Parameter Options for Undulator at End of Linac

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Simulation Conditions

- Normalized to 100m long RDR undulator, RDR baseline parameters.
- 0.4X0 Ti target
- AMD: 14cm long
- Flux concentrator: 14cm total length, 2cm ramping
- Lithium lens: 2cm long, 1.4cm in diameter
- Yield evaluated at 125MeV with damping ring acceptance parameters

Comparison of positron yield from different undulators

	High K Devices				Low K Devices		
	BCD	**UK I**	**UK II**	**UK III**	**Cornell I**	**Cornell II**	**Cornell III**
Period (mm)	10.0	11.5	11.0	10.5	10.0	12.0	7
K	1.00	0.92	0.79	0.64	0.42	0.72	0.3
Field on Axis (T)	1.07	0.86	0.77	0.65	0.45	0.64	0.46
Beam aperture (mm)	Not Defined	5.85	5.85	5.85	8.00	8.00	
First Harmonic Energy (MeV)	10.7	10.1	12.0	14.4	18.2	11.7	28

Target: 1.42cm thick Titanium, 500 m drift from center of undulator

Positron Source Layout

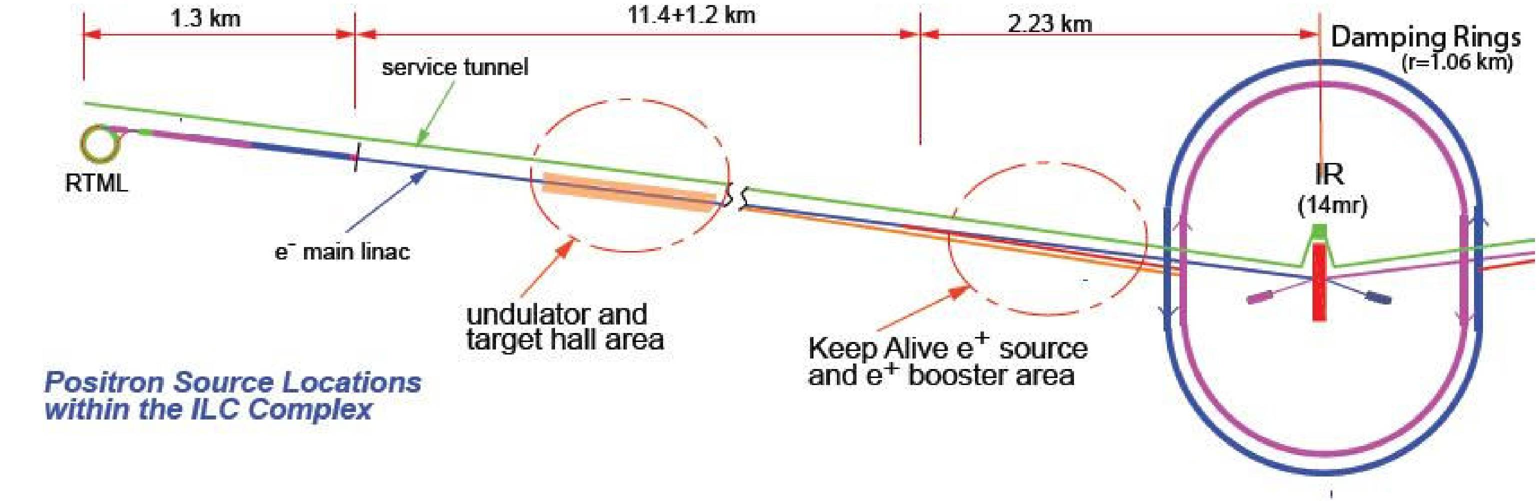


FIGURE 2.3-1. Layout of the Positron Source in the ILC

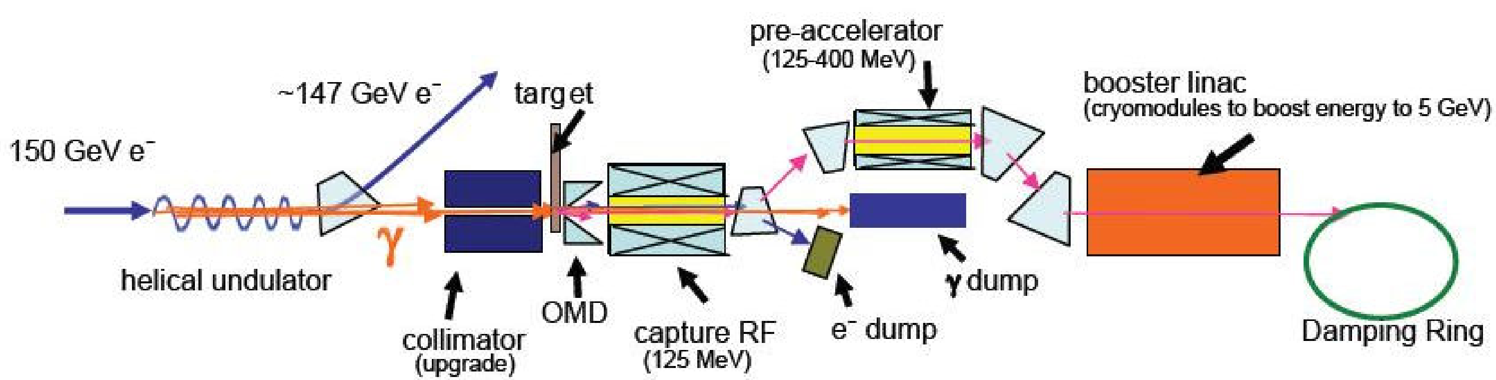
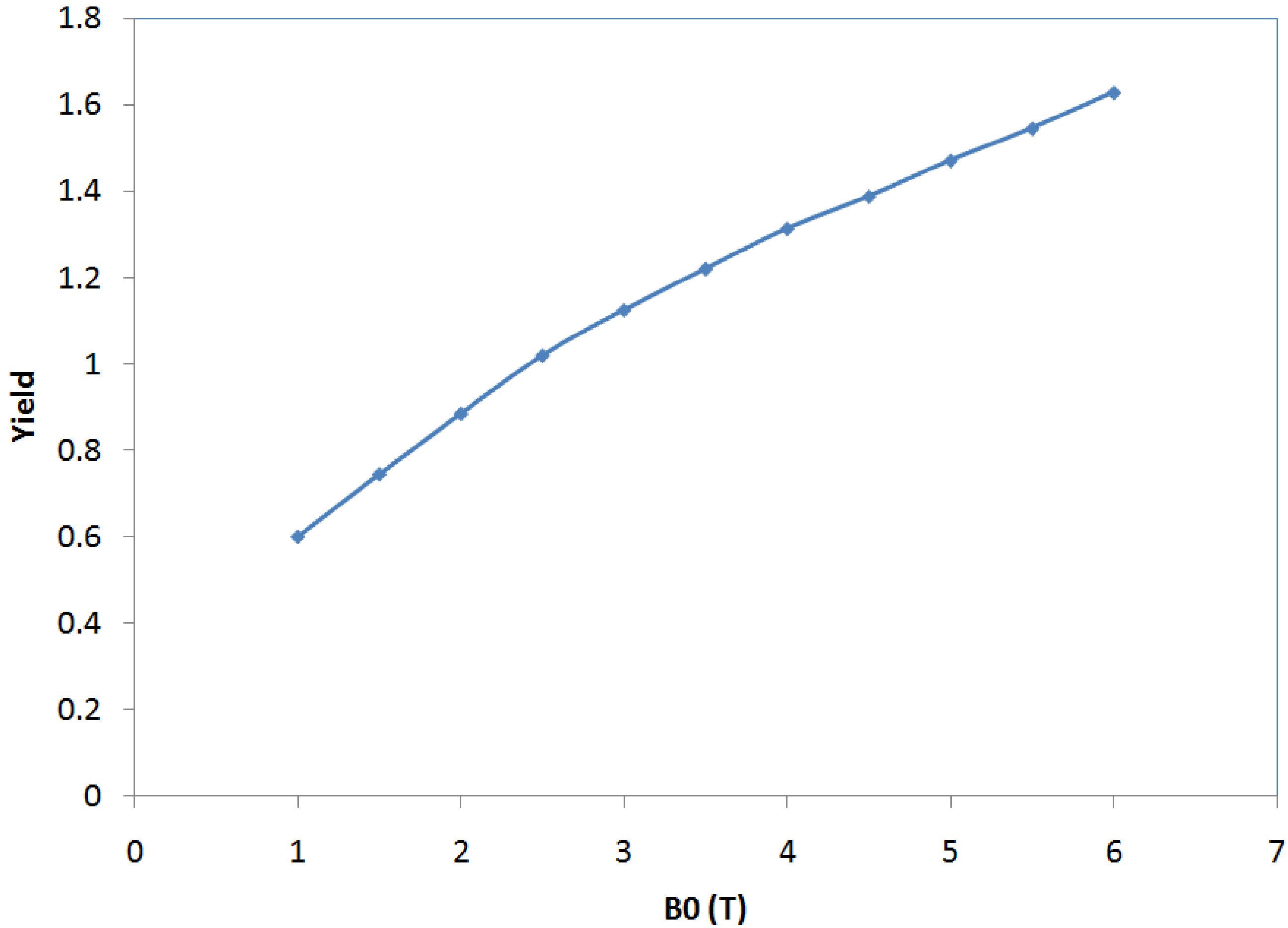


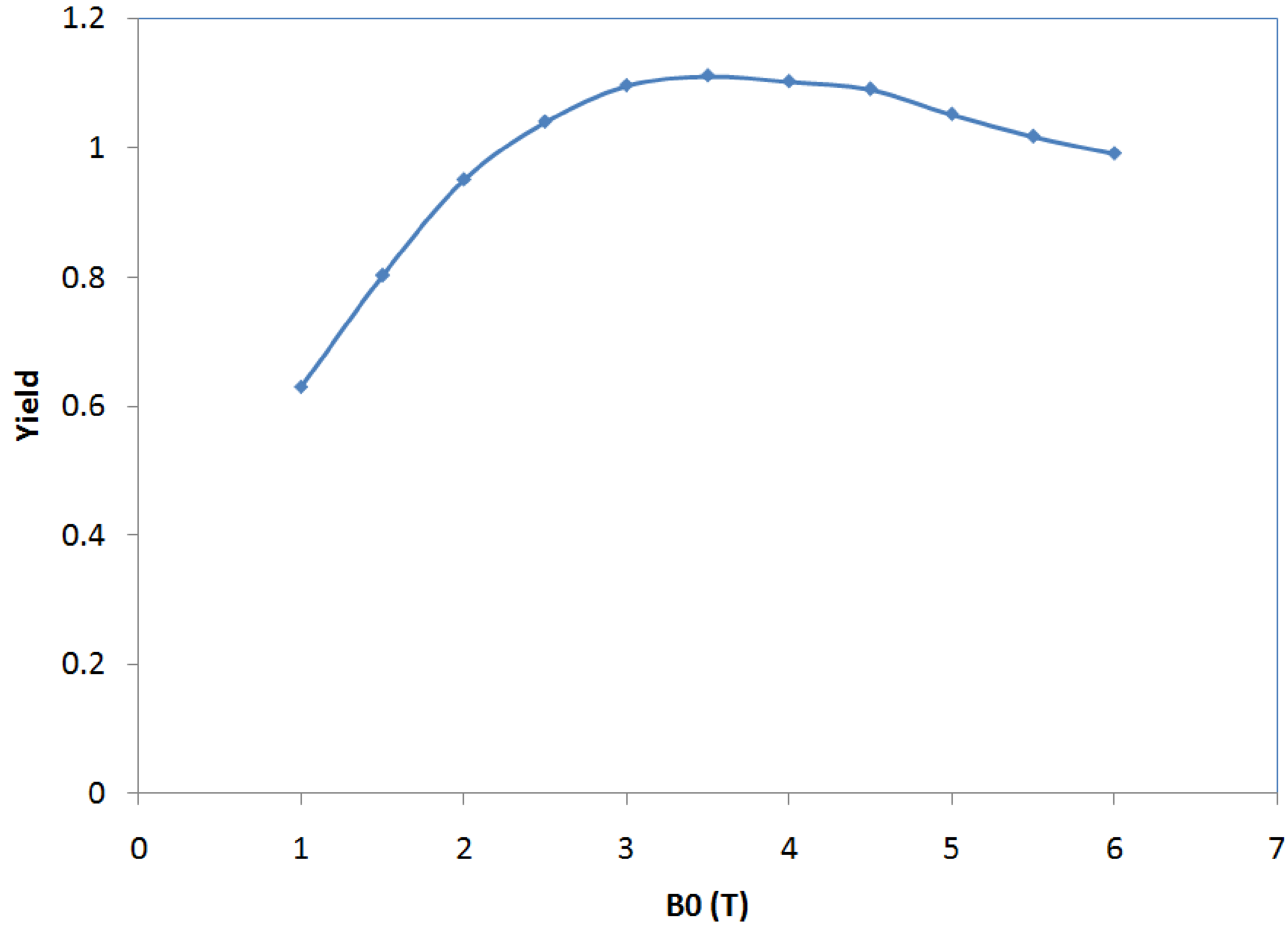
FIGURE 2.3-2. Overall Layout of the Positron Source

