GLD Overview

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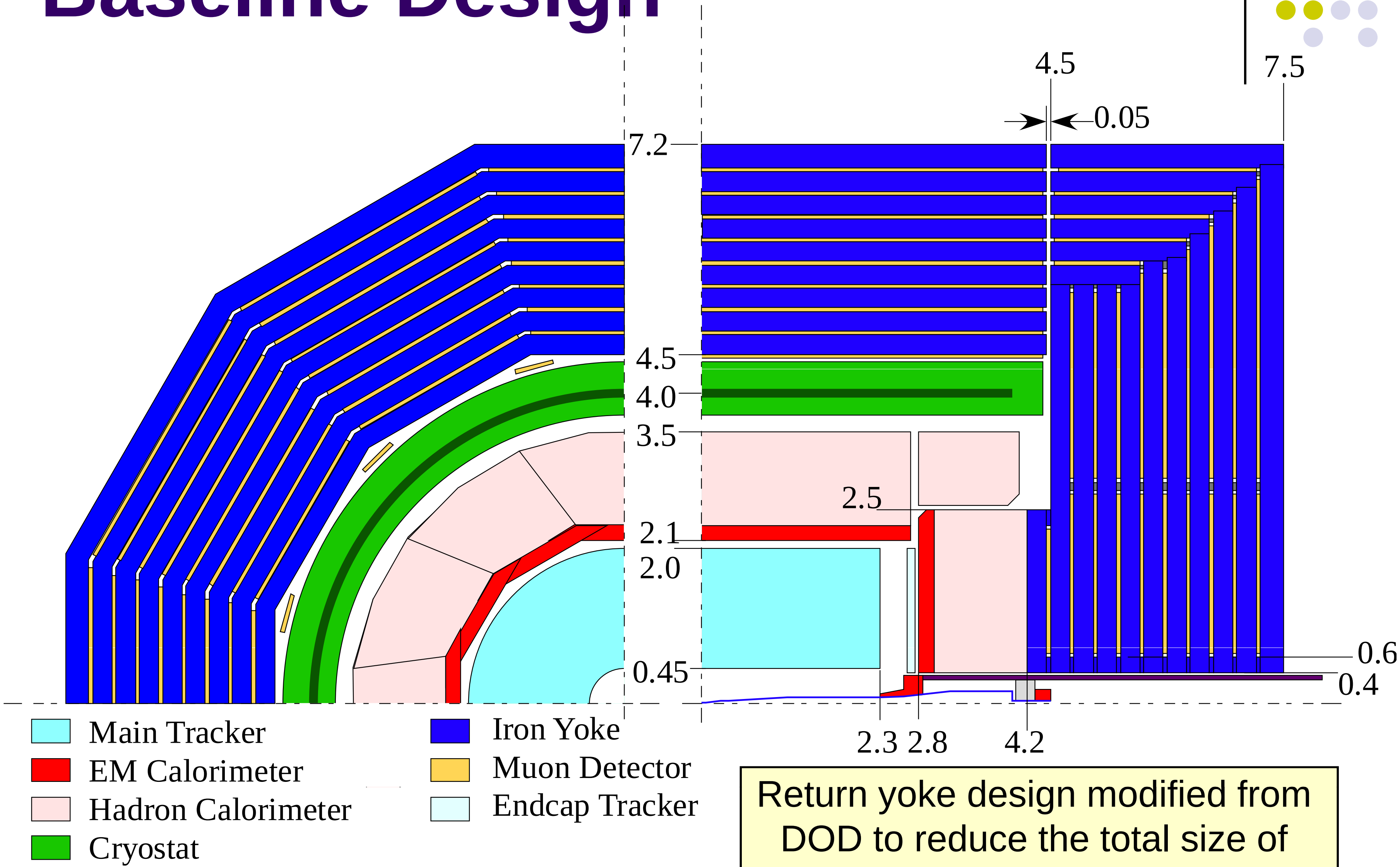
Baseline Design

