Background:

-> FCCee talk by Emilia (30 min.),
during the FCC week in Berlin (part of the REVIEW talks)
"The presentation will take place in front of the IAB, and need to contain the status of the study and the prospects towards the CDR corresponding chapter." (P. Janot)

-> rehearsal talk already on 8 May (!)

-> ok to show what we have at this point (including the software tools!), and show some performances / dependencies

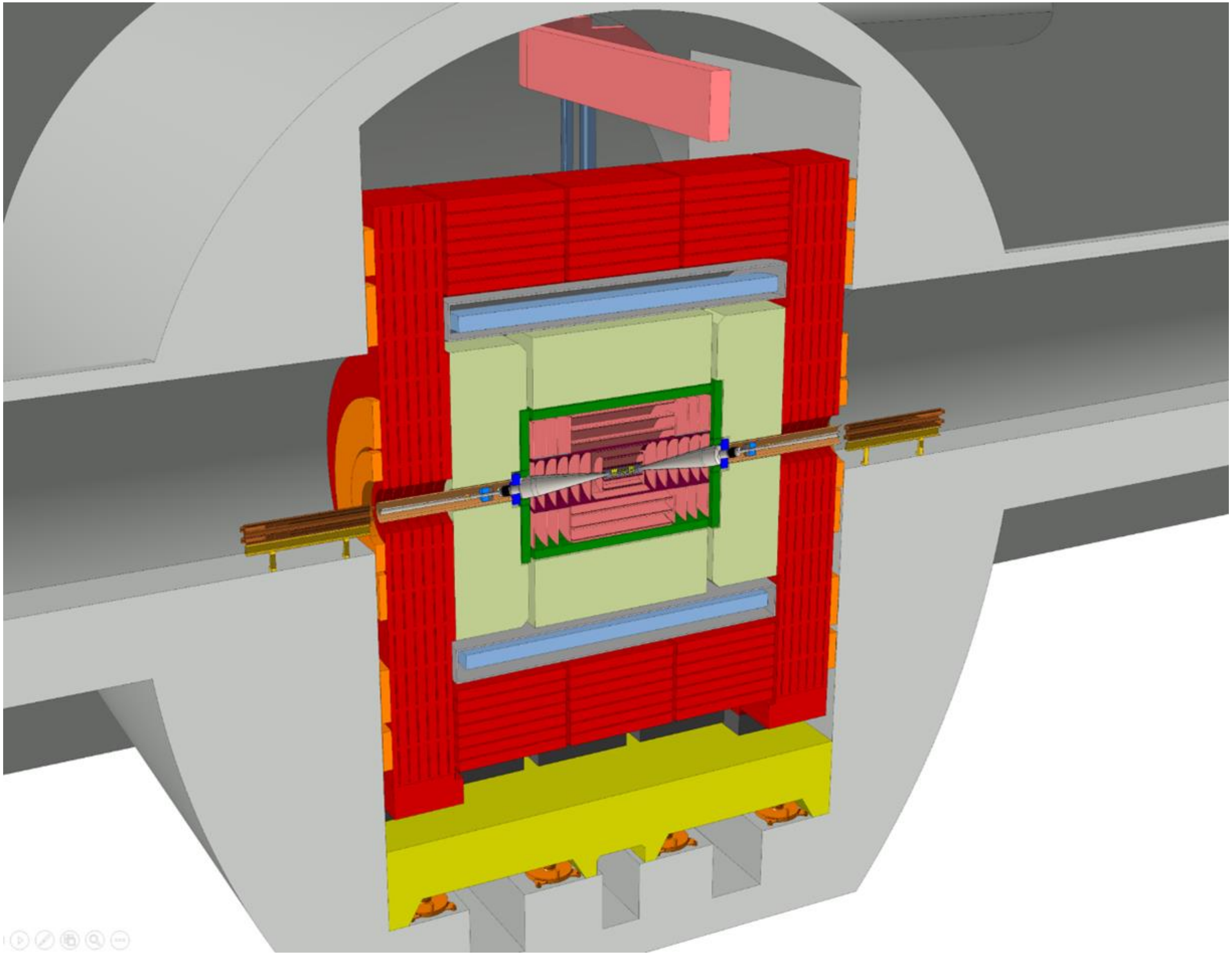
-> should show what we are planning to work on in the time until the FCC CDR, for which a draft is requested in July 2018 (?)

