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C3Or1A-01: Development of a Helium-3 Cryostat for Ultra-Cold Neutron Source

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Ultra-cold Neutrons (UCNs) are extremely slow neutrons of which the kinetic energy is below several hundred neV. As a consequence, UCNs are totally reflected at the surface of certain materials and can be confined in a material bottle. Using this unique property, UCNs are used for various experiments such as neutron electric dipole moment searches, neutron lifetime measurements, and gravity experiments. In order to improve the statistical uncertainty of those experiments a high intensity UCN source is required.
Super thermal method is used to produce UCNs. A cold neutron guided in superfluid helium excite a single phonon or multi phonons in the superfluid helium and lose their kinetic energy down to UCN region. The temperature of the superfluid helium needs to be maintained at approximately 1.0 K to avoid UCN loss by reverse reaction
The TUCAN (TRIUMF Ultra-Cold Advanced Neutron source) collaboration established for aiming to build a high intensity UCN source on a dedicated proton beam line at TRIUMF. The source is composed of a combination of a spallation neutron target and a superfluid helium UCN converter. Estimated heat deposit from spallation reaction on the superfluid helium is approximately 10 W. In order to achieve the requirement of superfluid helium temperature, a high-power helium-3 cryostat has been developing. Heat transport property in superfluid helium at 1.0 K is also a key element of the UCN source cryogenics.
In this presentation, the current status of the development of the cryogenic system and their expected performance will be discussed.

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