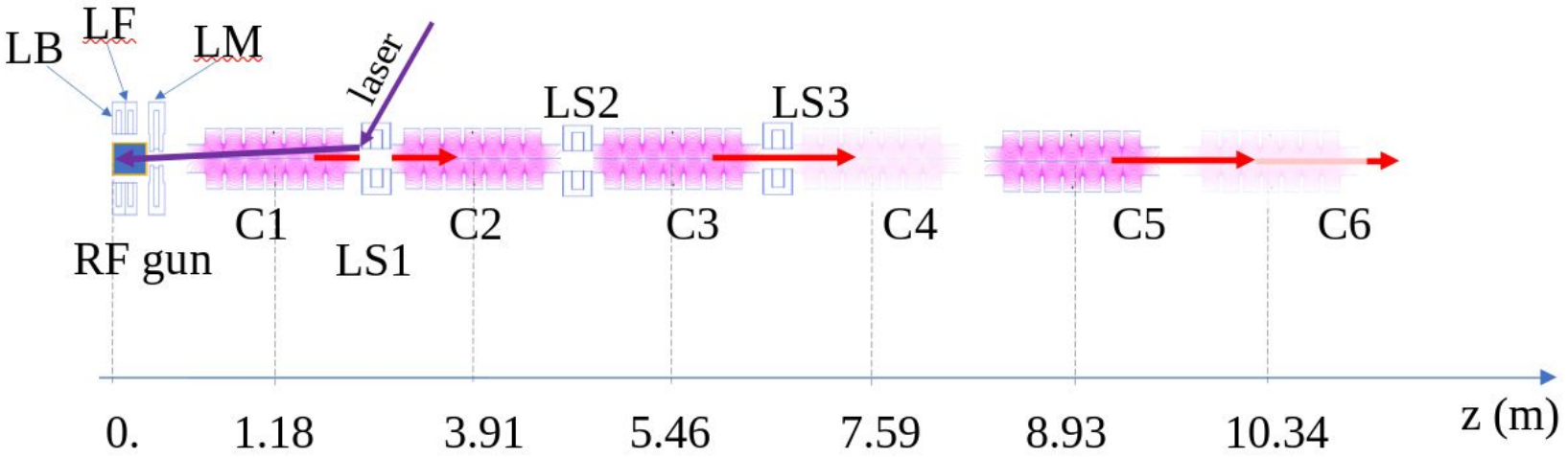
CBB Meeting: low-MTE photocathodes

Emily Frame

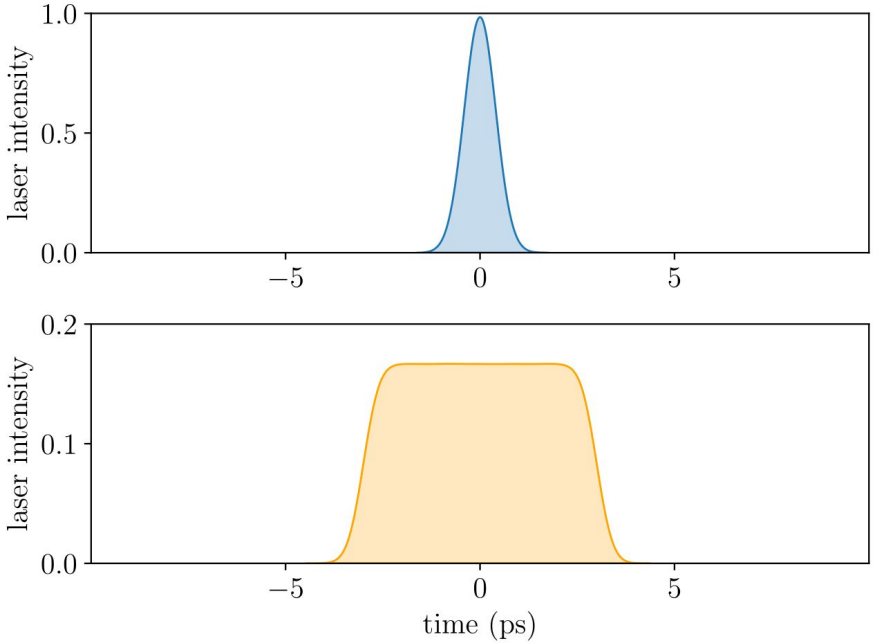
Argonne Wakefield Accelerator

- AWA is upgrading the photoinjector on the drive-beam accelerator (time scale is ~1 year)
  - Generates ~70 MeV electron bunches
  - RF photoinjector, 1 + ½ cells, with 1.3 GHz resonant cavity and Cs2Te photocathode
    - Field on cathode is 60 MV/m