(A) changes to CLICdet and the resulting performances ("detector optimization")

(B) overlay with background (pairs, hadrons and MAINLY synchrotron rad. photons)

(C) Which type of events relevant for FCCee ? Any benchmark analysis ??

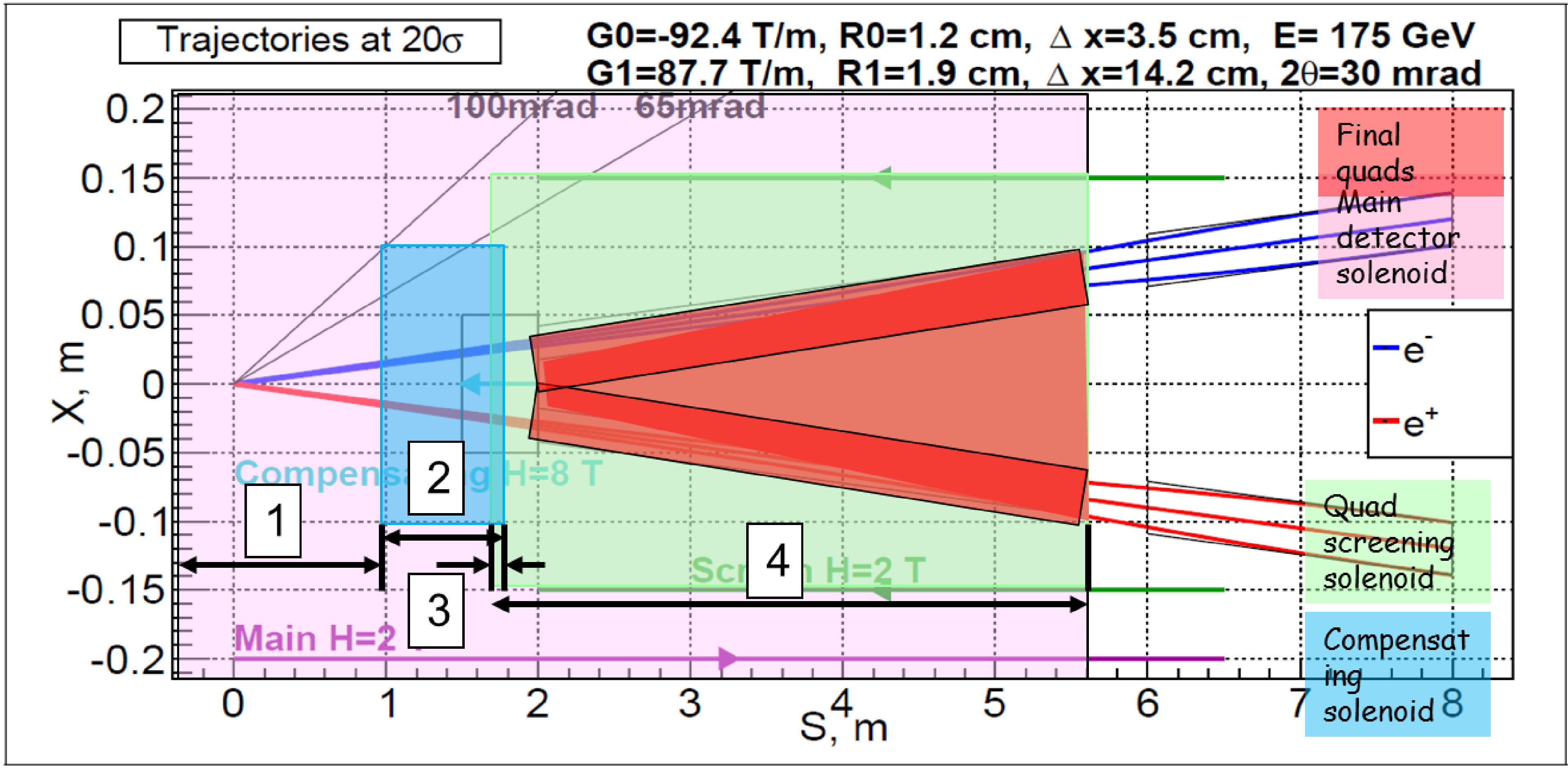
CLICdet (crossing angle 20 mrad)



