ILD models for a circular collider
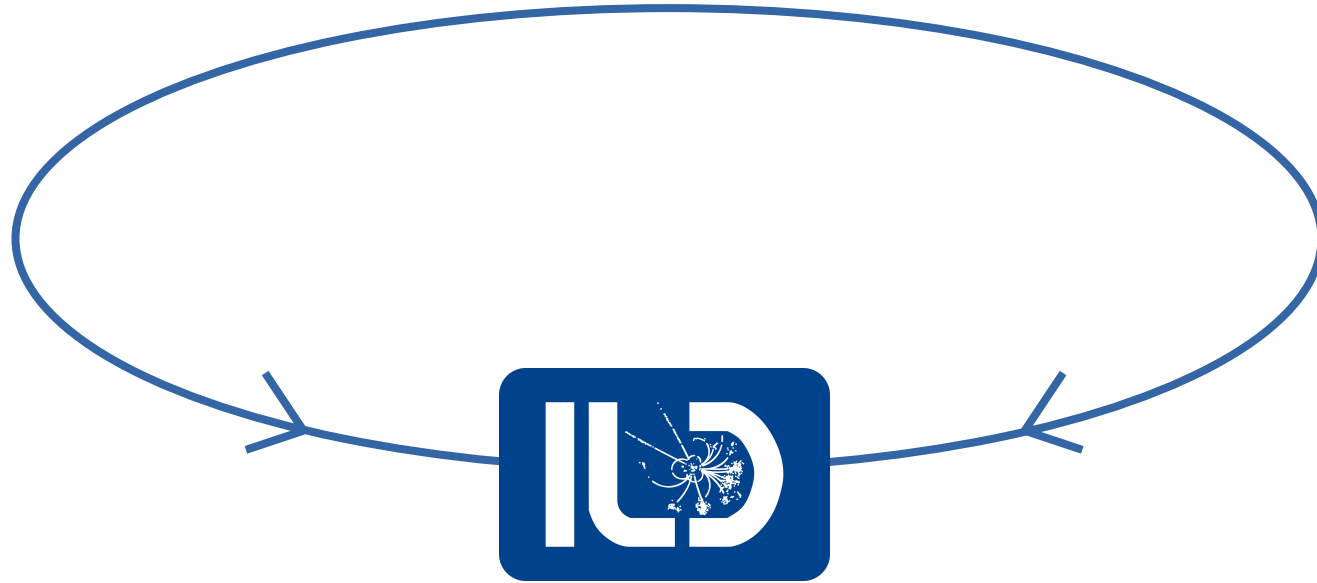
ILD was designed with the ILC in mind

circular Higgs Factory colliders

"same" colliding particles,
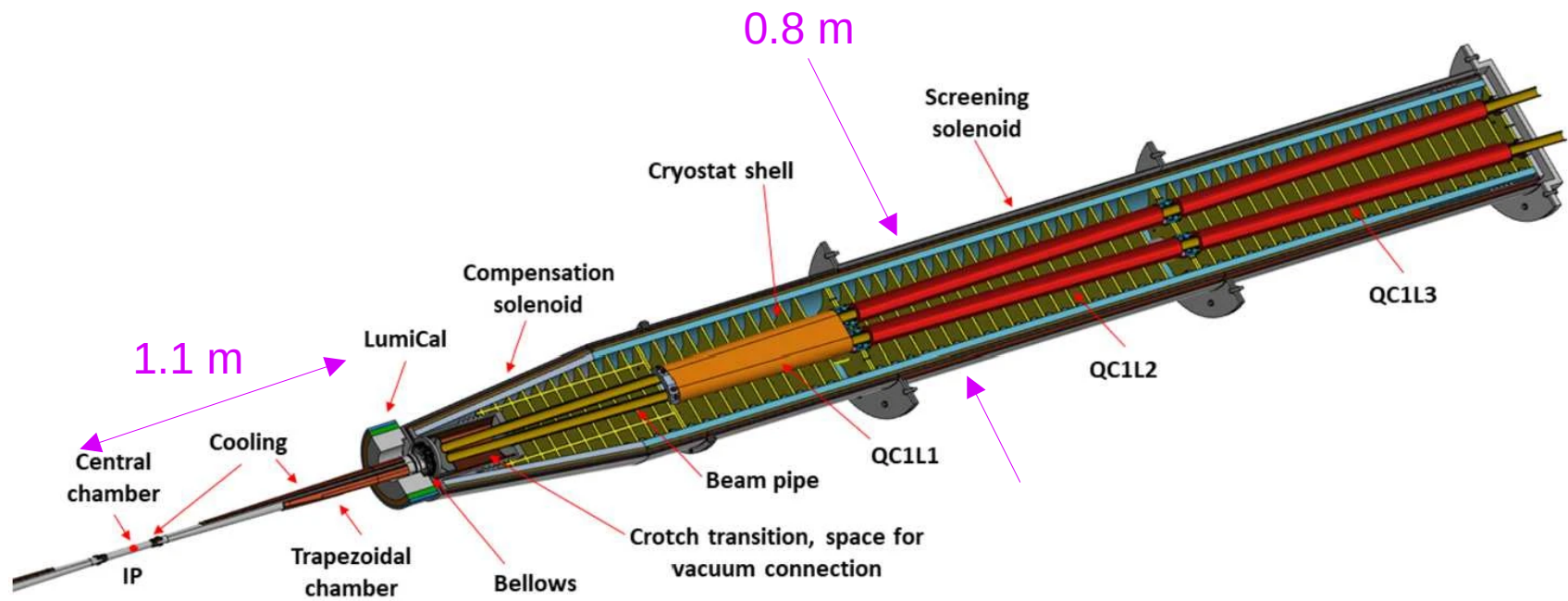"same" physics processes,
same detector ?

