



ILC Detector R&D

Tracking Review 5-8 February 2007

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RAL

On behalf of the ILC Detector R&D Panel
(a Panel of the World-Wide Study Organising Committee)

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Overview of these reviews

- To be included in every regional workshop from now on:
 - Beijing (Feb '07) **Tracking (Ch D)**
 - DESY (LCWS June '07) **Calorimetry (Wolfgang Lohmann)**
 - Fermilab (Oct '07) **Vertexing (Hwanbae Park)**
 - Asia (Feb '08) **PID, muon trkg, solenoid, beam diagnostics, DAQ**
- Our responsibility is to work with the R&D collaborations to ensure that the feasibility of their critical goals can be demonstrated by 2010-2012
- This means (for tracking) that the community can be confident that the option they choose will satisfy the challenging physics needs
- We reviewed the LCTPC, CLUCOU, SiLC and SiD tracking R&D collaborations
- We were extremely impressed by the great progress made by all these groups, in some cases with very limited resources
- **However, we concluded that we are currently far from the goals, for all tracking options**

What is at stake

Tracking technology	Detector A	Detector B
Gaseous + Silicon	?	?
All Silicon	?	?

It could be that both detector tracking systems will work well, or one well and one badly, or both badly. How to achieve the first outcome? (**maybe not by following the easy compromise of 'one of each technology'**)



Structure of this review

- **Collaboration reports** provided an overview of the projects through to 'completion' of R&D, meaning 'ready for engineering design and construction'
- **Open session presentations** provided summaries of status and plans
- **Closed session** was used to clarify technical and organisational issues, and to discuss their needs for additional resources
- **Closeout session:** Committee informed collaborations of our draft recommendations, and tried (with partial success) to obtain their verbal agreement
- **Report** was released by the WWS-OC chairs on 22nd May, along with appendices from 2 of the 4 the R&D collaborations, in which they discuss areas of disagreement. See the Detector R&D Panel Wiki page http://www.linearcollider.org/wiki/doku.php?id=drdp:drdp_home

