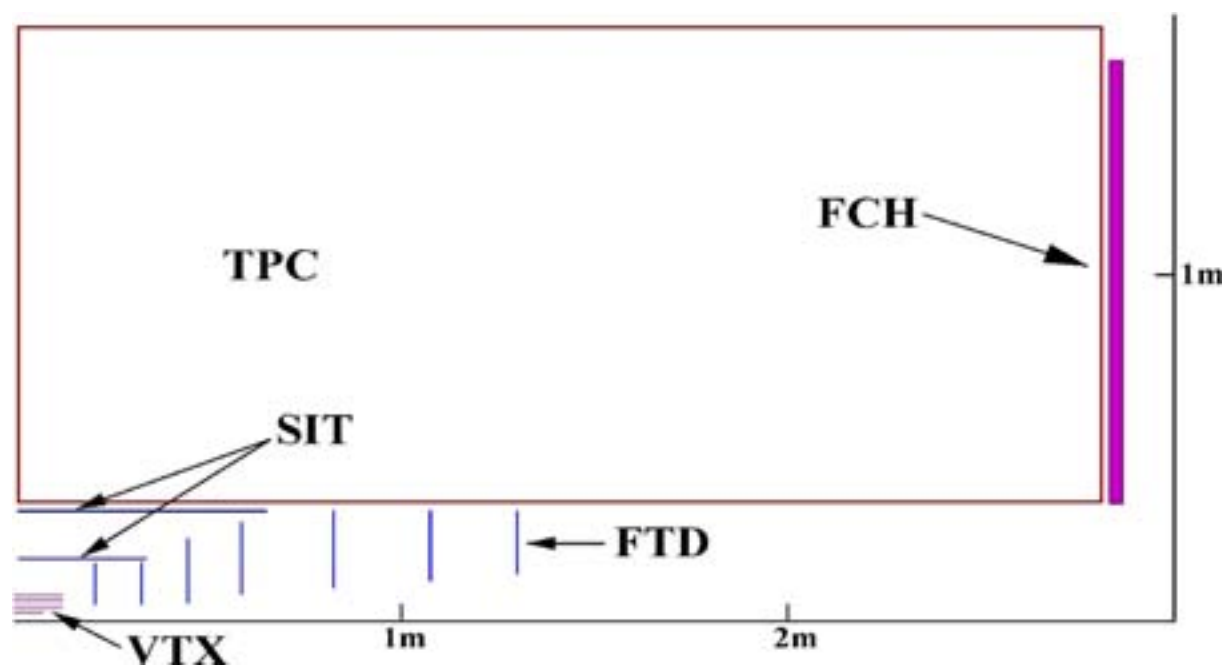


# Tracking in LDC

Ties Behnke, DESY

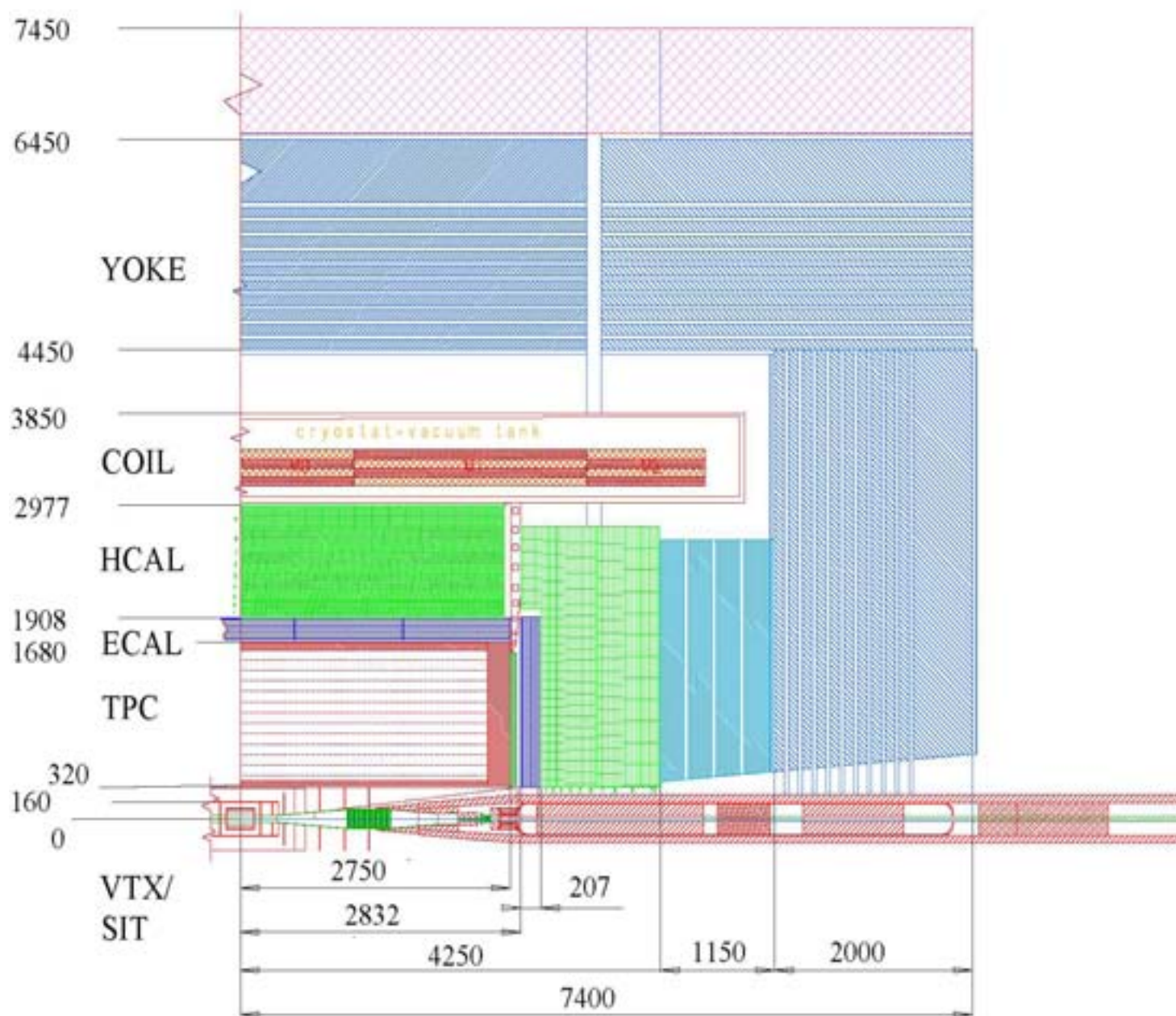
LDC: optimised for excellent tracking based on a large volume gaseous tracker: TPC

