Technical Coordinator Issue

T. Tauchi, ILD MDI Integration WG, 3 Dec.08

Concept for the ILD Integration Plan

Discussion Paper

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1 Introduction

Considerable efforts have been spent on engineering design and integration solutions for the GLD and the LDC detector concepts. Though both detectors follow similar design considerations, a merger of both concepts into ILD requests a coherent approach which needs to converge on a timescale which is given by the ILC detector LoI process initiated by the ILCSC.

2 Scope

The scope of the Integration Plan should encompass questions which need to be answered to be able to write an ILD Letter of Intent. The plan should be extended to the Engineering Design Phase afterwards.

The level of detail of the integration planning for the LoI should focus on conceptual questions like:

- General assumption about the assembly procedure
- Opening and closing strategy
- A forward region design with a strategy on how to support and supply the final focus magnets

A detailed engineering design lies beyond the scope for the LoI, but a conceptual design which shows that the proposed detector design has no show-stoppers needs to be developed.

Definition in “Concept for the ILD Integration Plan”

Technical Coordinator

A responsible technical coordinator needs to be nominated to lead the technical part of the MDI/Integration Working Group.

It is of extreme importance that one person – or if none could be found a team of competent people – takes over the responsibility of the technical planning for ILD.

The coordinator should plan and coordinate the technical part of the integration planning for the detector concept.

He should ideally be a technical competent physicist or engineer and should be able to communicate with the relevant physics groups like the optimisation or the MDI study group and the R&D collaboration where appropriate.

Suggestions in discussion

1. Roadmap of MDI/Integration towards LoI
2. Technical coordination group

   each one from KEK, DESY and France (LLR, LAL)
3. CAD librarian

   Necessary ? for EDMS (DESY)
4. Common data base

   BDS data will be stored and managed in EDMS.

   Detector geometrical data in EDMS also ?

MDI/ Integration

- Intense discussions:

2h + 2h on Tuesday
2h on Wednesday
Worked on MDI/Integration task list à most tasks are being worked on!
Discussed CAD formats and exchange mechanisms
Discussed technical coordinators
Japan: H. Yamaoka (KEK)
France: M. Joré (LAL, tbc)
DESY: K. Sinram (tbc)
Next phone meeting (tba) will concentrate on B-field issues, optimisation WG will be invited!

List of Issues/Tasks for ILD MDI/Integration

1. IR Issues/Tasks

1.1 IR design optimization with engineering studies

- beam pipes, pumps, wakefields
- innermost radius of VTX and B-field
- outer radius of support tube and inner radius of TPC
- calorimeters, pair monitor and beam instrument

1.2 Background estimation

- pairs v.s. B-field, (anti-)DID
- muons v.s. muon spoilers, collimation depth
- synchrotron radiations v.s. collimation depth, masks
- neutrons from pairs, extraction line and dump v.s. mask

1.3 Relevant parameters for IR optimization

The relevant parameters are listed in a following table, where differences will be studied and tried to be understood.

	GLD and GLDc		LDC
machine parameter set	1TeV, HiLum-1		nominal?
L^* (m)	4.5	same in GLDc	4.3
B (Tesla)	3	3.5 in GLDc	4
R_{Be} (cm)	1.5	z < 5cm	1.4
R_{VTX} (cm)	2.0	FPCCD	1.6
VTX angular acceptance	¦cos¦<0.95	3 super-layers	¦cos¦<0.952
R_{FCAL} (cm)	8	z = 2.3m	7.6
R_{BCAL} (cm)	1 and 1.8	z = 4.3m	1.3
support tube	cantilever 70cm dia.	10cm^t W-tube	cantilever 58cm dia.

Some parameters do not have the same meaning in GLD and LDC. For example R_{in} for TPC is the limit between TPC and SIT for LDC, in the case of GLD it is the inner radius of the sensitive part of the TPC, with the same definition LDC would be 36cm. We should first agree on definitions.

Common parameters have been suggested by the detector optimization working group as listed below.