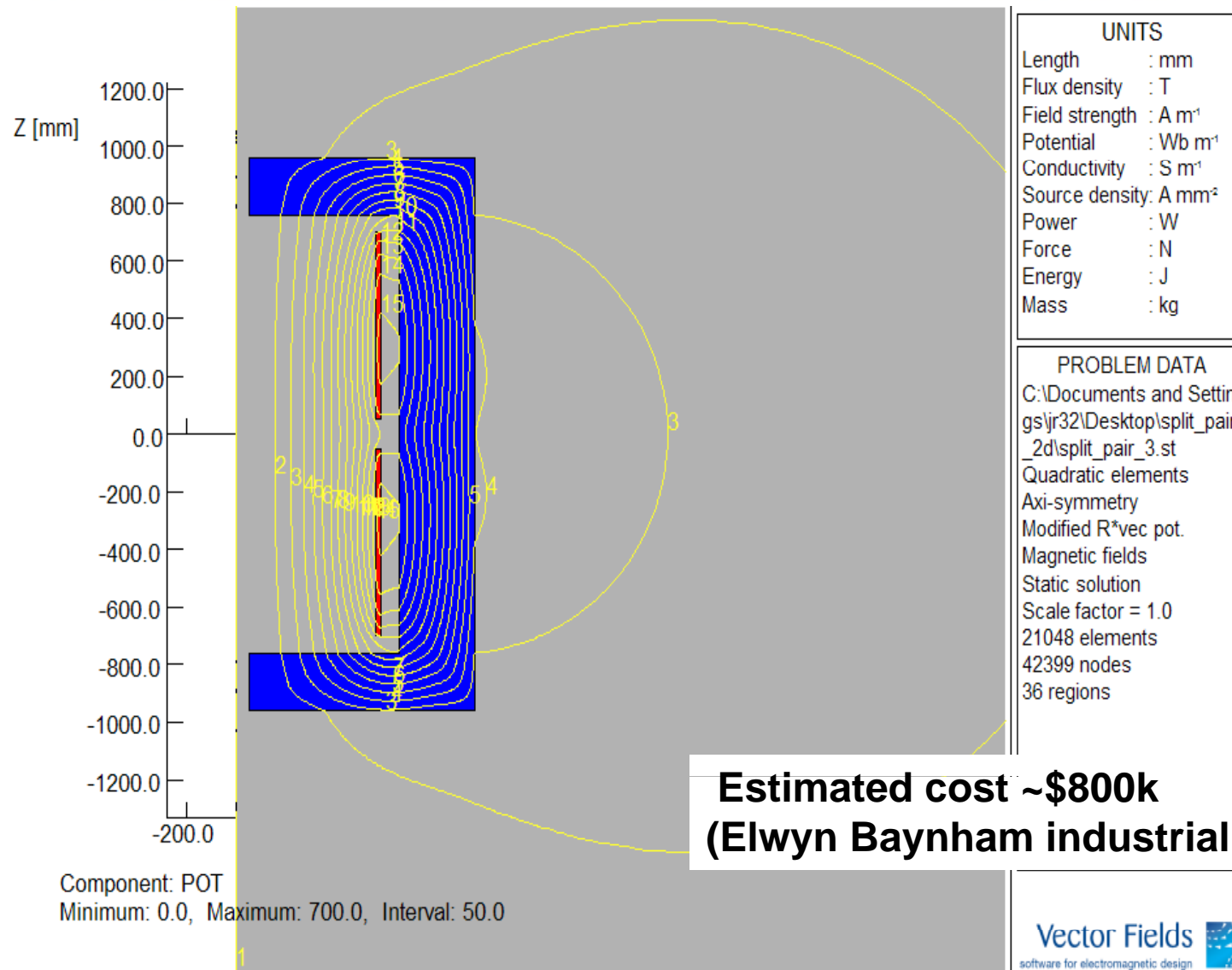


Main technical recommendations

- Building a tracking system with excellent performance for $\theta_p > 7$ degrees will be challenging. *Feasibility is not yet demonstrated*
- Why not simply move on to the 'engineering designs' of these tracking systems and study their performance with Geant 4?
- There is a risk that such designs would be too optimistic. Forward tracking has generally performed badly. We all know the solution (drastic reduction in material budget) but **can this be achieved in practice?** The committee concluded that this crucial question, on which a great deal of ILC physics depends, could not be answered only by adventurous designs
- We became convinced of the need to construct **large prototypes (~1 m diameter), and operate them under ILC-like beam conditions in a 3-5 T field**, to establish what performance will be achievable at ILC, both for central and forward tracking
- Until such tests are completed successfully, we do not consider that any of the three options proposed (all-silicon, TPC-plus-silicon, or drift-chamber-plus-silicon) could be considered ready for selection as an ILC tracking system **[a unanimous recommendation of the committee, but not every collaboration agrees with this; maybe we are wrong]**
- As well, our experts made numerous detailed suggestions (see the report) which we hope are proving useful to the groups in optimising their R&D programmes



A possible split-coil solenoid





Organisational considerations

- We were encouraged by the success of the task-forces that provide world-wide coordination of the ILC accelerator R&D, to wonder about the utility of a **Tracking Coordination Group (TCG)**
- NOT some external body (like the Review Committee) but one or two ‘insiders’ from each R&D group, plus perhaps cross-members from the Vertexing CG and the Test-beam CG
- They *would be free to work out their own charge*, within some very general guidelines, possibly as follows:
 - **Negotiate** for suitable funding for infrastructure (comprising a custom-designed test beam, solenoid, etc.), **coordinate** the use of these facilities, and ensure objective **evaluation** and **presentation** of the test results
- An important by-product would be that these individuals would rapidly become THE experts on every aspect of the world-wide tracking R&D, and hence become a valuable source of wisdom for the community
- The *choice of technologies* will as usual be made by experiment collaborations in conjunction with the IDAG, but the TCG would aim to *inform* those decisions in the most objective way possible



