

Inputs From 18GeV Lattice File (Ver 5.2 provided 12/23/19)

Index	Name	Key	s	length	β_x	β_y	Eta x	Eta'	α_x	α_y	gradient	field	σ_x	σ_y	σ'_x	σ'_y
			[m]	[m]	[m]	[m]	[m]					[T/m]	[T]	[cm]	[cm]	
0	BEGINNING	Beginning_El	0	---	0.42002	0.050001	2.10E-06	-3.19E-05	3.66E-05	-2.57E-05	---	---	0.01004	8.50E-07	0.000239	0.000184389
4	HQ0EF_5	Quadrupole	5.9	0.6	89.765	644.88	-1.93E-04	-5.61E-05	-2.58E+01	-2.86E+01	1.35E+01	---	0.146777	1.10E-02	1.64E-05	1.62362E-06
8	HQ0EF_5	Quadrupole	6.5	0.6	132.72	626.9	-2.35E-04	-8.48E-05	-4.77E+01	5.78E+01	1.35E+01	---	0.178474	1.07E-02	1.34E-05	1.64674E-06
10	HQ1EF_5	Quadrupole	11.065	0.805	859.73	228.74	-6.00E-04	-2.85E-05	-4.07E+01	1.20E+01	-7.23E+00	---	0.454241	3.89E-03	5.28E-06	2.72617E-06
14	HQ1EF_5	Quadrupole	11.87	0.805	857.68	227.22	-5.99E-04	3.00E-05	4.31E+01	-1.00E+01	-7.23E+00	---	0.453699	3.86E-03	5.29E-06	2.73528E-06
16	HQ2EF_5	Quadrupole	14.17	1.9	670.7	275.66	-5.30E-04	3.00E-05	3.81E+01	-1.10E+01	0.00E+00	---	0.401208	4.69E-03	5.98E-06	2.48335E-06
20	HQ2EF_5	Quadrupole	16.07	1.9	533.57	319.24	-4.73E-04	3.00E-05	3.40E+01	-1.19E+01	0.00E+00	---	0.35785	5.43E-03	6.71E-06	2.30763E-06
22	HQ3EF_5	Quadrupole	20.82	0.6	266.64	430.64	-3.35E-04	1.47E-05	1.19E+01	5.47E+00	4.49E+00	---	0.25297	7.32E-03	9.49E-06	1.98686E-06
26	HQ3EF_5	Quadrupole	21.42	0.6	259.57	412.73	-3.31E-04	-2.21E-07	1.52E-02	2.41E+01	4.49E+00	---	0.249593	7.02E-03	9.62E-06	2.02951E-06
32	HQ4EF_5	Quadrupole	29.95	0.6	256.45	105.42	-3.31E-04	6.52E-06	5.21E+00	9.95E+00	-2.03E+00	---	0.248089	1.79E-03	9.67E-06	4.01572E-06
36	HQ4EF_5	Quadrupole	30.55	0.6	247.18	95.014	-3.25E-04	1.32E-05	1.02E+01	7.46E+00	-2.03E+00	---	0.243564	1.62E-03	9.85E-06	4.22991E-06
38	HQ5EF_5	Quadrupole	34.515	0.6	173.11	45.225	-2.73E-04	1.32E-05	8.52E+00	5.09E+00	-1.13E-02	---	0.203829	7.69E-04	1.18E-05	6.13105E-06
42	HQ5EF_5	Quadrupole	35.115	0.6	163.03	39.333	-2.65E-04	1.32E-05	8.28E+00	4.73E+00	-1.13E-02	---	0.197806	6.69E-04	1.21E-05	6.57425E-06
44	HQ6EF_5	Quadrupole	43.415	0.6	54.983	1.7505	-1.55E-04	1.31E-05	4.68E+00	-2.00E-01	1.14E-01	---	0.114873	2.98E-05	2.09E-05	3.11633E-05
48	HQ6EF_5	Quadrupole	44.015	0.6	49.556	2.203	-1.47E-04	1.29E-05	4.37E+00	-5.54E-01	1.14E-01	---	0.109057	3.75E-05	2.2E-05	2.7779E-05
50	DB6EF_5	Sbend	50.915	6	8.5517	38.094	-1.48E-02	-4.88E-03	1.57E+00	-4.65E+00	0.00E+00	4.90E-02	0.045332	6.48E-04	5.32E-05	6.6803E-06

