IDAG Report

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PAC, November 14 2010, Prague

IDAG mandates and actions

- (1) IDAG appointed by ILCSC (end 2007) to advise RD on ILC experimental program
- (2) ILCSC (Feb. 2008): ask for validation of detector concepts as proposed in LOIs
- (3) meaning of validation clarified

  (IDAG report to PAC, Paris Oct. 2008)
- (4) IDAG validated 2 concepts (ILD, SiD) out of the 3 LOIs (August 2009); accepted by RD and ILCSC

  (IDAG report to PAC, Pohang Nov. 2009)
- (5) IDAG asked by ILCSC to continue work after validation by monitoring the progress of the 2 concepts towards a detailed baseline document to be ready simultaneously with the GDE technical design end 2012
- (6) The monitoring process is underway and has two aspects:
  - review progress of both detector concepts
  - monitor activities of the Common Task Groups (CTGs set up by RD)
- (7) Monitoring of R&D progress: more complex situation, so that IDAG took a broader view there

  (IDAG report to PAC, Eugene Nov. 2010)

IDAG Membership

• M. Danilov (ITEP, Russia)	exp	
• M. Davier (LAL-Orsay, France)	exp	Chairman
• C. Grojean (CERN, France)	th	
• E. Elsen (DESY, Germany)	acc	GDE
• P. Grannis (Stony Brook, US)	exp	
• R. Godbole (IIS, India)	th	
• D. Green (FNAL, US)	exp	
• J. A. Hewett (SLAC, US)	th	
• T. Himel (SLAC, US)	acc	GDE
• D. Karlen (Victoria, Canada)	exp	
• S. K. Kim (SNU, Korea)	exp	
• T. Kobayashi (ICEPP, Japan)	exp	
• W. G. Li (IHEP, China)	exp	
• R. Nickerson (Oxford, UK)	exp	
• S. Palestini (CERN, Italy)	exp	
• N. Toge (KEK, Japan)	acc	GDE

- Ex officio: S. Yamada, J. Brau, J. Fuster, H. Yamamoto

IDAG meetings in 2011

- held during ILC general workshops, twice a year

- Eugene meeting (March 20)
  - **Discussion with RD**
  - **ILD status**
  - **SiD status**
  - **Physics CTG document: new benchmark processes for DBD**
  - **Engineering Tools CTG review**
  - **Discussion and recommendations**
- Granada meeting (Sept. 27)
  - **Discussion with RD**
  - **ILD status**
  - **SiD status**
  - **Preparation of new physics analyses for DBD**
  - **Status of common costing group**
  - **R&D issues**
  - **Discussion and recommendations**

Recall DBD guidelines

http://www.linearcollider.org/physics-detectors/Research-Director%27s-report/2009/20-August-2009---Planning-for-the-next-steps

1. Demonstrate proof of principle on critical components.
   When there are options, at least one option for each subsystem will reach a?level of maturity which verifies feasibility.
2. Define a feasible baseline design.
   While a baseline will be specified, options may also be considered.
3. Complete basic mechanical integration of the baseline design accounting for insensitive zones such as the beam holes, support structure, cables, gaps or inner detector material.
4. Develop a realistic simulation model of the baseline design, including the identified faults and limitations.
5. Develop a push-pull mechanism, working out the movement procedure, time scale, alignment and calibration schemes in cooperation with relevant groups.
6. Develop a realistic concept of integration with the accelerator including the IR design.
7. Simulate and analyse updated benchmark reactions with the realistic detector model. Include the impact of detector dead zones and updated background conditions.
8. Simulate and study some reactions at 1 TeV, including realistic higher-energy backgrounds, demonstrating the detector performance.
9. Develop an improved cost estimate.

Reaching DBD goals

- DBD is intended for ILCSC and the HEP community to document the feasibility of ILC physics with realistic detector designs
- Initial guidance of 100 pages may be too restrictive, but should not exceed 150 pages/detector
- IDAG is not supposed to formally review the DBD, like it was done for the LOIs
- IDAG will provide comments and advice on the DBD drafts to the RD
- IDAG would like to monitor progress in reaching the goals well ahead of delivery date
- For next Gyeongju workshop 23-26 April 2011, IDAG has requested the two concepts to present their detailed DBD outlines (basically first rough draft)
- First version of final draft requested for Fall meeting in time for comments

ILD and SiD status (1)

