Simulation of hollow electron beam collimation in the Fermilab Tevatron collider

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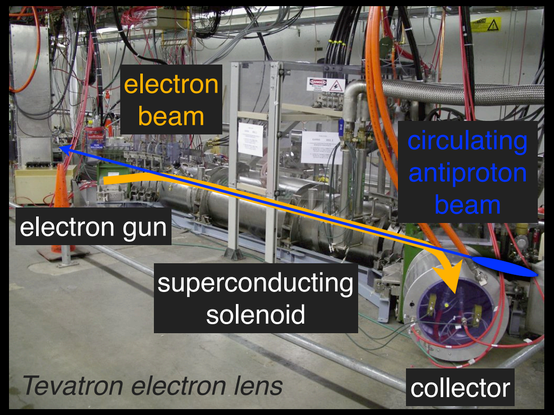
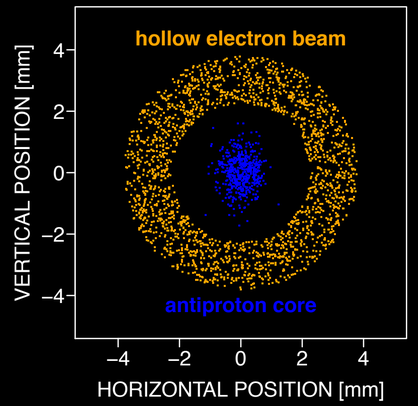
What's hollow electron beam collimation?

A magnetically confined, hollow, pulsed electron beam
is aligned and synchronized with the circulating beam

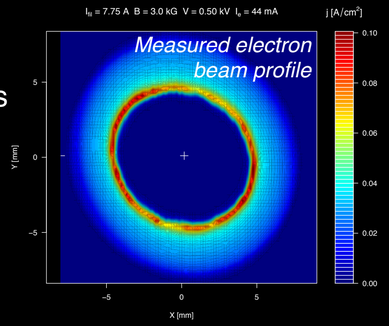




What makes it unique?

It complements collimation systems for high-power beams

- smooth and tunable scraping
- reduced halo population
- reduced sensitivity to orbit and tune jitter
- no material damage
- low impedance



Does it work?

Experiments at the Tevatron showed that

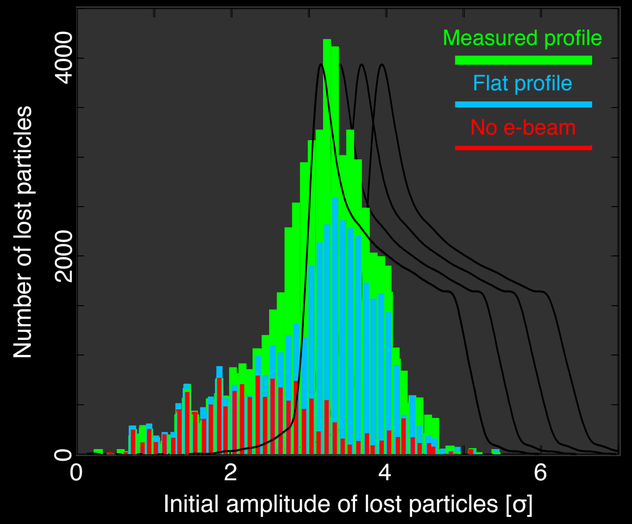
- it is compatible with collider operations
- the core of the circulating beam is not affected
- halo removal is significantly enhanced

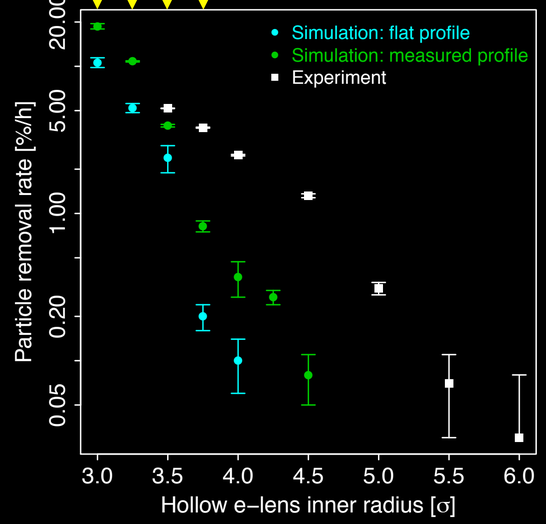
[Phys. Rev. Lett. **107**, 084802 (2011)]

Do we understand it?

The results of the numerical tracking code Lifetrac were compared with the Tevatron measurements

Particle removal vs. hollow beam radius and shape





Removal rates depend strongly on electron beam profile and halo population

The electron beam increases halo removal by a significant factor

Numerical tracking codes (Lifetrac / SixTrack) can estimate the performance of hollow electron beam collimation in other machines, such as the LHC at CERN

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