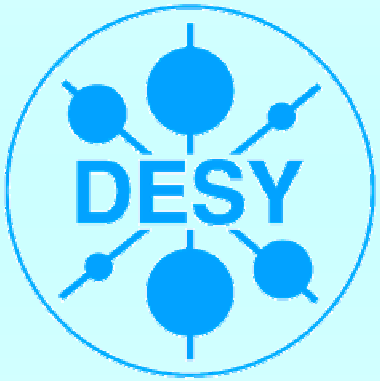
Report from the BDIR Sessions

Karsten Büßer



ECFA Workshop
Montpellier
November 16th, 2003

Two Messages from BDIR

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- Urgent tasks to be done before LCWS'04
- Recruitment

BDIR Agenda

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Thursday, November 13th, 15:15-16:45

- Peter Wienemann — Simulation of the machine background in the TESLA TPC with GEANT4
- Wolfgang Lohmann — Extracting beam parameters from LCAL energy distributions
- Wolfgang Lohmann — Simulations with realistic beams
- Karsten Büßer — Mask design update
- Hitoshi Yamamoto — Beam profile monitor

Thursday, November 13th, 17:10 – 19:00

- David Miller — Report from satellite meeting on beam instrumentation
- Eric Torrence — Report from the US beam instrumentation efforts
- H.-Jürgen Schreiber — Beam energy spectrometer
- Grahame Blair — Laser wire studies

Friday, November 14th, 08:30-10:15

Discussion about the plans of the BDIR working group for the next two years

Friday, November 14th, 14:00 – 15:45

- Stewart Boogert — Luminosity spectrum measurements
- Freddy Poirier — Luminosity spectrum measurements

Joint Session Polarisation/BDIR:

- Gudi Moortgat-Pick — Requirements on polarisation (informal talk)
- Peter Schueler — Status of polarisation measurement
- Roman Poeschl — Report on E166

MATRIX reloaded

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TASK	GOALS	STATUS	CONTACT	LINKS (Prelim.)
FFS optics Focus spot size at IP down to 550 and 5 nm Local chromatic correction with l* ~ 5 m	Achromatic over dp/p = ± 0.5% Solutions with and without X-angle Acceptable halo	l* = 5 m design for head-on coll. Needs more study Solution with X-angle needed		
Halo collimation No direct synchrotron radiation from final doublets to hit inner masks	Remove beam particles beyond 48 σ_x and 9 σ_y with dp/p from – 3 % to + 0.5 %	TDR design needs improving Study needed with X-angle		
Extraction line optical design	In head-on and in crossing angle setups	Head-on exists but does not allow good enough diagnostics (spectrometer and polarimeter)		
Mask design and detector relevant beam induced backgrounds Mask for back-scattered secondaries from pairs Bhabha monitor (LAT)	Aim for levels as with TDR design (tab.7.1.6 of TDR) Realistic background and LAT in detector simulation	TDR design being updated with l* = 5 m (head-on) Solution with X-angle needed		
Final doublet supports Adequate mechanical stability Alignment and in situ adjustments (→ with and without crossing angle) (→ cold option only ?)	Relative vertical motion of two final doublets .lt. ~ 0.5 nm in τ ~ (170 kHz)$^{-1}$ ~ 6 μs or better… From ATL model: 0.03 nm vibration; care not to amplify			
Incoherent pair prod. Estimate uncertainty in rate reaching VDlayer-1 (it corresponds to a ~ 10^{-3} tail…)	GinneaPig+Brahms calculations with present parameters Theory uncertainty from the treatment	TDR computations Further checks by Damien Grandjean		
Crossing angle or not Recommendation from global analysis of both cases, considering all aspects (cold option) Risk assessment	• Physics reach (mainly at low Pt), • IP beam tuning, • Extraction of spent beam and beamstr., • Electrostatic sep., • Optics constraints, • Crab-cross. cavity, • Super-conductive mini quadrupole, • IR design, • Spent beam diag.	TDR design with head-on collisions Variant with a very small vertical angle (Brinkman)		

