Low-energy injection and AMS beamline upgrade at the NSL and ^{36}Cl production in X-wind model revisited

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In conjunction with the upgrade of the Nuclear Science Laboratory's (NSL) FN-tandem's low energy (LE) injection beamline in 2016-17, the AMS beamline was upgraded in 2018-19 and a Time-of-Flight section was added. The figure below illustrates the improvement in isotopic selectivity that the new LE-system brings to the FN operations. In addition to the improved selectivity, the new system also provides off-axis Faraday cups for stable beam monitoring as well as sequential beam injection. The new capabilities greatly improve the precision of Accelerator Mass Spectrometry (AMS) measurements and the talk will present new results made with the system, in particular results associated with the production of ^{36}Cl for X-Wind models in the Early solar system.

In a previous measurement performed by Bowers et al. (2013) [1], the cross section of the ^{33}S(α,p)^{36}Cl reaction was studied using a combination of activation of a ^{4}He gas cell and analyzing the produced ^{36}Cl via AMS over an energy range of 0.7 – 2.42 MeV/A. The result of this measurement was a significantly higher yield of ^{36}Cl than usually predicted by Hauser-Feshbach cross section calculations [1]. A new experimental campaign in collaboration with PRIMELAB of Purdue University was started to confirm the production cross section of this reaction, which contributes significantly to the abundance of ^{36}Cl in the Early Solar System and is an important input in solar irradiation models [2].

In addition a new campaign to measure the ^{34}S(^{3}He,p)^{36}Cl production cross-section in the same energy range was recently performed at Notre Dame. Results of the ^{33}S(α,p)^{36}Cl re-measurements [3] as well as the new ^{34}S(^{3}He,p)^{36}Cl campaign will be presented.

1. [1] "First experimental results of the ^{33}S(α,p)^{36}Cl cross section for production in the early Solar System." M. Bowers, P. Collon, Y. Kashiv, W. Bauder, K. Chamberlin, W. Lu, D. Robertson, C. Schmitt. 2013, Nucl. Instr. and Meth. B 294, pp. 491-495.
2. [2] "Did Solar Energetic Particles Produce the Short-lived Nuclides Present in the Early Solar System?" J.N. Goswami, K.K. Marhas and S. Sahijpal. 2001, Astrophys. J. 549, p. 1151.
3. [3] "The ^{33}S(α,p)^{36}Cl cross section revisited" Tyler Anderson, Michael Skulski, Adam Clark, M. Beard, P. Collon, Y. Kashiv, Austin Nelson, K. Ostdiek, D. Robertson, Thomas Woodruff, Phys. Rev C 96 015803 (2017)