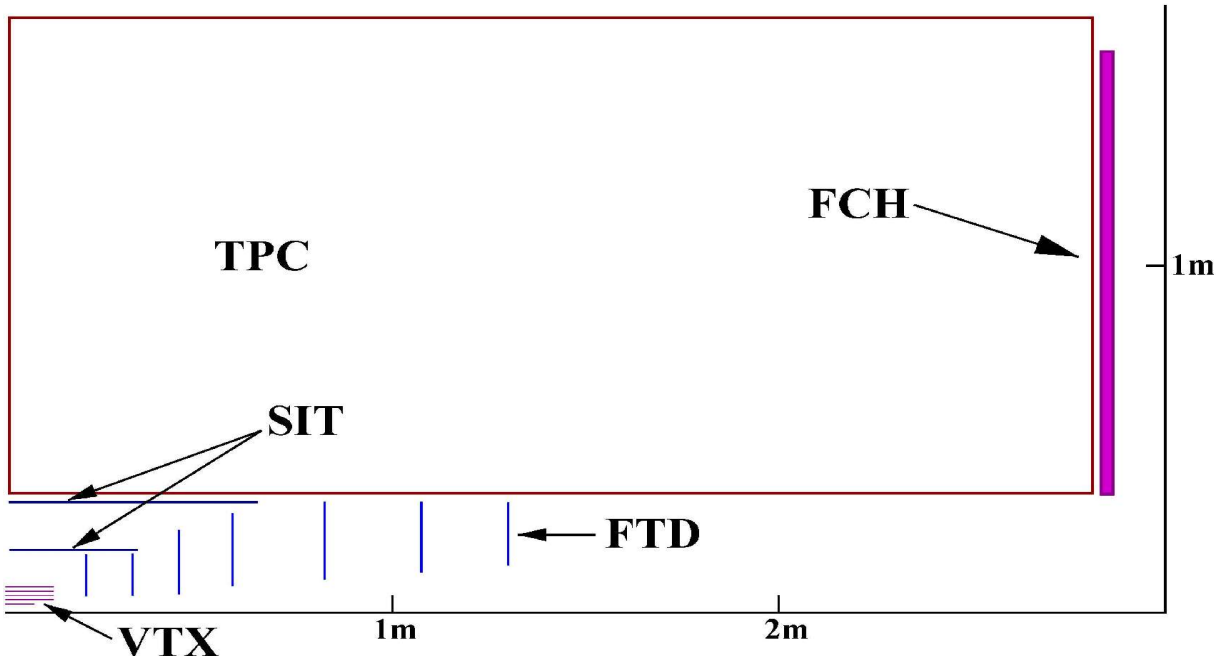
Tracking in LDC

Ties Behnke, DESY

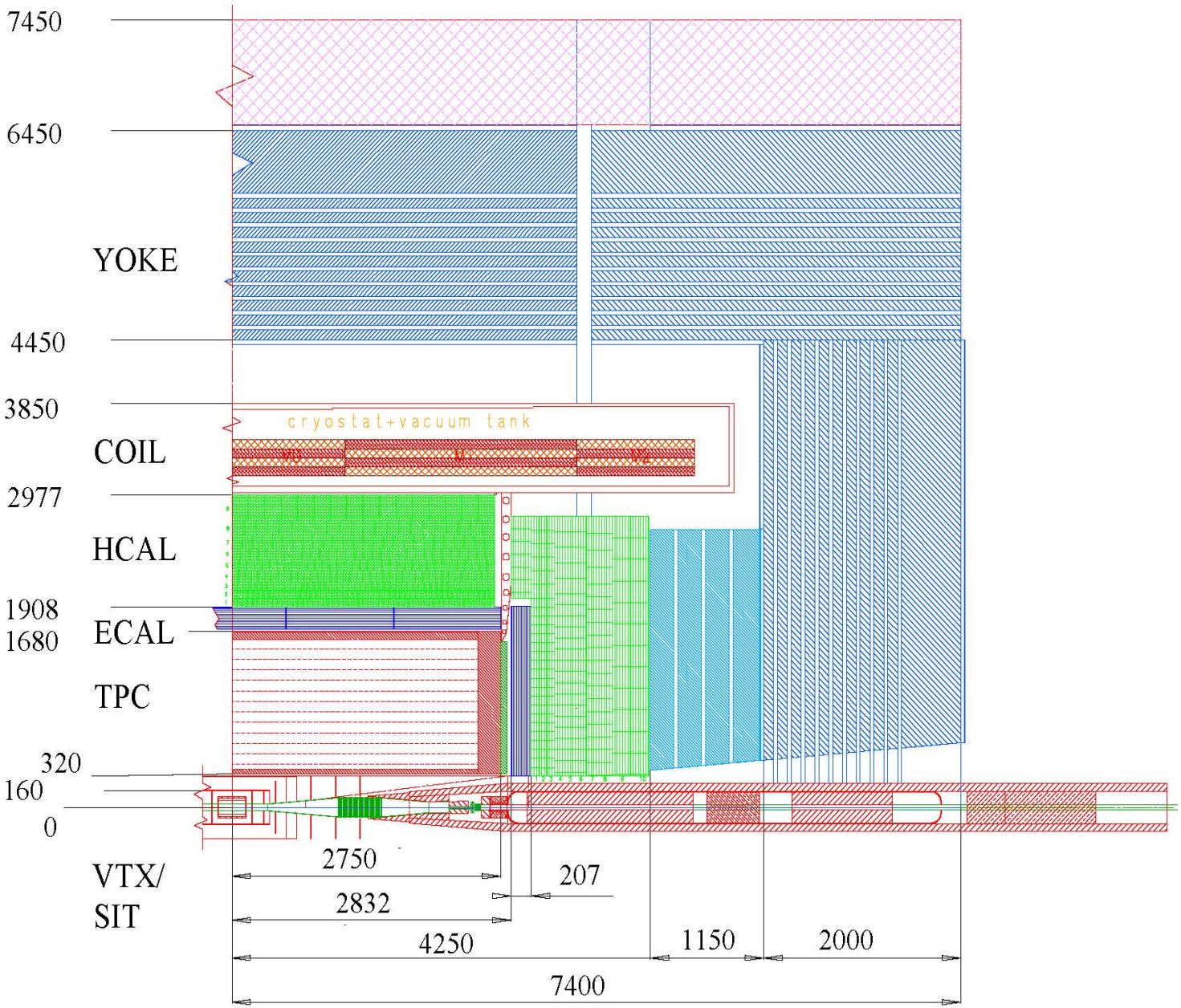
LDC: optimised for excellent tracking based on a large volume gaseous tracker: TPC

