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Characterization and Optimization of NIO1 Extraction Aperture by 3D PIC Model

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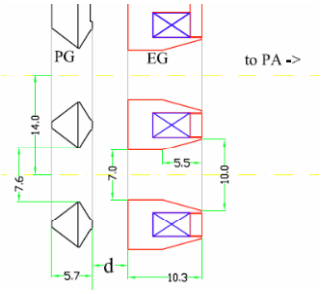
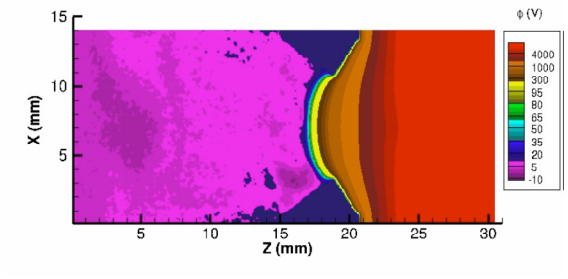
The geometry of a single aperture in the extraction grid plays a relevant role for the optimization of negative ion transport and extraction probability in a hybrid negative ion source [1]. For this reason, a 3D PIC-MCC model of the extraction region around the single aperture including part of the source and part of the acceleration (EG grid) regions has been developed for the new aperture design prepared for NIO1 source [2] (see Fig. 1.a).

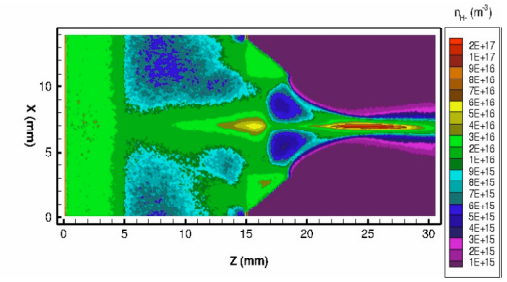
Results have shown as the dimension of the flat and chamfered parts and the slope of the latter in front of the source region maximize the negative ion extraction probability (allowing the best EG field penetration and therefore minimizing the potential well). In Figs. 1.b and 1.c, plasma potential and negative ion density in the plane {x,z} has been reported, respectively (the PG is biased at φPG=15 V, while φEG=9 kV).



(a)



(b)



(c)

Fig. 1 – (a) Schematic cross-cut ({x,z} plane) of the NIO1 aperture in the extraction region. (b) Map of (b) plasma potential φ(V) and (c) H- ion density *n*H-(m-3) in the same plane as result of the present numerical model.

References

[1] F. Taccogna, P. Minelli, S. Longo, *Plasma Sources Sci. Technol.* **22**, 045019, 2013.
[2] M. Cavenago, P. Veltri, *Plasma Sources Sci. Technol.* **23**, 065024, 2014.