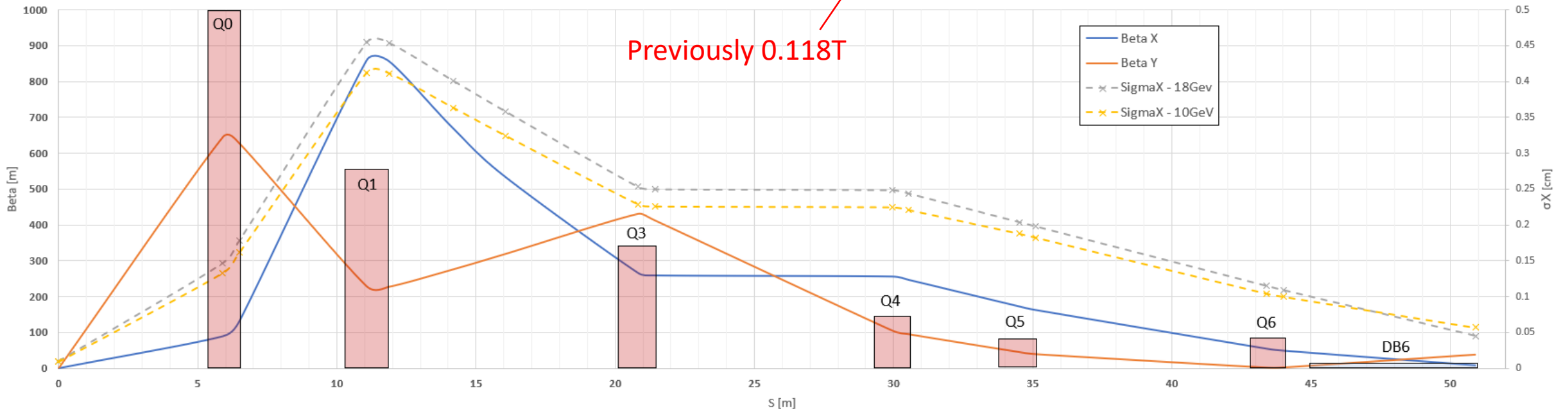
$E = 18 \text{ GeV}$
 $I = 260 \text{ mA}$
 $\epsilon_x = 24 \text{ nm}$
 $\epsilon_y = 1.7 \text{ nm}$
 $\Delta E/E = 1.09e^{-3}$

Beam standard deviations

$$\sigma_x = \sqrt{\epsilon_x \beta_x + \eta_x \left(\frac{\Delta E}{E}\right)^2} \quad \sigma_y = \epsilon_y \beta_y$$

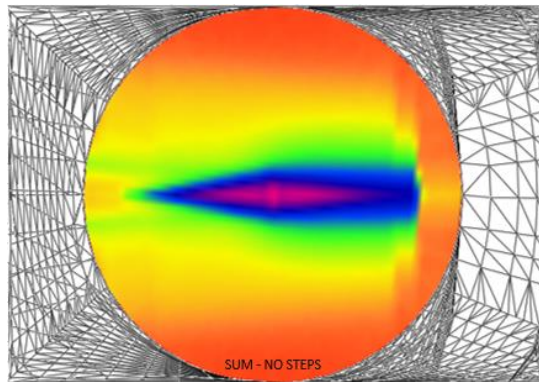
Std. dev. of photon direction divergence

$$\sigma'_x = \sqrt{\frac{\epsilon_x}{\beta_x} + \eta'_x \left(\frac{\Delta E}{E}\right)^2} \quad \sigma'_y = \sqrt{\frac{\epsilon_y}{\beta_y}}$$



