Vertex Tracker Questions for the LDC Detector

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Vertex Tracker Conceptual Design

Vertex Tracker Engineered Design

Vertex Tracker Performance

Conceptual Design

Innermost Layer:
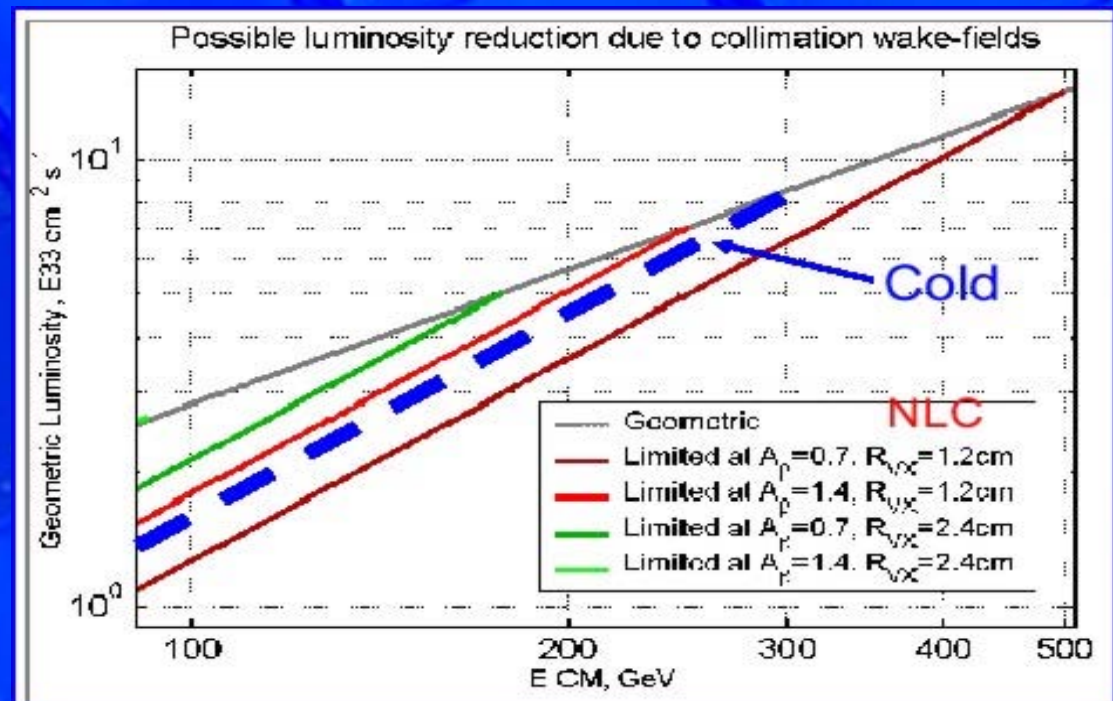Radius driven by machine collimation and pair backgrounds;
Length driven by envelope of pairs preceding in the solenoidal field;

$$R[cm] = 0.35 \sqrt{\frac{N}{10^{10}} \frac{1}{B[Tesla]} z[cm] \frac{1}{\sigma_z[mm]}}$$

$$z[cm] = 8.3 \ R^2 B[Tesla]\sigma_z[mm]\frac{10^{10}}{N}.$$

radius minimisation must be confronted with machine performance;

Pair background on first layer determines required r/o speed and therefore pushes R&D and sensor technology

Possible luminosity reduction due to collimation wake-fields

Geometric Luminosity, E33 cm^{-2} s^{-1} — E CM, GeV

Cold — NLC

Geometric
Limited at A_r=0.7, R_{vx}=1.2cm
Limited at A_r=1.4, R_{vx}=1.2cm
Limited at A_r=0.7, R_{vx}=2.4cm
Limited at A_r=1.4, R_{vx}=2.4cm

