Subject: Upstream polarimeter discussions
Posted by mwoods on Fri, 01 Apr 2005 17:12:08 GMT
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Hi, I would guess that Peter is right that the 5mm dispersion could be increased at least to 10mm dispersion. We chose a 5mm dispersion chicane to match the upstream energy chicane; Woodley presented calculations on the emittance growth for the 5mm chicane in this talk from March 8,
And the emittance growth was negligible. Can do the appropriate scaling to check for 10mm dispersion chicane or even 20mm.
For a gas cherenkov counter I would agree with Peter that don't want to go narrower than 1cm-wide channels. If need to go narrower, can consider a quartz cherenkov counter though more susceptible to synchrotron radiation background. Should anyway consider a quartz counter for comparison.
One other item questioned at LCWS for the upstream polarimeter was how easy is it to get 35uJ/pulse in the ILC pulse format for the laser beam as designed; re. presentation regarding the Fabry-Perot cavity. Can you address this as well?
Also, this discussion would be very useful to have in the MDI forum on polarimetry at http://forum.linearcollider.org/.
I'll take some liberty and post this message with the thread below there. Cheers, mike

-----Original Message-----
From: Peter Schuler [mailto:schuler@mail.desy.de]
Sent: Friday, April 01, 2005 7:06 AM
To: Moffeit, Kenneth C.
Cc: Peter Schuler; Woods, Michael B.; Walker, Nicholas John; Norbert.Meyners@desy.de
Subject: emittance growth in upstream chicane optics

Dear Ken,

hmm, only 5 mm chicane dispersion (at 250 GeV), instead of 20 mm.

That makes indeed a lot of difference, to the detector, vacuum chambers, etc. I had assumed 20 detector channels with a hor. aperture of 10 mm ea., covering a range of x = 20 -> 220 mm from the beam axis.

Scaling simply all x-dimensions by a factor 1/4 would give us very narrow detector channels of only 2.5 mm nominal, which is not comfortable. Maybe 5 mm would be possible. Also, I don't want to get closer to the beam than x_min = 20 mm. So that would decrease the maximum covered energy.

You indicate considerations about emittance growth as the origin of this much more docile chicane design. This surprises me, since we have actually investigated this point, based on earlier work by Nick Walker on the TESLA energy spectrometer. If you look at page 18 of the talk Norbert presented, we estimate an acceptabe emittance growth of 2.5%, but only at E_cm = 1 TeV, and totally negligible at lower energies. So, unless our estimate is bogus, it does not seem to be justified to decrease the dispersion of the upstream chicane so drastically. My gut's feeling is that we could absorb a factor of 0.5. But 0.25 would really hurt.

Even worse, and I would go as far as saying "unacceptable", would be only 1.7 meters between the inner dipoles. We assumed a center to center distance of 10 meters, which gives us nominally 8 meters of space for a typical magnet length of 2 meters. The reason for this space requirement is simple geometry for the laser beam insertion/exit. We went through this exercise already with our Tesla design, and the arguments have not changed and are still valid. You want to accomodate a crossing angle of 10 mrad, and you must keep the optics away from any synchrotron radiation. These conditions are met with our design, which accomodates a vertical beam crossing, but retains a minimal magnet gap height of only 20 mm for all dipoles. With a space of only 1.7 m, you would either have to increase the height of the gap by some unacceptable factor, or you would have to resort to horizontal beam crossing, which will jeopardize the optics and is therefore also not acceptable.

I have not had time to look at all the details of the current beam line elements, but I will take a closer look. Obviously, there are already enough issues of contention. Clearly the actual amount of emittance growth in the chicane should be checked with high priority.

Cheers,
Peter

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On Thu, 31 Mar 2005, Moffeit, Kenneth C. wrote:

> Dear Peter, Mike and Norbert,
>
> Peter, please forward this email on to Norbert Meyners.
>
> I noticed in Norbert talk that he had assumed the dispersion at the upstream Compton Chicane IP was the same as for the extraction line dispersion (2 cm). Actually it is only 5mm. It was shown correctly in my drawing of 24 Nov 04. This changes quite a bit the geometry for the detector with the backscattered e- offset from the beam line only ~4.5cm instead of the 17.8cm for the extraction line polarimeter. Assuming a beam pipe radius of ~1cm we only have 3.5 cm for the cerenkov cells. Can the upstream detector be made to work in the smaller horizontal dimension? The reason for the low dispersion number is to avoid emittance growth in the final focus.
>
> Note, there is only 1.7 meters between BPC2 and BPC3 at the Compton IP. Is that adequate for the laser light to collide? We can bring the laser light in/out on the outside of magnets BPC3 and BPC2. Norbert, can you redo the geometry drawings of your talk with the 5mm dispersion?
>
> I updated my 24 Nov 04 drawing to refect the upstream beam optics values from Mark Woodley. The new version of the drawing with the correct S location and nomenclature is attached. Below I give the web address for the Woodley optics deck, and have extracted the section around the compton chicane for display below. Note the chicane starts with bend labelled BPC1A. The 3rd column gives the s location in meters at the end of magnet and the number 0.121359E-03 is the bend angle the magnet. Note, he breaks each magnet, eg BPC1 into 2 parts BPC1A and BPC1B for optics reasons.
>
> Regards,
> Ken
>
>
>
> >From Mark Woodley,
>
> http://www.slac.stanford.edu/~mdw/ILC/Beam_Delivery/20050316 /ebds1.optics
>
> $ %16s %16s %e %e %e %e %e %e
%e %e %16s
> @ XIY %e 0.00000
> @ XIX %e 0.00000
> @ QY %e 8.84391

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> @ CIRCUM          %le     2550.52946695
> @ DELTA           %e    0.00000
> @ TYPE            %08s "OPTICS"
> @ COMMENT         %44s "e- Beam Delivery System 1 [20 mr] (ILC2005)"
> @ ORIGIN          %20s "MAD 8.51/15 Windows"
> @ DATE            %08s "16/03/05"
> @ TIME            %08s "13.03.11"
>
>
> * NAME              KEYWORD           S             L             K0L           K1L           K2L           K3L
          K4L           TILT          TYPE
>
> "MMOVER"          "MARKER"            708.695       0.00000       0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
>   "QPFF3"           "QUADRUPOLE"        709.695       1.00000       0.00000      -0.309720E-01
 0.00000       0.00000       0.00000       0.00000     "~"
>   "DPFFB"           "DRIFT"             710.195       0.500000      0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
>   "POLCHIC"         "LINE"              710.195       0.00000       0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
>   "PCBPM1"          "MONITOR"           710.195       0.00000       0.00000       0.00000
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>   "DPCBPM"          "DRIFT"             711.595       1.40000       0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
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>   "BPC1B"           "SBEND"             714.595       1.50000       0.121359E-03    0.00000
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>   "DPCBBI"          "DRIFT"             737.395       0.700000      0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
>   "PCBPM2"          "MONITOR"           737.395       0.00000       0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
>   "POL"             "MARKER"            737.395       0.00000       0.00000       0.00000
0.00000       0.00000       0.00000       0.00000     "~"
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> "BPMQ079" "MONITOR" 766.095 0.00000 0.00000 0.00000
0.00000
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