SynRad Results – 18GeV

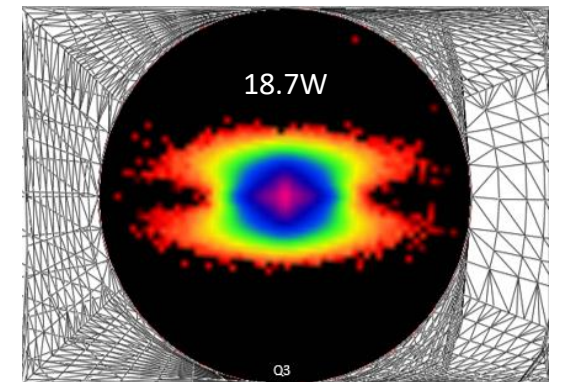
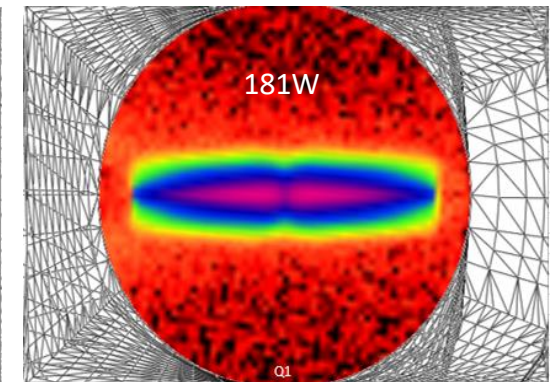
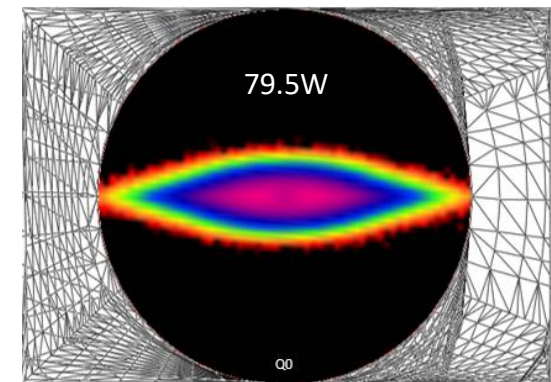
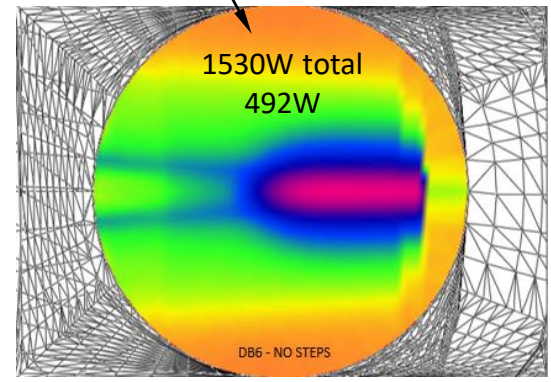
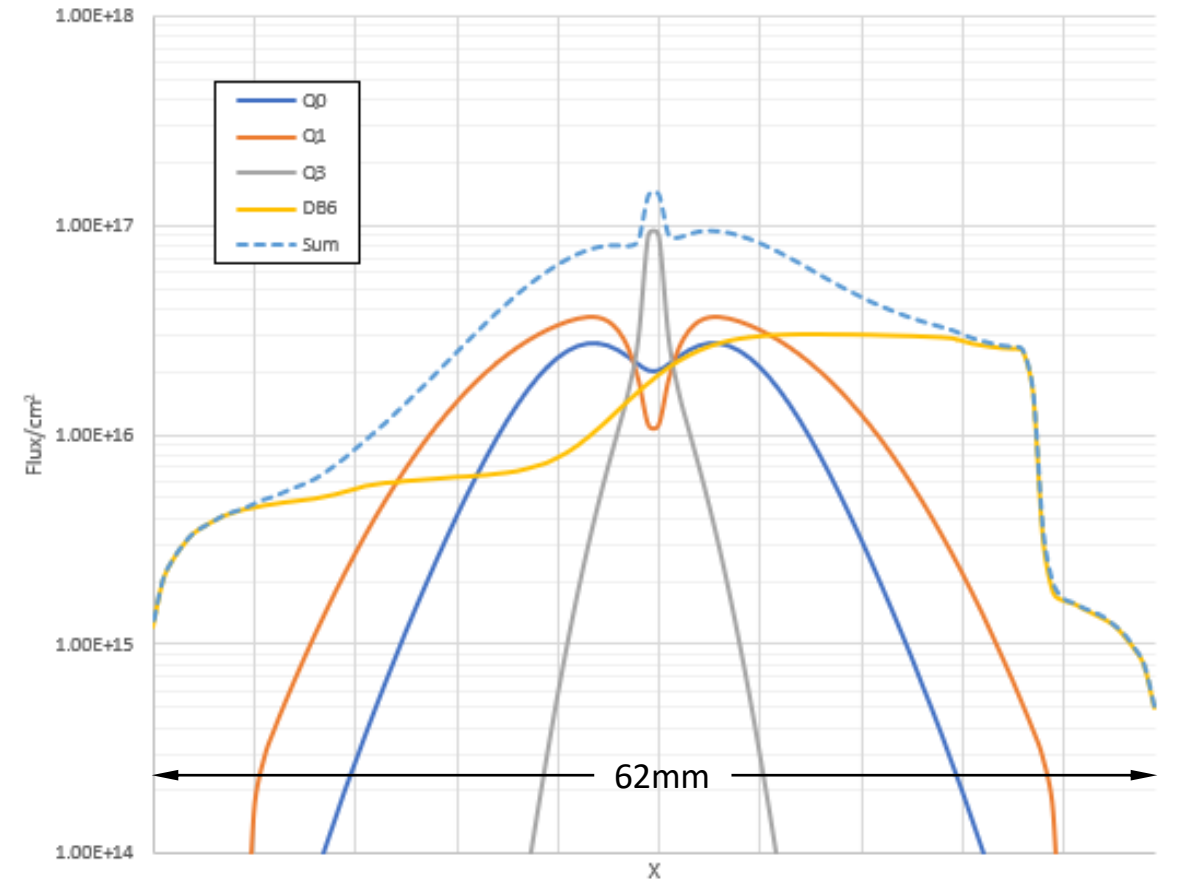
Q4, Q5 and Q6 are ignored due to lower gradients and small betas



