MDI Questions to the Concepts

At MDI workshop in SLAC, January 2005 Andrei Seryi reminded us that the machine people urgently need answers to hard questions about the needs of the detectors.

WWS asked its MDI panel (Woods, Tauchi, Bambade) to collaborate with WG4 conveners (Seryi, Blair, Sanuki) and compile an initial list of these questions.

At the RHUL BDIR workshop we had two intense lunchtime sessions editing them into a form which we could (not entirely reasonably) ask the concepts to reply to by Snowmass.

They have tried. The following talks summarise the answers.

2005 International Linear Collider Physics and Detector Workshop
and Second ILC Accelerator Workshop
Snowmass, Colorado, August 14-27, 2005

The Questions

(On basic detector properties affecting the machine)

• 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?

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.

17. What will be your detector assembly procedure.

18. What size is required for the detector hall?

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The Questions

(On variations in machine parameters)

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?

6. What is your preferred L*?
Can you work with 3.5m < L* < 4.5m?
Please explain your answer.

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The Questions

(Background related)

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)?

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?

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?

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The Questions

(On crossing angle issues)

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?

9. Is a 2mr crossing angle sufficiently small that it does not significantly degrade your ability to do physics analysis, when compared with head-on collisions?

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?

11. What do you anticipate the difference will be in the background rates at your detector for 20mr and for 2mr crossing angle?
Give you estimated rates in each case.

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The Questions

(On solenoid compensation)

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.)?

13. Similarly, what is you preliminary evaluation of the impact of compensation by anti-solenoids (LCC note 142) mounted close to the first quadrupole?

(On separate issues – as addressed to the concepts
        - BUT see next page)

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.

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?

16. Would you like the e-e- option to be included in the baseline, and if so what minimum integrated luminosity would you want?

So far we've asked the concepts

- BUT many of the questions also need answers
  from R&D projects: e.g. Spectrometry, Polarimetry;
  or from Physics groups: e.g. e^-e^-,
      minimum e-tag angle for SUSY veto, etc.

I suggest that the 6 conveners send a request to
all relevant R&D collaborations and to the Physics
working groups, asking them to look at the questions
(at http://physics.uoregon.edu/~lc/wwstudy/concepts)
and give their inputs before the end of Snowmass.

How do we take this further, into GDE period?

Two separate functions

1. URGENT. Make baseline decisions.
Object of present exercise. Needs best rapid input.
I suggest existing 6 conveners be asked to agree and recommend answers to GDE.

2. VITAL. Make the right decisions, long term.
Needs continual dialogue between machine designers, physics and detectors.
WWS-OC has proposed a joint GDE/WWS **MDI Panel.**
Would prepare cases to be put to Change-Control for updates to the baseline.
Would encourage and review R&D on MDI topics.

WWS-OC meets tomorrow morning to prepare proposals to GDE and ILCSC on how to plan the experiments.

Should it press for this joint MDI Panel?
Feedback needed today.

Scope might include
(adapted from M.Woods' definition of MDI)

1. Maintain overview of IR design; L*, crossing angle, vertex radius, collimation depth, B fields, GEANT simulations, etc. etc.
2. Maintain overview of all detector features which interact with the IR design.
3. Ensure optimal calculation of all backgrounds.
4. Ensure optimal energy and luminosity spectrum measurement.
5. Ensure optimal polarisation measurement.
6. Monitor and encourage forward-region detector development, including precise (+ fast) luminosity measurement.
7. Encourage increased understanding of EMI: sources, shielding etc.

WWS-OC has also suggested (following Jonathan Dorfan) that the GDE should have one identified person responsible for MDI – who would of course sit on the joint GDE/WWS MDI Panel.