
# Tracking Review at Beijing Post-Mortem

**SiD Workshop**
**April 11, 2007**
**Fermilab**

Rich Partridge, Marcel Demarteau
for the Tracking Group

# Is it dead yet ?

# Background

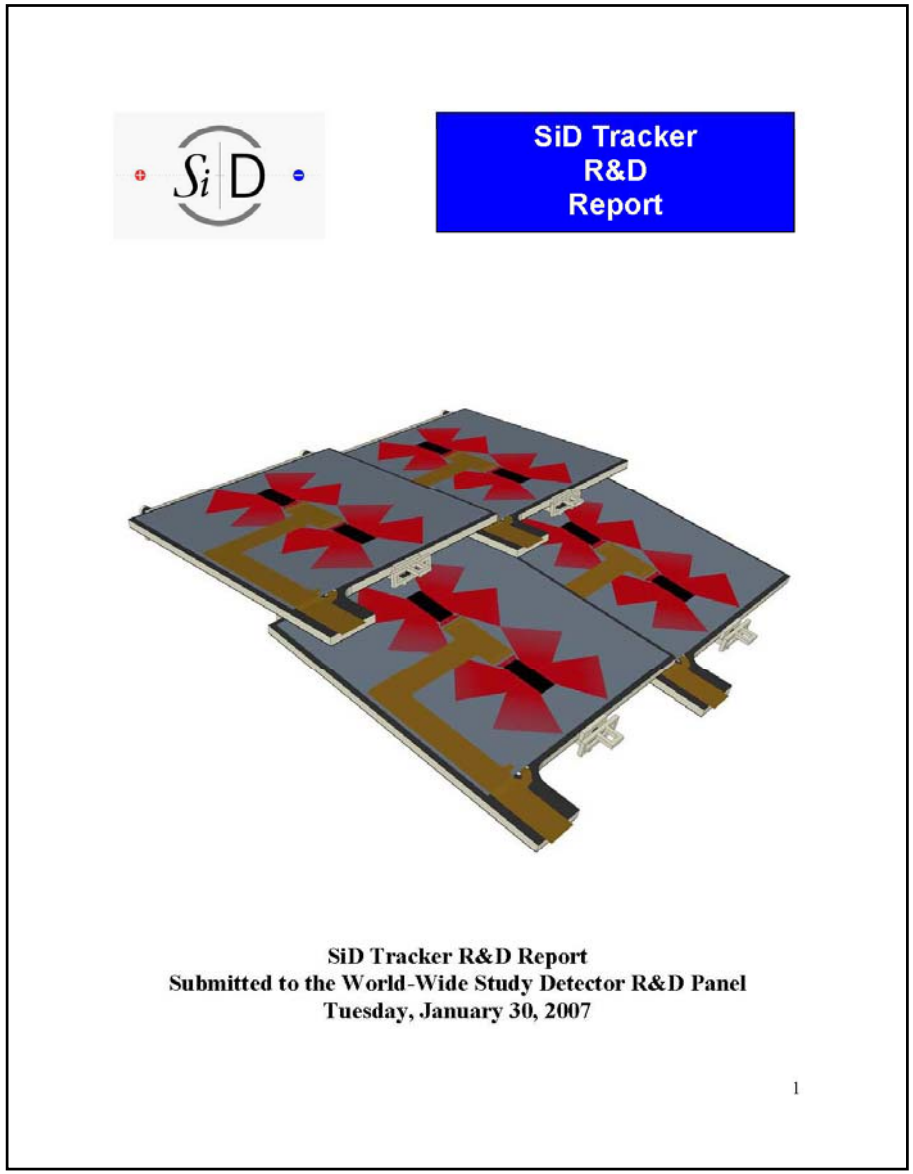
- The WWS appointed a detector R&D review panel chaired by Chris Damerell to evaluate the world-wide detector R&D.
  - Chris Damerell is also member of the GDE R&D board which establishes the link with the GDE
- These reviews will rotate between
  - Tracking (Beijing, February '07)
  - Calorimetry (LCWS07)
  - Vertexing (ALCPG07)
  - MDI, pid, (Spring '08)
- First review was in February at the ACFA meeting in Beijing

