Summary Talk at PITZ

From September 1, 2013 to August 30, 2014

- **Courses at HU-Berlin**
- **Astra Simulation of Plasma Acceleration**

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Zeuthen, 07.08.2014

HELMHOLTZ ASSOCIATION

DESY

Courses at HU-Berlin

- 4 courses participated including 1 experiment course, 2 theory courses and also 1 combined course
- Two semesters, WS2013 & SS2014
- All passed
- 32 studying points

Courses	Period	Points	Grades/Points	Catalogue
Solid State Physics	WS2013	8	3.7	Expe.
Theoretical Physics	WS2013	6	2.0	Theo.
Electrodynamics and Special Relativity	WS2013	6	3.0	Theo.
Quantum Physics	SS2014	12	2.0	Combined

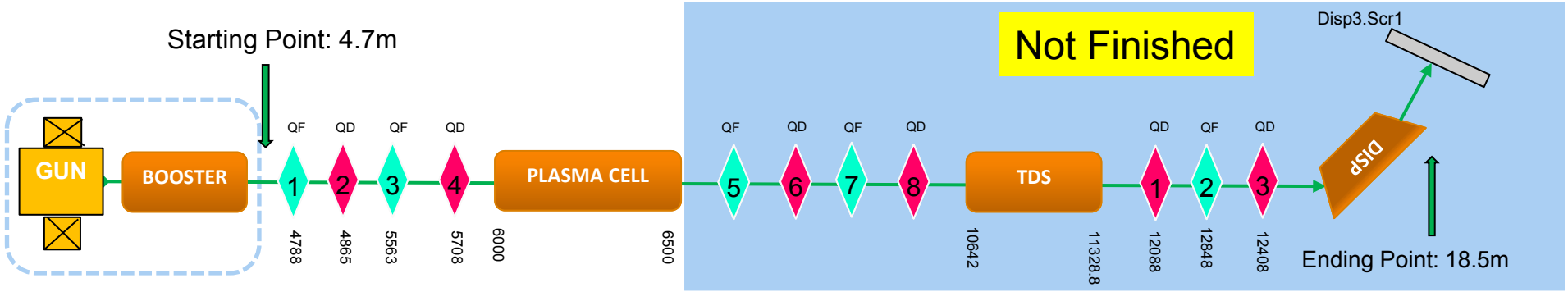
Astra Simulation of Plasma acceleration

- Astra simulation for the beam focusing before and after the plasma
- To transport the beam downstream cathode to High energy section at 4.7m. 2D space charge routine is used
- 4 quadruples are applied from 4.7m to 6.5m for beam transverse focusing in plasma cell by using 3D space charge routine (Kapton scattering is applied at the first window, 6.0m) to get required beam
- Catch the beam after the plasma cell to further transport though the TDS for the momentum measurements

Overview of the Elements in this Transport System

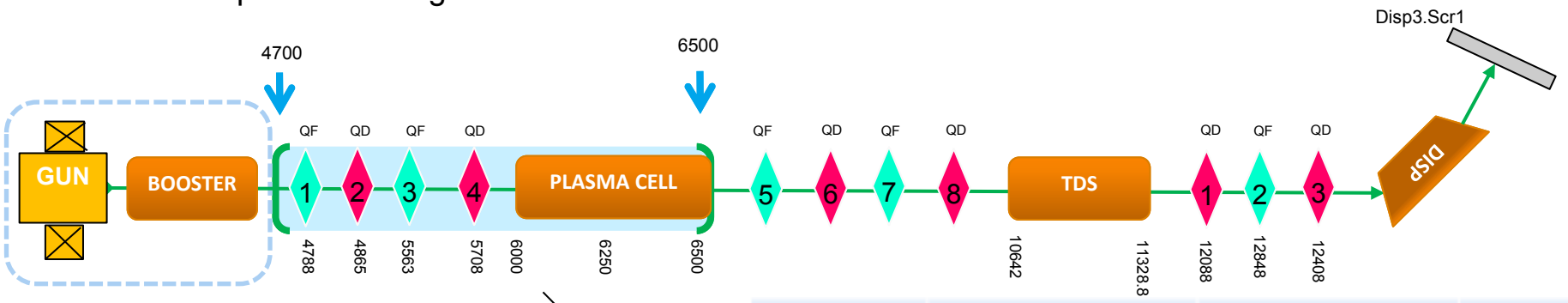
Name	Element	Mid-position [mm]	Strength
HIGH1.Q1	Quadruple Q1	4828	3.5 $[m^{-2}]$
HIGH1.Q2	Quadruple Q2	4970	-18.0$[m^{-2}]$
HIGH1.Q3	Quadruple Q3	5715	98.4$[m^{-2}]$
HIGH1.Q4	Quadruple Q4	5853	-129.8$[m^{-2}]$
	Plasma Cell	6000-6500 6250	
HIGH1.Q5	Quadruple Q5		[T/m]
HIGH1.Q6	Quadruple Q6		[T/m]
HIGH1.Q7	Quadruple Q7		[T/m]
HIGH1.Q8	Quadruple Q8		[T/m]
	TDS	10642-11328.8 10985.4	
PST.QM1	Matching-Quadruple QM1		
PST.QM2	Matching-Quadruple QM2		
PST.QM3	Matching-Quadruple QM3		
	Disp.Scr1	18600	
KS 1		6000	0.18 mrad
KS 2		6500	0.18 mrad

