

First ultracold neutrons from the new TUCAN source at TRIUMF

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The TUCAN collaboration is developing a next-generation spallation-based ultracold neutron (UCN) source at TRIUMF to supply high-density UCNs for fundamental physics experiments. The source's design leverages protons from TRIUMF's 500-MeV cyclotron and a large flux of cold neutrons created by a room-temperature heavy water moderator and a liquid deuterium shell, which then feed a superfluid liquid helium-4 volume at ~1 K. The unique properties of the superfluid allow for the efficient production and extraction of UCNs with a long storage lifetime.

Construction of the source was completed in 2025, and it is currently undergoing commissioning with beam. Following successful cryogenic commissioning, the first ultracold neutrons were produced from the spallation target's irradiation. Initial tests, conducted without the liquid deuterium moderator, demonstrated a significant UCN yield, with approximately 900,000 UCNs detected after a 60-second irradiation. We anticipate that the liquid deuterium moderator will increase this yield by an order of magnitude, up to a factor of 50.

This presentation will detail the source's innovative design, highlight the key milestones of its construction and commissioning, and discuss these exciting initial results.

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