Detector concept			GLD	LDC	GLD'	LDC'
TPC		R_{in} (m)	0.45	0.3	0.45	0.3
		R_{out} (m)	2.0	1.58	1.8	1.8
		Z_{max} (m)*	2.5	2.25	2.35	2.35
Barrel	ECAL	R_{in} (m)**	2.1	1.6	1.85	1.82
		Material	Sci/W	Si-W	Sci/W	Si-W
	HCAL	Material	Sci/W	Sci/Fe,Gas/Fe	Sci/W	Sci/Fe,Gas/Fe
Endcap	ECAL	Z_{min} (m)***	2.8	2.39	2.55	2.55
B-field (T)			3	4	3.5	3.5
VTX		inner layer (mm)	20	16	18	18

* GLD Z_{max} = 2.3 + 0.2m for TPC readout which has been included in LDC.
** LDC has less radial space between TPC and ECAL.
*** Fixed ECAL Z_{min} is proposed for well-defined TPC endplate region.

1.4 Beam pipe design

1. Vertex chamber
   B-field, pair background, collimation depth (synchrotron radiation profile at IP) and neutrons with BCAL as mask
2. In front of FCAL
   Precise luminosity measurement with ;
   - Beryllium or Aluminum straight pipe
     smearing effect to be studied
   - Right angular SUS pipe
     wake-field and minimum thickness for mechanical strength
3. Pump
   Background should be studied including electro-hadronic production in addition to bremmstrahlung process between beam and residual gas.
   - P > 10nTorr for no baking, no pump
   - P > 1nTorr for no baking with NEG pumps

1.5 Outer radius of support tube

1. QD0 and SD0
   - compact superconducting magnets (B.Parker's design, 39cm dia.)
   - compact permanent magnets (Y.Iwashita's design)
   - anti-solenoid
     installed in the same cryostat by B.Parker's design
   - support structure with fine adjustment
     dynamic range of ±1mm and nanometer accuracy?
2. Thickness of tungsten tube
   - LDC does not have a W tube anymore, the W is on the HCAL.
   - GLD : minimum value for backgrounds in endcap CAL and Muon chambers
   - CFRP tube which has less Young's modulus than tungsten
   - Mechanical strength for supporting QD0,FCAL,BCAL and LHCAL
3. Tracking in intermediate trackers between TPC and VTX
   - 4 layers for self-tracking capability in GLD
   - 2 layers for linkage in LDC

2. Detector Integration Issues/Tasks

2.1 Detector and its assembly on surface

- CMS-style assembly
  - coil support in the central ring, where the barrel part is divided into three rings
  - mechanical strength
  - B-field uniformity and leakage field

2.2 Iron structure

- deformation due to B-field
  thickness of iron yoke : 2.7, 2.8 and 2.15m for GLD, GLDc and LDC
- global shape : dodeca-, dodeca- and octa-gon for GLD, GLDc and LDC
- field uniformity and leakage magnetic field
  tolerances ?
- split of end-Yoke ?

2.3 Solenoid and cryostat design

- feasibility of (anti-)DID in terms of engineering, cryogenics and B-field uniformity etc.
- how to wind coils and where ?

2.4 How to support inner detectors and QD0

- mechanical feasibility of cantilever system
- diameter of endcap hole

2.5 Opening, closing procedures

- requirement of experimental hall size and crane capacity
  GLDc : 31m x 120m x 33m (height) and crane of 100 tonnes
  Crane size largely affects the size of experimental hall.
- max 6m for detector endcap door opening in GLDc

2.6 Underground hall requirements

- where to put electronic trailers, need for service caverns
- temperature, humidity stability, the gradient
- utility (power, cooling water, gases, cables etc.)
- safety for fire, earth quake

3. Push-Pull Issues/Tasks

3.1 Re-commissioning machine operation

Re-commissioning process has been identified by T. Okugi (KEK) as listed below;

1. initial alignment less than 1mm (long, 3 mm)
2. Beam Based Alignment (BBA) of QD0 relative to upstream beam line
3. IP position scan for collision between 2 beams
   the major task and the most time consuming item !
4. Luminosity scan by changing SD0 transverse position
5. beam size tuning by sextupole (SD0, SF1) -knob

He suggested movers each for QD0,SD0 as well as QF1,SF1 .

3.2 Alignment of VTX and QD0

1mm displacement could happen. Is it tolerable ?
Or, fine adjustment system is needed in VTX ?

3.3 Slow settlement (100μm/month is tolerable ?)

Is it tolerable ?

3.4 Radiation, shielding around beam line

We could ask experts, e.g. T. Sanami (KEK), for estimation of self-shielding property of ILD .

3.5 Cryogenics system for solenoid, QD0

What, how and where ?

