The Large Detector Concept

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Snowmass Linear Collider Workshop
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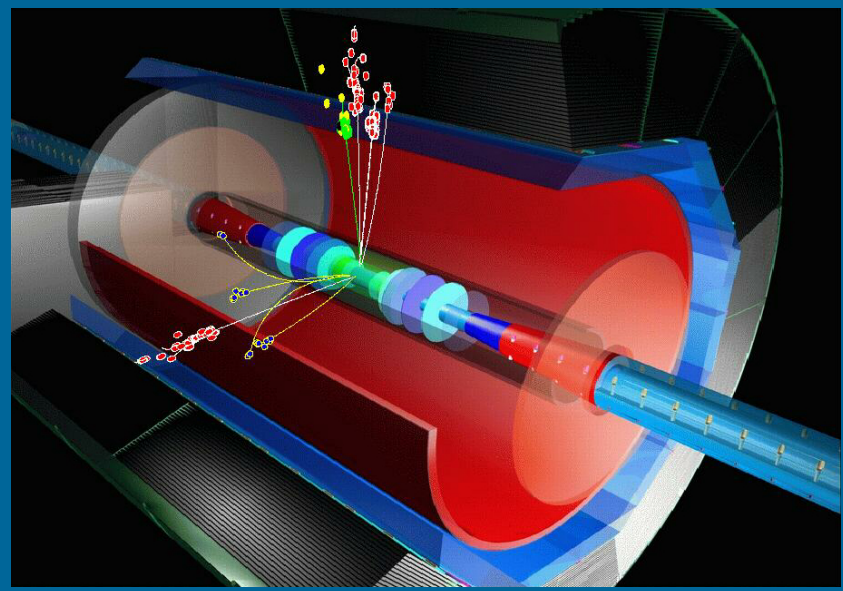
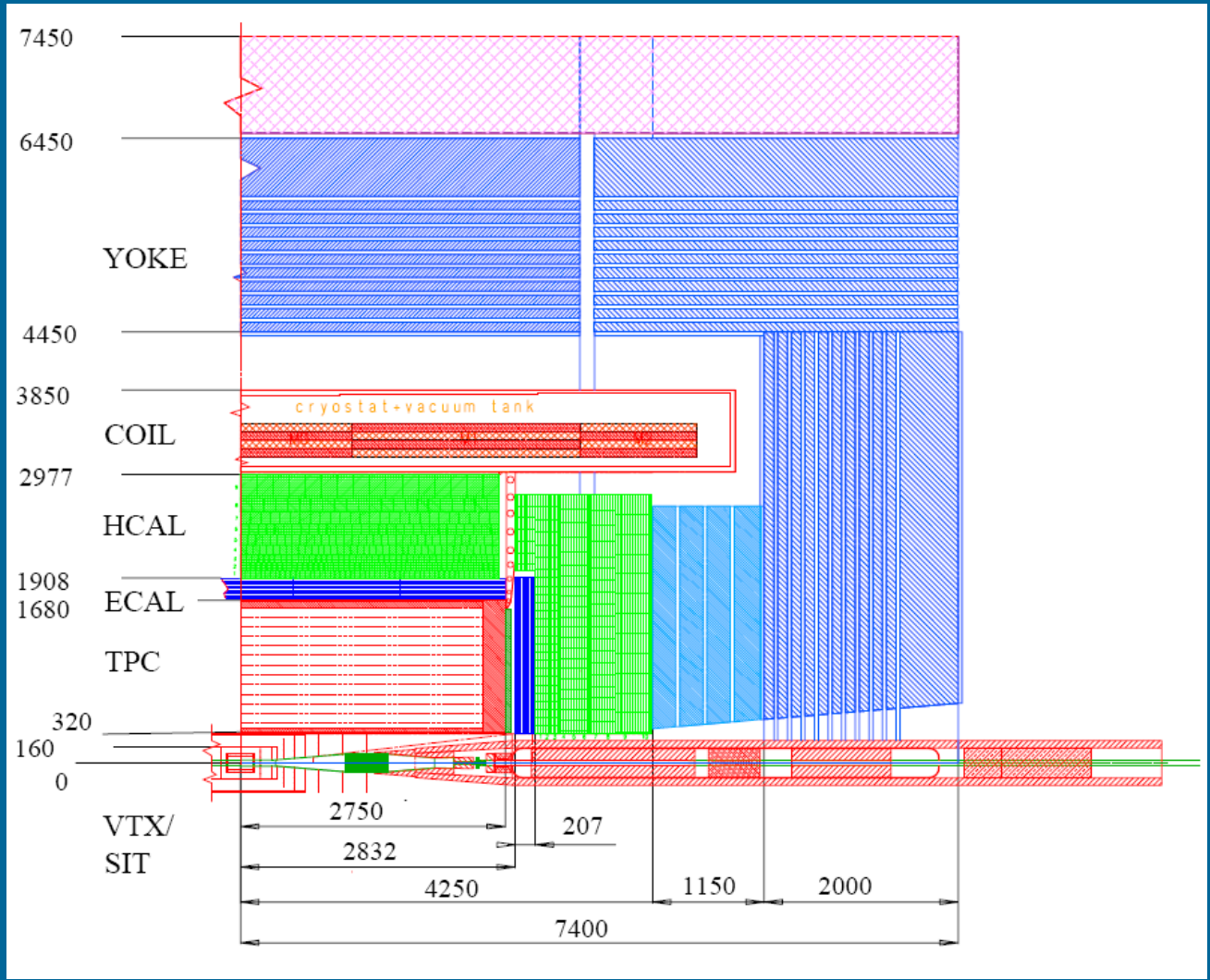
The LDC Model

