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## The DarkSide-20k argon procurement chain

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The DarkSide-20k experiment searches for dark matter by looking for interactions of WIMPs in a 50 tonnes target of liquid argon using double-phase time projection chamber technology. The key component of the experiment is low radioactivity argon depleted in the isotope  $^{39}\text{Ar}$ .

The supply chain begins with the Urania plant in Colorado, which can produce argon at a purity of 99.99% from a  $\text{CO}_2$  stream sourced from a deep well that reaches the Earth's mantle, at a rate of about 250 kg/day. The plant, which includes four distillation columns and a pressure swing absorption stage, has already been fabricated while the site is being prepared for installation. After this initial purification stage, the argon will be transported to Sardinia, Italy, where the Aria plant, based on a 350 m cryogenic distillation column, will further suppress impurities by several orders of magnitude. The Aria plant has already been fully fabricated and is now in the installation phase. A lower version, about

26 m high, has been tested over the last three years with very positive results confirming the cryogenic distillation technology.

The importance of this supply chain and of associated techniques extends well beyond DarkSide-20k. Low-radioactivity argon is also of interest for the LEGEND-1000 experiment and for the ultimate dark-matter search experiment using argon ARGO and is attracting the attention of the DUNE collaboration for its Module of Opportunity.

### Submitted on behalf of a Collaboration?

Yes

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