

## Low Radioactivity Argon from Underground Sources

*Wednesday, 29 May 2013 14:40 (25 minutes)*

The cosmogenic  ${}^39\text{Ar}$  concentration in atmospheric argon is  $8.1 \times 10^{-16}$ , which amounts to 1Bq of  ${}^39\text{Ar}$  decays in a kg of atmospheric argon. This decay rate can limit the size of liquid argon dark matter detectors due to pile-up. The cosmic ray shielding by the earth means that argon from deep underground should not contain  ${}^39\text{Ar}$ .  $\text{CO}_2$  wells in Southwestern Colorado have been found to contain approximately 500ppm of argon as a contamination in the  $\text{CO}_2$ . We have developed an extensive system of processes to extract the low radioactivity underground argon (UAr) from the  $\text{CO}_2$  and purify it for use in the Darkside 50 experiment. Through chromatography, our plant in Colorado extracts an UAr/He/ $\text{N}_2$  mixture from the  $\text{CO}_2$ , which, to date, has produced more than 170 kg of UAr. At Fermilab we have developed cryogenic plants that: separate helium at high pressure, remove residual organic contamination ( $\text{CO}_2$ ,  $\text{C}_4\text{H}_{10}$ ,  $\text{C}_5\text{H}_{12}$ , etc.), and finally purify the argon from the nitrogen through cryogenic distillation. We are also trapping residual argon in our waste streams to maximize UAr retention. In this talk I will discuss each of these plants and their performance, as well as the status of UAr purification.

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