IDAG Report

Michel Davier
LAL-Orsay

PAC, November 11 2010, Eugene

IDAG mandates and actions

- (1) IDAG appointed by ILCSC (end 2007) to advise RD on ILC experimental program and to recommend 2 detectors for the engineering design effort
- (2) ILCSC (Feb. 2008) reformulated task: 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 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, F. Richard, H. Yamamoto

IDAG meetings in 2010

- held during ILC general workshops, twice a year

- Beijing meetings (March 27-29)
  - **Discussion with RD: requests and mode of operation of IDAG**
  - **ILD status**
  - **SiD status**
  - **Physics CTG: review new benchmark processes for DBD**
  - **MDI CTG review**
  - **Discussion and recommendations**
- Geneva meetings (Oct. 20-21)
  - **Discussion with RD: monitoring of CTGs, DBD requirements**
  - **ILD status**
  - **SiD status**
  - **Detector CTG review and general overview of R&D status**
  - **Software CTG review**
  - **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.

Costing issues

- at Beijing meeting IDAG recommended that costing of the two detectors be done with common methods and common unit costs

- RD response: common costing group set up

- the 2 detectors followed different optimization process on performance vs cost $\Rightarrow$ disparity in (preliminary) costing at this moment.

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

- further iterations may require more specific cost guidance

Reaching DBD goals

- Who will read the DBD ? ILCSC, HEP community
- Initial guidance of 100 pages may be too restrictive, but should not exceed 150 pages/detector

- By the time of the next IDAG meeting, some specific effort should be made by the concept groups and the RD management to further improve the understanding of the DBD contents

- IDAG would like to monitor progress in reaching the goals early enough
- At next Eugene workshop 19-23 March 2011, IDAG requests the two concepts to present their detailed DBD outlines with sufficient explanation of what will be covered (and what not covered) within existing resources in addressing the 9 goals

ILD and SiD status

- good and measurable progress on sub-detector R&D
- uncertainties and shortcomings in funding
- progress on cooperation: push-pull (convergence expected in Spring 2011 on the platform/no platform issue), MDI and hall design, detector R&D (FCAL, vertex, HCAL), common software frameworks
- IDAG looks forward for further close collaboration
- clear that detector R&D needs to be pushed further after 2012
- Tight schedule for new physics benchmarks: event production with realistic simulation foreseen for the later part of 2011

ILD/SiD and CLIC collaboration

- approach of CLIC CDR created a phase transition in detector collaboration
- IDAG pleased to see this new situation
- 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 resources into CLIC detector design: expectation that help in the other direction will occur after CLIC CDR for advancing DBD work.
  IDAG hopes that this expectation will be met.
- 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

Physics benchmarking review

- Physics CTG (convener: M. Peskin) is producing 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?
- Generating event samples and background, running more realistic simulations, doing the analyses are effort/time consuming
- In response to IDAG suggestions in Beijing, Physics CTG is producing a reduced list of processes to document adequately the 1-TeV case which is hopefully within the capability of the concept groups

- ttbar H study to probe physics with a high multiplicity of jets
- ee → WW process, involving the forward detection of jet pairs with rather small opening angles.
- ttbar asymmetry
- + redo some of the LOI studies with more realistic simulation

Machine Detector Interface review

- nice progress from the MDI CTG (convener: K. Buesser)
- work greatly simplified since LOI validation
- differences between ILD and SiD push-pull schemes well identified: detector heights, supports, motion, and interface with accelerator
- program of studies underway to resolve these issues on scientific ground
- finite element results on vibrations, supplemented by real measurements: platform vs. rolling legs to be settled in Spring 2011 (valuable CLIC support)
- Important to reach convergence on this issue so that GDE can define the machine detector interface.
- MDI guidance document should evolve into MDI specification document with more specific engineering boundary conditions for the concept groups to abide by

Physics software review

- Report from the convener (A. Miyamoto)
- Very satisfactory progress on updating and enlarging common software tools (LCIO event data model)
- Generator subWG formed to share work for common event samples
- Worry about human resources to carry out the requested studies for DBD
- Good communication should be maintained between ILC and CLIC communities to avoid conflicts in computing and human resources in coming months

