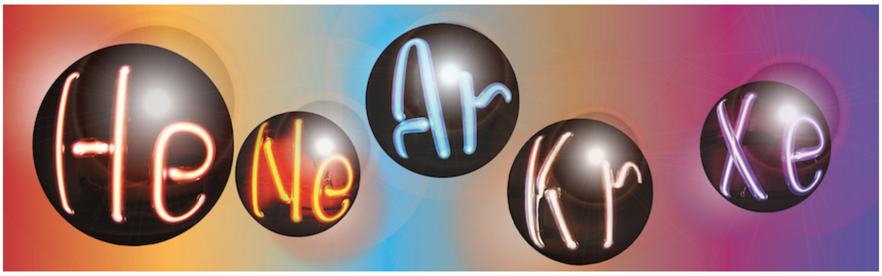

Contribution ID: **62** Type: **Oral Presentation**

Ultra-Low-Radioactive titanium alloy as a promising construction material for low background cryostats

Thursday, 23 October 2025 10:00 (20 minutes)

Modern experiments based on registration of scattering of neutral particles (neutrinos, neutrons, WIMPs, etc.) on ultra-low-background targets of liquid and compressed noble gases require a reduction in the energy threshold for success. This can only be achieved by reducing the natural radioactive background of both the target itself and the detector's structural materials. As the target mass increases to tens and hundreds of tons, the requirements for the structural materials increase, which creates a challenging task for the developers of such detectors. Searching for the necessary volumes of ultra-low-background materials for manufacturing a detector in finished product warehouses becomes unrealistic. The task of industrial production of tens of tons of construction materials with predetermined, guaranteed by technological processes, levels of intrinsic radioactivity at the level of μBqs/kg becomes relevant.
Basic principles of titanium alloys production together with very high technological culture of titanium industry predefined a possibility to develop a technological cycle of the ultra-low-radioactive titanium (ULR-Ti) production. It was confirmed experimentally that it is possible to produce a titanium sponge with a level of contaminations below 100 uBq/kg of U and Th within an industrial Kroll-process. Then, the ULR-Ti sponge was converted into the construction titanium of VT-00 grade using EB-vacuum melting followed by bi-directional cold rolling and annealing to avoid a recontamination and keep the material as pure as the original sponge. The mechanical properties of the manufactured ULR-Ti meet the requirements of VT-00 grade, which is very suitable for cryogenic applications. Hence, this material could be used for production of cryostats, containment tanks, passive shielding and other mechanical elements of the modern low-background detectors. It was also tested and confirmed that a laser welding is preferable to an arc welding in order to keep ULR-Ti original purity and mechanical properties. The mass of the first ULR-Ti bunch produced for test purposes and spent for radio-purity and mechanical tests at different production stages was of a scale of tens kilos. The jump from a laboratory kilos scale to the tons scale needs additional investigations, but it should be noted, that current kilos scale samples where manufactured by the standard industrial processes.

Primary author: CHEPURNOV, Aleksandr (Moscow State University, Skobelcyn Institute for Nuclear Physics)

Presenter: CHEPURNOV, Aleksandr (Moscow State University, Skobelcyn Institute for Nuclear Physics)

Session Classification: Detector techniques

Track Classification: Detector techniques (HV, purification, cryogenics, calibration etc.)