Simulation power result
 Total: 1810W
 Be exit: 492W

$$\rho[m] = \frac{E[GeV]}{0.3B[T]} = 1224.2m$$

Dipole power sanity check: $P[kW] = 14.08 \frac{L[m]I[A]E[GeV]^4}{\rho[m]^2} = 1.54kW$

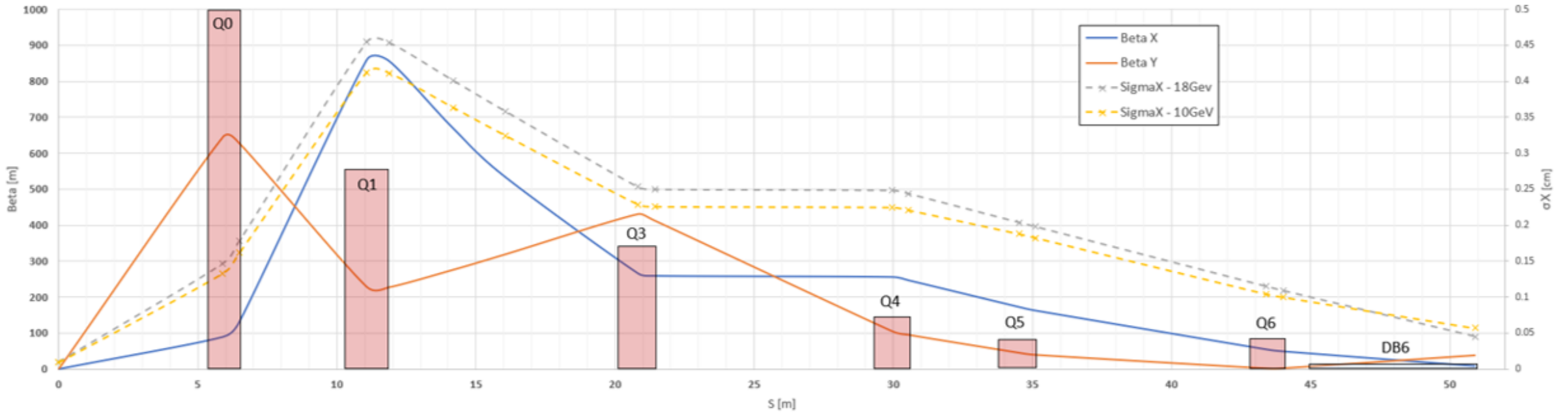


Note: Color scales auto scale

Inputs From 10GeV Lattice File (Ver 5.2 provided 12/23/19)

