L. Keller
Oct. 19, 2006

Ideas and Speculations for the Headon Extraction Line

1. **Give up the 3.5 m Separation between the Charged Dump and the Incoming Line:**

   a) Move the charged dump from 740 m to 420 m and locate it in a gap in the incoming beam line.

   b) The tunnel to the dump can be much narrower than 14 mrad crossing which saves blast and drill expense. It still allows room for diagnostic sections.

2. **Consolidate all Beam Losses on Three Dumps:**

   a) A small aperture intermediate dump at Z = 139 m in the B1 string absorbs most of the beamstrahlung and much of the charged beam low energy tail.

   b) A dump at Z = 320 m absorbs the remaining beamstrahlung and low energy charged tail before the Compton polarimeter.

   c) The main charged dump at Z = 420 m is located in a space within the B5 bend string.

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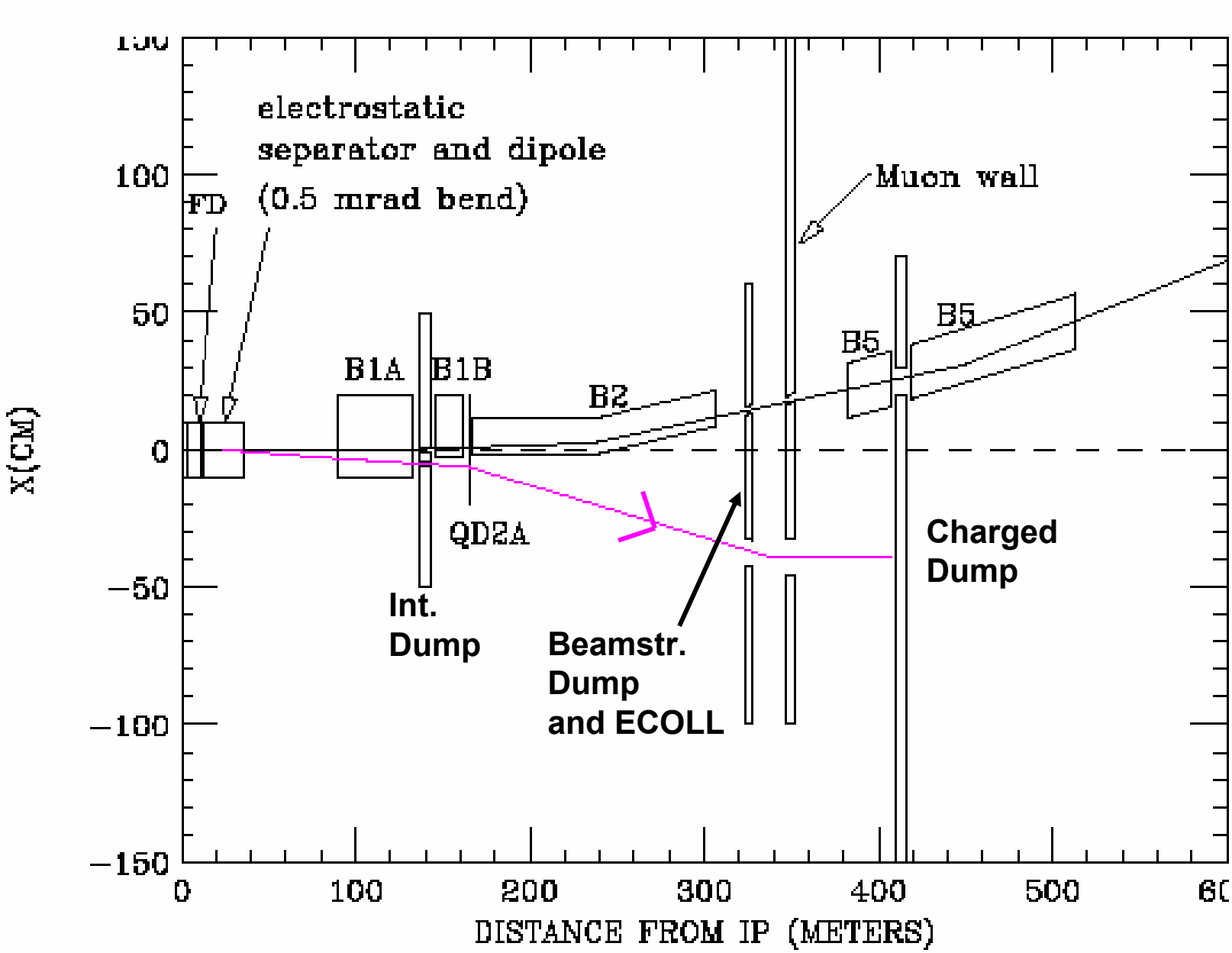
Plan View of Zero Degree Extraction from IP to Charged Beam Dump