- good and measurable progress on sub-detector R&D
- R&D funding and technical manpower shortage: most acute for SiD
- good progress on cooperation: push-pull (converged in Spring 2011 on the moving platform scheme), MDI and hall design, detector R&D (FCAL, vertex, HCAL), common software frameworks, generation of physics and background samples
- clear that detector R&D needs to be pushed further after 2012: pursue alternate options, some issues still behind (power pulsing)
- Tight schedule for new physics benchmarks: event production with realistic simulation in progress

ILD and SiD status (2)

Some IDAG worries:

- Some reluctance from ILD to reduce the number of options for subdetectors and reach a baseline solution, even for the benchmarking simulation and physics analyses: pros and cons, reviews of options early 2012

- R&D funding and technical manpower shortage for SiD: low priority at US national labs and in UK $\Rightarrow$ little done on integration work, very limited ability to perform tests on full-scale prototypes on DBD time scale (particularly Si tracker), problems encountered for bonding chips

Costing issues

- at Beijing meeting IDAG recommended that costing of the two detectors be done with common methods and common unit costs: common costing group set up by RD
- the 2 detectors followed different optimization process on performance vs cost $\Rightarrow$ seemingly disparity of costs in LOI
- common costing in progress, manpower and materials separated, some issues to be resolved

- separate agenda item at this meeting, costs may be closer than expected

- 1-TeV benchmarks offer a new possibility to compare functionalities and optimization

ILD/SiD and CLIC collaboration

- detector concepts developed for CLIC based on ILD and SiD
- good collaboration between CLIC and ILC detector groups on the ground
- solid engineering efforts engaged at CERN help ILC detectors:
  layout of experimental hall, push-pull design
- some shift of ILD/SiD resources into CLIC detector design: IDAG expects that help in the other direction will occur after CLIC CDR for advancing DBD work.
- CLIC and ILC both need benchmark simulations at 1 TeV
- software now largely in common: this efficient way to proceed should be maintained in the longer term
- overall, extremely positive development

- separate discussion item at this meeting

Physics benchmarking for DBD

- Physics CTG (convener: M. Peskin): very valuable work to identify key processes in order to assess the detectors performance and the ability to extract the physics
- In particular, detectors should demonstrate that they can operate without major modification at 1 TeV: are magnet and calorimetry as designed for 500 GeV adequate?
- IDAG reckons that generating event samples and background, running more realistic simulations, doing the analyses represent an enormous effort by ILD/SiD
- Following IDAG's suggestions, a benchmarking group appointed by RD has produced in January 2011 a reduced list of processes to document adequately the 1-TeV case which is hopefully within the capability of the concept groups

- $\nu\ \bar{\nu}$ H: simple topology H$\rightarrow\mu\ \mu$, c cbar, b bar, g g, W W*
- t tbar H: performance with a high multiplicity of jets (8) $\Rightarrow$ t Yukawa
- W W process, involving the forward detection of jet pairs with rather small opening angles $\Rightarrow$ check $e^{\pm}$ polarization in situ
- redo at least one process from LOI with improved 2011 simulation

Software preparation for benchmarking

- Very satisfactory progress on updating and enlarging common software tools
- Generator subWG sharing work for common event samples
- Enormous effort done for setting up generators (physics and background)
- IDAG impressed by the quality and the efficiency of the work produced

Detector R&D

- Work done by R&D collaborations (independent structures) discussed at Geneva IDAG meeting in Fall 2010
- Truly impressive activity done by the R&D collaborations
- Work initially motivated by ILC detectors, growing wider
- Major results obtained, validating expected detector performance
- Serious worry as level of funding/support has been shrinking

- Some positive points since: AIDA programme in Europe, Japan funding, generic R&D program in US
- Need to publicize the results obtained from ILC detector research and their applications in HEP in general, but most remarkably in other fields, including medical applications:
- IDAG suggested writing of a report on spin-offs from ILC R&D

- Report available since last month: a very good case for continuing and enlarging the effort on detector R&D !
- You are encouraged to read and reflect on this report…
- Long-term detector R&D effort must be sustained

Exemples of ILC detector R&D spin-offs (1)