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 efficient 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

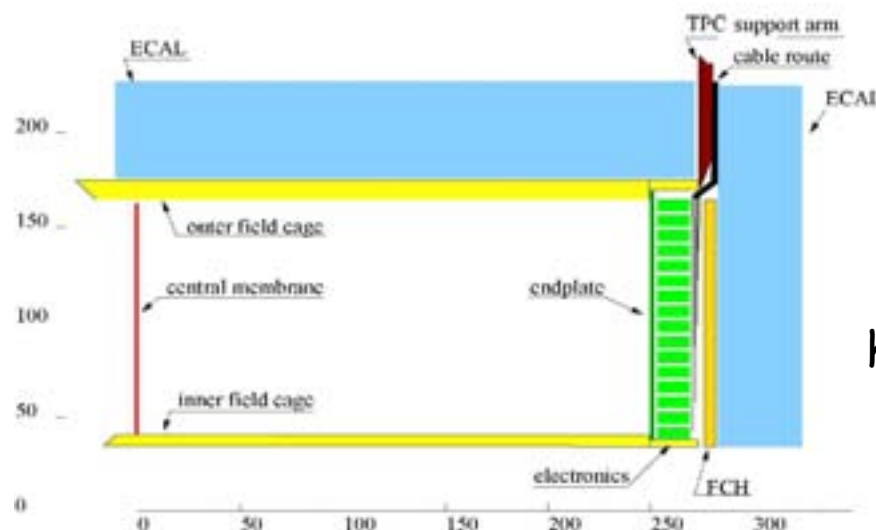
Silicon envelope: provide precision point outside the TPC

# 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  $dE/dx$

$R(\text{out})=168\text{cm}$

$R(\text{in})=32\text{cm}$

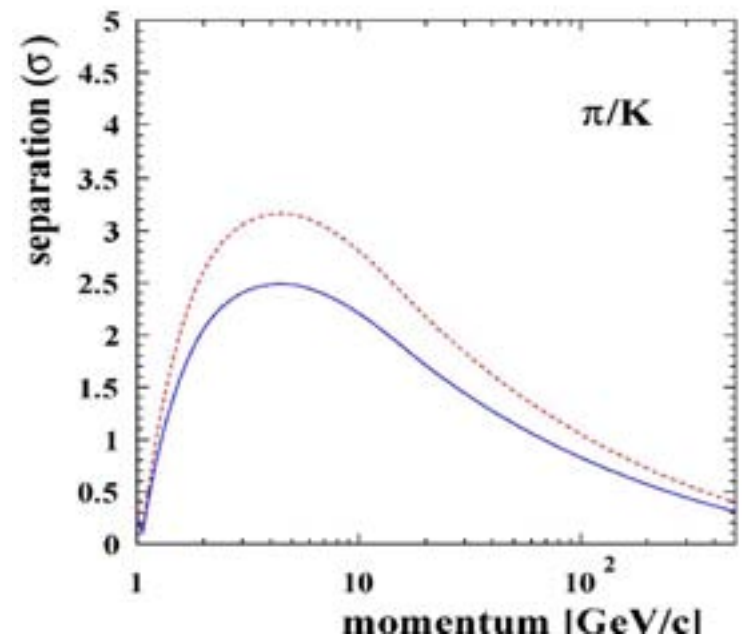
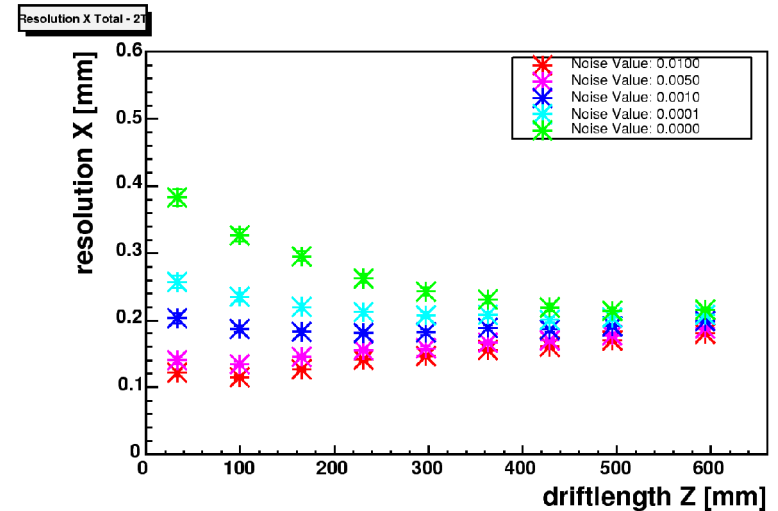


