

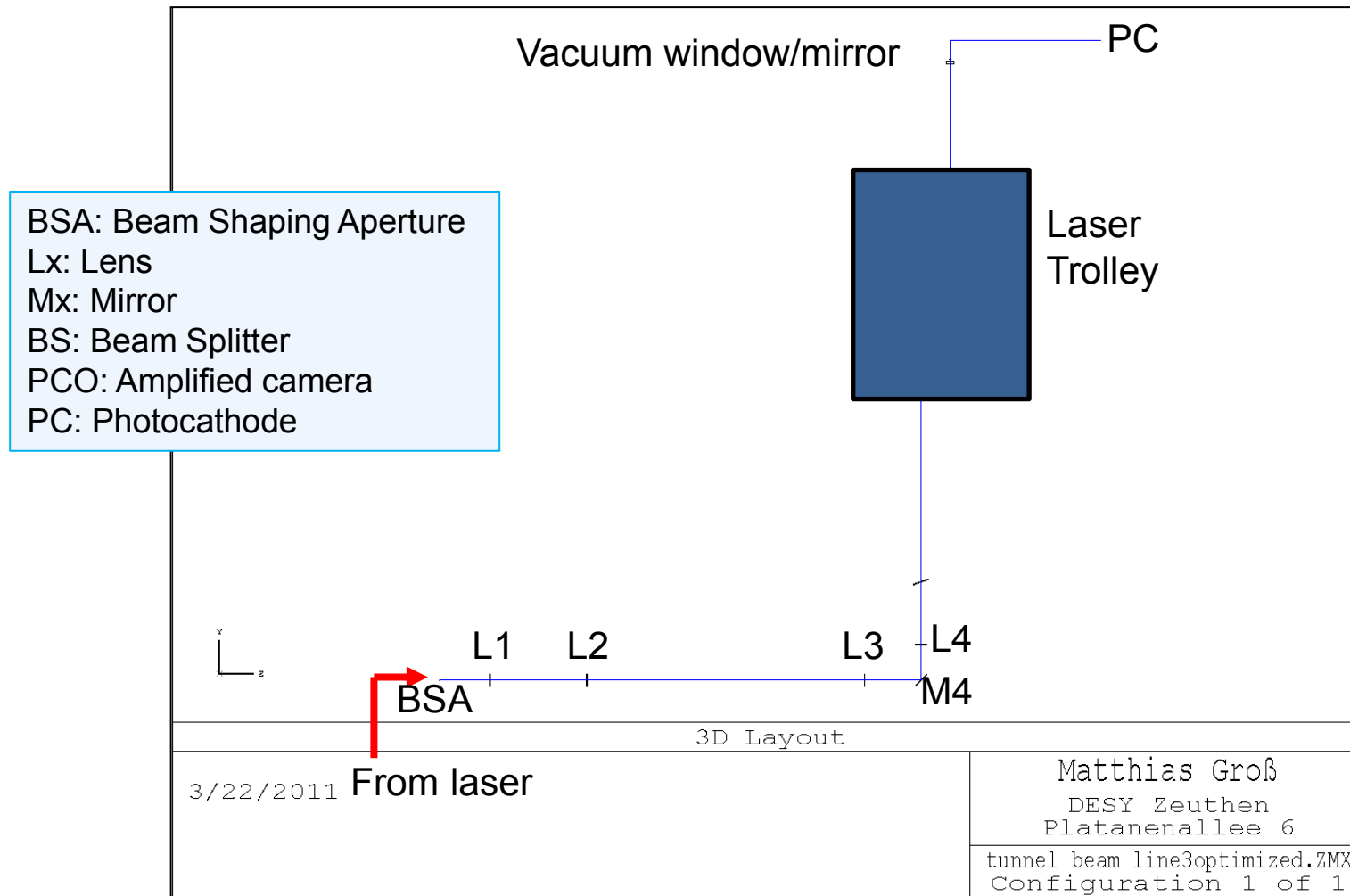
Simulations of the New Laser Beamline between BSA and Photocathode