150GeV drive beam, AMD, Immersed target



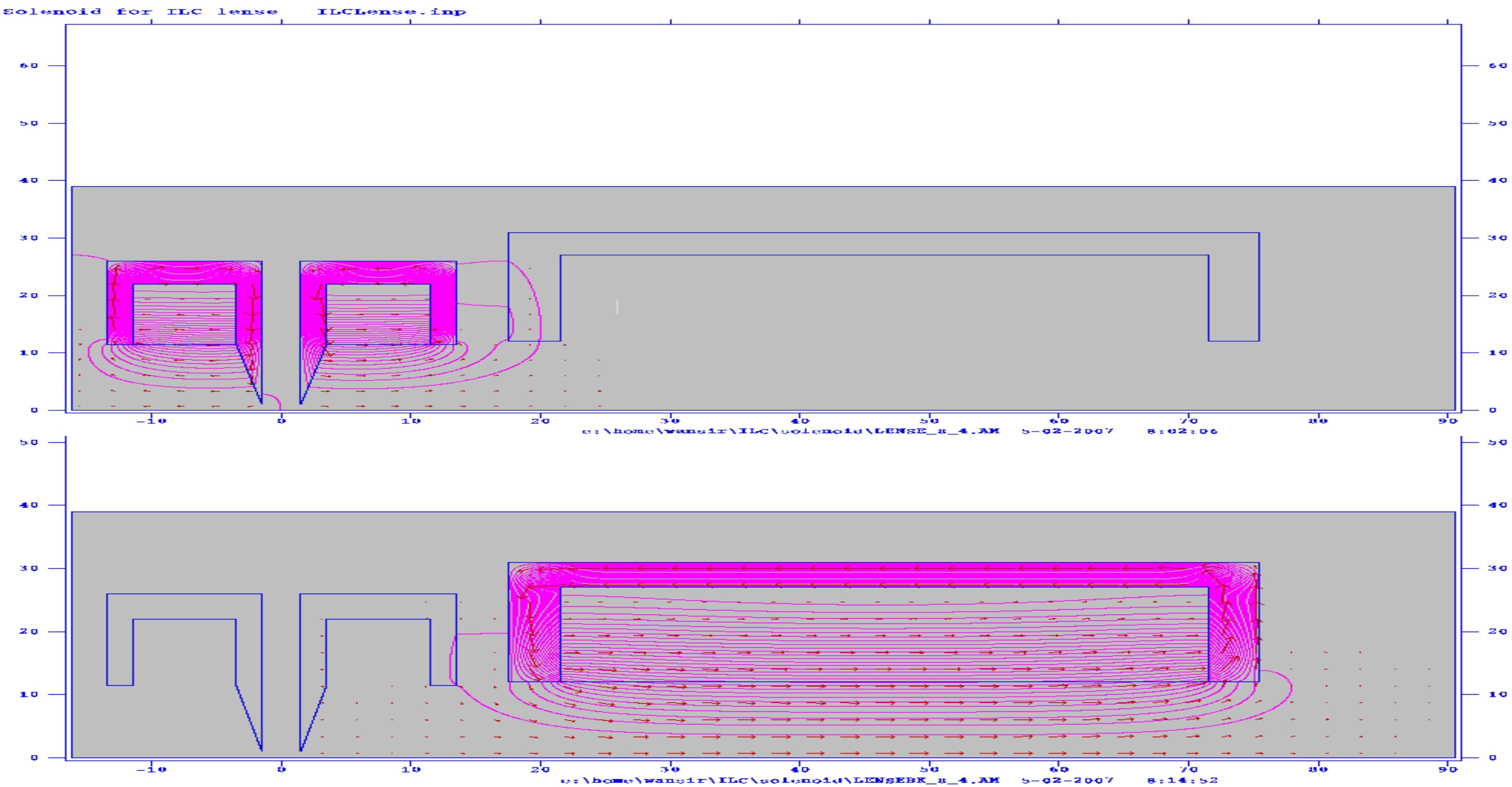
When B0 of AMD is >5.5T, 100m long undulator will give us a yield of 1.5