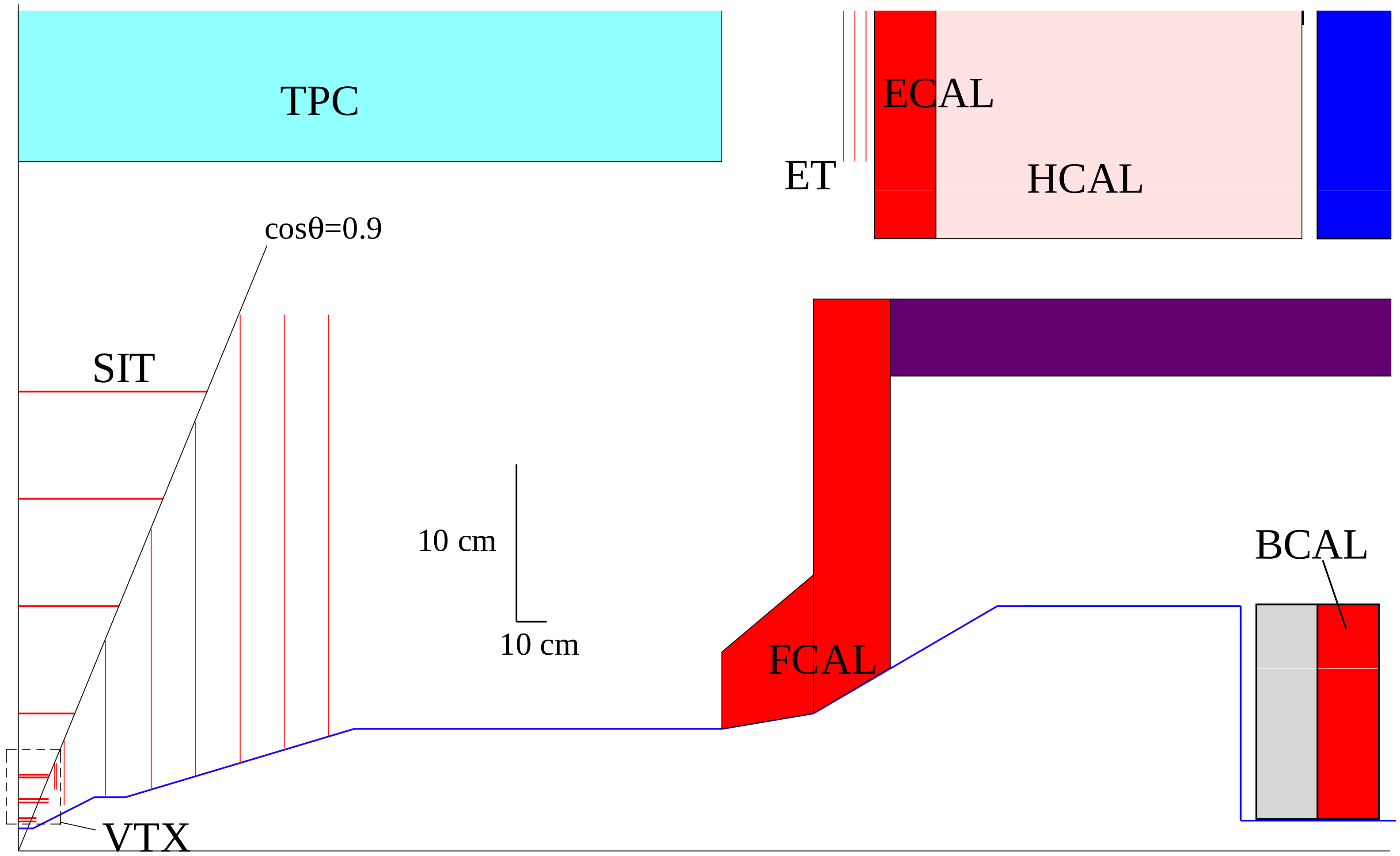
- Large gaseous central tracker; TPC
- Large-radius, high-granularity ECAL with W/Scinti sandwich structure
- Large-radius, medium granularity, thick (~6λ) HCAL with Pb(Fe)/Scinti. sandwich structure
- Forward CAL (FCAL and BCAL) down to 5mrad
- Precision Si micro-vertex detector
- Si inner tracker (barrel and forward)
- Si endcap tracker
- Beam profile monitor in front of BCAL
- Muon detector interleaved with iron plates of the return yoke
- Moderate magnetic field of 3T