Lessons from the ILC accelerator task forces

- 7 of them formed by the RDB January-May 2006 for all R&D areas of the machine
- They have functioned 'better than any of us could have expected' (Bill Willis)
- To learn about their achievements, look at the slides from the MAC review of ILC R&D, held in Fermilab 26-27 April, <http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=1388>
- Judging from their example, the TCG should not be given a detailed charge – that is something for them to work out. The TFs have (not surprisingly) contrasting styles of working
- What matters is not the charge, but the motivation and dedication of the members of the TF/Coordination Group
- However, it isn't only a question of their motivation. These TFs could not have flourished without being embedded in a supportive structure (GDE management)
- The suggested Research Director for Detectors (and directorate) provides an opportunity to consider how best to achieve equivalent functionality for our R&D community

- Spend on ILC detector R&D is considered by the community to be seriously inadequate (see R&D Panel Report of January 2006). Are these real needs or 'unrestrained desires'? The first of the R&D reviews (on tracking) confirmed the urgent need for some increase in resources
- Our committee echoed the comment of one of the collaborations: **'Ultimately, the greatest R&D risk is that insufficient resources will be directed towards achieving the goals of this plan'**
- We hope that the proposed **ILC Detector Directorate**, working with the funding agencies and lab directors, will help to secure the needed resources, just as the **GDE** is doing for the machine
- We should be very careful not to weaken the R&D groups (in order to support the Engineering Designs) just when they are most in need of support. The ILC physics programme depends on R&D which cannot be completed before about 2012, in the case of tracking and several other areas

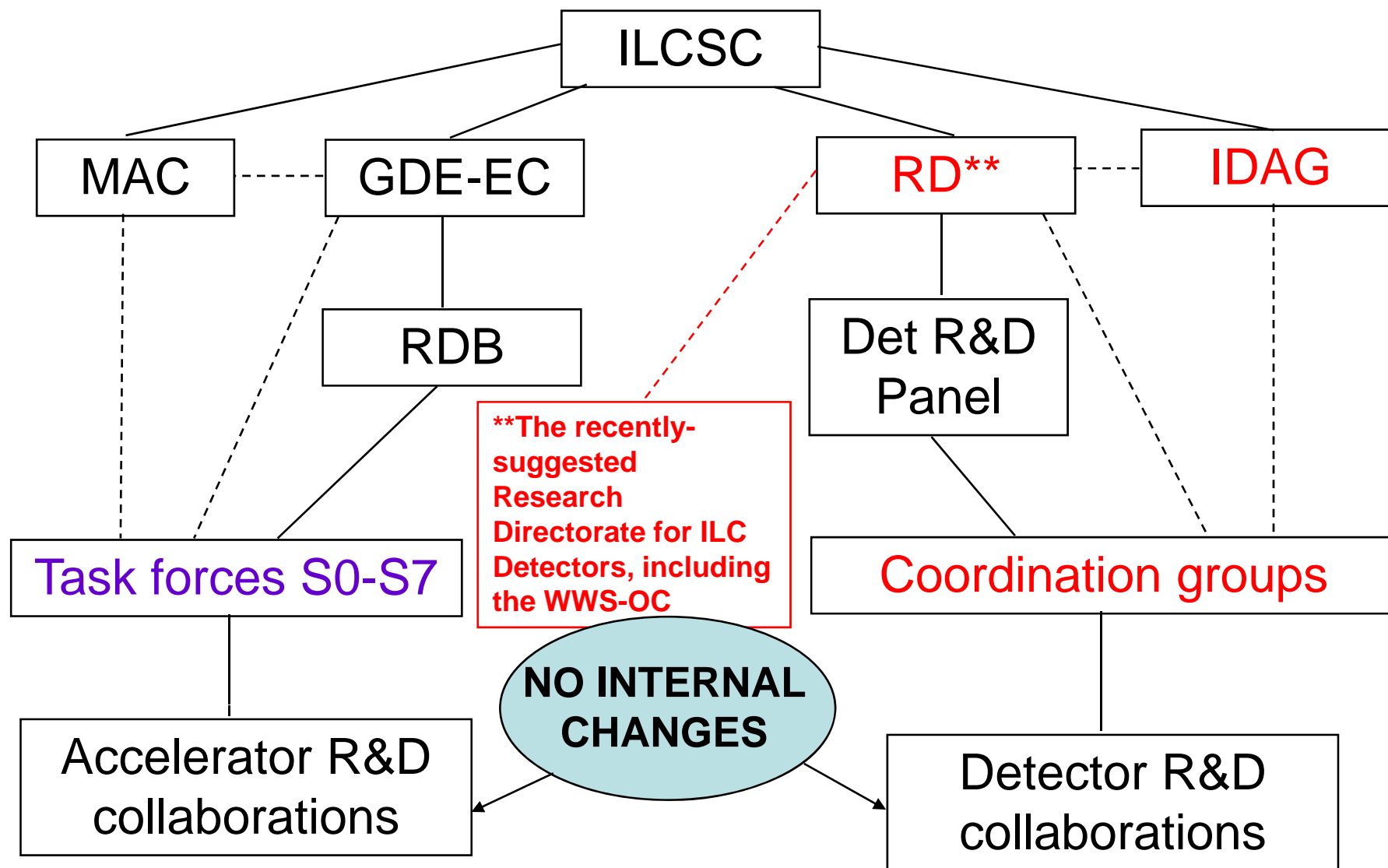
- **Some worrying comments, during the past couple of weeks**
 - **‘We have a perfectly adequate tracker design. We don’t need any more R&D’**
 - **We want to make the final choice of tracking systems in 2008**
 - **‘We don’t want to do much more R&D. We want to build it, and if it doesn’t work, we’ll fix it’**
 - **‘We cannot be doing R&D forever. Let’s form collaborations and get on with the Engineering Design’**
- **Remember Richard Feynman’s words of good advice – ‘Reality has to take precedence over Public Relations, for Nature cannot be fooled’**