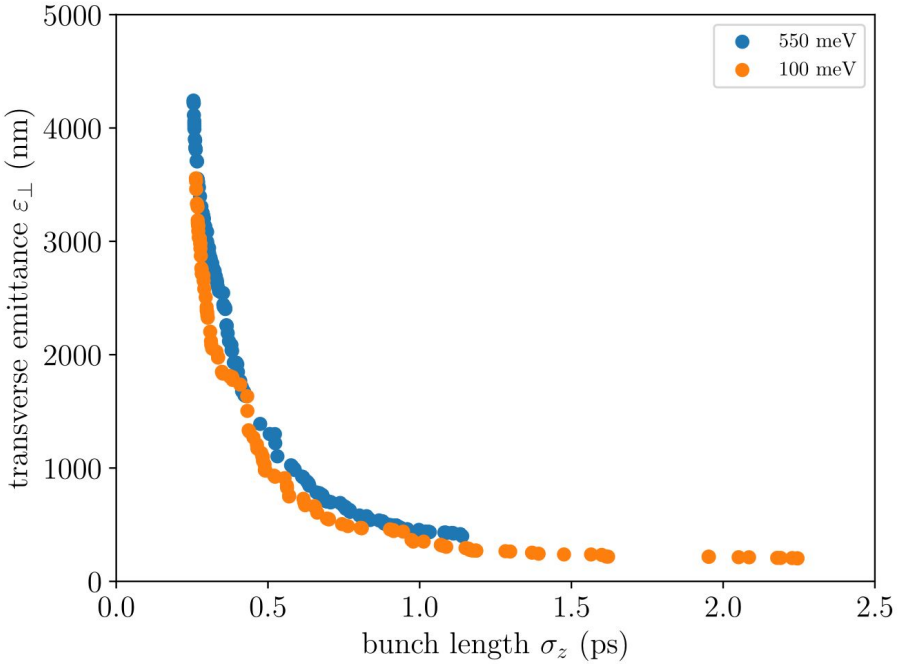
Low-charge optimization

- Part of the upgrade was redesigning a solenoid, allowing us to perform an optimization study
- Optimized for low- and high-bunch charge, short Gaussian (~400 fs) and long flat-top (12.8 ps) laser pulse
- Generated Pareto fronts for bunch length and emittance