backed up by extensive SI based tracking devices.



Baseline design: developed for the TESLA TDR 2000/2001

A reminder: The tracking system in LDC



The basic concept

The 1. central part: a large volume TPC for efficienct and robust pattern recognition

The 2. central part: a high precision vertex detector for superb secondary vertex reconstruction, complemented by forward tracking to low angles

Intermediate SI tracking: connect VTX and TPC

Forward Chambers: supplement tracking at intermediate angles behind the TPC endplate

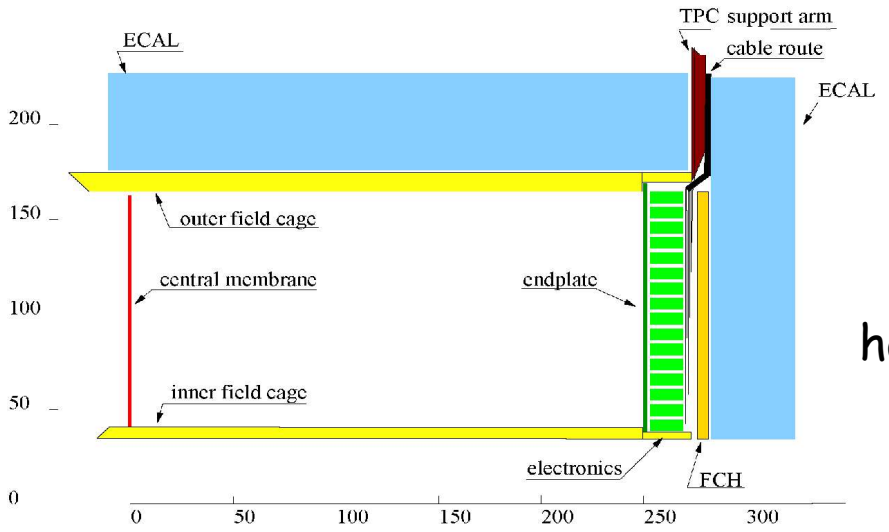
Silicon envelope: provide precision point outside the TPC

The TPC as the central tracker

- Provide many points on the track with reasonable precision
- Very thin field cage to limit multiple scattering
- Compact, thin endplate for good forward performance
- Continuous operation possible through a bunch train
- Particle ILD possible through dE/dx