Detector R&D review

- detector CTG set up to monitor tasks which are common to the 2 concepts
- however most of the needed R&D is done in a “non common” way by independent R&D collaborations
- still some information flows to the CTG through representatives of R&D collaborations
- IDAG is charged with the monitoring of the two concepts toward the DBD phase
- so it was felt necessary to go much beyond the review of the CTG activity and to understand the whole R&D picture relevant to ILD and SiD

Relevant overall R&D picture

Very informative session with the following presentations:

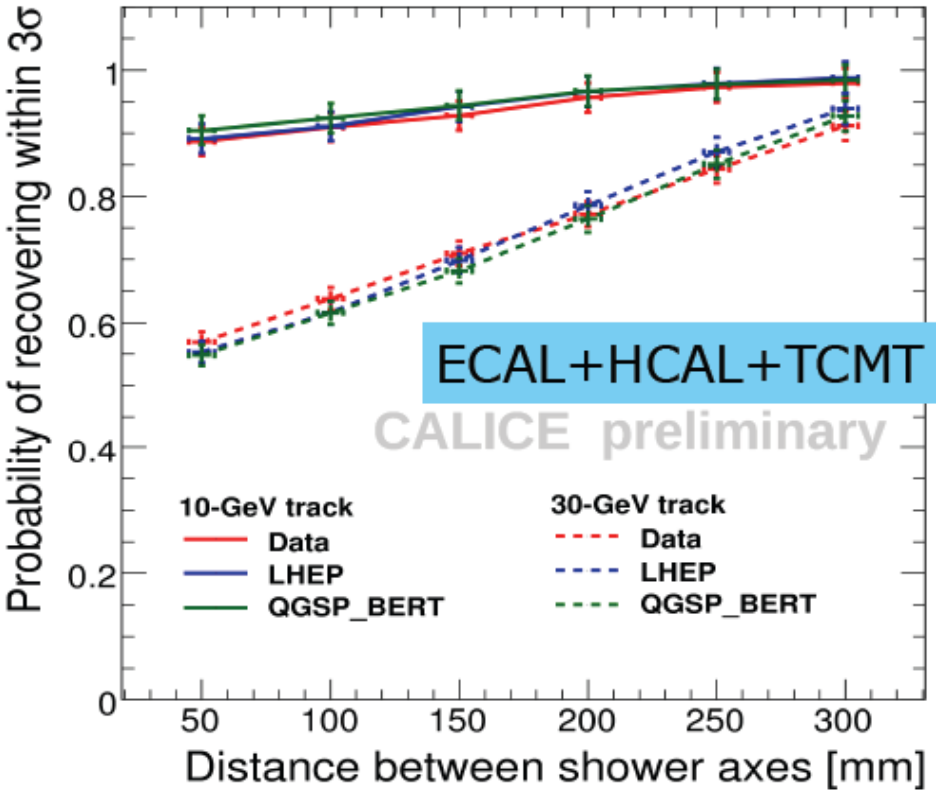
- introduction to detector CTG (convener: M. Demarteau)
- CALICE R&D collaboration (F. Sefkow) calorimetry
- LPTPC (J. Timmermans) TPC (ILD)
- SILC (A. Savoy-Navarro) Si trackers
- FCAL (W. Lohmann) forward detection
- vertex detector R&D (R. Lipton) pixels
- SiD R&D (A. White)
- reflections on detector R&D (M. Demarteau)
- discussion with CTG members and ILD/SiD representatives

R&D general assessment

- truly impressive activity done by the R&D collaborations
- the larger part of the effort is devoted to the ILC detectors
- major results obtained which validate expected detector performance
- 3 beautiful examples:
  - precision achieved in LCTPC (ILD)
  - software energy compensation and progress on Particle Flow (shower overlays) (ILD)
  - 1 m^3 digital HCAL under test (SiD)
- pixel development research for vertex detectors appropriately broad for this stage
- Serious worry as level of funding/support is shrinking

