The Interaction Region of the Large Detector Concept

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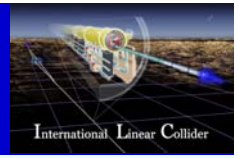
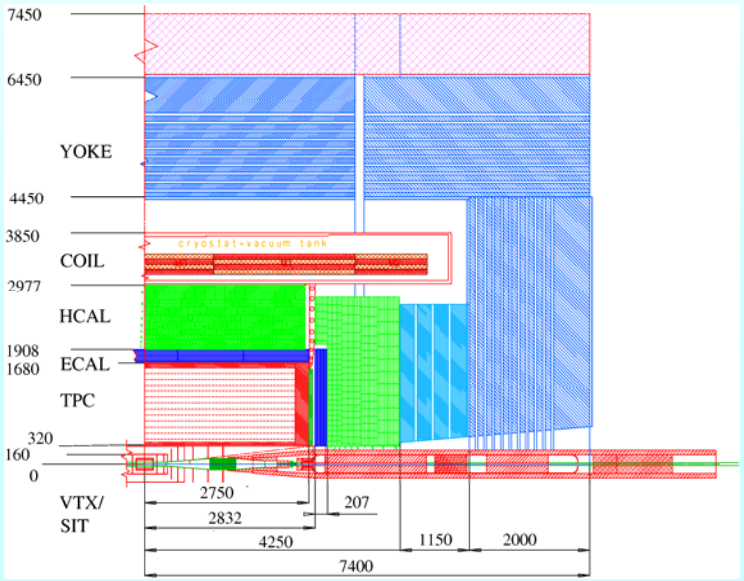
The Large Detector Concept



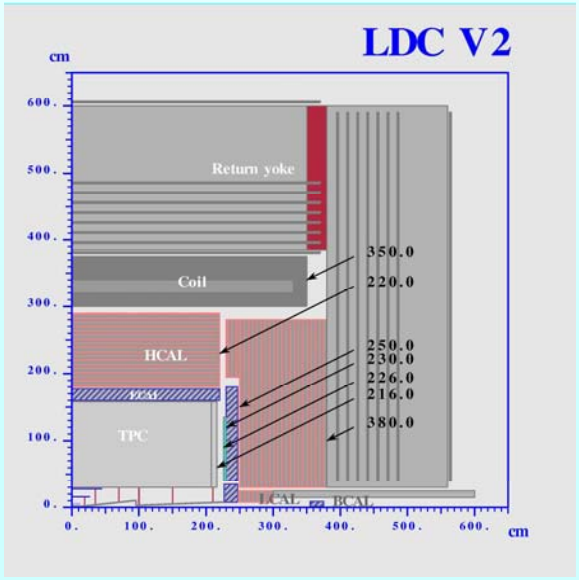
- The Large Detector Concept:
  - High precision 5 layer vertex detector
  - Additional SI tracking devices
  - TPC as central tracking device
  - High granularity SI/W ECAL
  - High granularity HCAL
  - Forward calorimetry
  - Instrumented yoke (tail catcher, muon system)
- The LDC has ist roots in the well studied TESLA TDR detector
- Recent optimisations have been performed which lead to an updated design of the detector