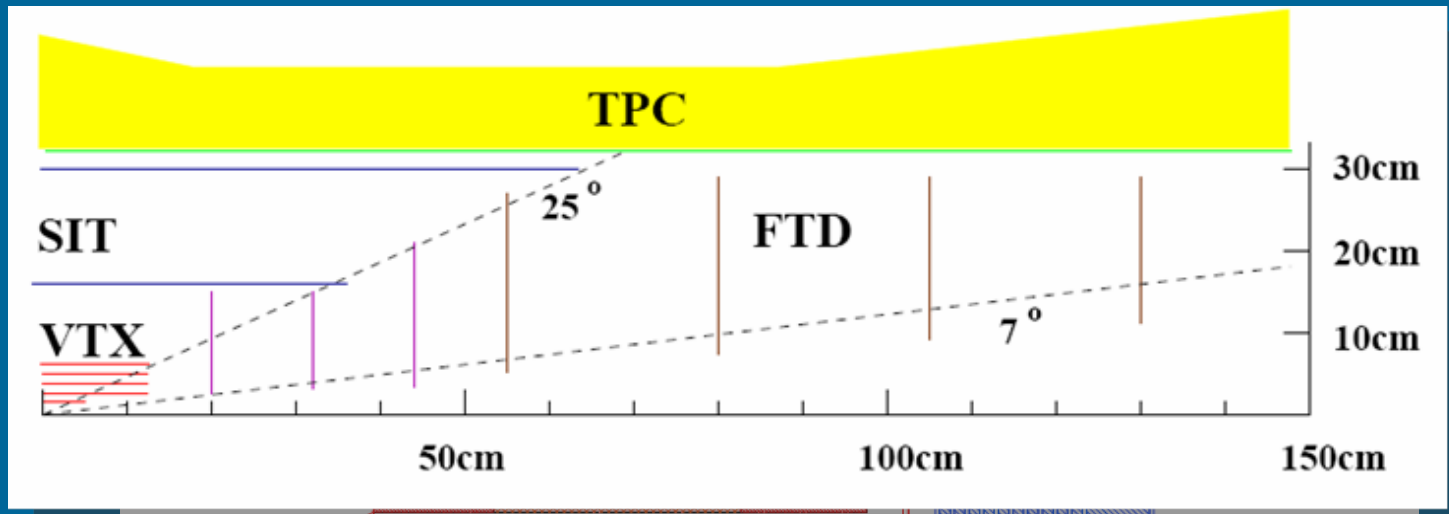
- The Large Detector Concept is based on a large continuous gaseous tracker surrounded by a highly granular calorimeter.
  - The TESLA detector concept, developed for the TESLA TDR in 2001, is taken as the starting point for further optimization.
  - Similar to the American LD concept.