Outer Layer:
Radius at the moment somewhat arbitrary.
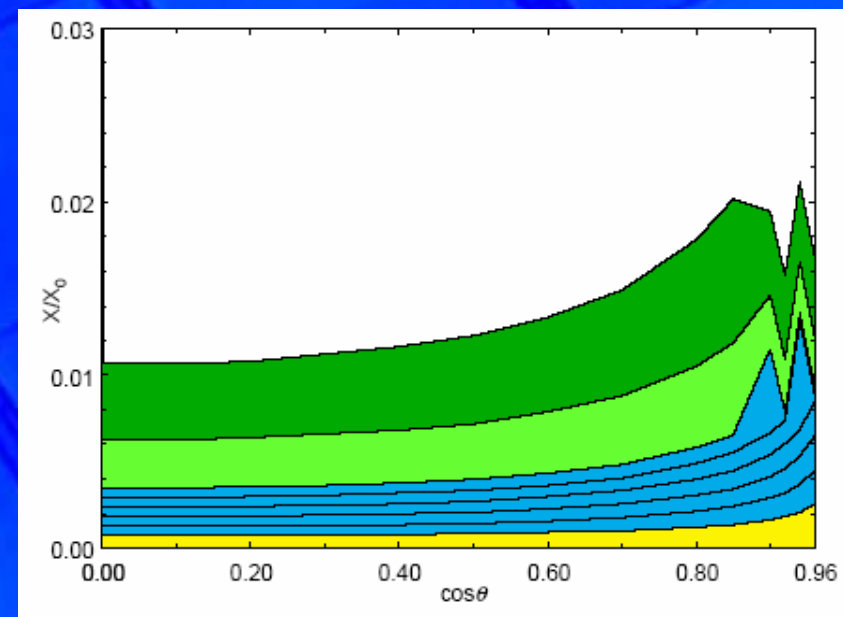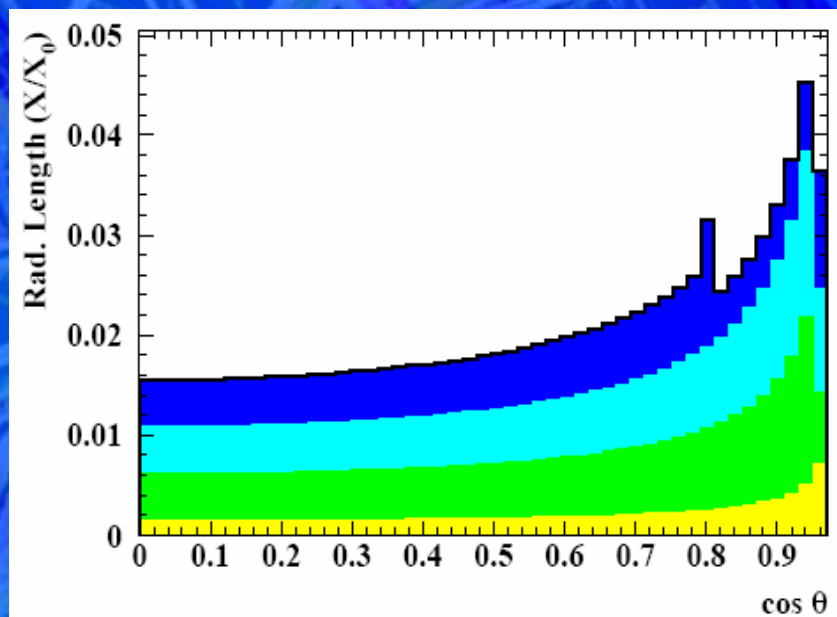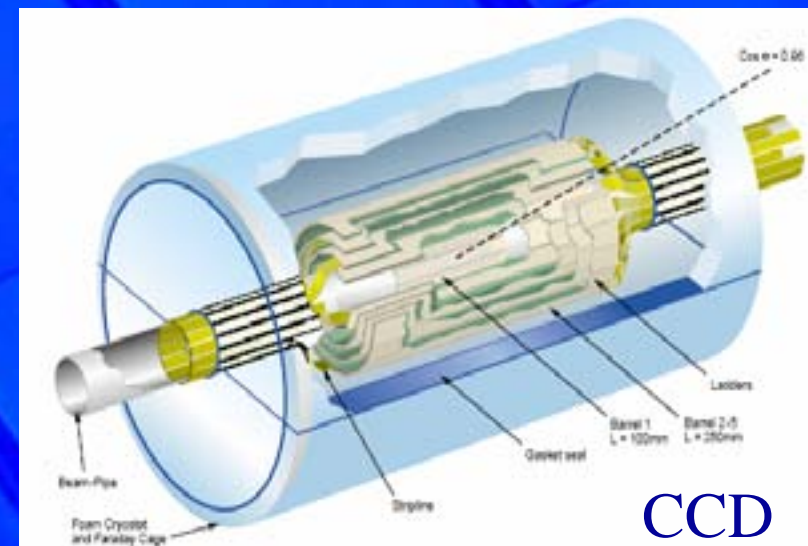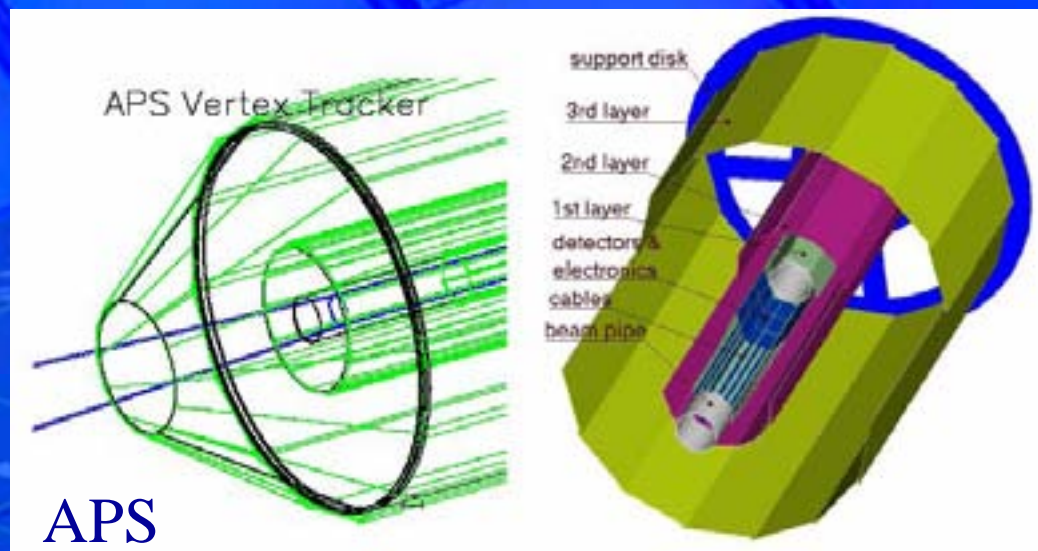Drivers and constraints in defining interface with SIT?

