# Electron beam spot an ILC

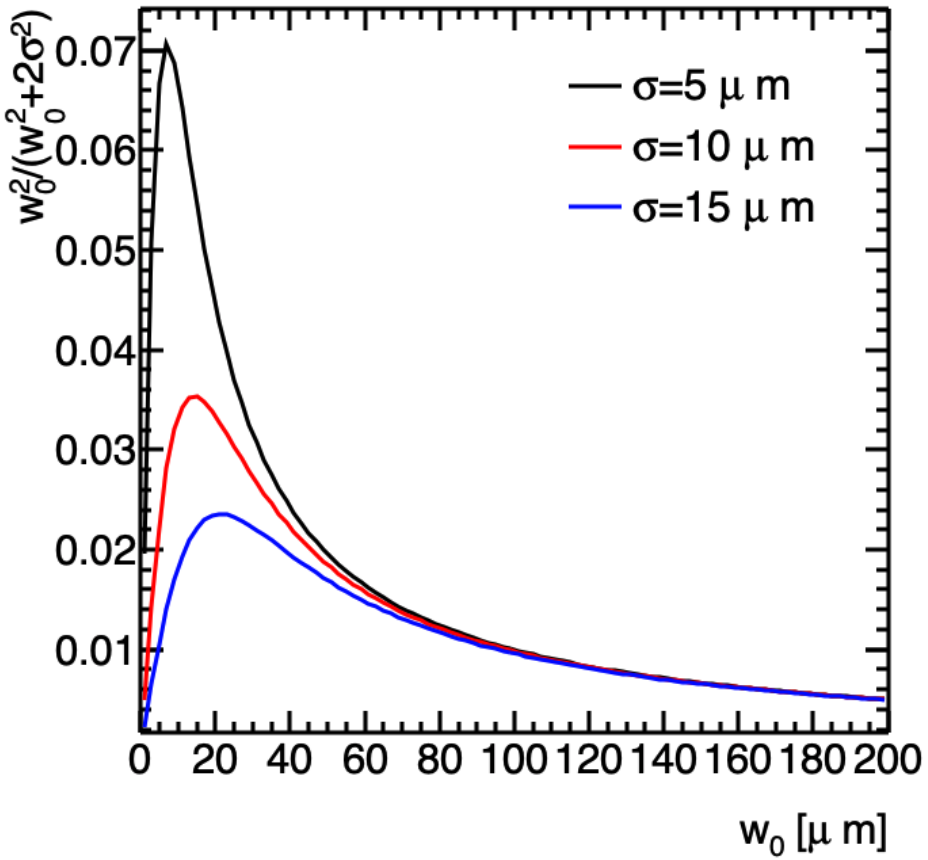
B. Heinemann,

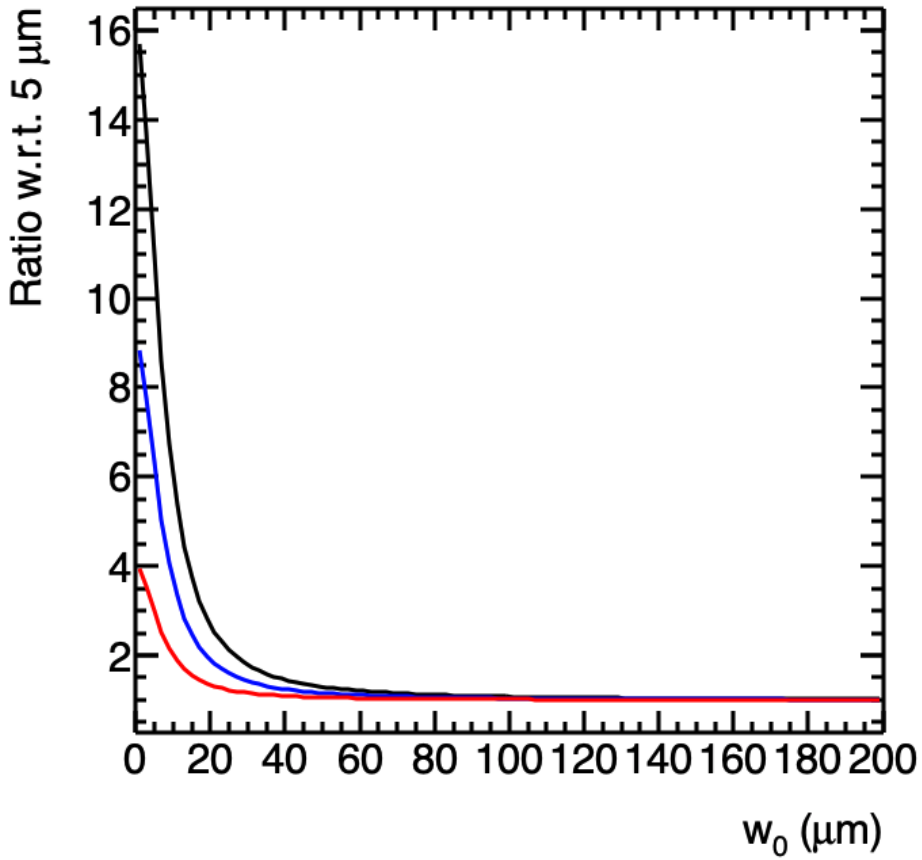
21/09/2021

# Electron beam spot size

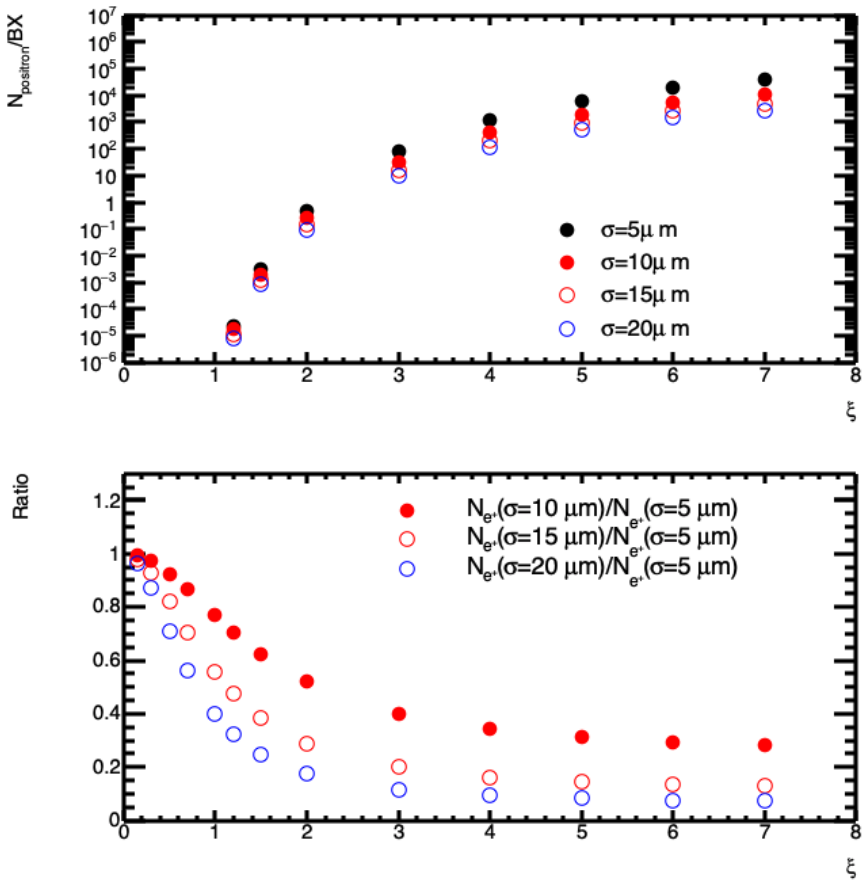
- The electron beam spot size was set to 5 um historically but was never a hard requirement => reexamine what we need
- Electron-Laser:
  - Cross section for Compton interactions scales with $\sqrt{2\sigma_e^2 + w_0^2}$ where $w_0$ is the laser waste (FWHM) and $\sigma_e$ is the gaussian width of the beam
    - Trident rate affected the same as already biased to be in overlap area
- Photon-laser:
  - Photon beam from Bremsstrahlung or ICS much larger than laser waste due to spreading with 1/gamma after IP => electron beam width negligible as long as <20 um, see page 52

