Ongoing ILC background studies in Japan March - April 2016

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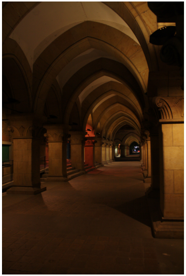
My time in Japan

Thanks to the E-JADE program (www.e-jade.eu) I could go to Japan for two months.

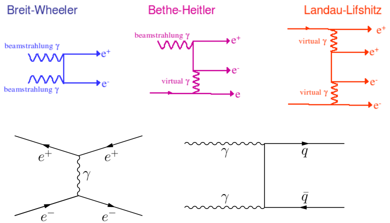





Background sources

The main sources of background:

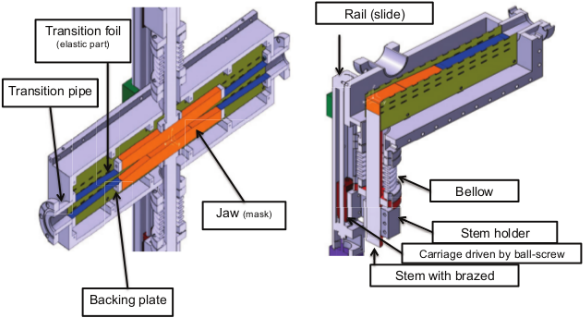
- Pair background
- Bhabha scattering
- $\gamma\gamma \rightarrow$ hadrons
- *Neutrons from the beam dumps*
- Background from Final-Focus system (*beam halo collimators*, muon spoilers)



ATF beam operation time - Background study for the beam halo collimator

Beam Halo collimators

Vertical collimators suggested for the ILC:



By driving the collimator blocks into the beam:

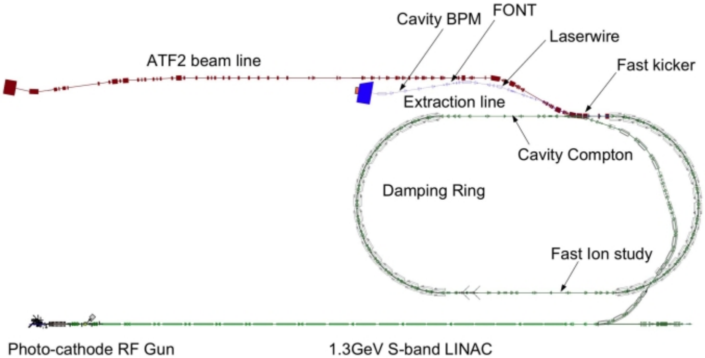
- The beam halo is cut off.
- New background is produced.

Beam time at ATF2 in March

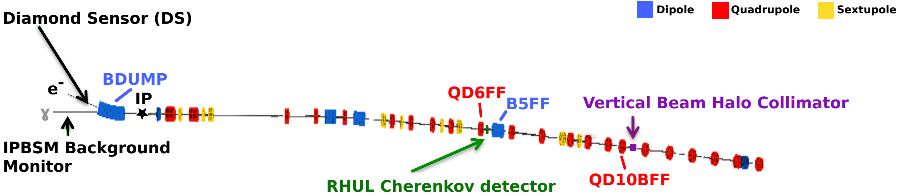
I joined the ATF2 beam operation time in March.

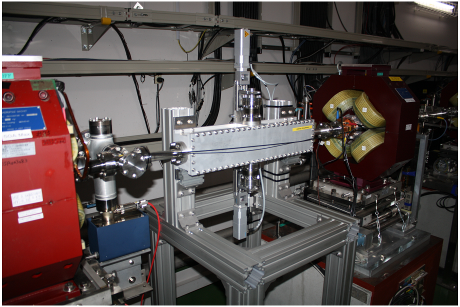
ATF2 is the ILC Final-Focus test bench at KEK in Japan, where the March beam time was dedicated to:

- Installing a new beam halo collimator
- Measuring the beam halo
- Studies of the generated background with a Cherenkov detector



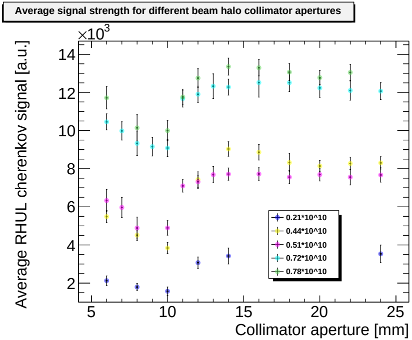
Installed collimator

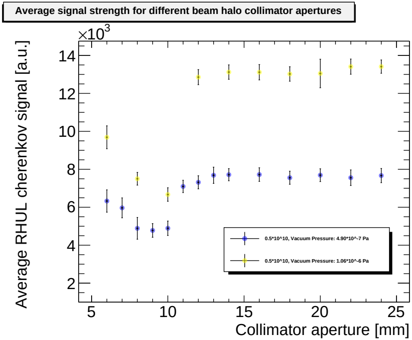




Data analysis

Data taken with the RHUL Cherenkov detector



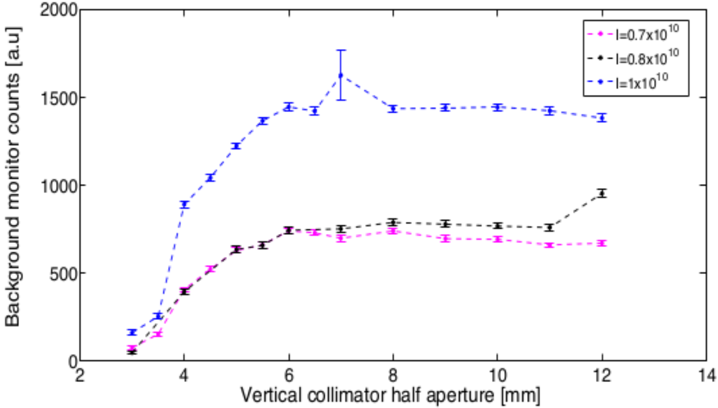


Background is reduced, but then rises again when collimator jaws are driven closer into the beam halo.

