TESLA

P. Kadlecik, M. Kalliokoski, J. Kalliopuska, M. Kortelainen,
M. Maksimow,

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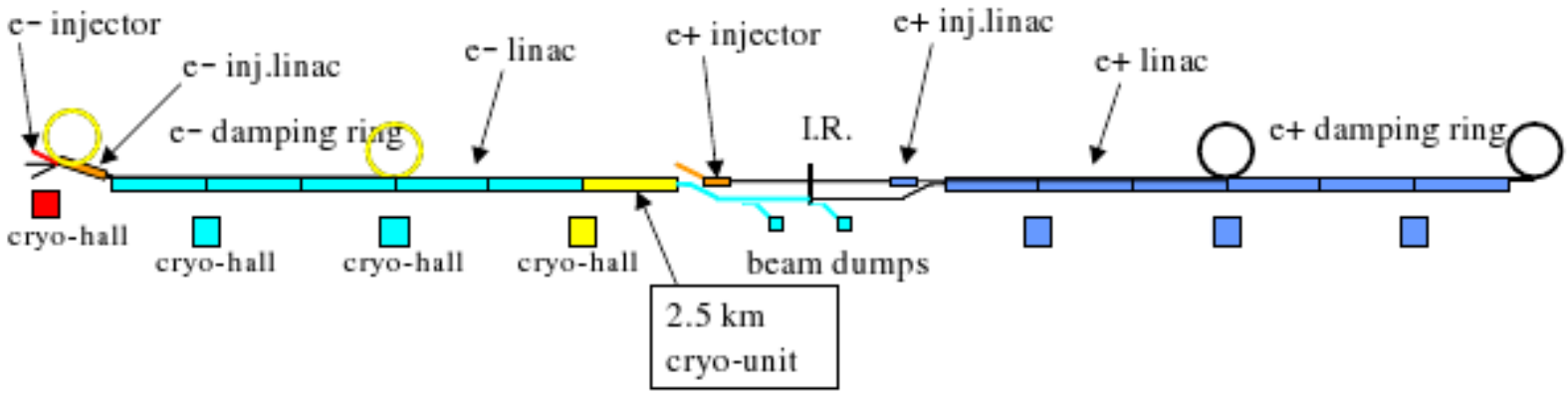
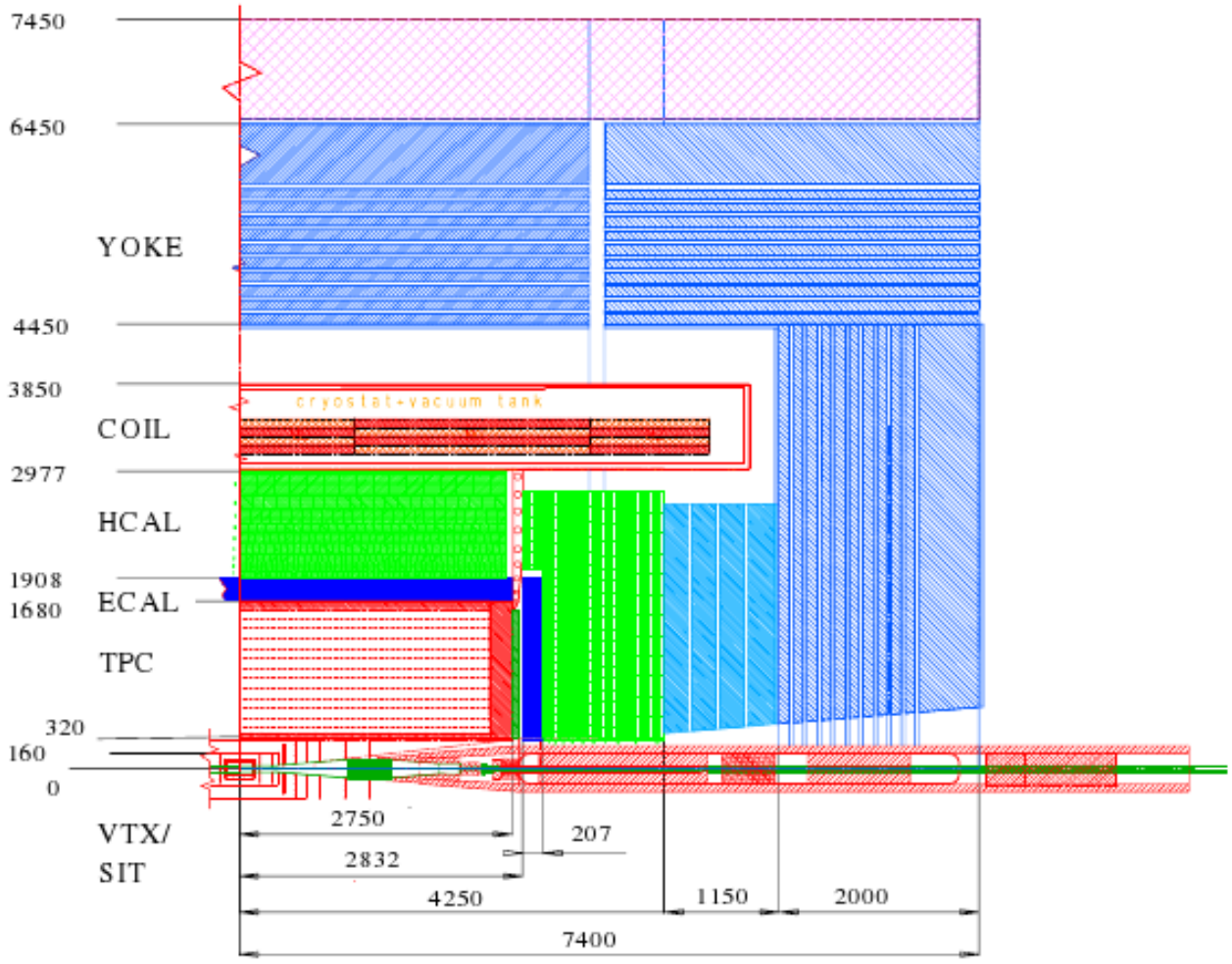
TeV Energy Superconducting Linear Accelerator