150GeV drive beam, flux concentrator, Non-immersed target

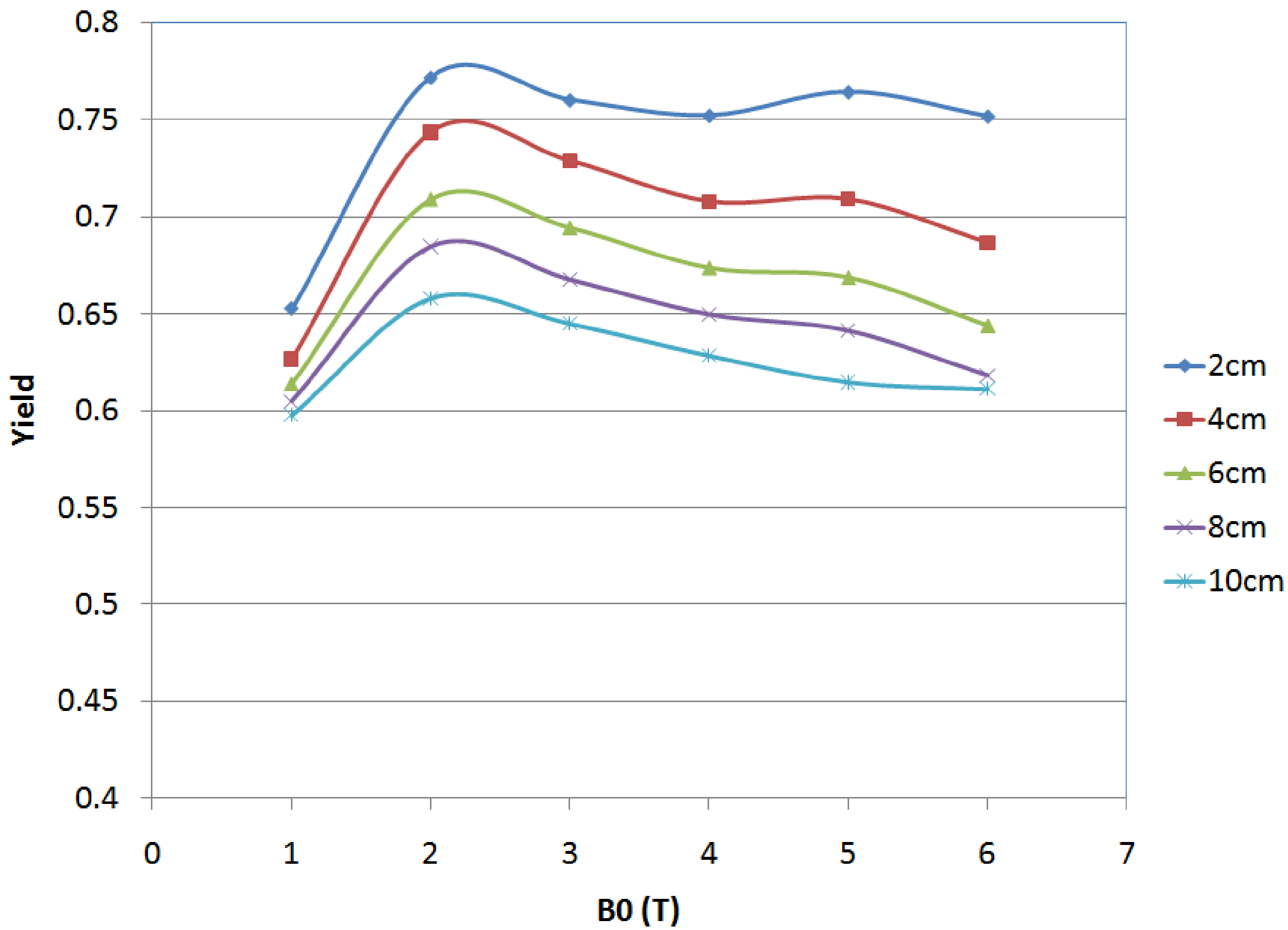


For 100m undulator, with flux concentrator, the yield maximized at about 1.1. In order to have a yield of 1.5, we need about 137m RDR undulator

Magnetic field profile: Superposition of two field maps.