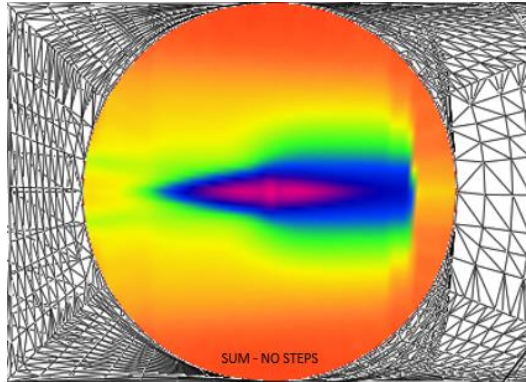
Index	Name	Key	s	length	β_x	β_y	Eta x	Eta'	α_x	α_y	gradient	field	σ_x	σ_y	σ'_x	σ'_y
			[m]	[m]	[m]	[m]	[m]					[T/m]	[T]	[cm]	[cm]	
0	BEGINNIN	Beginning_El	0	---	0.42611	0.050606	1.19E-03	-3.91E-03	-2.71E-03	-6.79E-04	---	---	0.009232	7.08E-07	0.0002167	0.00016633
4	HQ0EF_5	Quadrupole	5.9	0.6	88.532	637.18	-2.27E-02	-6.75E-03	-2.55E+01	-2.83E+01	7.52E+00	---	0.133072	8.92E-03	1.553E-05	1.4823E-06
8	HQ0EF_5	Quadrupole	6.5	0.6	130.89	619.42	-2.77E-02	-1.01E-02	-4.70E+01	5.71E+01	7.52E+00	---	0.161804	8.67E-03	1.369E-05	1.5034E-06
10	HQ1EF_5	Quadrupole	11.065	0.805	847.72	226.02	-7.14E-02	-3.44E-03	-4.00E+01	1.18E+01	-4.02E+00	---	0.411778	3.16E-03	5.25E-06	2.4888E-06
14	HQ1EF_5	Quadrupole	11.87	0.805	845.53	224.56	-7.13E-02	3.53E-03	4.27E+01	-9.94E+00	-4.02E+00	---	0.411246	3.14E-03	5.277E-06	2.4969E-06
16	HQ2EF_5	Quadrupole	14.17	1.9	660.65	272.63	-6.32E-02	3.53E-03	3.77E+01	-1.10E+01	0.00E+00	---	0.363515	3.82E-03	5.871E-06	2.2661E-06
20	HQ2EF_5	Quadrupole	16.07	1.9	525.11	315.88	-5.65E-02	3.53E-03	3.36E+01	-1.18E+01	0.00E+00	---	0.324088	4.42E-03	6.503E-06	2.1052E-06
22	HQ3EF_5	Quadrupole	20.82	0.6	261.52	426.45	-4.03E-02	1.69E-03	1.17E+01	5.49E+00	2.51E+00	---	0.228713	5.97E-03	8.8E-06	1.8119E-06
26	HQ3EF_5	Quadrupole	21.42	0.6	254.54	408.57	-3.98E-02	-1.17E-04	1.87E-02	2.40E+01	2.51E+00	---	0.22564	5.72E-03	8.864E-06	1.8511E-06
32	HQ4EF_5	Quadrupole	29.95	0.6	251.7	102.73	-4.06E-02	6.35E-04	4.65E+00	1.01E+01	-1.03E+00	---	0.224378	1.44E-03	8.922E-06	3.6916E-06
36	HQ4EF_5	Quadrupole	30.55	0.6	243.41	92.065	-4.00E-02	1.38E-03	9.11E+00	7.78E+00	-1.03E+00	---	0.220652	1.29E-03	9.1E-06	3.8996E-06
38	HQ5EF_5	Quadrupole	34.515	0.6	176.2	40.99	-3.45E-02	1.50E-03	8.34E+00	4.99E+00	-1.88E-01	---	0.187734	5.74E-04	1.069E-05	5.8442E-06
42	HQ5EF_5	Quadrupole	35.115	0.6	165.99	35.305	-3.35E-02	1.61E-03	8.66E+00	4.49E+00	-1.88E-01	---	0.182214	4.94E-04	1.102E-05	6.2972E-06
44	HQ6EF_5	Quadrupole	43.415	0.6	54.199	2.0466	-2.02E-02	1.33E-03	4.12E+00	-4.59E-01	7.61E-01	---	0.104121	2.87E-05	1.923E-05	2.6155E-05
48	HQ6EF_5	Quadrupole	44.015	0.6	49.793	2.7905	-1.95E-02	1.06E-03	3.24E+00	-7.77E-01	7.61E-01	---	0.099799	3.91E-05	2.005E-05	2.2399E-05
50	DB6EF_5	Sbend	50.915	6	16.055	40.878	-2.69E-02	-3.84E-03	1.65E+00	-4.74E+00	0.00E+00	2.72E-02	0.056687	5.72E-04	3.536E-05	5.8522E-06

$E = 10 \text{ GeV}$
 $I = 2500 \text{ mA}$
 $\epsilon_x = 20 \text{ nm}$
 $\epsilon_y = 1.4 \text{ nm}$
 $\Delta E/E = 5.8e^{-4}$



