IR Task Force in the GLD group

1. Minutes of meetings

6th July,2005

2. Purpose

to design the interaction region (IR) of GLD for both cases of 2 and 20mrad crossing schemes , where definition of the IR is a region within the final doublets at upstream and downstream.

Reference

- MDI task list with priorities for GLD
- urgent questions from WWS
- MDI_Panel_Report (Ver.1)

3. Detector: study items in the GLD

- based on the GLC detector (Aso's studies)
- beampipe within the IR - the innermost radius of the vertex detector masking system
- solenoid magnetic field, and anti-solenoid, DID
- pair monitor; distance from IP and innermost radius
- minimum veto angle by very forward calorimeter; efficiency and acceptance of e-ID
- background estimation (VTX and TPC, CAL for muons?); LCBDS and Jupiter
- studies with L*=3.5, 4.1m (UK/France and SLAC designs), and 4.5m ?

- choice of "crossing angle" - comparison with two schemes at least

4. Physics

- SUSY - stau pair production, impact of the minimum veto angle
- Physics with charm tagging with small beam pipe

5. Machine: study items in the ILC-BDS

- [crossing angle] - 0 crossing angle with RF kicker , if experimenters request?
- L*=4.5m - design of BDS optics
- final quadrupole magnet ; design/type and stabilization, location of the anti-solenoid
- design of extraction line from IP to the beam dump ; L*_ext, apertures and diagnostic section
- collimation depth and muon spoiler/attenuators
- feedback system in IR (BPMs and kicker)
    - It uses the beam deflection in two beam collisions with a finite vertical offset. The deflected orbit is measured by BPM at the downstream of IP, while the orbit is corrected by a kicker at the upstream. For simplicity and faster feedback, it is preferable to have no magnet between the BPM and the kicker. Therefore, the feedback system will be installed in the IR. However, in principle, they can be installed at more downstream/upstream if the feedback time is within the bunch separation.

Minutes of the first meeting for the IR task force

- Date and time: 6th July, 15:00-17:10
- Place: 3-gokan, 425, KEK
- TV conference (ID=31100)

Participants: T.Tauchi, A.Miyamoto, Y.Sugimoto (KEK), A.Sugiyama (Saga univ.) and T.Sanuki (Univ. of Tokyo)

First, Tauchi explained the purpose of IR task force referring the homepage of http://acfahep.kek.jp/subg/ir/bds/mdi/IR.task.force.htm . The primary goal is to design IR region for 2 and 20 mrad horizontal crossing angles in GLD by SNOWMASS.

1. Responsibilities

We agreed to share following responsibilities;

1. T.Tauchi: Preparation of incoherent pairs by CAIN, with the five parameter sets. The data will be stored on jlclogin.kek.jp . Input to Jupiter is a direct output of CAIN, while input to JIM is a special format. The JIM input is required by Y.Sugimoto. The statistics should correspond to 100 bunch crossings. Ask Tsuchiya-san for transition-space from cold to warm in the final quadrupole magnet.
2. Y.Sugimoto: Design of beam pipe by envelope of the incoherent pairs by JIM, and provide geometries of IR region in GLD as shown in an appended figure for the starting point.

3. A.Miyamoto: Installation of geometries in Jupiter, including the beam pipe, FCAL, BCAL, CH2-mask, pair monitor, fast feedback system(BPM, kicker) and final doublet in addition to the baseline GLD detectors such as VTX, TPC, CAL etc. . The parameters should be easily changed for optimization of the geometries. Also, a recommended package of neutron production will be compiled in Jupiter.
4. T.Sanuki: Preparation of baseline optics in the beam delivery system for LCBDS, i.e. from the LINAC end to the beam dump, and geometrical data of final doublet, by consulting with the ILC-WG4.
5. A.Sugiyama: Background estimation by using Jupiter and LCBDS. Background due to the incoherent pairs can be simulated by Jupiter, while synchrotron radiation, muon and back-scattered neutrons, gamma from the extraction line/dump can be simulated by both of LCBDS and Jupiter.

The above items should be studied in the two crossing schemes.

