Status of the SiD LoI

Philip Burrows

John Adams Institute

Oxford University

Hiro Aihara, Mark Oreglia

Thanks!

To the very many SiD colleagues who have worked hard to provide results + material for the LoI!

i.e. ALL of you!

The Good News!

‘Public’ draft of LoI:

SiD Letter of Intent

v0.94 25 February 2009

http://hep.uchicago.edu/~oreglia/SiDLOI/sidloi_v0.94withDAQ.pdf

Editors: H. Aihara, P. Burrows, M. Oreglia

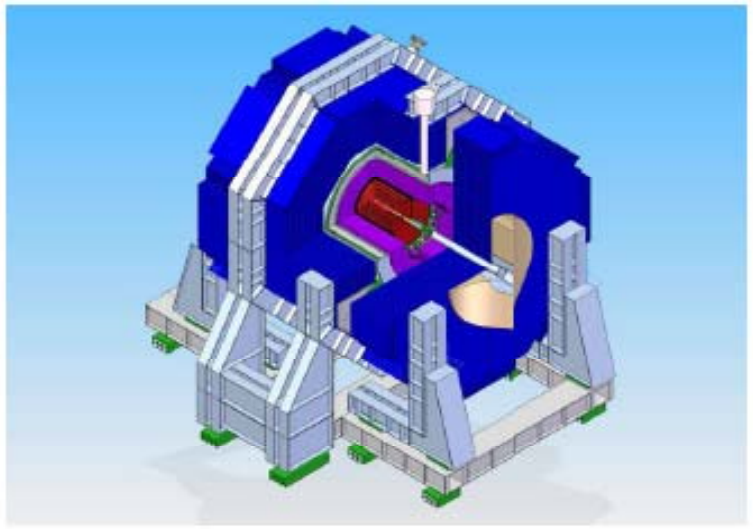

Figure 1: The SiD detector concept.

This Workshop

- **Invite comments + feedback on LoI**
- **Dedicated talks on each section**
- **Talks on benchmarking results**
- **Sessions for revision + editing**
- **Dedicated session for general discussion – Tuesday 17.00**

Outline

- **Reminder of LoI scope**
- **History of drafting process**
- **Status of LoI**
- **Suggested action plan for completion**

Reminder of scope (Yamada Oct. 3 2007)

‘Loi should contain:

information on proposed detector, its overall philosophy, its sub-detectors and alternatives, and how these will work in concert to address the ILC physics questions’

Reminder of scope (Yamada Oct. 3 2007)

‘Evaluation of detector performance should be based on physics benchmarks … some same for all LoIs … some chosen to emphasise the particular strengths of the proposed detector’

Reminder of scope (Yamada Oct. 3 2007)

‘discussion of integration issues with the machine …

state of technological developments for the components …

alternative technological options …

further R&D should be identified … with timelines and milestones …

a preliminary cost estimate’

Reminder of scope (Yamada Oct. 3 2007)

‘In addition, should present:

structure of group …

resource needs and evolution in time

…

enable the reader to judge the capacity and seriousness of the groups to carry out the work until the EDR’

Additional questions (IDAG June 22 2008)

1. Sensitivity of different detector components to machine background as characterized in the MDI panel.
2. Calibration and alignment schemes.
3. Status of an engineering model describing the support structures and the dead zones in the detector simulation
4. Plans for getting the necessary R&D results to transform the design concept into a well-defined detector proposal.
5. Push-pull ability with respect to technical aspects (assembly areas needed, detector transport and connections) and maintaining the detector performance for a stable and time-efficient operation.
6. A short statement about the energy coverage, identifying the deterioration of the performances when going to energies higher than 500 GeV and the considered possible detector upgrades.
7. How was the detector optimized: for example the identification of the major parameters which drive the total detector cost and its sensitivity to variations of these parameters.

IDAG Mandate (Yamada June 24 2008)

1. Are the physics aims of the detector convincing for an experiment at ILC?

2. Is the detector concept suited and powerful enough for the desired physics aims and the expected accelerator environment? Namely, is the arrangement of the employed detector components adequate?

3. Do the mechanism for the push-pull operation, related alignment and calibration methods enable the desired switching process?

4. Is the detector feasible? Namely, is the required R&D for the selected technologies advancing fast enough so that they can be completed during the design phase? Are the estimated cost and the way to obtain it reasonable when examined at the time of LOI?

5. Is the group powerful enough to accomplish the required design work through the technical design phase?

Executive summary (Nov. 08)

YIKES!

Updated executive summary

$%*&£*%$£!!!!