- Linear collider, e^-, e^+
- 33 km accelerator
- 1 kHz collision rate



TESLA Detector

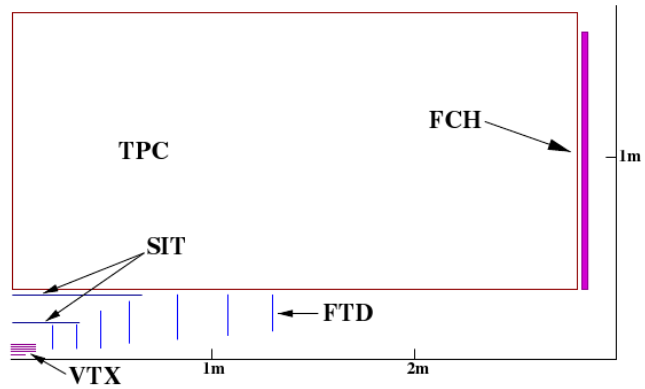


Tracking requirements

- Excellent momentum resolution ($\Delta(\frac{1}{p}) = 5 \cdot 10^{-5}\,(\mathrm{GeV/c})^{-1}$) in the central region
- Very high b- and c-tagging capabilities
- Good momentum resolution in the forward region
- Very good pattern recognition capabilities to find tracks in high-energy jets with a very high local track density
- Minimal material to be able to measure also electrons and to avoid additional background to the calorimeters.
- Radiation conditions for vertexing
  10^9 1 MeV-equivalent neutrons $\mathrm{cm}^{-2}\mathrm{year}^{-1}$

Technology for tracker

- Time Projection Chamber (TPC)
  ($r = 170\,\mathrm{cm}, L = 2 \times 273\,\mathrm{cm}$)
  with ~ 200 readout points
  in the radial direction



