



PhD position - 2017

Location: GIP Arronax (<http://www.cyclotron-nantes.fr/spip.php?rubrique69>)

Field: Accelerator physics and beam diagnostics PhD

Subject: Studies of beam characteristics (at high and low intensities) and diagnostics for the beam lines of the Arronax C70 Cyclotron.

Description:

The Arronax Public Interest Group (GIP) located in Nantes, France, supported by national and regional institutes is a large platform with an international Research and Development objective. For this purpose it uses a high power C70XP cyclotron [1]. The machine is a unique prototype and prefigures a broad use of equivalent high power machines in the near future throughout the world.

The Arronax C70XP cyclotron is operated for three types of light particles sent downstream to 6 beam lines vault. The range of energies (30MeV -70 MeV for proton particles, 15-34 MeV for deuterons and 68 MeV for alphas) and intensity (from a few pA up to 350 μ A for protons) of the accelerator allows a wide range of applications including radiobiology, radiolysis, radiochemistry, production of isotopes, neutrons and nuclear physics experiments. Depending on the applications, the duration of operation [2, 3] can be from a few seconds to several days and some of the applications asks for a fixed beam envelope while other applications require precise beam characteristics. The facility runs throughout the year and necessitates stable and regular operation. The intention for the future usage of the machine are to go beyond the present operation and expertise.

In order to support present operation, transition towards higher intensities and prepare developments of beam lines and experiments, it is essential to study several global beam characteristics. The PhD position aim to support these goals. Particularly, the thesis is expected to focus on studies of beam dynamics, beam quality, dimension, shape, intensities and particle losses along the beam lines. These studies will lead to methodology for emittance measurements and beam tuning in accordance to cyclotron uses by experimentalists (i.e. at high intensities and also at very low intensities, below 100 pA). For this work, it is necessary to implement and use specific diagnostics such as monitors for particle losses and transverse dimension measurements systems. The project will further tackle the implementation and use of on-site diagnostics as well as developments of new strategies for beam tuning. The thesis takes part in this project and will be on both experimental and simulation work.

Requirements:

Candidate with a completed MSc degree (or soon to graduate) in physics or closely related field. The ideal candidate has a strong interest in experimental physics and accelerator/nuclear physics. The candidate should be enthusiastic about research, capable of learning new skills, and comfortable working both independently and within team collaborations.



Offer:

The PhD position is offered for three years. The candidate will be employed by GIP Arronax with grants from both CNRS (National Center for Scientific Research) and the region of Pays de la Loire. The candidate will be registered at the doctoral school of Nantes-Anger-Le Mans University (3MPL) and will be encouraged to join other educational programs (e.g. international accelerator school) if necessary.

Application:

Applications should be sent to recrutement@arronax-nantes.fr before the 24th of April 2017. The Curriculum Vitae and application letter should be included and also the email addresses of at least two references, who are willing to send a letter of recommendation on your behalf.

Letters of Reference should be sent to: poirier@arronax-nantes.fr

For informal discussion contact:

Dr Freddy Poirier – poirier@arronax-nantes.fr

Prof Férid Haddad – haddad@subatech.in2p3.fr

Bibliography and references:

- [1] F. Haddad, L. Ferrer, A. Guertin, T. Carlier, N. Michel, J. Barbet, J.F. Chatal, Arronax, a high-energy and high-intensity cyclotron for nuclear medicine. Eur J Nucl Med Mol Imaging. 2008, 35, 1377-1387.
- [2] F.Poirier *et al*, “C70 Arronax and beam line status”, IPAC11-WEPS069, 2011 and references therein.
- [3] F.Poirier *et al*, “Studies and Upgrades on the C70 Cyclotron Arronax”, Proc.21st Conf. on Cyclotrons and their Applications, CYC2016-TUD02, (Sept. 2016) and references therein.
- [4] D. Vandeplasseche *et al*, « Extraction simulation for the IBA C70 cyclotron », CYC-2007.
- [5] X.Li, “Study of beam losses and monitor for the A1 beamline of the cyclotron Arronax”, master thesis-2014, internal documents Arronax