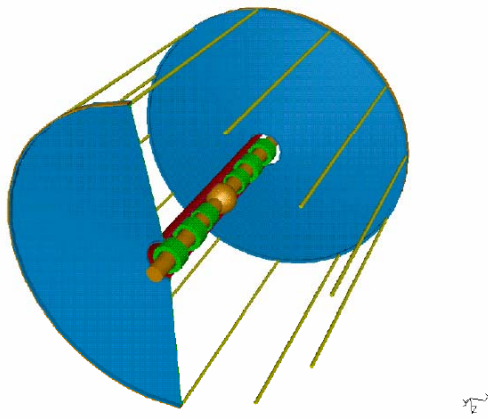


Testbeams for LC Tracking R&D



ILC Tracking Technologies

(stolen from Marcel's lcws07 talk)

- Drift Chamber with Cluster Counting (CluCou)
- Time Projection Chamber (LCTPC)
- Silicon Strip Tracking
 - As additional tracking with TPC (SiLC)
 - Silicon tracking only (SiD)

- ILC Parameters
 - Magnetic fields up to 5 Tesla
 - Power pulsing and material budget
 - 5Hz beam structure

Beam Requirements

- Beam particles
 - Electrons, protons and pions in large momentum range preferred
- Beam diagnostics
 - Good particle id over full momentum range
 - Particle beam telescope
 - Both exists already at most facilities
- Beam structure
 - 5Hz beam structure desired for intrinsic chamber studies
 - 5Hz beam structure required for power pulsing and anticipated associated Lorentz forces; the latter requires large magnetic field
- TPC
 - Currently testing small prototypes
 - Clear need for large aperture facility when testing Large Prototype (LP) TPC
- Silicon
 - Most studies can be carried out with small scale, small bore, high field magnet
 - Possibly need for larger scale test facility in the long term

Table 1: LCTPC R&D Scenarios for Large Prototype and Small Prototypes.

Lab	Testbeam Options	
	Beams	Availability
CERN SPS	10-400GeV e, h, μ	LHC absolute priority
DESY	1-6.5GeV e	> 3 months per year
Fermilab	1-120GeV e, h, μ	Continuous (5%), except shutdown
IHEP Protvino	1-45GeV e, h, μ	One month, twice per year
KEK Fuji	0.5-3.4GeV e	From fall 2007, 240 days per year
SLAC	28.5GeV e (primary) 1-20GeV e, h (secondary)	Parasitic to PepII, non-concurrent with LCLS

SiD tracking

Discussions with John Jaros, Marcel Demarteau, et.al.: planning in progress.

Studies are be carried out on small scale in SLAC testbeam (ca. 10 GeV/c).

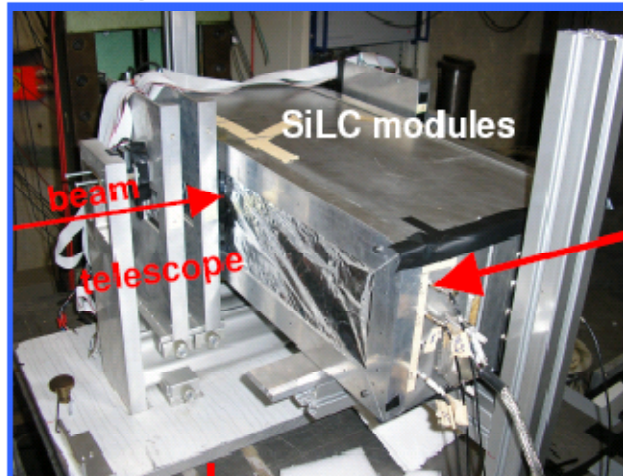
For future, will want small scale, small bore, high field magnet.

Possibly need for larger scale test facility in the long term.