Baseline Design

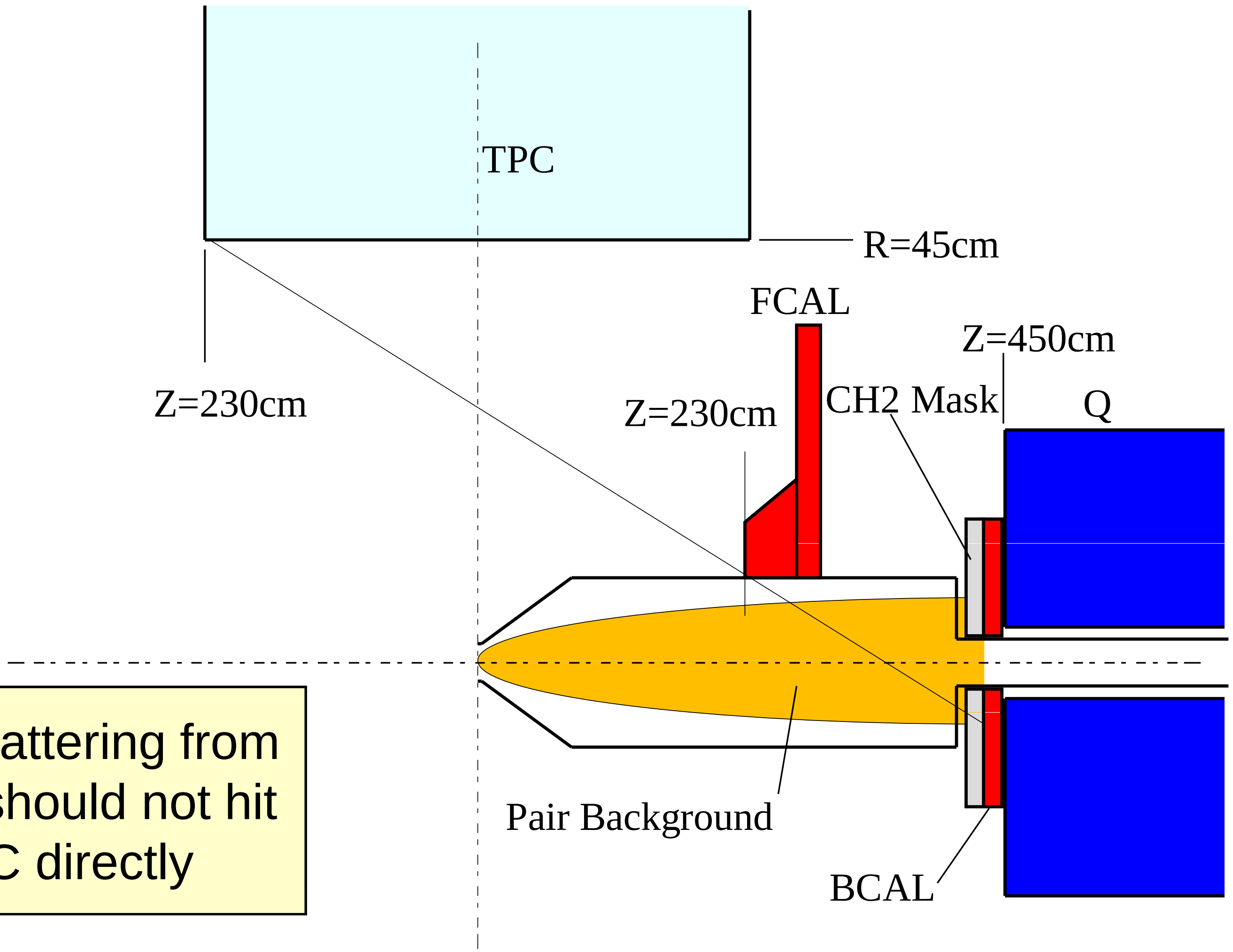


Return yoke design modified from DOD to reduce the total size of the detector and exp-hall size

