



Contribution ID: 237

Type: **Poster presentation**

Technical Approaches towards Intense High Charge State Ion Beam Production with Superconducting ECR Ion Sources

Monday, 16 October 2017 18:45 (15 minutes)

Superconducting ECR ion source incorporated with the cutting edge techniques provides the ultimate conditions for highly charged ion beam production. In the last 12 years (since ICIS 2005 in Caen, France), ECR ion source performance has got remarkable improvement, most of the typical ion beam intensity records have been renewed almost every year, with the great efforts in superconducting ECR ion source development. SECRAL and recently built SECRAL-II ion sources are both high performance 3rd generation ECR ion sources developed at IMP. Technical advancement has obviously helped boost the yield of high charge state ion beams. For instance, only 8.5 eμA Ar¹⁷⁺ has been produced in 2007 with SECRAL, while 10 years later, SECRAL-II delivered up to 130 eμA Ar¹⁷⁺ during a high microwave power test. Similar improvement also applies to many other highly charged heavy ion beams. These promising results owe to the continuous technical modification and optimization for dense hot plasma buildup, highly charged ion production, intense beam extraction and high efficiency transmission with reasonable beam quality. This paper will summarize the achievements performed with both SECRAL and SECRAL-II. The technical solutions to produce very intense highly charged ion beams will be discussed and presented.

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Session Classification: Poster Session 1

Track Classification: Production of highly charged ion beams