

Simulation Study of the Low Energy Beam Transport with Einzel Lens

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I Introduction

Einzel Lenses are widely used in low energy beam transport(LEBT), which has the advantages of cheap, compact, easy to machining and operate. We design a triple electrostatic lenses in order to transport H⁺ beam with 30keV energy and 10mA current between ion source and RFQ. The purpose is to focus the beam and match the RFQ. The total length of low energy transport system is about 185mm.

II Simulation setup

Finite element software CST and PIC program TraceWin are used to simulate the low energy system transport. In the simulation process, we change the einzel lens radius and gape to study the influence on beam transmission. Finding some regular conclusion for the future design.

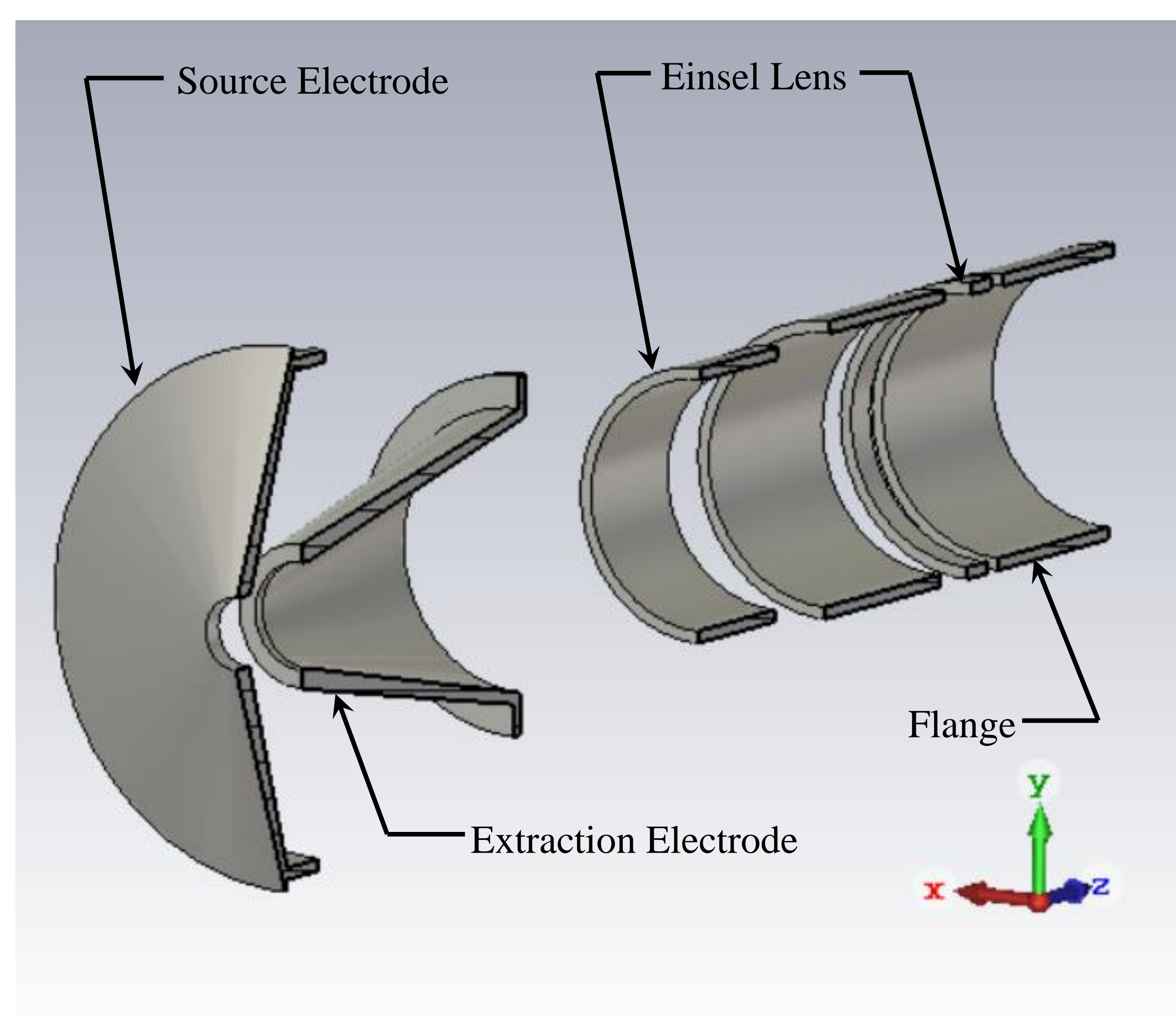


Fig.1 Low energy system transport

Table 1: LEBT Parameters

Parameter	Value	Unit
Beam species	proton	
Ion Source Energy	30	keV
Current	10	mA
LEBT Length	185	mm
LEBT Output Energy	30	keV
Maximum aperture of extraction	23	mm

