

Electron Beam Final Focus System for Thomson X-ray Sources

Jakob Matthias Krämer
Danfysik A/S, Taastrup, Denmark
jmkr@danfysik.dk



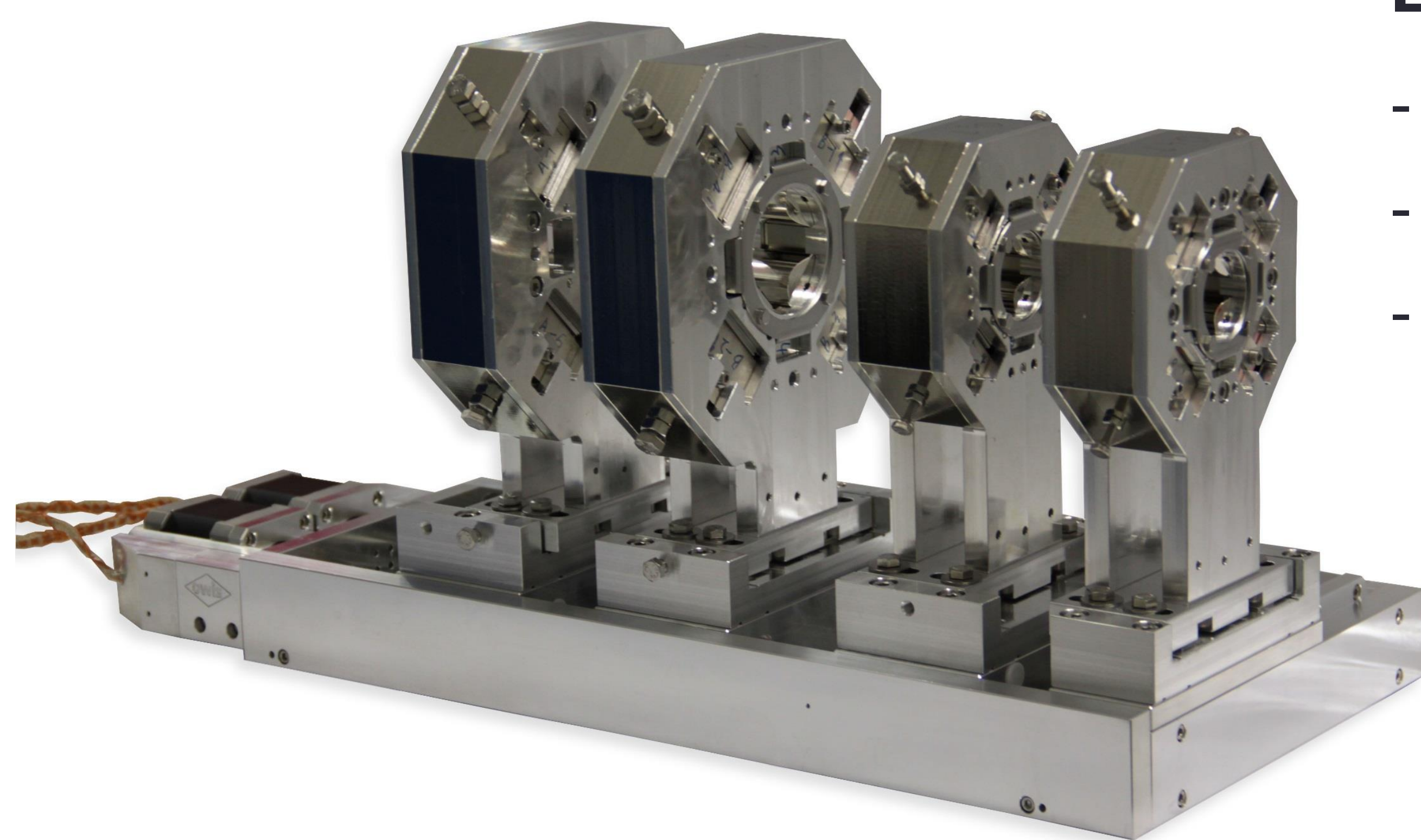
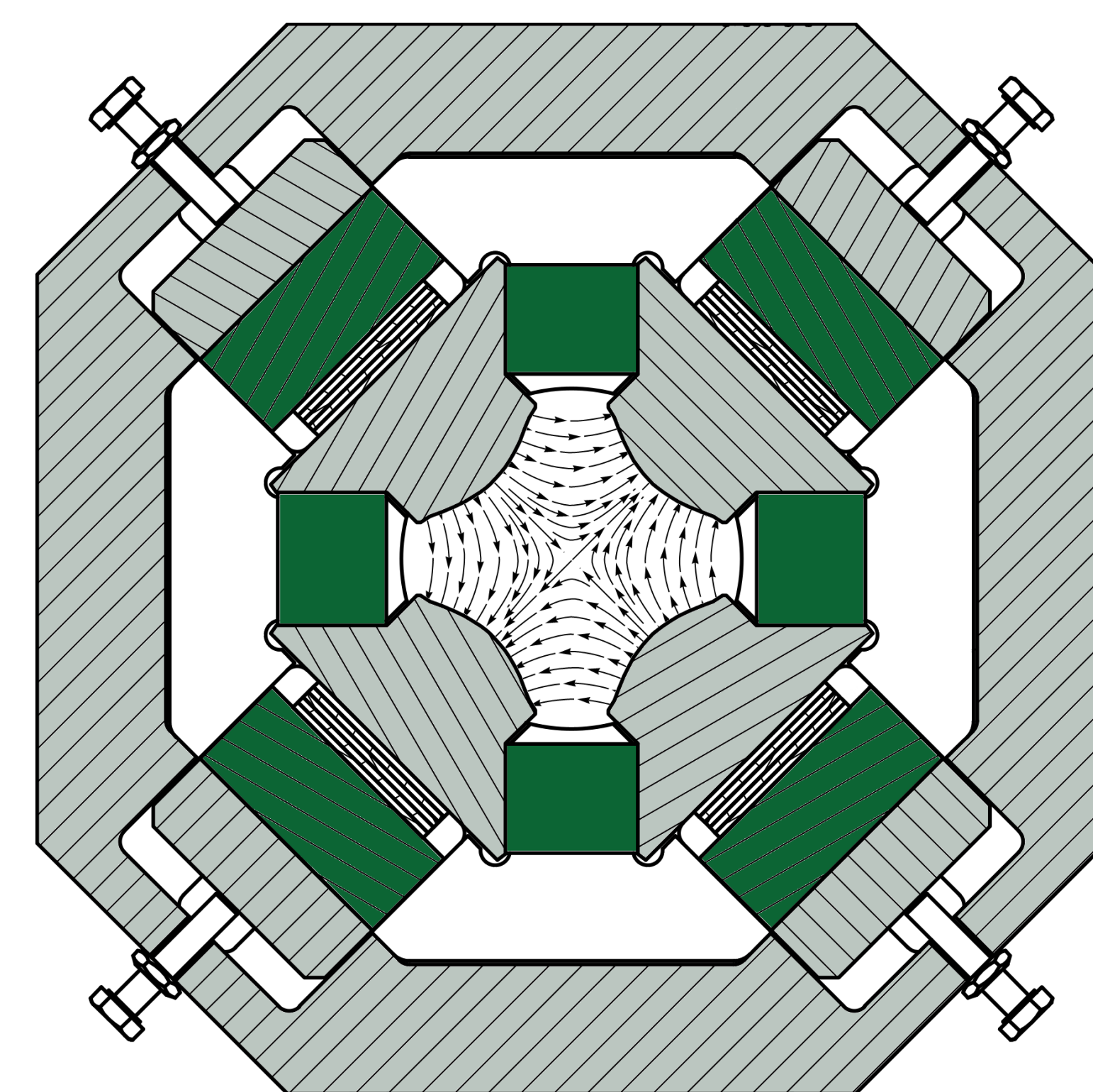
DANFYSIK