Baseline Design



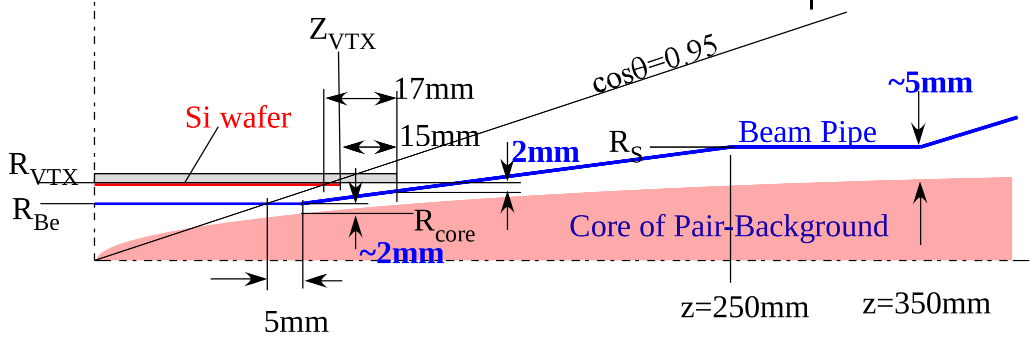
Baseline Design

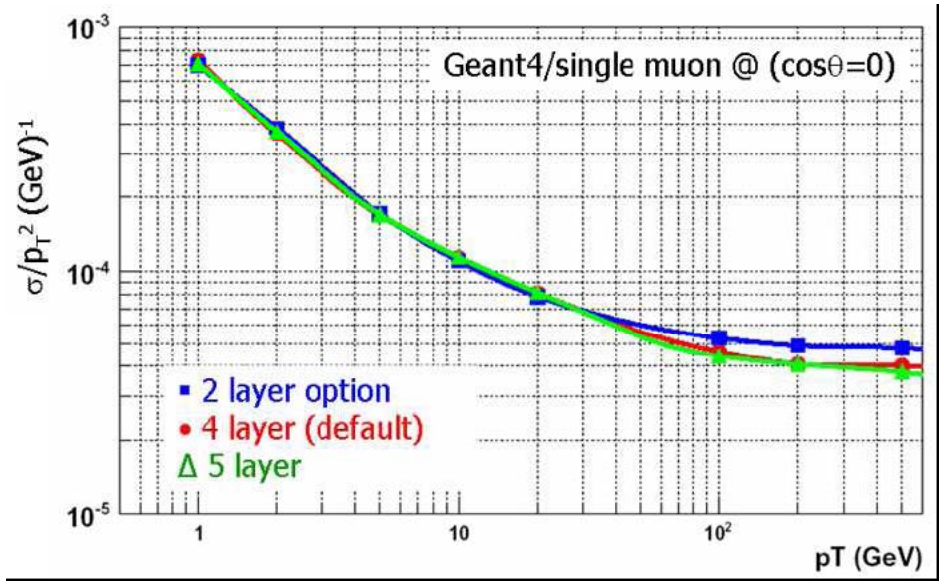


Back-scattering from BCAL should not hit TPC directly

Detector Parameters

- VTX
  - 6 layers (3 doublets)
  - R=20(18) mm – 50 mm
  - Fine pixel CCD as the baseline design
- SIT
  - DSSD, 4 layers,R=9 - 30 cm
  - 7 discs in forward region, Z=15.5 - 101.5cm
  - Bunch ID capability
- TPC
  - R=45 cm – 200 cm
  - Z=230 cm





Detector Parameters

- ECAL
  - W/Scintillator/Gap = 3/2/1 mm
  - 33 layers
  - 1cmx4cm scintillator strips, w.l.s. fiber+MPPC (SiPM) readout
  - 2cmx2cm scintillator tile as an option
  - 26 X_0, 1 λ
- HCAL
  - Pb(Fe)/Scinti./Gap = 20/5/1 mm
  - 46 layers
  - 1cmx20cm scintillator strips + 4cmx4cm scintillator tile, w.l.s. fiber+MPPC readout
  - 5.7 λ
- Muon detector
  - 8/10 layers in 4-cm gaps between 25-30 cm thick iron slabs of return yoke
  - X-Y scintillator strips with w.l.s.fiber+MPPC readout

