ALLEGRO detector concept: Alternative proposal

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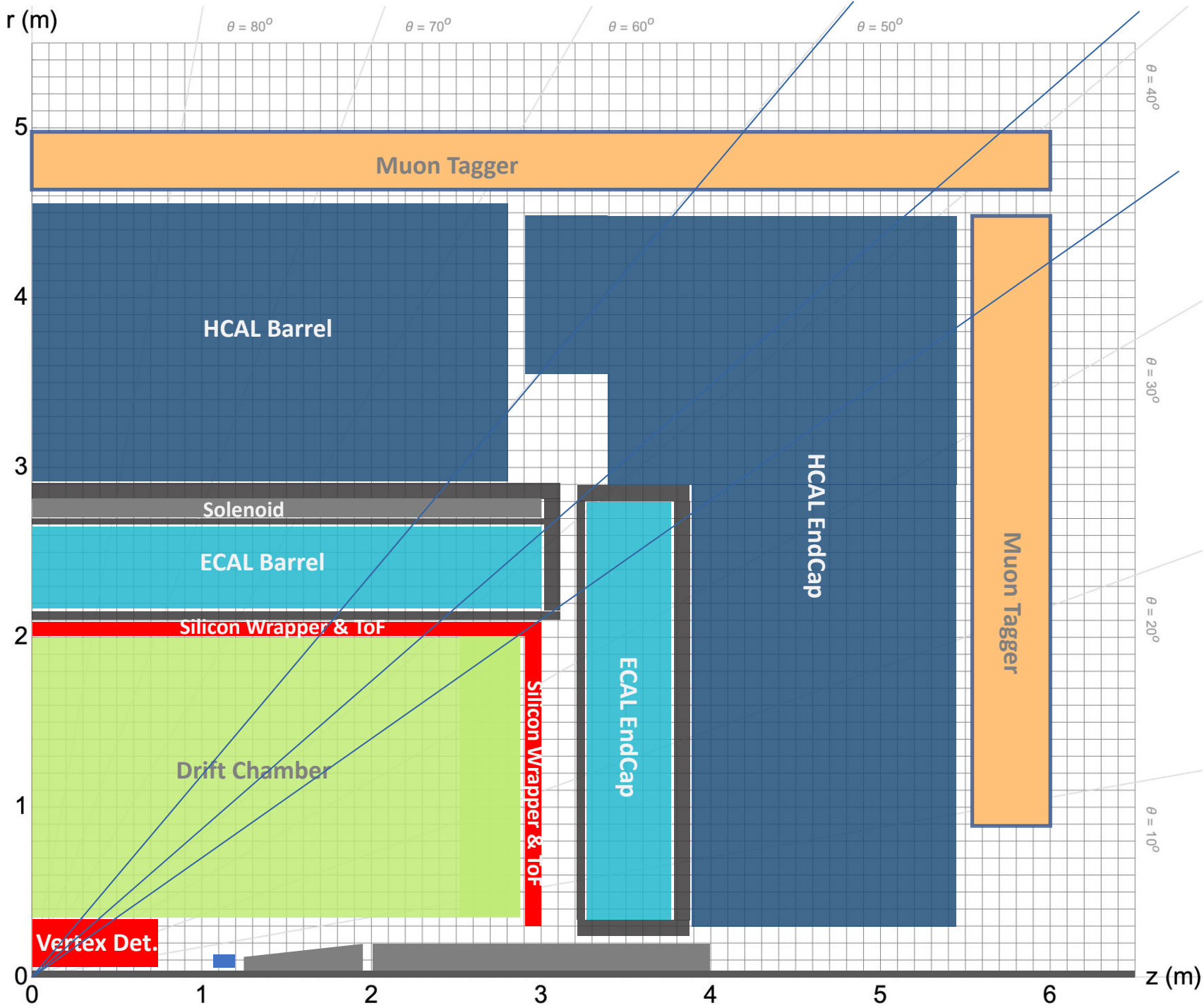
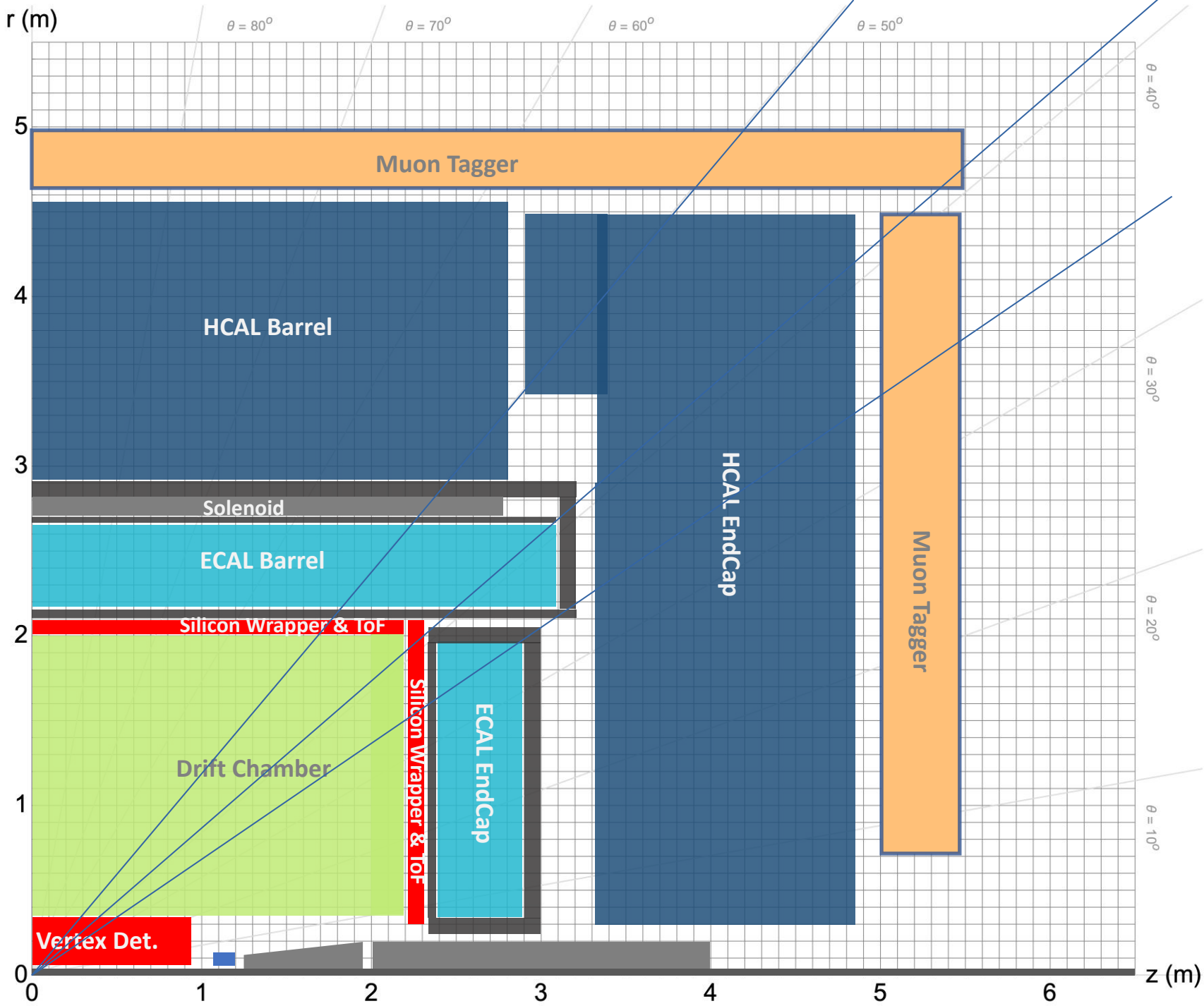