Number of Layers:
Are five layers optimal in terms of material and performance ?

General Layout:
Barrel only + Fwd Disks or integrated end caps?

Are there strong advantages with integrated endcaps
(smoother material budget profile, angle of incidence of tracks)
overcoming engineering complexity ?

Vertex Tracker Layouts in TESLA TDR

APS

CCD

Engineered Design

Material budget:
model of realistic ladder and support structure estimate, electronics, cables, etc. Where are the cables routed? Where does the repeater electronics sit? Is the TDR solution on the mask still viable, given that the distance between detector and mask has changed significantly? impact of cooling and thermal management.

Alignment:
How to align the VTX internally to an accuracy comparable to its single point resolution ? How to align the VTX wrt SiT and TPC ?

Performance

How critical is standalone pattern recognition in LDC ?

Is the LDC putting any specific emphasis on the VTX performance or design ?

The VTX WG at Snowmass

http://alcpg2005.colorado.edu:8080/alcpg2005/program/detector/VTX/agenda

SG1: Conceptual Design
<u>Organisers</u>: *Marc Winter and Su Dong*
Layout, geometry, physics banchmarking,
reconstruction software, concept dependance of VTX design

SG2: Engineering Design
<u>Organisers</u>: *Chris Damerell and Leo Greiner*
Material budget, sensor backthinning, mechanical support,
cooling, RF pick-up

SG3: Sensor Technology
<u>Organisers</u>: *Massimo Caccia and Gerhard Lutz*
Review of current sensor R&D, perspective, priorities,
synergies with other applications beyond ILC/HEP