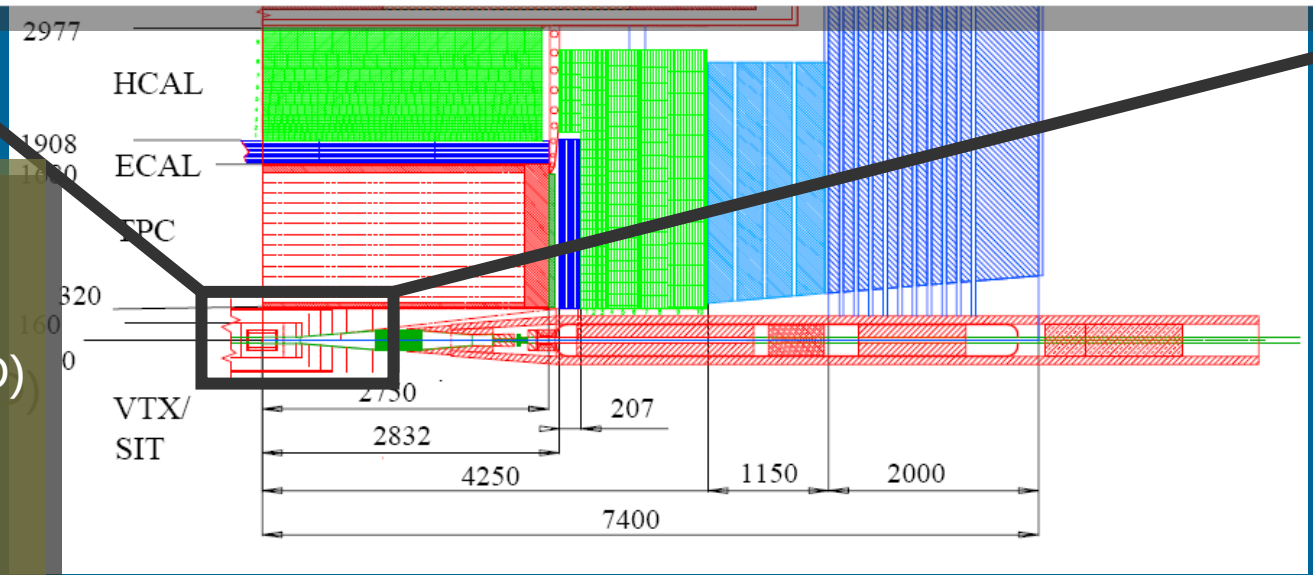


Quadrant view



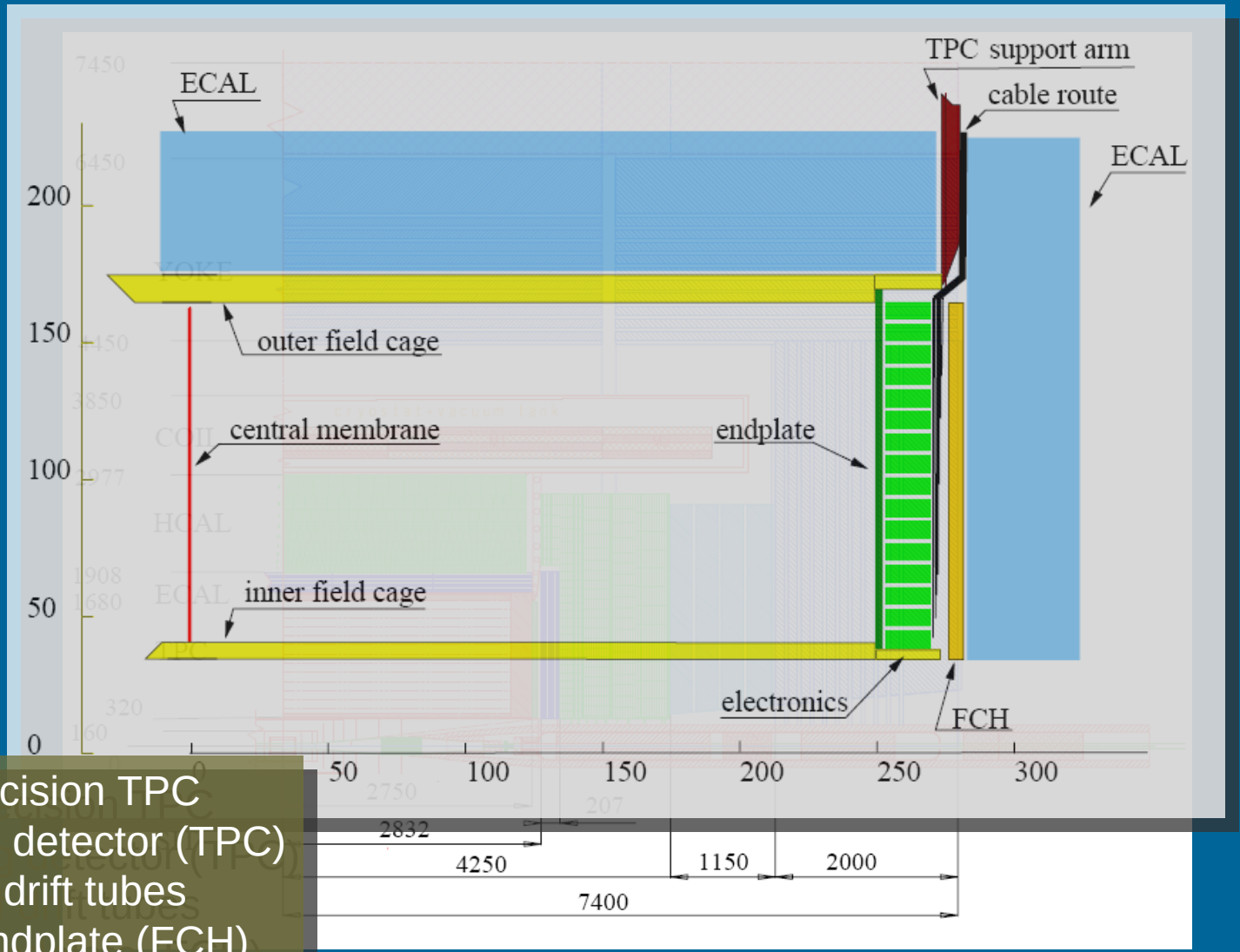
Quadrant view – vertex and forward tracking





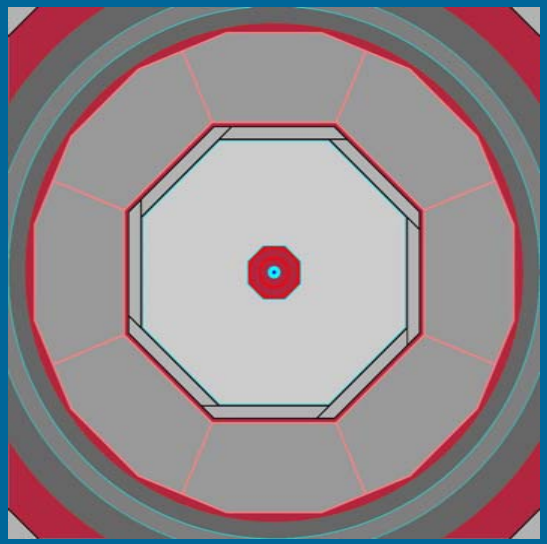
- 5 layers of vertex pixel detectors (VTX)
- 7 Si disks in the forward direction (FTD)
- 2 layers of Si strip detectors outside the VTX detector (SIT)