Upgrade to symmetric 4f beamline à la XFEL

Matthias Gross

Simulations of new laser beamline
PPS, 09. February 2016

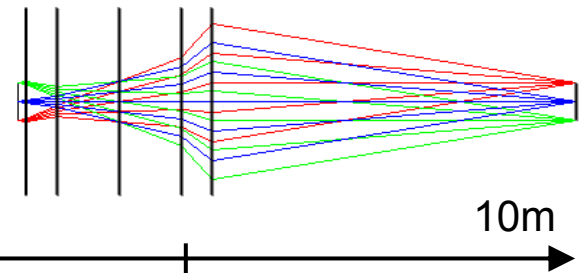
Laser Beam Line Layout in PITZ Tunnel



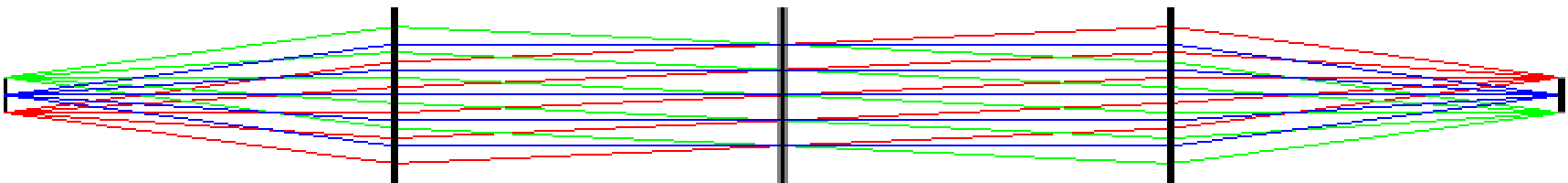
Principle of Upgrade

- > Idea: make beam line symmetric (Details: PPS 19Nov2015) thereby reduce influence of diffraction (see PPS 08April2011)
- > Main restriction: distance of last lens to photocathode has to be at least $\approx 4.5\text{m}$
- > Consequences:
 - Lenses have large focal length f
 - Beam line is much longer

Current setup: 4 lenses with $f = \pm 750\text{mm}$ ($9f$)

