Generation of attosecond X-ray pulses with slotted foil in the XFEL

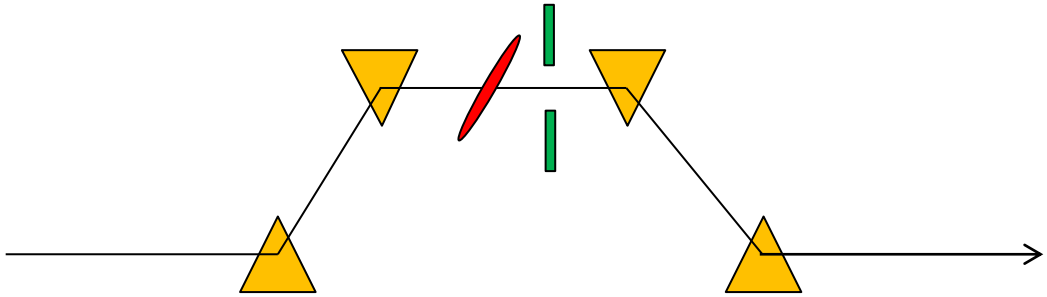
Hyunchang Jin

HELMHOLTZ ASSOCIATION

DESY

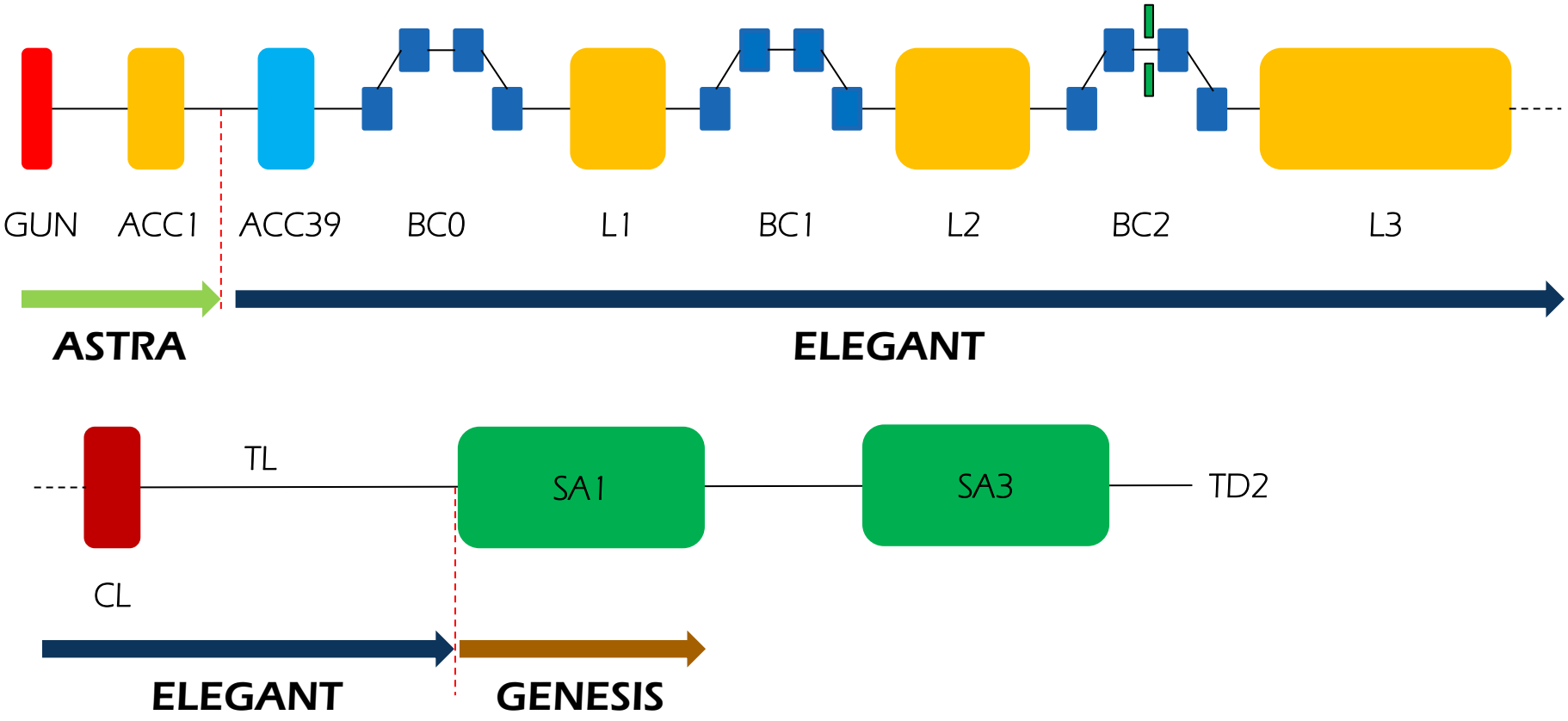
Setup I