Energy calibration – 1 Upstream spectrometer through measurements of a reference bending magnet and of beam trajectories before and after	Relative precision of a few 10^{-4} - 5 10^{-5} for top and W masses Absolute precision of 10^{-5} - 10^{-6} to improve M_Z measurement Information on each bunch	Technical design exists – plan report Spring 2004 Integration in BDS and design of Cavity-BPM with 0.1 μm resolution May reach 5 10^{-5}	Jürgen Schreiber	Document with
Energy calibration – 2 Downstream spectro. based on measuring a reference bend and the synchrotron radiation from smaller bends in orthogonal direction before and after (SLC)	Same as upstream spectrometer Measure energy spread (and tails) from beam-beam interaction Check feasibility with and without crossing angle	Not yet considered Our US colleagues have proposed one based on the SLC experience		
Energy calibration – 3 Measurement of spin precession through existing bends to extract the total field Reduce requirements	Same as upstream spectrometer Feasibility of precise position measurements at large distances for absolute calibration ?	Proposal by Valery Telnov		
LAT and LCAL calorimeters		demonstrated		
Energy calibration – 5 CMS energy from measurements of ee → (Z→ll,qq)γ	Statistics limited if only muons are used. Can ee,tt and qq be used ? Systematics ?	Under study		
Energy calibration – 6 CMS energy from the acolinearity in Bhabha events		Under study		
Energy spread Track relative changes in energy distribution by measuring the spent beam	Use existing bends and plan mechanical or laser wires for beam size measurements	Initial study by Nick Walker		
Strategy / scenario for energy calibration	Define scenario using compl. info. from beam + physics meas.	Under study		
Measure luminosity -1 Use LAT to measure Bhabha cross-section Hermetic calorimetry (83.8 to 27.5 mrad)	Accuracy for absolute measurement ? Energy resolution : ~ 10 % stochastic ~ 1 % constant	Under study		

Measure luminosity -2 Use LCAL to measure pairs and track fast luminosity changes Hermetic calorimetry (30 to 5.4 mrad)	Relative accuracy 1 % in 30-50 ns → input to luminosity feedback	Under study	x.y.	WEB-page of the collaboration on *R&D for the TESLA*
Optimise luminosity Use beam-beam deflections, pairs and BDS trajectory meas.				
Beam monitor – 1 Measure Comptons photons off focussed laser beam				
Beam monitor – 2 Measure photon and secondary emission off thin (carbon ?) wire				
Beam monitor – 5 Beam position monitors (cavity)	Upstream spectrometer Precision ~ 0.1 μm		H.J.Schreiber P1 Test in beam environment ?	
Beam monitor – 6 Beam position monitors (stripline and cavity)	In final doublet for beam-beam deflections Precision ~ 5 μm ? Work with high SR ?		? P1 Test in beam environment ?	
Beam monitor – 6 Exploit bremstrahlung dependance on beam size for low intensity tuning, include at large vertical offsets	Explore feasibility	Observation and explanation in VEPP4 paper (ref. from will be obtained from Valery)	Philip Bambade (Orsay) Valery Telnov P3	Papers by Baier and Katkov
Polarimetry – 1 Exploit Compton process in setups both before and after the IP	Relative precision of ~ 0.5 % (averaging at least 30 bunches) Compare result before and after to probe depolarising effects	Design available and location planned for the upstream setup Downstream setup to be considered	P. Schüler (DESY) P1	Papers and talks by P. Schüler

	Need information on each bunch ? (No…) Combine with Telnov energy measurement		downstream also essential ?	
Polarimetry – 2 Analyse ee → WW and ee → Wev processes	Absolute precision ? averaging over ? Works without e+ pol.	Early study by Klaus Mönig and later by François Richard	? + F.R. P2 Full analysis needed to get real estimate on precision ?	Slides from François Richard
Alignment and active mechanical stabilisation Relative vertical	Specific needs for warm option considering tolerances and bandwidth of the feedback		Only for warm option	
ion –1			BDIR ?	
ion –2			BDIR ?	
tion l spin rotators in RTL section			BDIR ?	

Great Opportunities !

- Identified 30 tasks for the BDIR group, assigned priorities and some names
- MATRIX will appear on the web soon (announcement will be done by e-mail)

Most Urgent Task

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- Are there topics which could influence the technology decision ?
- One obvious question: The crossing angle problem
  - Are there real show-stoppers for the x-angle?
    - If yes: Warm machines will have a hard time
    - If no: Do we still want to stick with the head-on scheme and invest a MAJOR effort in tackling the extraction line problems?

- The crossing angle question has to be answered before LCWS'04 to have an influence on the technology decision.
- The wise persons will probably ask us.

  We should have a good answer by then !

Questions to be answered

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Outcome of Friday morning discussion:

The answers to just two questions can really save the head-on collisions scheme.