Recent Changes

TESLA Detector

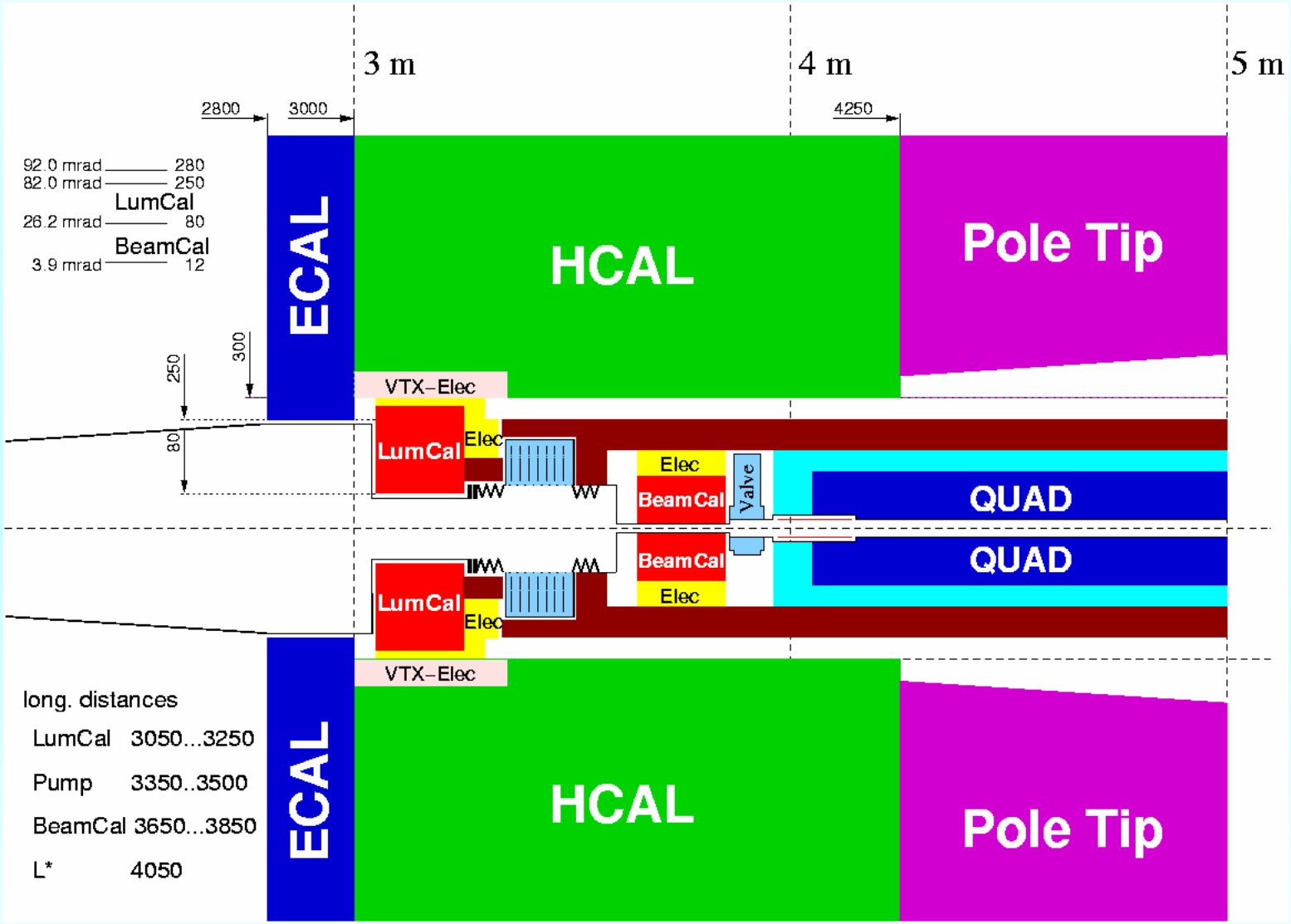


LDC V2

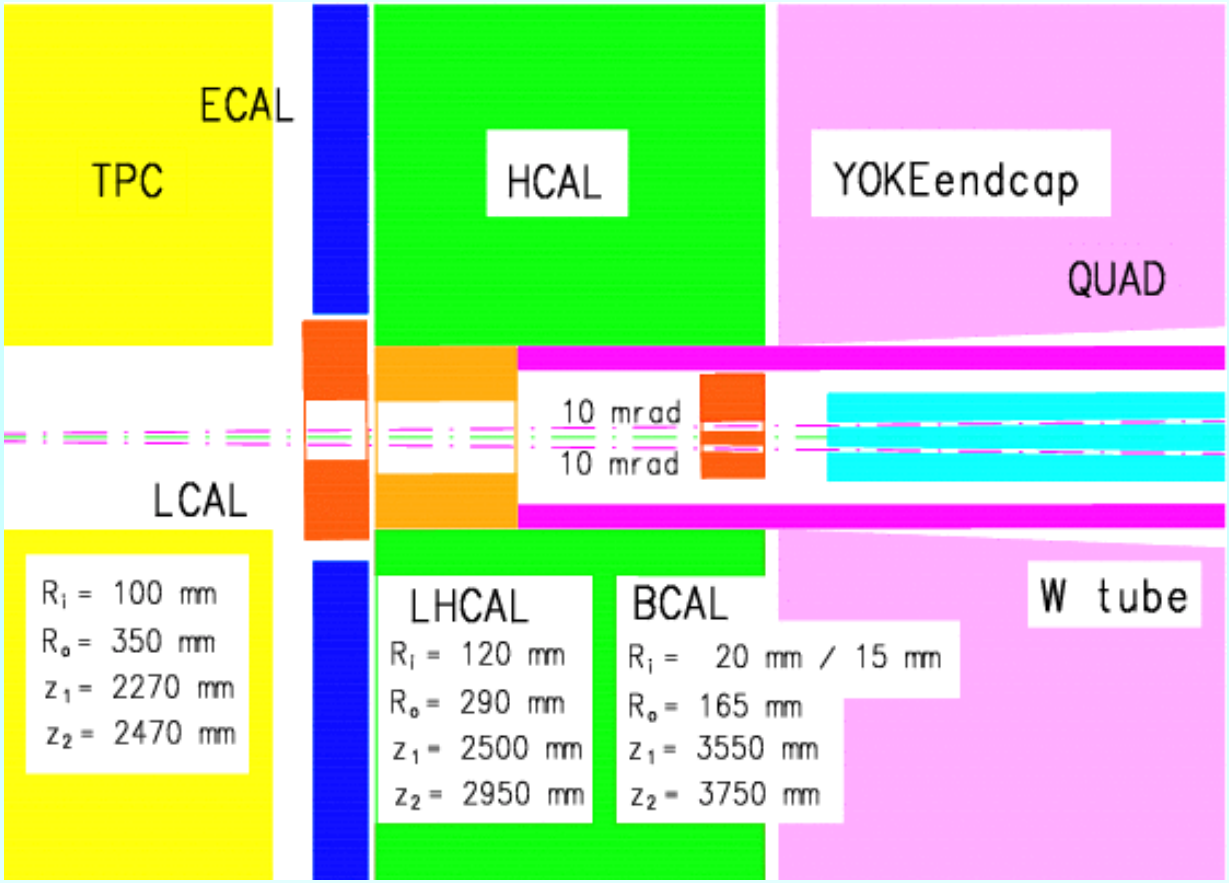


- Major changes in LDC V2:
  - Coil shortened by ~150 cm (half length)
    → Removed iron plug
  - TPC shortened by ~65 cm (half length)
  - Re-design of the forward region
- Detector footprint: 1120cm · 1120cm · 1200cm (length · width · height)
  (TESLA: 1480 cm · 1480 cm · 1290 cm)
- Note: Final geometries have been agreed upon at LDC meeting in February
  → All simulation results with regards to backgrounds, etc., have yet to be updated !

