SR Update

M. Sullivan

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Plan for talk

- **Upstream SR**
  - **Nominal settings**
  - **Upstream SR backscattering from dump line apertures**
  - **Settings where SR starts to hit the detector chamber**

- **Downstream SR from the dump line**
  - **Model 3 different beam energies**
    - **250 GeV (optics set to this value from the lattice)**
    - **225 GeV (Above optics scaled to this energy 90% of nom.)**
    - **200 GeV (Above optics scaled to this energy 80% of nom.)**
  - **Put these optics into SYNC_BKG (my version of QSRAD)**
    - **My version has the ability to track the beam using the lattice α and β functions**
    - **This allows me to start the beam at the IP and trace it out to the dump (300 m away)**
  - **Get rates for photons striking downstream surfaces**
  - **Compute backscatter rate to the detector beam pipe**

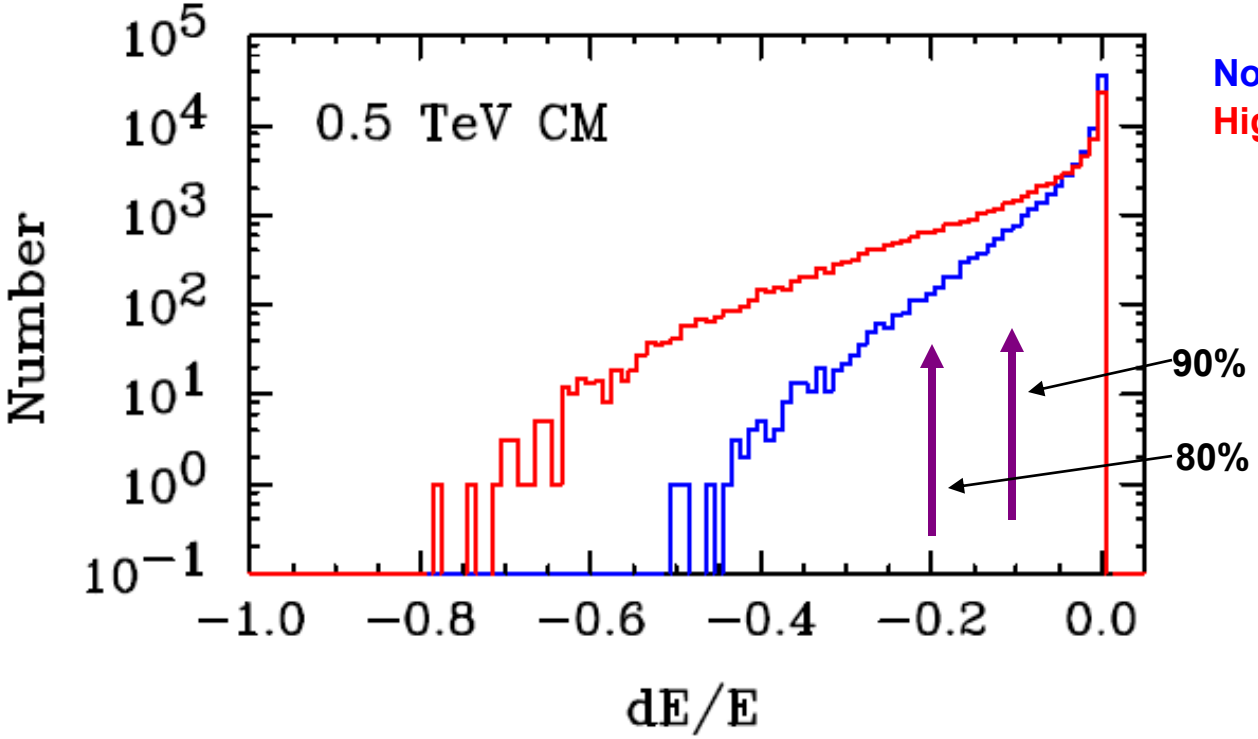
IP parameters

IP and General Parameters							
							upgrade
Centre-of-mass energy	E_{cm}	**GeV**	**200**	**250**	**350**	**500**	**1000**
Beam energy	E_{beam}	GeV	100	125	175	250	500
Lorentz factor	γ		1.96E+05	2.45E+05	3.42E+05	4.89E+05	9.78E+05
Collision rate	f_{rep}	Hz	5	5	5	5	4
Electron linac rate	f_{linac}	Hz	10	10	5	5	4
Number of bunches	n_b		1312	1312	1312	1312	2625
Electron bunch population	N_-	$\times 10^{10}$	2	2	2	2	2
Positron bunch population	N_+	$\times 10^{10}$	2	2	2	2	2
Bunch seperation	Δt_b	ns	740	740	740	740	356
Bunch seperation $\times f_{RF}$	$\Delta t_b f_{RF}$		962	962	962	962	463
Pulse current	I_{beam}	mA	4.33	4.33	4.33	4.33	9.00
RMS bunch length	σ_z	mm	0.3	0.3	0.3	0.3	0.3
Electron RMS energy spread	$\Delta p/p$	%	0.22	0.22	0.22	0.21	0.11
Positron RMS energy spread	$\Delta p/p$	%	0.17	0.14	0.10	0.07	0.04