major differences:

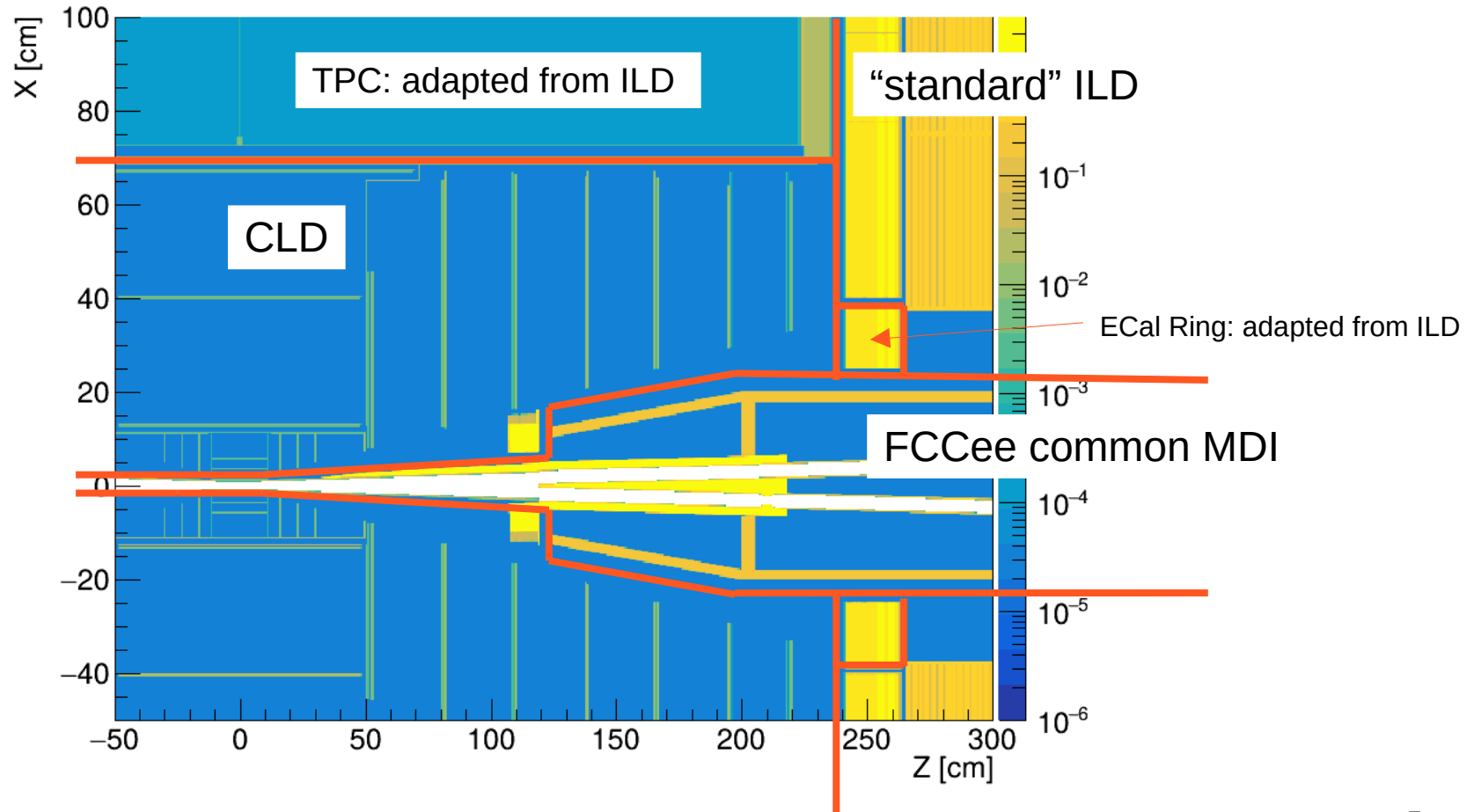collision rate

interface to the collider
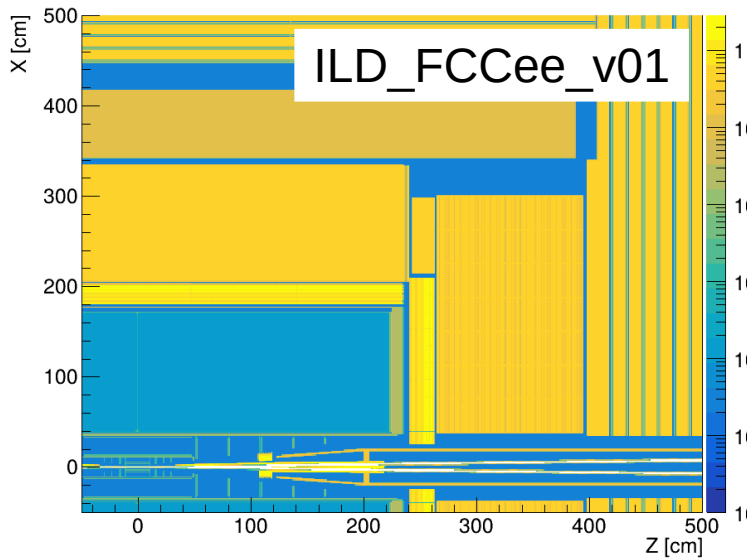
importance of different collision energies

these impose constraints which "ILD for ILC" may not satisfy

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