Old LDC Interaction Region

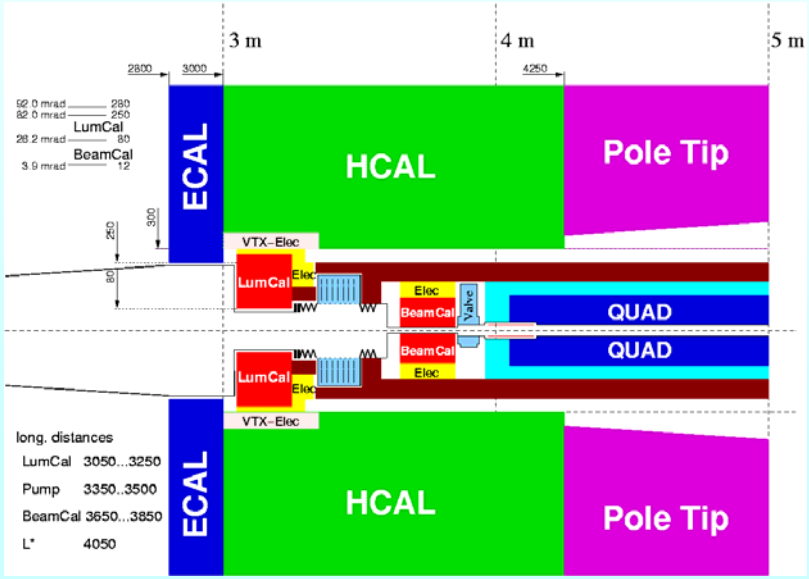


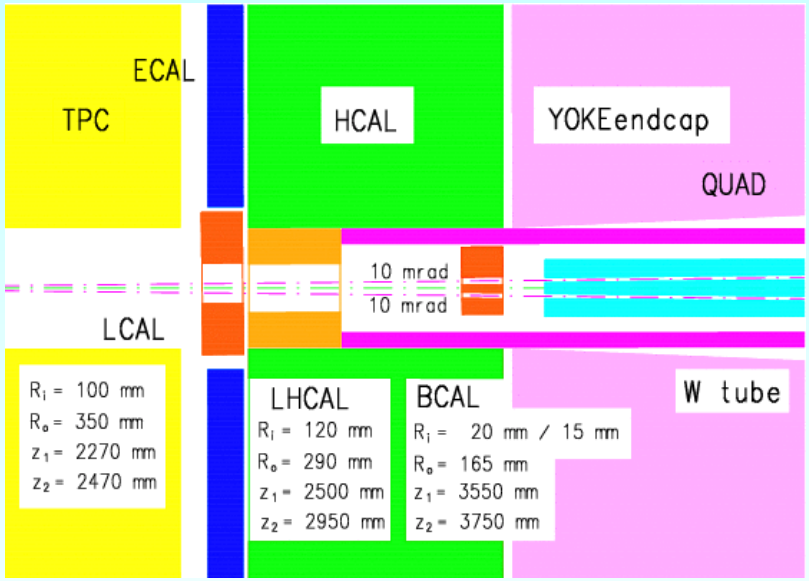
New LDC Interaction Region



Changes

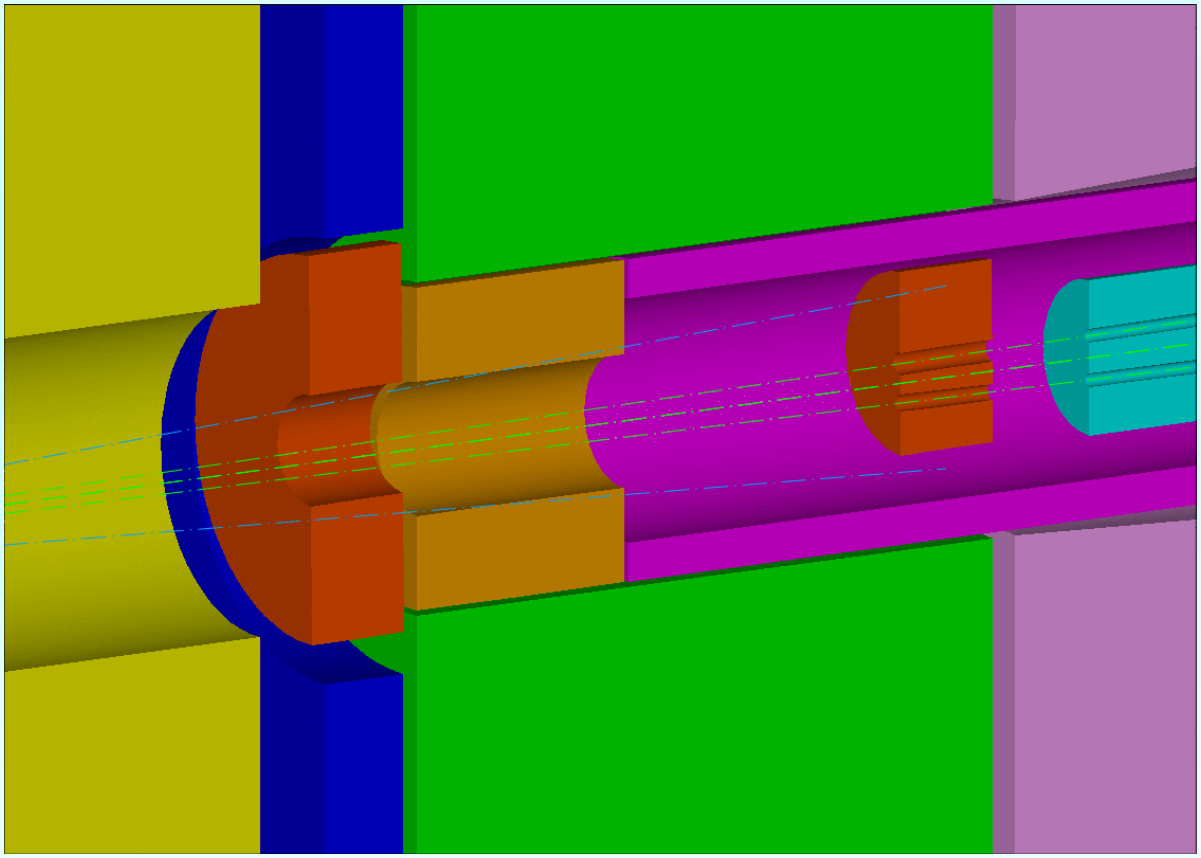
- L* unchanged at 4.05 m
- LumiCal moves to ECAL front
  - → Additional effect from the shortened TPC!
- BeamCal stays close to quad
- Increased space between LumiCal and BeamCal should absorb backscattering from BeamCal better
- LumiHCAL increases hermeticity for hadronic calorimetry
- Better detector opening concept
- Acceptance hole between ECAL and LumiCal needs attention





