SiD Vertexing

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- **Main design questions**
- **Recent News**
- **Next steps**

Disclaimer:

The SiD vertexing group is just being formed and I am also a new recruit for the SiD design studies. Apologies in advance for any omissions or misrepresentations for the work already been done up to now.

It's a good time for you to join and contribute !

The Main Questions (I)

- **What do we want out of the vertex detector for physics ?**
  - **Besides the self tracking capability to help overall tracking in general, what are the vertexing performance bench marks ?**
    - **b-tag is `easy', but c-tag needs attention (e.g. H->cc)**
    - **Vertex charge will be the most effective quark charge identifier at LC (already the most powerful at SLD). Many angular distribution analyses can benefit. Combinatorial reducer.**

- **What technology will work ?**
  - **The cold LC design with long bunch trains has made VXD readout a much harder task. Must readout/store many times during the train.**
  - **We are spoiled by SLD so that we only accept performance at least as good (3D pixels, <4μm spatial resolution and thin active layer ~20μm and thin overall material <<0.4% rl/layer). Most popular candidates at present:**
    - **CCD with in situ storage (ISIS) ?**
    - **Monolithic pixel devices e.g. MAPs ?**
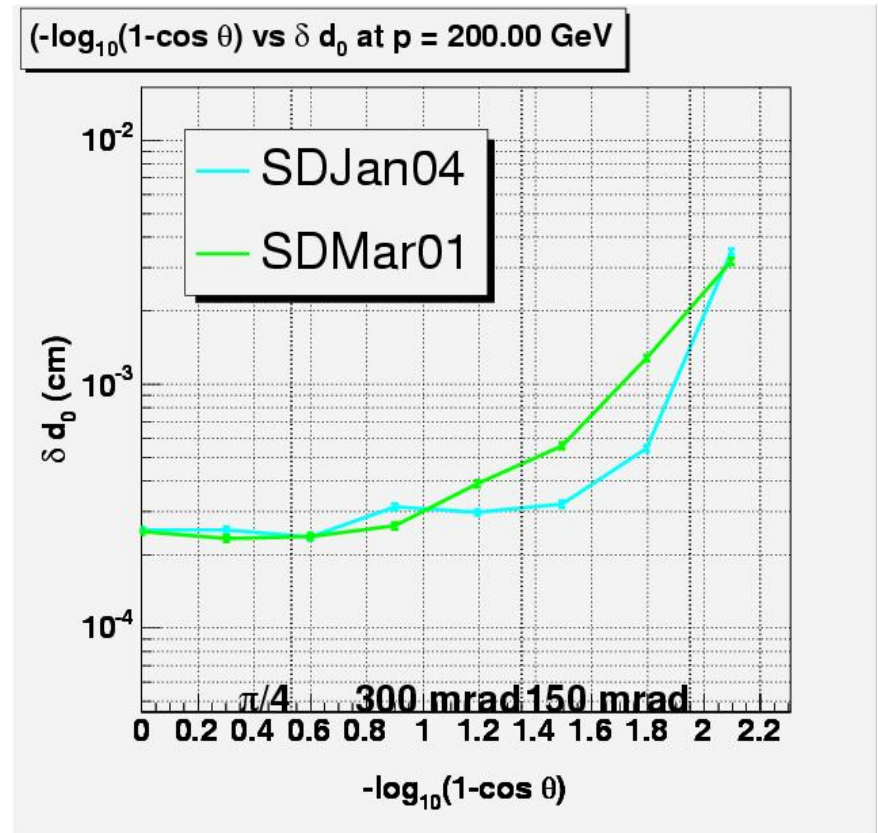 - *Tough R&D ahead in any case.*

The Main Questions (II)

- **Detector geometry and Tracking**
  - **Long barrel vs barrel + endcap ?**

    May be to some extent independent of the eventual sensor technology choice so that study can proceed in parallel.
  - **Realistic tracking performance vs background density**
- **Other sensor issues**
  - **Radiation damage**
  - **Is it completely out of question to have room temperature sensors ?**
- **Mechanical issues**
  - **Thin support and structure integrity against cooling**
  - **Access to the vertex detector**
- **Other reality issues**
  - **Sensor/electronics resilience against beam pickup**
  - **Can SiD take high enough rate cosmics for alignment ?**

Recent News (I)

Toshi Abe

- **First look at the endcap VXD tracking performance (Toshi Abe)**
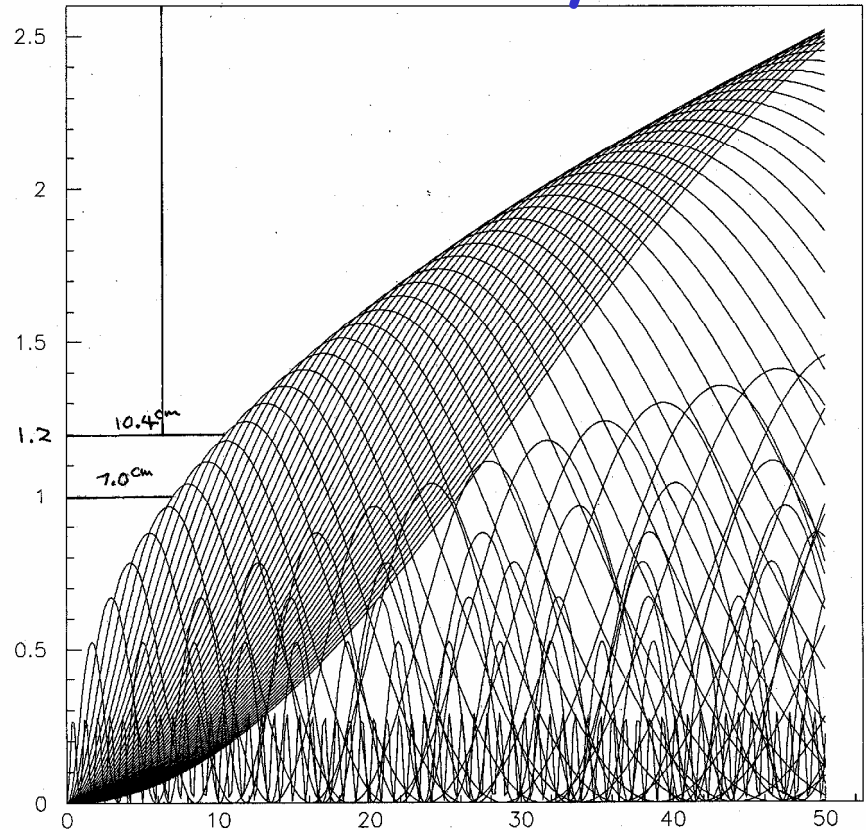
- **VXD alone pattern recognition (Nick Sinev)**