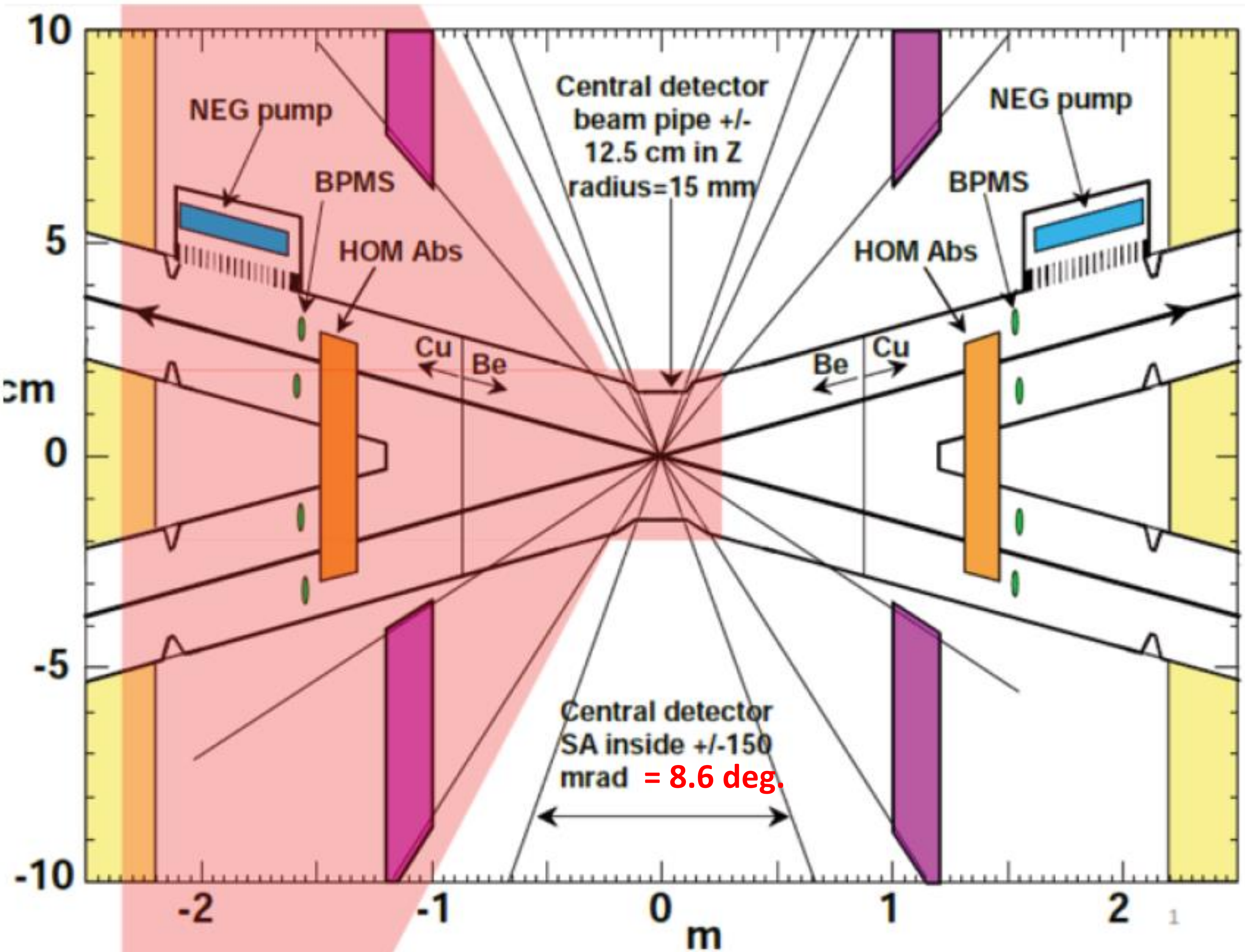
FCCee (crossing angle 30 mrad)

MDI extended region – all inside 100 mrad cone (= 5.7 deg)

