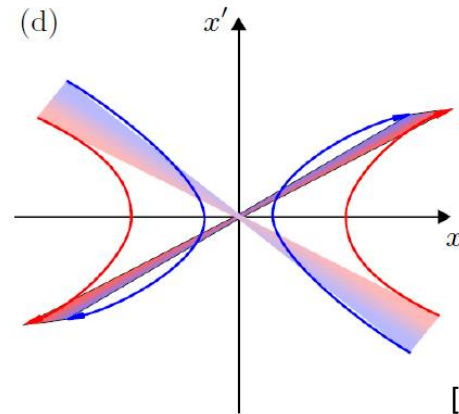
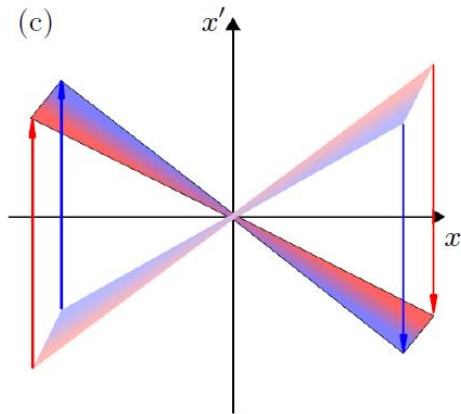
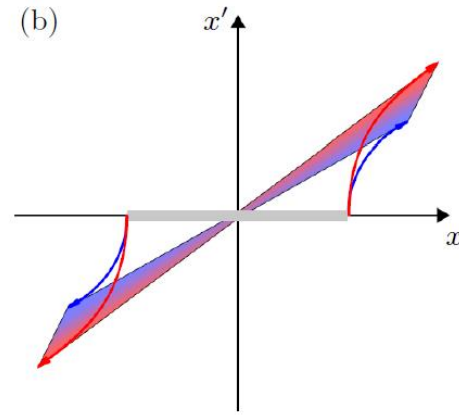
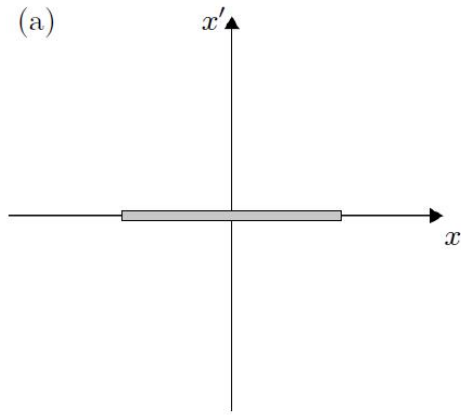


Slit-Based Slice Emittance Measurement Optimization at PITZ

Raffael Niemczyk et al., Darmstadt, October 16th 2019

Emittance Compensation in Photoinjectors

Reducing projected emittance by aligning slice phase space ellipses



- a) Beam starts from cathode with thermal emittance
- b) Due to space charge, slices with different space charge defocus differently strong
- c) Solenoid magnet used to invert phase space
- d) Slice phase space ellipses start to overlap after following drift space, reducing projected emittance

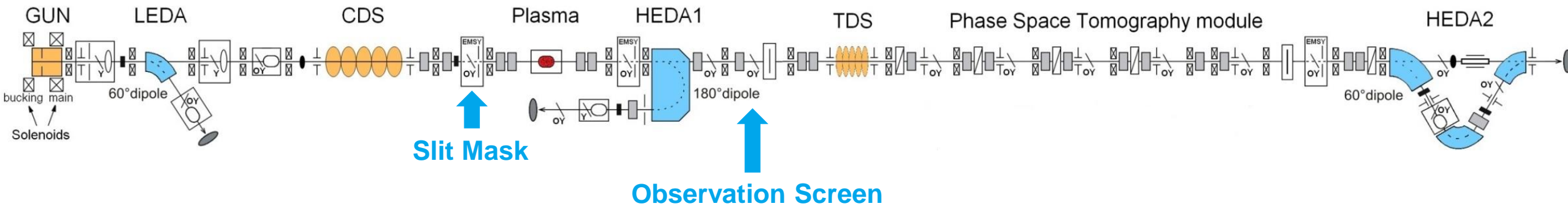
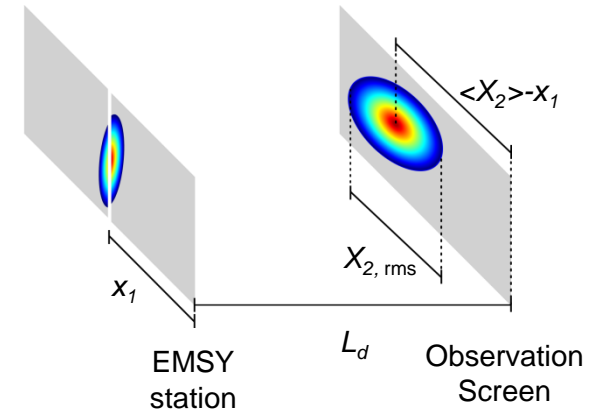
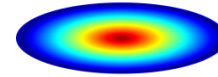
[1]