$(-\log_{10}(1-\cos\theta)$ vs $\delta\,d_0$ at $p = 200.00$ GeV

- SDJan04
- SDMar01

$\pi/4$ 300 mrad 150 mrad

$-\log_{10}(1-\cos\theta)$

$\delta\,d_0$ (cm)

Recent News (II)

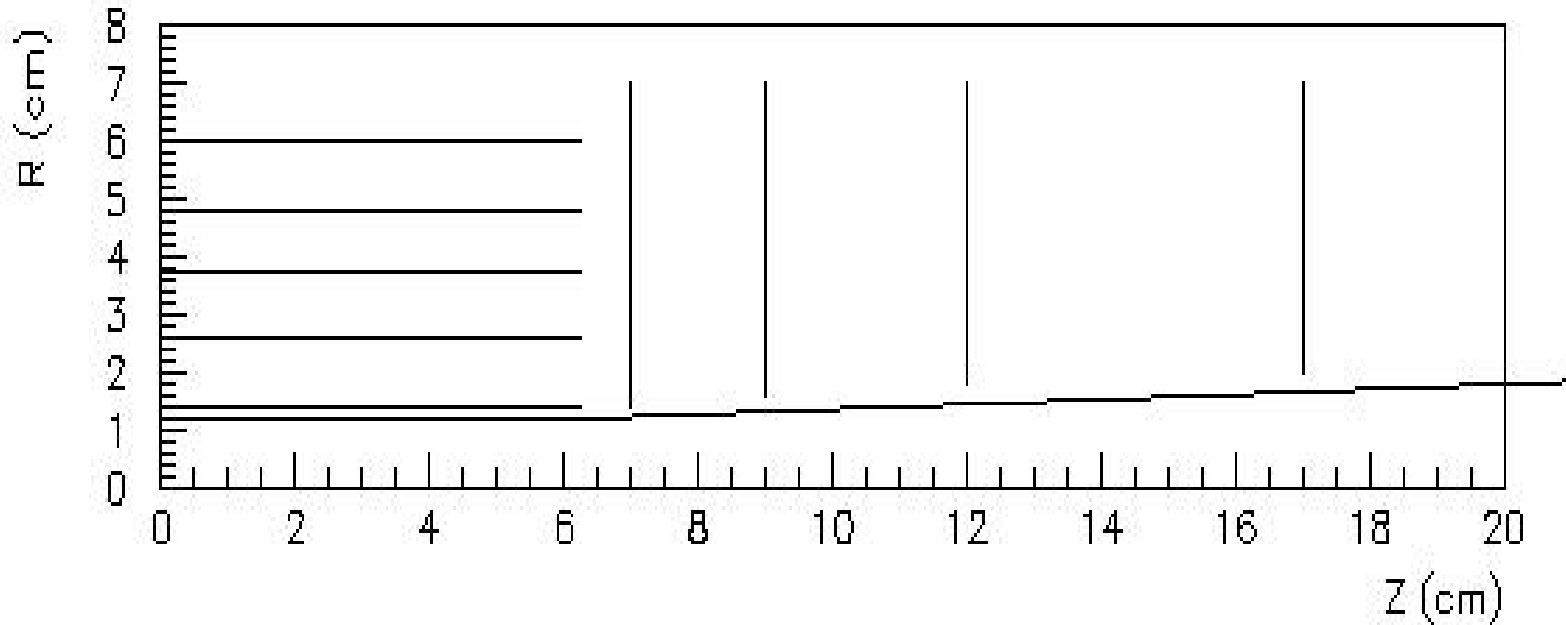**The new ILC beam parameters**
⇒ **Updated beampipe and VXD geometry**

The old 1cm beampipe radius looked risky.

The new beampipe inner radius is R=1.2cm and VXD sensors starts at R=1.4cm with a half barrel length of 6.25cm.

Takashi Maruyama

500 GeV Nominal 5 Tesla +20mrad crosssing angle

Nominal Geometry

A rough starting point. Many questions already.

- Endcap 1st disk too close to barrel ? (cabling for barrel)
- Endcap outer disk inner radius ?

Start iterations from here…

Next Steps

- **The main near term goal is to establish a baseline VXD conceptual design by Snowmass integrated with SiD overall design, with bench mark performance from simulation.**

- **Organization is just starting and your suggestions and contributions are very much welcome.**

- **Our vertexing parallel today at 4:30pm will be at the B-Hive (Central Lab G203/214 just outside the library).**