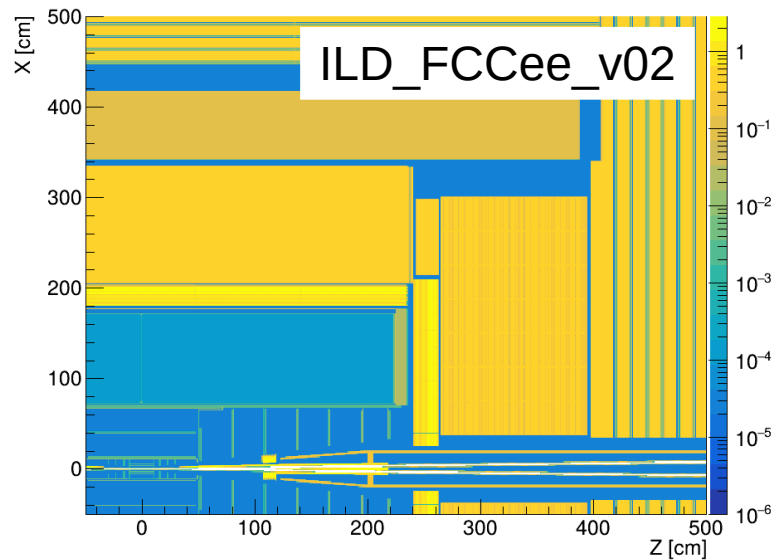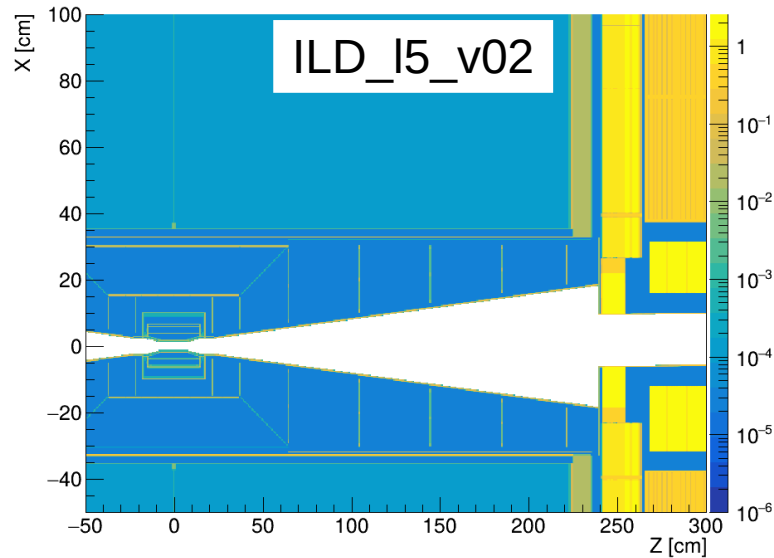|	ILC	FCCee
crossing angle	14 mrad	30 mrad
L* [distance from IP to last accel focusing quadupole magnet]	4.1 m	2.0 m
detector solenoid	3.5 T	2.0 T
additional B-fields	anti-DID (?)	- compensating - screening