- Slotted foil in the middle of BC2
  - Metal : aluminum
  - Thickness : 2.0 μm
  - Gap : 0.3 mm



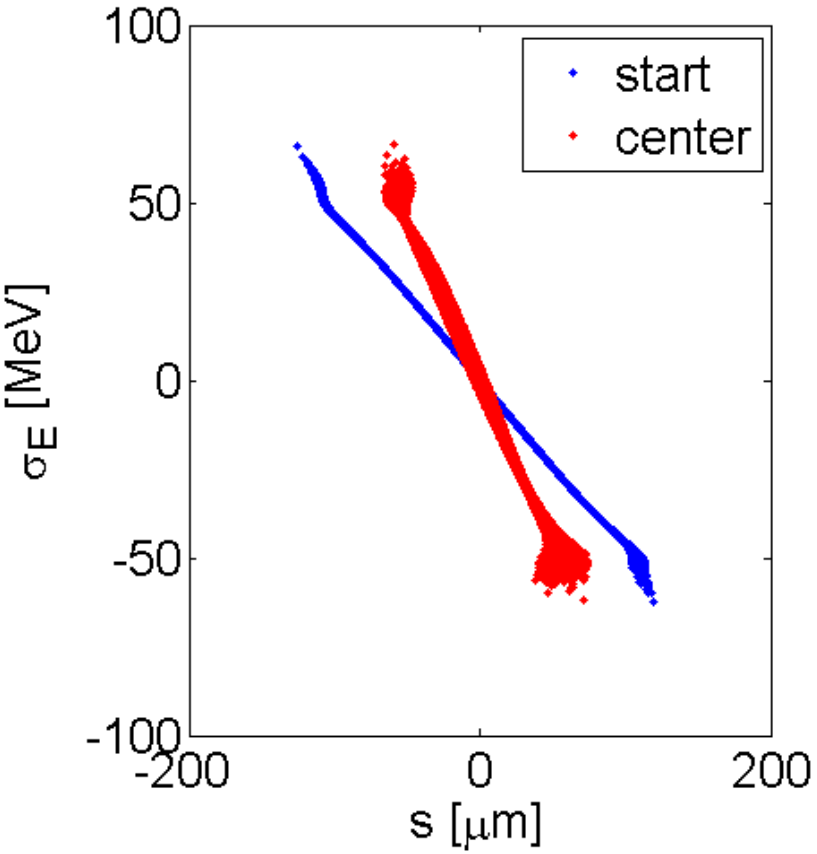
- Beam
  - Charge : 100 pC
  - Macro-particles : 200k
  - Peak current : 10 kA