Quadrant view – central tracking

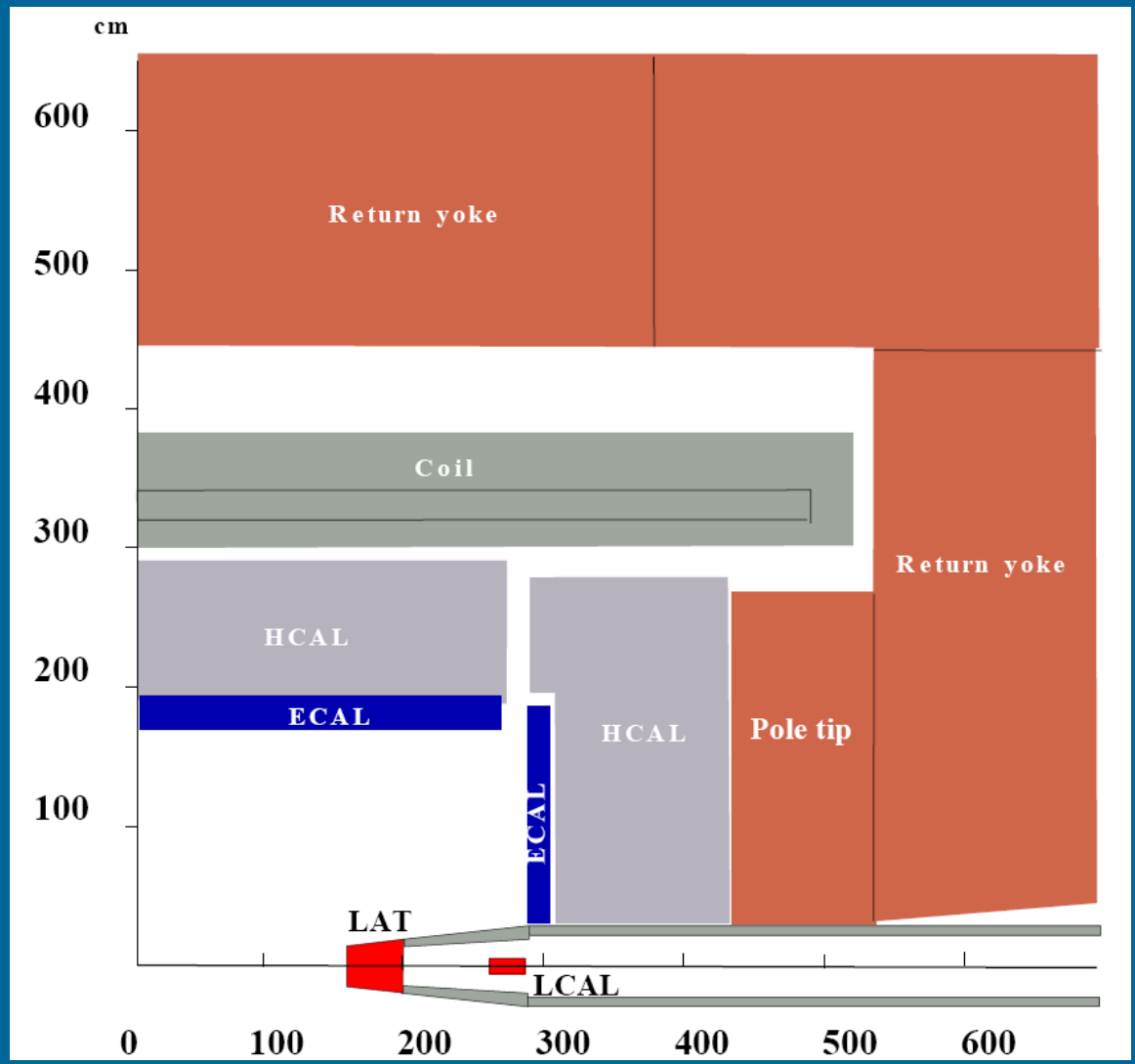


- large volume precision TPC as central tracking detector (TPC)
- several layers of drift tubes behind the TPC endplate (FCH)