NB. In this sketch, the main detector solenoid extends to z =5.6 m



FCCee MDI present schematic layout



Concept	CLICdet	FCCee
Vertex inner radius [mm]	31	17
Tracker technology	Silicon	
Tracker half length [m]	2.2	shorter ? depends on R ($L^* = 2.2$ m)
Tracker outer radius [m]	1.5	**2.0 ???** (ILD: 1.8)
ECAL absorber	W	
ECAL X_0	22	
ECAL barrel r_{min} [m]	1.5	
ECAL barrel Δr [mm]	202	
ECAL endcap z_{min} [m]	2.31	
ECAL endcap Δz [mm]	202	
HCAL absorber barrel / endcap	Fe / Fe	
HCAL λ_{I}	7.5	
HCAL barrel r_{min} [m]	1.74	
HCAL barrel Δr [mm]	1590	
HCAL endcap z_{min} [m]	2.45	
HCAL endcap Δz [mm]	1590	
Solenoid field [T]	4	2
Solenoid bore radius [m]	3.5	3.3 (no change?)
Solenoid length [m]	8.3	8.0 (no change?)
Overall height [m]	12.9	
Overall length [m]	11.4	
Overall weight [t]	8100	

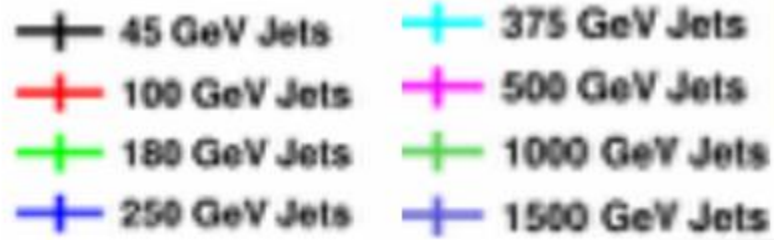
ECAL sandwich structure

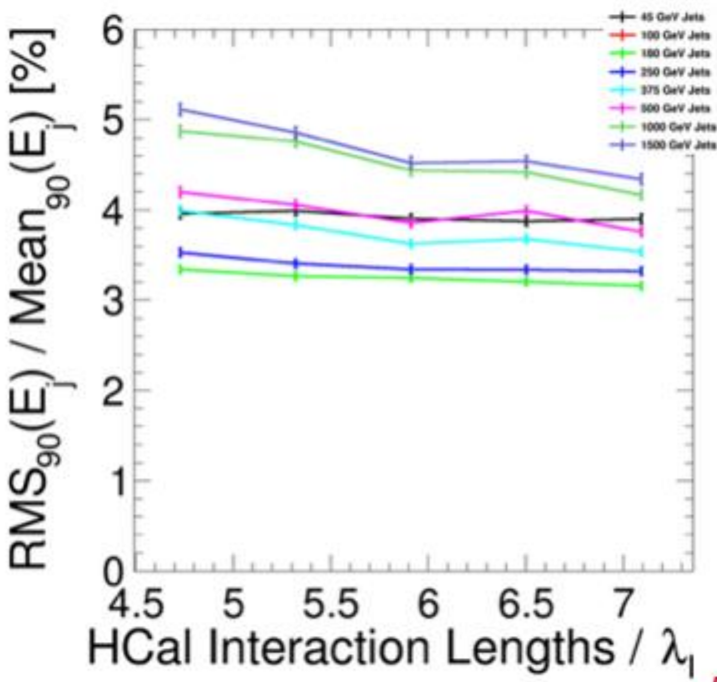
CLICdet: 40 layers (1.9 mm W + 3.15 mm “rest”) total about 22 X_o
Total thickness **202 mm**