R(out)=168cm

R(in)=32cm

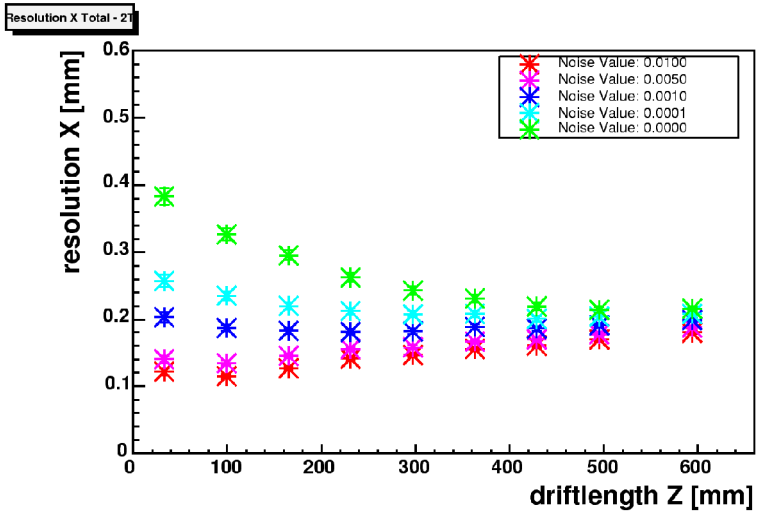


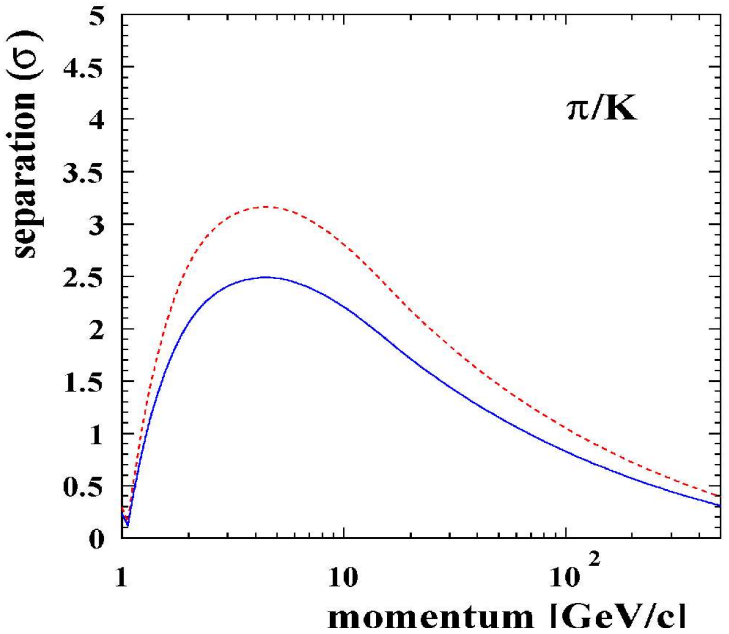
half-length=275cm

TPC parameters

- Max drift length ca 250cm
- Envisioned point resolution around 100 um
- "Some" dE/dx performance
- Around 200 pad rows
- Pad size around 2x6 mm²
  (ca 5-8 10^5 pads in total)

For more technical details see the R&D sessions on Thursday ff

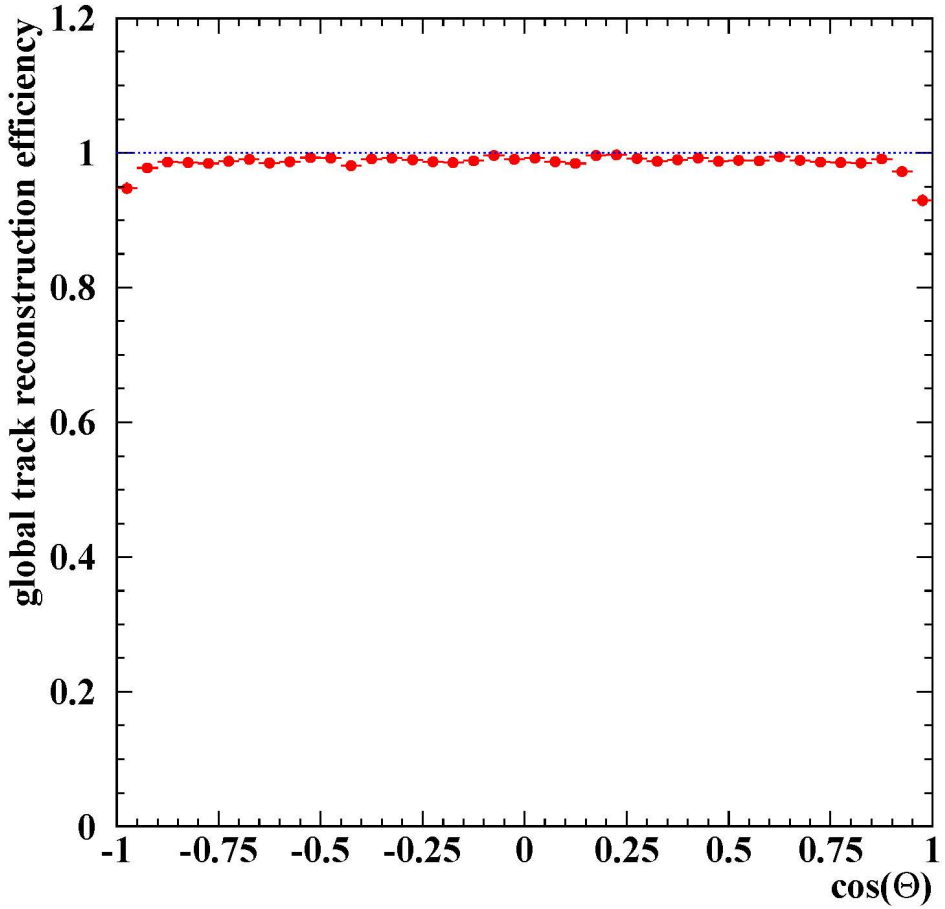




TPC performance

- Results from simulation: very efficient tracking is possible in the TPC
- Efficiency: 98.8% TPC only