half-length=275cm

# TPC parameters

- Max drift length ca 250cm
- Envisioned point resolution around 100  $\mu\text{m}$
- "Some"  $dE/dx$  performance
- Around 200 pad rows
- Pad size around  $2 \times 6 \text{ mm}^2$   
(ca  $5\text{--}8 \cdot 10^5$  pads in total)

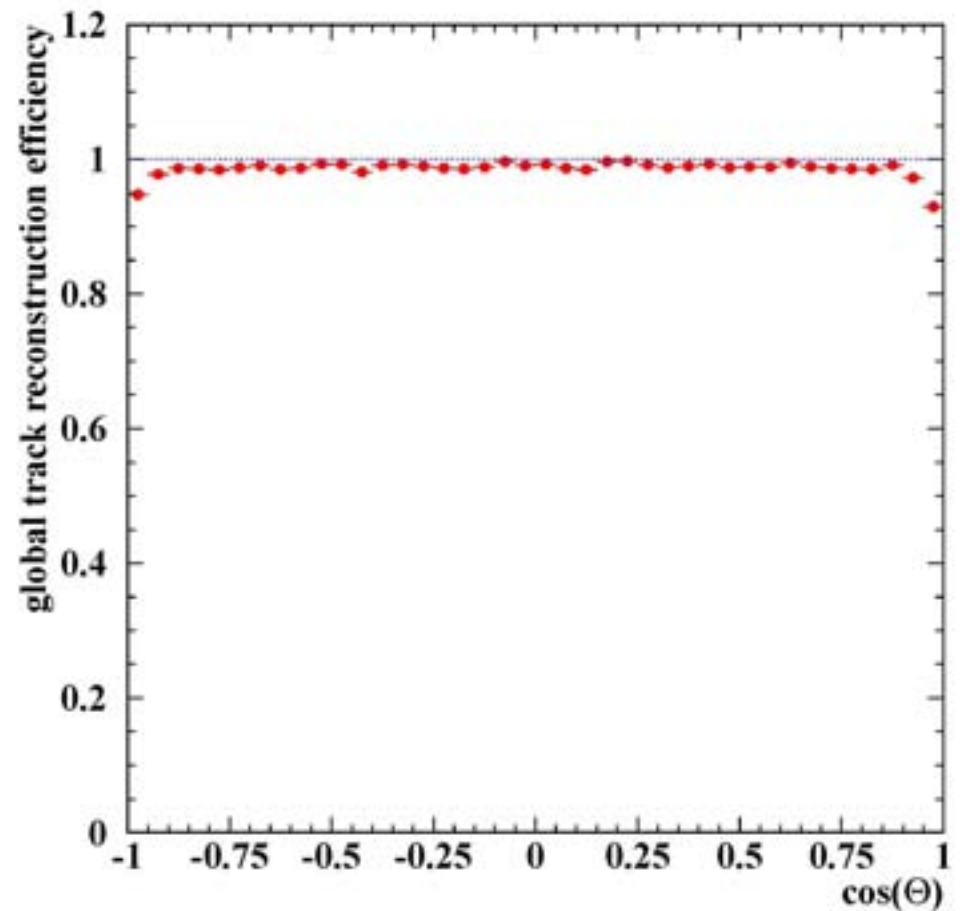
For more technical details see the  
R&D sessions on Thursday ff



