# GLD Surface Assembly

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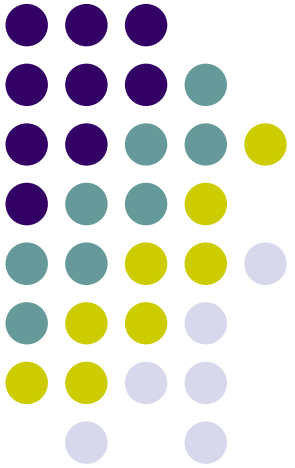
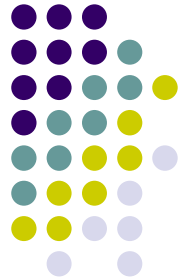


# Outline

- Weight of GLD components
- GLD assembly scenarios
  - Scenario 1: Assemble mostly underground
  - Scenario 2: CMS style
  - Scenario 3: Something between 1 and 2

# Weight of GLD components

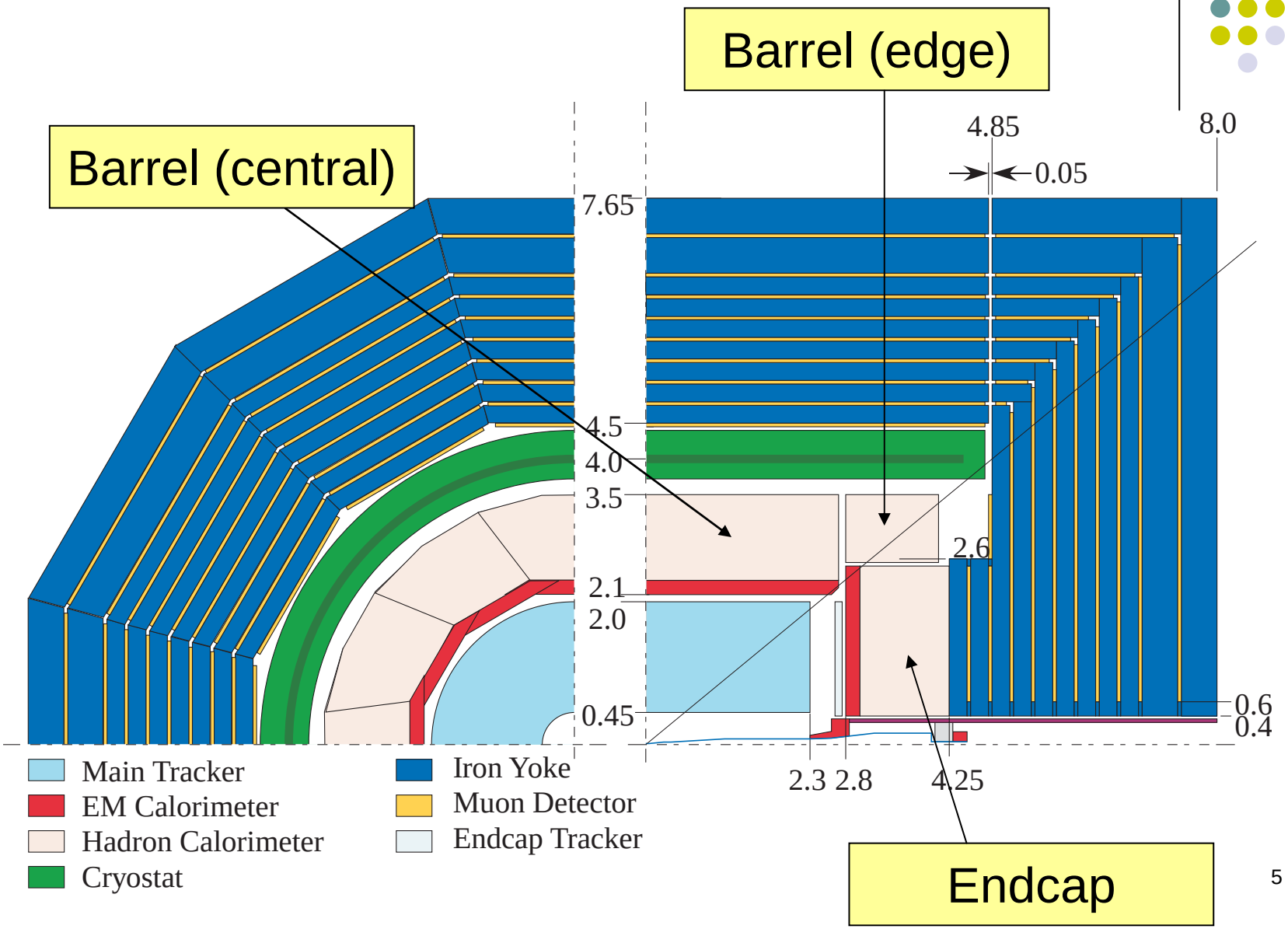


- Return Yoke
  - Barrel (Baseline design)
    - Leakage field < 50 G @10m
    - 50-150 t/slab
    - 700 t/sector(30 deg)
    - 8300 t total
    - 15 OKU\ (1 OKU\ ~ 0.9 M$)
  - Barrel (Previous design)
    - Leakage field = 90 G @10m
    - 50-72 t/slab
    - 540 t/sector
    - 6500 t total
    - 12 OKU\
  - Endcap (Baseline design)
    - 20-370 t/slab(180 deg)
    - 2100 t/180 deg
    - 4160 t/side
    - 8300 t total
    - 15 OKU\
  - Endcap (Previous design)
    - 20-160 t/slab
    - 1500 t/180 deg
    - 3000 t/side
    - 6000 t total
    - 11 OKU\

Relaxing the requirement for leakage field would reduce cost for return-yoke, exp.hall, etc.

# Weight of GLD components

- Calorimeter
  - Barrel (central)
    - 1100 t (HCAL)
    - 220 t (ECAL)
  - Barrel (edge)
    - 235 t/side
    - 470 t total
  - Barrel (total)
    - 1800 t
  - Endcap
    - 220 t/side (HCAL)
    - 60 t/side (ECAL)
    - 280 t/side (H+E)
    - 560 t total
- Solenoid+Cryostat
  - 270 t

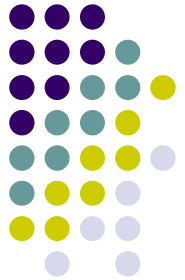

Barrel (edge)