SiLC

5°) Beam Tests (CU Prague, IFCA, IEKP, LPNHE, Torino, HEPHY)

- Beam test at DESY: June 4-15 2007, continuation of the beam test in Nov06, prepa:
- Beam test at CERN: October 10-22,2007, just successfully achieved
- Preparation of beam tests for next years



Beam test at DESY: 5 GeV electron beam
B.U., DESY, IEKP, LPNHE, CU Prague, IFCA

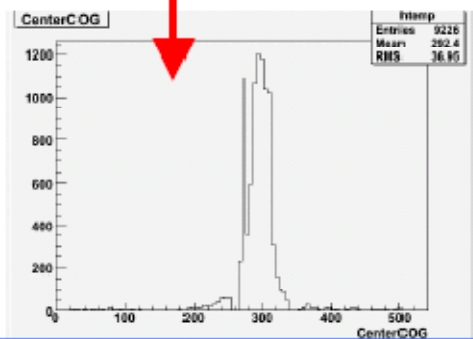
→ Continuation of tests at DESY (Nov 06) &
new Lab tests at LPNHE testbench with
CMS-180nm vs VA1 (i.e. reference)

→ Attempt to test S/N with Si module:
3CMS & 16ch of SiTR-130_v1prototype

- New DAQ Hardware: digitized FE+
FPGA + USB interface
- New DAQ software (VHDL + LabView)
- New FE board
- New cabling

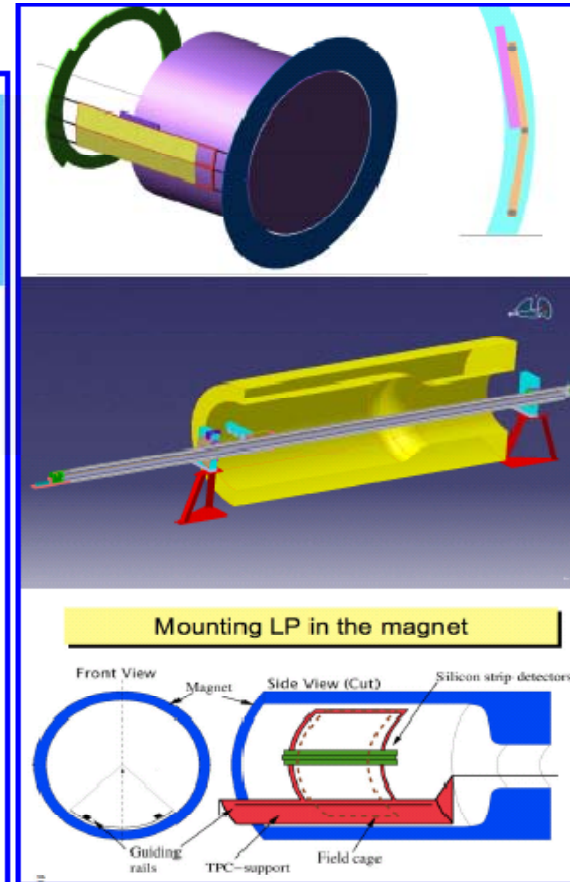
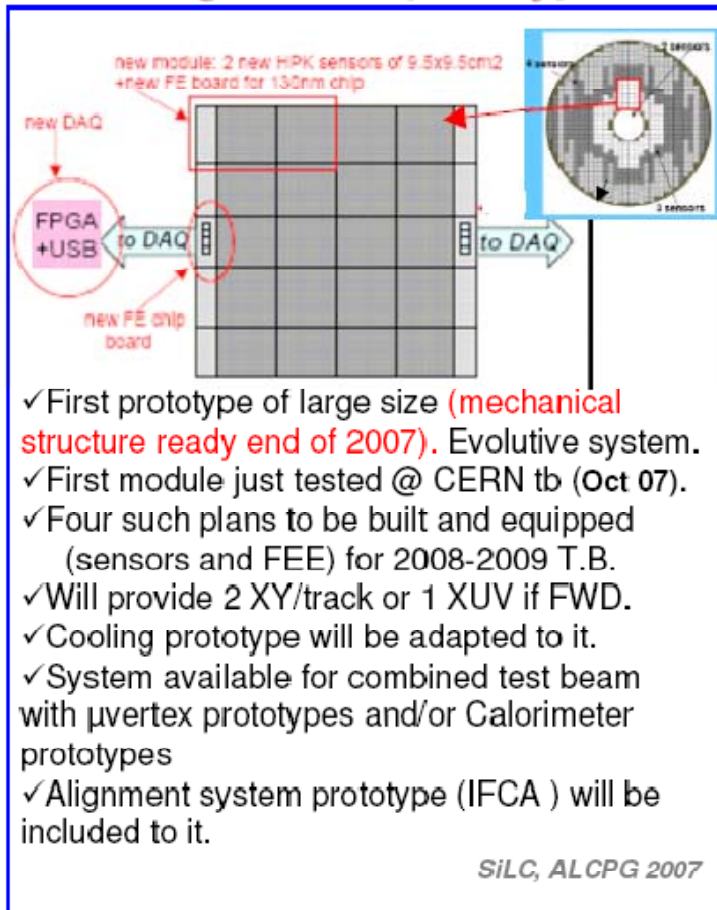
• Preliminary tests at the Paris Lab test bench
DAQ hard + soft, new chip on FE board connected
to Si module