The vertical beam size at the location of the collimator was about 0.32 mm with an offset of 0.2-0.5 mm.

Data analysis

Data taken with the post-IP background monitor

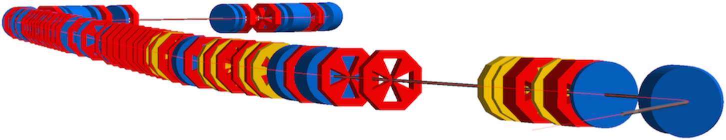


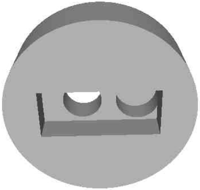
Preliminary results by Nuria Fuster Martinez (IFIC, Spain)
⇒ Background is reduced at the IP.

BDSIM simulation

Simulation of ATF2 with BDSIM (developed by RHUL)

- to compare data taken at ATF with simulation results.
- to understand where background particles are generated and stopped exactly.





Beam pipe flange between a rectangular and a circular beam pipe at the location of the Cherenkov detector.

I helped Laurie Nevay (RHUL) to improve the ATF2 lattice geometry for BDSIM.

FLUKA simulation of the ILC Beam Dump

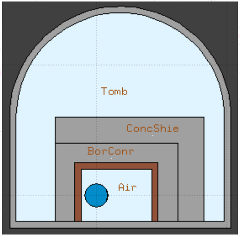
FLUKA simulation of the ILC Beam Dump

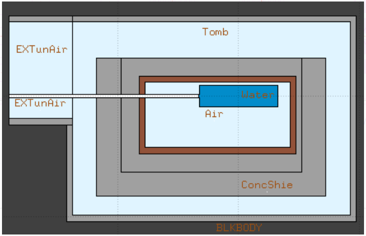
The beam is dumped into a water tank after collision.
Neutrons ($\lesssim 10^{10}\,\text{cm}^{-2}\,\text{yr}^{-1}$) are emitted that radiate the surroundings, and travel back towards the detectors.

Redoing the simulation studies that were done in 2007 (design was not decided yet).

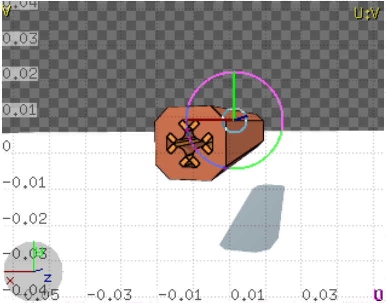
Simulation step 1

Simulating the neutrons from the beam dump with FLUKA, using the design drawings by B. Smith [1] to model the dump and the surrounding.





FLUKA simulation of the ILC Beam Dump



FLUKA simulation model of one of the ILC EXT lattice quadrupoles.

Simulation step 2

With Benno List (DESY): Python program to plug the real extraction line lattice into FLUKA.
Realistic simulation of the interaction between the neutrons and the lattice.

Simulation step 3

Simulating the neutrons reaching the interaction point in a full detector simulation.

All goals of this study in an overview:

- Simulating the neutron flux,
- the number of neutrons reaching the IP,
- the dosis of the surrounding,
- the influence of the water composition (amount of Deuterium),
- the effect of the beam dump design.

[1] B. Smith (Rutherford Lab), *Design drawings 0-TB-0067-300-00-A, 0-TB-0067-210-00-A, 0-TB-0067-404-00-A*, Dec. 2006 - Jan. 2007

Bhabha and $\gamma\gamma \rightarrow$hadrons

Available files:

- Bhabha (-80e^- +30e^+, and +80e^--30e^+):
  - sidloi3
- $\gamma\gamma \rightarrow$hadrons
  - sidloi3
  - sidloi3 realigned
  - sidloi3 realigned with anti-did
  - sidloi3 realigned with circle/wedge cutout

Is there a plan to simulate the bhabha events also for the other SiD geometries?

How to calculate the number of events per train?

- Take cross section from the Whizard log files (with which Tim Barklow simulated the events)
- Get luminosity per train: Lumi/train$=\frac{Lumi/s}{5}$ (5 trains per second)

$$\#\text{events/train} = \text{Lumi/train}\cdot\sigma$$

Example:

$$\begin{aligned}\#events/train &= Lumi/train \cdot \sigma \\ &= \frac{1.8 \cdot 10^{34} cm^{-2} s^{-1}}{5} \times 80nb \\ &=\sim 2900\end{aligned}$$

Do I need to use a $\gamma\gamma$-luminosity or is that taken care of by the cross sections specified in the Whizard log files?
$\rightarrow$ Tim will send a mail on Monday.