Parameter	Value
Total charge(pC)	-100
Number of Particles	200,000
Bunch length (mm)	1.5
Initial momentum (KeV/c)	13.7
Horizontal rms beam size (μm)	0.3
Vertical rms beam size (μm)	0.3



Before the plasma cell

- 4.7m – 6.5m section
  - As small as possible focused beam in the plasma cell
  - Kapton scattering



HIGH1.Q1	Quadruple Q1	4828	3.5 [m⁻²]
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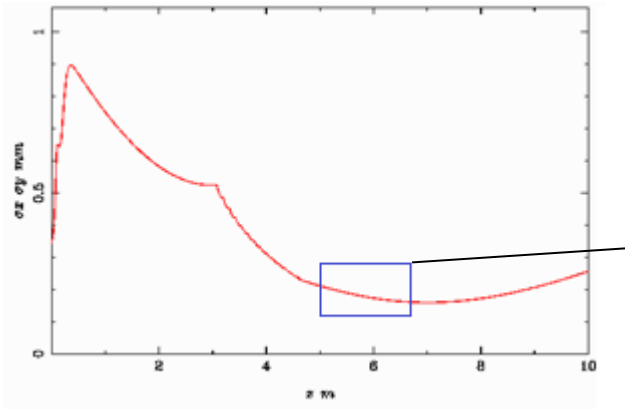
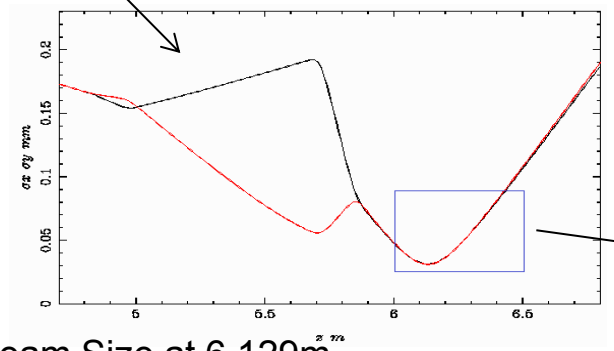
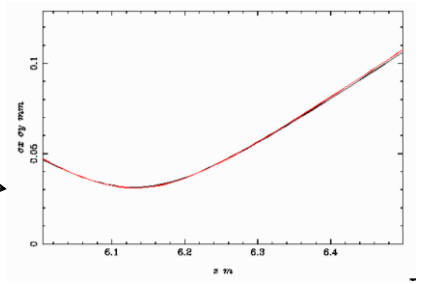
HIGH1.Q4	Quadruple Q4	5853	-130.2[m⁻²]