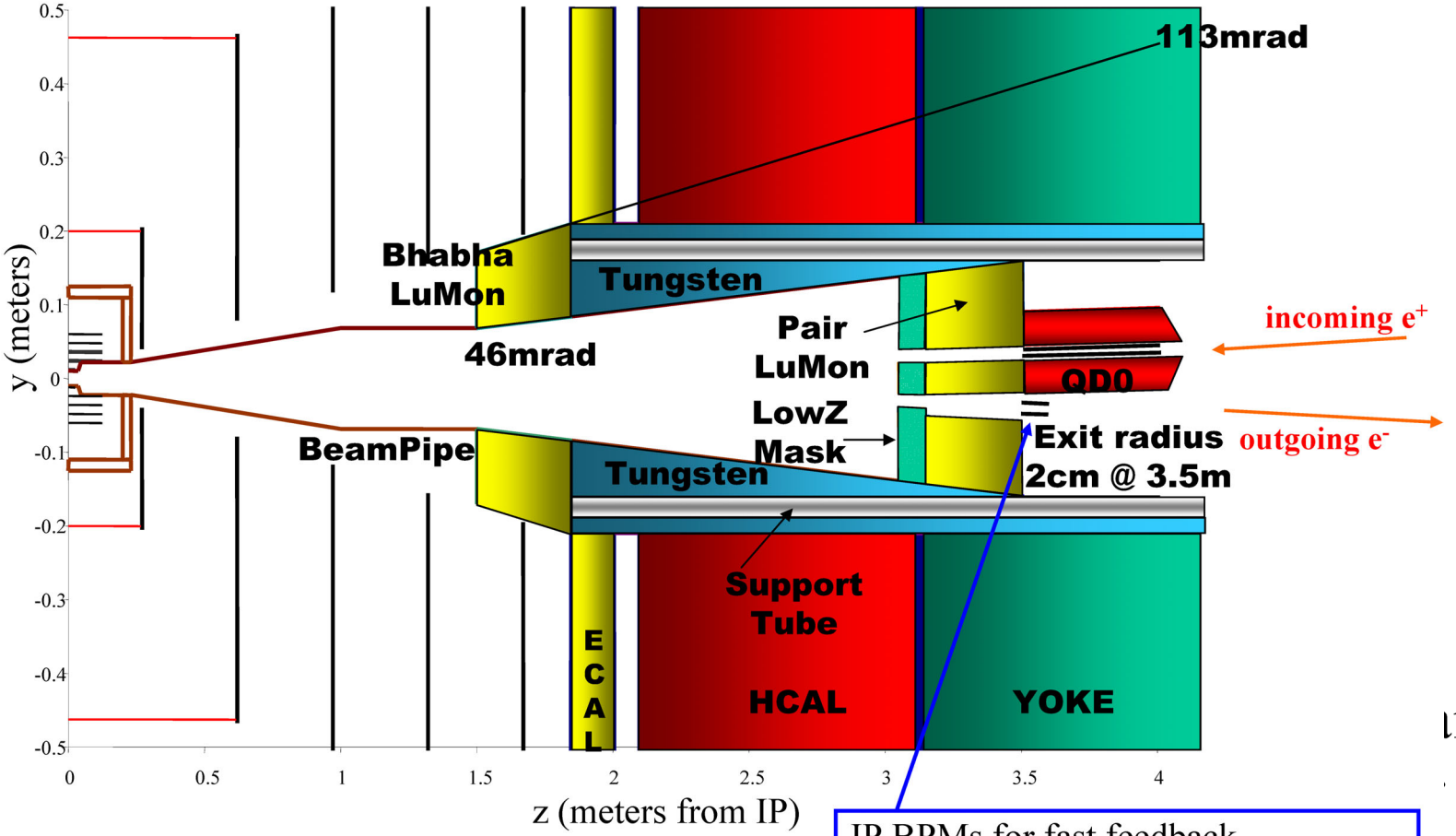
- Is there a good physics case ?
- Will the different masking scheme and backgrounds be a problem ?

Other technical challenges to the x-angle:

- SC mini quads
- crab-crossing

have still to be shown solvable, but experts are optimistic.

NLC Masking



IP BPMs for fast feedback
and feed forward @ ~z = 3.5 meters

Consequences

- X-angle masking is much more complicated
  - Backgrounds have to be checked for the TESLA case
  - Are there major problems for, e.g. the VTX?
  - There will be a larger acceptance hole in the forward detectors.
- Background question will be tackled by BDIR group.
- Low angle acceptance problem must be answered by the physics (e.g. SUSY) groups:
  - Redo their favourite well motivated analysis with an acceptance cut in the forward region which will be provided by the BDIR group.
  - Quantify the losses before LCWS'04.

Announcements

- X-angle meeting with emphasize on physics case:
  January, 19, 2004 in Zeuthen: video/phoneconference
- BDS optics review meeting:
  January, 20, 2004 in Zeuthen (TESLA meeting week)

- Inter-regional BDIR/MDI pre-meeting to the LCWS'04 in Paris.

Recruitment

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- The extremely complex questions on the BDIR matrix need the input from all persons here in the room:
  - The methods and tools of HEP people are supplementing the machine guys' approaches in a con-genial way.
  - The machine groups are sub-critical and need badly our help.
  - Machine related projects broaden the horizons of the typical HEP analysis/detector person and are a very valuable asset for the cv.
  - If we (HEP people) want to have influence on the things the machine guys impose on our detector (and physics capabilities) we have to be part of the game.

Open Positions on the Horizon

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- UK PPARC bid was successful
  - Money (positions+hardware) will be available middle of next year
- 15 M€ bid to EU FP6 will (hopefully) result in funding end of 2004.
  - European collaboration to form the prototype of the:
- European Linear Collider Design Team
- All this will be just-in-time for the wise persons panel decision about the technology !

Accept the Challenge

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It is in our hands to develop the most complex machine ever built on the world:

„The experiment starts at the gun."