SynRad Results – 10GeV

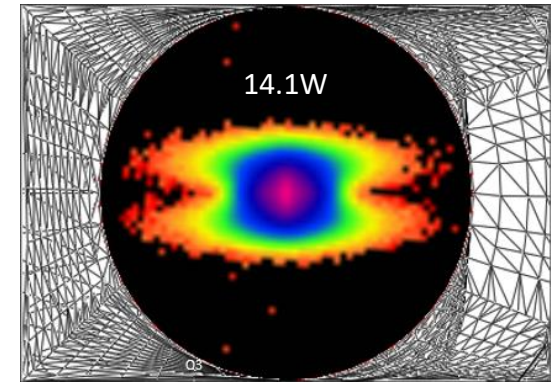
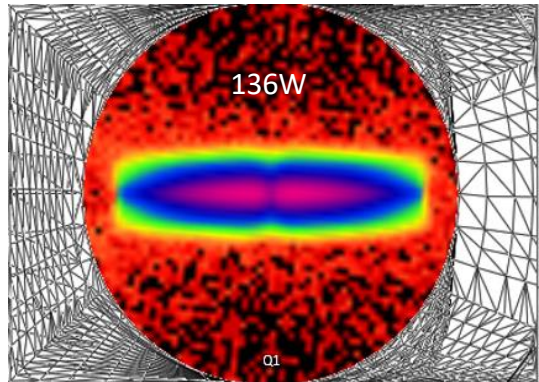
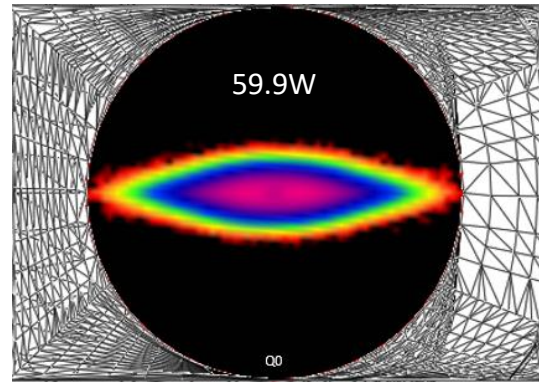
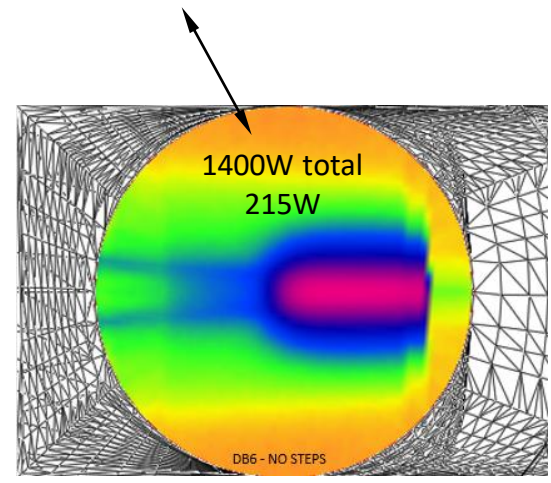
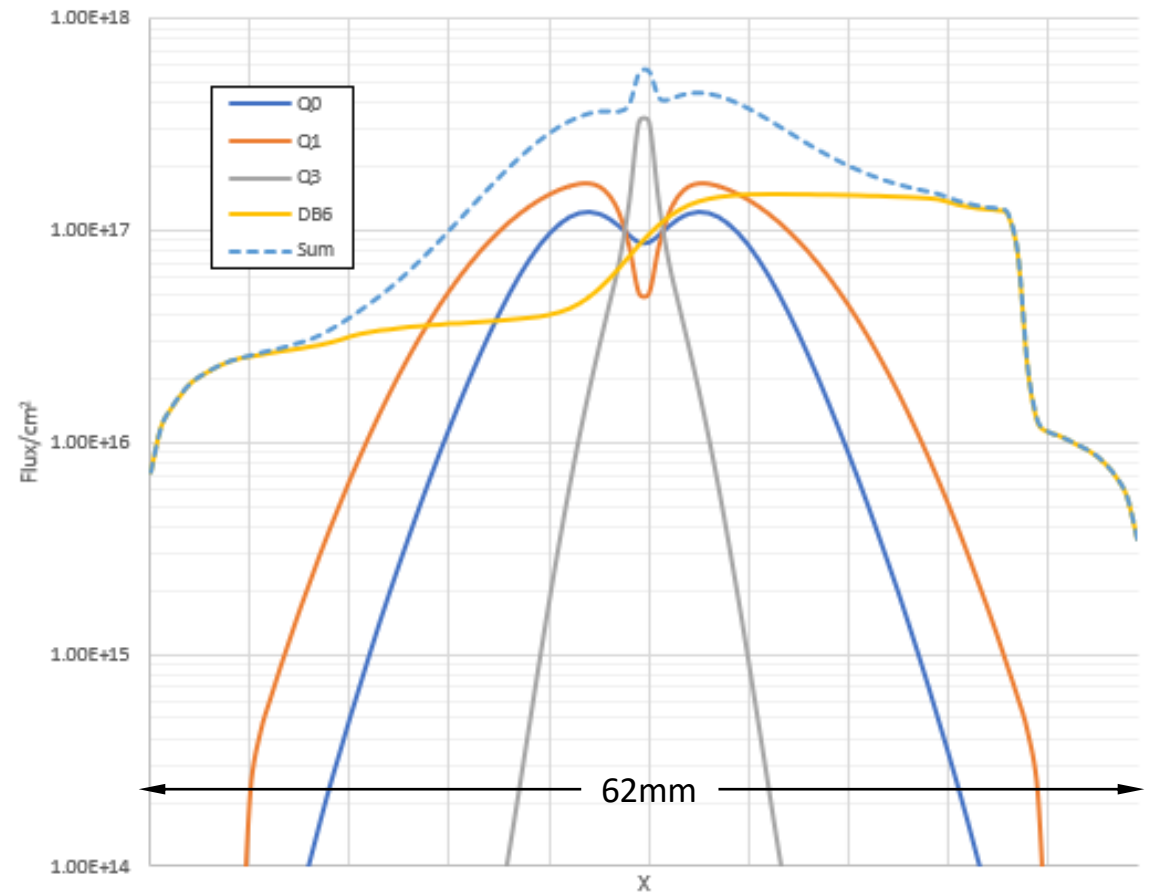
Q4, Q5 and Q6 are ignored due to lower gradients and small betas



