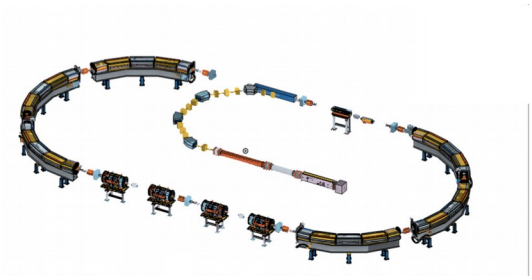
Proposal for a Master 2 degree internship.
Spring semester 2022.
BMI/BNL iRCMS project design studies

Period: *March 2022 to summer 2022. PhD may follow.*
Location: Brookhaven National Laboratory, Collider-Accelerator Department, LI, NY, USA
Collaboration team: *François Méot, Nick Tsoupas, Joshi Piyush (BNL), Joseph Lidestri, Manny Subramanian (BMI), Johann Collot (Grenoble Alpes University)*

Objectives of the internship:

Best Medical International (BMI) and the Brookhaven National Laboratory (BNL, New York) have been collaborating in the recent years on the design of a rapid cycling proton and ion synchrotron (iRCMS) for hadrontherapy (left figure below). Design studies have been covering the details of a prototype 60° magnetic sector comprised of 5 alternating gradient combined function (CF) dipoles, which has been constructed and is subject to magnetic field measurements at BNL (right figure below). The iRCMS ring RF system has been constructed and is at present under commissioning at BMI.



Details regarding the iRCMS, its design, field measurements, future goals, can be found for instance in
https://accelconf.web.cern.ch/ipac2019/papers/thpmp050.pdf,
https://accelconf.web.cern.ch/ipac2019/papers/mopgw123.pdf.

The goal of this internship is to finalize the parameters of a recent optimized design of the 60° sector and its 5 CF dipoles. This is a work essentially based on beam optics theory and numerical simulations. It may include, depending on student's interests:

- pursuing and finalizing on-going beam optics and beam dynamics studies. These are based on the use of computed field maps derived by modeling the 60° setor using the OPERA computer code. The goal is to validate the new 5-magnet 60° sector design. Validation with simulation of AC magnet excitation is part of the objectives;
- computing the dynamic aperture and study momentum acceptance, using the so optimized 60° sector field maps for the iRCMS 180° arcs lattice (left figure above); confirm the optimum parameters.

Beyond, the internship may include, as time permits:

- contributing to the design of beam injection & extraction into and out of the iRCMS racetrack accelerator;
- studying longitudinal dynamics issues associated with injection from various technologies such as LINAC and cyclotron;
- beam dynamics studies associated with the commissioning of the iRCMS RF system.

At the completion of this internship, the student will have acquired the necessary basic knowledge and skills to efficiently join on-going accelerator projects. One option is to carry on with the iRCMS project, in the framework of a PhD.