

Research Director's SB2009 Working Group - Physics Questions -

Karsten Buesser
DESY



AD&I Meeting
DESY
02 December 2009

- Sakue Yamada has set up a Working Group to coordinate the studies to evaluate the impact of SB2009 on the ILC physics reach and the detector performances
- Initial Members:
 - Jim Brau (Management, Chair)
 - Mark Thomson (ILD)
 - Tom Markiewicz (SiD)
 - Karsten Buesser (MDI CTG)
 - Akiya Miyamoto (Software CTG)
 - Keisuke Fujii (Physics CTG)
- First actions were to collect concerns and questions from the concepts and the Common Task Groups and send them to the GDE for answers and clarifications about the definitions on SB2009

- The main concern is the impact of SB2009 on the potential physics programme of the ILC. In particular the possibility of studying a low mass Higgs boson at the optimal centre-of-mass energy of $\sqrt{s} \sim 250$ GeV. Understanding the nature of the Higgs boson is central to the ILC and reduced luminosity at low energies could significantly damage the physics reach of the ILC.
- Increased beamstrahlung reduces the useful luminosity at given centre-of-mass energy.
- Beam energy spread is also important; in the Higgs recoil mass analysis, this is the limiting factor for the Lol studies (RDR parameters).
- Increased backgrounds will impact on detector performance, e.g.
 - may imply moving VTX inner radius out to 20mm, which will degrade (somewhat) flavour tagging performance and may have a large impact on the ability to reconstruct the charge of displaced vertices.
 - increased background levels may result in moving the inner acceptance of the forward calorimeters (LumiCAL/BCAL) which will reduce the hermeticity of the detector.

- The above effects will **degrade the physics reach of the ILC**; we are concerned about the **impact on the competitiveness of the ILC compared to the LHC and CLIC**.
- There are concerns about the **impact of the reduction of the size of the damping rings on possible upgrade options for the ILC**.
- The **narrowed margin for performance raises concerns regarding the risk for delivering the design luminosity**; concerns include **kicker jitter, collimation tolerances & jitter, traveling focus feasibility, and others**.
- There were also questions about the **economics of cost saving on the machine and longer ILC operation to reach the same integrated luminosity**.

- To assess the physics impact, we need **beam parameters** at several key energies:
 - **250 GeV** (to compare with Lol),
 - **350 GeV** (a likely operating energy for SB2009),
 - **500 GeV** (again to compare with the Lol).
- Beam parameters should include electron/positron beam energy spread.
- We would like to understand the effect on backgrounds/luminosity spectrum for **SB2009 with vs without traveling focus**.
- **For low energy operation, we would like to understand the GDEs position on a conventional positron source.** ← initial question. We were asked for clarification (see next slide)
- **How stable would the Luminosity, Energy spread, and positron polarization be during a threshold scan, for example for ttbar or susy?** ← initial question. We were asked for clarification (see next slide)
- **Can you provide a rough sketch of $L(E_{cm})$, Energy spread(E_{cm}), and $Pol_{e^+}(E_{cm})$ showing how they might be expected to vary between $E_{cm}=91$ and 500 GeV?**

- Question on Positron Source (reformulated)
 - Despite the questions of feasibility, the conventional positron source remains very interesting in order to maximize yield and therefore luminosity. Please provide estimates of the **expected luminosity and beam energy spread that would be possible with either a conventional positron source, or an undulator source, at cms energies between 200 and 300 GeV.** Will the conventional source possibility remain an option in the re-baselined design? What R&D will be pursued either within the GDE or by other groups to ensure its development?
- We were also asked to clarify the question on stability. We need to be more specific about periods of times and energies
 - Re-formulation of that question is still underway.

- GDE has set up a Physics Questions Committee which is in charge of interacting with RD's SB2009 WG on these issues
- Members:
 - Brian Foster (co-chair)
 - Andrei Seryi (co-chair)
 - Mike Harrison
 - Toshiaki Tauchi
 - Daniel Schulte
 - Jim Clarke
- Discussions have started (c.f. clarifications of questions)
- We are expecting the answers to the questions soon

- SB2009 WG is starting to plan the studies which need to be done once the answers from the GDE are there
 - Preparations for the studies are already ongoing within the concept groups
 - SB2009 WG will be expanded by 4-5 experts who will help to coordinate the necessary studies
- Some of the required studies will need time! Full detector MC studies are needed which are CPU time consuming
- Evaluation of the new SB2009 based on the input coming from the machine group will be a very challenging task at the given timescales (LCWS2010)