# Calculated Rate reductions for e-laser



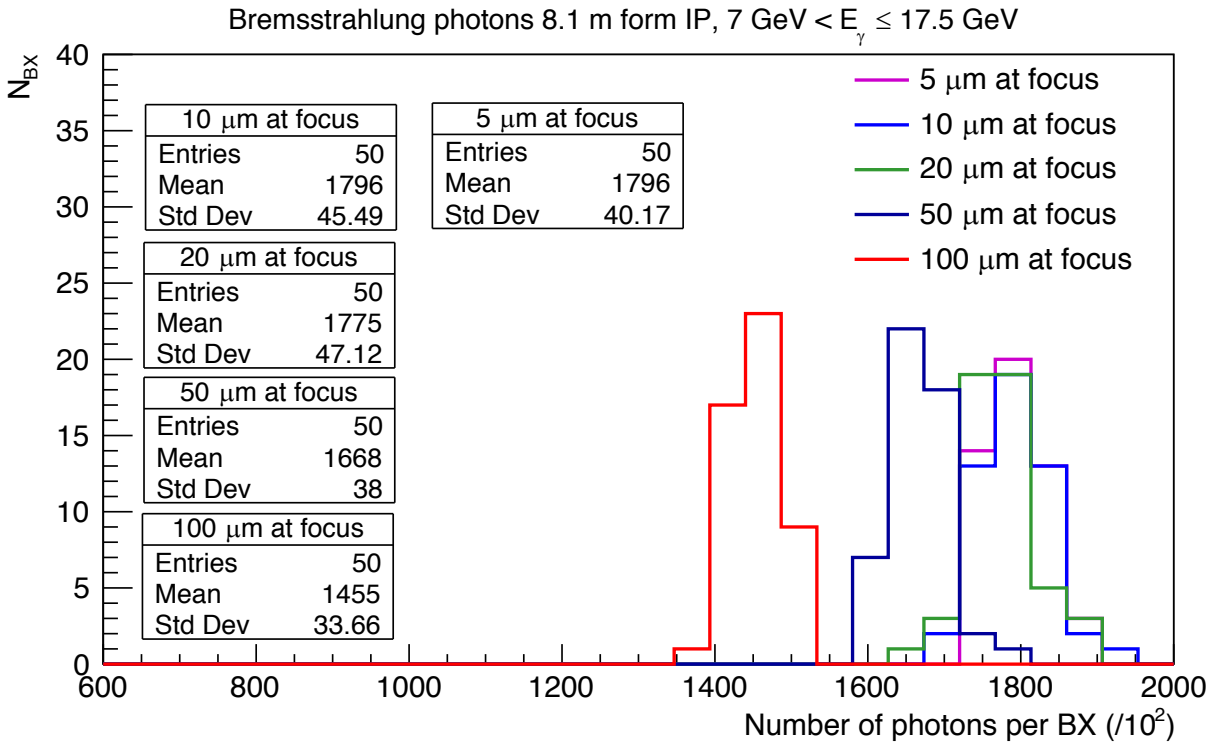



# Calculated Rate reductions for e-laser




- Positron rate reduced
- At high xi the effect is largest but that is where we anyway have a lot of statistics
- At low xi<2 effect is a factor of 2-3 for 10-15 um => not critical, can just run 2x longer