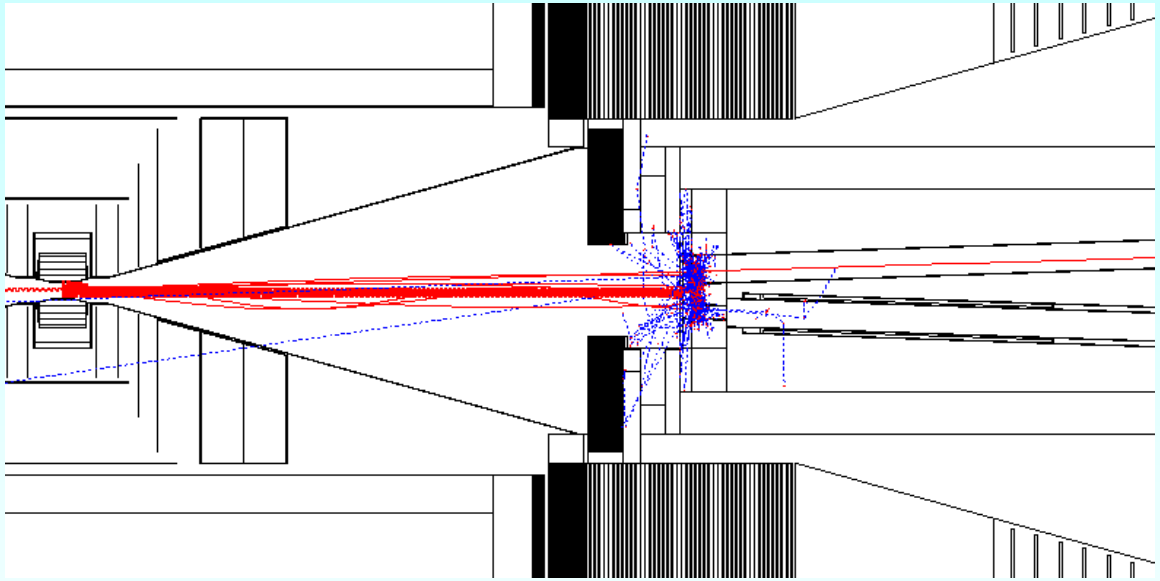
Modification for Crossing Angle Choice

- Forward calorimeters LumiCal and BeamCal have to be centred around the outgoing beampipe for the 20 mrad crossing angle case
- Acceptance hole between ECAL and LumiCal gets asymmetric



Performance of Forward Region

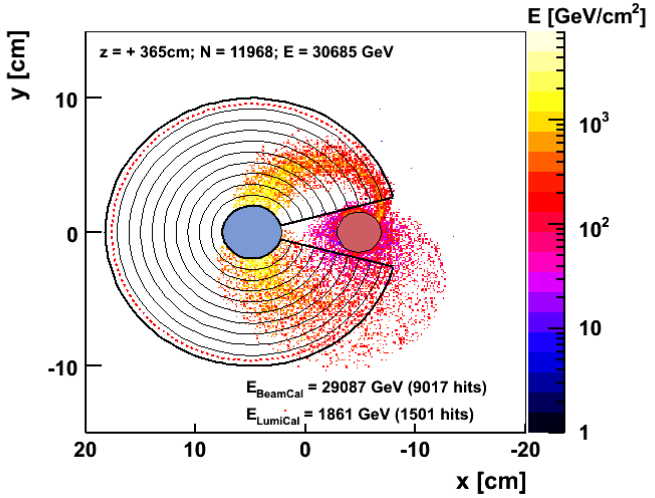
- Performance of the forward region has been studied in detail for the old LDC/TESLA detector
  - Background suppression worked well
  - Performance of the forward calorimeters was good
- We expect the new forward region to be not worse than the old one
  - Larger ‘tunnel’ between LumiCal and BeamCal should indeed improve the shielding from backscattering
  - This has yet to be proven! No detailed simulations so far available!