Updated executive summary

A Brief History

- **Oct 07: Yamada's charge**
- **June 08 (Warsaw): clarified scope issues w. IDAG**
- **October 08 (SLAC): agreed basic outline and assigned 'responsibles'**
- **November 08 (Chicago): discussed status, revised outline, timeline**
- **December 08: collected all first-pass materials**
- **Jan/Feb 09: 2 drafts to Advisory Group**

b'marking, tracking, calorimetry, muons, cost, DAQ

- **February 27 09 : draft to whole SiD group**

LoI Framework

1. Introduction
2. Subsystems
3. MDI + global issues
4. Phys. performance/benchmarking
5. Cost estimate
6. R&D issues

LoI Framework (Nov. 08)

1. Introduction (5)
2. Subsystems (45)
3. MDI + global issues (10)
4. Phys. performance/benchmarking (25)
5. Cost estimate (5)
6. R&D issues (5)

Total (c. 100)

LoI Framework (Mar 08)

1. Introduction (5)	15
2. Subsystems (45)	100
3. MDI + global issues (10)	5
4. Phys. performance/benchmarking (25)	37
5. Cost estimate (5)	7
6. R&D issues (5)	TBD
Total (c. 100)	164

LoI Framework

1. **Introduction** — **Jaros**
   - **ILC physics**
   - **SiD rationale + overview**
   - **Polarimetry and energy spectrometry**
   - **ILC environment +backgrounds**

Aside on energy + polarimetry

Pan-concept ILC note describing E, P systems

In LoI we make key points and link to this document

DESY 09-028
SLAC-PUB-13551
February, 2009

Polarimeters and Energy Spectrometers for the ILC Beam Delivery System

S. Boogert[1], M. Hildreth[2], D. Käfer[3], J. List[3], K. Mönig[3], K.C. Moffeit[4], G. Moortgat-Pick[3], S. Riemann[3], H.J. Schreiber[3], P. Schüler[3], E. Torrence[5], M. Woods[4]

[1]Royal Holloway, University of London, UK
[2]University of Notre Dame, USA
[3]DESY, Hamburg and Zeuthen, Germany
[4]SLAC National Accelerator Laboratory, Stanford, USA
[5]IPPP, University of Durham, UK
[6]University of Oregon, USA

Abstract

This article gives an overview of current plans and issues for polarimeters and energy spectrometers in the Beam Delivery System of the ILC. It is meant to serve as a useful reference for the Detector Letter of Intent documents currently being prepared.

1 Introduction and Overview

The ILC will open a new precision frontier, with beam polarization playing a key role in a physics program that demands precise polarization and beam energy measurements. [1] The baseline configuration of the ILC, as described in the Reference Design Report (RDR), [2] provides polarized electron and positron beams, with spin rotator systems to achieve longitudinal polarization at the collider IP; upstream and downstream polarimeters and energy spectrometers for both beams; and the capability to rapidly flip the electron helicity at the injector, using the source laser. The possibility of fast positron helicity flipping is not included in the baseline configuration. A scheme for fast positron helicity flipping has been proposed. [3]

The electrons will be highly polarized with $P(e^-) > 80\%$. Positrons will also be produced with an initial polarization $P(e^+) \sim 30 - 45\%$. The expected small positron polarization can be used with great benefit for physics measurements if the possibility of fast helicity flipping of the positron spin is also provided. Excellent polarimetry for both beams, accurate to $\Delta P/P = 0.25\%$, is planned. [1, 4] Polarimetry will be complemented by e^+e^- collision data, where processes like W^+ pair production can provide an absolute scale calibration for the luminosity-weighted polarization at the IP, which can differ from the polarimeter measurements due to depolarization in collision.

Precise beam energy measurements are necessary at the ILC in order to measure particle masses produced in high-rate processes. Measuring the top mass in a threshold scan to order 100 MeV or measuring a Standard Model Higgs mass in direct reconstruction to order 50 MeV requires knowledge of the luminosity-weighted mean collision energy $\sqrt{s}$ to a level of $(1 - 2) \cdot 10^{-4}$. [1, 4] Precise mea-

LoI Framework

1. **Introduction** — **Jaros**
   - **ILC physics**
   - **SiD rationale + overview**
   - **Polarimetry and energy spectrometry**
   - **ILC environment +backgrounds**

Good shape: needs minor edit + new fig.

LoI Framework

2. Subsystems

- Vertex + tracking system
- Calorimeters
- Magnet
- Muon system
- DAQ + electronics
- Forward detectors

LoI Framework

2. Subsystems

Vertex + tracking system	Demarteau et al
Calorimeters	White/Frey et al
Magnet	Krempetz et al
Muon system	Band/Fisk et al
DAQ + electronics	Haller et al
Forward detectors	Maruyama/Markiewicz/Nauenberg et al

LoI Framework

2. Subsystems

Vertex + tracking system

Track digitisation session missing

Performance section needs beefing up

Major edit

LoI Framework

2. Subsystems

Calorimeters

Needs rationalising

Non-baseline → appendix (?)

Major edit

LoI Framework

2. Subsystems

Magnet

Good shape: minor edit

LoI Framework

2. Subsystems

Muon system

Non-baseline → appendix (?)