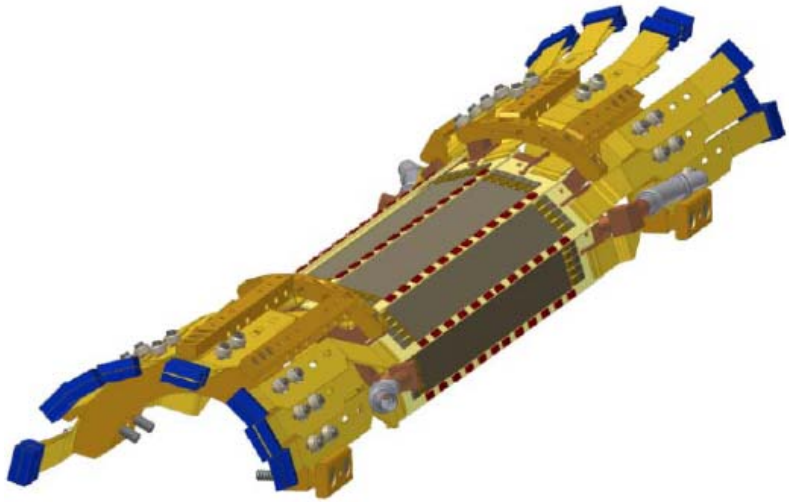

Fig. 1: Isometric view of one half of the vertex detector for the BELLE-II experiment, based on the DEPFET technology. Image: DESY

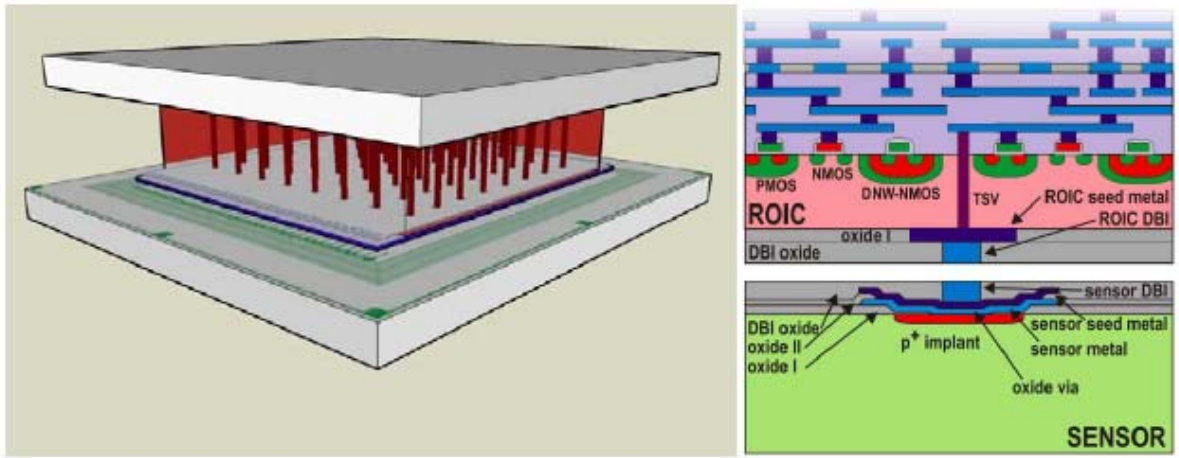

Fig. 4: Conceptual view of a 3D silicon assembly for a track trigger for an LHC upgrade showing a silicon sensor at the top and bottom interconnected through an interposer (left) and a cross section of a connection between sensor and readout chip (right). Image: Ron Lipton

Fig. 6: MicoMegas based Time Projection Chamber for the T2K experiment in Japan, based on ILC detector R&D. Image: T2K

Examples of ILC detector R&D spin-offs (2)

Fig. 14: View of the PEBS balloon prototype. From left to right: the balloon being readied in Sweden in October 2010; the detectors arrangement in the payload; the scintillating fibers and SiPM readout arrays; and the SPIROC ASIC mounted on hybrid to perform low noise low power readout.

Fig. 15: Picture of the Trecam camera (left), developed by CNRS, to aid in breast cancer surgery (centre). The data acquisition system of the camera (right) employs a readout chip developed for the digital hadronic calorimeter for the ILC. Images: CNRS

Next IDAG Meeting

- Gyeongju workshop, April 19-23 2010
- ILD/SiD review with emphasis on the DBD drafting
- Discussion of results from 1 TeV benchmarks and updated studies with current simulation

Conclusions

- Satisfactory ILD/SiD progress toward Detailed Baseline
- Several important design features (tracking, calorimetry) have been validated with prototypes
- Still a lot of work remains to be done for the DBD, in particular to document the detectors performance at 1 TeV
- Manpower is a serious problem: some studies limited, but still reasonable at the DBD level
- Collaboration with CLIC detector work enhanced
- Common activities on physics benchmarking, software, and MDI are efficient and ensuring convergence
- Detector R&D is mostly done independently in separate collaborations. Impressive results have been achieved which are essential for ILC, but also in a broader range of applications. Sustaining detector R&D effort in the longer run should be considered a high priority for ILC, but also for HEP in general.