

## Luminosity calculations for NESR experiments\*

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The obtainable isotope intensities in the NESR are of prime interest for e.g. the AIC, ELISE, EXL, ILIMA and SPARC experiments. This paper describes briefly a newly developed programme that allows reliably predicting them. At energies around 1 GeV/u, the isotope production process can be well described by the intra-nuclear cascade model, or - in the case of heavy-ion collisions - by the

molecules. In addition, for the case that the internal target is used, charge exchange in collisions with the gas atoms of the jet target must be considered. Usually, this gives the most important contribution to beam losses and determines the overall beam lifetime. Target density  $\rho$  ( $\text{p/cm}^2$ ) and charge exchange rate  $\lambda$  are simply connected by  $\lambda=1/\tau = \rho \sigma f$ , where  $f$  denotes the revolution fre-

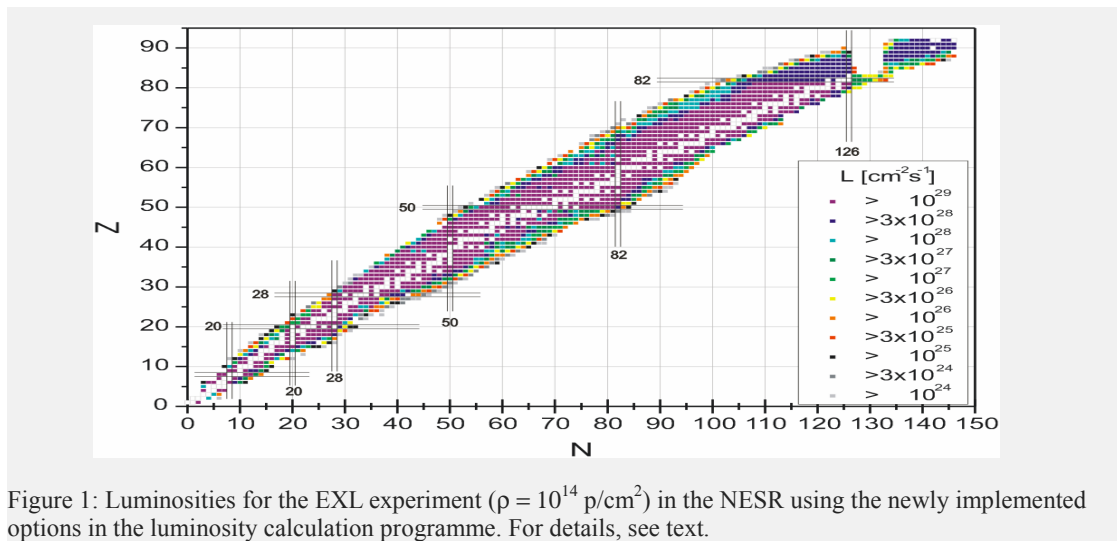


Figure 1: Luminosities for the EXL experiment ( $\rho = 10^{14}$   $\text{p/cm}^2$ ) in the NESR using the newly implemented options in the luminosity calculation programme. For details, see text.

abrasion model. For quantitative predictions these have been modelled in terms of two-step (abrasion plus evaporation) codes (ABRABLA), with a careful description of fission included [1]. Alternatively, fragmentation cross sections of non-fissile projectiles have been fitted to an empirical formula, EPAX [2]. The transport through the SuperFRS [3] is calculated using a parameterization that is obtained from a full ion optics simulation, together with a model calculation for the nuclear and electromagnetic breakup processes in the Nb degrader material. The degrader thickness is hereby optimized to allow for the necessary fragment resolution while restricting the maximum energy loss in the material. The new primary beam intensities and cycling schemes [4] for the SIS cyclotron installations have been taken into account. A more refined full production simulation is planned. The beam life time ( $\tau$ ) for cooled and stored ion beams in the NESR is determined by recombination processes in the electron cooler and charge changing collisions with residual gas atoms /

quency of the circulating ion beam and  $\sigma$  the atomic charge-exchange cross-section, respectively. Assuming a stored beam of bare ions, the two most important charge exchange processes for bare ions are Radiative and Non-Radiative Electron Capture (REC and NRC) [5]. In case of H- and He-like ions K-shell ionization occurring in atomic collisions have to be considered in addition [6]. Together with the tabulated nuclear life times and an optimized measurement cycle in the NESR e.g. the result shown in Fig. 1 is obtained.

### References

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\*Supported by the EC under INTAS contract number 03-54-6545  
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