

Structural Optimization of the AISHa Ion Source

F. Noto¹, M. Piscopo¹, L. Celona¹, D. Cittadino¹, S. Gammino¹, G. Cuttone¹, G. Gallo¹, G. Schillaci², C. Campisano³, L. Lo Nigro⁴, G. Costa⁴, A. Campisano⁵

¹Laboratorio Nazionale del Sud, Santa Sofia , Catania, Italy

²Laboratorio Nazionale del Sud, Santa Sofia, Catania, Italy

³HITECH 2000, Gravina di Catania, Sicily, Italy

⁴C3 S.R.L., Trinacria, Canalicchio, Catania, Italy

⁵Unico Informatica, Via delle Rose, Sant'Agata, li Battiati, Catania, Italy

Abstract

Different facilities for hadrontherapy have been built or designed in the recent past and Italy is present in the field either with synchrotron-based and with cyclotron-based facilities. For both types of accelerators the availability of high brightness multiply charged ion beams is essential and R&D efforts in this subject are increasing. Optimization of beam emittance and intensity is of primary importance to obtain the necessary current in the RFQ-LINAC and future facilities may require much better performances in terms of beam brightness than the ones provided by such commercial ECRIS[1].

The design of a relatively compact ECR ion source operating at 18 GHz, named AISHa, has been studied recently. The AISHa ion source has been designed by keeping in mind the typical requirements of hospital-based facilities, where the minimization of the mean time between failures (MTBF) is a key point together with the maintenance operations which should be fast and easy. The study of some critical parts of the facilities: the plasma chamber, the containment chamber, etc. have been optimized with the COMSOL Multiphysics® software. The development of this model was made using the fluid dynamics and structural mechanics modules (Figure 1 and 2).

In conclusion we have studied in particular the plasma chamber under certain conditions imposed: the room needs to be cooled by water, which flows in a given path to achieve, through an entrance and septa.

Reference

[1] L. Celona, G. Ciavola, S. Gammino, L. Andò, D. Mascali - INFN-LNS, Via. S. Sofia 62, 95123 Catania, Italy DESIGN OF THE AISHA ION SOURCE FOR HADRON THERAPY FACILITIES - Proceedings of ECRIS2012, Sydney, Australia, ISBN ISBN 978-3-95450-123-654.

Figures used in the abstract

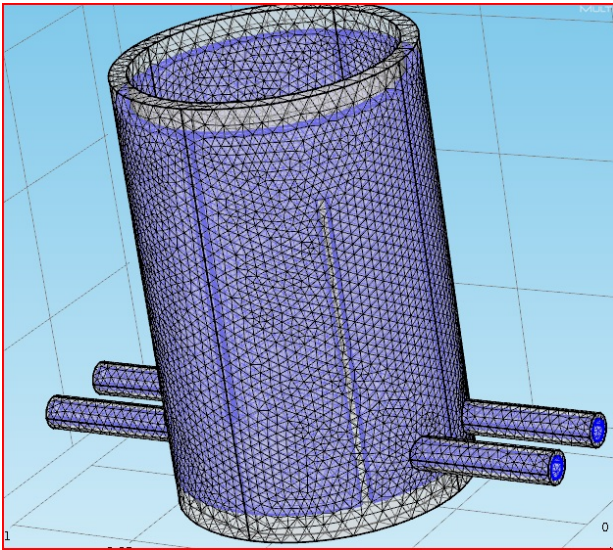


Figure 1: Tetrahedral mesh.

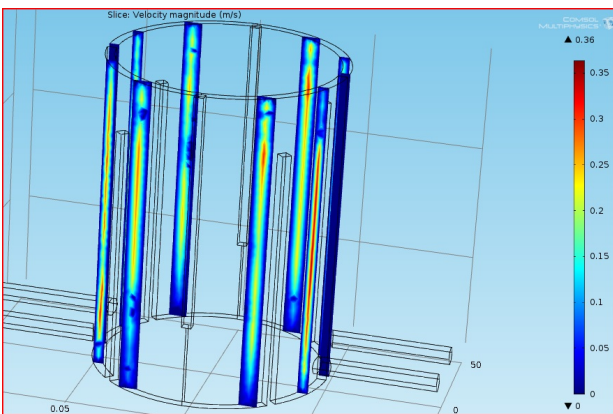


Figure 2: Velocity field in the plasma chamber.