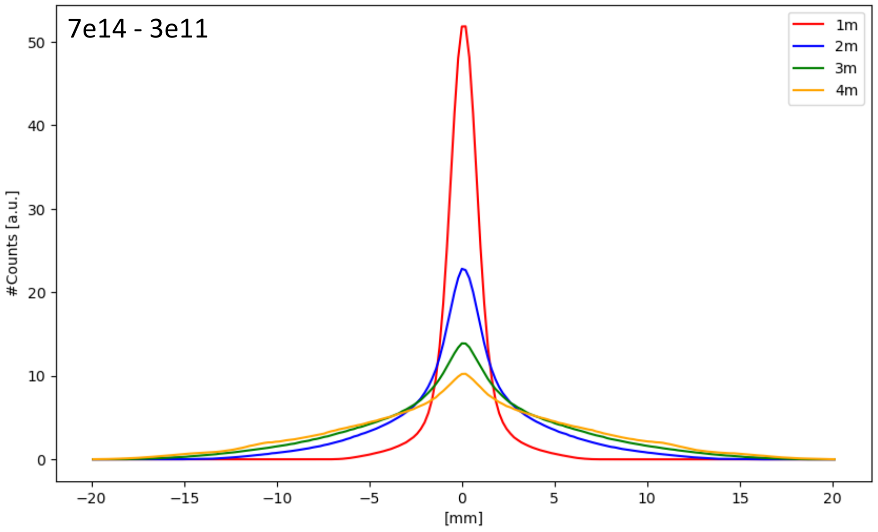
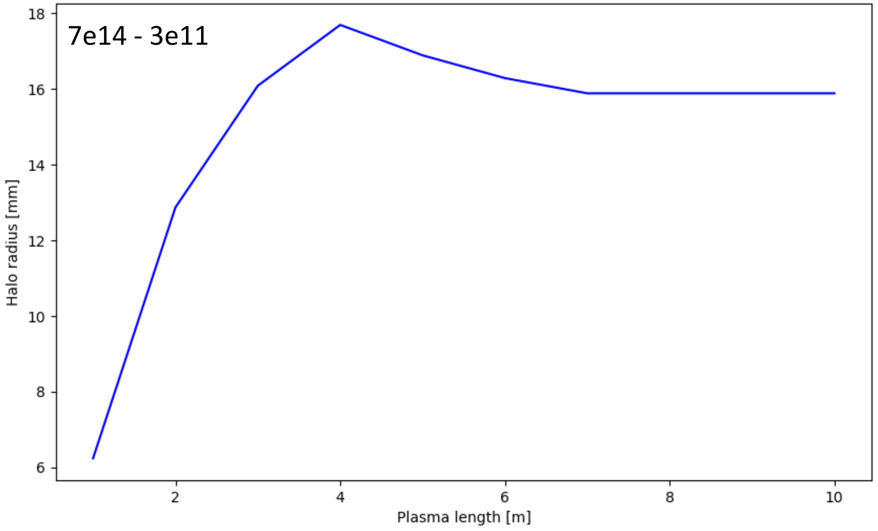
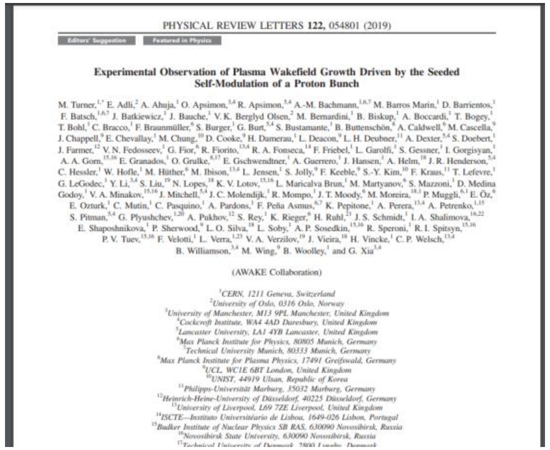
Simulated transverse bunch profile at IS2 for different plasma lengths (uniform)



Simulated halo size at IS2 for different plasma lengths




PHYSICAL REVIEW LETTERS 122, 054801 (2019)

Editors' Suggestion Featured in Physics

Experimental Observation of Plasma Wakefield Growth Driven by the Seeded Self-Modulation of a Proton Bunch

(AWAKE Collaboration)

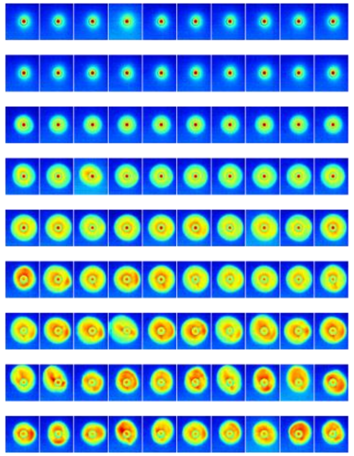
[1]CERN, 1211 Geneva, Switzerland
[2]University of Oslo, 0316 Oslo, Norway
[3]University of Manchester, M13 9PL Manchester, United Kingdom

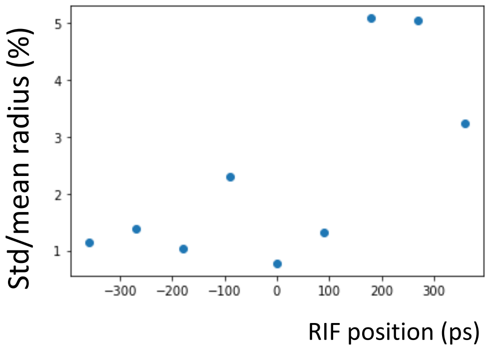
Halo edge is formed early along the plasma