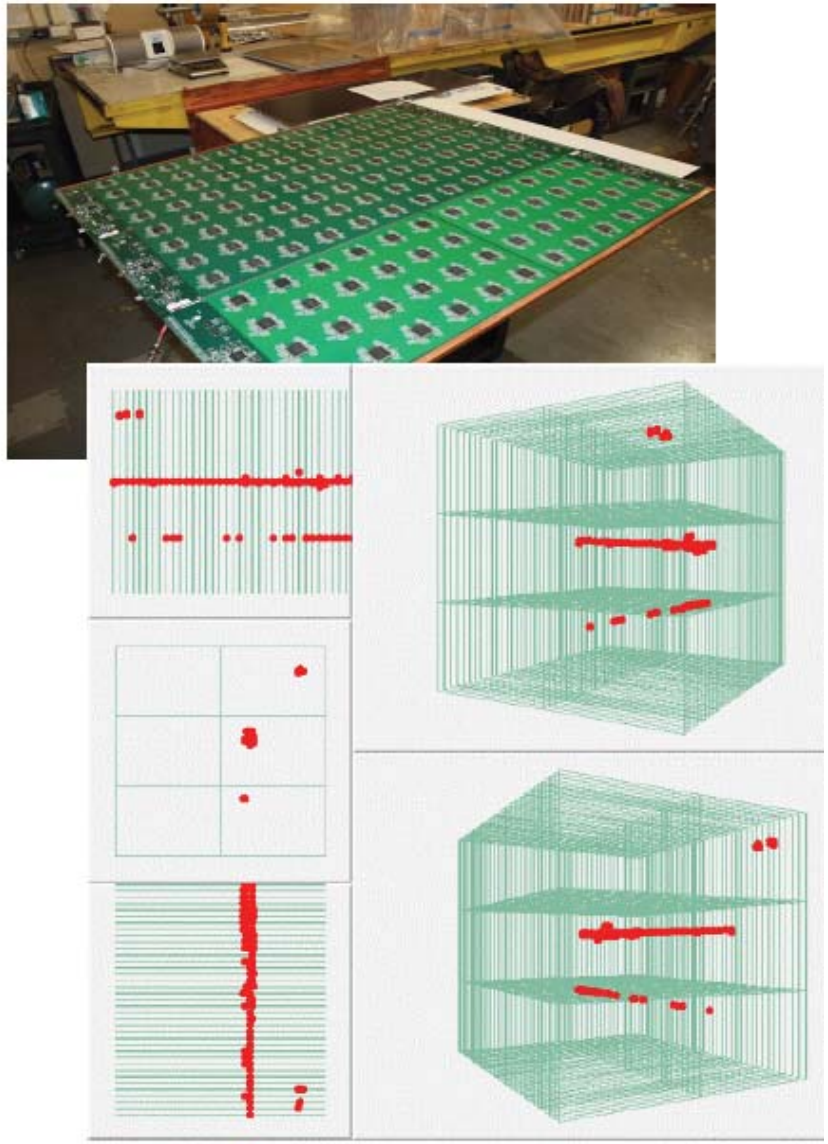
PFLOW: two-particle separation

10 GeV track + 10/30 GeV close track



Data/MC comparison

RPC DHCAL m3 at FNAL



Suggestions on R&D

- in many areas applications outside ILC of ILC-motivated R&D have emerged: a document emphasizing these applications outside ILC and even outside HEP would be extremely valuable and could be used to encourage funding agencies to increase funding for detector R&D
- Some beginnings of power cycling tests, but still looking forward for more incisive investigations in the near future
- Encourage solutions to be found for the shortage of beam test facilities in 2012-13. They are critical for further sub-detector tests and progress

Securing long-term support for R&D

- IDAG agrees that lack of funding stability is hampering progress for the ILC detector development, but also for HEP in general
- as discussions proceed to secure appropriate sources of funding beyond delivery of the GDE TDR, an equivalent case should be made for detector development. The detector R&D needs to continue. Making such detector support a part of a more generic detector R&D funding could well be appropriate.
- It is essential to convince funding authorities that long-term R&Ds are essential for our field. Such R&Ds also provide visible and very valuable spin-offs
- We note with interest a proposal to introduce more global or regional peer-review evaluation of generic detector R&D. We are in favour of calling for a dialogue in order to improve the climate for sustaining such generic R&D.