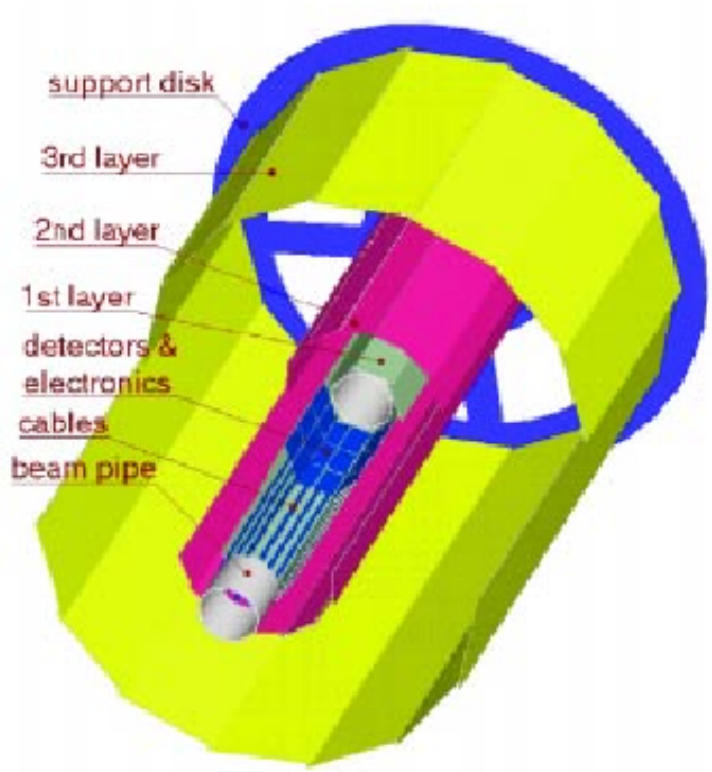
- Multi-layered pixel micro-vertex detector (VTX)
  ($r = 1.5\,\mathrm{cm}$–$6\,\mathrm{cm}$)
- Additional Si tracking detector between VTX and TPC
  - Cylinders in the barrel (SIT)
  - Discs in the forward region (FTD)
- Precise forward chamber located behind the TPC endplate (FCH)

Vertex detector

- Manufactured from silicon
- Thin sensors required

Options

- CCD
  - radiation damage
  - requires cryostat
  - long read-out time
- CMOS
- Hybrid pixels
  - thickness



Intermediate silicon detector

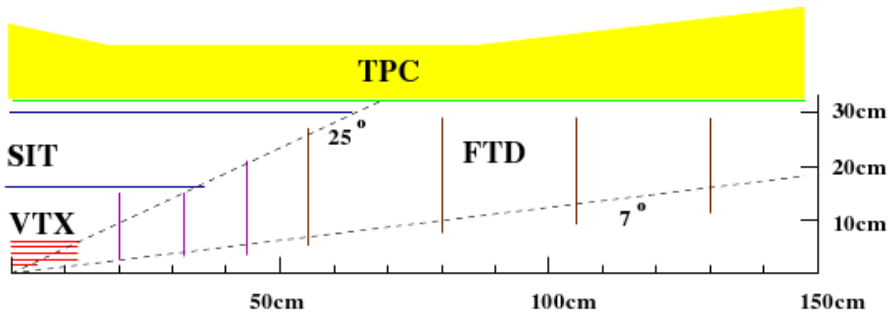
- Built in order to
  - improve pattern recognition (linking tracks from VTX and TPC) $\Rightarrow$ improves momentum resolution
  - improve finding secondary vertices
  - give fast trigger on charger paricles
- Early ideas: Honeycomb chamber, scintillating fibers

SIT

- Double sided strip detectors
- 10 μm resolution

FTD

- Pixel and strip detectors
- 50×300 μm^2 pixels
- 25 μm resolution



Central tracking system (TPC)

- Two options: MSGC and TPC, from which TPC was chosen
- GEMs or Micromegas for read-out

\+ Extremely high tracking redundancy and granularity

\+ Good particle identification via $\mathrm{d}E/\mathrm{d}x$ of charged particles

\+ Performance profits from the operation in a high B field

\+ Wires are strecthed azimuthally at end-cap sectors $\Rightarrow$ TPC can be made long

\+ Divided into small sectors $\Rightarrow$ easy to maintain

\− Long memory time (50 s)

\− B-field must be mapped well

The End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THE CELIBATE SCIENTIST
BUT ALL THE WOMEN WANT YOU!
YES BUT CELIBACY IS THE SECRET TO MY GENIUS!
GOOD EVENING! WELCOME TO THE DEMONSTRATION OF MY NEWEST ELECTRICAL WONDER
TESLA!
LADIES! LADIES! I AM NOT INTERESTED IN YOUR ROMANTIC ADVANCES BUT IN SCIENCE! CONTROL YOURSELVES
TESLA!! TESLA!
NOW, GENTLEMEN, IF I COULD JUST DIRECT YOUR ATTENTION OVER-
WHIRRRR
WHAT IS THAT NOISE?
SIR IF I MAY
IT LOOKS LIKE SOMEONE HAS THROWN A PAIR OF BLOOMERS INTO THE MACHINE
LADIES WOULD YOU PLEASE
TESLA!!!
Beaton 07