INTRODUCTION

For the development of high-flux laser-Thomson backscattering X-ray sources at HZDR, an electron beam final focus system has been developed. By focusing the electron beam to smallest spot sizes, it increases the yield of X-rays from the interaction with the laser.

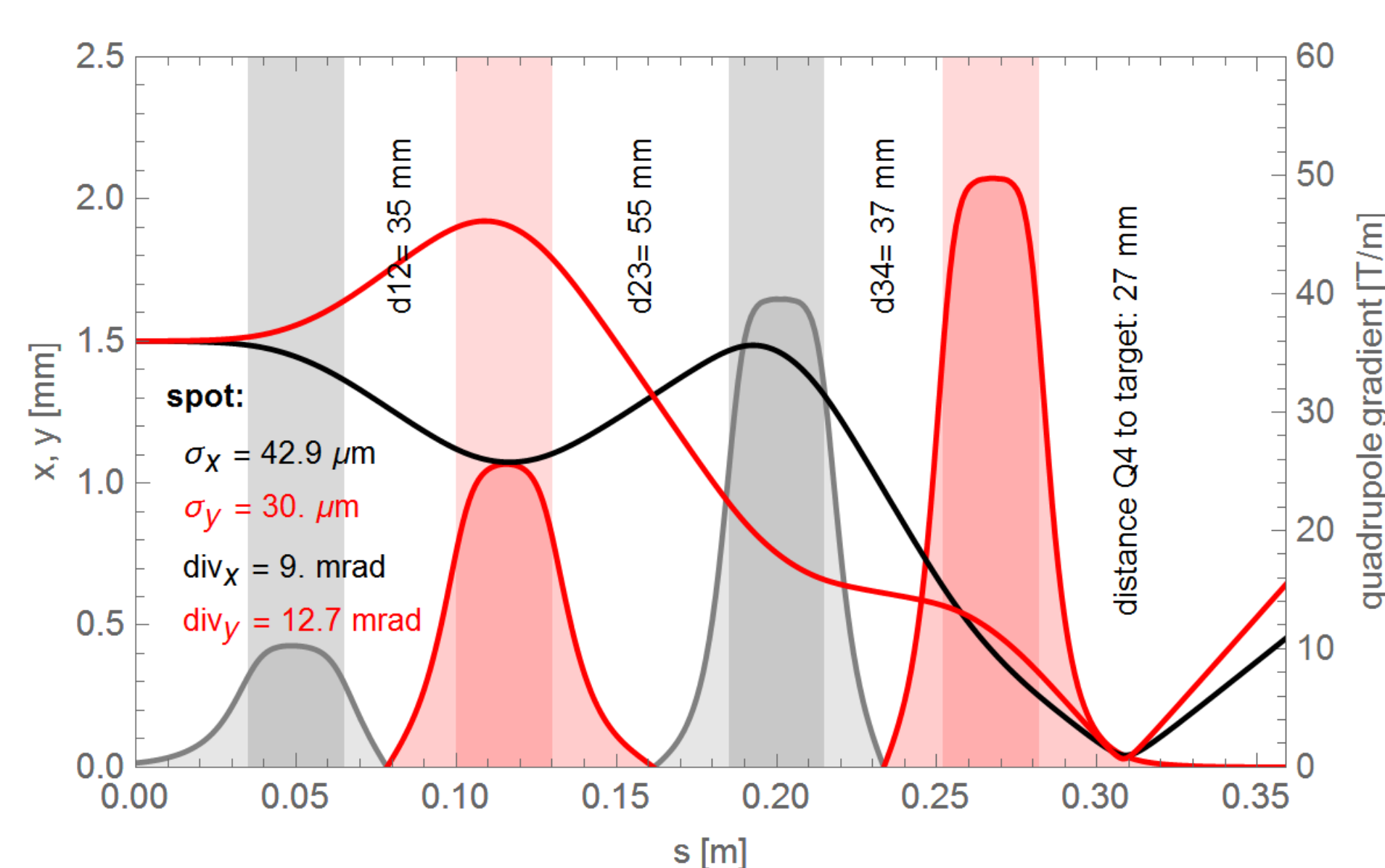
Quadrupoles – lenses for charged particle beams

- Focusing in one plane, defocusing in the other plane
- At least two quadrupoles needed for focusing a beam
- Four quadrupoles for strong focusing with little chromatic aberrations
- Permanent magnets (green) drive the magnetic flux
- Ferromagnetic yoke and poles (grey) define the quadrupole field

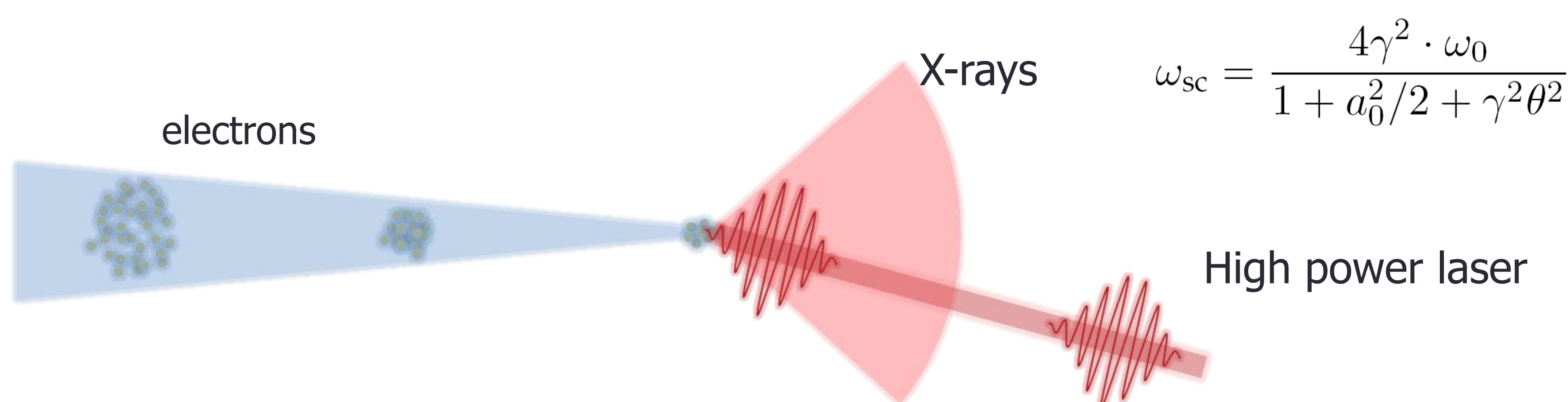


Electron beam final focus system

- Four permanent quadrupoles mounted on a motorized linear stage
- Focal strength changes with distance between quadrupoles
- Small spot size of 40 μm are obtained



Application: Thomson scattering X-ray sources



- Photons from high power laser are backscattered off the electrons
- Photons gain energy proportional to the square of the electron energy
- For our setup, the energy gain is about a factor of 10000
- Challenge: spatial and temporal overlap (40 μm, few picoseconds)

First light 12.05.2015