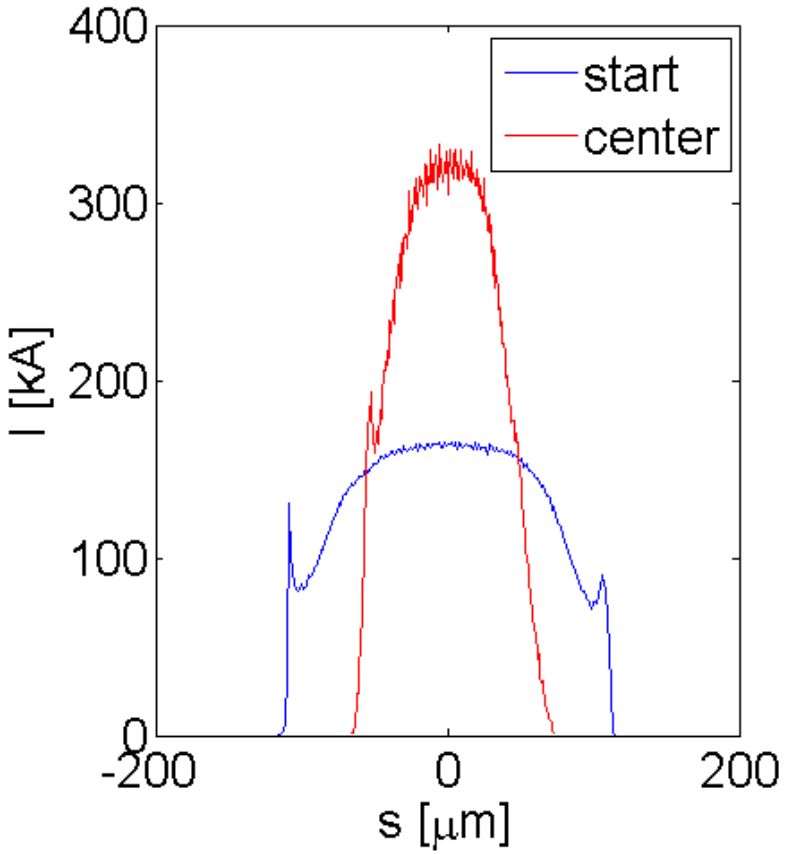
Setup II



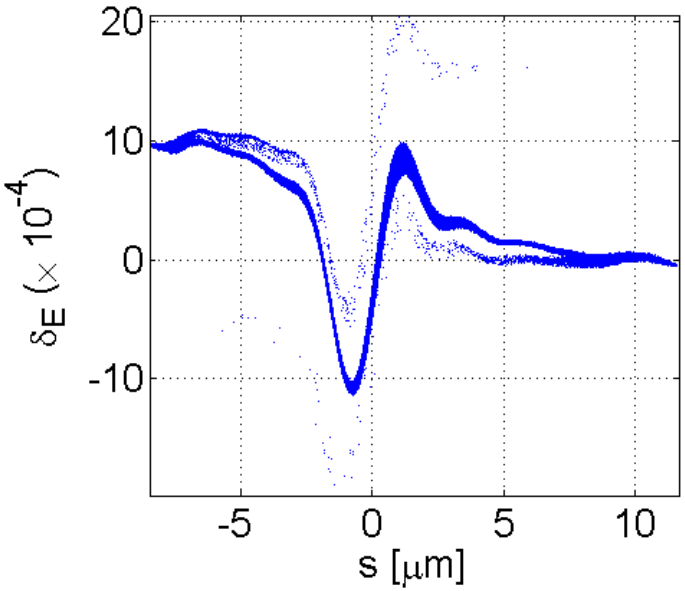
> Collective effects : CSR + LSC + WAKE (RF cavities)

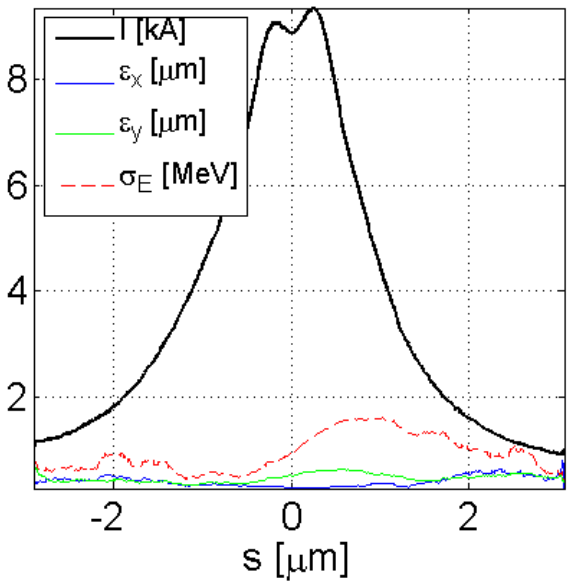
Chirped bunch at start and center of BC2