# Impact for photon-laser collisions

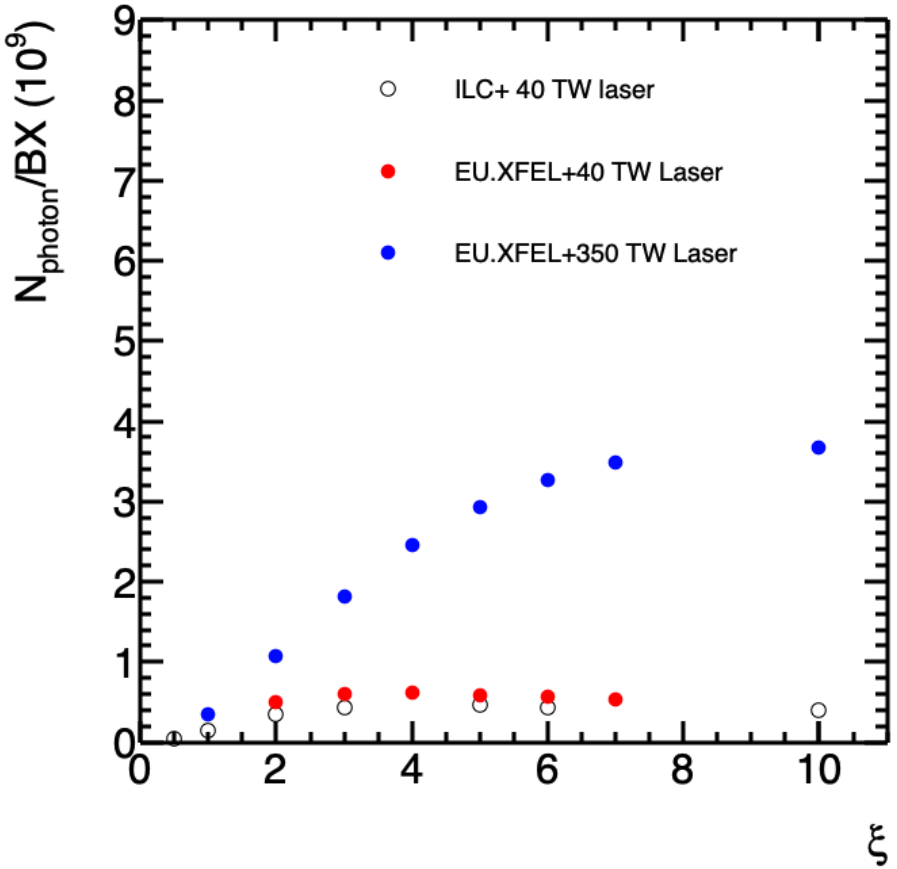


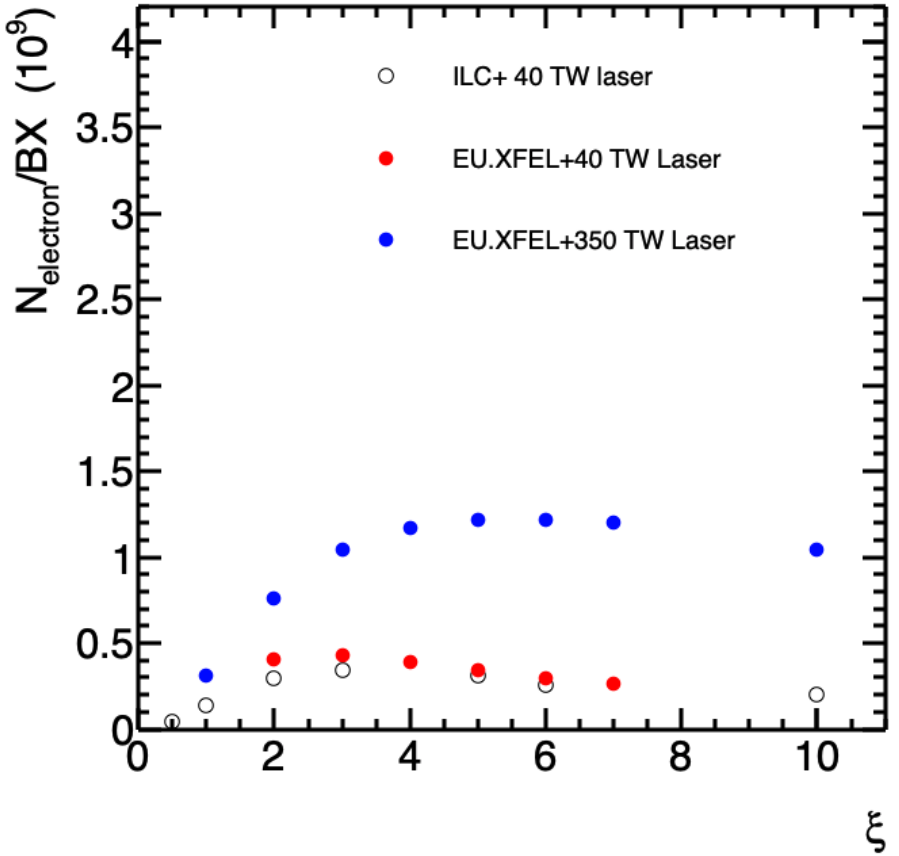

- Sasha ran simulation for electron beam sizes between 5 and 100 um
- Conclusion: impact <1% for electron beam widths <20 um
  - Comparing the mean values

# LUXE@ILC

- What could a LUXE-like experiment do at the ILC with a 125 GeV beam?
