Vertex Group Beam Test Requirements

(and Commonalities with Tracking)

-: Not the current test beam activities

→ see talk from Marco Battaglia, Testbeam workshop at FNAL

-: Requirements for the planned test beam facility

→ Contributions from **Ingrid Gregor** and (in arbitrary order):

Chris Damerell, Marc Winter, David Strom, David Christian, Jaap Velthuis, Lars Reuen

Almost no consideration of the needs of the tracking community

→ this would need much more discussion

Outline

- -: VTX Technologies
- -: Test Beam
  - -: Beam structure
  - -: Telescope
  - -: Solenoid

Of course there is much more to define like the technical infrastructure, computing power, DAQ, cooling facilities etc.

VTX Technologies

-: Currently there are about 10 candidates for pixel technologies as the ILC VTX Detector.

-: ILC vertex detector community (informally) agreed that any candidate will be evaluated in a test beam (2010-2012) with "full scale" ladders.

-: So far, we did not agree on the set of tests and requirements we have to meet, hope this will emerge from discussions after the R&D Review

Three families of pixel architectures

read out during bunch train accumulation of about 150BX	read out during the 200ms pause accumulation of about 3000BX	read out during the 200ms pause time stamping of each hit
CPCCD, DEPFET, MAPS/CAPS/FAPS, SOI, 3D, …	FPCCD, ISIS (in-pixel storage of ~20 frames) …	chronopixel …

→ different needs for the test beam structure, telescope, etc. ..

What do we want to test? → **Beam Energy and Structure**

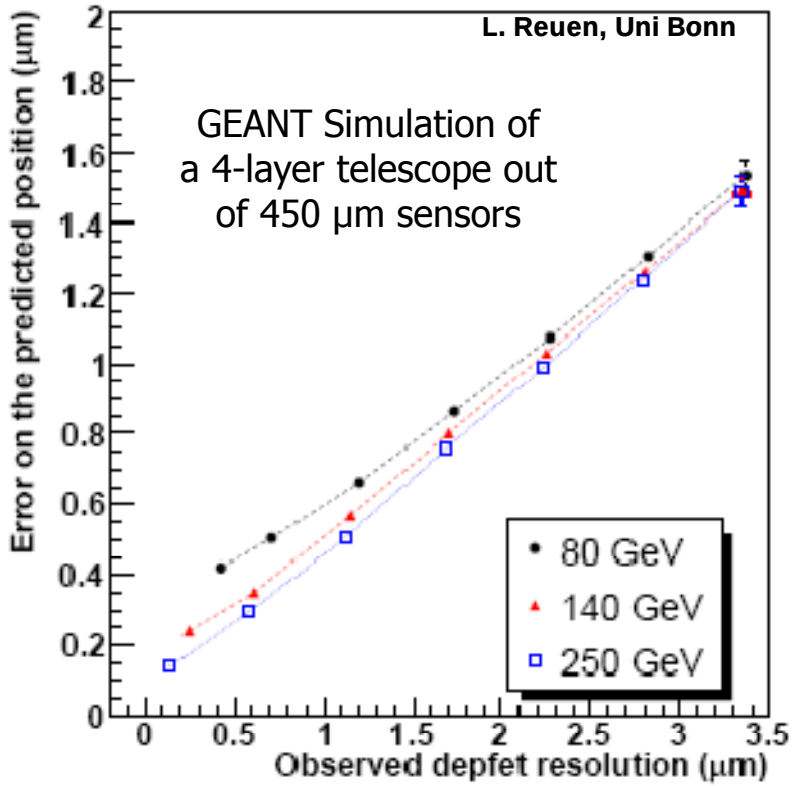
Although **not completely agreed**….we will certainly test

<u>at the level of single ladders:</u>

-: S/N, single point resolution, efficiency
-: double hit separation
-: homogeneity of the detection
-: read out and data handling

<u>with multiple layers:</u>

-: standalone tracking capabilities
-: tracking under high occupancy
-: low momentum tracking



<u>What does it mean for the beam?</u>

-: We would need both, a **high energy hadron beam** (~100 GeV) for position resolution testing **and a low energy** beam for the low momentum tracking.
-: The beam spot should be adjustable from ~mm^2 to ~cm^2
-: For all candidate technology we would like to have "ILC-like" spills (1ms beam at 200ms intervals) to see the effects on the read out when particles arrive and to allow a read out during a "quite" phase.