Electron polarisation	P_-	%	80	80	80	80	80
Positron polarisation	P_+	%	31	31	29	22	22
Horizontal emittance (linac exit)	$\gamma\varepsilon_x$	μm	10	10	10	10	10
Vertical emittance (linac exit)	$\gamma\varepsilon_y$	nm	35	35	35	35	35
IP horizontal beta function	β_x^*	mm	16	12	15	11	30
IP vertical beta function (no TF)	β_y^*	mm	0.48	0.48	0.48	0.48	0.30
IP vertical beta function (TF)	β_y^*	mm	0.2	0.2	0.2	0.2	0.2

IP parameters

	IP RMS horizontal beam size	σ_x *	nm	904	700	662	474		554	
	IP RMS veritcal beam size (no TF)	σ_y *	nm	9.3	8.3	7.0	5.9		3.3	
	IP RMS veritcal beam size (TF)	σ_y *	nm	6.0	5.3	4.5	3.8		2.7	
No TF	Horizontal distruption parameter	D_x		0.2	0.3	0.2	0.3		0.1	
	Vertical disruption parameter	D_y		20.7	23.8	21.3	24.9		19.2	
	Horizontal enhancement factor	H_{Dx}		1.1	1.1	1.1	1.2		1.0	
	Vertical enhancement factor	H_{Dy}		5.7	6.0	5.8	6.1		3.6	
	Total enhancement factor	H_D		1.8	1.9	1.8	2.0		1.5	
	Geometric luminosity	L_{geom}	$\times 10^{34}$ cm^{-2}s^{-1}	0.2	0.4	0.5	0.8		1.8	
	Luminosity	L	**$\times 10^{34}$ cm^{-2}s^{-2}**	**0.5**	**0.7**	**0.8**	**1.5**		**2.8**	
	Fraction of luminosity in top 1%	$L_{0.01}/L$			0.96	0.88	0.73			
	Average beamstrahlung parameter	Y_{av}		0.013	0.021	0.032	0.063		0.109	
	Maximum beamstrahlung parameter	Y_{max}		0.032	0.051	0.075	0.150		0.260	
	Average number of photons / particl	n_γ		0.96	1.22	1.28	1.74		1.46	
	Average energy loss	δE_{BS}	%	0.53	1.04	1.55	3.76		4.83	
	Number of pairs per bunch crossing	N_{pair}	$\times 10^3$		97.4	214	494			
With TF	**Luminosity**	L	**$\times 10^{34}$ cm^{-2}s^{-2}**	**0.5**	**0.8**	**1.0**	**2.0**			
	Average energy loss	δE_{BS}	%		0.6	1.6	3.6			
	Number of pairs per bunch crossing	N_{pair}	$\times 10^3$		115	255	596			
	Fraction of luminosity in top 1%	$L_{0.01}/L$			0.89	0.77	0.72			