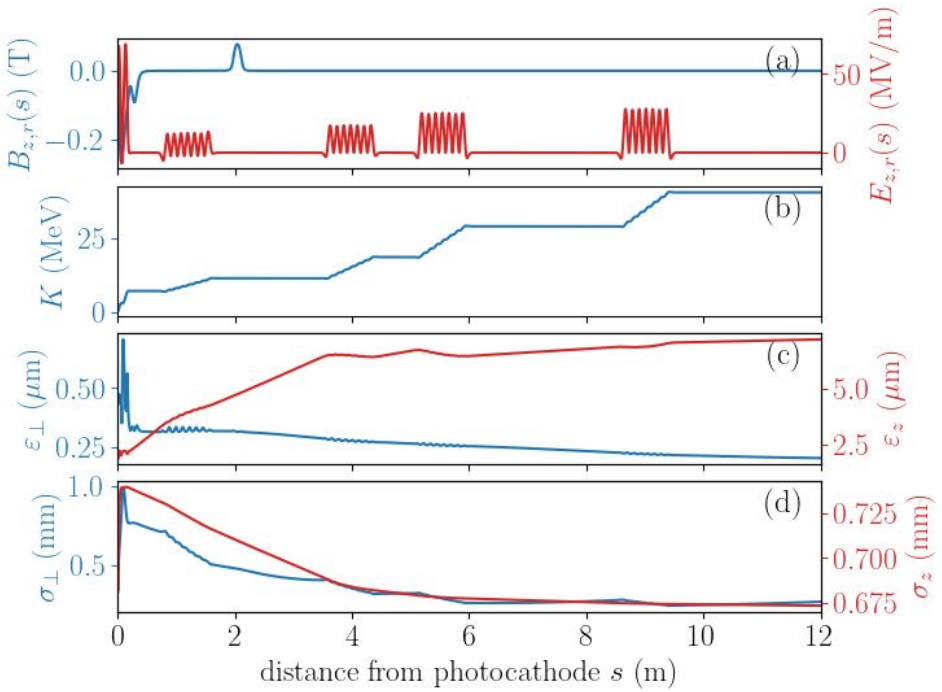


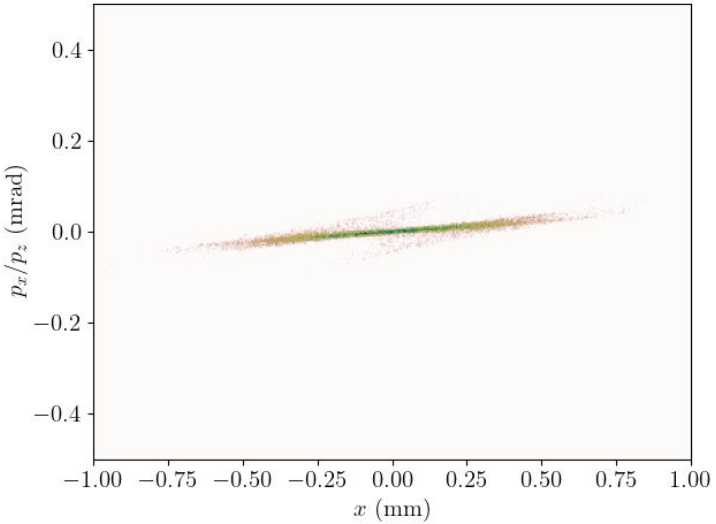
Short laser pulse at 100 pC

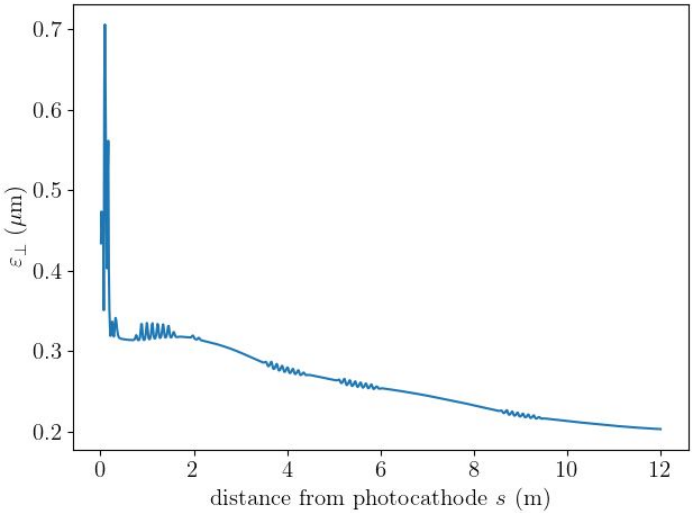
- At 100 meV excess KE, we reach emittance of 203 nm
- At 550 meV excess KE, we reach emittance of 399 nm