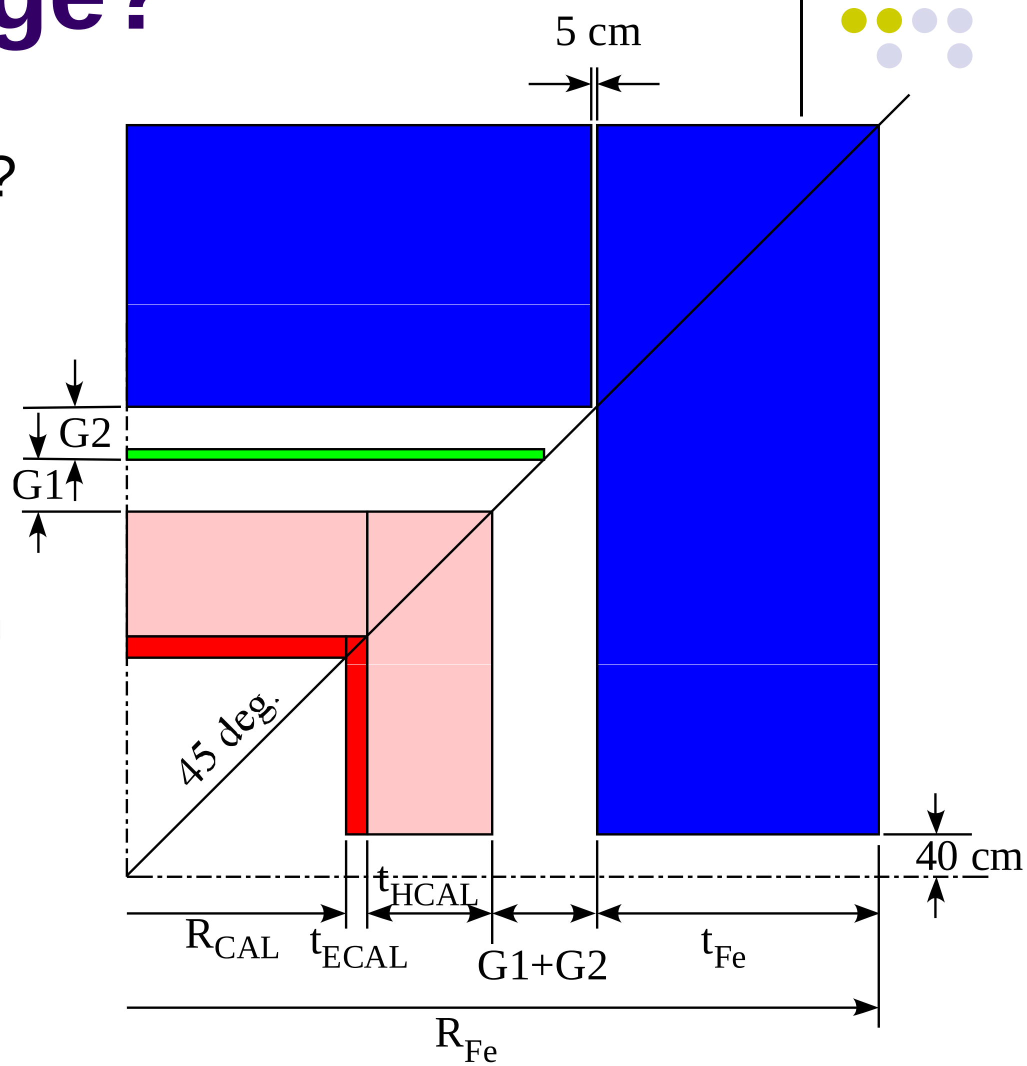
Detector Parameters

- PFA

	GLD	LDC	SiD
B (T)	3	4	5
R_{CAL} (m)	2.1	1.6	1.27
p_t^{min} in CAL (GeV/c)	0.95	0.96	0.95
B R^2_{CAL} (Tm^2)	13.2	10.2	8.1
t_{HCAL} (λ)	5.7	4.6	4
E_{store} (GJ)	1.6	1.7	1.4
R_{Fe} (m)	7.2	6.0	6.45

Why is GLD large?

- How much iron do we need?
  - B-field calculation based on a toy model using a FEA program was done
  - BR^2, t_{ECAL}, t_{HCAL}, G1, G2; fixed
  - Leakage field at Z=10 m was estimated as a function of B, and t_{Fe}
  - t_{Fe} to satisfy the leakage limit of 100G was obtained for each B

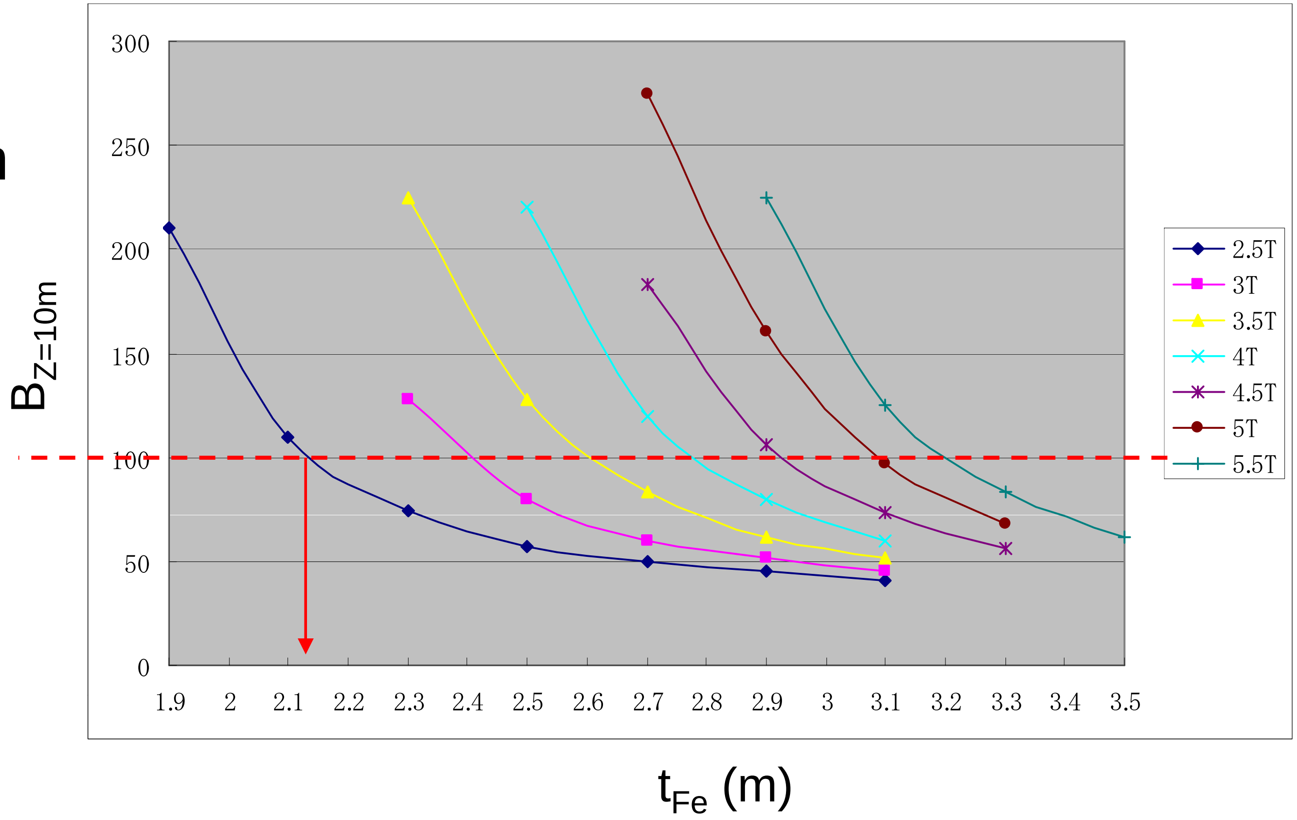


Leakage B-field

- GLD-like
  - $BR^2=13.23$
  - $t_{ECAL}=0.17m$
  - $t_{HCAL}=1.23m$
  - G1=G2=0.5m