Essentially independent of backgrounds,
very robust,
stable performance

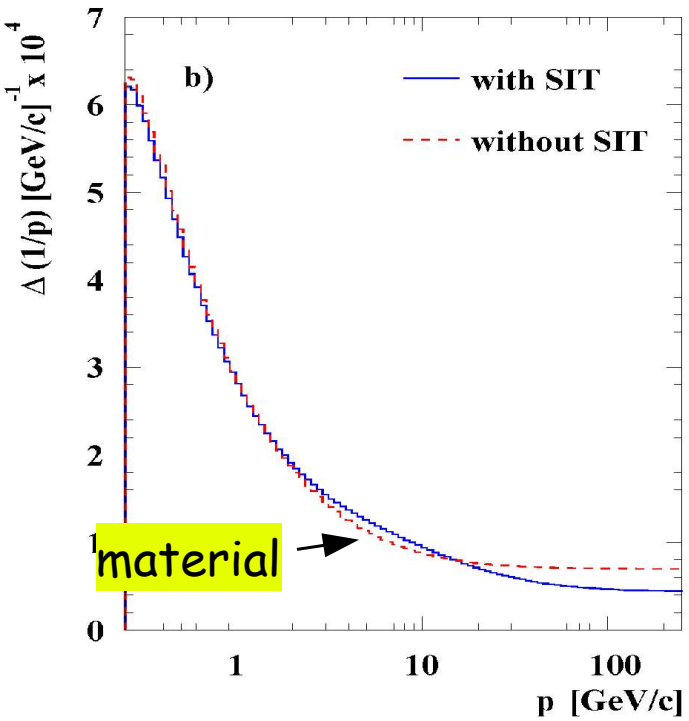


The SI tracker

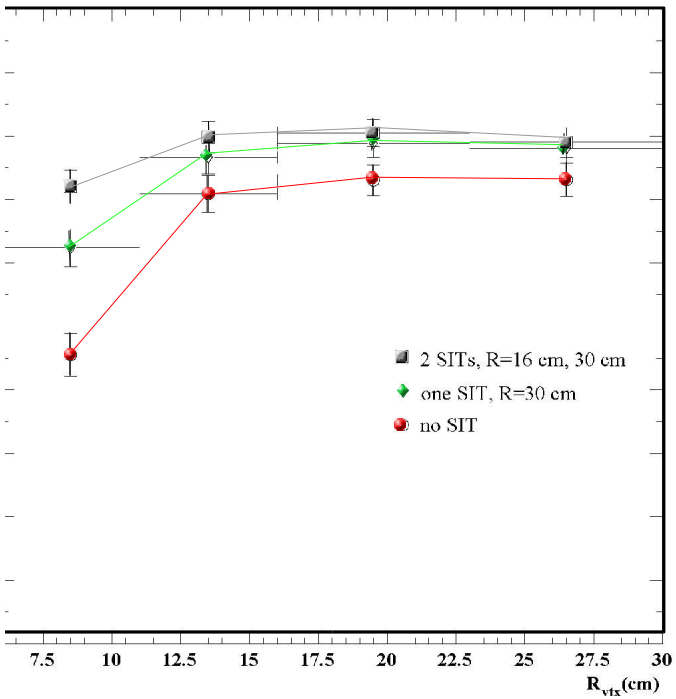
- SIT: Si intermediate Tracker

Introduced to fill the gap between the VTX and the TPC
conventional strip detector