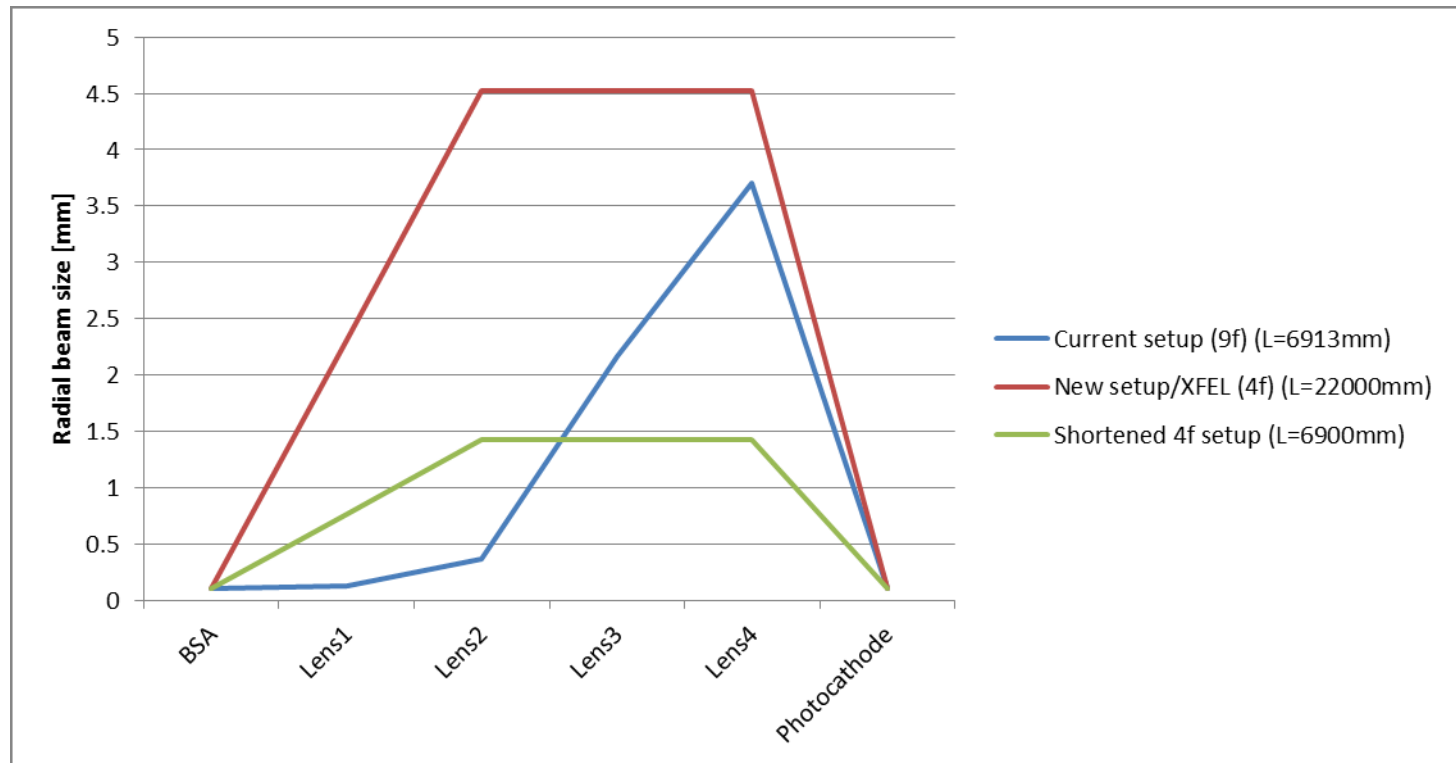


New (XFEL) setup: 2 lenses with $f = 5500\text{mm}$ ($4f$)



ZEMAX Simulations: Paraxial Gaussian Beam Data

- Beam waist at BSA: 0.5mm



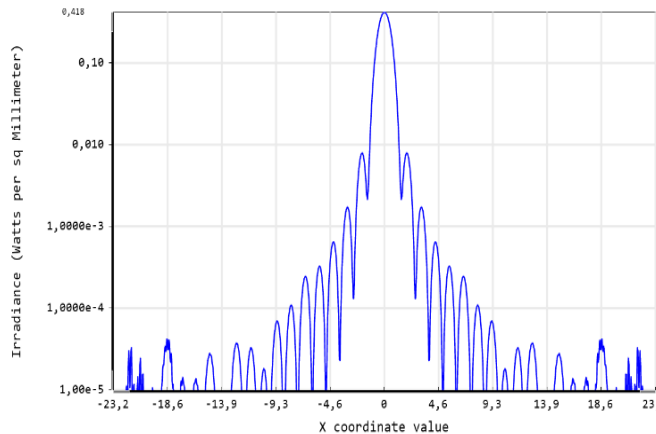
- At lens4: current and new setups about the same – shortened 4f setup better (but not possible to implement)



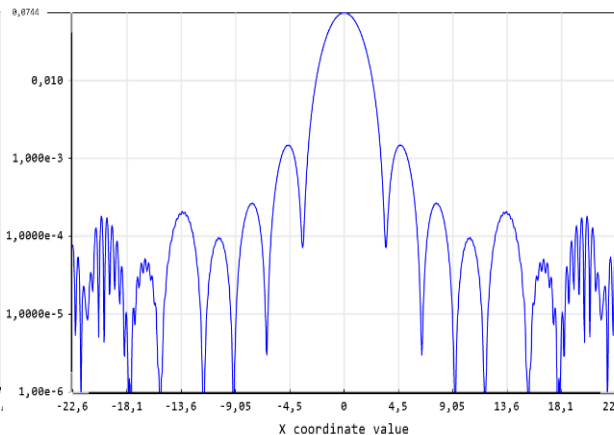
ZEMAX Simulations: Physical Optics Propagation

- At BSA: Flat top with 0.5mm radius – Simulation point: lens4

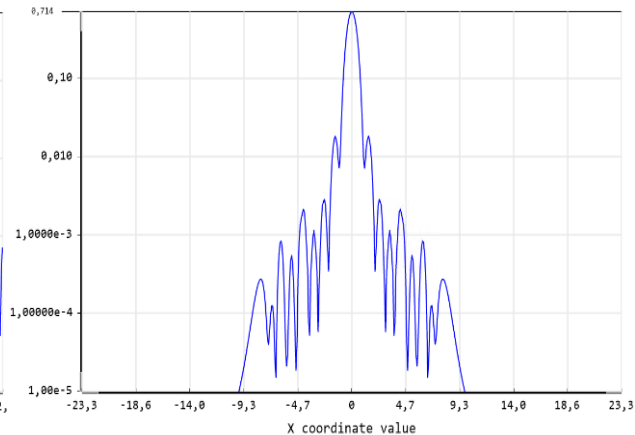
Current setup (9f)



New setup/XFEL (4f)