0.8 m

Screening solenoid

Cryostat shell

Compensation solenoid

LumiCal

1.1 m

Cooling

Central chamber

IP

Trapezoidal chamber

Bellows

Beam pipe

Crotch transition, space for vacuum connection

QC1L1

QC1L2

QC1L3

Boscolo, M., Palla, F., Bosi, F. et al. Mechanical model for the FCC-ee interaction region.
EPJ Techn Instrum 10, 16 (2023). https://doi.org/10.1140/epjti/s40485-023-00103-7

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k4geo : "plug and play"

TPC: adapted from ILD

"standard" ILD

CLD

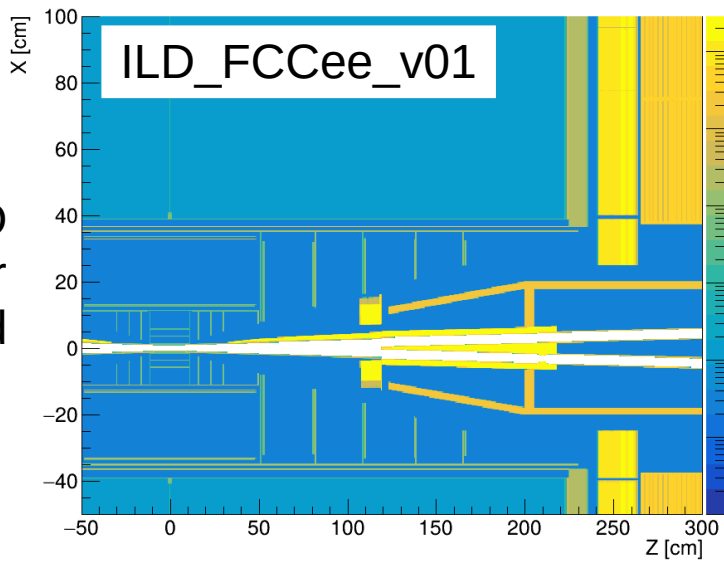ECal Ring: adapted from ILD

FCCee common MDI

Work
In
Progress
with
Victor Schwan

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ILD_l5_v02

TPC (almost) unchanged

TPC inner radius increases ~40 cm

ILD_FCCee_v01

CLD inner tracker squeezed