203 nm emittance

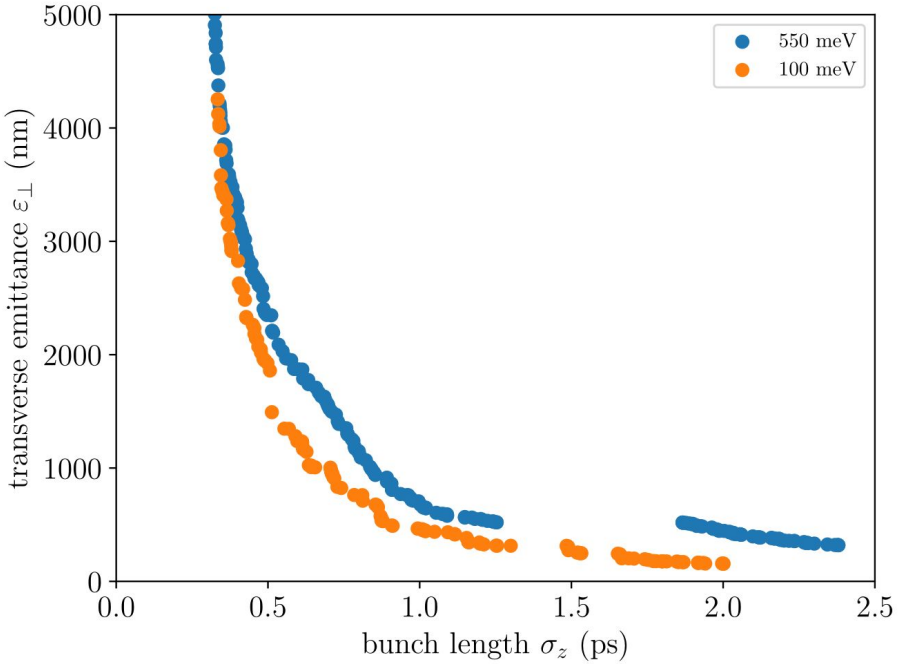




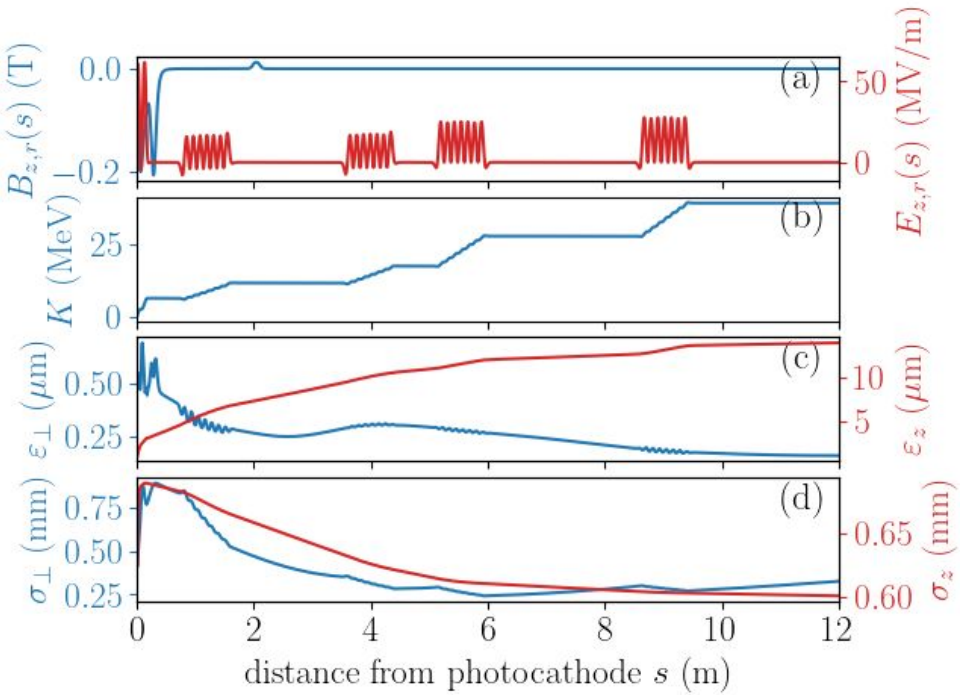


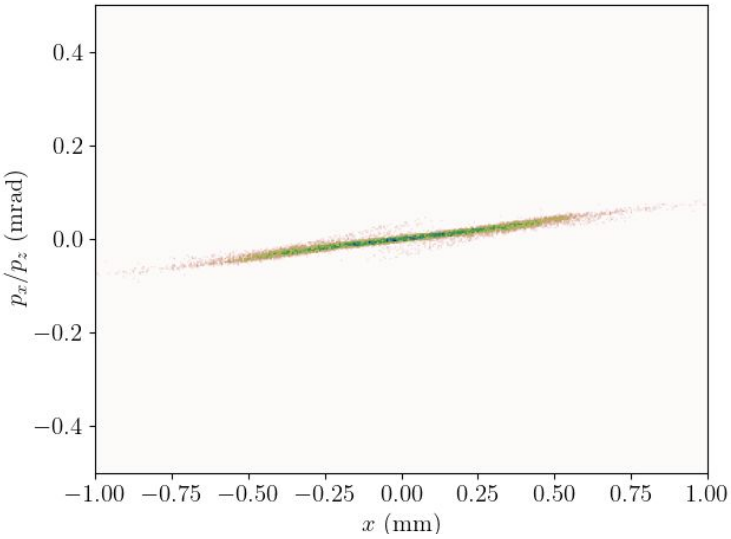
Long laser pulse at 100 pC

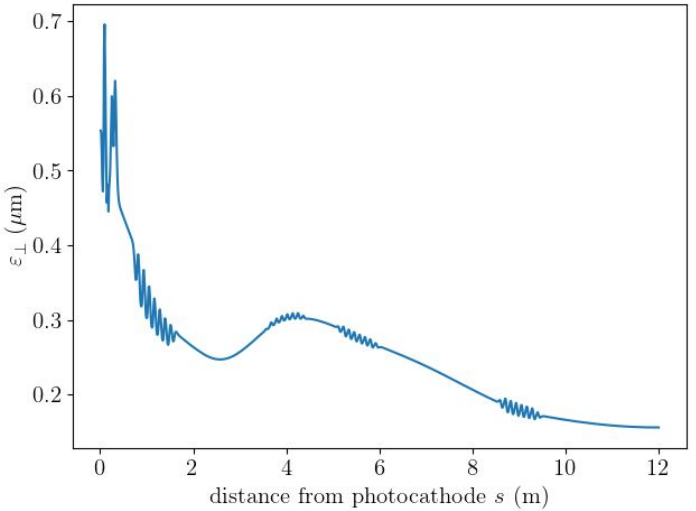
- At 100 meV excess KE, we reach emittance of 156 nm
- At 550 meV excess KE, we reach emittance of 319 nm



156 nm emittance







Further work

- So far the field are cylindrical symmetric:
  - The RF gun to be installed this year will have a symmetrized geometry (dummy coupler)
  - AWA has received symmetrized linac from LBNL which will be installed during this injector upgrade.
  - The other linac are side coupled and field map were recently generated in ACE3P (but not yet used in the simulations)
- The UV laser shape assumed in the simulations so far is best guess from measurements of the IR
  - A pulseChecker system was received (this week!) and will provide the exact distribution for more realistic simulation once commissioned
  - There is some flexibility in pulse shaping (longer pulse?)
  - The details will also depend on the wavelength…
- Any other suggestion?