# 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

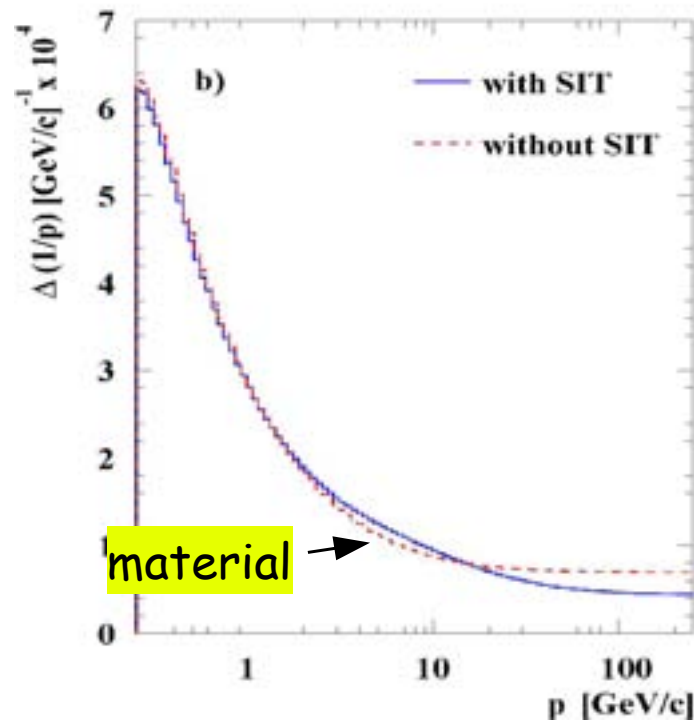


# The SI tracker

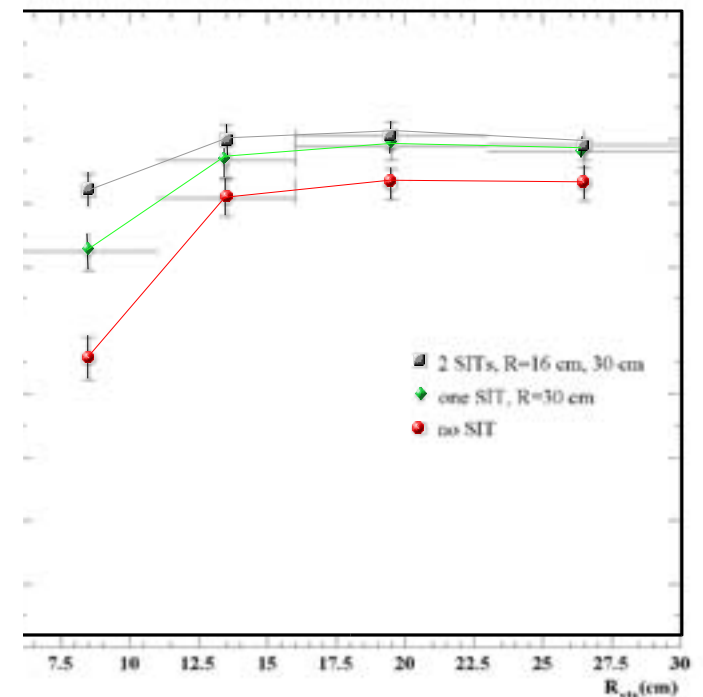
- SIT: Si intermediate Tracker

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

Momentum resolution