Quadrant view – calorimetry, muon

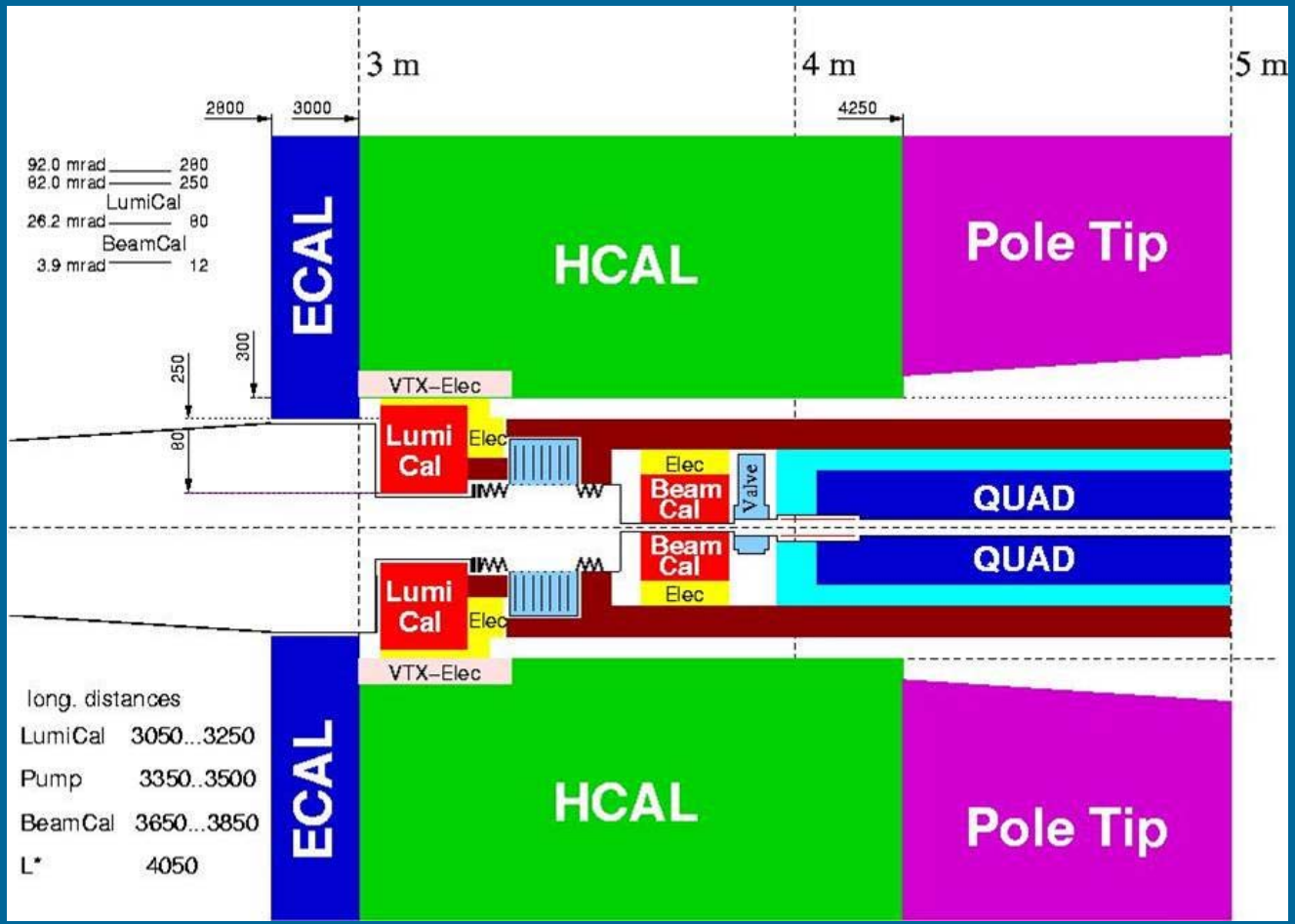


- Si-W ECAL in barrel and end cap (ECAL)
- Steel-Scint. or steel-RPC barrel and end cap (HCAL)
- 4T superconducting coil
- Instrumented iron return yoke with RPC (MUON)



