

Tests of RP sub-systems have occurred in a cryo-vacuum chamber [4-6] that accommodates a tube filled with lunar simulant, NU-LHT-3M, prepared with known abundances of water. During 2016, once the average soil temperature reached \( \approx 180 \) K, drilling activities commenced and NIRVSS alternated between obtaining spectra and images.

**Experimental Data:** NIRVSS measures diagnostic signatures of water ice near 2000 and 3000 nm and two band depths (BDs, BD2000 and BD3000) were defined to track the ice behavior during drilling [7]. As ice-bearing soils are emplaced onto the surface these BDs increase and then decrease as the ice sublimes (Fig. 1 top). Imaging revealed complex behavior of the drill cuttings piles; including down-slope soil movement, slope failures, and funnel blockage preventing deposition of new soil onto the surface. This dynamic activity discourages using the active drilling observations to assess ice sublimation. On several occasions, the drill, while static, was percussed in an attempt to document the sublimation behavior of exposed ice (Fig. 1, top, orange lines).

**Characterizing Sublimation Behavior:** Fig. 2 shows BD2000 (blue circles), and BD3000 (red circles) after the final of three one-second percussions. Each percussion was fit with a 3-term exponential decay function: \( BD = y_0 + a \cdot e^{-bx} \), where \( x \) is the elapsed time after the percussion. Example fits are shown as the solid lines in Fig. 2 with residuals at the top for each BD.

**Discussion:** BDs derived from the NIRVSS spectra document sublimation of exposed water ice during drilling (Fig. 1, top) and after percussion (Fig. 1 bottom). Exponential fits to the BDs after percussions provide an estimate of the sublimation time of the exposed ice (Fig. 2), documenting a decay to background levels in \( \approx 60 \) seconds. Compared to calculations of pure ice [8], this behavior is consistent with relatively fine grained sub-surface ice exposed to temperatures above 150 K, a temperature consistent with the measured average soil temperature (\( \approx 180 \) K). The BD behavior after the percussive events may permit more detailed models of sublimation behavior from the more complex soil-water ice mixture [e.g. 9].

**References:**