- Tom made MC with that (thanks!) for the electron-laser case with the JETI40 laser configuration
- I checked the rates of electrons, photons and positrons

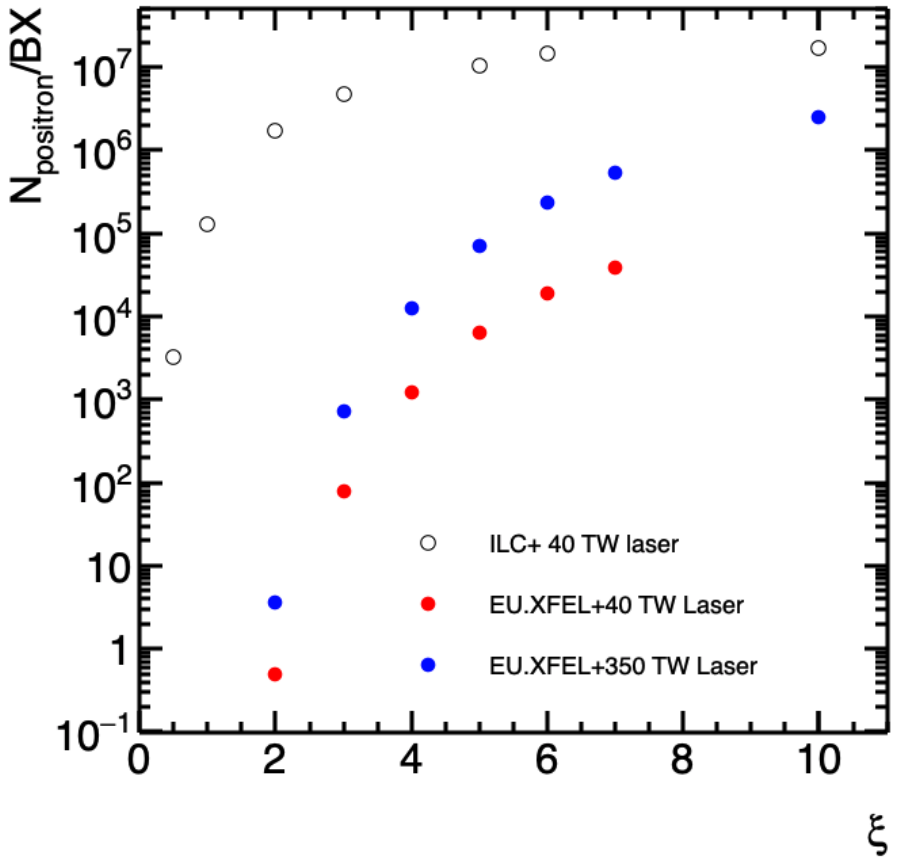
# LUXE@ILC: photon and electron rates




Compton rate determined by laser => LUXE@ILC very similar to LUXE@XFEL

# LUXE@ILC positron rate




Gamma factor 10x higher for ILC
=> much higher rate!