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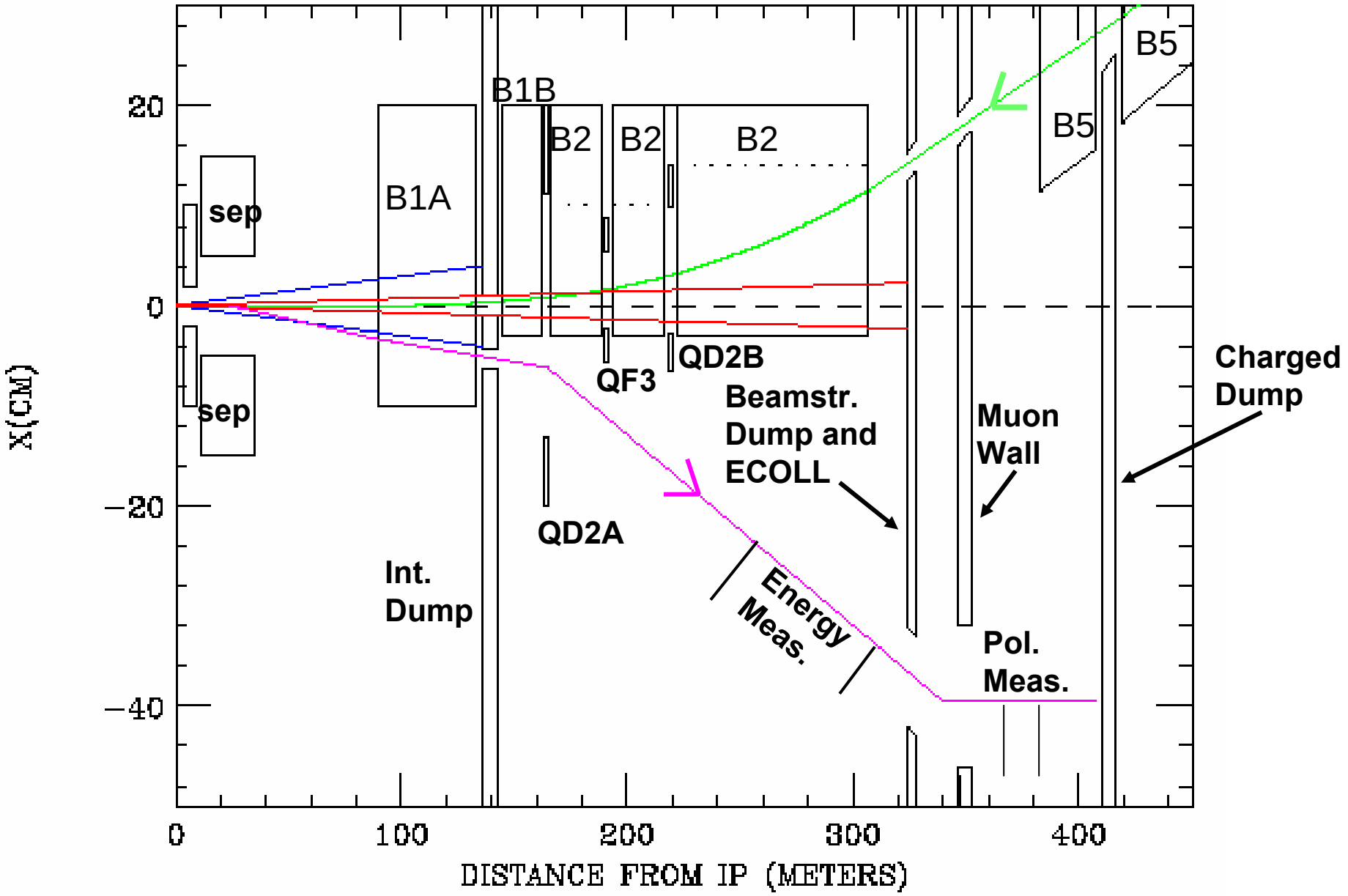
Plan View of Zero Degree Extraction Showing Beamstrahlung Collimation



