

Characterization of Emittance in High Intensity H- Ion Sources

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High intensity H- ion sources are currently or soon will be employed in large accelerator facilities and projects such as spallation neutron sources, neutrino factories, etc. Ion sources for these applications can be broadly categorized as surface plasma (magnetron) sources, Penning sources and larger RF or filament driven volume-type sources.

Emittance data from these sources has been measured and analyzed using a variety of techniques applied at individual institutions. Direct comparison of statistical emittances is difficult and confusing because of (i) emittance definition (ii) emittance measurement technique and (iii) emittance analysis algorithm. For example, a small variation in

the assumed detector bias by the emittance analysis algorithm leads to dramatic variation in the calculated emittance values. This report presents a comparison of the emittance data produced by H- sources operating in major facilities using a single analysis routine. Both statistical emittance values (RMS and 90%) and characteristic emittance – intensity curves are determined from raw data obtained from sources operating at JAERI, DESY, ISIS, BNL, FNAL and SNS-LBNL. The physical origin of the emittance - intensity curves is discussed in terms of ion temperature, extraction and transport aberrations and other effects which contribute to emittance growth.

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