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Commissioning a CTBT Coincidence Detector System Underground at SNOLAB

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The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is a United Nations General Assembly adopted treaty with basic obligations stating that no ratified nation may detonate nuclear explosions. To detect possible nuclear events, xenon isotopes stemming from such nuclear events can be found in atmospheric air samples through beta-gamma coincidences.

The CTBT system can detect these beta-gamma coincidences using two detectors in conjunction. Beta particle emissions are detected by a PIPS detector. Gamma ray emissions are detected by a High Purity Germanium (HPGe) detector. Simultaneous beta particle and gamma ray detections indicate a coincidence.

Commissioning this system at SNOLAB's underground clean lab is of interest to significantly reduce background radiation present on the surface of the earth.

Bringing the CTBT system into working order requires both the PIPS and HPGe detectors be brought into accurate operation, reached when a source's beta or gamma spectrum is well detected compared to theoretical values.

For the PIPS detector, quantities such as rise times and flat tops for pulse processing were adjusted at the recommendation of Health Canada, removal of (spectrum) noise generating components, and adjustment of gain. The HPGe detector was calibrated similarly to the other Germanium detectors underground at SNOLAB, notably the programmatic optimization of flat top and rise time pulse processing, and high voltages levels.

The final component in commissioning was the adjustment of liquid nitrogen (LN2) flow rate to purge radon from the source chamber. A preferred LN2 flow rate is determined between three levels.

This talk will outline the trials and steps taken to bring the CTBT system into its current state of operations, with additional preliminary results.

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