A software to manage and follow up in real time the activity of samples undergoing irradiation

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The production of long-lived radioisotopes may require an irradiation time which could surpass the operational daily availability of a facility. Under such a condition, a feasible alternative is to perform multiple irradiations. An irradiation may be also unexpectedly interrupted by some equipment malfunction obliging the operator to resume it later on. In both cases, it is a cumbersome task to register all the relevant data in order to resume the irradiation. All these tasks only deviates the operator attention from its main attributions, namely the control of the irradiation and surveillance of the equipment and instrumentation. Even for uneventful irradiations the operator can rely only on the elapsed time to evaluate the so far reached activity. A *Fortran 90* program has been developed to deal with all these cases, setting thus the operator free to concentrate in the reactor operation itself. Although the main target is the irradiation with thermal neutrons in a reactor, the program can be as well employed for other kind of irradiations involving charged particles, like in a cyclotron for instance. The researcher must provide 4 parameters to the operator: nuclide half-life, saturation activity, final activity and irradiation time. Once the first two parameters are defined, the last two are tied through a logarithmic function. Yet, it is necessary to specify both, because the irradiation time could not be applied due to logistic constraints at the facility, obliging the operator to perform more than one irradiation in order to reach the specified activity.

After the input of the four parameters in the program, the operator simultaneously starts the irradiation and the software. A table is then displayed on the screen of a PC monitor showing a table of the current *activity x elapsed time*, as well as a related graphics. When the irradiation time *or* the activity is reached, a train of beeps is emitted alerting the operator to simultaneously shut down the irradiation and the program itself. Should the irradiation be interrupted by any other reason, the operator interrupts as well the software run. If the irradiation should be at any time resumed, the operator does not need to register any data concerning the end of the former irradiation, nor the beginning of the next one, but simply start the software again after specifying that it is a *subsequent irradiation*. The software then reads the file containing data of the previous *irradiation* corrects the radioactive decay and starts to run the next one. It should be stressed that disregarding the cumulative activity from previous irradiations no extra action is required from the operator, but solely to re-start the program - simultaneously with the new operation - which manages properly all the relevant parameters. This simultaneity is essential, since there is no direct connection between the irradiation facility and the program itself, other than *time*. Once the *saturation activity* [1] and *nuclide half-life* [2] are specified, the *irradiation time* and *final activity* are tightly tied to each other, i.e., both would be reached simultaneously at the end of the irradiation. In the example shown in Figure 1, the prescribed irradiation time of 8 hours was sufficient to produce the aimed activity of 1 mCi of a 3-hours half-life nuclide under a saturation activity of 1.187 mCi. Further details can be found elsewhere [3]. The software and operating instructions are freely available on request to msouza@ien.gov.br.
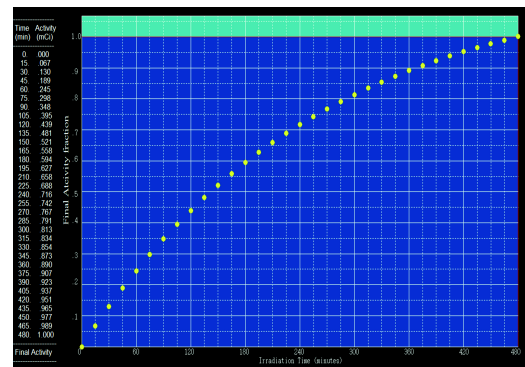

Figure 1. Actual monitor display of a typical operation. The table at left shows the elapsed time and the so far reached activity.

References
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