Detector Concept 1a

- Vertex Detector:
  - MAPS or DMAPS possibly with timing layer (LGAD)
  - Possibly ALICE 3 like?
- Drift Chamber (±2.5m active?)
- Silicon Wrapper + ToF:
  - MAPS or DMAPS possibly with timing layer (LGAD)
- Solenoid B=2T, sharing cryostat with ECAL, outside ECAL
- High Granularity ECAL:
  - Noble liquid + Pb or W
- High Granularity HCAL / Iron Yoke:
  - Scintillator + Iron
    - SiPMs directly on Scintillator or
    - TileCal: WS fibres, SiPMs outside
- Muon Tagger:
  - Drift chambers, RPC, MicroMegas



Detector Concept 4a

- Vertex Detector:
  - https://indico.cern.ch/event/1307378/contributions/5726732/attachments/2789625/4864591/Annecy%20Physics%20Week%20Jan%202024.pdf
- Drift Chamber (±2.5m active?)
  - https://indico.cern.ch/event/1307378/contributions/5727842/attachments/2789988/4865303/primavera_FCCFranceworkshop_Jan2024v1.pdf
  - Now same size as IDEA, i.e 2m active length + 20cm services
- Solenoid B=2T, sharing cryostat with ECAL, outside ECAL
  - shorter by 20cm
  - Will that be good enough in terms of field quality in DC ?
  - But now allows to easily route cables outside of cryostat
- High Granularity ECAL:
  - Noble liquid + Pb or W
  - Radius of endcaps shorter by ~80cm !!! Huge simplification of design
  - Barrel longer by 10cm to ensure shower containment
- High Granularity HCAL / Iron Yoke:
  - Scintillator + Iron
    - SiPMs directly on Scintillator or
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- Muon Tagger:
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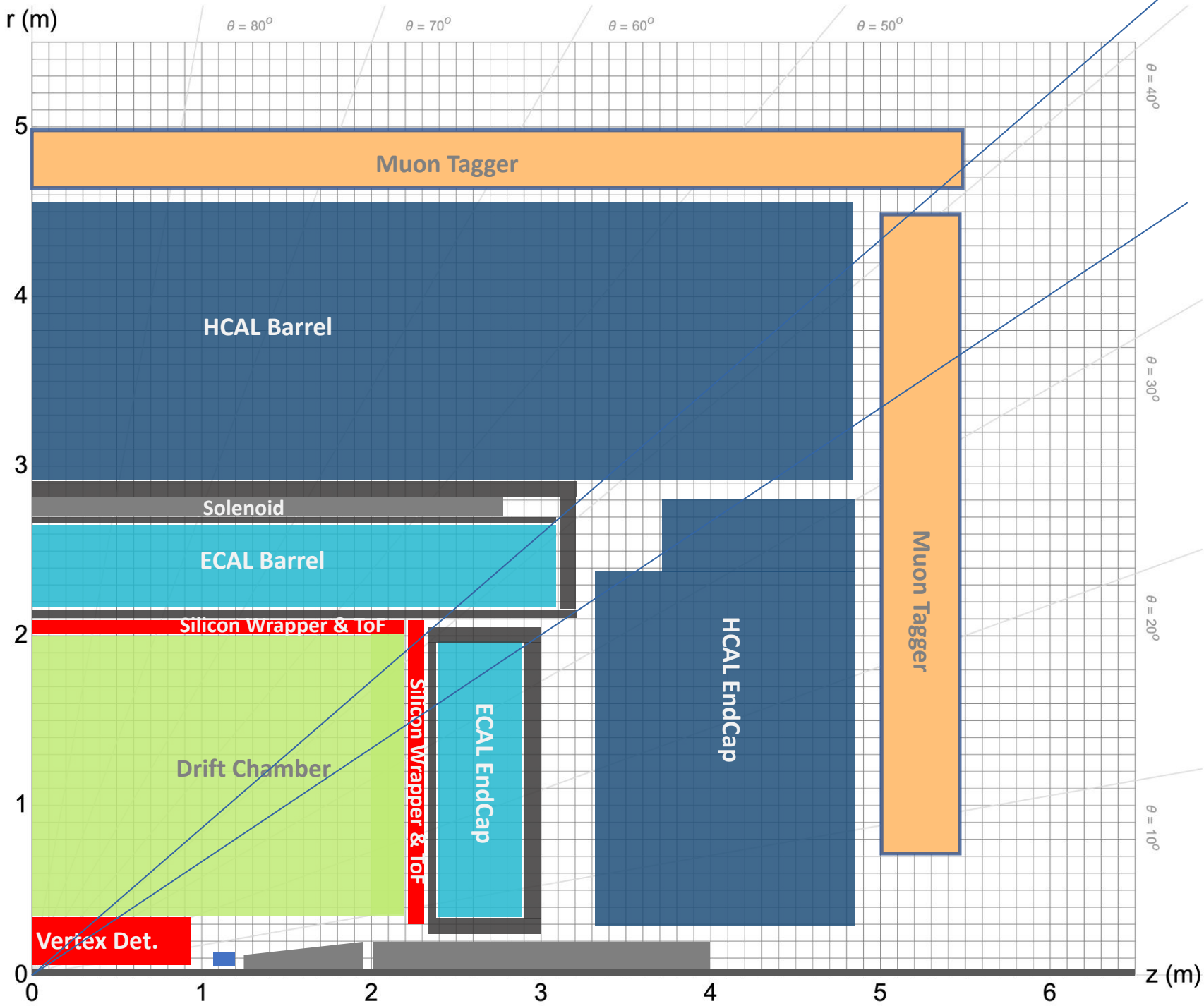
Comments on concept 4a