[1] M. Hänel, dissertation, University Hamburg (2010)

Emittance Measurements at PITZ

Slit-based emittance measurement

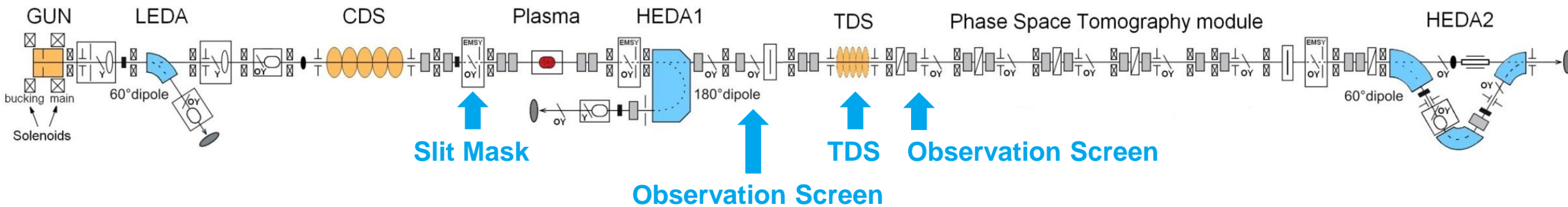
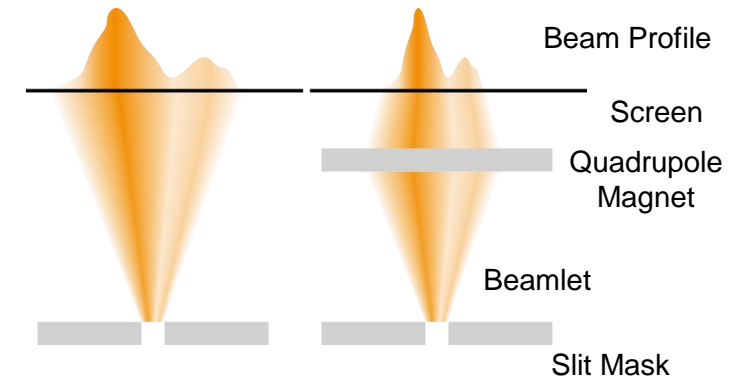
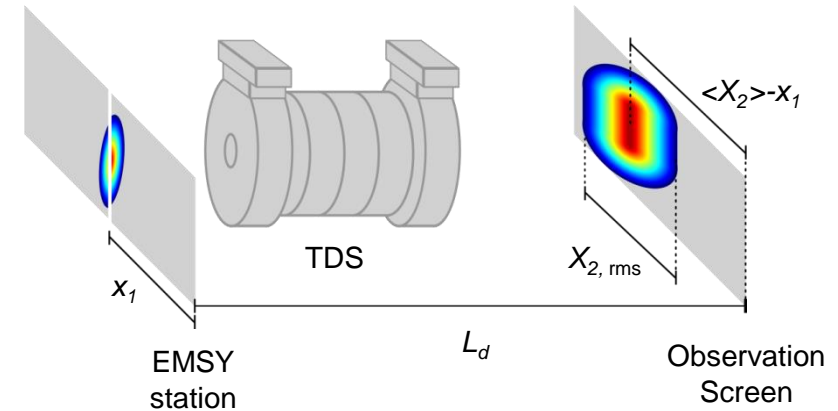
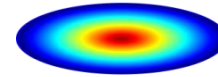
- > Single-slit scan as emittance measurement
- > To find best solenoid strength for emittance compensation



Emittance Measurements at PITZ

Slit-based emittance measurement

- > Single-slit scan as emittance measurement
- > To find best solenoid strength for emittance compensation
- > Addition of TDS yields time resolution
- > Low signal strength due
 - > Charge reduction at slit mask
 - > Wide beam due longer drift
 - > Wide beam due TDS deflection
- > Quadrupole magnets for beam transport necessary



Emittance Measurements at PITZ

Slit-based emittance measurement

- > Calibration of accelerator optics
- > Reconstruction of slice phase space
- > Slice emittance measurement with/without quadrupole magnets