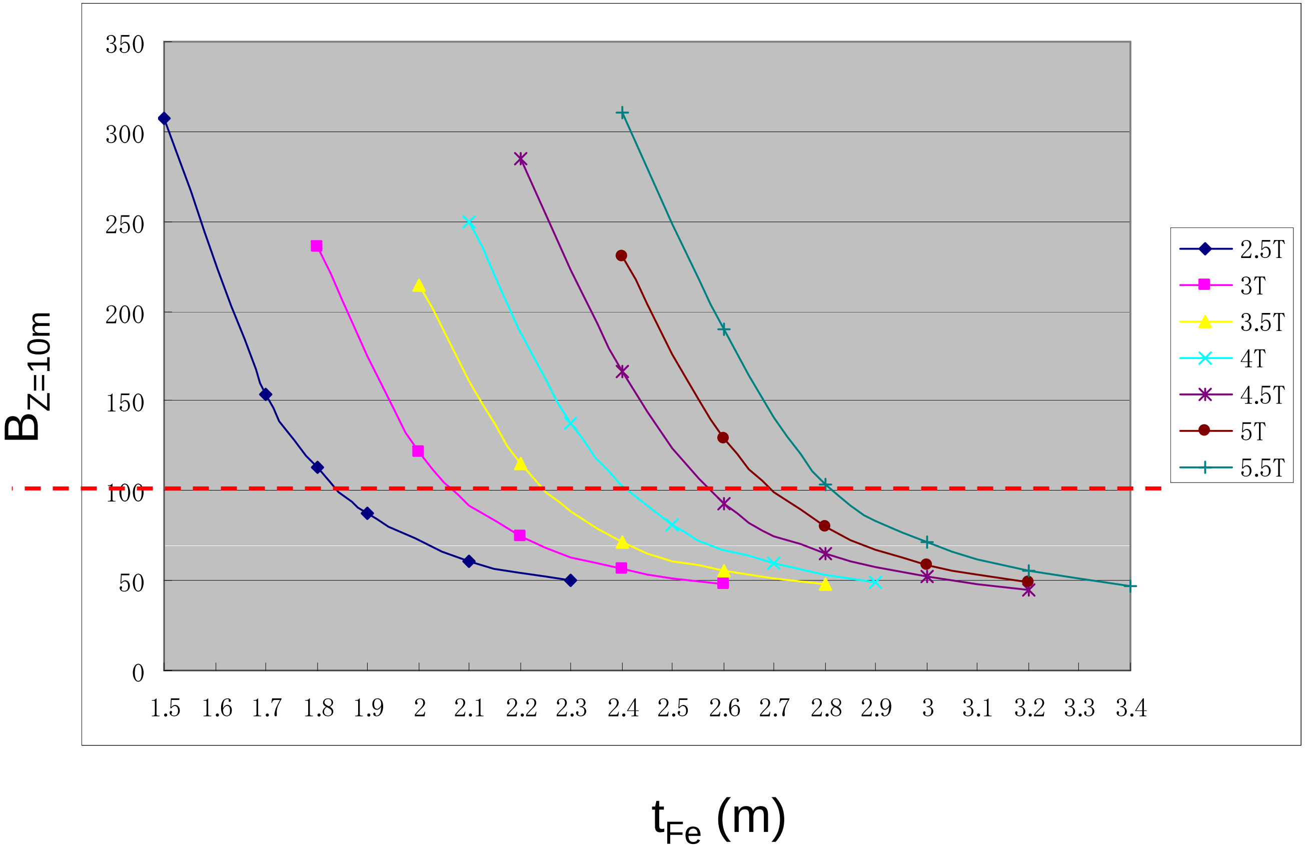
Leakage limit

Andrei put the limit to 50G, but 100G can be reduced to <50G by low cost Helmholtz coil