Momentum resolution



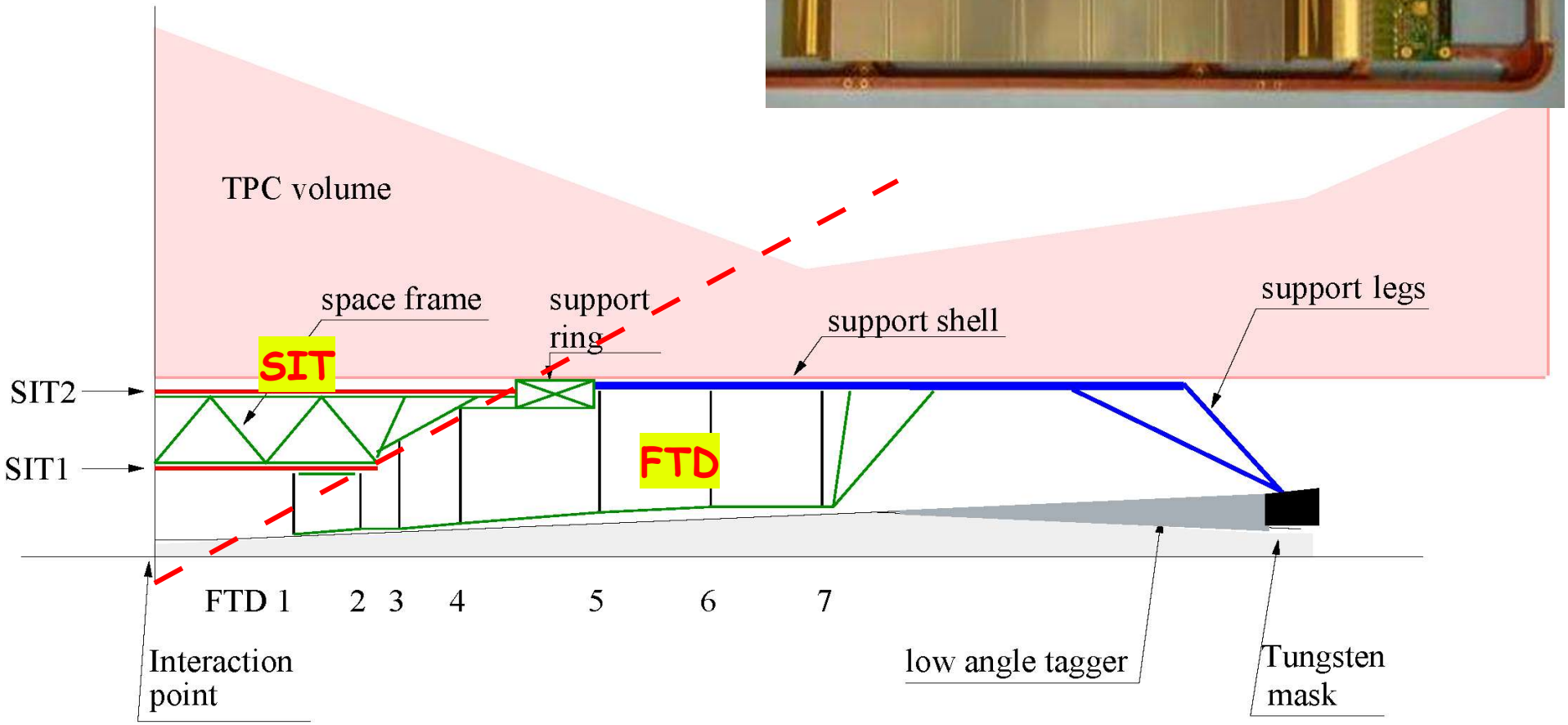
K0(short) efficiency



SIT layout

2 layers of SI strip detectors

Challenge: lomg SI ladders, minimum material

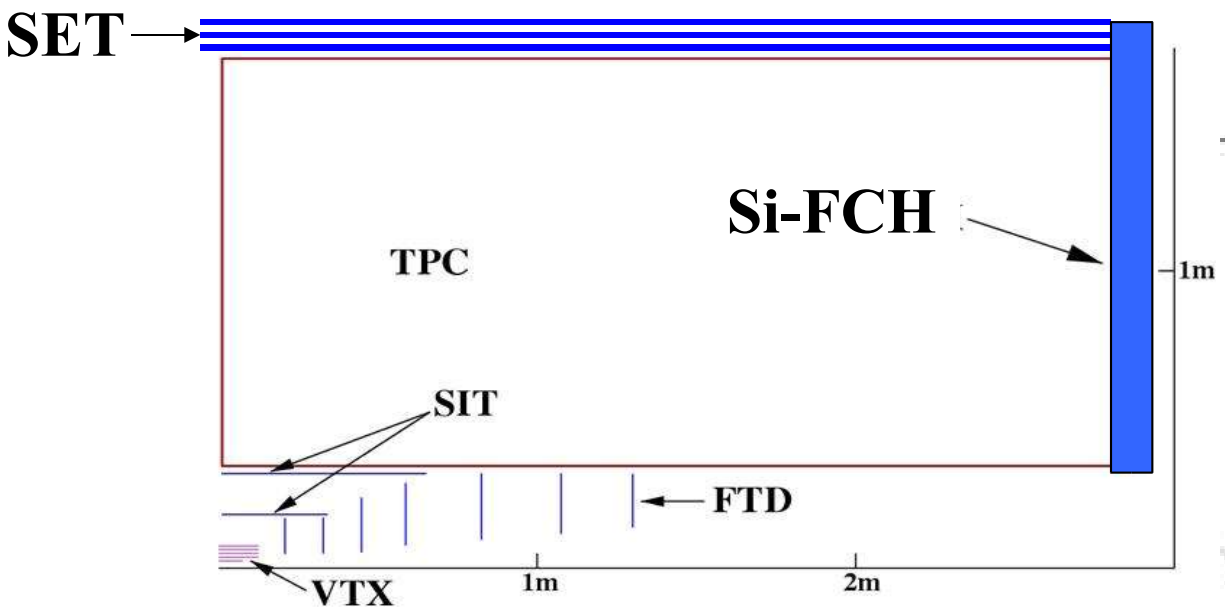


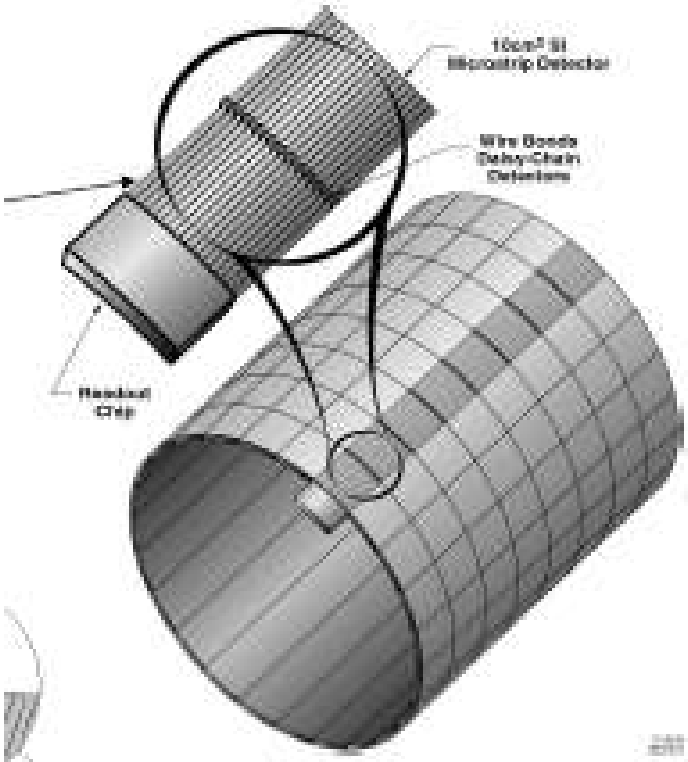
SI external tracker

At the moment considered an option:

a SI detector on the outside of the TPC

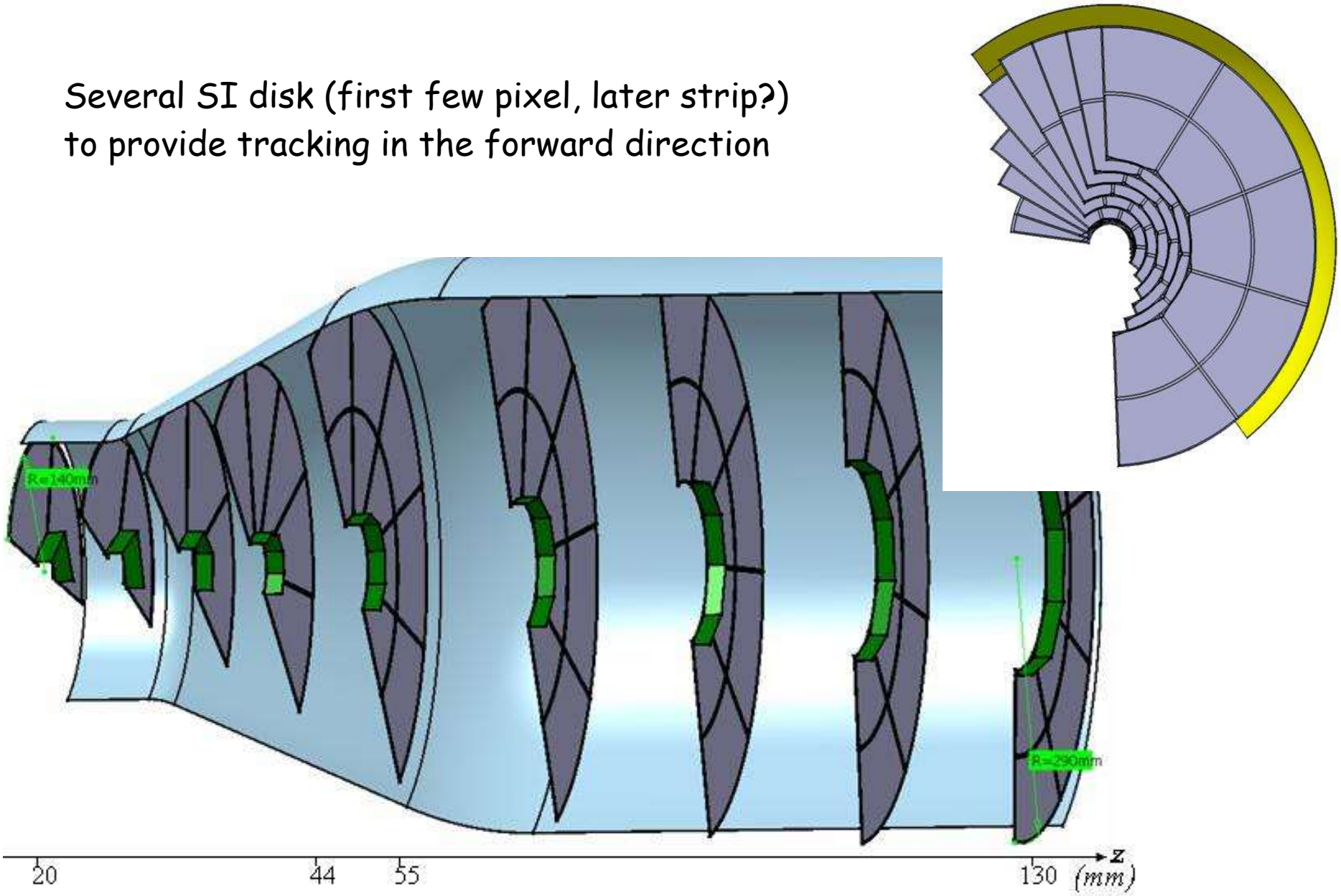
provide an additional precise point close to the calorimeter
useful for calibration of the TPC?
Helps tracking in very complex events?





The Forward Silicon

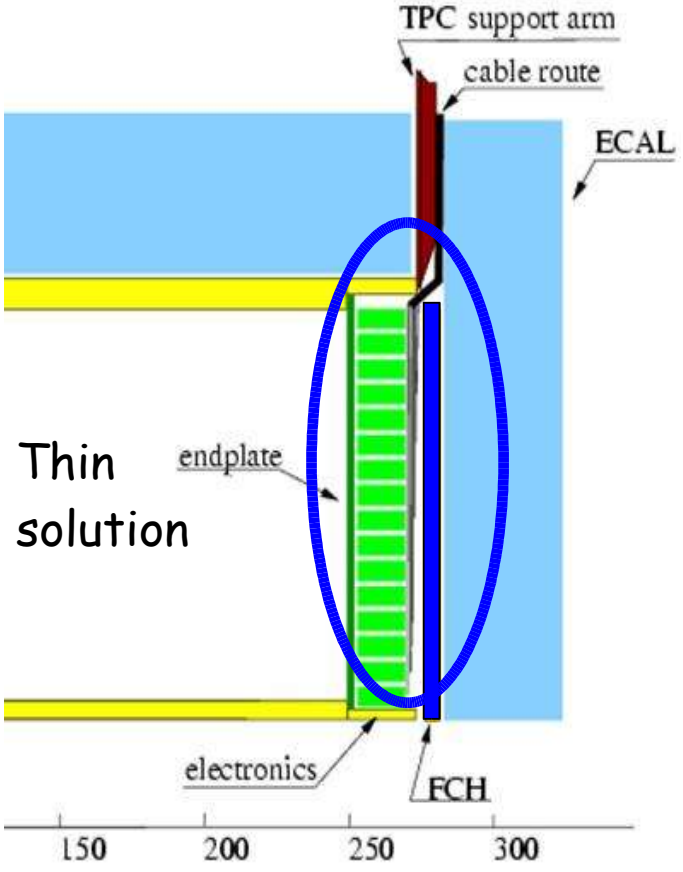
Several SI disk (first few pixel, later strip?)
to provide tracking in the forward direction

