



Contribution ID: 139

Type: Poster

Measurement of Emittance at CSNS Ion Source without Analyzing Magnet

High current beam is required for CSNS update in future. Over 50 mA H^- will be designed to deliver to linac in CSNS II. For the present state of CSNS ion source, the beam emittance cannot satisfy the requirement of RFQ entrance when the beam current increase to 50 mA. In order to optimize the beam, CSNS ion source needs to improve further. Simulation shows that when the beam transfers inside of the analyzing magnet, emittance growth induced by space charge forces in the intense H^- beam. After considering the neutralization of space charge, the emittance growth could be suppressed. The analyzing magnet thus is considered to removed, which might destroy the neutralization of space charge. The beam emittance is also measured. Measured results show that beam emittance without analyzing magnet becomes smaller than that of CSNS ion source. At the requirement of 0.2 mm.mrad, beam current is larger than 30 mA. It reveals that analyzing magnet could destroy space charge neutralization and result in the significant increase of emittance. Although the results presented are preliminary, it is important to improve the beam quality. This paper details the ion source modification and measurement process.

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Presenter: LIU, Shengjin

Session Classification: Poster Session 2

Track Classification: Negative ion sources