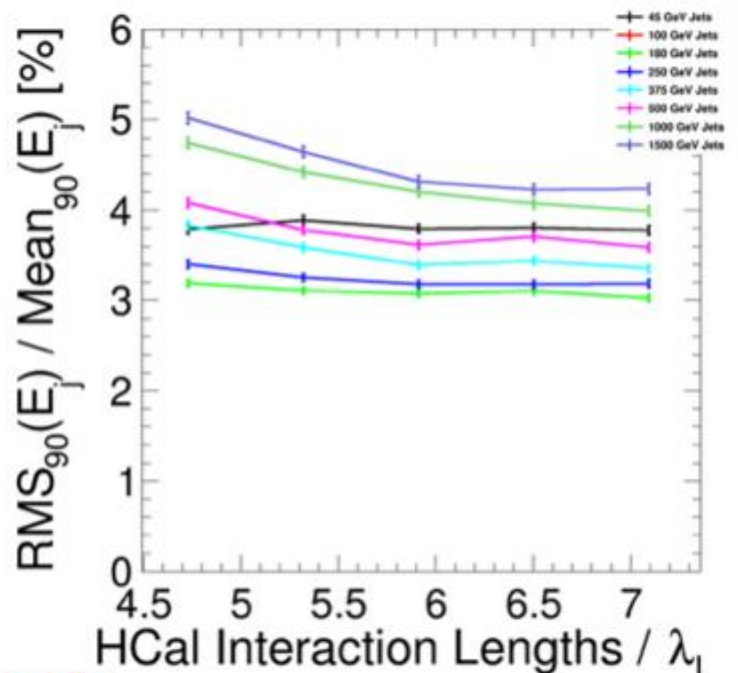
Proposal:
FCCee: 30 layers (2.6 mm W + 3.15 mm “rest”) total about 22 X_o
Total thickness **173 mm**