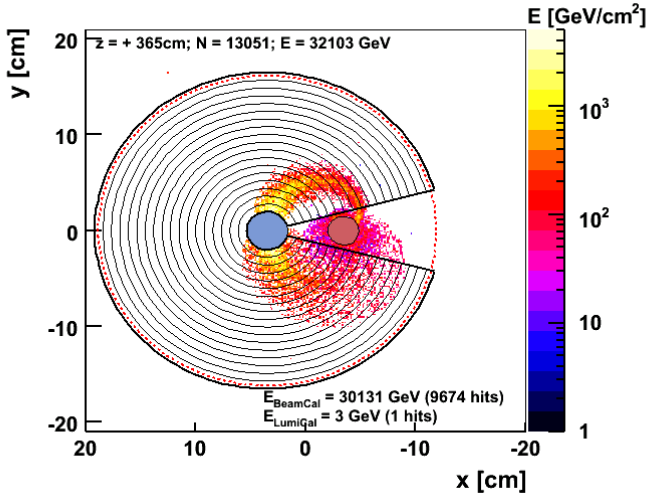


Adjustments to DID

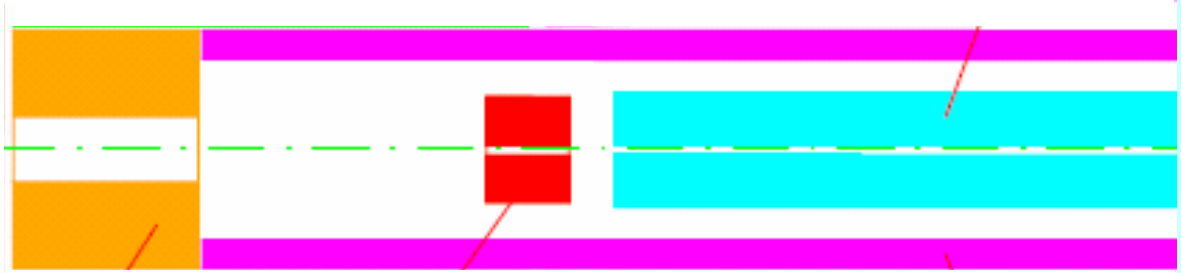
- Detector Integrated Dipole field has been suggested to correct for unwanted machine effects in the 20 mrad case
- DID blows up the distribution of the pairs from beamstrahlung
- LumiCal gets hit by a significant number of pairs
- Backscattered photons increase backgrounds in the TPC by factors of 5-7
- New Design: Increased aperture of LumiCal and adjusted BeamCal

