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Correlation H- beam properties to Cs-coverage

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A cesiated RF driven source delivers H- ion that, after stripping at the end of the 160 MeV H- linear injector, provides protons to CERN's accelerator complex including LHC, where the protons reached a record energy of 6.8 TeV. During initial caesiation, the dual production mechanism of H- ions, via dissociative attachment of electron onto roto-vibrationally excited H2-molecules (volume) and re-emission as negative ions of protons or hydrogen atoms colliding on a low work function caesiated molybdenum plasma electrode (surface), exhibits a stunning reduction of co-extracted electrons correlated to an increase of the H- ion current to RF-power yield. This paper describes the evolution of the beam-profile and -emittance at today's operational beam intensities of 35 mA for various ratios of volume and surface ion-origin. The presence of surface produced ions occurring on a conical plane is characterized by the electron to ion ratio and by measurement of the Cs-coverage of the molybdenum plasma electrode down to a fraction of a monolayer. Angular distributions are extracted from Beam Emission Spectroscopy (BES) measurements for specific volume and surface production modes. These experimental results provide an initial comparison to beam formation simulation software packages (ONIX [1]) coupled to Beam transport codes (IBSimu [2]) presented in ref. [3].

1) Mochalskyy S, Doctoral thesis, Université Paris Sud - Paris XI, 2011, theses.fr –Serhiy Mochalskyy , Modeling of the negative ion extraction from a hydrogen plasma source : application to ITER neutral beam injector
2) T. Kalvas, O. Tarvainen, T. Ropponen, et al, IBSimu, Rev. Sci. Instrum. 81, 02B703, (2010).
3) A. Vnuchenko et.al. "Beam formation simulation of CERN's H cesiated RF source", presented at NIBS-Padova, 2022, these proceedings.

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