**The complete new 130nm-system could not be ready
for June tests thus tests were pursued at Lab,
in preparation of CERN beamtest**



SiLC, ALCPG 2007

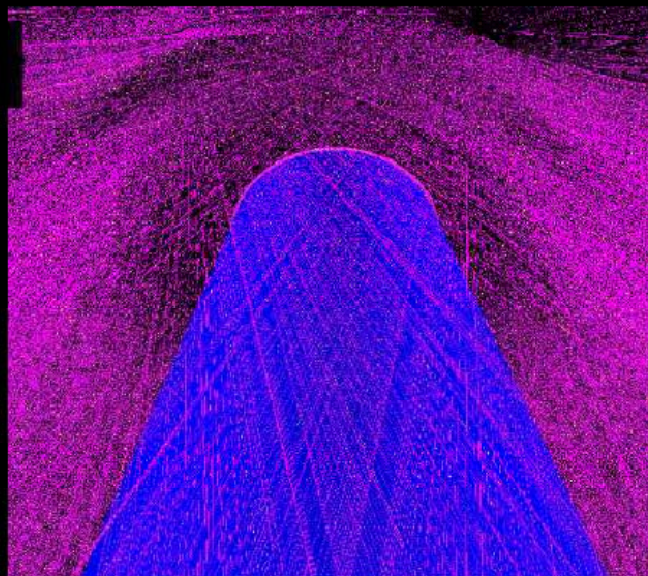
Large size Si prototypes:



Tests with LCTPC (Fall 08)
IEKP, HEPHY, DESY, LPNHE

DCH Layout

- Vessel: 23-150 cm
- Active volume: 37-145 cm
- Individual wires simulated
 - 60000 20 μm W sense wires
 - 120.000 80 μm Al field wires
- Gas: 90% He + 10% iC4H10
- Layers: 152
- Cells size and shape:
 - 6.35 mm x 6.35 mm axial square for reconstruction studies
 - Exagonal all-stereo superlayers, r-dependent size, for occupancy studies