Beam profile before SASE1 without foil



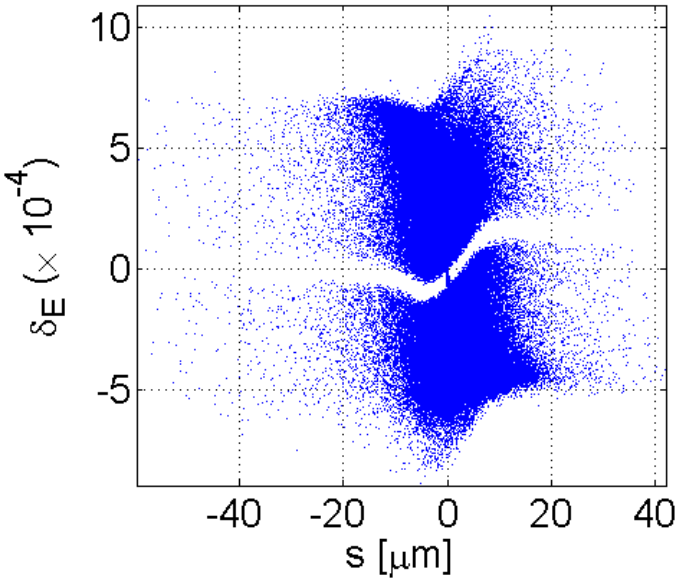


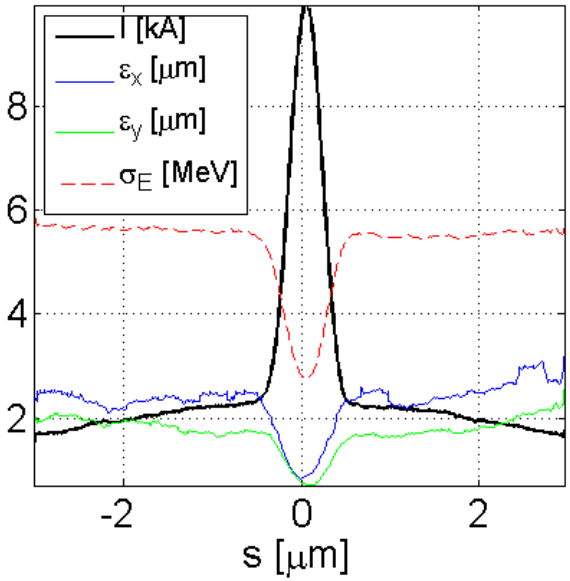
$\varepsilon_{proj,x}$ = 0.56 μm

$\varepsilon_{proj,y}$ = 1.5 μm

FWHM = 6.27 fs

Beam profile before SASE1 with foil



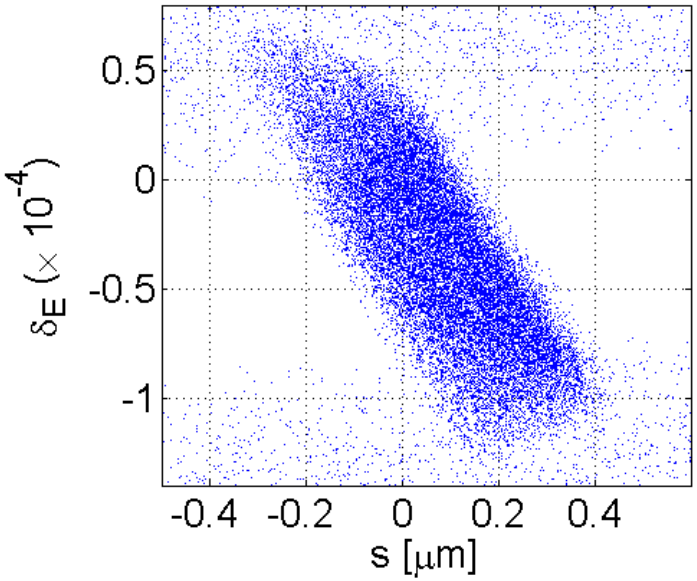