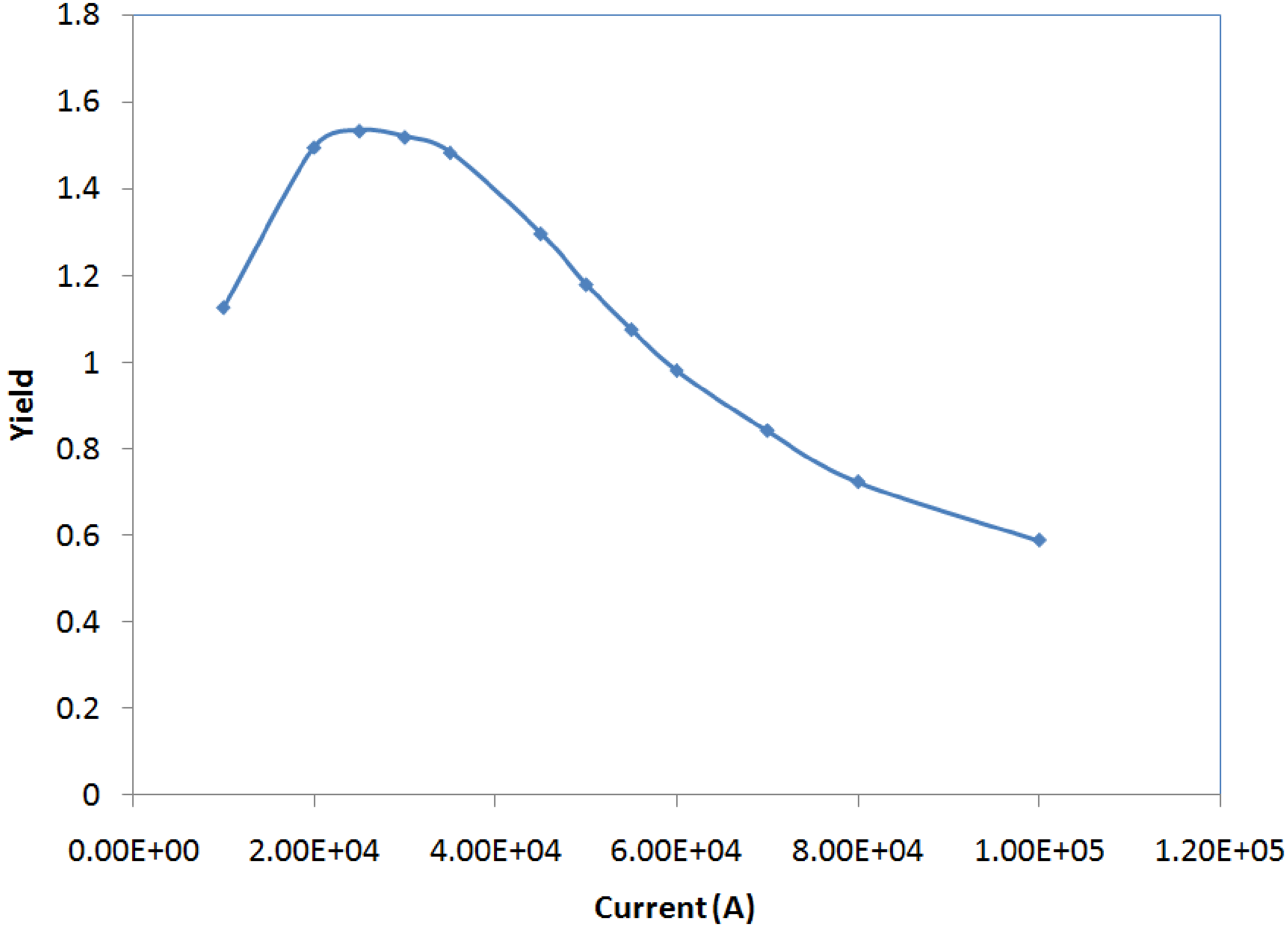


150GeV drive beam, QWT with different length



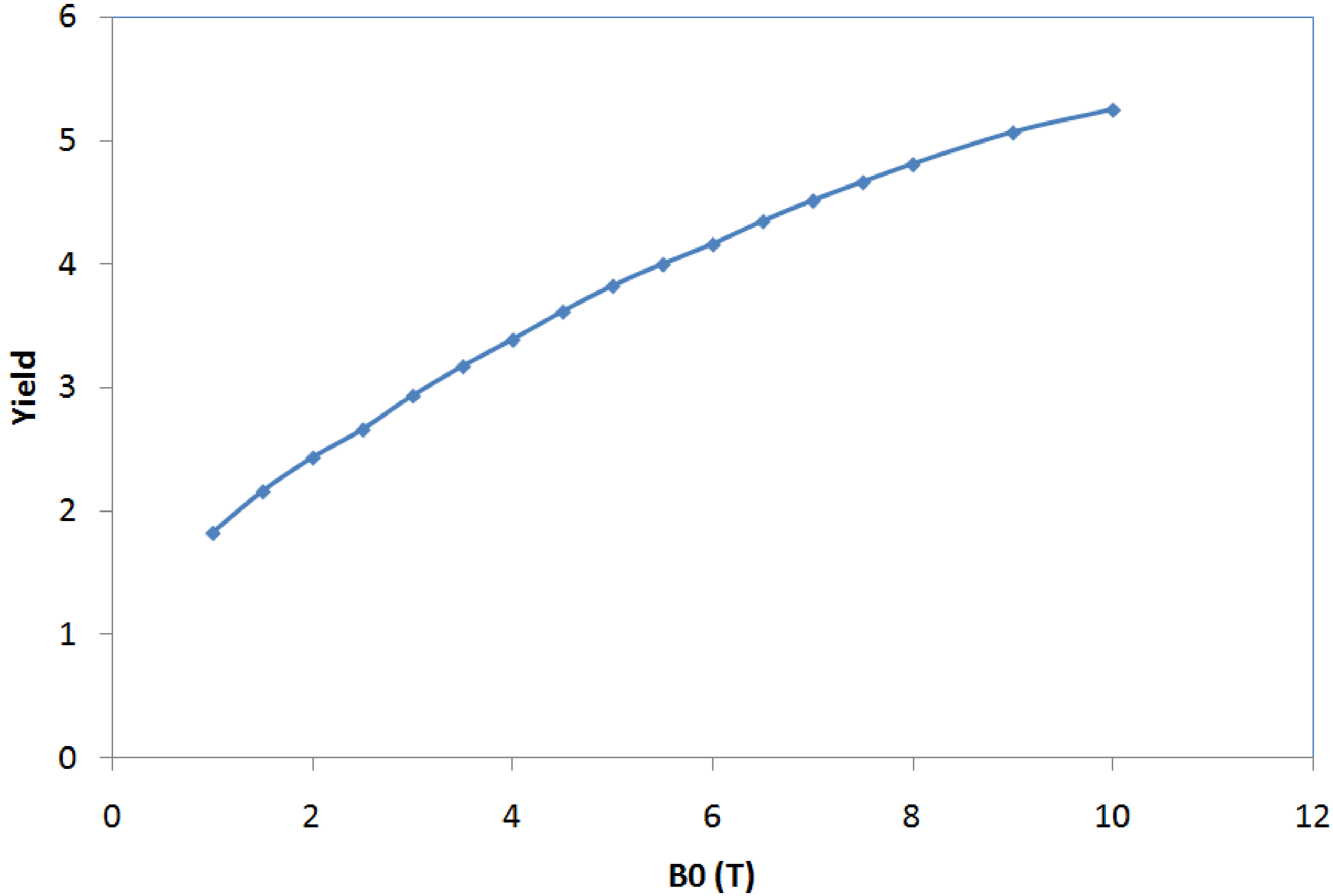
With QWT, assume 1T field, the yield for 100m long undulator will be about 0.65. In order to have a yield of 1.5, we need about 231m RDR undulator.