Shortened 4f setup



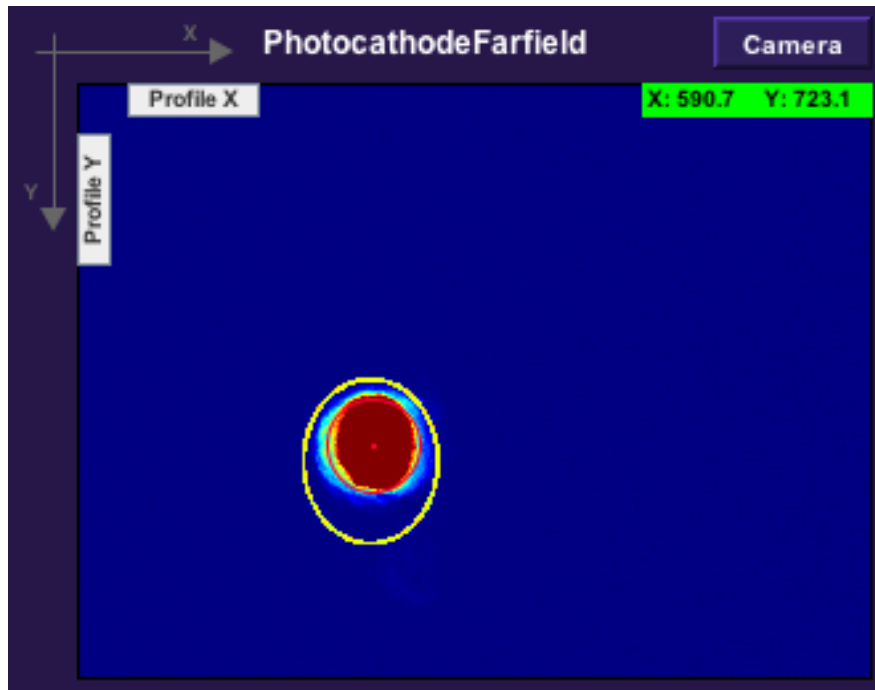
- New setup worse than current setup (wider energy distribution)
- Shortened 4f setup the best



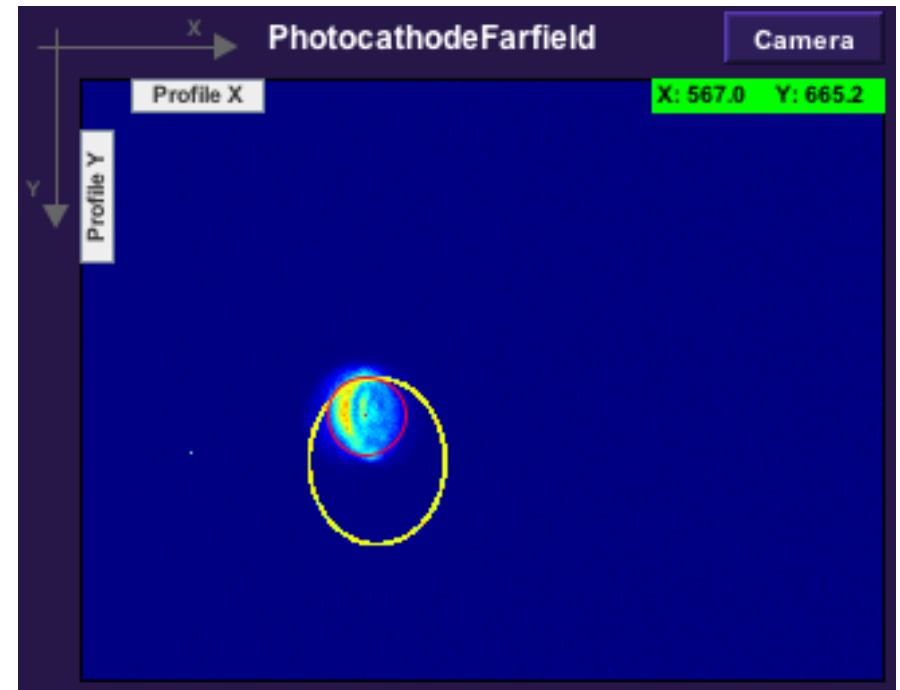
Check: Virtual Cathode Pictures at XFEL

- From XFEL e-logbook

20.01.2016 10:34



19.01.2016 23:07



- Saturated; bad resolution → no good comparison to PITZ

> Summary

- ZEMAX Simulations of current and planned beamline setup after BSA were conducted
- Beam sizes are similar (criterion: beam distribution at last lens)

> Conclusion

- No improvement to be expected regarding influence of diffraction (“rings”)?

> Recommendation

- When setting up new beamline keep possibility to revert to old configuration



> Backup



Irradiance at Photocathode

Current setup (9f)

New setup/XFEL (4f)