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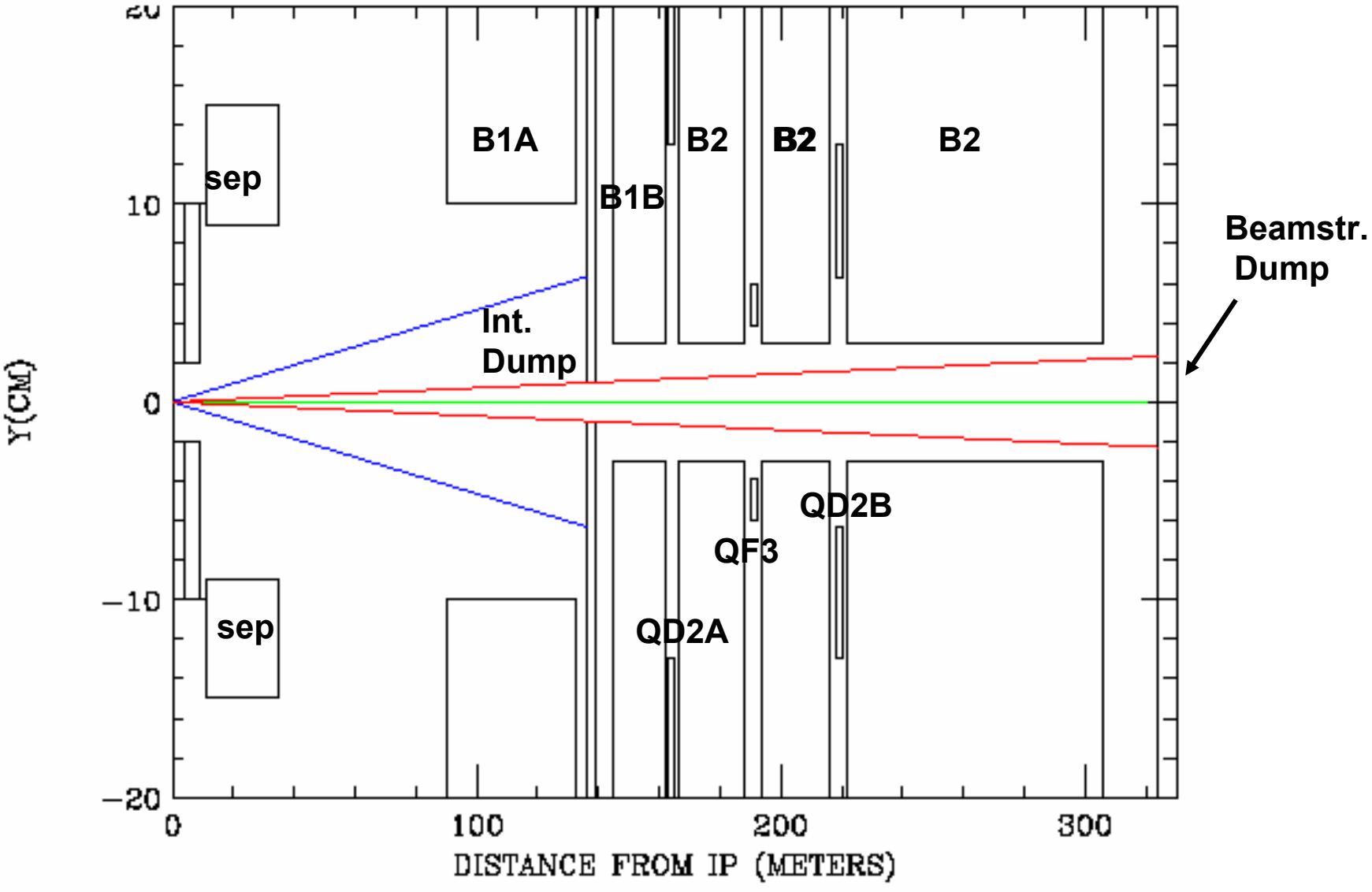
Elevation View of Zero Degree Extraction Showing Beamstrahlung Collimation



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Rough Cost Estimate of Blast and Drill for Three Tunnel Layouts

1. The BDS boring machine cuts a 4.5 m diameter tunnel all the way to the IR hall.

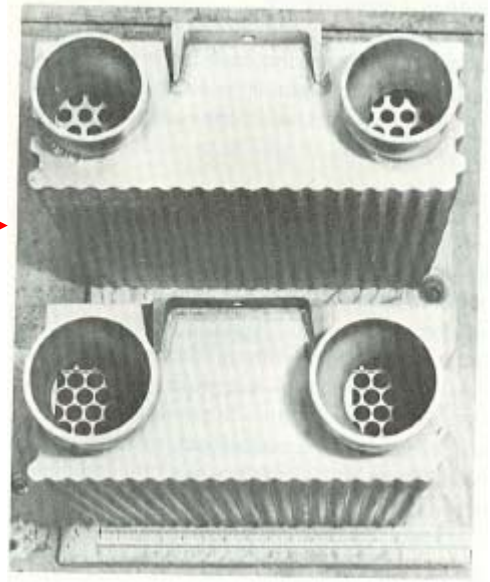
2. Then the triangular region from the IR hall to the dump is excavated by drilling and blasting. The estimated cost of this part of the operation is $800/cubic meter (F. Asiri).