Next IDAG Meeting

- Eugene Workshop, March 19-23 2010
- ILD/SiD review with emphasis on the DBD outline and work plan
- Review of CTG on Engineering Tools

Conclusions

- ILD/SiD progress toward Detailed Baseline very satisfactory
- Several important design features (tracking, calorimetry) are being validated
- 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
- Collaboration with CLIC detector work is much increased
- 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. More global or regional peer-reviewing of R&D projects should be established.

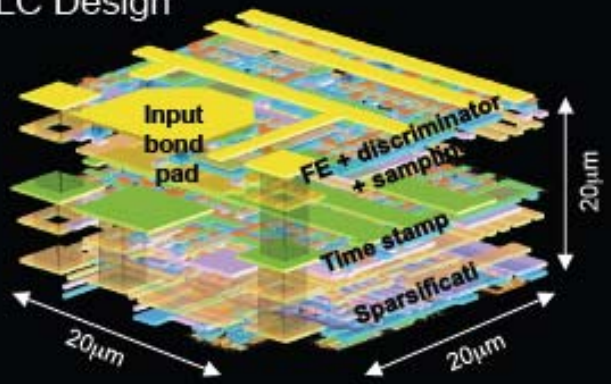
Backup slides

from M. Demarteau presentation to IDAG in Geneva

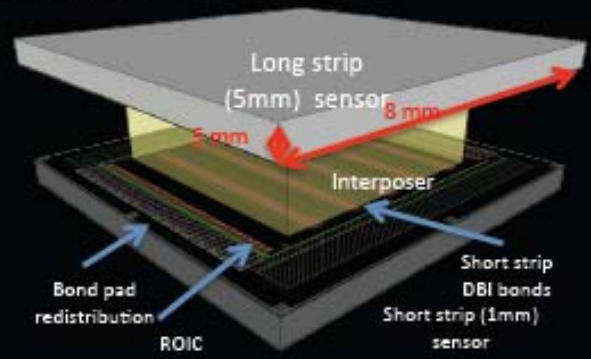
Benefits of ILC Detector Program

- The development of new technologies and the implementation in prototype detectors has been very beneficial to the community at large
  - 3D Silicon

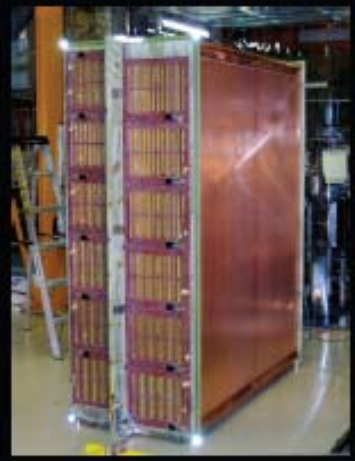
ILC Design



LHC Upgrade



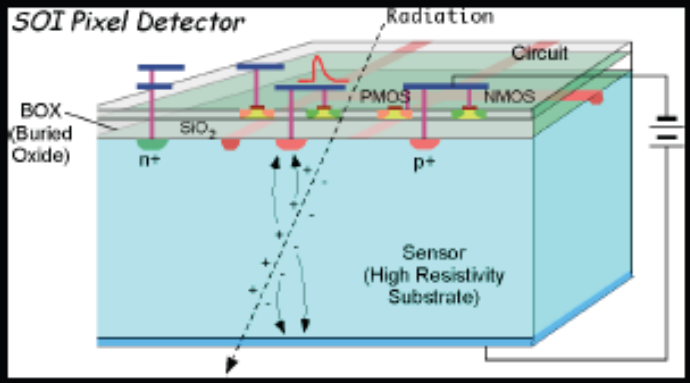
  - Micromegas TPC



T2K TPC

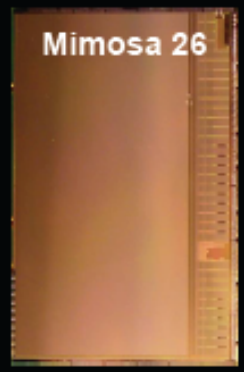
Benefits of ILC Detector Program

- Silicon On Insulator started as purely ILC driven technology



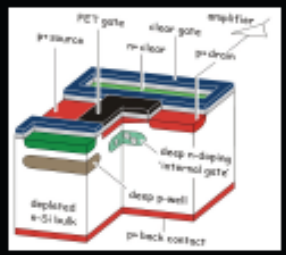
X-ray detection with femtosecond timing (LBNL)