- Background suppression has yet to be tested in detailed simulations

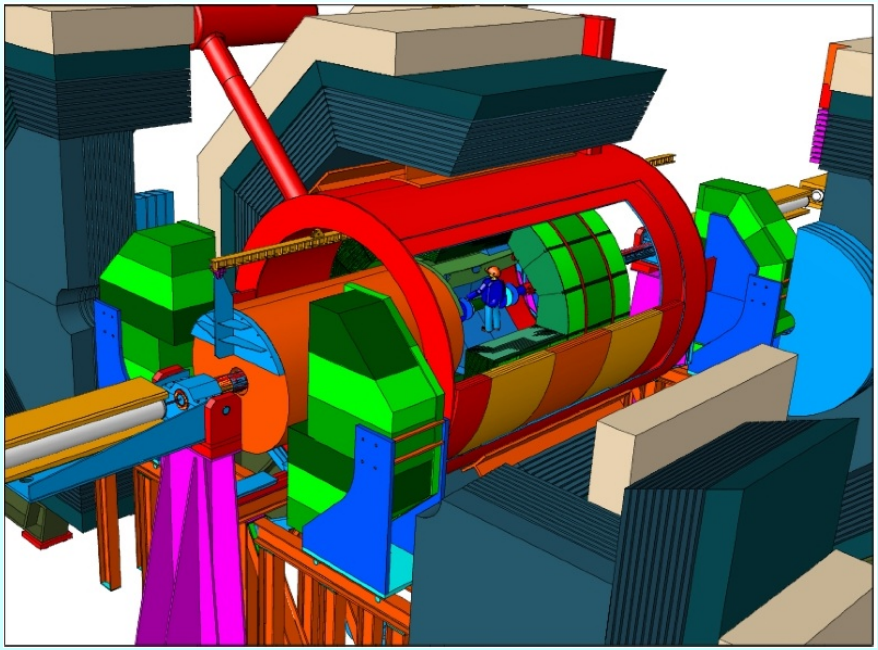


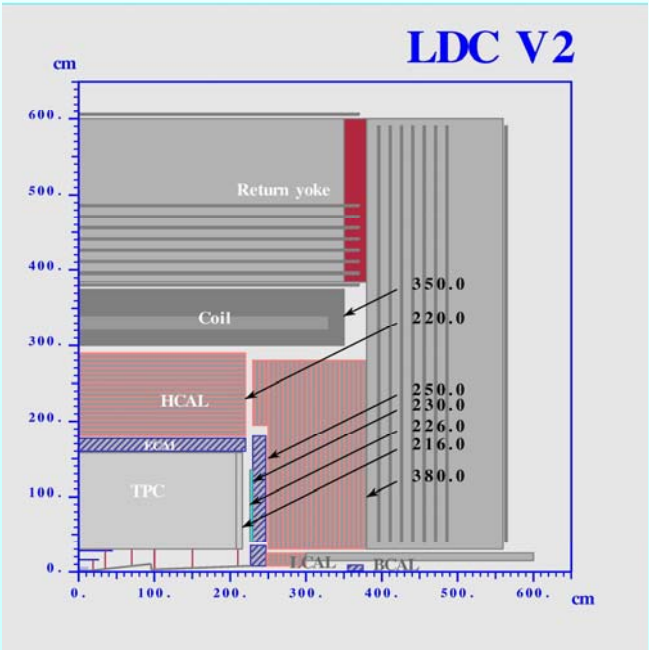


Opening Scheme



Opening scheme II

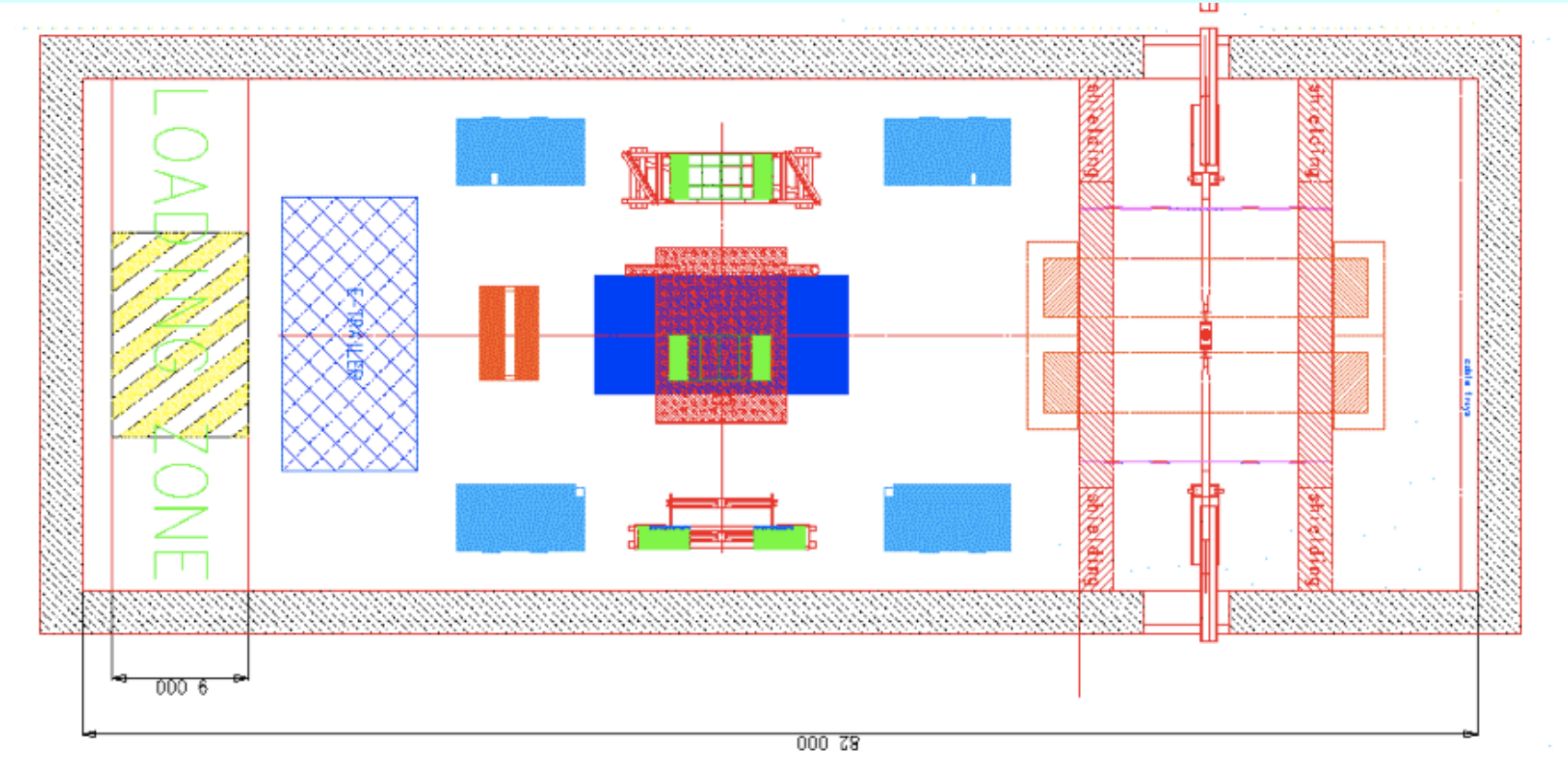




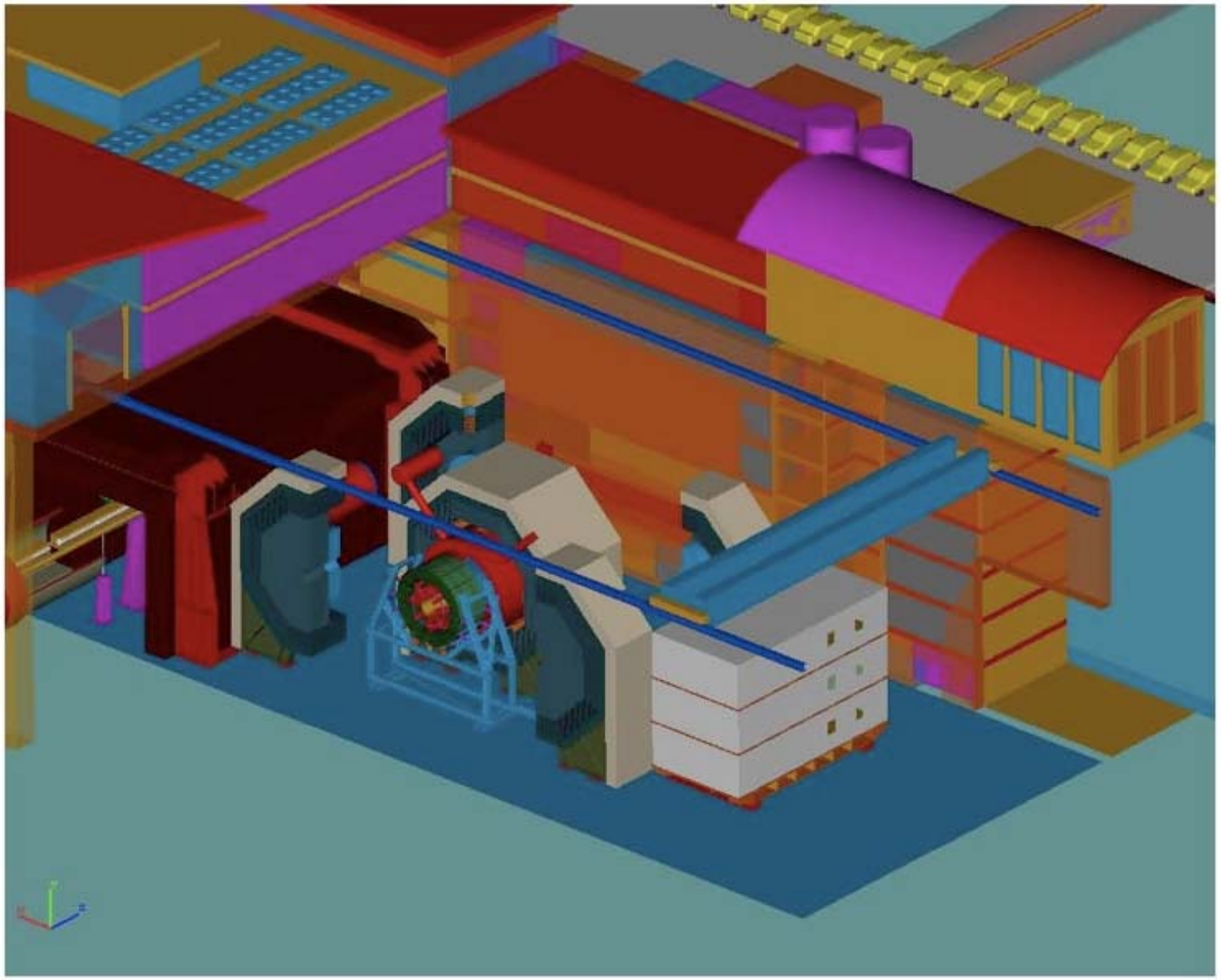
- Heavy parts (e.g. yoke segments) are foreseen to be moved on air pads
- Longitudinal clearance of ~1.75m behind the detector is needed to pull the endcap calorimeter out of the coil
- Beamline elements have to fit inside the tungsten mask at r_i=20cm for z<600cm.

Detector Hall

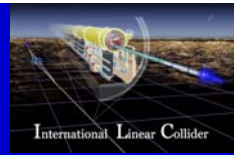
- Detector hall size: 82 x 30 m
- Beam height: 8m above floor level



LDC Detector Hall



Conclusion and outlook



- The LDC design has been changed recently
- A major re-design of the forward region has been done
  - Conceptual design has been done, detailed design is needed
- The opening scheme is much easier than in the previous LDC version (TESLA design with A. Stahl forward region)
- We expect that the performance of the forward region with respect to forward calorimetry and background suppression is not worse, maybe even better

- Detailed simulations are yet to follow!