# Preparation

- Requested a written report by Jan. 28
- Overview of the goals, starting from current status, up to the completion of their R&D programme, ready to start construction:
  - overall physics-driven performance goals
  - track-finding efficiency, down to what lower limit of polar angle and momentum
  - special case: tracks originating from *B* and *D* decays beyond the vertex detector
  - forward tracking - a weak area or not?
  - combination of difficult factors, such as long-lived decays, small polar angles, tracks in core of jets
  - momentum resolution vs momentum and polar angle over full range
  - *dE/dx* performance - how useful is this for physics?
  - design of sensors, modules, and support structures
  - readout electronics and DAQ system
  - system power dissipation, quantifying the benefits of pulsed power if used
  - cooling system
  - cabling and fibre optics - power and data
  - other infrastructure such as gas control systems
  - overall mechanical stability - implications of push-pull on calibration needs
  - vulnerability to errant beam bunches - 'fliers'
  - overall material budget; implications of secondary interactions and photon conversions on system performance such as jet energy resolution
  - other topics that lie in the cracks between tracking and other subsystems
- Report should discuss R&D program subdivided into work packages with breakdown of FTE and M&S established and required
- Charge was far too ambitious given the current state of R&D

# Report

- Submitted a 64 page report a week before the review
- Input from all institutions participating in tracker development
  - Brown
  - New Mexico
  - UCSC
  - Colorado
  - Oregon
  - Michigan
  - Purdue
  - KSU




http://ilcdoc.linearcollider.org/collection/SiD%20Tracking

# Review Committee

- Bill Willis willis@nevis.columbia.edu (absent)
- Bing Zhou bzhou@umich.edu
- Chen Yuanbo chenyb@ihep.ac.cn
- Chris Damerell c.damerell@rl.ac.uk
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# Program

- Monday 5th Feb: open session presentations
  - LC-TPC
  - 4th Concept (CluCou)
  - SiLC
- Tuesday 6th Feb: SiD
  - Tracking Strategy for SiD — Marcel Demarteau (15 mins)
  - Mechanical Design and R&D — Bill Cooper (40 mins)
  - Sensor and Module design and R&D — Tim Nelson (40 mins)
  - SiD related University R&D — Rich Partridge (20 mins)
- Thursday 8th Feb: closed session

- At the review SiD had the impression that our presentations were very well received and that our R&D effort was well focussed.

- During the closed session we were presented a list of questions to be answered within a week

# Closed Session

- We were led to believe that this was going to be about funding, but specific funding issues never came up during the review
  - There were some general comments about not duplicating effort, etc.
- The committee for the first time mentioned that they would like to recommend a Tracking Coordination Group
- The session also asked us further questions about our design
- We were given a list of “questions” during this session
  - See next slide for list
  - These questions were given to all four groups
  - There were later specific questions from Sauli (gaseous tracking only) and Karlen (all groups)
  - We answered only those questions relevant to SiD
    - Total of 22 questions

# Homework

- List of 10 most pressing issues/ risks? Overall plan of issues, their impact and mitigation program including schedule, identify show stoppers
- Major technical decisions needed and time scale
- What corrections have to be applied to the data to get the desired resolution
- How much data and analysis overhead
- How much computer time needed to analyze an event? On-line, offline?
- What is worse resolution you need for science, how close are you?
- How well is BC time measured
- How many BC are integrated over? Can it be reduced?
- What is noise/background, show efficiency vs. resolution including backgrounds (noise and machine backgrounds)
- Largest uncertainty in material budget
- Largest uncertainty in performance
- Pulsed power needed: issues
- Temperature uniformity required/achieved
- B-field dependence in performance/ operations
- Electronic issues
- Cost drivers
- Schedule drivers
- Distinction to other similar efforts
- Collaborative tasks with other projects
- Simulations required at what time schedule

