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The N=126 factory: a new facility to produce the very-heavy neutron-rich isotopes

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A new facility, the N=126 factory, is currently under construction at Argonne National Laboratory. It will use multi-nucleon transfer reactions to create neutron-rich isotopes of the heaviest elements for studies of interest to the formation of the last abundance peak in the r-process. This region of the nuclear chart is difficult to access by standard fragmentation or spallation reactions and as a result has remained mostly unexplored. The nuclei of interest, very neutron-rich isotopes around $Z=70-95$, will be produced by multi-nucleon exchange of a high intensity 10 MeV/u heavy-ion beam on the most neutron-rich stable isotopes of heavy elements such as ^{198}Pt and ^{238}U . This reaction mechanism can transfer a large number of neutrons and create with larger than mb cross-section very neutron-rich isotopes. The reaction mechanism is a nuclear surface process and the reaction products come out at around the grazing angle which makes them very difficult to collect. The N=126 factory circumvents this difficulty by using a unique large high-intensity gas catcher, similar to the one currently in operation at CARIBU, to collect the target-like reaction products and turn them into a low-energy beam that will then be mass separated with a medium resolution electromagnetic separator ($DM/M \sim 1/1500$), followed by an RFQ buncher and an MR-TOF ($DM/M \sim 1/100000$) system. The extracted radioactive beams will be essentially pure and be available at low-energy for mass measurements with the CPT mass spectrometer or decay study with the X-array. Status of the overall facility construction will be presented, together with commissioning results of the novel front end and the observed yield.

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