

# Improvement of Beam Quality in Plasma Wakefield Acceleration

Mason Stobbe

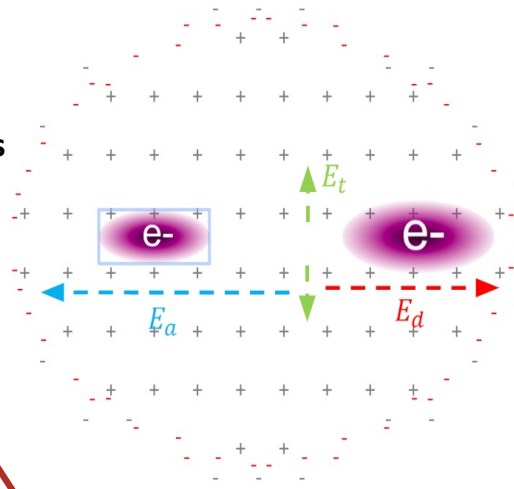
## What is Plasma Wakefield Acceleration (PWFA)?

PWFA uses strong electric fields created in plasma to accelerate charged particles over short distances

$$E_{WB} = \frac{cm_e\omega_p}{q_e} \propto \sqrt{n_e}$$

**~ 10 GV/M!**

**Scales with Plasma Density**

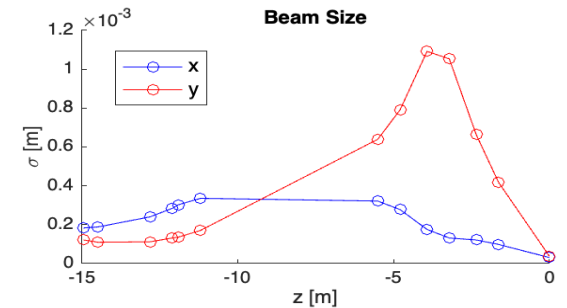


## Beam Matching to Plasma

$$\beta = \frac{\langle x^2 \rangle}{\sqrt{\langle x^2 \rangle \langle x'^2 \rangle - \langle xx' \rangle^2}} \quad \beta_{match} = \frac{c_0}{q_e} \sqrt{\epsilon_0 m_e} \sqrt{\frac{2\gamma}{n_e}}$$

Beam size and momentum  
matched to beam energy  
and plasma density

## Quadrupole Scanning



Strength of focusing Quadrupole Magnets adjusted to manipulate beam parameters and match into plasma