3.6 Commissioning during assembling/survicing detectors

stability, safety in the interference

3.7 Large platform scheme

H. Yamamoto suggested it in terms of stability and reproducibility.

Subdetector Contacts and Engineers

Candidates will be nominated by each R&D group.

ECAL - Jean-Claude Brient, K.Kawagoe

HCAL - F.Sefkow, I.Laktineh

TPC - R.Settles, K.Fujii

VTX - Y. Sugimoto, M. Winter

FCAL - W.Lohmann

SiLC - Aurore Savoy-Navarro, H.Park

Muon - nobody. Structure is covered by MDI

DAQ - G.Eckerlin, M.Wing

Solenoid - F.Kirchre, H.Yamaoka

Pacman -

Integration (including support structures of sub detectors) -

M.Jore (LAL), C.Clerc, M.Anduze(LLR)
K.Sinram, N.Meyners(DESY)
H.Yamaoka, Y.Higashi, N.Higashi (KEK)

T. Tauchi, TILC08, 7th March 2008

MDI issues and personnel in ILD

1. platform in the push pull scheme : A.Herve, J.Amann
2. background : A.Vogel
   - minijets (T.Barklow,Jan.04) for positive ion in TPC
   - anti-DID for BCAL as well as TPC background
3. beam pipe : Y.Sugimoto, M.Winter, M.Jore
   - heating : H.Yamamoto, Y.Suetsugu
   - vacuum pump system : Y.Suetsugu
   - engineering design (buckling analysis) : M.Anduze
4. self-shield for radiation in ILD : T.Sanami
5. iron structure : U.Schneekloth, H.Yamaoka, Y.Sugimoto
   - tail catcher - M.Thomson's study
   - CMS style for surface assembly
   - gaps (assembly, cables, cooling pipes) and stray field

T. Tauchi, LCWS08, 18th December 2008, http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3150

6. solenoid; 3.5T operation but design at 4T

: F. Kircher, H. Yamaoka (cryostat, coil support)

- strong coil support for the push pull
- coil design for stability
- uniformity

7. anti-DID : B. Parker, Y. Iwashita for passive anti-DID

8. support of final quadrupole magnets, forward calorimeters :

H. Yamaoka, M. Jore

9. assembling/installation and maintenance method :

Y. Sugimoto, H. Yamaoka, U.Schneekloth, H. Videau

- period - 5 years as in the RDR

10. option in machine parameters : K.Buesser, H.Videau, T.Tauchi

- new Low-P
- L*= 7 -8 m

T. Tauchi, LCWS08, 18th December 2008, http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3150

The technical coordinators have been nominated by the MDI and Integration working group. They have been selected as engineer contacts at three major institutes, i.e. DESY, LAL/LLRL and KEK, since there is no dedicated candidate.

Actually ,the coorddination has bee taken by MDI/Integration WG conveners .

Charges (proposed)

- Technical coordinators are engineering contacts at three major institutes, who coordinate local engineers with given tasks.
- Conveners of MDI and Integration working group take the responsibility of the technical planning for ILD as well as MDI. Technical coordinators are deputies in the technical aspects.

References for LoI works

Summary

- ILD Integration and MDI issues are a major engineering endeavour
  - but engineering resources are limited
- We are confident that we will have a conceptual idea of the detector design which is ready for an LoI
- Many isolated engineering studies still need to be put together into the integrated detector model
- Most urgent points to be done:
  - complete yoke design incl. opening procedure
  - define cabling concept
  - define push-pull procedure
  - adapt mechanical design of magnet to ILD
  - finalise inner detector and QD0 support
  - define on how to integrate common MDI issues (i.e. LEP) to the LoI
  - how to integrate all subdetectors into the detector model
- IR Interface document needs critical review and eventually approval from ILD

Push Pull

- are there serious open questions?
- Can we estimate the time it takes to open or close the detector
- Can we estimate the platform?

Backgrounds

- backgrounds need to be re-calculated with a central field of 3.5 T. We have a serious manpower problem.
- For background reasons the current design of the central region might not be optimized. We might need to work on a IR optimization for the background.
- For practical reasons, the physics production might not be done with the final IR configuration.

Tracking Detector

- Mechanical concept for the SIT, FTD, SET and EDT need to be clarified.
- Central question for SIT and FTD: from where are these detector suspended?
- Cables and services to be confirmed