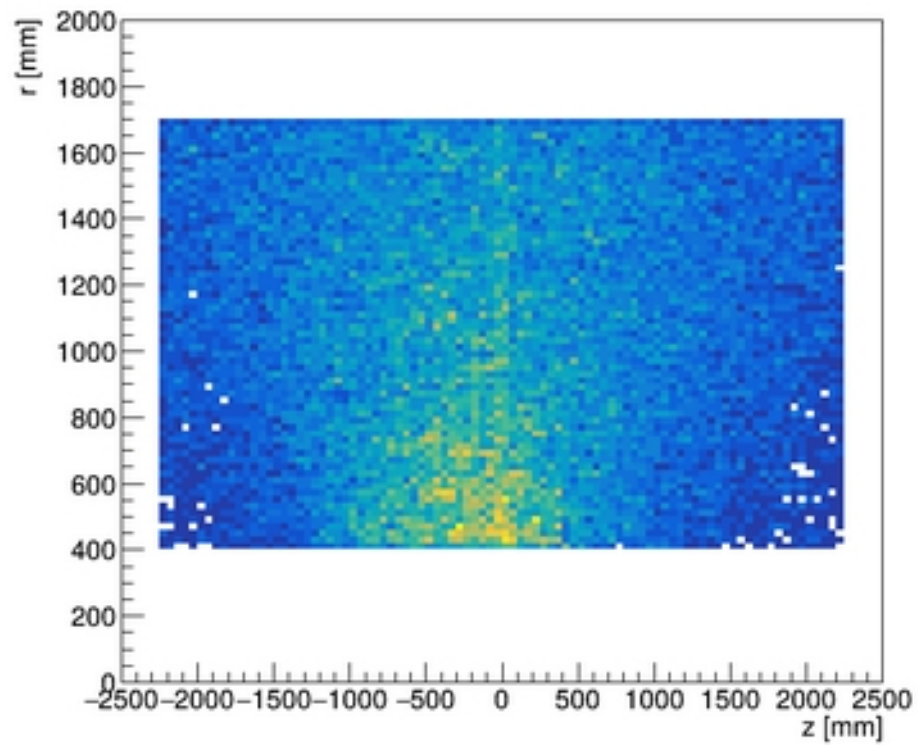
More investigation needed on if it's possible to mitigate this

backup

materialScan at  $Y=0.01$  mm :  $1/X_0$



hSRhalo\_TPCLowPtCollection\_zr



hSRhalo\_TPCLowPtCollection\_xy

