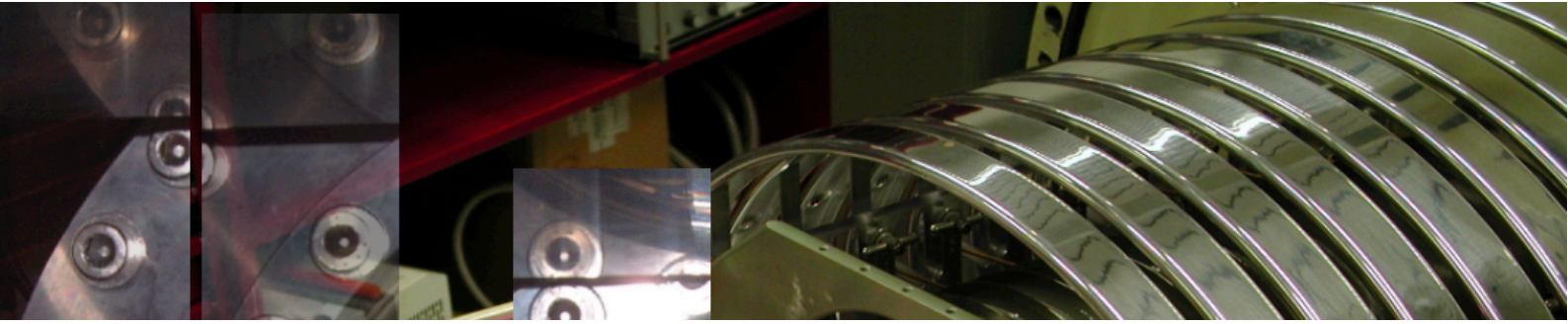

GIORNATA ACCELERATORI 7-8.04.2022

Speaker: David Mascali, on behalf of LNS and LNL Ion Sources groups

Ion Sources and related developments at LNS and LNL

Electron Cyclotron Resonance plasma based ion sources are nowadays able to produce extremely intense (tens or hundreds of mA) beams of light ions (p,d, He), and relevant currents of heavier elements (C, O, N) up to heavy ions like Xe, Pb, U. Such beams can be extracted and accelerated from a magnetic trap (that in the most advanced systems is made by superconducting magnets) by a suited electrostatic system, reaching energies up to several tens or even few hundreds of keVs.

The R&D on high performance ion sources plays a role of paramount importance to support hadron accelerators developments towards new ion species, as well as higher energies and beam intensities. Relevant applications can be also found in the post-acceleration of radioactive beams allowed by the so-called charge breeders employed in ISOL facilities, like SPES at INFN-LNL. More recently, a revival of interest about these machines in fundamental research has come from the PANDORA project, that will be the first setup attempting nuclear decays measurements in stellar like conditions.

INFN has been playing an international leading role in the development and modelling of ECR plasmas both for ion sources and for fundamental studies (including the description of the physical processes underlying their operations), proposing innovative technological solutions (including patent claims), and exploring the plasma properties with unprecedented precision by means of a variety of diagnostics systems and methods (interferometers and polarimeters, X-ray spectroscopes and pin-hole cameras, RF probes, etc.).

INFN leading role has been recognized, e.g., in the contexts of the European Spallation Source project (INFN was in charge of the Front-End realization responsibility) and of other regional and national funding programs supporting the AISHa project, i.e. an advanced ion source supporting hadrontherapy facilities and designed to operate in hospitals. More recently, LNL and LNS jointly took part in the EUROLABS initiative with a focus on ion sources services development with several European partners. The relevance of this research has permitted to open other interdisciplinary links with, e.g., thermonuclear fusion: the expertise gained on electromagnetic plasma heating systems and the above-mentioned diagnostics are providing valuable synergies with the DTT (Divertor Tokamak Test) project.