HCal Depth

S. Green, Cambridge







$Z \rightarrow uds$

10 ns HCal Timing Cut

10^6 ns HCal Timing Cut

- **Results in line with previous studies: ~7.5λ in the HCal is optimal**

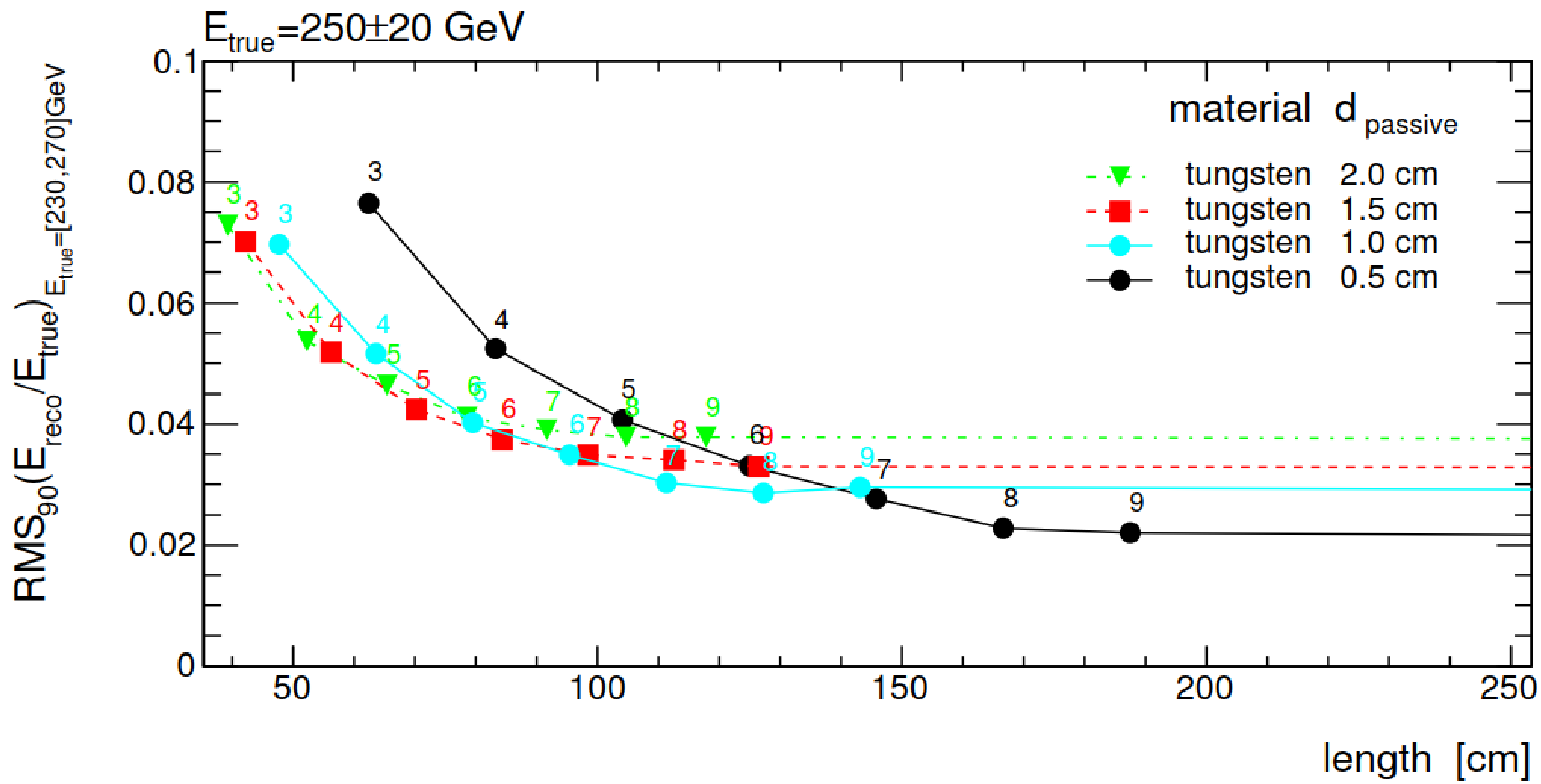


Figure 3: Energy resolution for particles in the HCAL with an energy from 230 GeV to 270 GeV as a function of the HCAL length (i.e. the depth of the calorimeter). The resolutions for passive layers made of tungsten and with thicknesses $d_{passive}$ ranging from 5 to 20 mm are shown. The numbers above the data points indicate the corresponding nuclear interaction length λ_I.

