

## Referee Report on the Theme

“STATUS OF THE SUPERHEAVY ELEMENT FACTORY: Separator, target and detector units”

### 1. Overview

The target, the separator and detecting stations are part of the core development of the SHEF factory, and to take advantage of the performances of the DC-280 cyclotron and of the expected beam intensity (10 $\mu$ A) new advanced projects had to be exploited and are partially under development.

### 2. Target

The target station is one of the most critical subunit of the factory. The many features that such a units has to fulfill, and stated in the report, make its design a very difficult task. I consider as positive the strategy to start the commissioning of the factory with the well know rotating target technology or the fixed target cooled with the gas used in the separator in the gas filled mode.

I would welcome more detailed information on the new project for the gas-filled separator expected to accept beam current up to 8-10 $\mu$ A, which would be already an outstanding achievement

### 3. Separator

After the target, the separator has the important task of suppressing unwanted reaction products and the beam itself. The unwanted reaction products have however the largest intensity, up to 10<sup>15</sup> larger than the fusion-evaporation products. The rejection factor is therefore very high and requires a careful design of the separator. I consider as efficient and positive the strategy to work around three types of separators: 1) a pre-separator as a suppressor of the primary beam to be used for chemical studies of superheavy elements, 2) a velocity filter dedicated to the spectroscopic studies, 3) a gas filled separator dedicated to the studies of productions of superheavy elements. The velocity filter SHELS (point 2) is already in operation at U-400 accelerator complex and is already producing new physical results. Concerning the gas filled separator (point 3), its construction is in progress and its installation on beam line #3 is expected by October 2017. Concerning the pre-separator (point 1) the construction is under discussion. I would welcome more technical information on point 1 and 3 so to evaluate the design parameters with respect to the achievements, being the latters of more importance for the first phase of the commissioning of the full facility and the first day experiments.

### 4. Detector units

The detectors and associated electronics being developed seem to be suitable for the dedicated measurements involving an increased energy and position resolution with respect to the setup previously used. The adoption of cooling and digital electronics will certainly favor the increment of the bulk performances. I consider very important the decision to include in the setup 5 germanium detectors to register photons in coincidence with the implanted evaporation residues.

## **5. Closing remarks**

The progress of the separator and detection stations seem to be very much appropriate for the foreseen experimental program. I also support the strategy of using, at its best, the known technology for the construction of the target. I would welcome a more deep insight presentation on a strategy for the development of new concepts for a high power target

June 13, 2017

Emanuele Vardaci

A handwritten signature in black ink that reads "Emanuele Vardaci". The signature is written in a cursive style with a small flourish at the beginning.

**“SYNTHESIS AND PROPERTIES OF NUCLEI AT STABILITY LIMITS”**  
**Period 2010/2016**