

The SABRE North experiment at LNGS to search for Dark Matter annual modulation

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The SABRE experiment aims to deploy arrays of ultra-low-background NaI(Tl) crystals to carry out a model-independent search for dark matter through the annual modulation signature. SABRE will be a double-site experiment, consisting of two separate detectors in the two terrestrial hemispheres, reliant on a joint crystal R&D activity. The SABRE North detector will be installed underground at LNGS and will deploy ultra-high radio-purity NaI(Tl) detectors in a Cu and PE passive shielding. The expected background rate in the ROI [1,6] keV is of order 0.5 dru. To this end SABRE North will make use of zone refining purification of the NaI powder. The collaboration has recently confirmed the technology to produce 5 kg size NaI(Tl) crystals after zone refining purification of the powder. This is a breakthrough in the production of ultra-high radio-purity NaI(Tl) scintillators. Based on this development SABRE North is starting crystal production. The first crystal after zone refining will be delivered at LNGS in early 2025 for characterization. The SABRE North detector will be equipped with 9 crystals of about 5 kg each located inside a thin Cu box and shielded against environmental background with Cu and PE.

Results from zone refining runs and crystal growth development will be reported together with the potential of the detector for the specific physics case. Segregation coefficients of different impurities will be reported to show how this method is more or less effective to reduce background components which limit the dark matter search sensitivity. The time schedule of crystal production and detector deployment will be reported.

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