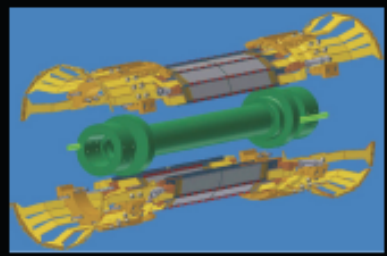
- Mimosa Pixel Chip



Beam test telescope at DESY and CERN

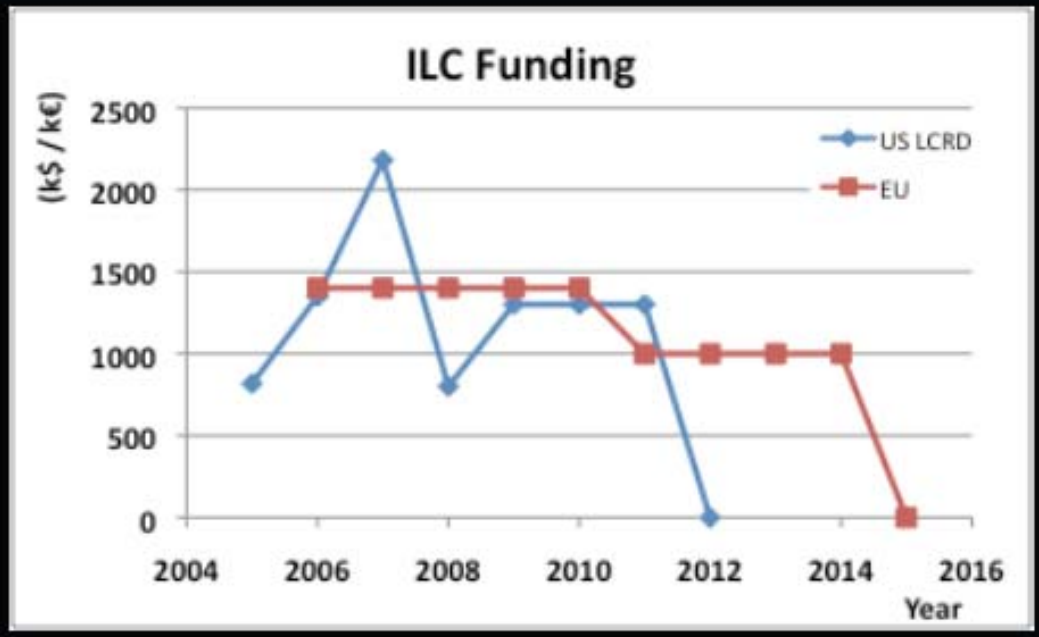
- DEPFET





Belle

Funding



- US ILC support
  - Universities (LCRD)
- EU support
  - EUDET and AIDA

- Some further facts:
  - US ILC funding through LCRD program will be terminated FY12
  - Japanese funding as it exists now will terminate next year
  - Individual country contributions to R&D collaborations can widely fluctuate from year to year (+/- 30%)
  - EU funding is geared towards infrastructure, not R&D
  - UK funding has been eliminated

Recommendation

- We believe the time has come to organize the detector R&D at a more global level in a broader context.
  - Many projects share the same concerns and the same needs.
  - A global coordinated program should be beneficial for the field

- We ask IDAG to recommend the ILC community to go to ILCSC and ICFA to recommend initiating a process for:
  - Development of a strategy aimed at defining a stable environment for detector R&D with a time-scale commensurate with the projects
  - Development of a global mechanism for evaluating the R&D needs of future projects
  - Coordination of selected global physics and detector efforts
  - Evaluation of common goals, objectives and commonality of tools
  - Guidance and monitoring of the R&D