What do we want to test? → **Telescope**

At the level of single ladders:

-: Strasburg, Bonn, LBNL have already their own telescope,
EUDET JRA1: high precision, low mass MAPS telescope, available 2008!

With multiple layers:

-: Required standalone tracking capabilities → do the track finding with the ladders under test!

But:

-: For technologies which use the single BX structure of the ILC for time stamping and are only sensitive for a short period, one would need to tag a subset of particles of a spill (on a time scale of tens of ns)

What does it mean for the telescope?

-: We would need a high precision telescope which could provide the time stamp at this level of accuracy
→ 4..6 planes of double side strip detectors with fast read out

-: Or, if feasible, take advantage of the EUDET telescope!

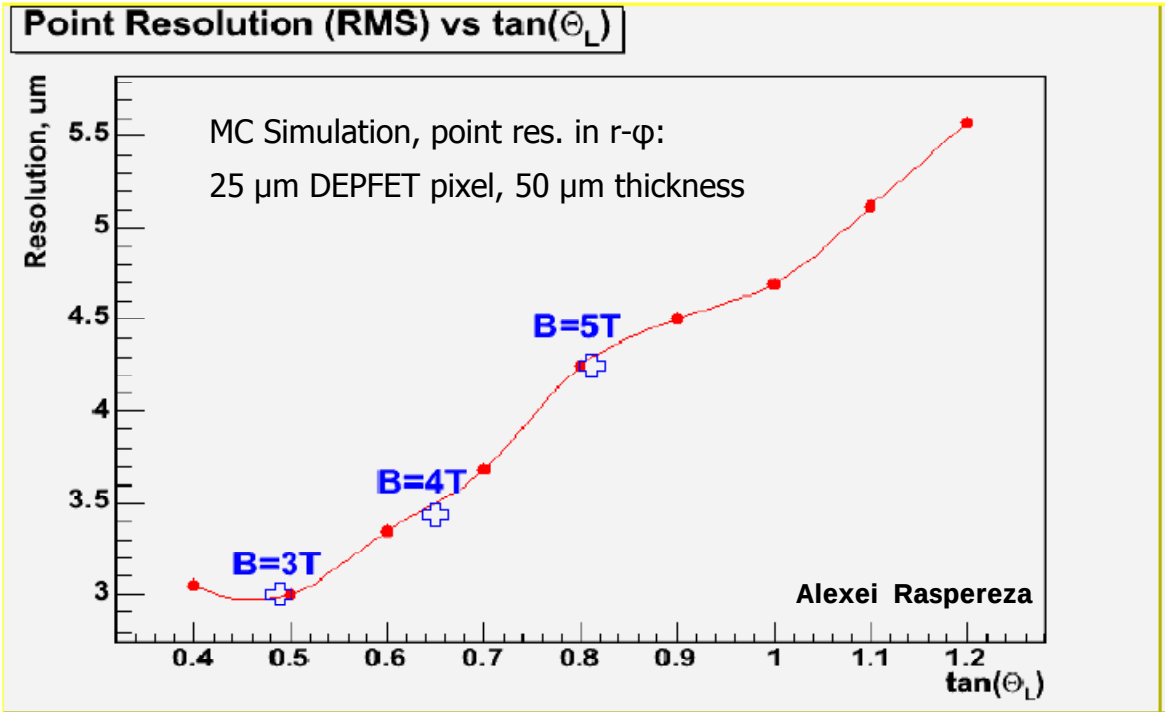
What do we want to test? → **Magnet**

At the level of single ladders:

-: Single point resolution in various magnetic fields (Lorentz angle effects)
-: Robustness against power pulsing in magnetic field (mechanical forces)

With multiple layers:

-: combined tracking in magnetic field
-: mechanical stability in the field



What does it mean for the magnet?