October 22nd, 2007

ALCPG07 - C. Gatto

10

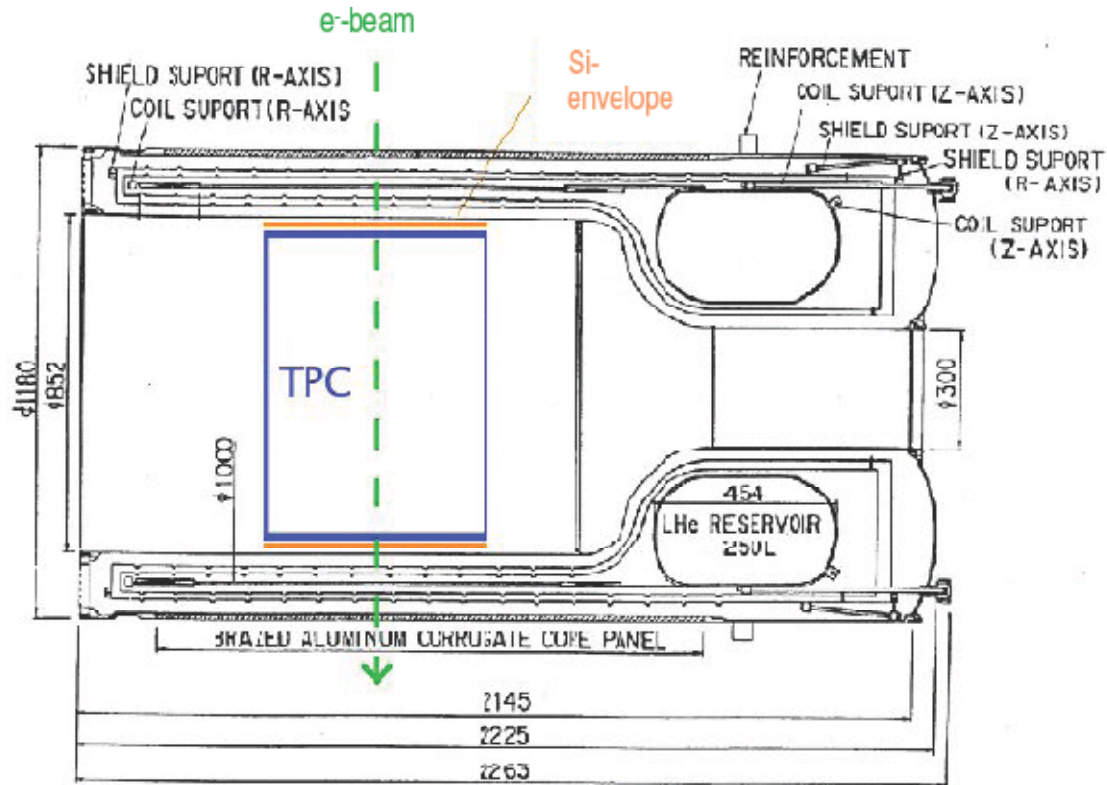
Discussion
with John
Hauptmann:

No testbeam
plan yet.

Testing small
prototype with
cosmics for
cluster-
counting at
the moment...

TPC R&D Planning

- 1) Demonstration phase
 - Continue work with small prototypes on mapping out parameter space, understanding resolution, etc, to prove feasibility of an **MPGD TPC**. For CMOS-based pixel TPC ideas this will include proof-of-principle tests.
- 2) Consolidation phase
 - Build and operate the Large Prototype (LP), $\varnothing \sim 90\text{cm}$, drift $\sim 60\text{cm}$, with EUDET infrastructure as basis, to test manufacturing techniques for MPGD endplates, fieldcage and electronics. LP design is starting \rightarrow building and testing will take another $\sim 3\text{-}4$ years.
- 3) Design phase
 - During phase 2, the decision as to which endplate technology to use for the LC TPC would be taken and final design started.



$$B_{\max} \cong 1.25 \text{ T}$$

L. Hallermann, DESY

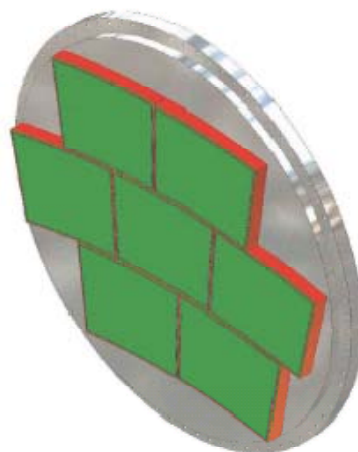
EUDET Annual Meeting 2007,
Status report TPC tasks