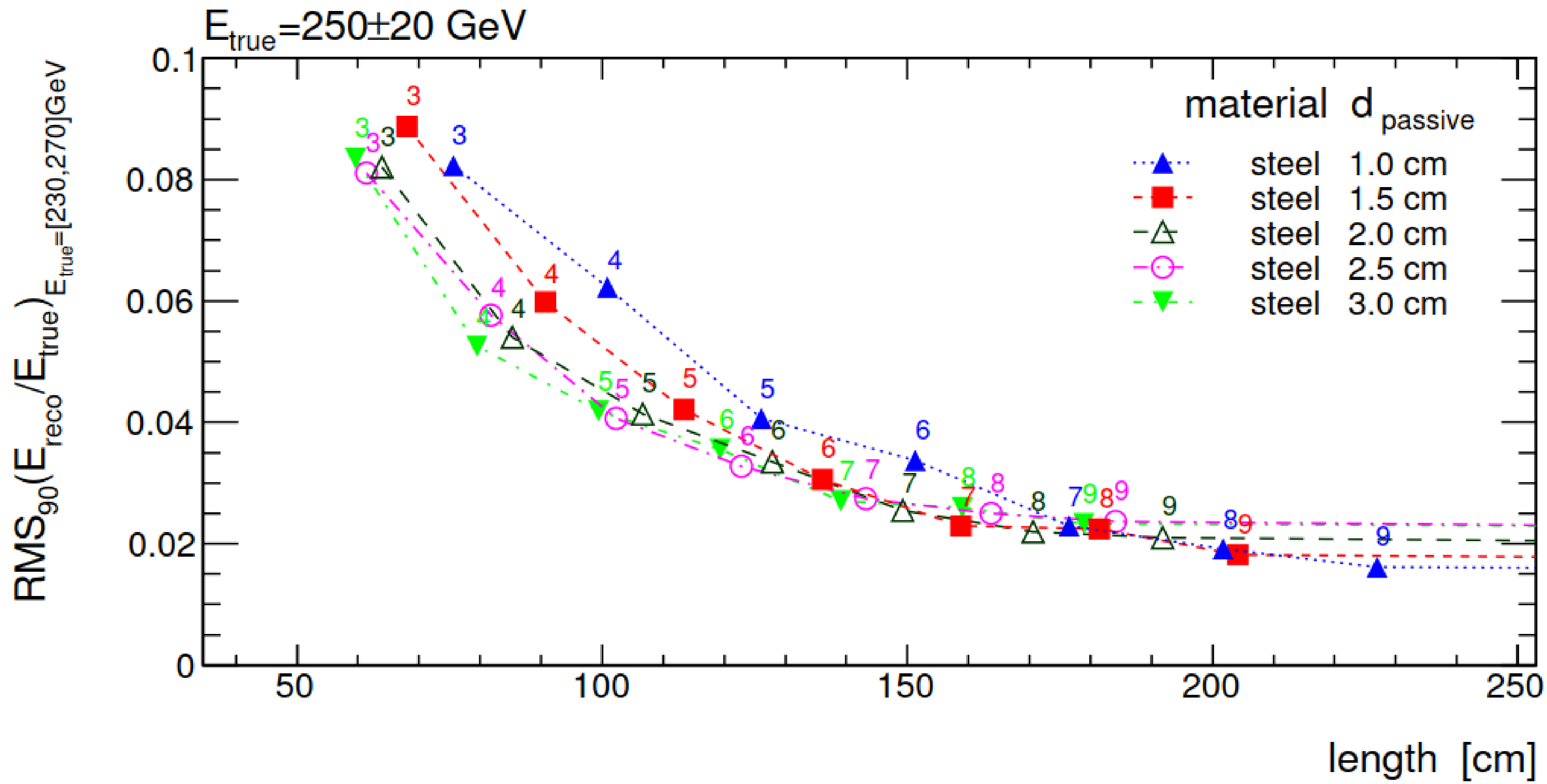


Figure 4: Energy resolution for particles in the HCAL with an energy from 230 GeV to 270 GeV as a function of the HCAL length (i.e. the depth of the calorimeter). The resolutions for passive layers made of steel and with thicknesses $d_{passive}$ ranging from 10 to 30 mm are shown. For very deep calorimeters where (almost) all hadronic showers are fully contained (outside the scope of the figure) the energy resolution is best for 10 mm thick passive layers and worsens for 15, 20, 25 and 30 mm in that order.