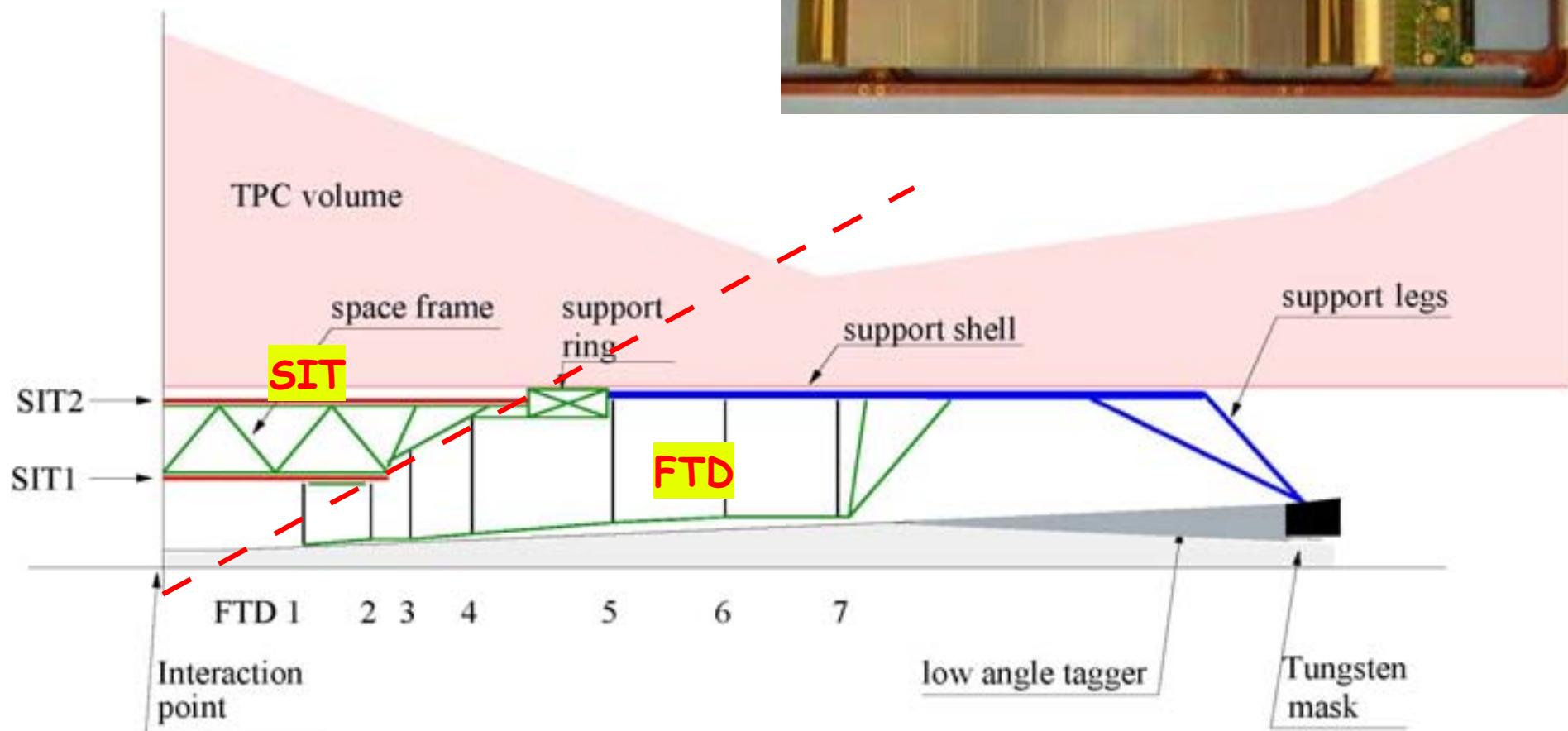
K0(short) efficiency



# SIT layout

2 layers of SI strip detectors

Challenge: long SI ladders, minimum material



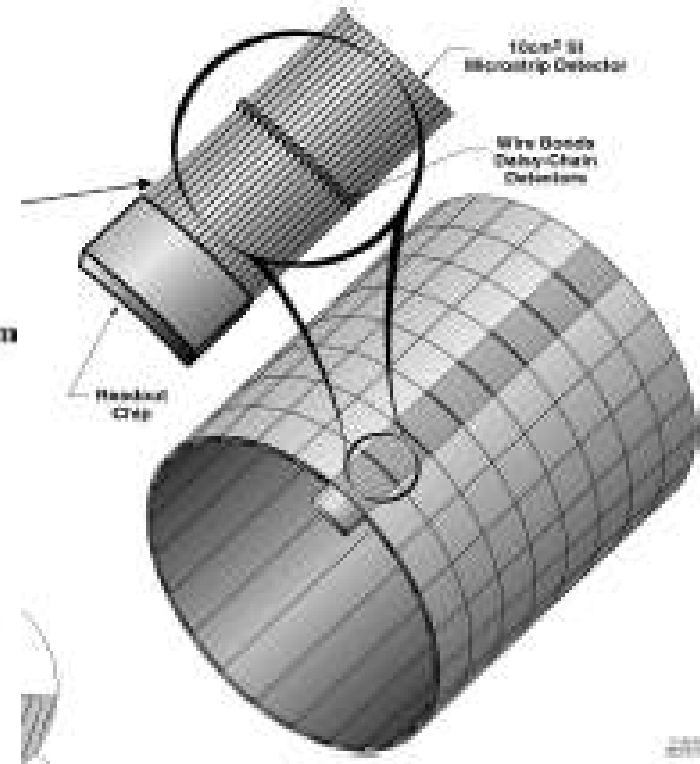
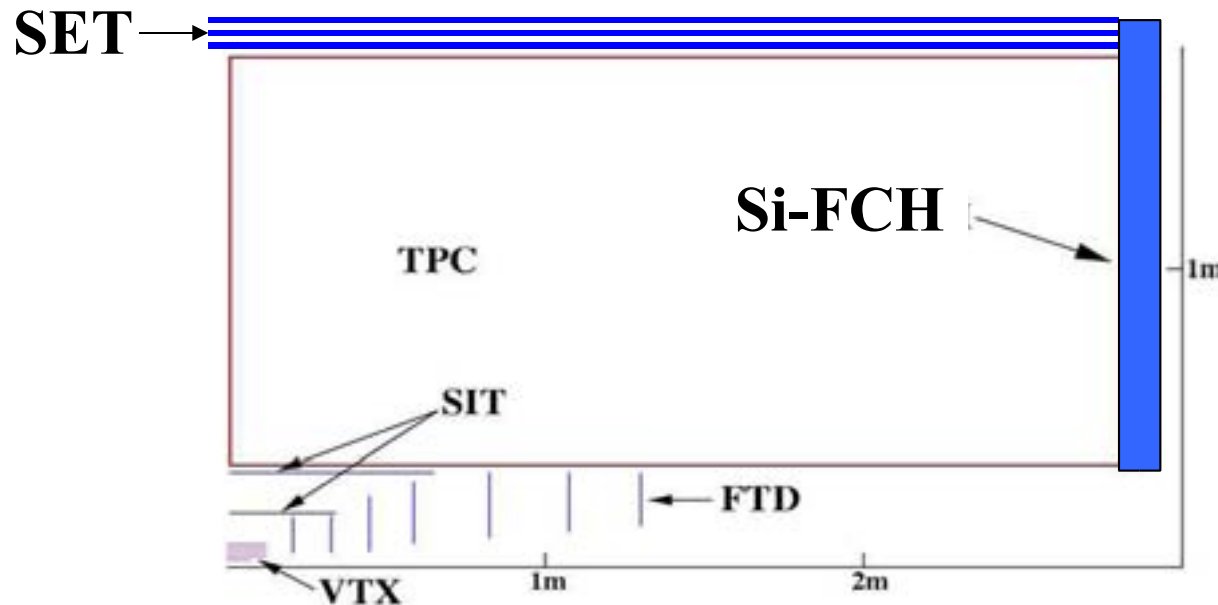
# SI external tracker

At the moment considered an option:

a SI detector on the outside of the TPC

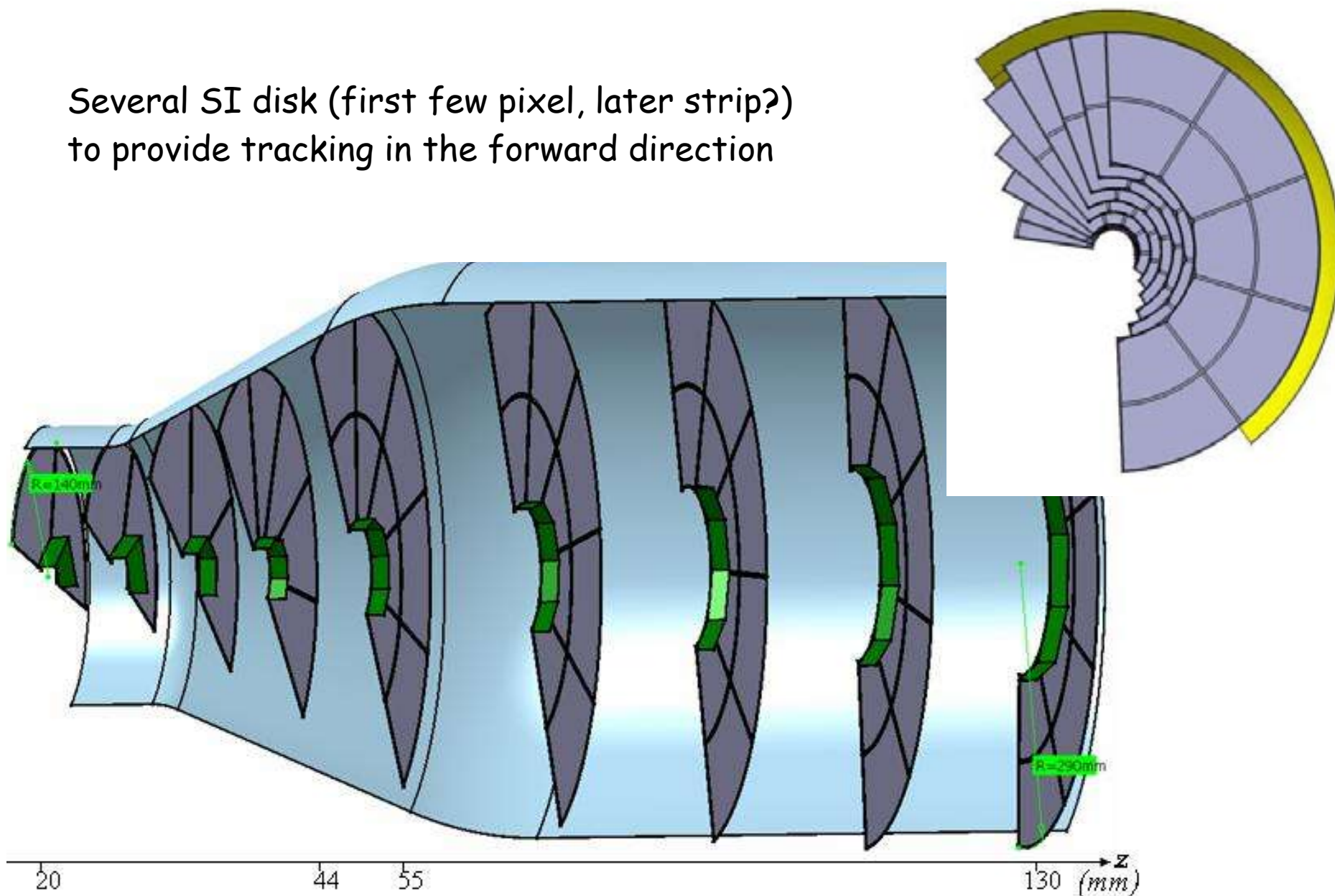
provide an additional precise point close to the calorimeter  
useful for calibration of the TPC?

Helps tracking in very complex events?



# The Forward Silicon

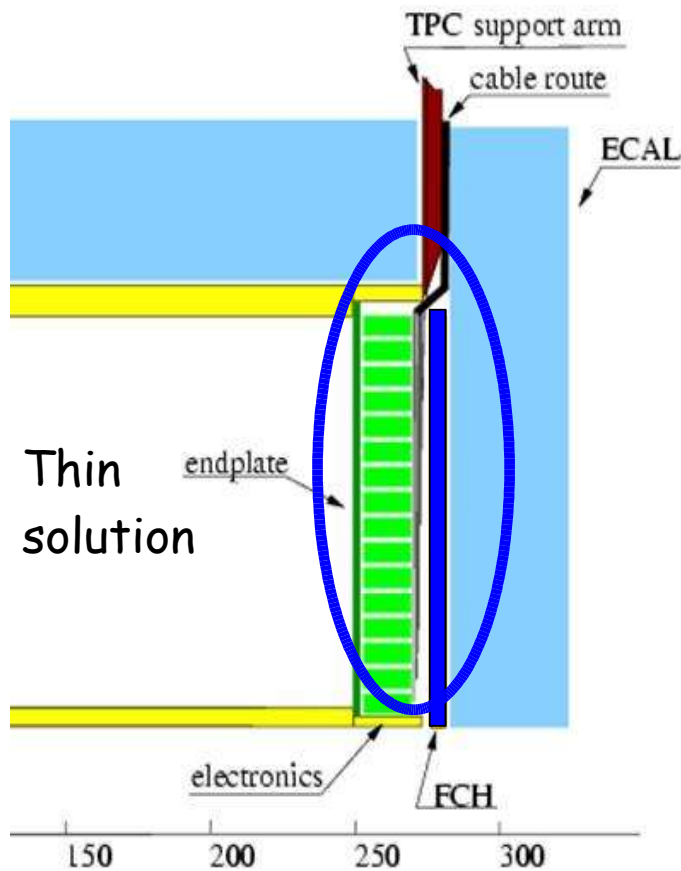
Several SI disk (first few pixel, later strip?)  
to provide tracking in the forward direction