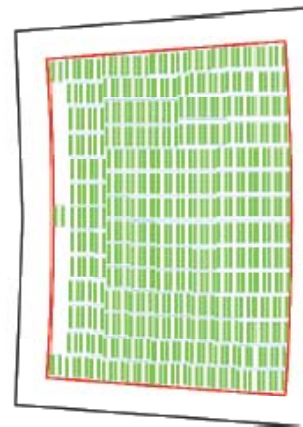
K. Dehmelt



Endplate with panels

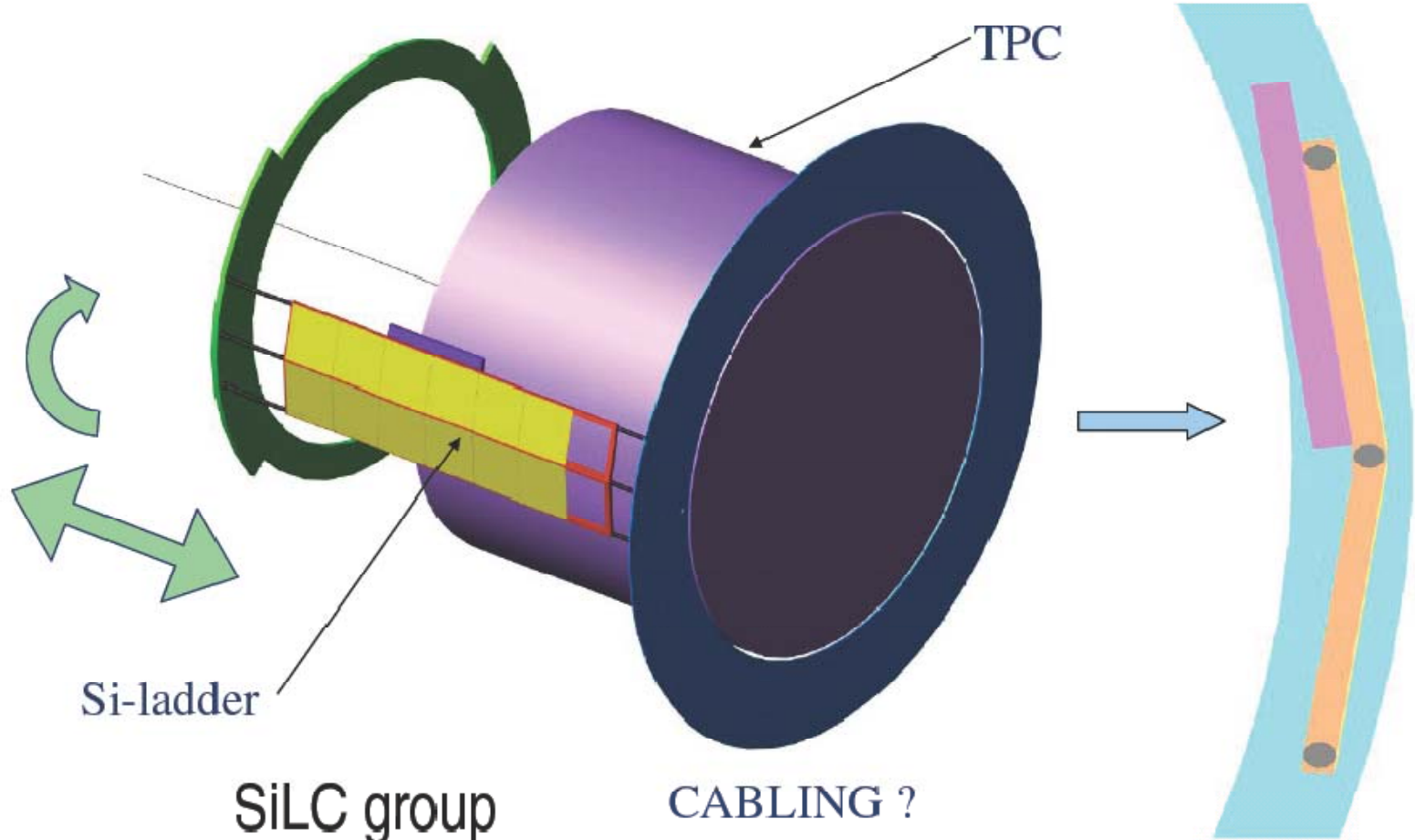


Panel with connectors



Two strategies pursued in EUDET

- FADC-based (Lund, CERN)
- new TDC (Rostock)



EUDET Annual Meeting 2007,
Status report TPC tasks



K. Dehmelt



One LCTPC testbeam scenario

- 2008
 - Q1-fieldcage,endcap,electronics,software collected at Desy
 - Q2-commission LP1 + test with cosmuics
 - Q3/4-start R&D tests w/ 6 GeV/c beam
- 2009
 - Q1/2-more R&D measurements at Desy
 - Q3/4-move to Fermilab, test with ILC beam structure with unchanged LP1 hardware/software
- 2010
 - More tests with PCMAG, then with 3-4T magnet
- 2011
 - Test of true prototype LCTPC endplate+electronics