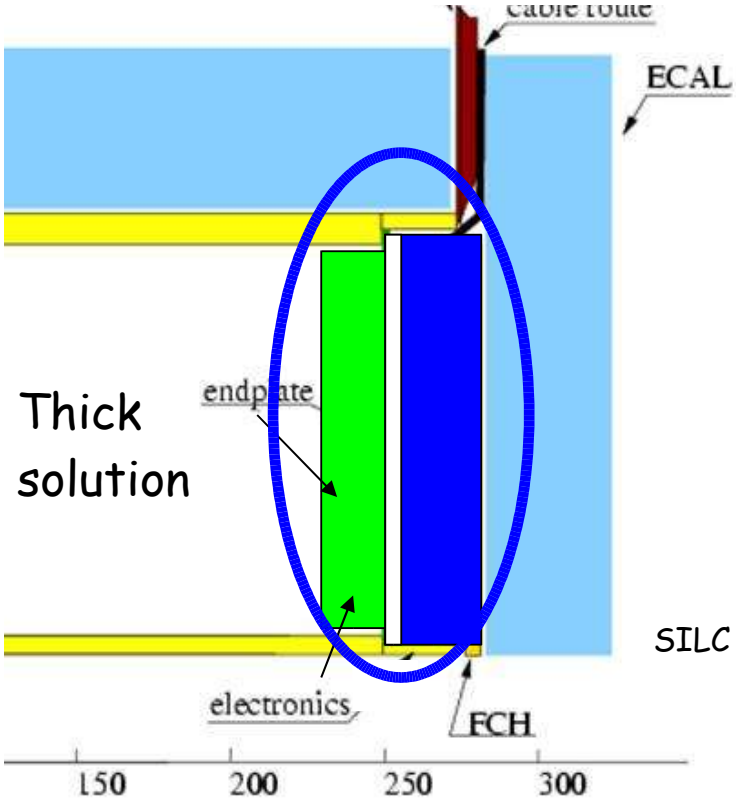


Proposal by the SILC collaboration

Forward Chambers

FCH: located nehind the TPC endplate
provide tracking for forward tracks
act as a "presampler" for the calorimeter





SILC collaboration

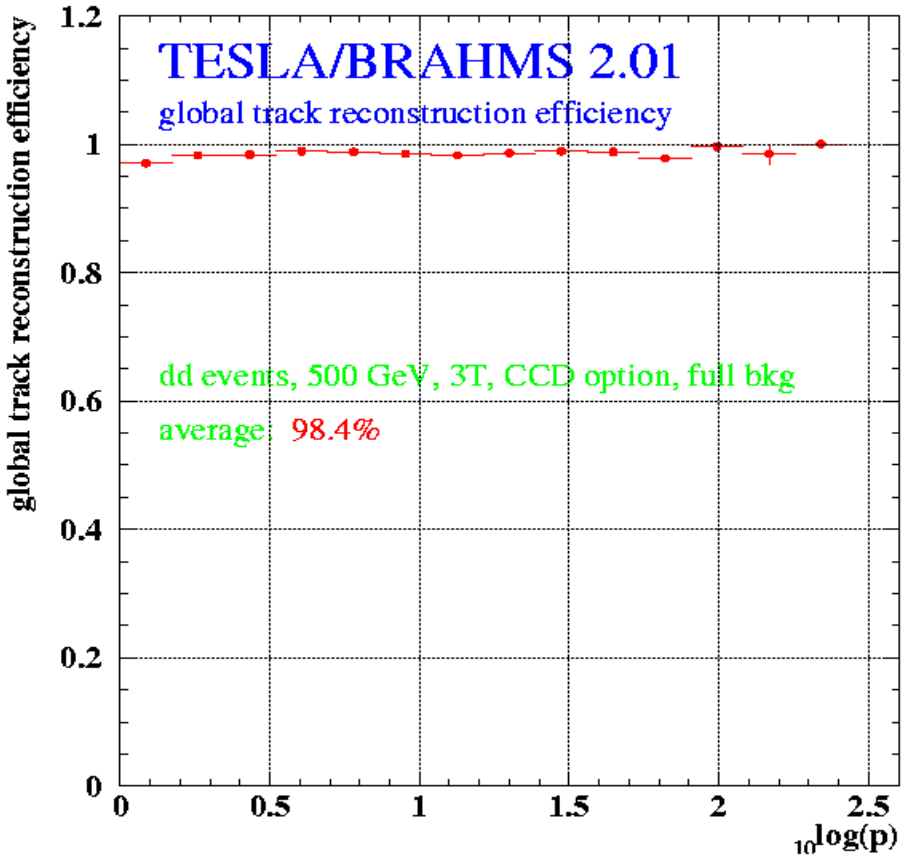
Linking - helping

Stand-alone tracking

Tracking performance

Simulation of overall tracking performance

backgrounds included, full simulation and reconstruction



Redundance of tracking:

barrel:
VTX + TPX
transition
TPC + FCH
forward
FTD + (VTX)

