WG6:Interaction Region Summary

ISG2 meeting, July 16, 1998 at KEK
T. Markiewicz(SLAC)
T. Tauchi(KEK)

Start evaluating joint research plans for issues in the interaction region(IR)

General Goals

S. Iwata (head of JLC promotion office, KEK) said;

The objective of the study will be to

1) Set a guideline for IR performance,

2) Identify necessary hardware elements and their specifications,

3) Identify and evaluate scientific tools available for designs of individual parts,

4) Set efficient procedures for overall design,

5) Identify R&D items.

Let's start to list up IR issues at JLC and NLC with tools and R&D items.

IR issues	JLC	NLC	tools	R&D other choices
Collimation	non-linear 1.2km/1.5TeV $6\sigma_x$ x $40\sigma_y$	linear 2.4km/1TeV(1.5TeV?) $7\sigma_x$ x $35\sigma_y$	SAD, EGS MUCARLO	wake field measurement detail tunnel geometry shorter collimation
muon background	6 cylinders (iron or lead) 0.6ϕ x 120m	4 spoilers tunnel filler 3 x 3 x $9m^3$		radio-activation in tunnel optimization with two schemes exotic : laser, liquid metal collimation....
Crossing angle	8mrad toward smaller angle limited by SR backgrounds	20mrad toward larger angle,limited by "3 Tesla".	ABEL,CAIN, Guinea-Pig	tolerance for crab cavity requires 0.2^ophase stability
Crab cavity	option (lum. 40% up) why? higher luminosity without crab cavity.	must why? easier extraction of disrupted beam.		needs prototype-cavity (measurement at SLAC, M.Ross) KEK B-factory crab cavity can be prototype?
Final focus Q-magnet	warm magnet, 2.2m long inner radius=6.85mm 2m from IP, why?	2 permanet magnets, 1m long each, + Q1SC(0.5m) inner radii=7 and 8 mm outer radii=2 and 2.5cm PEP-II experience 2m from IP, why?		warm magnet: water cooling w/o vibration permanet magnet: no beam-based alignment smaller angle: superconducting magnet how to extract beam?

longer distance makes smaller dead cone and less background (back-scattered photons) and
it must be benifit if it is set outside the conpact detector.
if $*$=1m, 25% shorter final focuss system
if $*$=3m, 20% longer final focuss system

optics with large $*$

IR issues	JLC	NLC	tools	R&D other choices
Superconducting compensation magnet	must	must (permanet magnet has no advantage with this?)		thinner cryostat for smaller dead cone
Detector solenoid	2 Tesla	4 Tesla, even higher 20mrad crossing angle OK?	GEANT	Optimization of mag. field, calorimeter performance
Support of FF-Q vibration	support tube no additional "anchor" is necessary at TRISTAN tunnel.	optical anchor compact detector with support tube (grounded)	ANSYS	their prototypes calculations with measured ground motion.
Feedback Slow feedback(SLC type)	**collisions:** can be corrected at <10Hz with BPM by using beam-beam deflection. O(nm) ground motion at >10Hz..... 5% lum. loss **nm beam spot size:** needs orbit correction by 10nm-res. BPMs	Slow feedback(<10Hz) fast feedback(2.8ns, <200Hz) by BPM with pilot beam and also by beam beam deflection.	SAD,TURTLE, MERLIN,CAIN	SLC and B-factory's experiences feedback simulations 10-100nm resolution BPM.
Synchrotron radiation (SR) background	no problem because of collimation and mask (for that from last bend).	similar to JLC but... needs recalculation	MQRAD QSRAD GEANT	SLD experineces, that is large fluctuation of the background in CDC. What is a stability of beam?

IR issues	JLC	NLC	tools	R&D other choices
Pair background	VTX: 3.6hits/mm^2 /train by "electrons" at r=2.5cm CDC: 100hits /pulse by "photons" at Ecm=500GeV	VTX: 5-10 hits/mm^2/train at r=1cm CDC: 3x10^4 photons/pulse no gas chamber allowed at Ecm=1TeV This result may be consistent with JLC because of "photon conversion" in the chamber and its higher beam energy.	ABEL,CAIN, Guinea-Pig GEANT,EGS	Detailed geometry at IP Tolerable background hits: VTX: < 1hit/mm^2/train CDC: occupancy < 1% radiation damage? need cross check with common background-rays and geometries. Comparison between ABEL, CAIN and Guinea-Pig.
neutron backgrounds from pairs, (disrupted beam and beam dump)	10^6 n/train (n/E_e=0.13/GeV)	VTX:3x10^{-3}hits/cm^2/train corresponds to 10^{7}hits/cm^2/year	GEANT	Tolerable background hits: CCD/VTX <3x10^9 hits/cm^2 so, no problem.

	IR issues	JLC	NLC	tools	R&D other choices
	Pair monitor	double discs at 1m from IP	**???** Very big SR background! How does SR background fluctuate event by event inside masks at SLD ?	ABEL,CAIN, Guinea-Pig GEANT	pixel device(50x50μm^2) with dE/dX measurement. What's kind of feedback?
	Shintake monitor				Laser optics close to IP? σ_x measurement at least
	IP-BPM				O(10nm) resolution
	Luminosity meas.	acollinearity angle of Bhabha scattering		Toomi's program	How to measure luminosity distribution within a beam energy spread(1%) ? (toponium physics)
Exstraction Beam Line	Beamstrahlung monitor				
	Radiative Bhabha meas		There is a chicane in extraction beam line to separate electron beam and photons with a common dump.	ABEL,CAIN, Guinea-Pig SAD GEANT	Design extraction lines and beam diagnostic equipments for small(JLC) and large (NLC) crossing angles.
	Energy measurement				
	Polarization measurement	Hirose's talk at LCWS95 (Appi, Morioka)			
	Beam dump				

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Preliminary Goals at ISG3

From the R&D items in the list;

1) Common understanding of backgrouds
synchrotron radiations and e^+e^- pairs

2) Optimization for muon background
with muon attenuators and muon spoilers.

3) Design dump lines for small (JLC) and large(NLC) crossing angles with appropriate equipments of beam diagonstics and **evaluate these two schemes.**