Good shape: minor edit

LoI Framework

2. Subsystems

DAQ + electronics

Good shape: minor edit

LoI Framework

2. Subsystems

Forward detectors

Good shape: minor edit

LoI Framework

3. MDI + global issues

Breidenbach, Oriuno

SiD assembly

Push-pull

Aside on MDI issues

Pan-concept MDI-D note specifying MDI ‘boundary conditions’:

ILC-Note-2009-nnn
March 2009
Version 4, 2009-02-25
Functional Requirements on the Design of the Detectors and the Interactior Region of an e+e- Linear Collider with a Push-Pull Arrangement of Detector
B.Parker (BNL), A.Mikhailichenko (Cornell Univ.), K.Buesser (DESY), J.Hauptman (Iowa State Univ.), T.Tauchi (KEK), P.Burrows (Oxford Univ.), T.Markiewicz, M.Oriunno, A.Seryi (SLAC)

See Marco’s talk for details/discussion

LoI Framework

3. MDI + global issues

Breidenbach, Oriuno

SiD assembly

Push-pull

Good shape: needs minor edit, figures to add

LoI Framework

4. Physics performance + benchmarking

Barklow, Nomerotski, Graf

- **Simulation**
- **Benchmark reactions**
- **Performance results**

LoI Framework

4. Physics performance + benchmarking

Barklow, Nomerotski, Graf

- **Simulation**
- **Benchmark reactions**
- **Performance results**

Await significant update of results [this workshop], then thorough edit

LoI Framework

5. Cost estimate **Breidenbach et al**

LoI Framework

5. Cost estimate **Breidenbach et al**

Minor edit, figure format, physics vs. cost

LoI Framework

5. Cost estimate **Breidenbach et al**

Minor edit, figure format, physics vs. cost

6. R&D issues **White/Brau**

LoI Framework

5. Cost estimate **Breidenbach et al**

Minor edit, figure format, physics vs. cost

6. R&D issues **White/Brau**

Lot of R&D text in document – needs collating + rationalising in light of R&D proposals

IDAG Mandate

1. **Are the physics aims of the detector convincing for an experiment at ILC?** ✓

IDAG Mandate

2. Is the detector concept suited and powerful enough for the desired physics aims and the expected accelerator environment? Namely, is the arrangement of the employed detector components adequate? ✓

IDAG Mandate

3. Do the mechanism for the push-pull operation, related alignment and calibration methods enable the desired switching process? ✓

IDAG Mandate

3. Do the mechanism for the push-pull operation, related alignment and calibration methods enable the desired switching process? ✓

Good on ‘mechanics’ of push-pull

More needed on alignment + calibration?

IDAG Mandate

4. Is the detector feasible? Namely, is the required R&D for the selected technologies advancing fast enough so that they can be completed during the design phase? Are the estimated cost and the way to obtain it reasonable when examined at the time of LOI?

IDAG Mandate

4. Is the detector feasible? Namely, is the required R&D for the selected technologies advancing fast enough so that they can be completed during the design phase? Are the estimated cost and the way to obtain it reasonable when examined at the time of LOI?

Some work to do outlining R&D scope, timescale …

IDAG Mandate

5. Is the group powerful enough to accomplish the required design work through the technical design phase?

IDAG Mandate

5. Is the group powerful enough to accomplish the required design work through the technical design phase?

Not addressed in current draft!

Additional IDAG questions

6. A short statement about the energy coverage, identifying the deterioration of the performances when going to energies higher than 500 GeV and the considered possible detector upgrades.

Additional IDAG questions

6. A short statement about the energy coverage, identifying the deterioration of the performances when going to energies higher than 500 GeV and the considered possible detector upgrades.

Not addressed in current draft!

Additional IDAG questions

7. How was the detector optimized: for example the identification of the major parameters which drive the total detector cost and its sensitivity to variations of these parameters.

Additional IDAG questions

7. How was the detector optimized: for example the identification of the major parameters which drive the total detector cost and its sensitivity to variations of these parameters.

Cost model well described.

More on ‘optimisation’?

LoI Timeline (Nov. 08)

- **November 15: 1st draft subsystem reports**
  - **feedback to subsystems**
- **December 15: 1st draft physics/benchmarking chapter**
  - **identify and fill gaps, iterate etc.**
- **January 15: revised subsystem sections**
  - **focussed collaboration meeting early Feb?**
- **February 15: complete draft for collaboration review**
- **March 15: final draft ready**
- **March 31: submit to Research Director**

Suggested timeline for completion

- **March 9:** minor edits done
- **March 13:** draft R&D chapter
  draft ‘group structure’
  tracking + calorimetry sections
  benchmarking chapter
- **March 20:** FINAL DEADLINE FOR MATERIAL
- **March 25:** final draft for review
- **March 31:** submit to Research Director

We can do it!

To the very many SiD colleagues who have worked hard to provide results + material for the LoI!

i.e. ALL of you!