It yields information about:

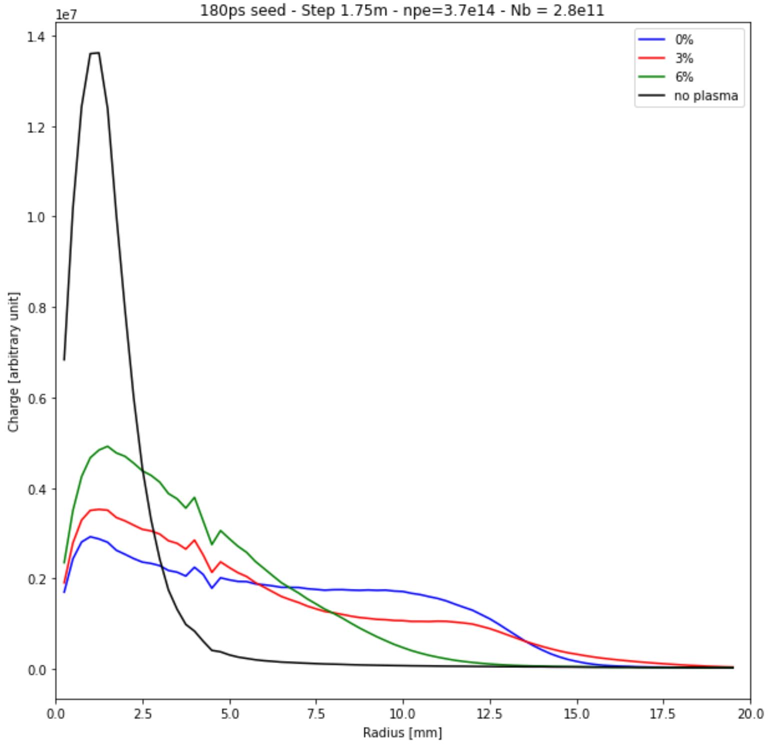
- **Growth of the transverse wakefields**
  - **By observing the increase in halo size as a fct of z**

- **Reproducibility of SM**
  - **By fixing z during the growth of the halo and changing the RIF position along xi**

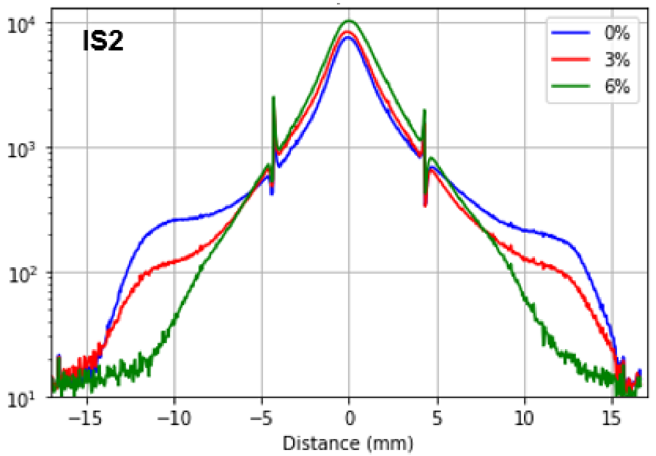




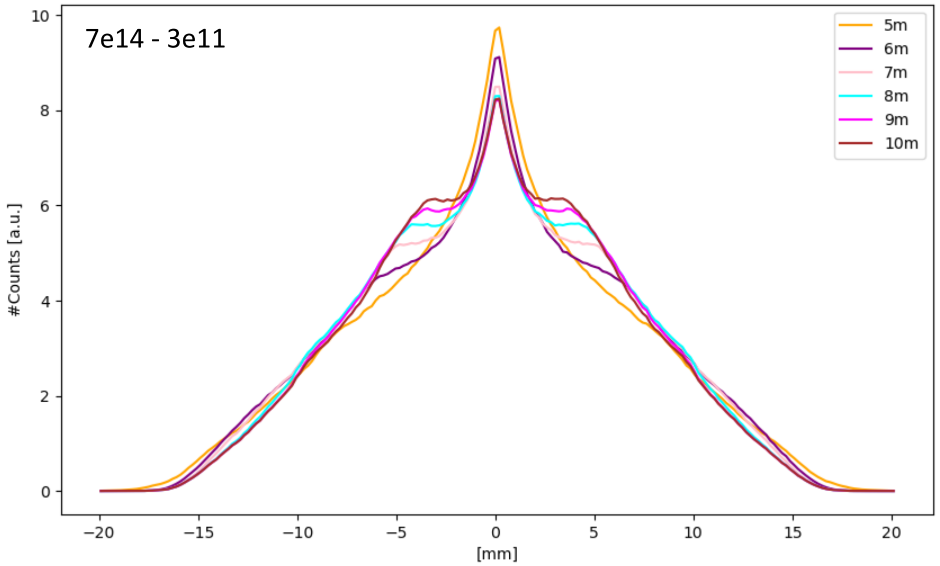
Transverse charge distribution for different steps (polar coordinates)



Transverse bunch density for different steps (log scale)



Simulated transverse bunch profile at IS2 for different plasma lengths (uniform)



Halo shape also yields information about the plasma density step, we observe:

- **Difference uniform/step**
- **Difference between steps**

By observing the formation of the halo

- **Qualify the effect of a given step**

Strong incentive to have beam dumps at every plunger location (reproducibility, growth, plasma density step)