Additional material



One possible structure for coordination of detector R&D, for consideration



XXX not yet formed



Accelerator TF responsibilities

- S0/1 RF cavities **Lutz Lilje**
- S2 Cryomodules/string tests **Tom Himel, Hasan Padamsee**
- S3 Damping rings **Andy Wolski**
- S4 Beam delivery system **Andreij Seryi**
- S5 Positron source **John Sheppard**
- S6 Controls
- S7 Main linac RF **Chris Adolphsen**

These TFs typically organise the R&D into WPs, hold phone meetings at 1-2 week intervals, hold occasional workshops, **review progress on baseline and alternatives**, aim to ensure that all important R&D is adequately covered, encourage groups to avoid unnecessary duplication, alert RDB and GDE to major technical and funding problems ...

Through participation in national reviews (so far in USA, UK, Japan) they have some influence over funding, but don't have direct control. Their role will be strengthened by MoUs in the ED phase

If the TCG is formed, I would suggest that they consider talking to any or all of the above, as well as reading the recent slides for the MAC review of R&D. We can learn some things from our accelerator colleagues



S0/S1: Gradient Task Force Charge

- The RDB is asked to set up a Task Force to carry out a closely coordinated global execution of the work leading to the achievement of the accelerating gradient specified in the ILC Baseline.
- A definition of the goals for the cavity performance in terms of gradient and yield and a plan for achieving them **should be proposed by this group**, which should take account of the global resources available and how they may be used most rapidly and efficiently.
- The accelerating gradient performance and yield **should be specified** both for an individual 9-cell cavity and for an individual cryomodule, and the plan should cover the demonstration of this performance in both cases.
- **The GDE will facilitate the coordination at the global level to achieve this vital goal as soon as possible.**