150GeV drive beam, lithium lens



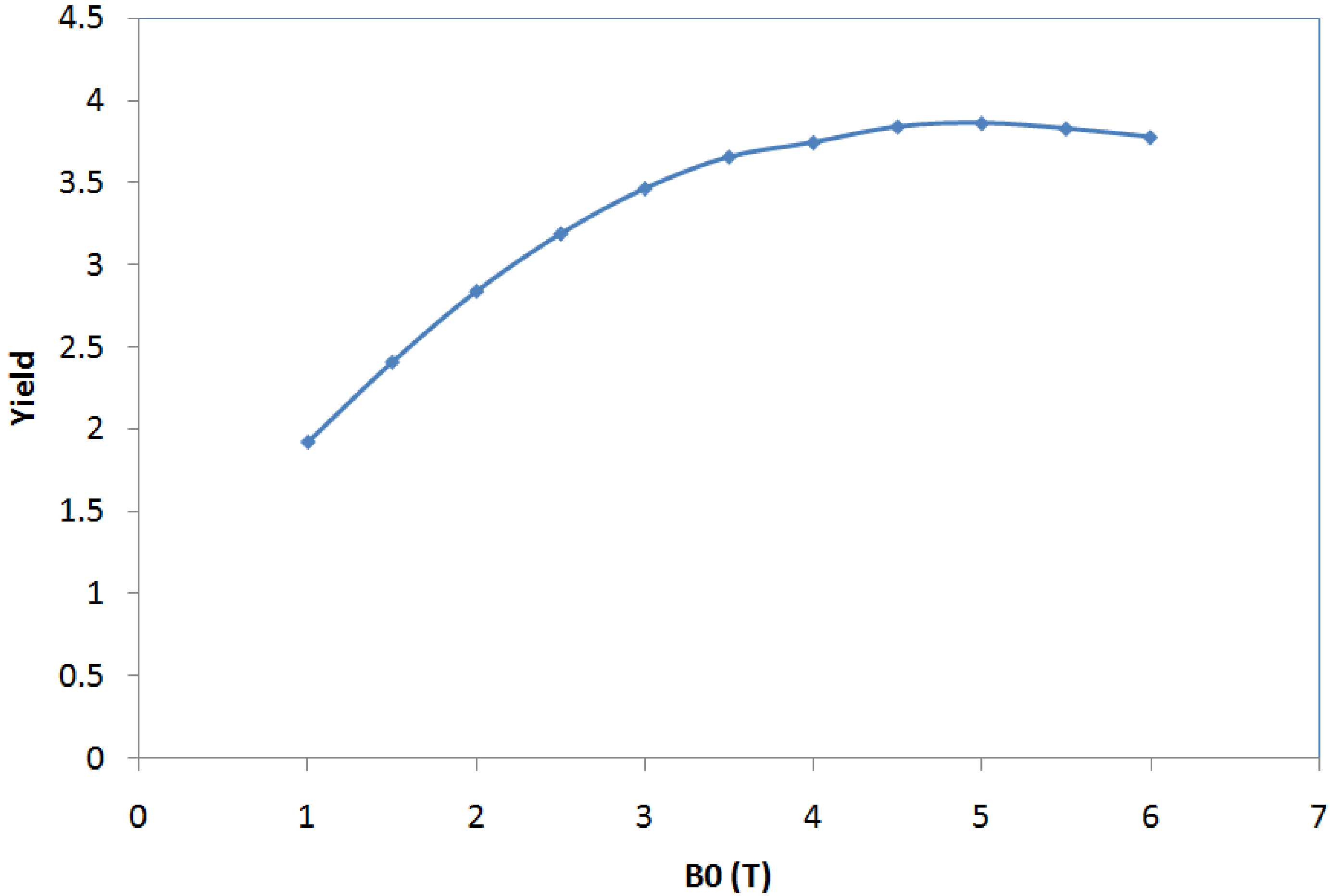
With lithium lens, a yield of 1.5 can be reached by using 100m RDR undulator with a lithium lens driving by about 30KA current

250GeV drive beam, AMD, immersed target



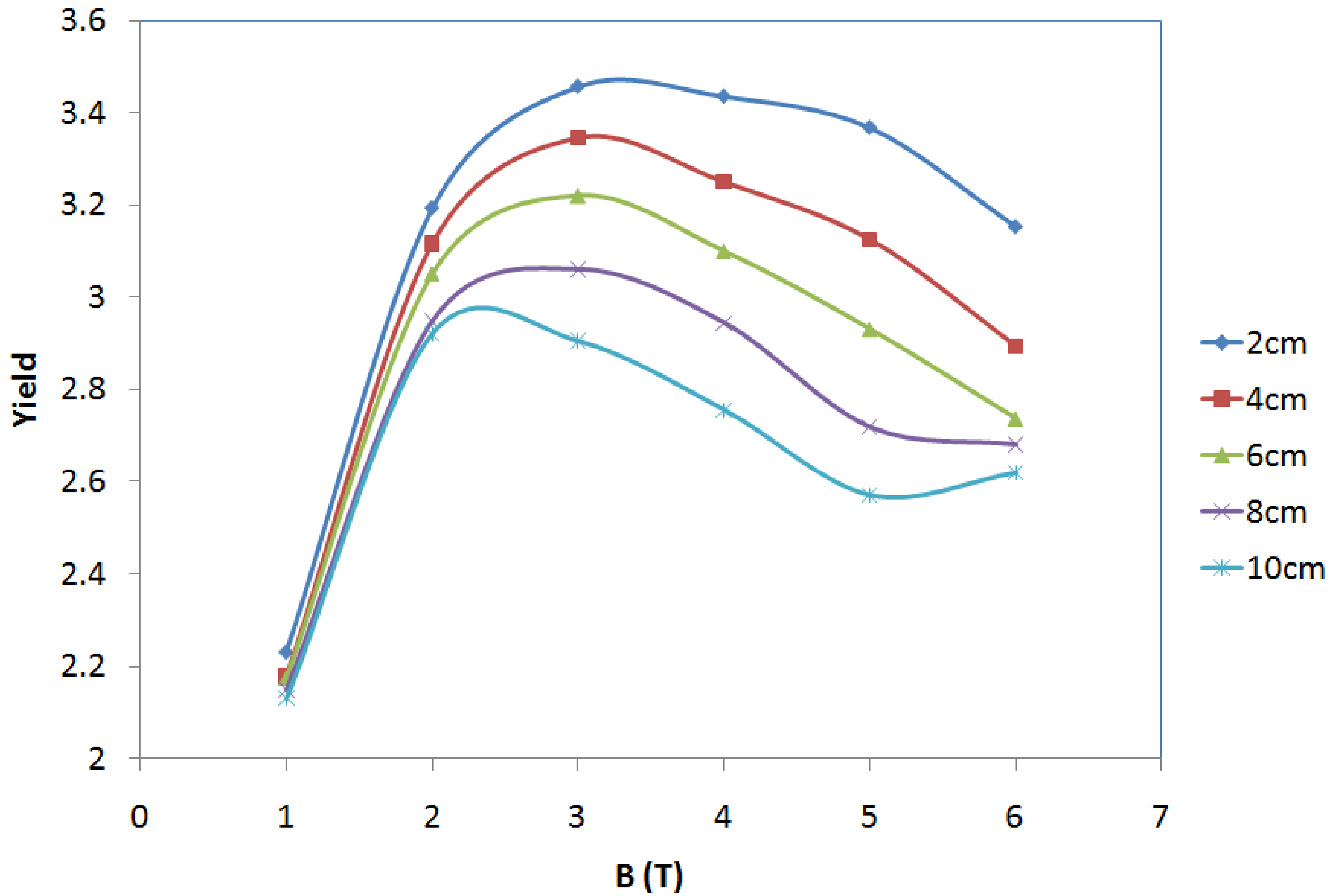
With a AMD field of about 6T, the yield for 100m undulator will be about 4. In order to have a yield of 2, we need only 50m long undulator with an AMD field of 6T.