Barrel (central)
4.85
8.0
0.05
7.65
4.5
4.0
3.5
2.6
2.1
2.0
0.45
0.6
0.4
2.3
2.8
4.25
Main Tracker
EM Calorimeter
Hadron Calorimeter
Cryostat
Iron Yoke
Muon Detector
Endcap Tracker
Endcap

# Key milestones

- Detector assembly building ready: $t_0$+3y
- Detector hall ready for detector: $t_0$+4y11m

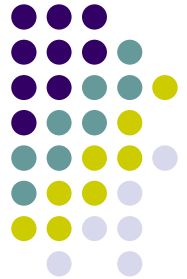
from Martin Gastal's talk at VLCW2006

# Scenario 1



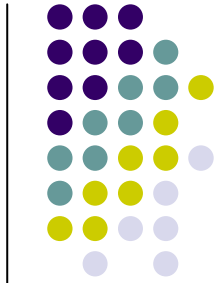
- If the cavern gets ready for detector at $t_0$+4y11m, only 2y+1m is left before machine commissioning, which seems too short
- BCD assumes 80 t crane in the cavern. This is too little for GLD ($M_{solenoid}$ = 270 t)
- So, we need CCR anyway

# Scenario 2: CMS style



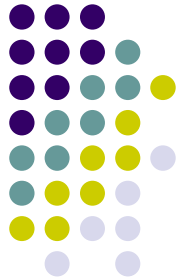
- Surface assembly hall has 2000t non-traveling crane
- Detector is segmented into several large pieces < 2000t
- So, each segment of the detector has to crawl to the loading area by itself
- Then, CMS-like segmentation (divide the barrel into wheels) would be the only solution
- Possible problems in this method;
  - Can we get enough mechanical precision in assembly ?
  - Cryostat is supported only at the center. Mechanical strength to support 1800t CAL is not clear
  - Gaps for cables between wheels → Leakage field ?
  - Surface assembly hall gets ready at $t_0$+3y. It would be impossible to assemble and test the whole detector in 1y11m.
  - We need larger access shaft (diameter>20m)