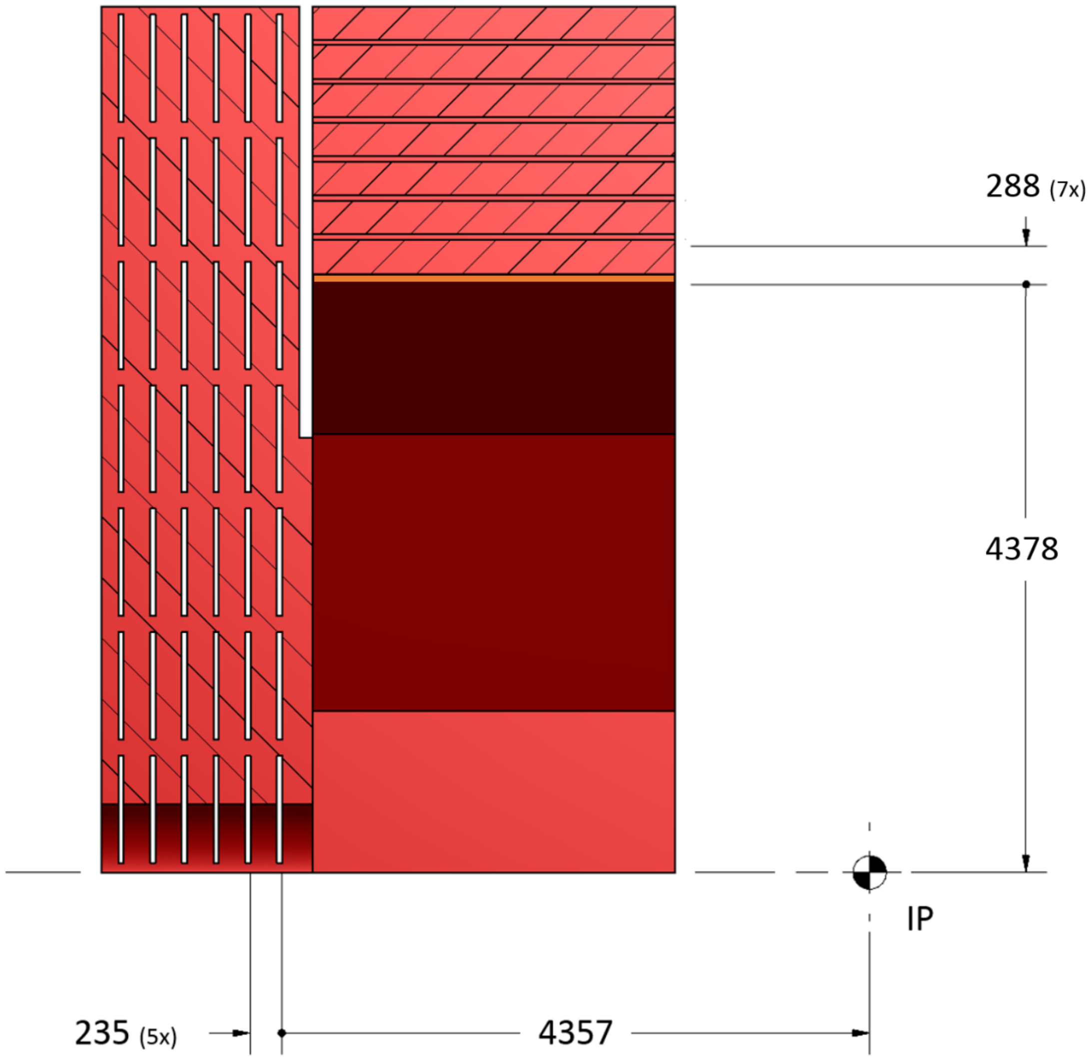
Concept	CLICdet	FCCee
Vertex inner radius [mm]	31	17
Tracker technology	Silicon	
Tracker half length [m]	2.2	shorter ? depends on R (L^* = 2.2 m)
Tracker outer radius [m]	1.5	**2.0 ???** (ILD: 1.8)
ECAL absorber	W	
ECAL X_0	22	
ECAL barrel r_{min} [m]	1.5	
ECAL barrel Δr [mm]	202	173
ECAL endcap z_{min} [m]	2.31	
ECAL endcap Δz [mm]	202	173
HCAL absorber barrel / endcap	Fe / Fe	
HCAL λ_{I}	7.5	**6 ???** (= ILD)
HCAL barrel r_{min} [m]	1.74	
HCAL barrel Δr [mm]	1590	
HCAL endcap z_{min} [m]	2.45	
HCAL endcap Δz [mm]	1590	1280
Solenoid field [T]	4	2
Solenoid bore radius [m]	3.5	3.3 (no change?)
Solenoid length [m]	8.3	8.0 (no change?)
Overall height [m]	12.9	
Overall length [m]	11.4	
Overall weight [t]	8100	

Yoke and muon detection system:

(NB. Some experts pretend no yoke is needed – and that's the det. model for FCC-hh – but stray field effect on the ee beams are still much discussed)

Thickness as in CLICdet in end-caps (but without end-coils);

Thinner than CLICdet in barrel (same thickness as end-caps?)



… more discussion…

CLICdet (from the CLICdp Note)

Description of the coil elements as implemented in the simulation model. For all elements the material, the longitudinal extent in one half of the detector $z_{min/max}$ and the radial extent $r_{min/max}$ are given.

Material	z_{min} [mm]	z_{max} [mm]	r_{min} [mm]	r_{max} [mm]
Steel	0	4129	3483	3523
Vacuum	0	4129	3523	3649
Aluminium	0	3900	3649	3993
Vacuum	0	4129	3993	4250
Steel	0	4129	4250	4290
Vacuum	3900	4089	3649	3993
Steel	4089	4129	3483	4290

Solenoid coil and vacuum tank (steel option)

item	CLICdet [mm]	FCCee [mm]
Conductor (“aluminium”) z(max)	3900	3820
Conductor (“aluminium”) R(inner)	3649	3450
Conductor (“aluminium”) ΔR	344	120
Steel inner tank R(inner)	3483	3300
Steel inner tank (average) ΔR	40	50
Steel outer tank R(inner)	4250	3770
Steel outer tank (average) ΔR	40	24
Steel end plates (lid) z(max)	4129	4000
Steel end plates (lid) Δz	40	40 (?)
Vacuum inner layer ΔR	126	100 (?)
Vacuum outer layer ΔR	257	200 (?)
Vacuum (ends) Δz	189	180 (?)