2. Discussion on the urgent questions by WWS

The questions were briefly reviewed and possible responsible person/group name are added.
The questions with replies and comments

Reply and Comments by GLD: IR task force

1. What factors determine the strength and shape of the magnetic field in your detector? Give a map of the field, at least on axis, covering the region up to +-20 m from the IP. What flexibility do you have to vary the features of this field map?
    - Concept (GLD) by Y.Sugimoto, field data (iron structure and field distribution (pdf), and the field map (htm or xls)) by H.Yamaoka, flexibility (field non-uniformity) by TPC group
2. Provide a GEANT (or equivalent) geometry description of the detector components within 10 meters in z of the IP and within a radial distance of 50 cm from the beamline.
    - GEANT-4 geometry(homepage) by A,Miyamoto, while the study by IR task force
3. Would you mind if the baseline bunch-spacing goes to ~150 ns instead of ~300ns; with ~1/2 the standard luminosity per crossing and twice as many bunches?
    - Tracking detectors do not mind. CAL group ? IR task force for FCAL, BCAL, pair monitor, fast feedback ?

      This corresponds to LowQ option of the ILC parameter sets ; incoherent pairs in VTX .
4. For each of your critical sub-detectors, what is the upper limit you can tolerate on the background hit rate per unit area per unit time (or per bunch)? Which kind of background is worst for each of these sub-detectors (SR, pairs, neutrons, muons, hadrons)?
    - VTX, TPC and CAL groups
5. Can the detector tolerate the background conditions for the ILC parameter sets described in the Feb. 28, 2005 document at www-project.slac.stanford.edu/ilc/acceldev/beamparameters.html ? Please answer for both 2-mrad and 20-mrad crossing angle geometries. If the high luminosity parameter set poses difficulties, can the detector design be modified so that the gain in luminosity

offsets the reduction in detector precision?
    - IR task force
6. What is your preferred L*? Can you work with 3.5m < L* < 4.5m? Please explain your answer.
    - L* > 4.5m, explanation by IR task force; references: pdf and ppt by Y.Sugimoto.
7. What are your preferred values for the microvertex inner radius and length? If predicted backgrounds were to become lower, would you consider a lower radius, or a longer inner layer? If predicted backgrounds became higher, what would be lost by going to a larger radius, shorter length?
    - VTX, Y.Sugimoto presented the baseline parameters; i.e. r=20mm, length=+/-65mm and beam pipe radius of 15mm. The impact parameter resolution is lost for larger radius, shorter length (Fujikawa's study) reference is the VTX task list (pdf, table 1) .
8. Are you happy that only 20mr and 2mr crossing angles are being studied seriously at the moment? Are you willing to treat them equally as possibilities for your detector concept.
    - prefer 2mr for ? by IR task force
9. Is a 2mr crossing angle sufficiently small that it does not significantly degrade you ability to do physics analysis, when compared with head-on collisions?
    - Physics group for precision measurements, e.g. Z-pole, SUSY, luminosity measurement
10. What minimum veto and/or electron-tagging angle do you expect to use for high energy electrons? How would that choice be affected by the crossing angle? How does the efficiency vary with polar angle in each case?
    - SUSY physics group, K. Fujii
11. What do you anticipate the difference will be in the background rates at your detector for 20mr and for 2 mr crossing angle? Give your estimated rates in each case.

    - IR task force
12. What is your preliminary evaluation of the impact of local solenoid compensation (see LCC note 143) inside the detector volume, as needed with 20mr crossing angle, on the performance of tracking detectors (silicon, and/or TPC, etc.)
    - TPC group
13. Similarly, what is you preliminary evaluation of the impact of compensation by anti-solenoids (LCC note 142) mounted close to the first quadrupole?
    - IR task force
14. Do you anticipate a need for both upstream and downstream polarimety and spectrometry? What should be their precision, and what will the effect of 2 or 20 mr crossing angle be upon their performance.
    - Which is essential ? POL physics group, T.Omori
15. Is Z-pole calibration data needed? If so, how frequently and how much? What solenoid field would be used for Z-pole calibration? Are beam energy or polarization measurements needed for Z-pole calibration?
    - Yes, VTX, TPC and CAL
16. Would you like the e-e- option to be included in the baseline, and if so what minimum integrated luminosity would you want?
    - Probably No, New physics ?
17. What will be your detector assembly procedure.
    - H.Yamaoka
18. What size is required for the detector hall?
    - Y.Sugimoto and H.Yamaoka, update a file(htm or pdf) .