# Scenario 3: Our proposal

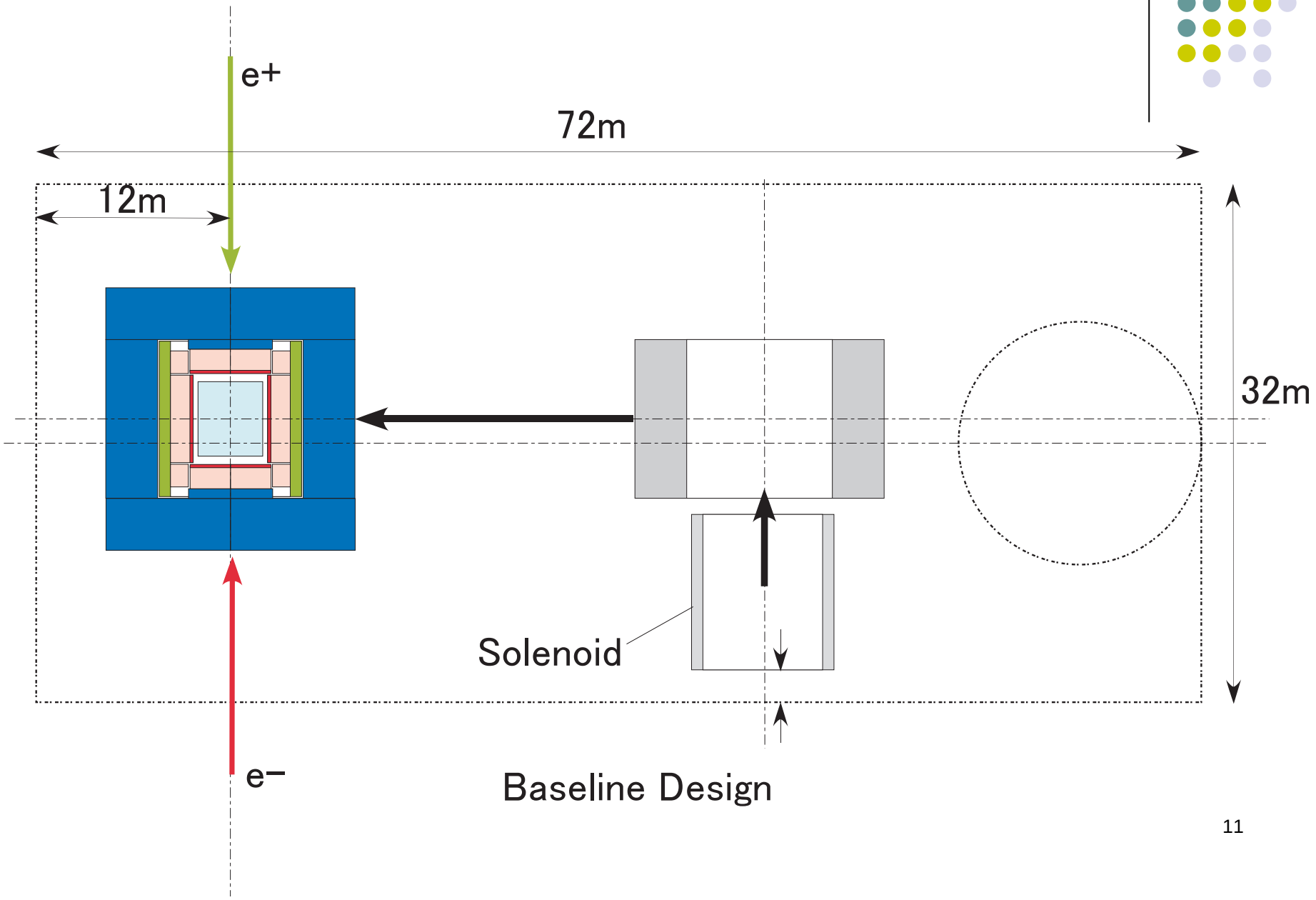


- Each of the surface assembly hall and the underground experimental hall is equipped with a relatively large capacity (>400t) overhead “traveling” crane
- Detector is assembled on surface up to few tens of segments lighter than the crane capacity. For example,
  - Barrel Yoke + muon detector: 12($\phi$) x 2(r) = 24 pieces (~350t/piece)
  - End Yoke + muon detector: 2(side) x 4($\phi$) x 3(z) =24 pieces (~350t/piece)
  - Barrel CAL: 7 rings (260t/ring)
  - Endcap CAL: 2 (side) x 2 ($\phi$) = 4 pieces (140t/piece)
  - Solenoid, TPC, FCAL, BCAL, and inner Si trackers are installed individually
- These segments are lowered to the cavern and assembled to form a complete detector

