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Fermilab 反陽子ターゲットステーションでのガス実験
Gas Experiment at Fermilab anti-proton target station

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Various radiations, such as proton, neutron, pion, γ-ray, and X-ray produced by bombarding high energy beam to a target, occur in a target station used for a high energy nuclear physics during machine operation. On the other hand, such kinds of radiations are also present at the upper atmosphere. Therefore, we could assume high energy accelerator environment as a mimic environment of the upper atmosphere. In the upper atmosphere, not only cosmogenic nuclides such as Be-7 and Cl-36 but also various molecules are produced by a cosmic-ray irradiation and photodegradation of terrestrial gaseous materials by an UV-ray etc. It is believed that these nuclides and/or molecules adsorb on aerosol and then migrate. Sometimes, cosmogenic nuclides are used for a proxy to investigate airborne particles. But, the behavior of halogen has not been known well. In this work, we investigated behavior of the nuclides using Fermilab anti-proton target station.

120 GeV-proton beam was introduced to the Inconel 600 target at Fermilab anti-proton target station. Primary and secondary particles activate the target and air. Various radionuclides which originate from the target and air are present in the target vault. Particulate and gaseous component were collected by the filter stack, ADVANTEC 5A filter, Teflon membrane filter with pore size of 0.1 μm, charcoal filter, and $NaCO_3$-impregnated filter, using an air pump. The 5A and membrane filter were subjected to rough size-discrimination of the particle, charcoal filter to gaseous component. The $NaCO_3$-impregnated filter was subjected to collect acid gaseous component which was not adsorbed on the charcoal filter. After sampling, radioactivity in each filter was measured using a HPGe detector.

Approximately 70% of Be-7 and Na-22, produced by activation of air, were collected to 0.1 μm membrane filter, and 5% of other spallogenic activities such as Mn-54 and Co-56, originate from target, were collected to 5A filter. These nuclides were not detected in the charcoal filter. Cl-39 and Br-82 were observed in only charcoal filter. No activity was detected in the $NaCO_3$-impregnated filter. It was confirmed that halogen migrates as gaseous state and the radioanuclides except for halogen as particulate material.

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