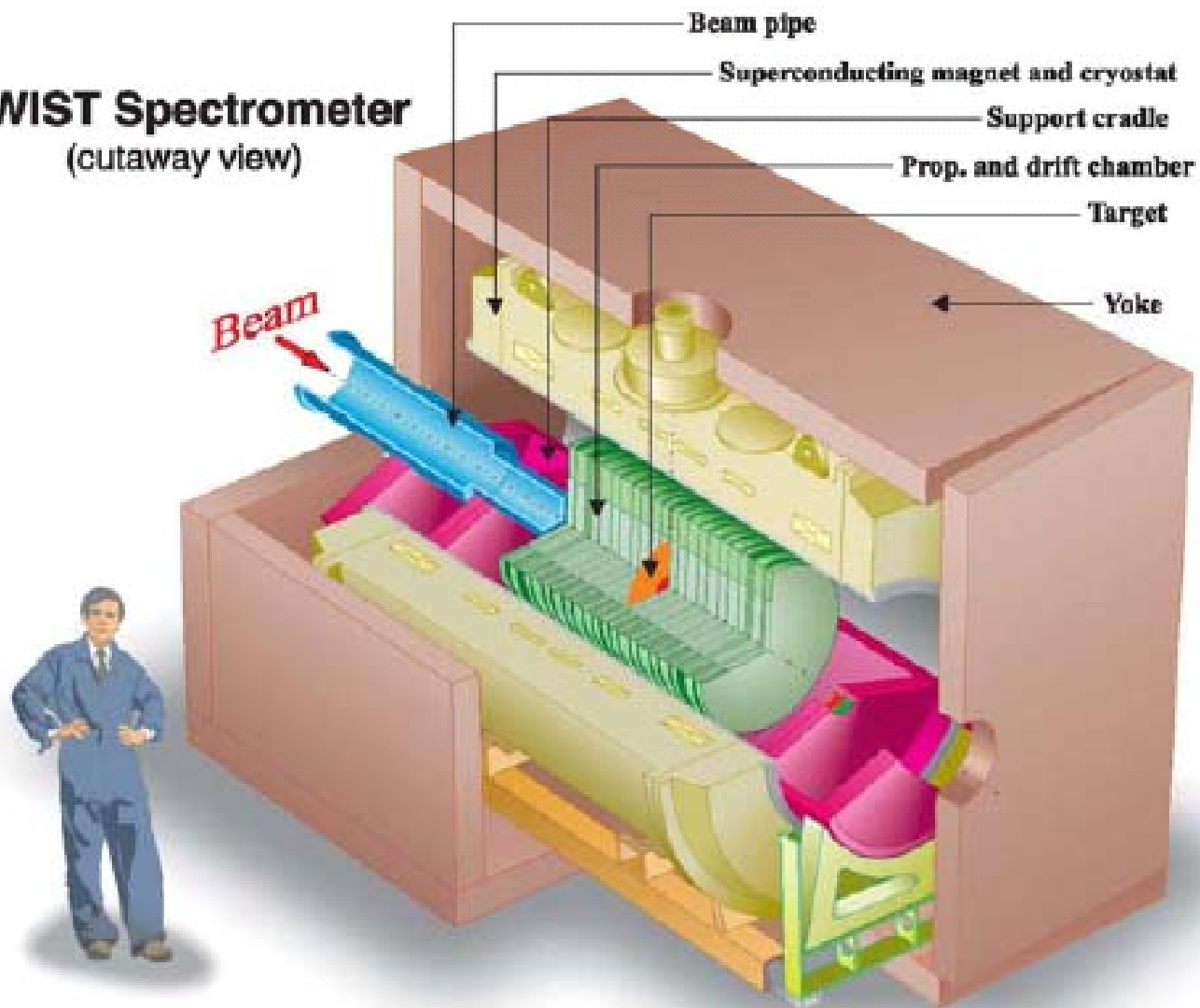
Small Prototype R&D

Device	Lab(years)	Test
SP1	KEK(2007-2008)	Gas tests, gating configurations
SP2,SP3	Fermilab(2008-2009)	Performance in jet environment
SPn	LCTPC groups(2007-2009)	Performance, gas tests, dE/dx measurements, continuation of measurements in progress by groups with small prototypes

