

On-Line Separator for γ -Spectroscopic Studies

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In recent years γ -spectroscopy of heavy nuclei has been very intensively developed in two directions. In the first case one detects prompt γ -rays using 4π -Ge-detector arrays placed around the target [1]. In the second case α -, β - and γ -spectroscopic measurements will be performed with detector arrays placed at the focal plane of an on-line separator [2].

A JINR – IN2P3 collaboration project aimed at the nuclear spectroscopy of transfermium elements using the modernized recoil separator VASSILISSA was launched 2004 at JINR in Dubna. This project was named “GABRIELA” - Gamma Alpha Beta Recoil Investigations with the Electromagnetic Analyser [3].

In the close future the FLNR cyclotron U400M will go through a major upgrade (U400MR) with the goal to deliver heavy ion beams at energies close to the Coulomb barrier in a new experimental area. This possibility is of great importance for the development of the GABRIELA project also in the direction of prompt γ -ray spectroscopy at the target position.

To realize new possibilities we plan to construct an on-line electromagnetic separator for spectroscopic studies of nuclei produced in heavy ion induced reactions. The new separator will be of MQ-MQ-MQ-ES-DI-DI-ES-MQ-MQ-MQ-DI type (where MQ stands for quadrupole lenses, ES for electrostatic sector, DI for dipole magnets) and will operate in vacuum mode. The ion optical calculation of the set-up were performed using the COSY [4] computer code.

The following table illustrates the planned characteristics of the separator:

Maximum beam current on the target	5×10^{12} part/sec
Target thickness	100-500 $\mu\text{g}/\text{cm}^2$
Angular acceptance	$\pm 4.0^\circ$
Energy transmission range	$\pm 15\%$
Charge transmission range	$\pm 15\%$
Transmission efficiency for ER's	5 - 50%
Suppression factors for scattered beam	$10^{11} - 10^{13}$
Suppression factor for transfer products	$10^4 - 10^5$

References:

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3. K. Hauschild *et. al.*, Nucl. Instr. & Meth. A560(2006)388;
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