# Handing in Homework

- Feb. 26 answers to list of questions submitted:
  "SiD Answers to Beijing Tracking R&D Review Questions"
- Organized as answers to 22 questions:
  - List the 10 most pressing issues / risks. Provide an overall plan that describes the issues, their impact, and mitigation plans. Identify potential show stoppers.
    - Readout Chip Design
    - Bump Bonding
    - Power Delivery and Power Pulsing
    - Vibration
    - Forward Tracker Design
    - Alignment
    - Simulation Studies
    - Material Budget
    - R&D Funding and Resources
  - Answers available at:
    http://ilcdoc.linearcollider.org/collection/SiD%20Tracking

# Draft Report

- March 11, received first copy of draft Review Report (Draft version 4)
- Report was received in utter disbelief ...

A one-sentence summary of our recommendations: *Form a Tracking Coordination Group to coordinate the completion of the R&D programme, so that the community will be able to finalise the choice of tracking technologies*

high magnetic field. Minor stresses could distort the assembly, and the hammering at 5 Hz due to the Lorentz forces could induce vibrations of unacceptable amplitude. The minor gale of gas used for cooling could also induce vibrations of micron amplitude, and perhaps very much larger. Fortunately, their FSI alignment system will respond to this approach is likely to satisfy the requirements of homogeneous tracking quality over the full solid angle range, there is the risk that its performance might be uniformly *sub-standard*. Such concerns arise because of the phenomenal

# Response to Draft Report

- Submitted our response to Draft 4 on March 19. Response organized as:
  - Three observations
  - List of issues addressing specific untrue statements with regard to our design
  - In general we “took the high road”

- *Observation 1*
  We imagine the funding agencies in each of the regions will look on this report with great interest. A short section in the executive summary which describes the R&D of each group reviewed would most likely be useful to them. That section could summarize current R&D and comment on future plans, whether those plans are appropriate and sufficient, whether their time scale meets the committee's expectations, and whether resources, including funding, are appropriate. We expect your recommendations to carry a good deal of weight, and ease the reviewing burden of the individual agencies.

# Response to Draft Report

- *Observation 2*

  While SiD cannot comment on the global R&D funding picture, we have considerable experience with US R&D funding. In short, the present situation for ILC R&D funding in the US is horribly inadequate...

  In section 5, the report says: "The ILC tracking R&D is currently consuming about $10M p.a. [4], and the cost of the required facilities to be built up over the next 3-4 years is surely affordable on that scale". We agree with the committee that investing in the required facilities is an important goal. Unfortunately, little of this resource is available in the US, which raises two concerns. First, significant additional US ILC R&D funding is needed to support a combined program that properly funds the detector R&D and acquisition of the required facilities described in this report. Second, we are worried that should these additional funds not be forthcoming, diversion of our present scarce resources into providing future infrastructure could be quite damaging....

# Response to Draft Report

- *Observation 3*

  The review proposes the creation of a Tracking Coordination Group (TCG), ... We agree that the proposed TCG could be helpful in coordinating ILC tracker activities before collaborations are established, and that it could assist in procuring the common infrastructure needed for upcoming tests. However, we have some reservations about its role. The relationship between the TCG and this review panel is not addressed. It is unclear to us why some of the responsibilities listed for the TCG are not assumed by this review panel. Moreover, other responsibilities seem either to overlap fully with existing WWS working groups, like the test beam working group, or not to be under the purview of the TCG, like the scheduling of the use of beam test facilities.