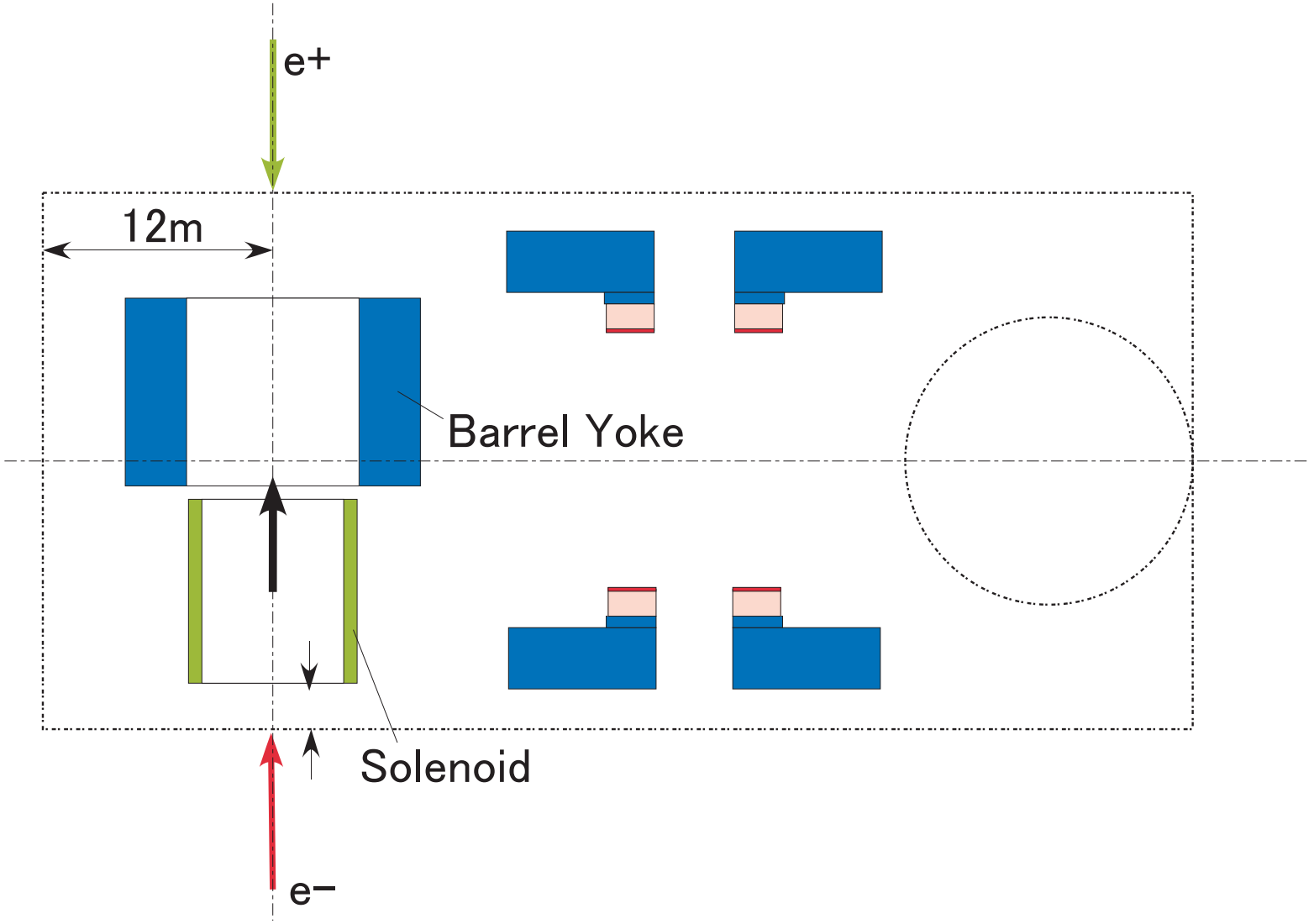
# Comments on Scenario 3

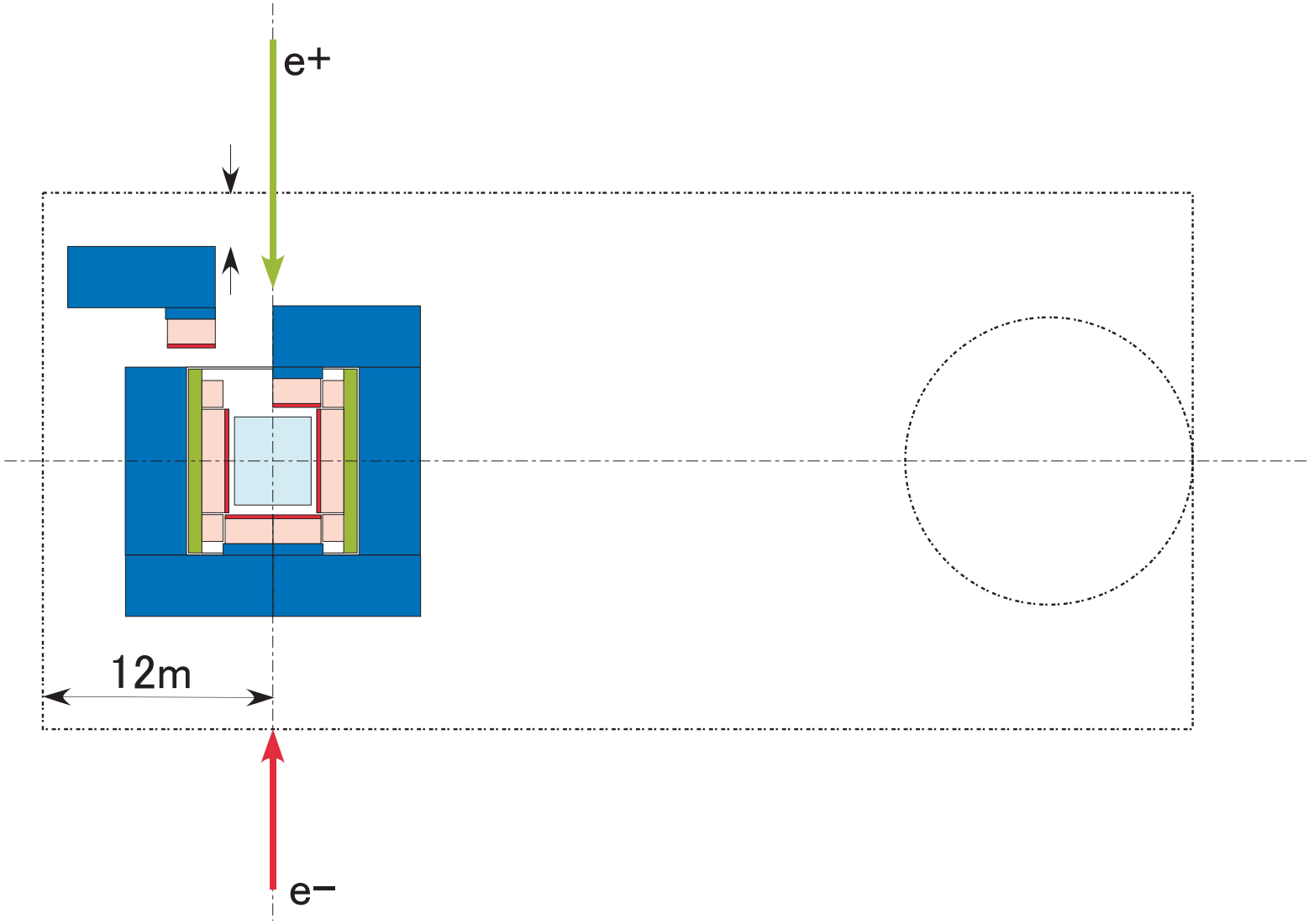


- Since muon detectors are installed in the surface assembly hall, the endcaps do not have to fully open. The wall only 12m from the beam line is acceptable.
- If the barrel part can move both along and normal to the beam line (probably possible by using air-pallet), the width of the experimental hall (32 m in the baseline design) can be somewhat smaller. (see next slides)
- Because less assembly work is done in the experimental hall than the Scenario-1, the size of the cavern could be still smaller
- Detailed assembly procedure will depend on the machine commissioning scenario
- In addition to the surface assembly hall, a large-area warehouse would be necessary to store many pre-assembled detector segments. No large-capacity crane is necessary in this warehouse if we use air-pallets to move the detector segments.

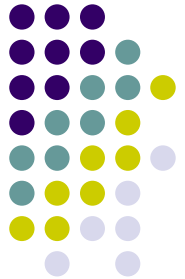



Baseline Design


e+
12m
Barrel Yoke
Solenoid
e−


e+
12m
e−

# Conclusion



- If the cavern gets ready for detector at $t_0$+4y11m, only 2y+1m is left before machine commissioning. This period seems too short to assemble the detector totally underground.
- We absolutely need a large assembly hall on surface
- It is not clear for us whether we can assemble the detector exactly like CMS or not
- We would like to consider the assembly scenario in which the detector is segmented into smaller pieces than that in the CMS assembly scenario
- In that case, we need >400t overhead traveling crane in both the surface assembly hall and the underground experimental hall
- In addition to the surface assembly hall, a large-area warehouse would be necessary to store the pre-assembled segments
- We have to investigate more to determine the necessary size of the surface assembly hall and the underground experimental hall in our assembly scenario