Crossing Angle	Blast and drill cost of extraction line, both sides
14 mrad	$5.8 M
headon, dump at 740 m	$12.7 M
headon, dump at 420 m	$3.6 M

Photographs of SLAC 2 MW Aluminum/Water Collimator and Dump

Figure 20-9 Top view of slit modules.

Beam



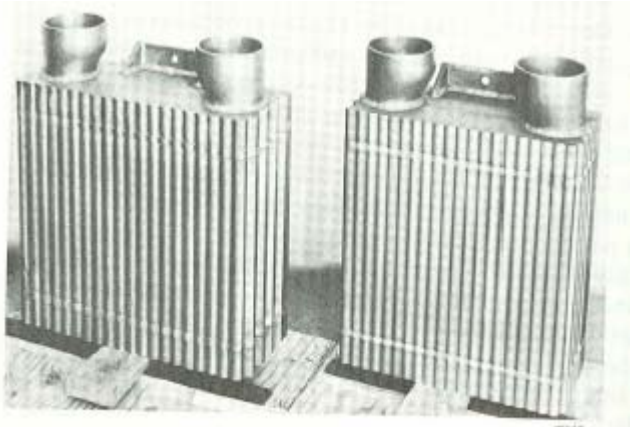
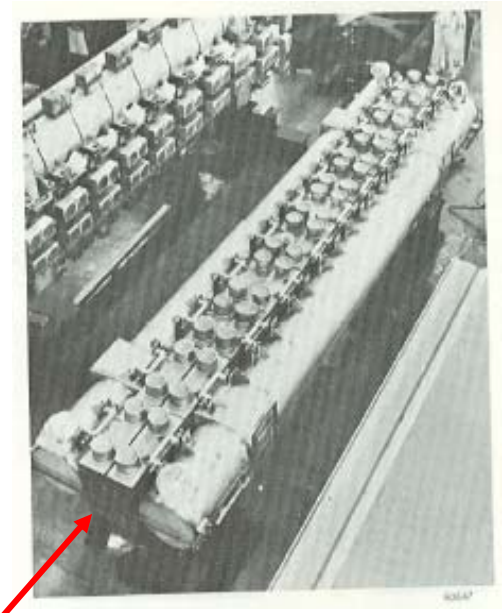


Figure 20-8 Front view of high-power slit modules.

Assembled 2 MW slits ≈ 5 m long



Beam

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New Estimate of Beam Losses, kW

charged
beamstrahlung

Dump Location	Function	Nominal Parameters		Low Power Parameters	
		Headon	Vertical offset	Headon	Vertical offset
Z = 139 m	Beamstrahlung and charged tail	360 165	840 315	650 225	1340 405
Z = 320 m	Beamstrahlung core and charged tail	350 100	300 60	280 90	155 40
Z = 420 m	Charged beam	~10,000	~9,500	~4500	~3600

Comments:

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1. Is it feasible to place high power dumps and collimators in the middle of a beam line?

   a) We have to convince ourselves that the dump has sufficient peripheral shielding and space to protect people and nearby hardware.

   b) With beam pipes passing through dumps we have to worry about leakage of secondaries back into the beam line where they can irradiate magnets .

2. What magnitude cost savings get management's attention - e.g. is a few $M really important?

3. The intermediate dump at Z = 139 m allows outboard dipoles to have small gaps. Need to check whether backscattered neutrons and photons don't swamp the detector and cause problems in the separator.

4. The above design removes the septum dipole and vertical collimation chicane. It may be that ~1 mrad septum dipole is necessary to create more separation from the incoming line.

Comments (cont.):

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5. If we give up all diagnostics, the charged beam could be dumped in the beamstrahlung dump at Z = 320 m.

6. With the above design the dc electric power should be < the 14 mrad extraction line power because of relatively small aperture, warm magnets in headon.

Summary:

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1. Can save ~$10M in tunneling cost in the headon design by locating the charged dump in the middle of the incoming beam line. Tunneling would also be cheaper than 14 mrad.

2. With a small aperture intermediate dump we can concentrate many beam losses in one place, including beamstrahlung.

3. With the present extraction line optics design, we need to collimate 100's of kW upbeam of the Compton polarimeter. This collimator can possibly be integrated into the beamstrahlung dump.