- Starting point 1: solenoid should be longer than trackers to ensure good field quality in all tracking volume
  - All the more important that we try to put it behind the Ecal barrel
  - This imposes strong constraints on routing of cables in/out of the Ecal cryostat
- Starting point 2: 5m drift chamber (ALLEGRO) is harder to do than 4m (IDEA), and 4m should be enough in terms of tracking
- Proposed idea: endplugs instead of endcaps
  - DC has same dimensions as that of IDEA (2m long + 20cm services on each side)
  - Endcap outer radius ~80cm shorter (!!!)
    - Probably large simplification of the design, esp. regarding gap widening effect
  - Barrel is 10cm longer to ensure full containment of showers
  - Solenoid can maybe be a bit shorter (20cm ?) which gives lots of space to route cables in feedthroughs. Note: IDEA solenoid is 6m long for 4m DC
  - Similar angular coverage as concept 1b for regions with “bad” Ecal measurements and regions with “bad” Hcal measurements (feedthroughs, electronics)
- Drawbacks
  - Feasibility !!! How is the endplug supported ?
  - Space for tracker services is fixed once and for all (inner radius barrel - outer radius endplug). Cannot change for bigger space later on. Note from Daniel: in ATLAS space for ID services had to be increased. We simply had to move the endcaps back by 5cm without changing the design.



