Contribution ID: **179** Type: **Parallel Session (Contributed Oral) talk**

New Commissioning Results of the MIST-1 Multicusp Ion Source

Monday, 20 September 2021 06:00 (20 minutes)

For the sterile neutrino experiment IsoDAR (Isotope Decay-At-Rest), we have developed a compact particle accelerator system delivering a 10 mA, continuous wave (cw) proton beam at 60 MeV to a neutrino production target. The accelerator comprises a compact isochronous cyclotron, an RFQ embedded in the cyclotron yoke, and an ion source. To reduce space charge effects during injection and acceleration, we are accelerating H₂⁺ instead of protons. To produce the needed cw H₂⁺ beam current of 10 mA (nominal) at the required purity and quality, we have built a new filament driven, multicusp ion source (MIST-1). Here we report commissioning results for long-time running at reduced power, demonstrating the feasibility of the design. Highlights include an H₂⁺ beam current density of 12 mA/cm², > 80 % H₂⁺ fraction, and emittances of 0.05 π-mm-mrad (RMS, normalized) after extraction. We also present high fidelity simulations that are in good qualitative and quantitative agreement with emittance measurements in our test beam line.

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Funding Information

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Track Classification: Production of high intensity ion beams