  It is proposed that the newly created TCG oversees full-scale ILC tracking prototypes, and evaluates the different approaches by the year 2011, when "definitive selection of technologies" is possible. ... it seems unlikely to us that this information will be used to choose tracking technologies for the detector collaborations, since they are scheduled to have delivered engineering design reports before these final test results are available. They must make tentative decisions at least a year or two before this time. We also imagine that it will be the two extant ILC detector collaborations, and whatever funding agencies are providing support for the detector EDRs, and not the TCG, that will be looking at the new data with the most interest. SiD does agree that, if our aggressive schedules slip significantly, a TCG-like panel could be useful for the evaluation role proposed.

# Response to Draft Report

- Addressing specific issues in the report:
  - We are concerned that words and emphasis such as “hammered” and “uniformly *sub-standard”* may discourage support of that R&D
  - “The minor gale of gas used for cooling could also induce vibrations of micron amplitude, and perhaps very much larger.” We agree with the committee that it is important to verify that the flow of cooling gas does not introduce mechanical vibrations. However, the description of the gas flow as a minor gale may lead to an incorrect impression of the situation. Our current design has forced flow velocities in the range from 0.0016 m/s to 0.0047 m/s in the sensor module regions of barrels 1-4.

# New Draft Report

- Received a new " final" draft repoort on March 20.
- Some of our comments were incorporated.
- The chair of the committee indicates:
  "My hope is that everyone will be satisfied and that this can be sent as the final agreed version to the WWS-OC chairs on Friday 23rd."

- Before the chair of the committee received SiD's and the TPC input on this report, the chair or the committee sends out a note to the chairs of the WWS stating:

  Dear Francois, Hitoshi and Jim,

  I attach the final report of the tracking review we held in Beijing, which has now been agreed by the committee and by all the collaborations whose work we reviewed. I'm happy that we were able to reach unanimous agreement on this report.

# SiD Response

- Even though Chris has already sent the “final” report to the WWS, SiD reponds to draft 5, on Friday March 23, as follows:

  Dear Chris,

  We are very appreciative of the committee's addressing our comments on draft 4 and have no further points that we wish to raise.

  We would like to thank the review committee for conducting this review. There have been many positive aspects that have come as a result of preparing for the review and the many points of interaction that took place in Beijing, and we look forward to meeting the future challenges that lie ahead.

  Best regards,

  Marcel and Rich for the SiD Tracking group

# SiD Response to “Final” Draft

- Dear Chris,
  Your note to the chairs of the WWS states: ...

  We believe that your report presents a critical evaluation of the work presented and the committee's recommendations.

  We appreciate having been given the opportunity to comment on the draft report and we registered our objections in our note titled "SiD Comments on Draft 4 of the Tracking Review Committee Report". Some, but not all of our comments and objections have found their way into the final report.

  In our reponse to draft 5 of the report we stated that we had no further points that we wished to raise. This is not to say that we agree with all aspects of the report and its recommendations. We don't, as must be clear from our comments. We are quite uncomfortable with your characterization that we reached "unanimous agreement."

  That said, we would like to move on and are looking forward to a continued fruitful dialogue with you and your committee about our R&D program. We are grateful for the feedback we received and we look forward to meeting the future challenges that lie ahead.

  With best regards,

  -- Rich, Marcel for the SiD tracking group

# Current Situation

- TPC collaboration was also very unhappy with draft version 5 and sequence of events.
- Chris has currently deferred to the WWS-chairs to await further action

# Closing Remarks

- Significant effort in putting together report, talks, responses to questions
  - Did receive some positive feedback from the review committee with respect to our effort/focus/organization
  - Probably won points for presenting a coherent R&D plan
- Many good technical questions, and some useful feedback during the review
  - Very high degree of technical expertise on the committee
- Committee was very set on establishing a “Tracking Coordination Group”
- Several aspects of the review were not handled very well; led to disappointment of many involved

- SiD benefited from the review, but if the review will be beneficial to SiD with regard to the broader issues is an open question
  - Will this exercise help advance the case for SiD R&D funding ?
  - Will a Tracking Coordination Group benefit SiD ?