Simulation power result
 Total: 1610W
 Be exit: 425W

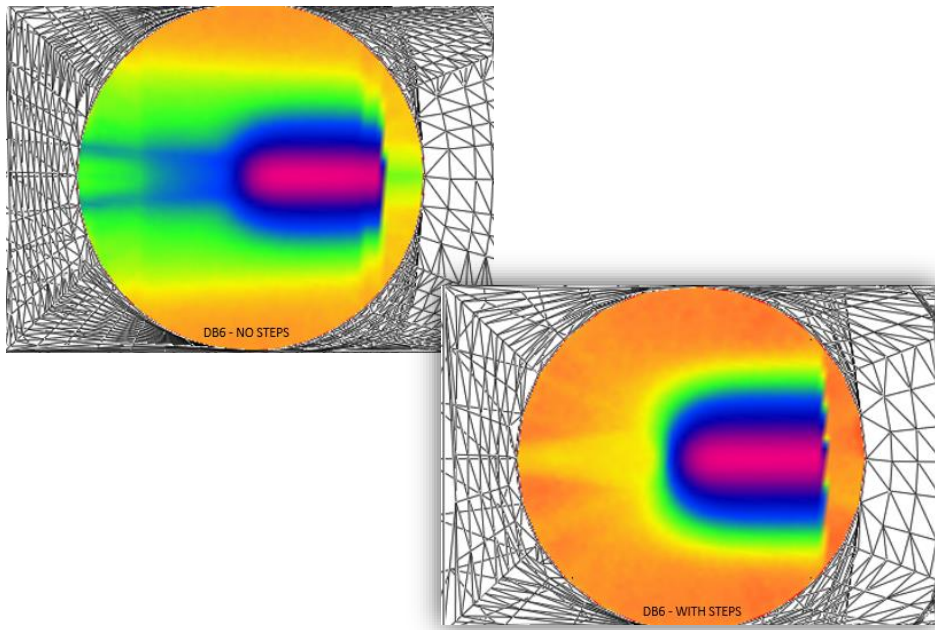
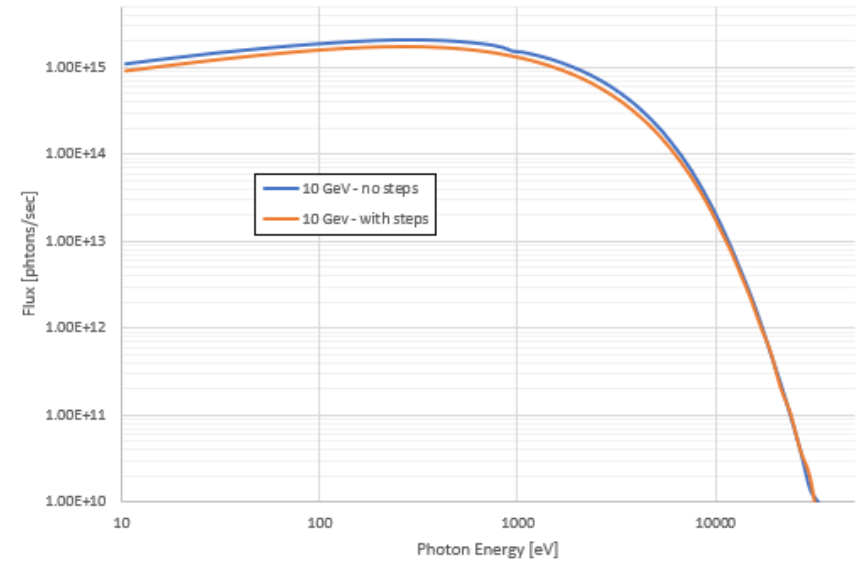
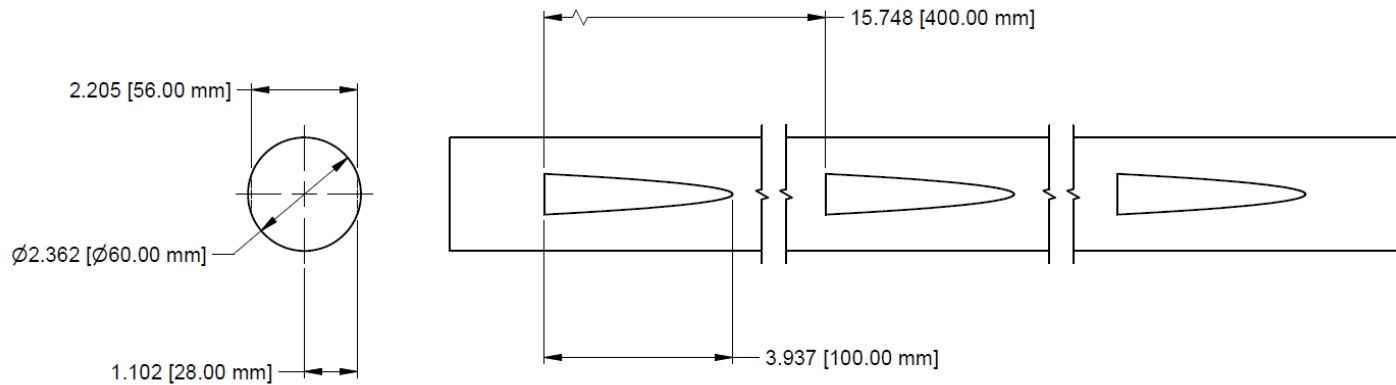
$$\rho[m] = \frac{E[GeV]}{0.3B [T]} = 1224.2m$$