Forward calorimetry

- Modified from TESLA to conform to larger L*

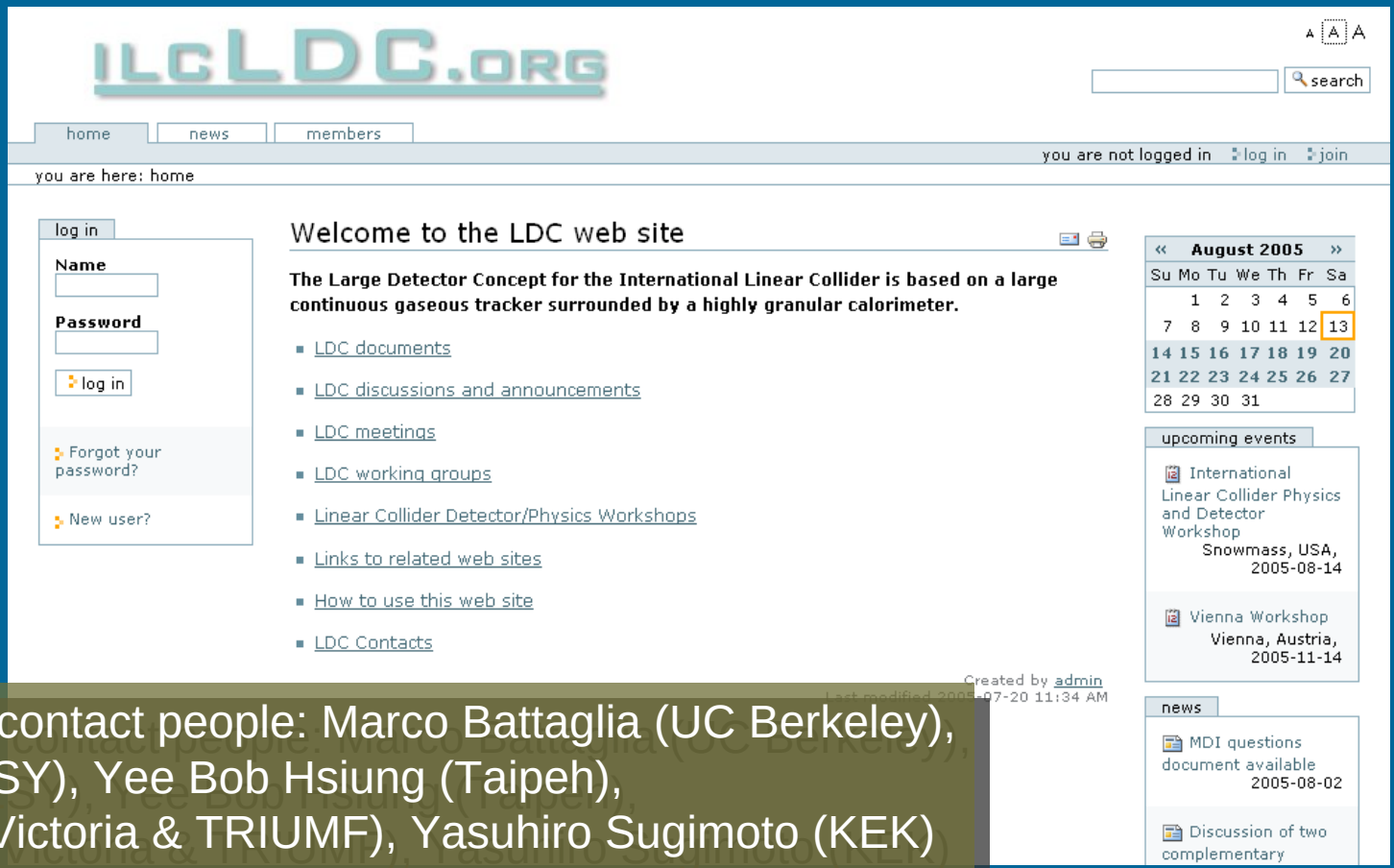


LDC goal

- To further improve on the TESLA design, taking into account:
  - modified machine design parameters
  - updated physics benchmarks
  - results from ongoing detector R&D
  - new ideas

LDC group

- A community of physicists ~100 registered



steering by the 6 contact people: Marco Battaglia (UC Berkeley), Ties Behnke (DESY), Yee Bob Hsiung (Taipeh), Dean Karlen (U. Victoria & TRIUMF), Yasuhiro Sugimoto (KEK) Henri Videau (LLR-Ecole Polytechnique)

LDC plans for Snowmass

- Advance the discussion and work to answer detector optimization questions that cross subdetector boundaries
- LDC Snowmass schedule (Sinclair room):
  - Tuesday morning:
    - Introduction to LDC – general overviews
    - Introduction to LDC software tools
  - Tuesday afternoon:
    - Free to participate in other concepts or physics plenary
  - Wednesday morning:
    - Face the major questions…

LDC plans for Snowmass

- The following people will introduce the questions and help organize discussion groups on these questions during the workshop:

Marco Battaglia	vertex detector configuration questions
Sonja Hillert	beam pipe radius and its optimization for the VTX
Steve Aplin	How large should the TPC be? How close should the ECAL endcap be to the endplate of the TPC? How much material in front of the ECAL is acceptable?
Klaus Moenig	In the forward direction, the FTD is currently a system of pixels and disks. How important is its material? What are the important performance goals for tracking in the forward region?

LDC plans for Snowmass

Aurora Savoy-Navarro	The SIT was introduced for track merging and for V0 efficiency reasons. These studies should be redone. Is the current SIT and SET layout optimal? Which role does the material play in the overall track reconstruction?
