Proposition de Thèse (Oct 2017 – Sep 2020)

Title: **Calorimetry at Jefferson Lab & the Electron-Ion Collider**

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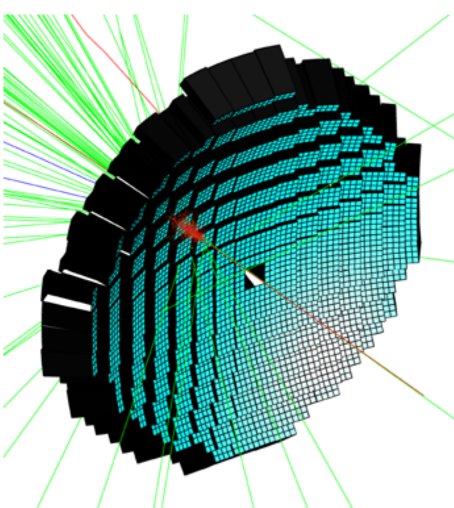
Description:

Nucleons represent 99% of the visible mass in the Universe, and yet there still many outstanding physics questions concerning their internal structure: how are the sea quarks and gluons, and their spins, distributed in space and momentum? Where does the saturation of gluon densities set in at high energy? How does the nuclear environment affect the distribution of quarks and gluons and their interactions in nuclei?

These open questions will be answered by the next-generation of e-p/e-A colliders, and in particular the Electron Ion Collider (EIC) to be built in the USA in the near future. Extensive R&D work is necessary in order to define the new detectors required to accomplish these ambitious physics goals. In particular, an important specification for the EIC endcap electromagnetic calorimeter is high-resolution in the electron-going direction in order to measure the energy of the scattered electron with precision.

The student will participate to the development of the technologies for the calorimetry measurements required by the experiments at the EIC. He/she will model the interaction regions with detailed Monte Carlo simulations and make estimates of the radiation dose. The simulation tools and interaction-region geometry developed will allow to study and design also the actual detectors to be used in the future EIC.



In addition, the student will be involved in the construction of a lead tungsten calorimeter (NPS, for Neutral Particle Spectrometer) to be used at Jefferson Lab. He/she will characterize the newly available crystals by measuring their light yield, optical transmission and, more importantly, their radiation hardness. Despite the high radiation hardness of some crystals, a significant loss of transmittance is expected at small angles with respect to the beamline. Methods to cure the crystal damage produced by the high radiation doses expected need to be developed and tested.

All this work will be performed in close cooperation with Brookhaven National Lab (New York, USA) and Jefferson Lab (Virginia, USA), with whom our group maintain close collaborations, and where many of the tests will be performed.