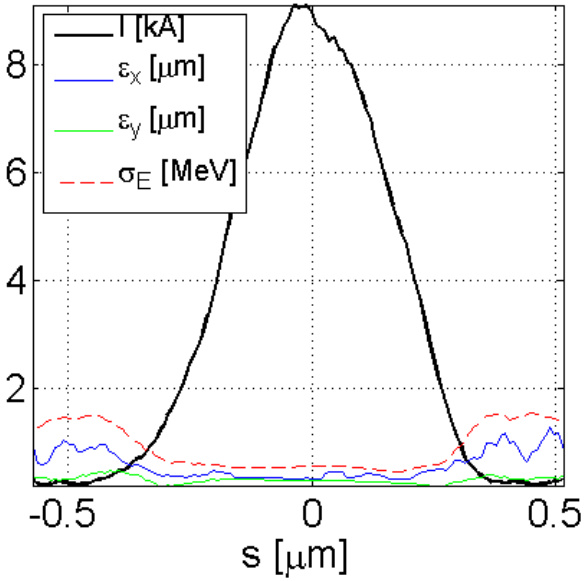
$\varepsilon_{proj,x}$ = 2.1 μm

$\varepsilon_{proj,y}$ = 1.8 μm

FWHM = 1.37 fs

Beam profile before SASE1 with foil unspoiled



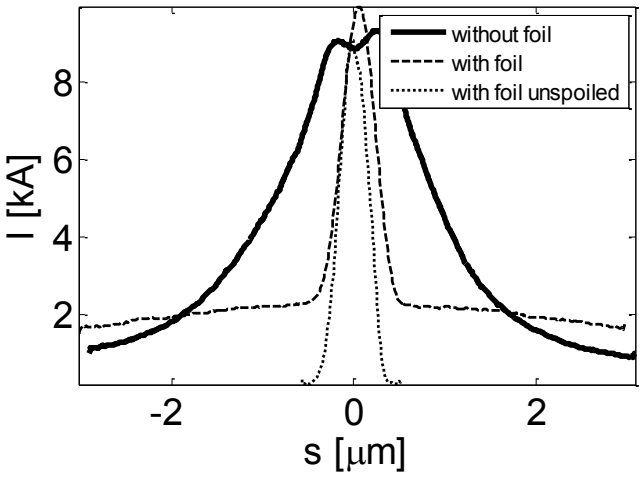


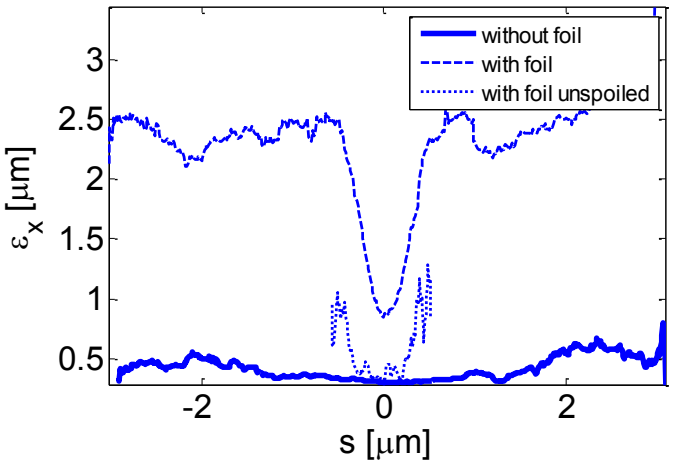
$\varepsilon_{proj,x}$ = 0.46 μm

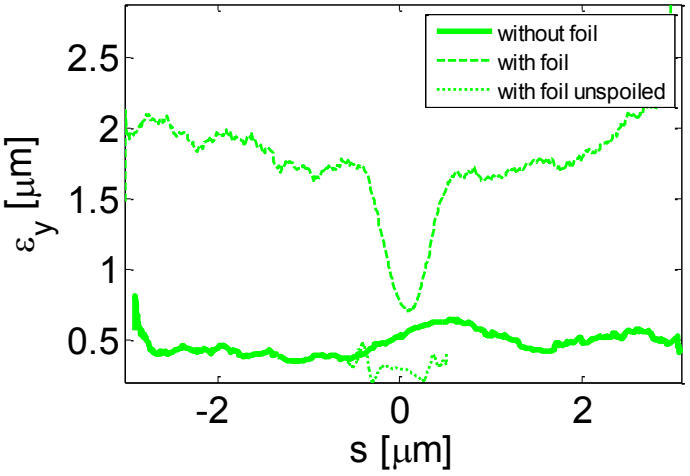