III Results and discussion

The influence of lens radius

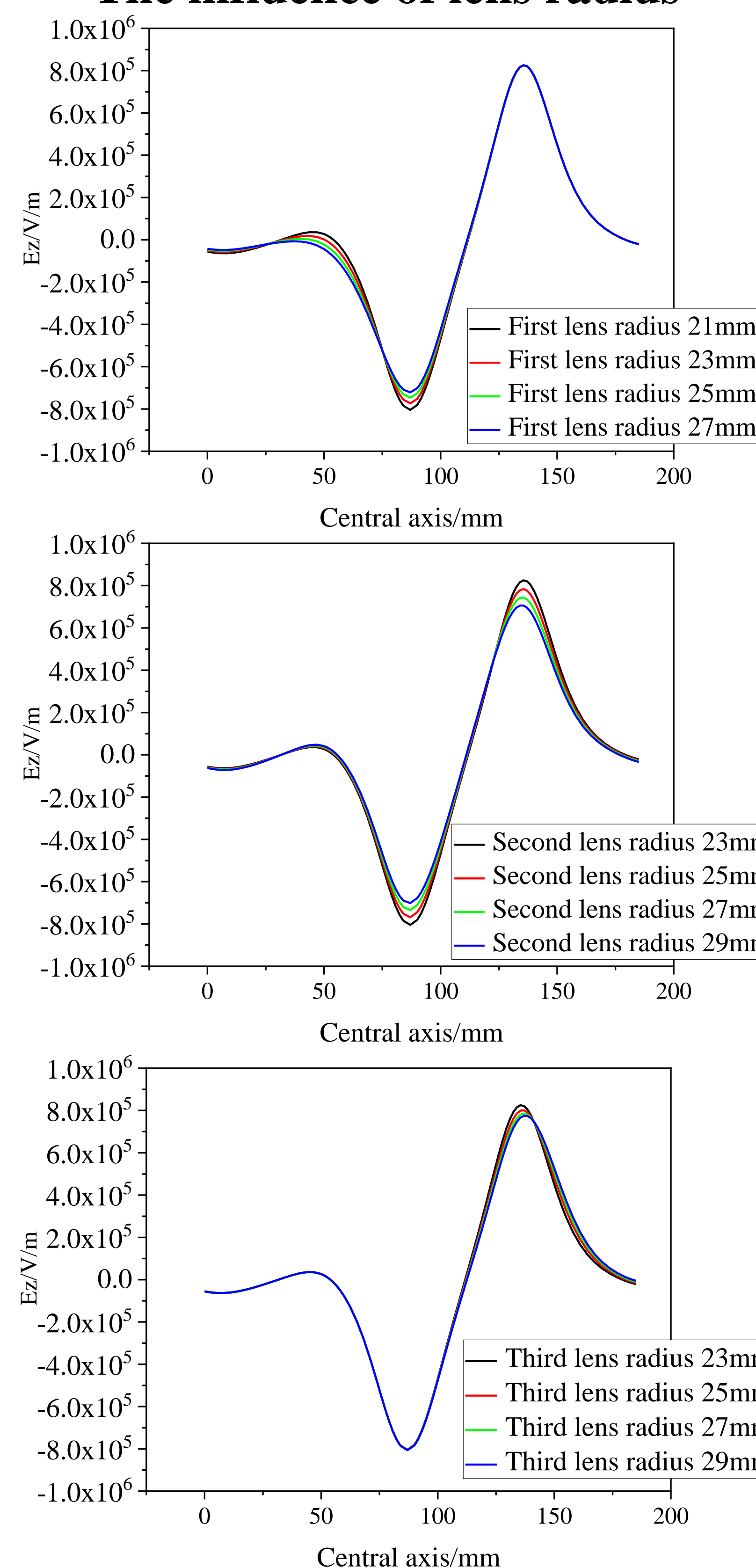


Fig.2 Influence of different lens radius on Ez of central Z axis

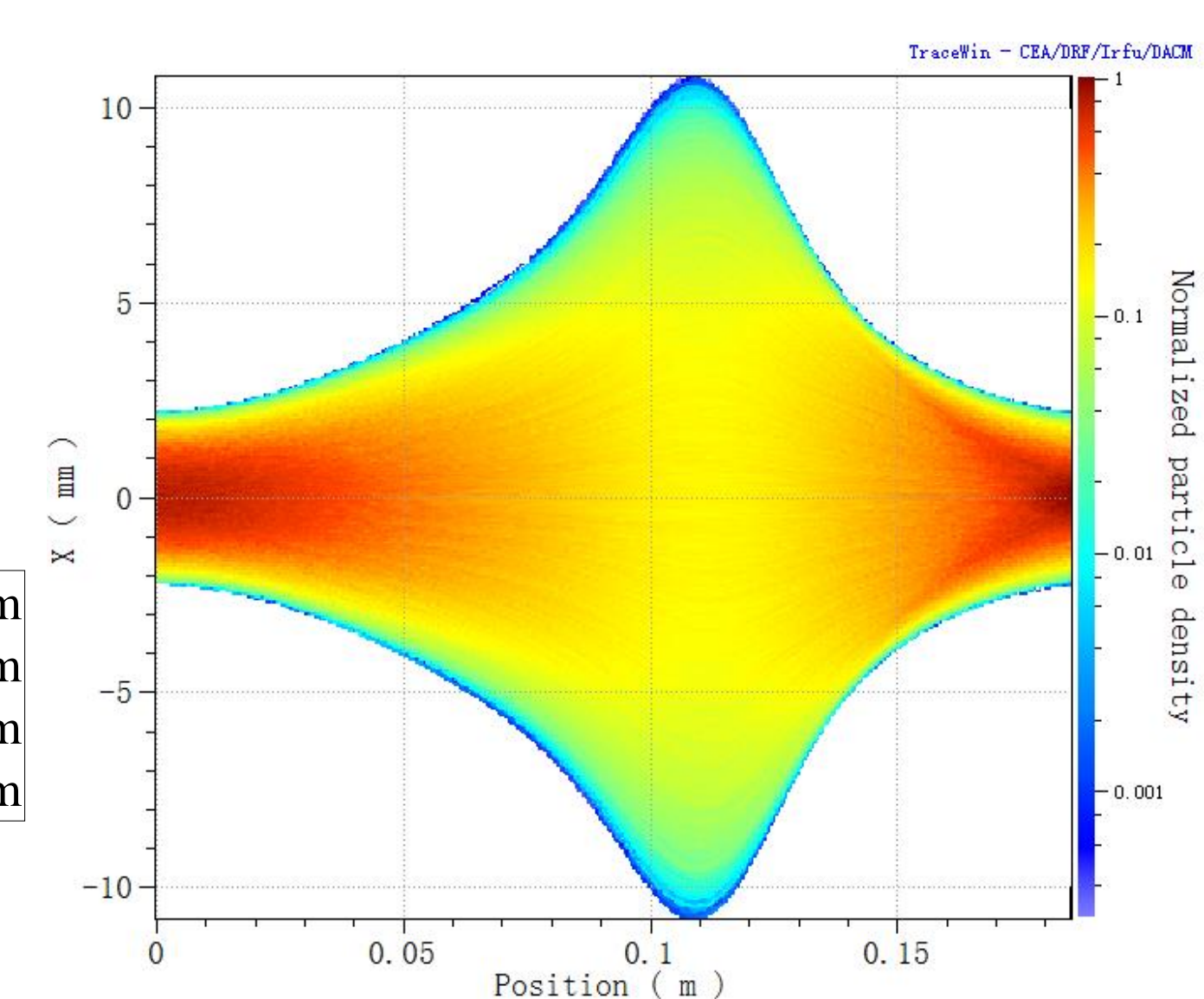


Fig.3 Normalized particle density

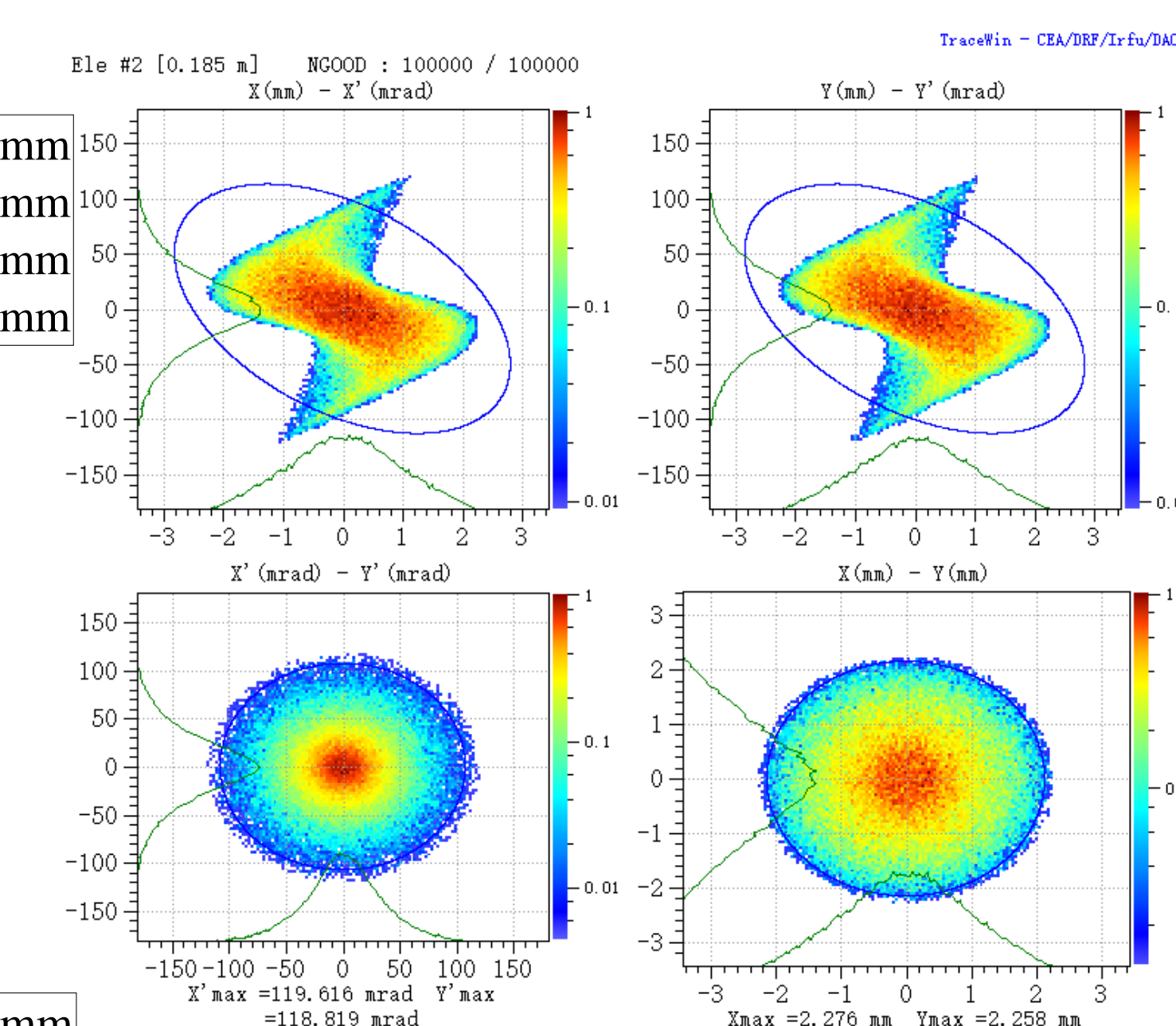


Fig.4 Einzel Lens output phase diagram ($\alpha: 0.5, \beta: 0.0278$ mm/ π . mrad)

From the simulation, the radius of first and second lens have no effect on beam transmission. The radius of the second lens has a great influence on transmission, when the radius is 23mm, the transmission result is what we expect.

IV Conclusion

- The radius of first lens has little effect on beam transmission, but it affects the first half of Ez curve.
- The radius of third lens has little effect on beam transmission, but it affects the second half of Ez curve.
- When the second lens radius of changes in a small area, it will have a great influence on beam transmission.
- The total length of third lens, gap and flange should be as short as possible, so that the output beam can be focused to a certain extent.