-: Adjustable magnetic field from (3 to 5 T)
-: Large enough to accommodate a multi-layer assembly, small enough to be rotatable

A possible solution…

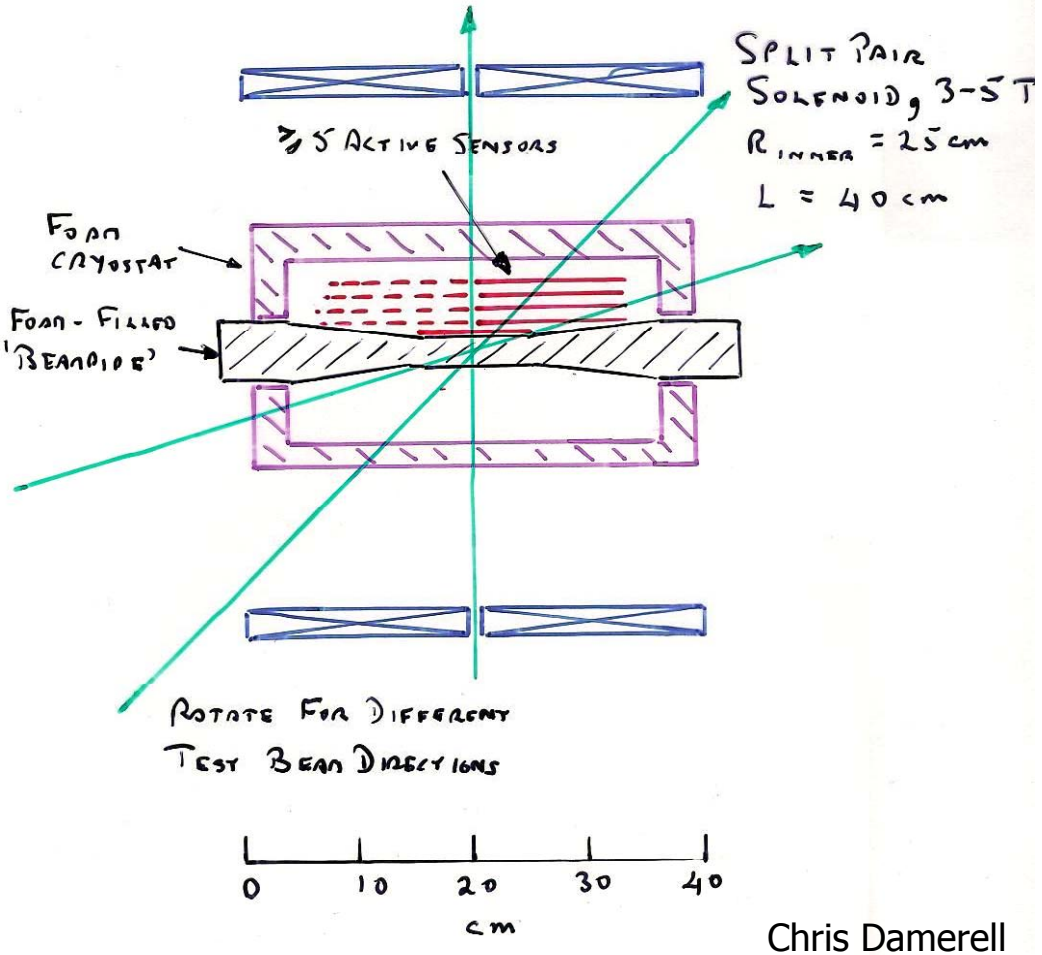
proposed by Chris:

<u>Split pair super-conducting solenoid</u>,

-: large enough to accommodate the whole CCD Kryostat (and for all the other technologies of course)

-: B-Field 3-5T, R_{inner}=25cm, L=40cm

-: rotatable for different incident angles of the beam



Chris Damerell

Concluding Remarks

-: These are all more or less obvious requirements….

-: The representatives of the VTX candidate technologies have to sit at one table, define the minimum set of tests and extract from this the more detailed requirements.

-: The same is true for the tracking community! The requirements on the beam are (probably) very similar. The biggest difference is most likely the size of the magnet.

-: At some point we would need to run a combined test beam with VTX and Tracking detectors in the same magnet. This is probably not needed by the time when we would like to decide on the technologies to be used in the VTX.

-: The test beam facility will most likely be pretty overbooked at this time. In order to avoid conflicts and have an efficient testing one should therefore consider having two magnets: a small one for the VTX and a larger one for tracking, which can then be used for the combined run.

Think there is a lot to discuss….