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Updating the LISE^{++} software and future upgrade plans

Production of new isotopes is one of the opportunities at the intensity frontier of nuclear physics. The associated science ranges from tests of the Standard Model to exploration of the origin and evolution of the chemical elements in the universe. Leading facilities in this effort are RIBF at RIKEN, TRIUMF in Canada, and ISOLDE at CERN. New large scale facilities under development at the nuclear intensity frontier include FAIR in Europe, FRIB in the United States, and others in countries including China, France, Korea, and Italy.

This talk will describe capabilities and future upgrade plans for the isotope production and simulation software that is used at many of these facilities, namely LISE
$textsuperscript{++}$ [1]. For reference of its wide-scale use, the LISE
$textsuperscript{++}$ website had approximately 3000 unique visitors in 2013, with Japan, USA, Germany, France, and China as the top five countries in terms of visitors.

LISE
$textsuperscript{++}$ is software used to predict beam intensity and purity of rare isotope beams produced in-flight by magnetic and electric separators. The primary use of LISE
$textsuperscript{++}$ at most facilities is to predict and identify the composition of Radioactive Nuclear Beams [1]. Intensity and purity of a desired beam can be predicted, along with the separator magnet settings. Included in the LISE
$textsuperscript{++}$ package are models of isotope production mechanisms, ion optical transport through magnetic and electric systems, and ion interactions in matter. The suite includes a full set of utilities for simulation of experiments.

The talk will highlight the process and methods of updating the software while retaining the computational integrity of the code. To accommodate the diversity of our users, we extend the software from Windows to a cross platform application. In addition, the C++ standard will be updated from Borland to C++11. The calculations of beam transport and isotope production are becoming more computationally intense with the new large scale facilities. For example, the 90 m long FRIB separator will have around fifty magnetic elements and ten points of beam interactions with matter. In order to perform the calculations in acceptable time, numerical optimization and parallel methods are applied. Computational improvements as well as the process of updating this large code will be discussed.

[1] LISE++: Radioactive beam production with in-flight separators. O.B. Tarasov, D. Bazin

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