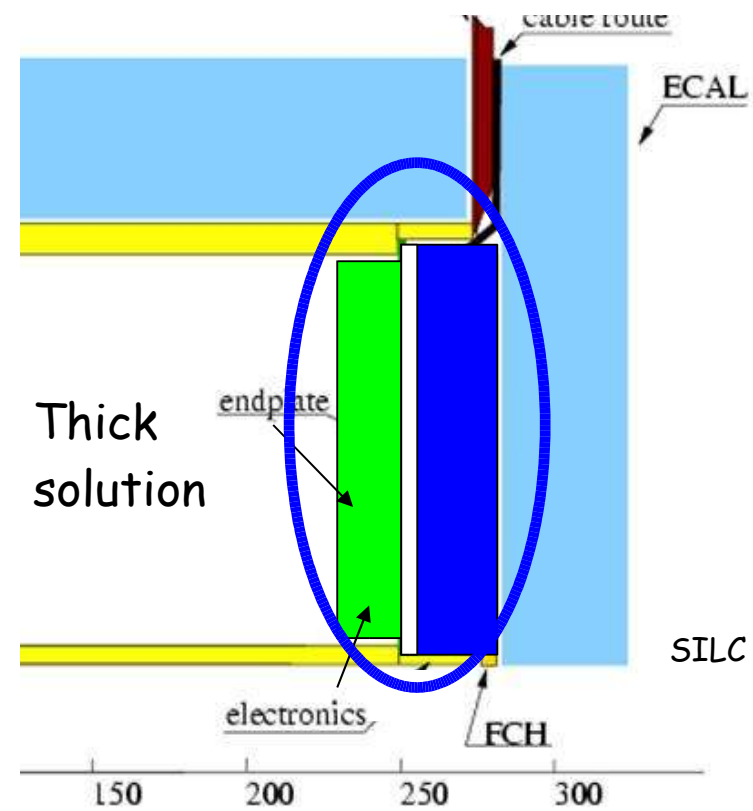
Proposal by the SILC collaboration

# Forward Chambers

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



Linking - helping



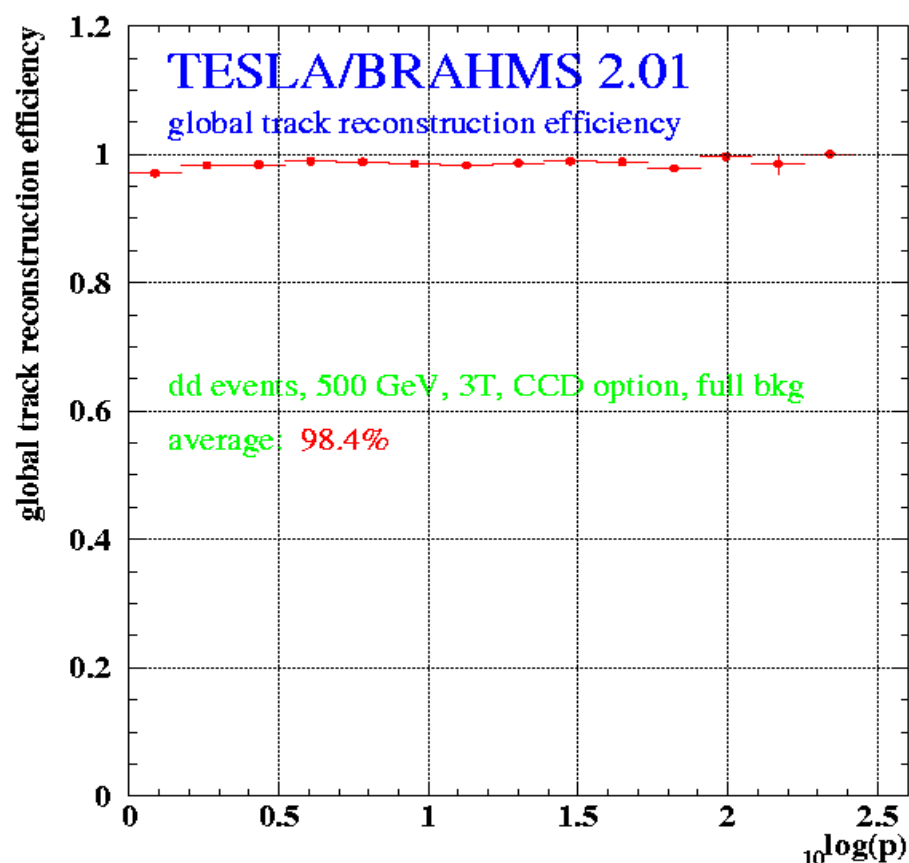
Stand-alone tracking

SILC collaboration

# 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 COLL: characteristics

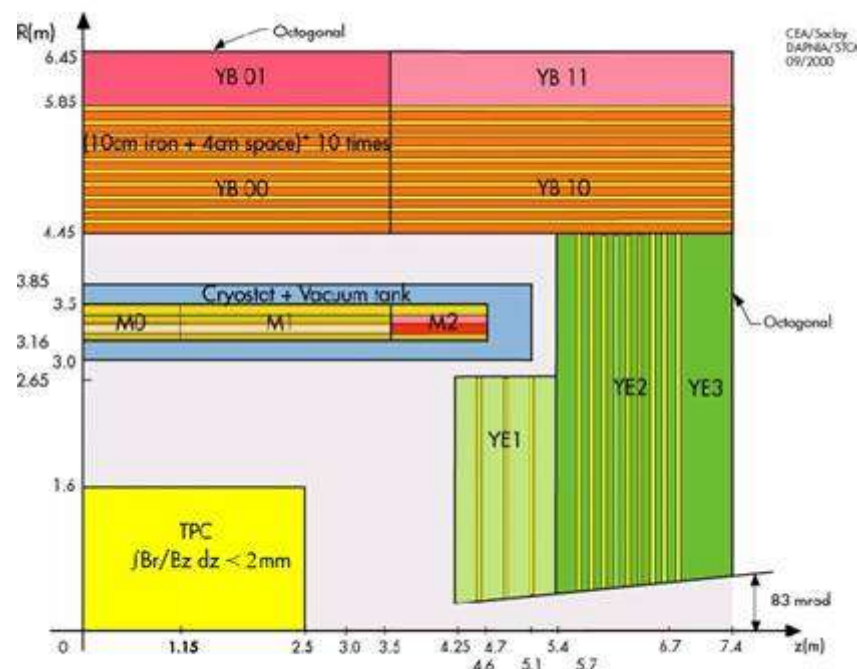
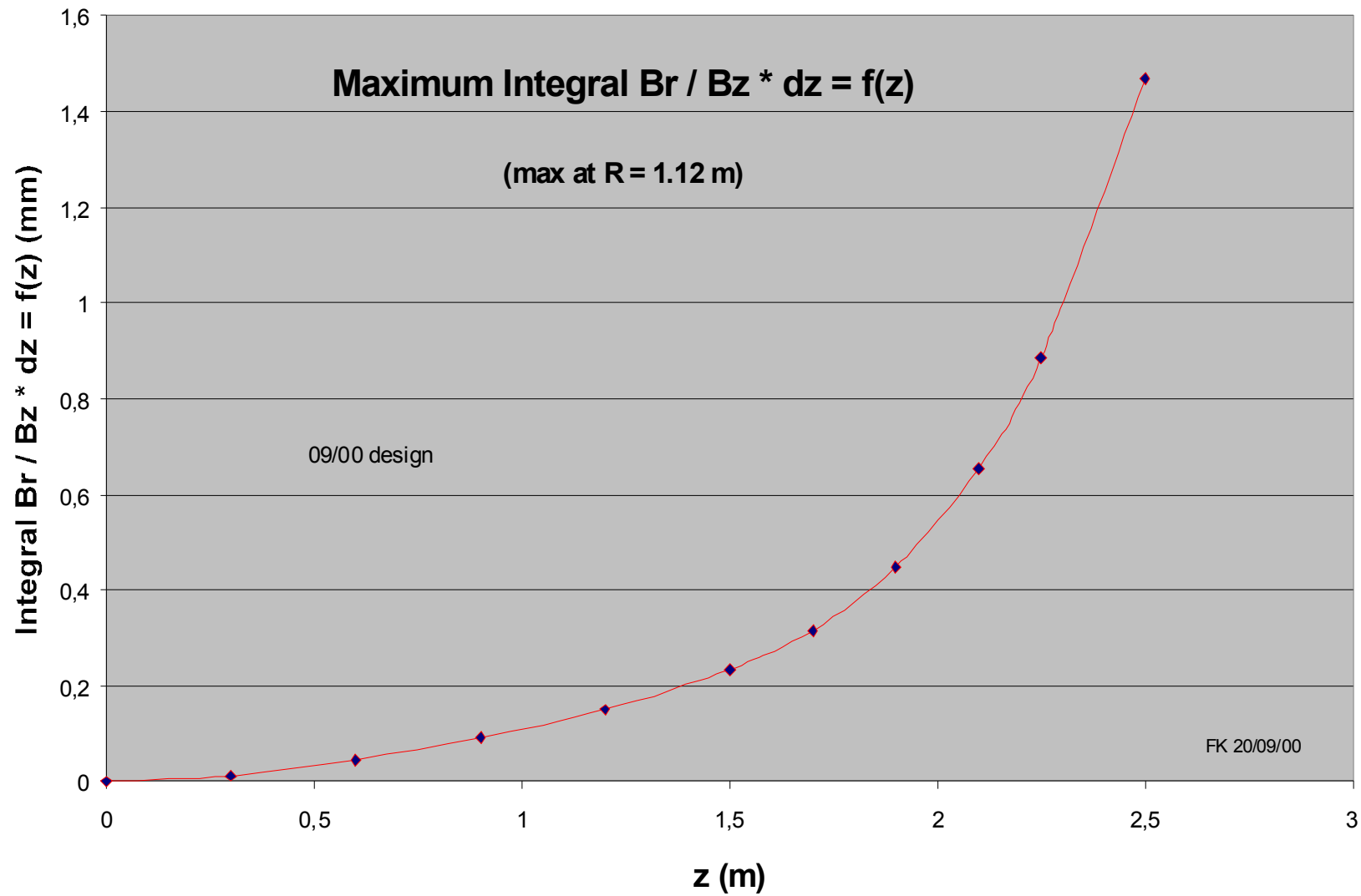


Figure 1. One quadrant of the TESLA detector magnet

- 5 modules : 2 external modules 1.1 m long each  
3 central modules 2.35 m long each
- 4 layers per module
- Nominal current :  $I_0 \sim 18.8$  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  $\sim 1.5$ mm

# 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 simulated events: we can start a reoptimization of the complete tracking system!