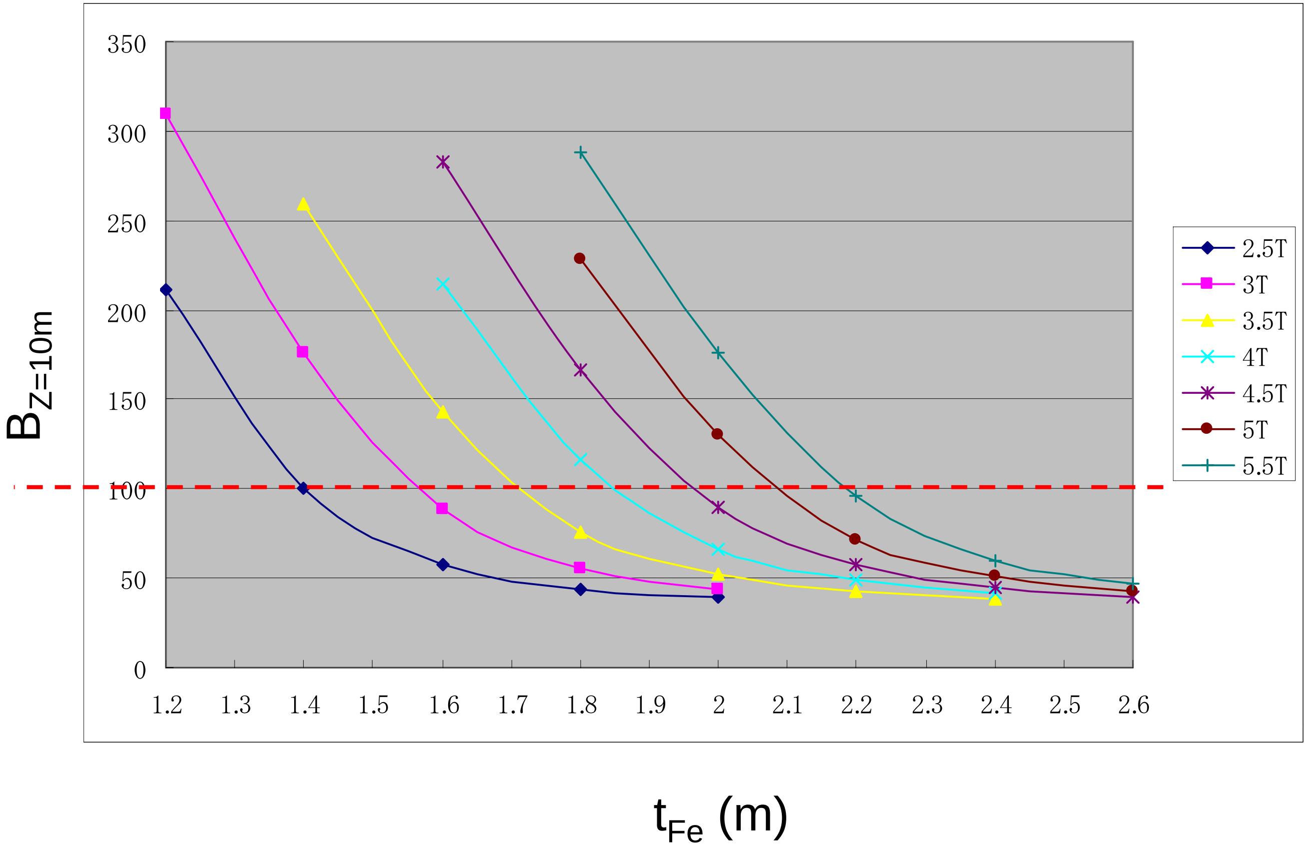
Leakage B-field

- LDC-like
  - $BR^2=10.24$
  - $t_{ECAL}=0.17m$
  - $t_{HCAL}=1.13m$
  - G1=0.46m
  - G2=0.49m

