Machine-Detector Interface Topics at workshops in

Montpellier 13-16 November (ECFA)

Mumbai 15-17 December (ACFA)
Goals of the ECFA Study (excerpt)

Machine-Detector Interface
--------------------------------
- to study the impact of realistic beams and the associated backgrounds on the detector.

- when the linac technology and crossing angle choice are made, to update all designs to match.

- to interact with the designers of the beam delivery system, ensuring that physics goals can be achieved.

- to participate in planning and R&D for polarimetry, beam energy measurement, beam monitoring, luminosity measurement.

- to study the special requirements of the gamma-gamma, e-gamma and GigaZ options.
ECFA Study; Beam Delivery and Interaction Region
(new name for MDI working group)

Growing activity, with many particle physicists
(N.B. 2 linked working groups at Paris; MDI and “ARDBDBPP”)

Woods, Tauchi, Bambade. Blair, Patterson, Anon

* UK putting >£7.2 million into BDS design study
  including laserwire, feedback, beam monitoring, survey

* DESY Zeuthen leading R&D collab’n on small angle calorimeters and masking.

* Crossing angle is urgent.

* Philip Bambade’s “jobs to do” Matrix.
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<td>1° ± 5 m design for head-on coil.</td>
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<td>Final doublet support</td>
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**Great Opportunities!**

Europe cannot do all of these jobs; they'll have to be shared. See MATRIX at [http://www-flc.desy.de/bdir/BDIRprojects.html](http://www-flc.desy.de/bdir/BDIRprojects.html)

- Identified 30 tasks for the BDIR group, assigned priorities and some names
Proposed Design for $l^* \geq 4.1$m

Achim Stahl (presented in Amsterdam)
New Mask Design

Advantages

• Flat LAT geometry
• LAT is behind ECAL, no scattering of particles off the LAT edge into the ECAL
• Mask moved out of the tracking system
• Vacuum situation much better

Questions

• How to open the detector?
• What is the background situation?
• What is the performance of the LAT/LCAL (Lumical/Beamcal)?
Extraction Line Issues
Nick Walker at Montpellier

To cross, or not to cross,

That is The Question
Spent beam extraction

ECFA + ACFA
Linear Collider Workshops

horizontal

vertical

Nick Walker
Beamstrahlung Extraction

Nick Walker
Beamstrahlung Extraction

Nick Walker
Beamstrahlung Extraction

Indicated power loss is for perfect design beam only!

Nick Walker

David J. Miller @ SLAC 8/01/04
Beamstrahlung loss on septum increases drastically (few W → several kW) under (realistically) non-perfect collision conditions (A. Seryi, SLAC)

May be partially cured by increasing separator deflection angle – impact on FFS and extraction line (length!)?

Separator issues: sparking?
Bunch-to-bunch ($10^{-6}$) and pulse to pulse ($>10^{-5}$) stability?
(Large) Crossing Angle Concerns

• 20 mrad angle will need new final doublet design
  – Compact s.c. quads possible (R&D needed)
• Crab-crossing required
• More complicated IR
• Impact on physics capabilities
  – NLC says not!
• Civil engineering (cost!) implications
300µr vertical x-angle solution

- shines BS away from septum blade and
- away from incoming beam @ BS dump
- needs quadruplet instead of doublet to obtain spent beam bandwidth
- crab-crossing needed but not so bad as that needed for 20mr horizontal crossing angle
- much optics and tracking work to do!!
Decision needed on X-angle for cold machine

Phone-in meeting at Zeuthen, 19 January
organised by Philip Bambade, agenda at
http://www-flc.desy.de/talks-public/bdir/meeting190104.html

Input on Physics (SUSY veto etc.)
and machine aspects.

Aim to clarify issues before LCWS in Paris.
Some representative slides from very interesting talk.

Tauchi Mumbai

Roadmap Report, 2003

Bypass

Switchyard & diagnostics

Collimator

Final Focus System

Beam Dump

IP1

7 mrad

Main Linac

IP2

30 mrad
Tauchi Mumbai

IR: Crossing Angle Issue

\[ \frac{2\sigma_x}{\sigma_z} = 4.4 \times 10^{-3} \]

Small angle: \( \phi \lesssim \frac{2\sigma_x}{\sigma_z} \)

Large angle: \( \phi \gtrsim \frac{2\sigma_x}{\sigma_z} \)

Why Small Crossing Angle?

- Detector \( \cos \theta \) coverage
- Timing of crab cavity
- Radiation in the solenoid magnet

\[ \sigma(\Delta y) \propto \phi^{3/2} = 0.074 \text{nm with } \phi = 20 \text{ mrad} \]

Why Large Crossing Angle?

- Background to the detector
- Multi-bunch crossing instability
- Design of the final quadrupole magnet
- Layout of the beam dump

\[ \frac{\Delta y}{\sigma_y} = 1.8 \text{ vs } 0.6 \]

at \( L^* = 3.5 \text{m} \)

\( (\Delta y = 0.5 \sigma_y) \)

Further details on Tauchi’s following Slides.
Tauchi Mumbai

Collimation: Muon Attenuators

T. Ohgaki

Collimator (Spoiler/Absorber)

$e^-$ beam

60 cm$^\phi \rightarrow 156$ cm
surrounded by sand stone

20 cm$^\phi \rightarrow 36$ cm
Tauchin Mumbai

Background: Muons

\[ E_{\text{FM}} = 250 \text{ GeV} \]
with iron shield

\[ E_{\text{BM}} = 250 \text{ GeV} \]
without iron shield

\( e/\mu \text{ at IP} \)

Distance from IP (m)
Tauchi Mumbai

Dumpline: Layout (1)

K. Kubo

2nd FP at 140m

Beam Spot at the 2nd FP

Polarization?

ΔE/E

-1.0%

-0.8%

-0.6%

-0.4%

-0.2%

0%
Stabilization R&D: Support Tube

Results 1/10 Model
(Taper flange, 12-M6)

A: 77.5Hz
B: 90Hz
C: 258Hz
D: 522Hz

ANSYS- FEM
76, 256, 489 Hz

H.Yamaoka, 7/30 2003

Further details on Tauchi's neighbouring slides.
Conclusions

1. There's a lot to do - and we're all in it together, Worldwide.

2. We look forward to seeing you in Paris in the Spring.