ILD_FCCee_v02
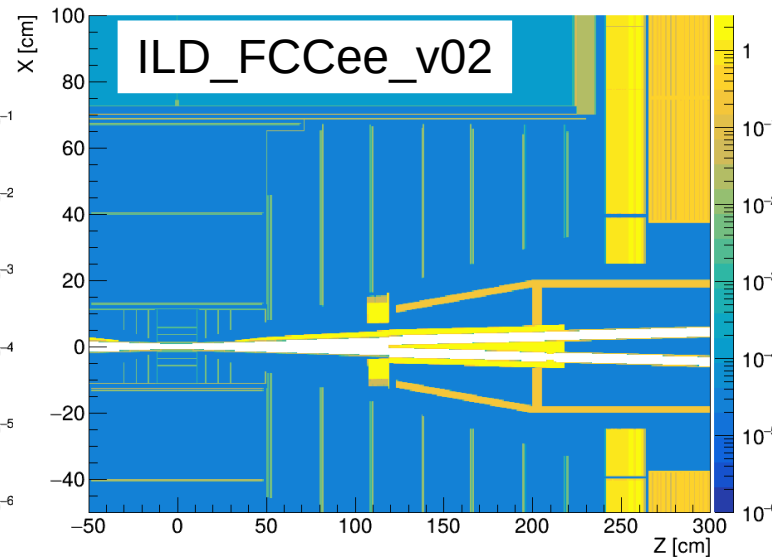
CLD inner tracker unchanged

7
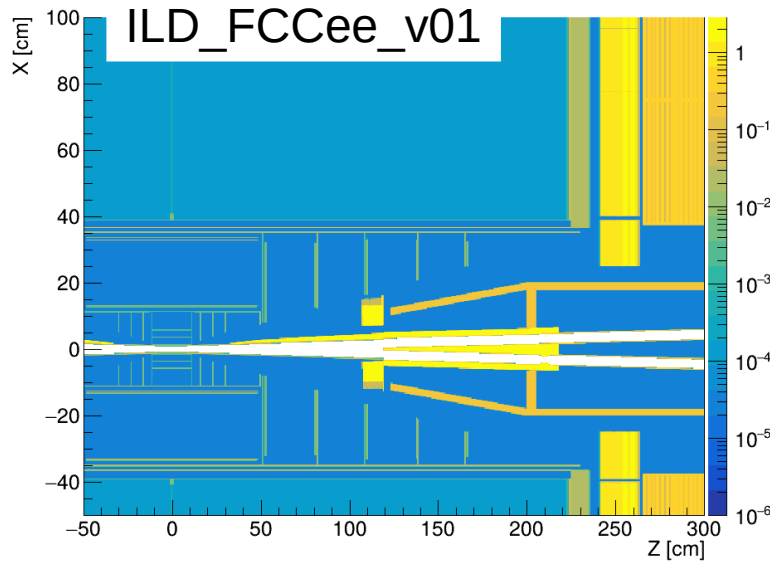
better TPC coverage
→ better dEdx
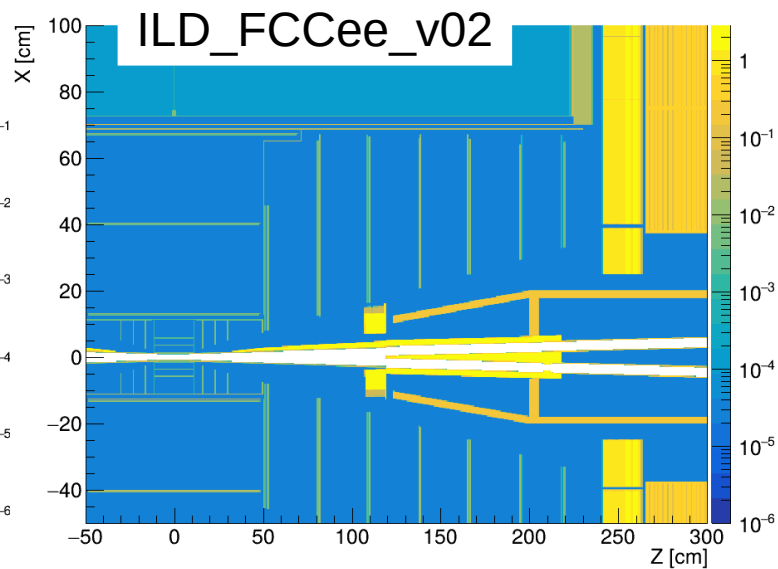
better forward tracking (?)
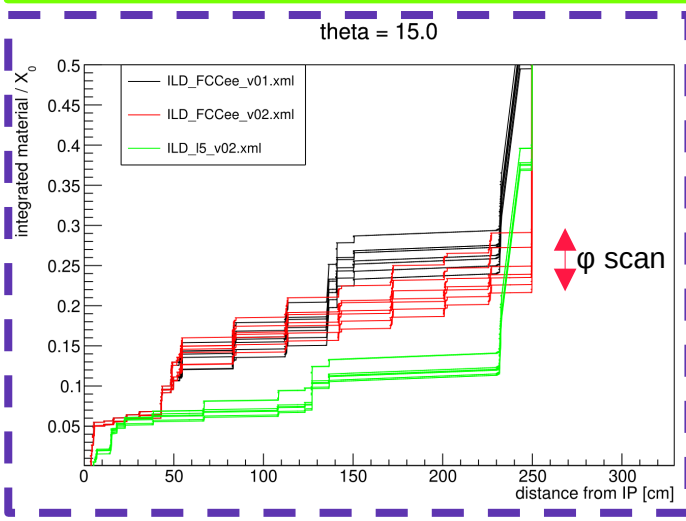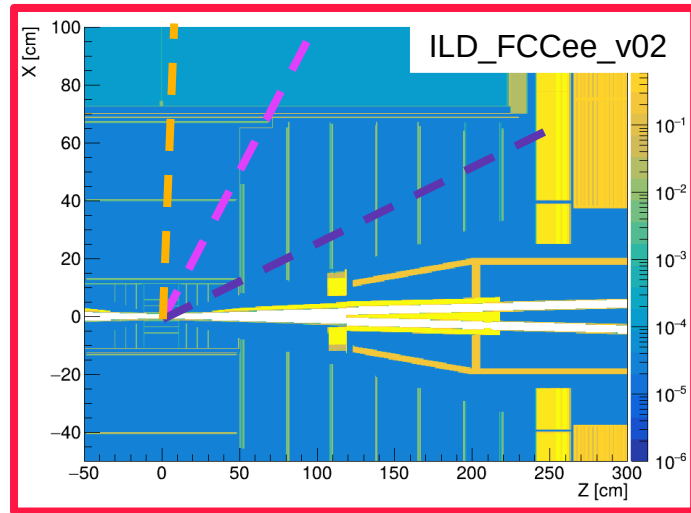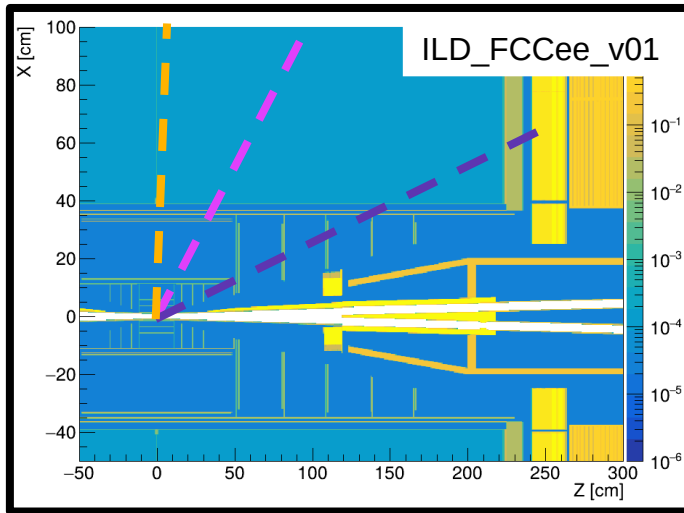
TPC avoids more severe
beamsstrahlug bg.
@ smaller radius

