



Contribution ID: 127

Type: **Parallel Session (Contributed Oral) talk**

High Power Density Beam Measurement of the Single Beamlet Multi-Grid Prototype H- Negative Ion Accelerator

Thursday, 23 September 2021 08:55 (20 minutes)

This paper reports the first emittance measurement of the 160 MW/m² high power density negative ion beam at target perveance condition of the ITER accelerator. Previously, the ITER requirement on grid heatloads at <5% of the total acceleration power has been achieved but the aperture edges has been damaged limiting long pulse acceleration. To solve this issue, thermal imaging on 1D-CFC tiles was newly developed to simultaneously measure both profiles and emittances of high power density beams and investigate the overall beam parameters for a single-beamlet. As a result, unknown divergent components up to 10mrad comprise >2% of the total beam current, which can scrape the electrode apertures, was experimentally identified for the first time. However, it was found that the divergent components were within the acceptance loads of the ITER beamline. These measurement results for the single beamlet contributes to future multiple-beam analysis and design of the ITER accelerator and beamline.

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Funding Information

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Track Classification: Negative ion sources