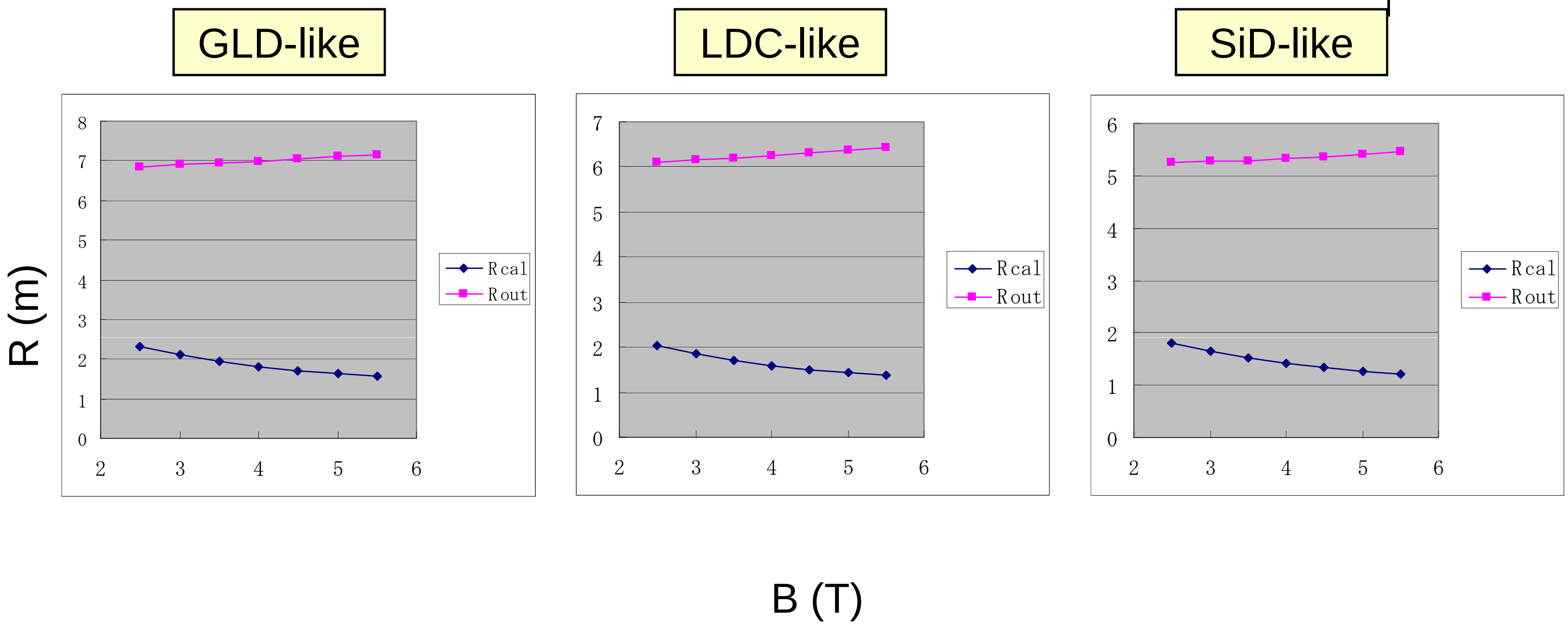


Leakage B-field

- SiD-like
  - $BR^2=8.06$
  - $t_{ECAL}=0.13m$
  - $t_{HCAL}=1.09m$
  - G1=0.21m
  - G2=0.63m



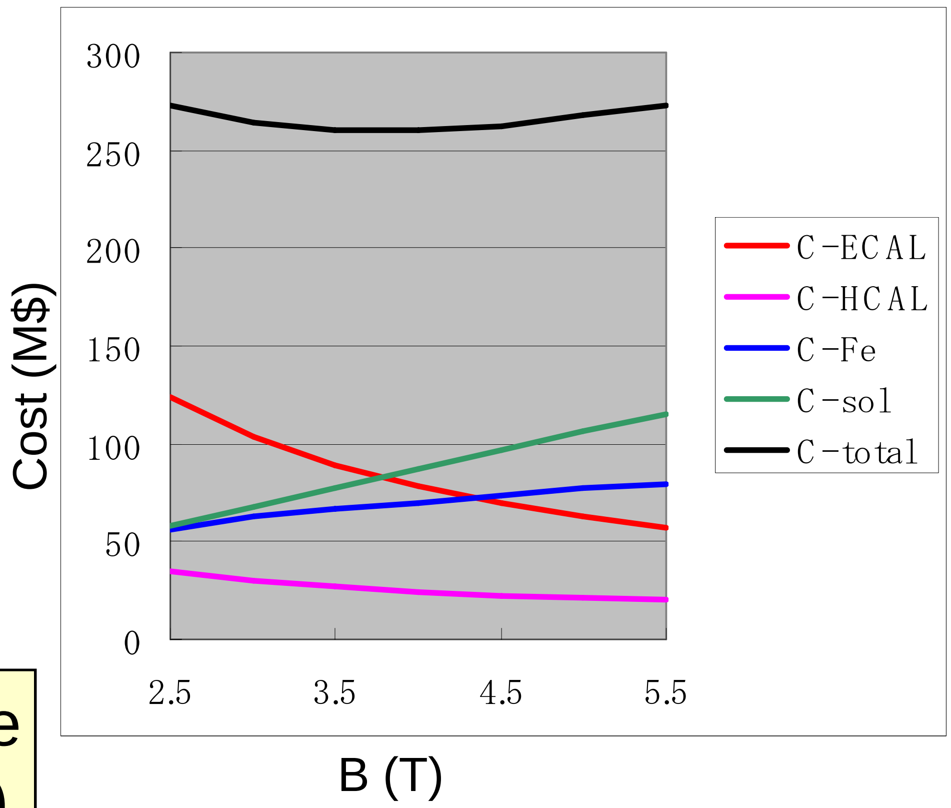
B and R



For a given BR^2, larger B (smaller R_{CAL}) gives larger detector size

B and Cost

- GLD-like detector model
- Unit cost assumption
  - ECAL: 6.8M$/m^3
  - HCAL: 0.16M$/m^3
  - Fe: 42k$/m^3
  - Solenoid: 0.523x[Estore]$^{0.662}$ M$



B-field dependence of the total cost (CAL+Sol.+Fe) is very small

Summary

- GLD is the largest detector among the three PFA detectors
- GLD is the largest NOT because it has the largest inner radius of the calorimeter, but because it has the largest BR^2, the thickest HCAL, and the smallest leakage field