250GeV drive beam, flux concentrator, non-immersed target



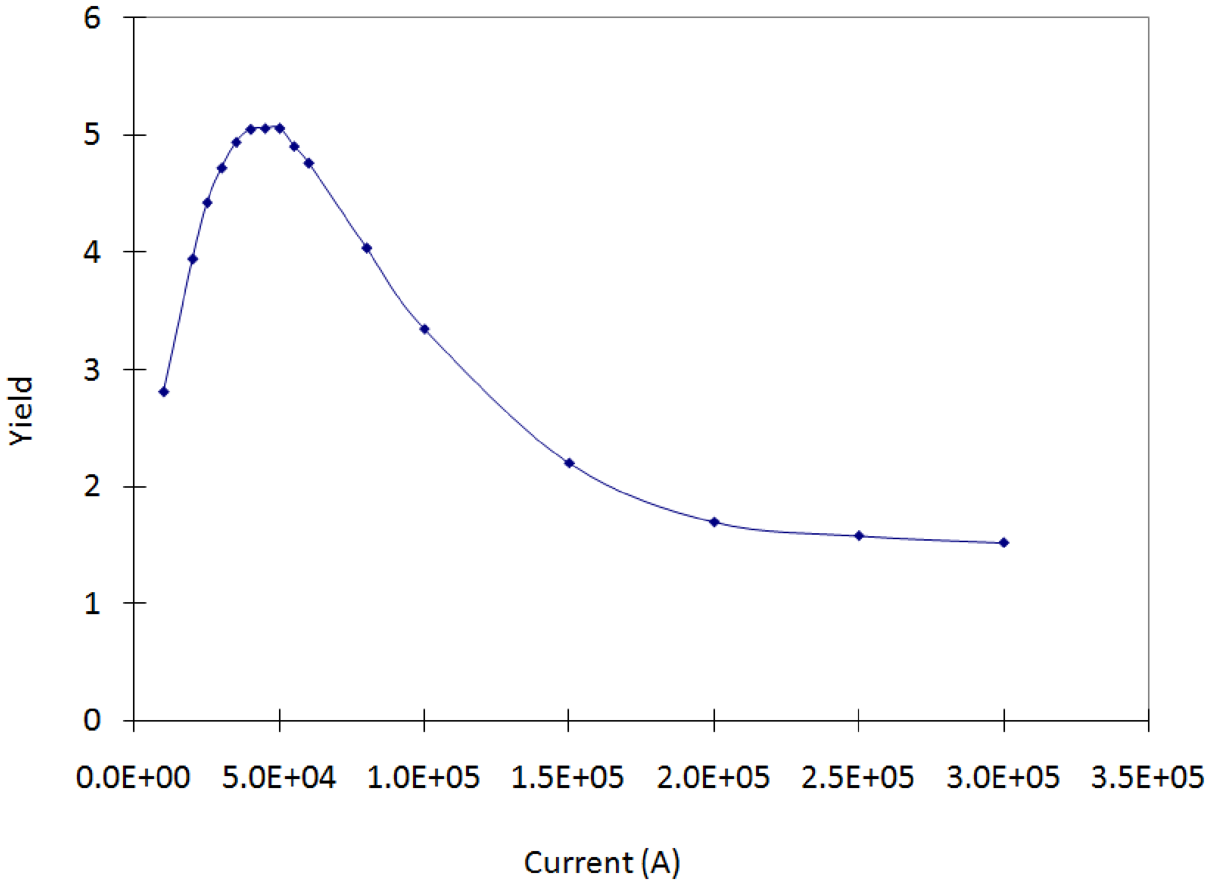
With non-immersed target, the yield of 100m long undulator maximized at about 3.8. In order to have a yield of 2, we need about 53m long undulator.

250GeV drive beam, QWT with different length



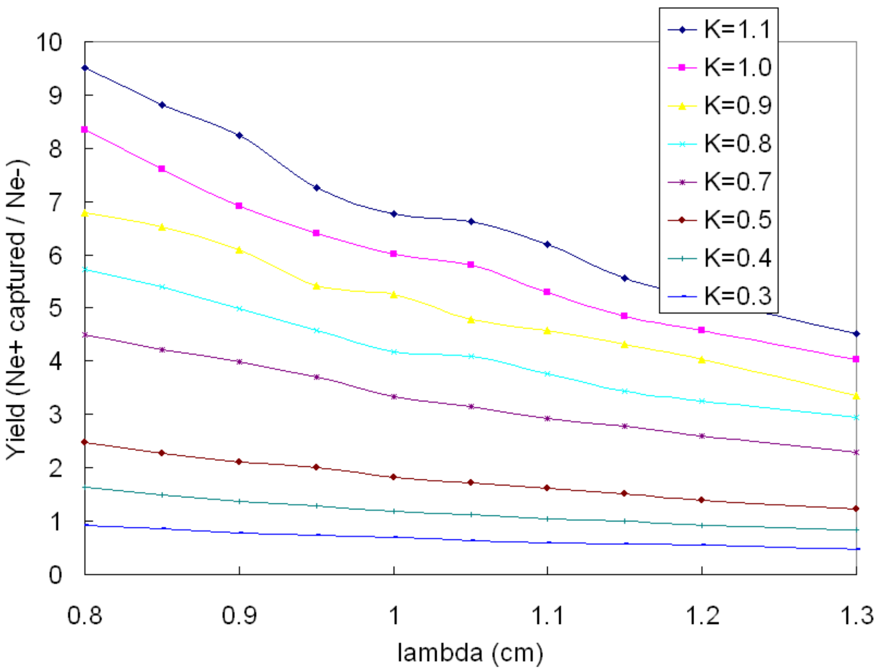
The yield of 2 can be reached with QWT and 100m long RDR undulator driven by 250GeV beam