Candidate magnets discussed at lcws07: maybe not feasible

- Triumph (Twist) Magnet (Madhu Dixit)
 - 2 T
 - 1m φ , 2.2m length
 - Available beginning 2008
- KeK (Amy) Magnet (Takeshi Matsuda)
 - 3 T
 - 2.4m φ , 1.6m length
 - Available now (in principle)

TWIST Spectrometer (cutaway view)



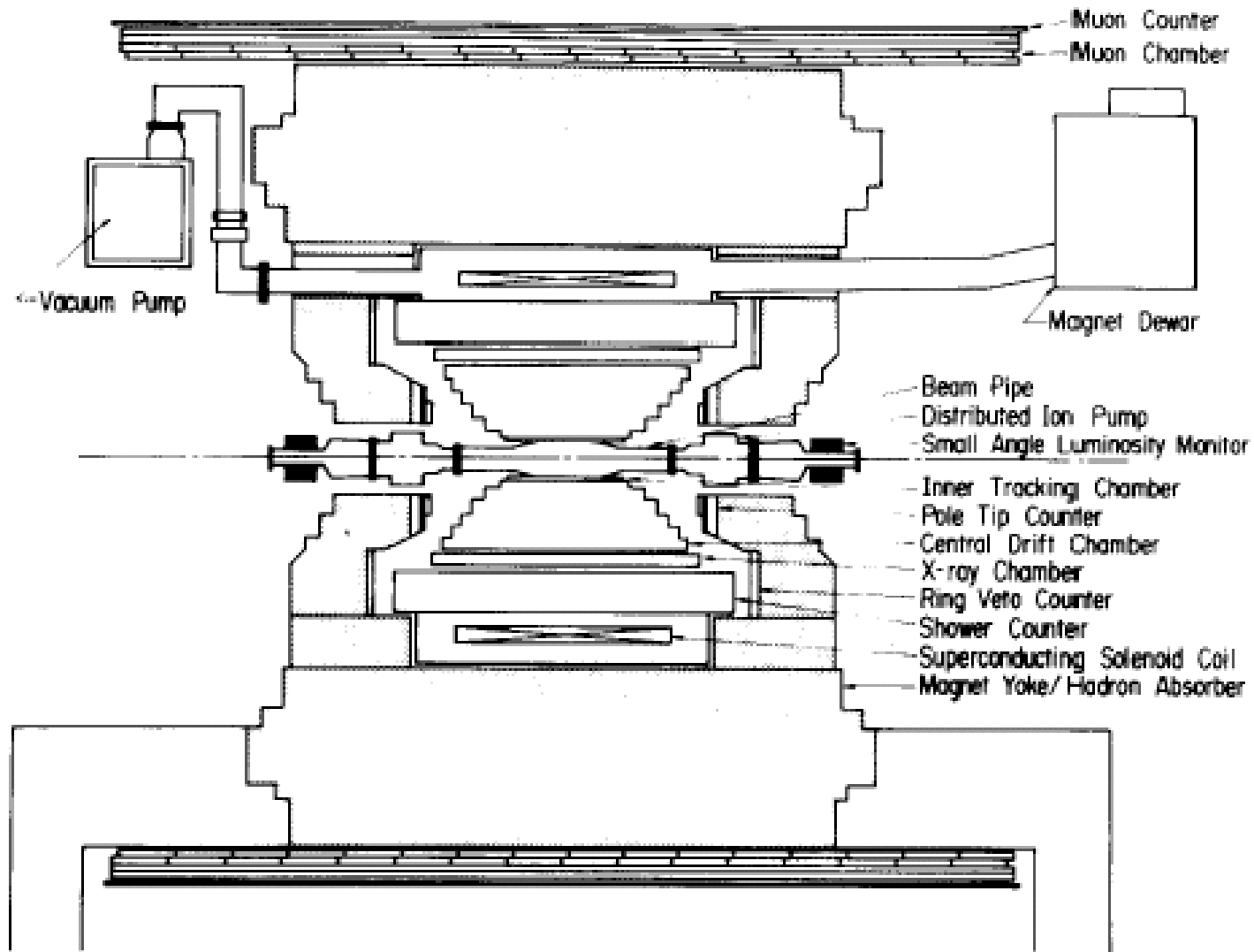


Fig. 1. A cross-sectional view of the AMY detector.