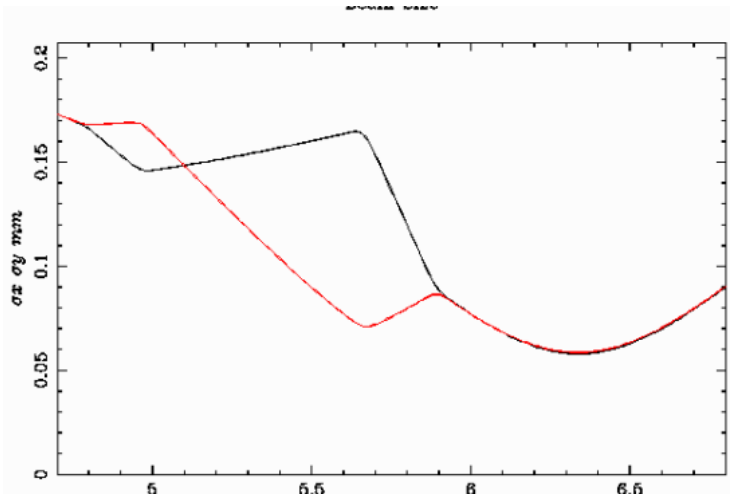
Beam Size at 6.129m

σ_x=31.3μm

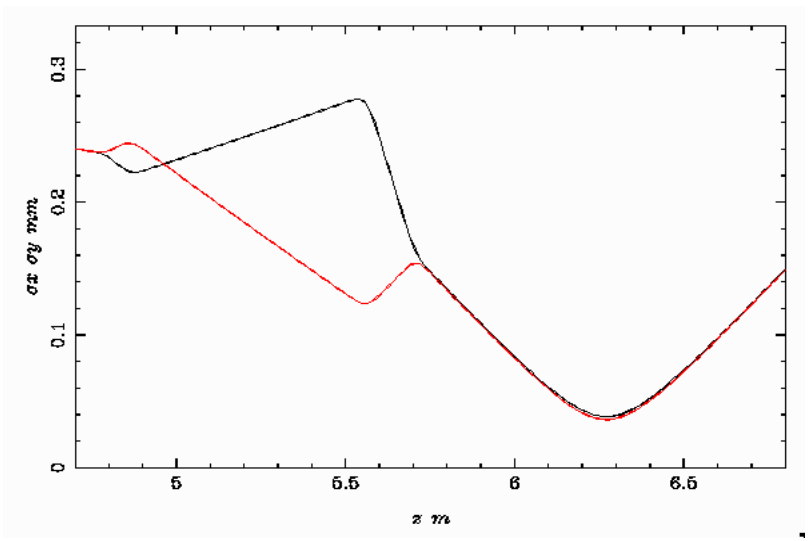
σ_y=31.0μm

σ_{xy}=31.1μm

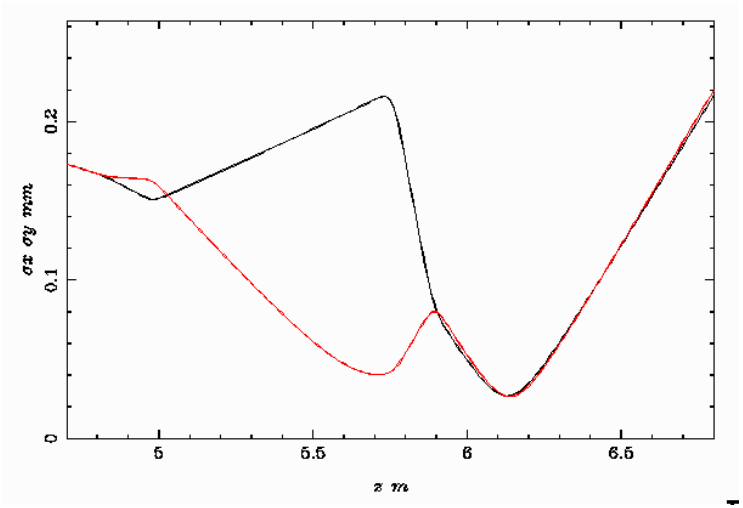
Set-up and Results 1/3: Different Focused Beam



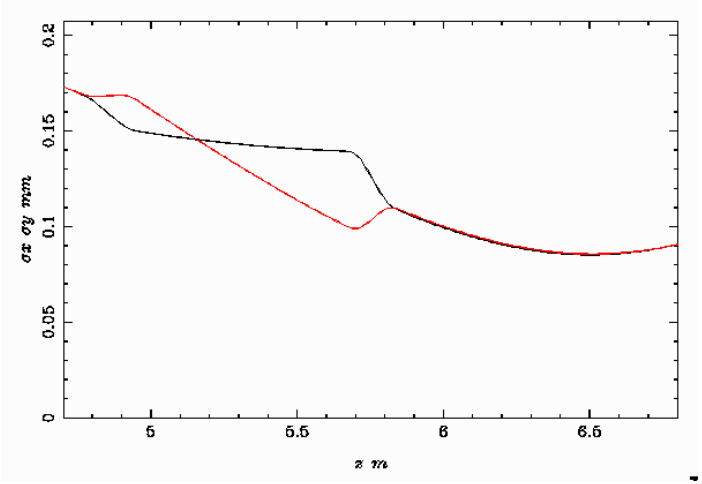
58 um at 6.34m



38 um at 6.25m



26 um at 6.138m



85 um at 6.5m

Summary

- All the required courses are completed successfully
- A simple Astra simulation during the interval of two semesters (1 month)

Thank you so much for warmly giving me help during this year.
All my best wishes for everyone here.