Detector Concept 4b

- Vertex Detector:
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- Drift Chamber (±2.5m active?)
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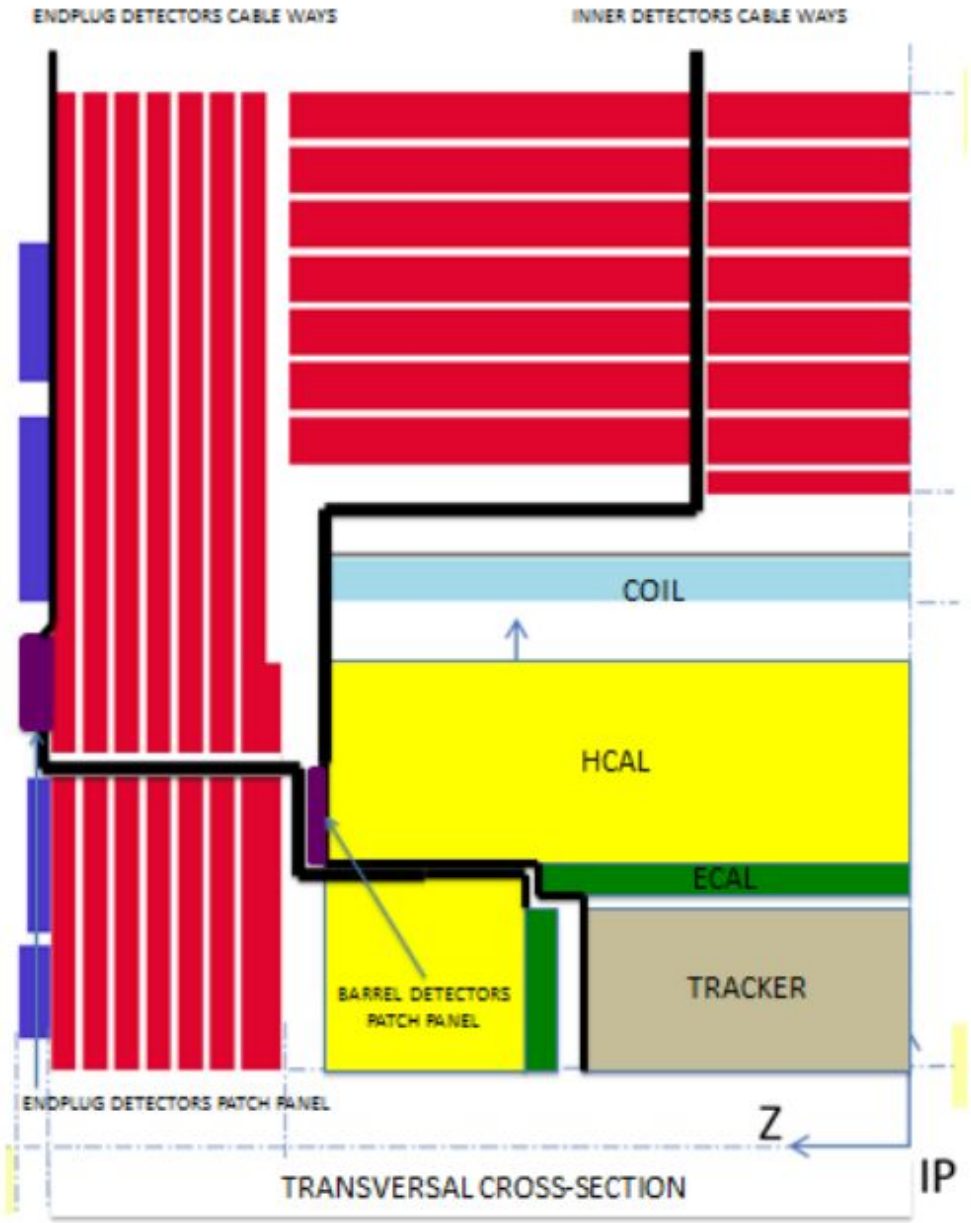
Comments on concept 4b

- Use endplug concept also for Hcal
  - Same angular coverage for “bad” Ecal and Hcal measurements
  - Can route cables for barrel at the end of the barrel

- Discussion
  - Same angular coverage for “bad” Ecal and Hcal measurements: is it an advantage or a drawback ?
  - Technical feasibility of feedthroughs on end of barrel: easier, or more difficult ?
  - Hcal barrel can be divided in barrel and extended barrel (as in ATLAS) to simplify the engineering

- Note: kept “big empty box” for feedthroughs and FE electronics as in original concept
  - If we have cold FE electronics, how smaller can we make these holes ?

Detector Services routing



From PED workshop
Just to keep in mind…

General considerations on detector services:

Barrel and Endcap sub-detectors services shall follow indipendent paths to allow quick opening of the detector.

Patch-panels at the periphery of the detector allow for an easier services installation, check-out and troubleshooting.