momentum resolution ?

tracking efficiency ? at low pT, with backgrounds ?

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material budget
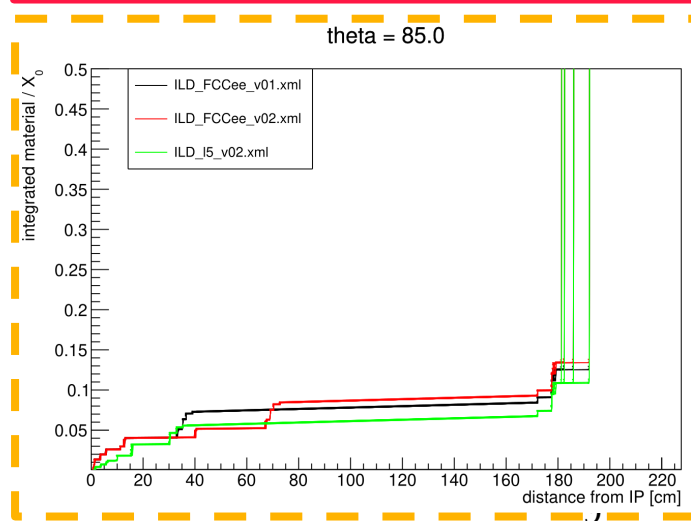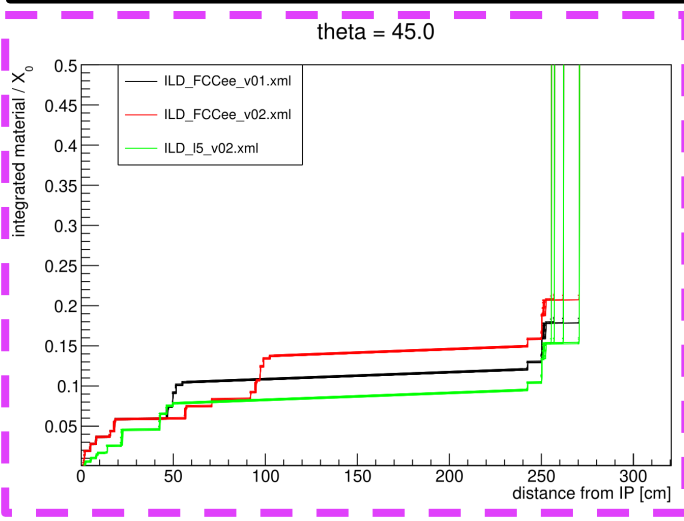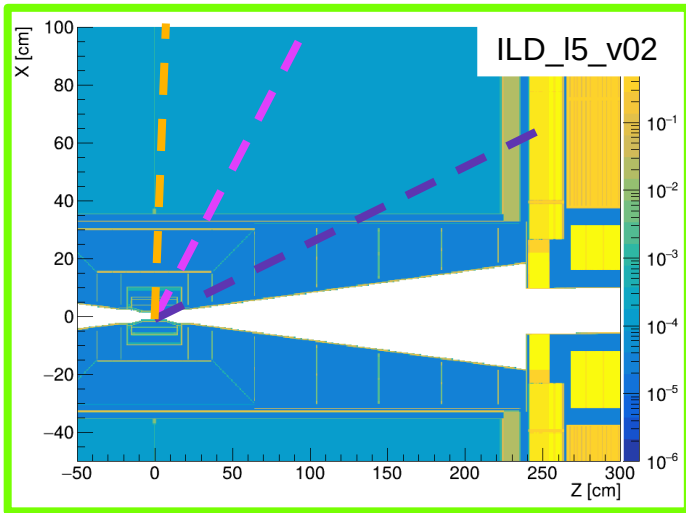
more material in CLD-tracker: effect on momentum resolution, b/c-tagging ?

future improvements for "circular" models

    - WIP: get track reconstruction working
        now we get separate tracks from the
            inner silicon ("Conformal Tracking") and TPC ("Clupatra")
        need to be combined, + SET, ...

    - review of tracker material budget ?

    - implement other hardware changes (eg cooling infrastructure)
        needed to maintain ILD's degree of "realism"

    - pixel TPC

Summary

propose two ILD variants which would fit at a circular collider

should allow study of the 1ˢᵗ order differences between ILC & FCCee

simulation models have been written
    currently labeled "work in progress"
    if you are happy with them, we can make them official (ie release into k4geo)
    plan to put under k4geo/FCCee/ILD_FCC directory

track reconstruction is being worked on (V. Schwan, T. Madlener, …)

then need to get PFA working, and extract the usual performance plots.

your contributions, suggestions, comments are highly welcome

backup

new FCCee models			
ILD_FCCee_v01	2.0 (uniform)	FCC-ee	351 ± 115
ILD_FCCee_v01	2.0 (map)	FCC-ee	261 ± 86
ILD_FCCee_v01	2.0 (map), no mask	FCC-ee	707 ± 116
ILD_FCCee_v01	2.0 (map), no mask HOM	FCC-ee	536 ± 114

- many TPC hits induced by beamstrahlung
   interactions with shielding

- if we remove the shielding, they just interact
   elsewhere: actually *increases* TPC backgrounds

- limited scope to reduce MDI-related backgrounds?
   any ideas out there?