Referee Report to the presentation by Vladimir Utyonkov on the

“Programme of Day-1 experiments at the SHE Factory”

The first paragraph of the proposal and the largest part of the second paragraph comprise a program of several years. It is justified to point out the long-term program but it has to be marked as such. The program more adequate to the Day-1 experiments is presented in the first three sentences of the second paragraph.The main part of the presented experiments starting with a detailed study the reaction 243Am+48Ca followed by an investigation of the reaction 242Pu + 48Ca including chemistry of Fl and Cn covers already a very sophisticated program which in my opinion is not appropriate as Day-1 experiments.

As Day-1 experiments I fully support a study of the various conditions and parameters using reactions with beams of 48Ca and 50Ti for production of isotopes of elements Z = 90 to 104. Testing the capabilities ofDGFRS-2 coupled to DC-280, as outlined in the proposal, must have first priority. Among these tasks are the measurements of the image size of the distribution of the synthesized nuclei, their transmission through and their dispersion after DGFRS-2. Unfortunately, the proposal is not very specific in what measurements will be performed in detail and how particularly the experimental requirements for the long-term production runs are provided, tested and optimized.

The following items partly repeating the ones given in the proposal, I would like to add as important parts of Day-1 experiments:

1. Items related to the beam: energy, energy distribution, intensity, beam profile and stability with respect to these features. The study of these items must be carried out commonly with people from the accelerator and the experiment.
2. Stability of targets, continuous control of the target quality during a running experiment, control of the size and intensity distribution of the beam spot on target. For testing the performance of targets at high beam intensities, an oxide of a rare earth element could be used for simulating an AmO2 target which is planned to be used in a next step.
3. The measurement of transmission through DGFRS-2 and total efficiency including detection efficiency is another important task for the beginning. The results can be compared with calculations thus providing confidence into the calculations for situations when only calculated efficiencies can be used for determining the cross-sections of the heaviest elements.
4. Test of the detector system including electronics with respect to resolution, noise, disturbances, and stability of the amplification. Optimization of the efficiency of the TOF detectors when used as anti-coincidence detectors. Test of the analysis programs. For the future study of the reaction 243Am + 48Ca, I consider additional gamma and X-ray detectors as essential. Test runs of such an extended detection system using reactions producing isotopes of elements from Z = 90 to 104 are necessary.

Starting with a completely new set-up there will arise certainly also unexpected problems which need to be solved before the first production runs can start. The removal of all problems will need time which has to be provided so that all follow up experiments will profit from this preparation.

As a most important item of those mentioned before, I consider the optimization of the beam intensity on the target, an efficient target control, and a moderate increase of the beam intensity on the target during the testing phase.Such a sophisticated treatment of target preparation and target control is essential for reaching the limits of beam intensity which will be provided by DC-280. Only after satisfactory results from the preparatory experiments a detailed program for the first physics experiments can be set up. The envisaged study of the reaction 243Am + 48Ca is certainly a good choice for the next step of experiments at the new SHE Factory.

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