$\varepsilon_{proj,y}$ = 0.34 μm

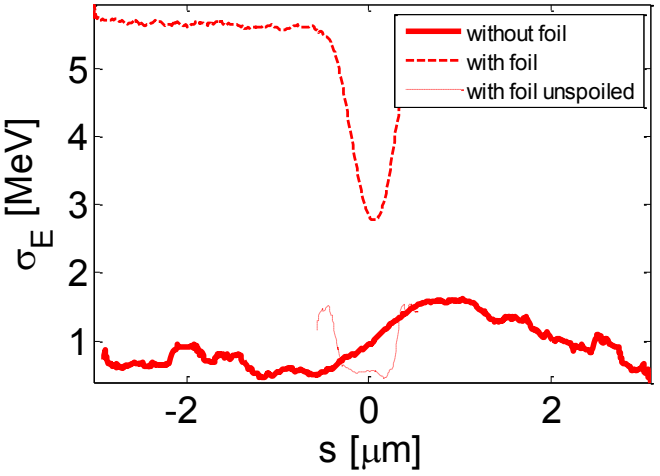
FWHM = 1.17 fs

Comparison between with & without foil



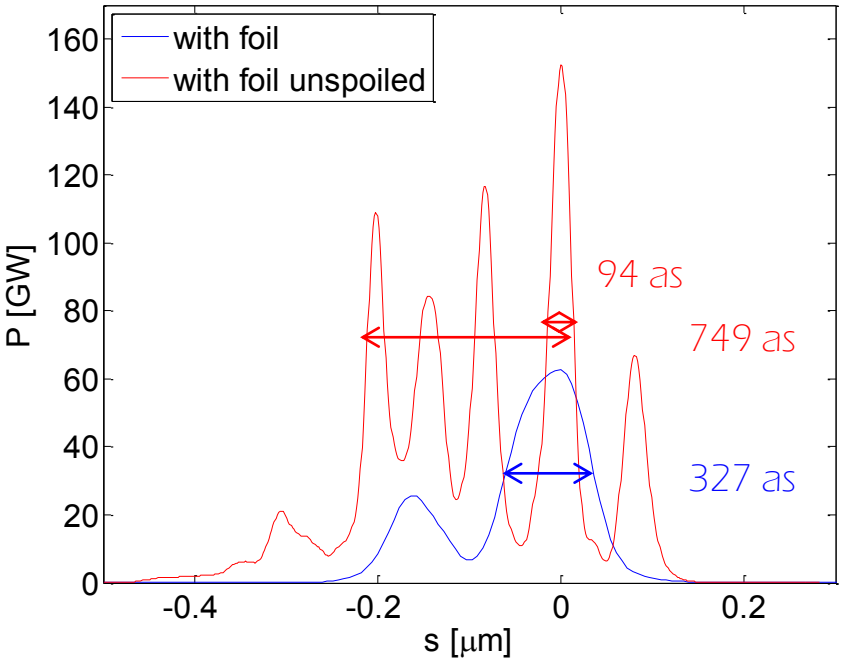




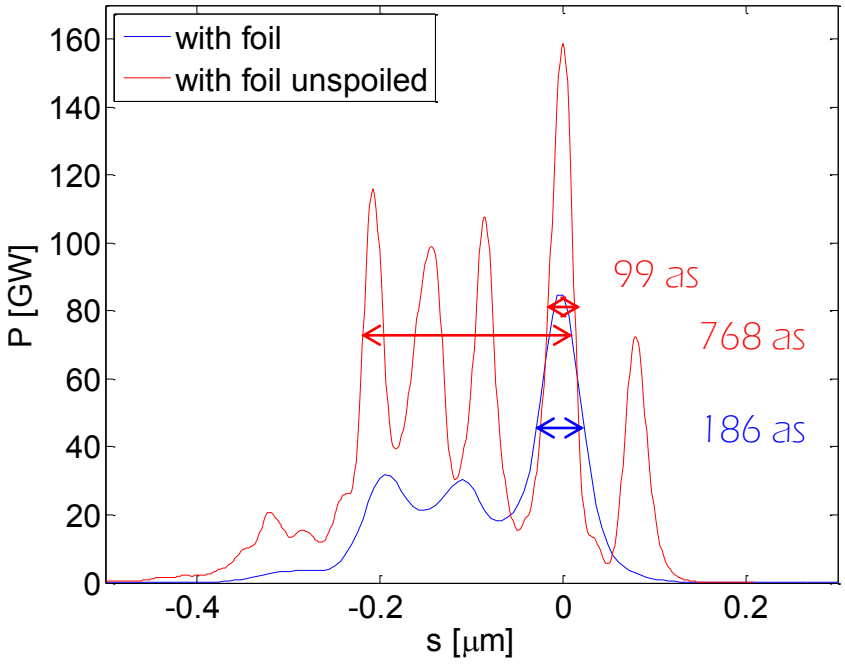


Radiation power

100 m



130 m



Averaged for 10 random seeds