Dipole power sanity check: $P[kW] = 14.08 \frac{L[m]I[A]E[GeV]^4}{\rho[m]^2} = 1.41kW$



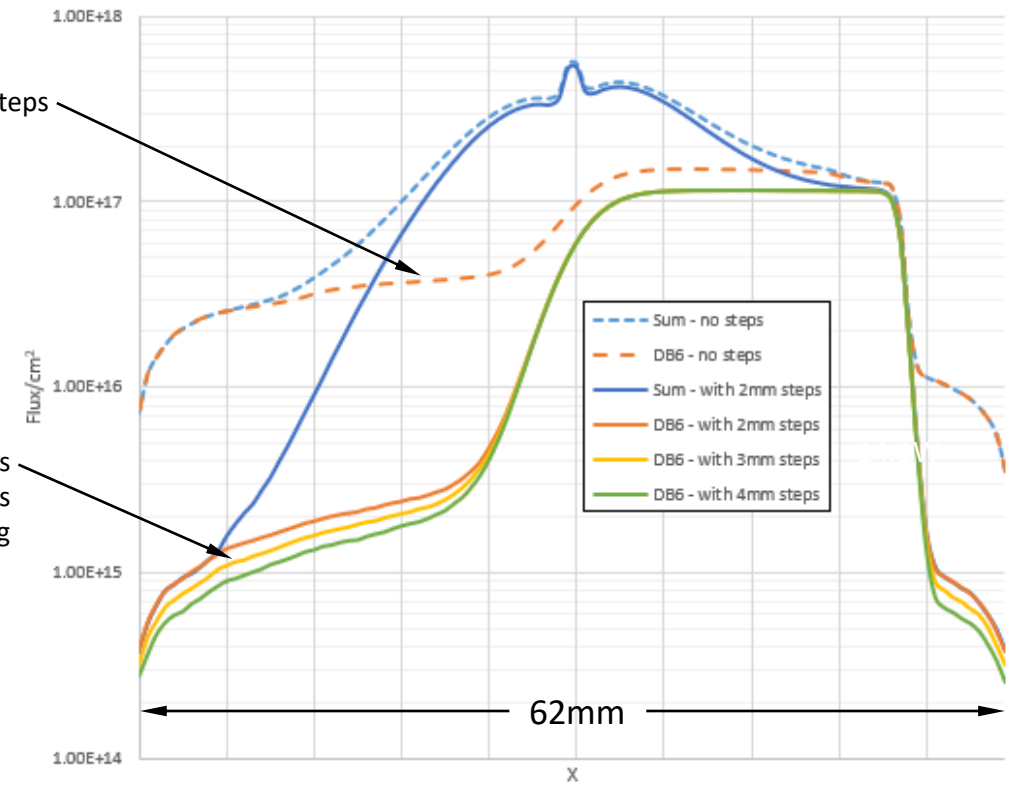
Note: Color scales auto scale

Wall Steps to Reduce Scatter Based on New DB6 Angle



Dipole flux with no steps

Dipole flux with steps
Small improvements with larger steps
No improvement with tighter spacing



Note: Color scales auto scale