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The N=126 factory at Argonne National Laboratory

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The properties of nuclei near the neutron $N = 126$ shell are critical to the understanding of the production of elements via the astrophysical r-process pathway, particularly for the $A \sim 195$ abundance peak [1]. Unfortunately traditional particle-fragmentation, target-fragmentation, or fission production techniques do not efficiently produce these nuclei. Multi-nucleon transfer (MNT) reactions between two heavy ions, however, can efficiently produce these nuclei [2]. The $N = 126$ factory currently under construction at Argonne National Laboratory's ATLAS facility will make use of these reactions to allow for the study of these nuclei [3]. Because of the difficulty collecting MNT reaction products, this new facility will use a large-volume gas catcher, similar to the one currently in use at CARIBU, to convert these reaction products into a low energy beam that will initially be mass separated with a magnetic dipole of resolving power $R \sim 10^3$. Subsequently, the beam will pass through an RFQ cooler-buncher and MR-TOF system to provide high mass resolving power ($R \sim 10^5$) sufficient to suppress isobaric contaminants. The isotopically separated, bunched low-energy beams will then be available downstream for measurements such as mass measurements using the CPT mass spectrometer or decay studies. The status of the facility under construction will be presented, together with commissioning results of the component devices. This work was supported in part by the U.S. Department of Energy, Office of Nuclear Physics, under Contract No. DE-AC02-06CH11357; by NSERC (Canada), Application No. SAPPJ-2018-00028; by the National Science Foundation under Grant No. PHY-1713857; by the University of Notre Dame; and used resources of ANL's ATLAS facility, an Office of Science User Facility.

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Primary author(s) : Dr VALVERDE, Adrian A. (Argonne National Laboratory)

Co-author(s) : BRODEUR, Maxime (Notre Dame); Dr CLARK, Jason A. (Argonne National Laboratory); KNAACK, Russell (Argonne National Laboratory); Prof. SAVARD, Guy (Argonne National Laboratory/University of Chicago); Prof. SHARMA, Kumar S. (University of Manitoba); Dr YAN, Xinliang (Argonne National Laboratory); ZABRANSKY, Bruce J. (Argonne National Laboratory)

Presenter(s) : Dr VALVERDE, Adrian A. (Argonne National Laboratory)