The COIL: characteristics

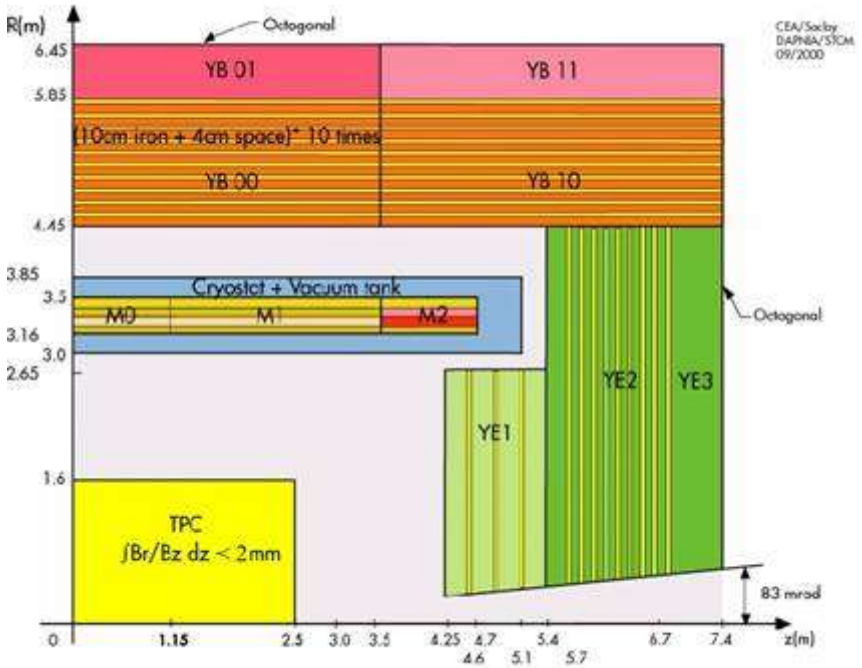
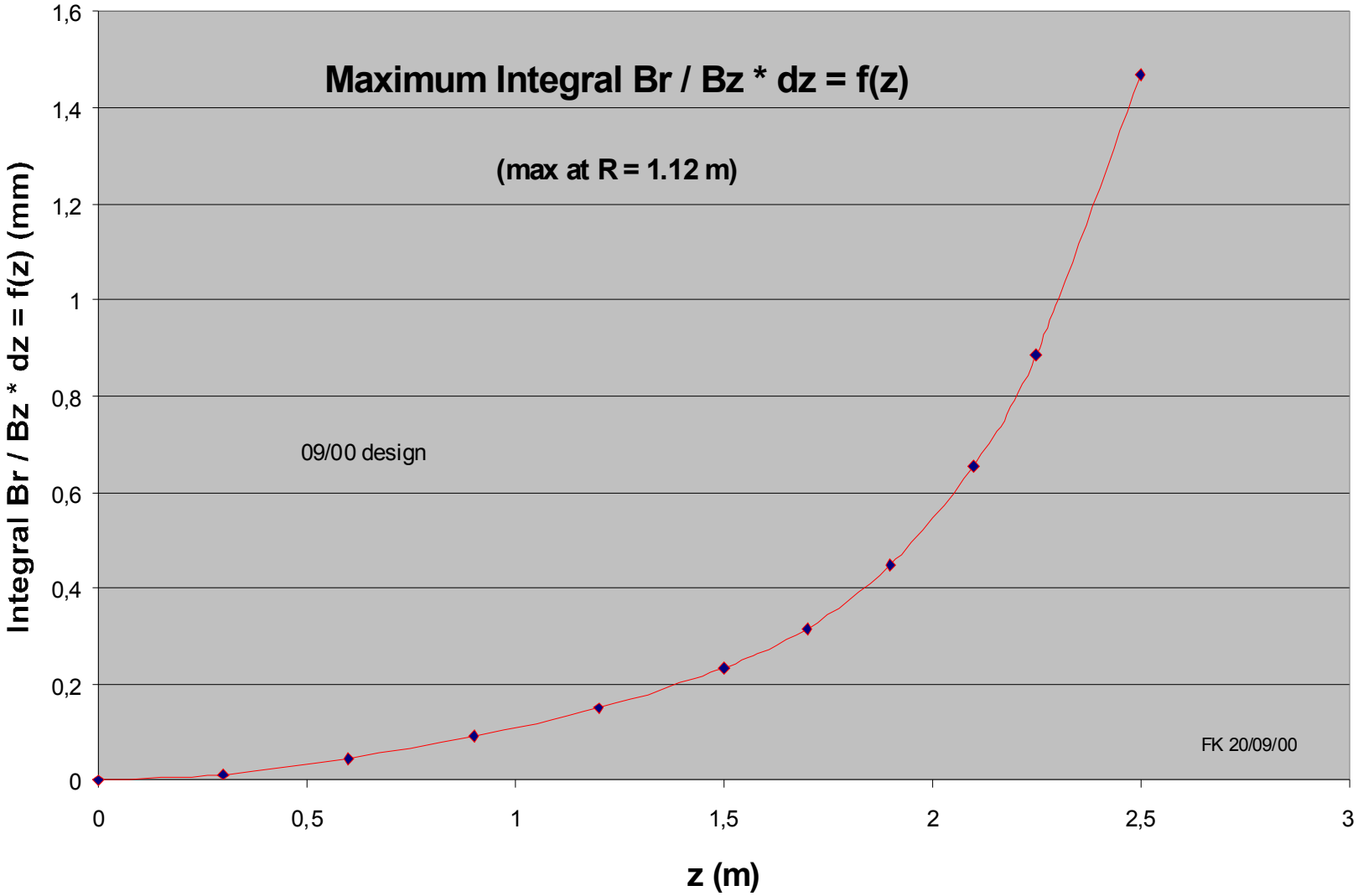


Figure 1. One quadrant of the TESLA detector magnet

- 5 modules : 2 external modules 1.1 m long each
  3 central modules 2.35 m long each
- 4 layers per module
- Nominal current : $I_o \sim 18.8$ kA
- Correction current : $\Delta I_c \sim 24.5$ kA added in the two middle layers of the two external modules

Field homogeneity



Maximum field distortion ~ 1.5mm

Where do we go from here?

The TESLA detector design was a first iteration

Since 2001 TESLA has evolved into LDC with small changes

Now is the time to revisit all the aspects of LDC and re-optimize LDC

Relative weight of TPC to SI detectors
Role of material
Redesign in view of recent R&D results
optimized interface to the VTX detector
Is the TESLA approach still the best for a PFLOW detector?
.....

Questions....

In tomorrows session:

Steve Aplin: TPC optimisation, interface to the calorimeter

Klaus Moenig: Forward Tracking

Lee Sawyer: Forward Chambers

Aurora Savoy Navarro: SI tracking in LDC

Mike Ronan: Alternatives?

Dan Peterson: Magnetic fields in the TPC

Tools

Introduction into tools:

second morning session combined with tutorial

Tools are available (though not yet complete)

Studies can be done based on fully simulted events: we can start a reoptimzation of the complete tracking system!