USING BECA TO MAP THE SUBSURFACE COMPOSITION AT THE LUNAR POLES. A. M. Parsons[1] and M. Ayllon Unzueta[1,2], [1]NASA Goddard Space Flight Center, 8800 Greenbelt Rd., Greenbelt, MD 20771 (Ann.M.Parsons@nasa.gov), [2]Oak Ridge Associated Universities, Oak Ridge, TN.

Introduction: The Bulk Elemental Composition Analyzer (BECA) is a new instrument that has been matured through NASA's Development and Advancement of Lunar Instrumentation (DALI) program and has great potential for use in lunar In Situ Resource Utilization (ISRU) activities[1]. BECA employs nuclear techniques to measure the in situ near-surface bulk elemental composition on planetary bodies without the need to make physical contact with the surface. BECA's lunar ISRU capabilities are extensive with its ability to determine the elemental content of lunar regolith down to ~30 cm below the surface. BECA would thus be a valuable ISRU resources tool when placed on a rover where it could measure the lunar subsurface composition as the rover traverses the lunar surface. The resulting map of the locations and concentrations of key elements for ISRU would make the recovery of these resources much more efficient. In addition to H, BECA can measure subsurface abundances of C, O, Al, Ca, Fe, Mg, Na, Si and Ti.

Relevance of BECA to Conference Goals: When placed on a rover, the BECA instrument can map out the basic composition information over the lunar polar region that is needed to evaluate ice deposits at the lunar poles. Its inclusion on relevant types of future missions should be considered.

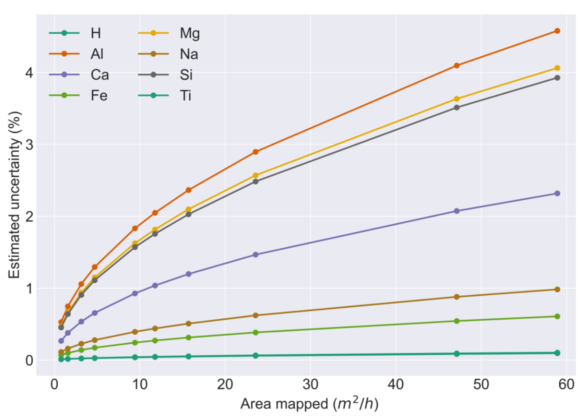

Figure 1: Taking a 1 m wide path, BECA would be able to map the abundance of the shown example elements at a rate that depends on the required measurement uncertainty.

Figure 1 shows the areal mapping speed obtainable for example elements given different measurement uncertainty requirements. BECA on a rover would measure the bulk elemental composition along a 1 m-wide path as the rover moves along. Note that the areal mapping speed is higher for some elements than others, with H being the fastest. The looser one's requirements for measurement uncertainty, the faster the area can be mapped, thus the mapping speed for larger measurement uncertainties is significantly higher than for higher precision measurements with lower measurement uncertainties.

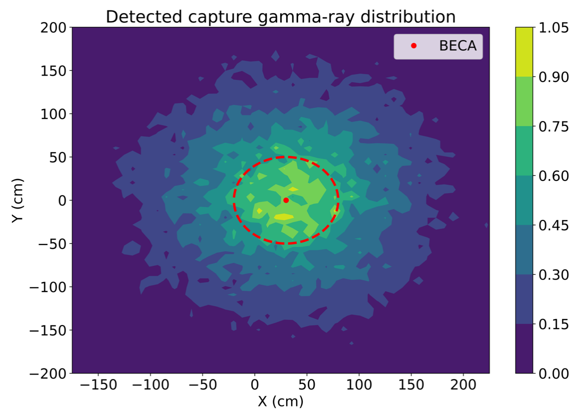

Figure 2: BECA's bulk measurement area shown as an area distribution of the gamma rays it detects to produce elemental composition information.

BECA's Measurement Footprint: Figure 2 shows the size of BECA's measurement "footprint" for bulk observations. One can see that most of the gamma ray events BECA detects occur within the 1 m diameter circle shown on top of the area distribution of gamma rays detected. Since the gamma rays carry information about elemental composition, this Figure shows that BECA will measure the composition of about a 1 m wide swath as it moves over the lunar surface.

Conclusions: BECA is an instrument that should be considered for use when defining the needed information for characterizing the ice deposits and other resources available at the lunar poles.

Reference:

[1] Ayllon Unzueta, M. et al. (2022) LPSC LIII, Abstract #2674.