Improvements in the radiation-testing hardware and software

V. Horvat and B. Hyman

In 2020 our software package (SEUSS) [1], used for control of the hardware and characterization of the beams at the Radiation Effects (SEE-line) Facility, has undergone a major upgrade from its 2019 version [2], in which SEUSS results for ion energy loss and range were set to match those obtained using the latest version of the Stopping and Range of Ions in Matter (SRIM) code [3], while keeping an option to do the calculations using the pre-upgrade method. Meanwhile, development of the software continued in response to hardware updates and users' requests.

In 2021 the selection of K500 beams imbedded in SEUSS was updated and made consistent with the list of K500 beams available for radiation testing. Furthermore, a separate selection of K150 beams, consistent with the list of K150 heavy-ion beams available for radiation testing, was created and made available for runs involving the K150 cyclotron. In the new beam lists atomic mass number of the ion is now a part of the beam name.

Since the 2022 version of SEUSS the users may define the background flux level used by the software to determine whether the beam is present or not present. This has an effect on the live-time fraction of the run time. The background flux level may be significant in a series of runs involving high beam intensity. Under these conditions the detectors and the surrounding structures may be activated, so that the ion detectors count even in the absence of the ion beam.

The data from the most-recently finished run are now available in the JSON format, which is easily read and parsed using java scripts. This is convenient for the users who want to analyze the data in real time, as soon as each run is finished.

A pdf tutorial for new users of SEUSS is now available online [4]. This tutorial is also a good reference for more experienced users and it provides answers to frequently asked questions. In contrast to the existing SEUSS Manual, which addresses the features of the software available in each dialog box or window, the tutorial explains the use of available features as needed during a run in a typical chronological order.

Further progress has been made regarding the migration toward a complete hardware and software solution supported by the Windows 10 operating system. To reach this goal, a new hardware has to be acquired and set to be controlled by the software in order to perform the following tasks: (*i*) generate suitable output voltages for inputs to nine detector power supplies, as well as provide an indicator that the beam path is clear all the way to the target; (*ii*) count the signals originating from the ion detectors; and (*iii*) physically move the target and the beam-energy degraders. The hardware for items (*i*) and (*ii*) already has been obtained from National Instruments [5], while the hardware for item (*iii*) is expected to become available soon. Development of the software for items (*i*) and (*ii*), illustrated in Fig. 1, is now completed and ready to be tested.

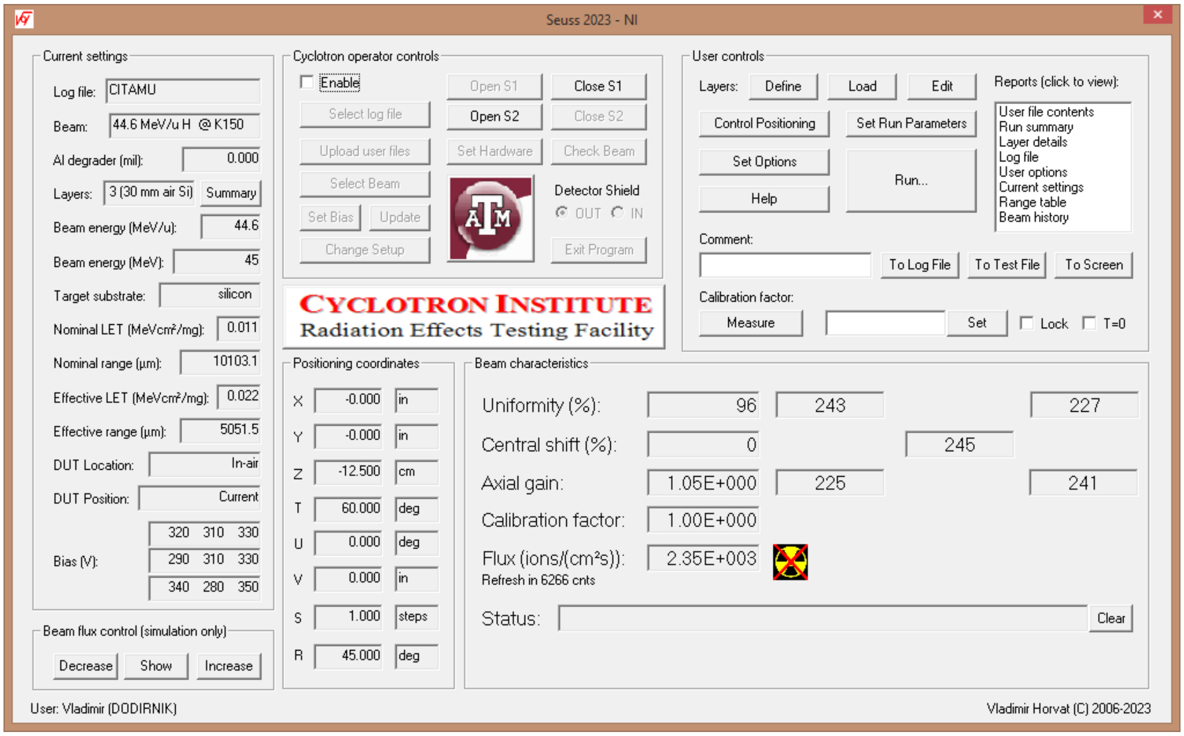

Fig. 1. A fully functional version of SEUSS software that supports hardware from National Instruments [5] is now available. Two NI modules are to replace the obsolete CAMAC system. One of the modules sets the required voltage levels, while the other module counts signals generated by the ion detectors.

[1] https://cyclotron.tamu.edu/vladimir/SeussW-Download.htm .

[2] V. Horvat, B. Hyman, M. Kennas and H.L. Clark, *Progress in Research*, Cyclotron Institute, Texas A&M University (2019-2020), p. IV-26.

[3] http://www.srim.org/ .

[4] https://mare.cyclotron.tamu.edu/vladimir/SEUSS-Tutorial.pdf .

[5] https://www.ni.com .