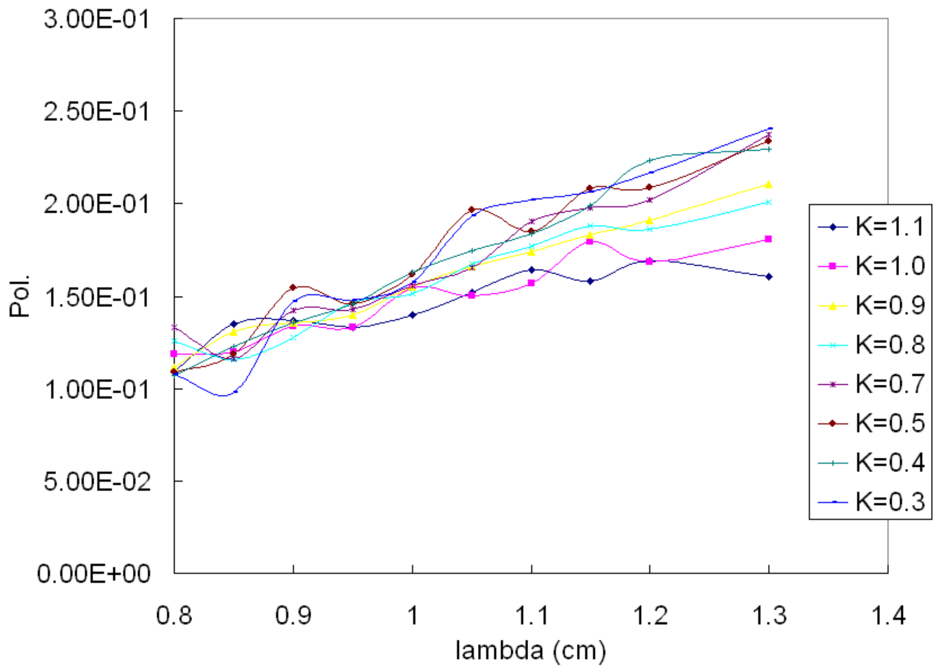
250GeV, Lithium lens



With lithium lens driving by about 40KA current, 100m long undulator gives us a maximized yield of about 5. A yield of 2 can then be achieved with 40m long undulator.

250 GeV drive e- beam, No photon collimator, AMD 6T-0.5T, 14cm

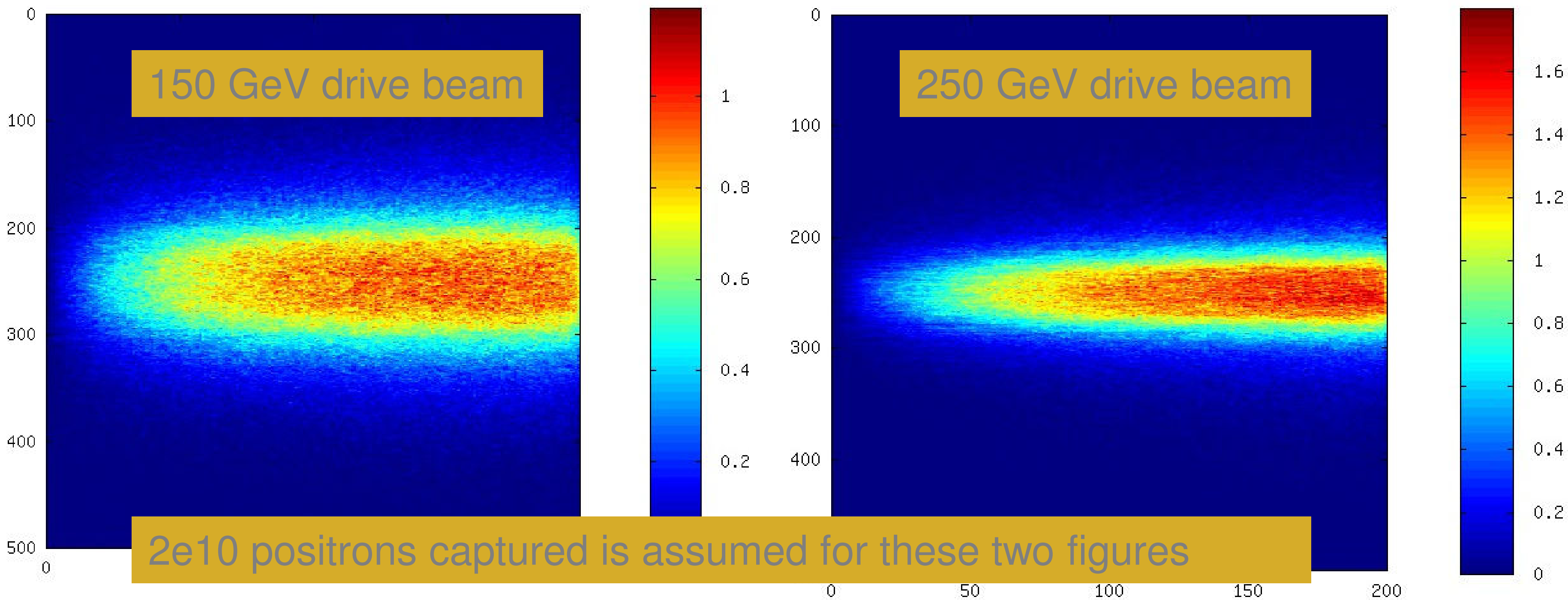




When driven by 250GeV, undulator based positron source can easily have a yield higher than 1.5 when using AMD. If there is no photon collimation, the polarization will be lower than using 150GeV drive beam.

Since γ has increased by 2/3, the opening angle of photon beam will reduce by 40% and the target need to move further down stream to keep the thermal loading on target the same as using 150GeV drive beam.

Energy deposition profile
RDR undulator, AMD immersed Ti target



For 1 positron captured, using 250GeV drive beam with RDR undulator, the deposited energy in Ti target will be ~62.8MeV which is lower than the 101MeV energy deposition when using 150GeV drive beam. But due to the smaller opening angle, as shown in the figures, the energy density for 250GeV drive beam is ~60% higher than that from 150GeV drive beam. Target needs to be further down stream in order to keep the heat loading the same.