Lee Sawyer	How important is the FCH behind the TPC? Do we need stand-alone tracking capability in there, or is a simple device which adds one or two hits sufficient? Which technology is optimal for the FCH?
Alexei Raspereza	What is the possible particle flow performance? What have we achieved?
Mike Ronan	How important are gaps between the calorimeter components? How important are gaps between the calorimeters and other components such as the TPC? What is the penalty for a round TPC inside an octagonal ECAL? How efficient is the TPC for detecting backscattered particles? etc…

LDC plans for Snowmass

Graham Wilson	What is optimal thickness of the ECAL/ HCAL? What is the optimal sampling structure? Is the approach used in the LDC detector optimal, can it be improved?
Marcello Piccolo	What is importance of muon system: muon id, tail catcher, cosmic veto? How many layers are needed?
Week 2:	
Dan Peterson	What quality of the B field do we need? How can we measure and monitor the field distortions at the required level of accuracy? Can the large distortions in the large crossing angle be accounted for? Can control samples be used to improve the knowledge of the field map? Does it make sense to eliminate the plug, at the cost of a shorter magnet and thus a less homogeneous field?
Henri Videau, Felix Sefkow, Steve Magill	Calorimetry optimization questions

LDC plans for Snowmass

- LDC Snowmass schedule (cont.):
  - Wednesday (Aug 17) late afternoon:
    - organize into discussion groups
    - prioritize the questions
    - define goals for Snowmass and beyond
  - Late afternoon sessions
    - updates on progress from discussion groups

- To be kept informed on LDC session plans, be sure to register at ilcLDC.org and subscribe to the Snowmass announcements forum.