Energy distribution

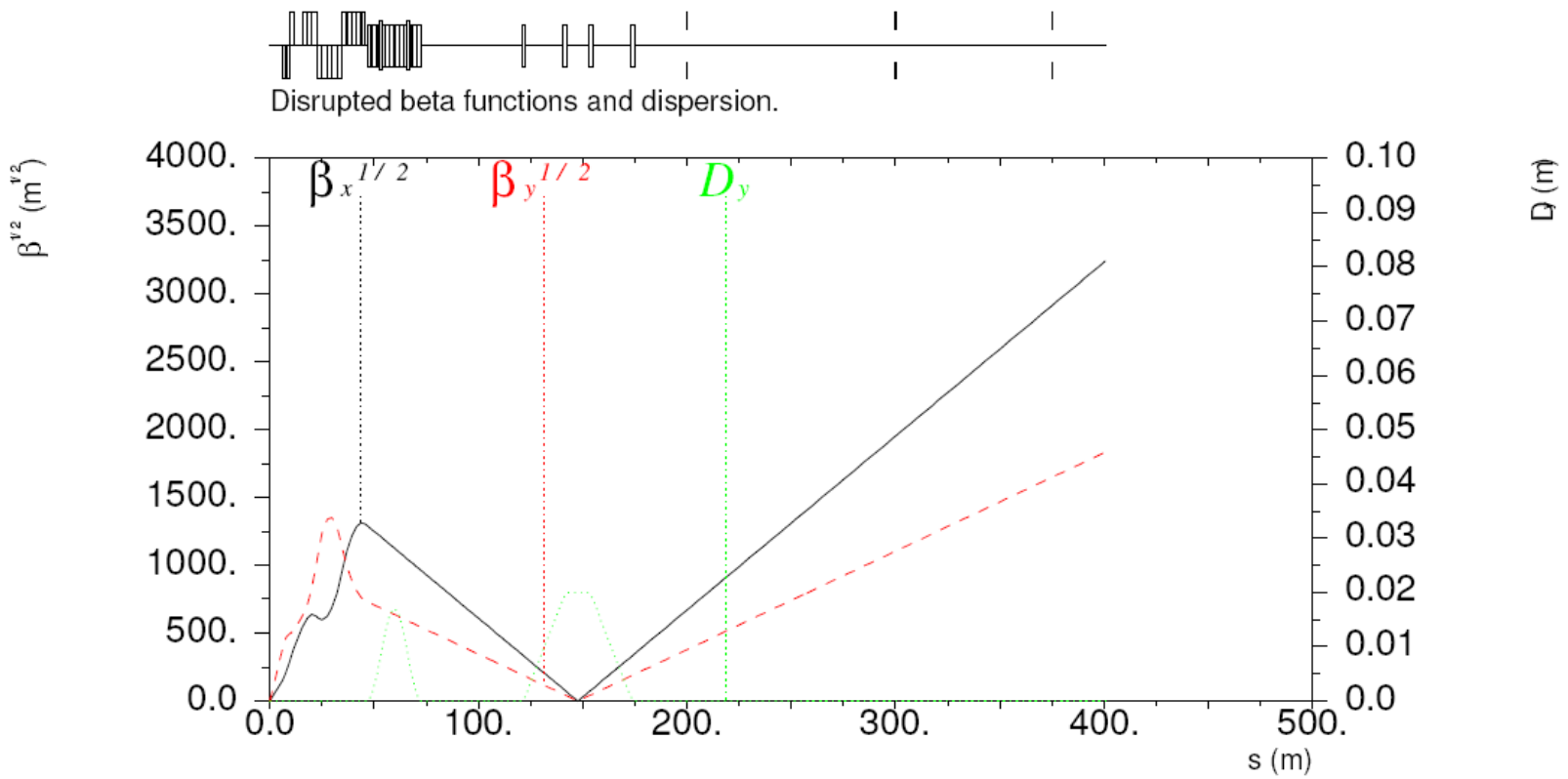


Nominal design C11
High Luminosity design C15

Beam energy distribution going into the dump line

From SLAC-PUB-1159, Nosochkov, *et. al.*, "ILC Extraction Line for 14 mrad Crossing Angle", 2005

Beta functions



Dump Line beta functions

Beta functions from 2007 lattice

Magnet Apertures

Sync_bkg results

Further work

- **Put actual energy distribution into program**