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Suggested subtopic among all:
NEO Characterization
Space Mission & Campaign Design
Impact Effects & Consequences

TOWARDS A 3D-GIS FOR HERA

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ABSTRACT

The Hera Mission [Michel et al., 2022] will rendezvous with the binary asteroid system Didymos in 2027, to perform a detailed post-impact survey of the orbiting Moonlet Dimorphos, after NASA's DART impact on 2022-09-26 [Rivkin et al., 2021]. Hera carries remote sensing instruments to characterize primarily Dimorphos' surface during its half-year approach, observation and experimental phases. Imaging in the visible and infrared range is complemented by hyperspectral images, a laser altimeter, radio science, and CubeSats.
Laser altimetry and imaging in various phases will enable the assembly of 3D models in gradually improving levels of detail to support analyses of global properties, shape, volume, geomorphology, optical and thermal properties, space weathering, composition, debris and dust distribution, as well as a particular focus on the DART impact crater and its properties in highest available resolution. Medium-level products and layers such as albedo map, thermal inertia map, colour and hyperspectral texture, the instruments' footprints, observation conditions (shadows, sun exposition, incident angles), and (spatially distributed) knowledge about observation uncertainty help establish high-level products to determine global properties, orbital state, gravitational acceleration, internal structure, composition and, most importantly, the effects of the DART impact on those entities.
The spatio-temporal maintenance of the medium-level data products (including links to their raw data origins) on top of the asteroids' models – which are emerging as Hera approaches – is key for a holistic understanding of the science return. The definition and localization of targets and regions of interest on (different versions of) the shape models, the ability to annotate and analyse the geomorphologic properties in a quantitative way (measure distances, angles, areas, volumes and derived statistics), and the ability to maintain different versions of the named entities are

further requirements that lead to the decision to provide a 3D Geographic Information System (3D-GIS), being able to represent the necessary functionalities.
PRo3D (The Planetary Robotics 3D Viewer, [PRo3D, 2022]) is a viable candidate for such a 3D-GIS. By current design, it shall ingest geometry and texture layers describing medium-level products and cues, allows their interactive 3D and textural display (Figure 1), manipulation and arbitrary combinations thereof, enables annotations and quantitative 3D analysis and, by means of an underlying data base, supports the reference between observations and to raw data products and their observation conditions. A target and Region-of-Interest maintenance capability is within the set of requested functions, similarly the evaluation of 3D surface changes.
We report on the current status of PRo3D, making use of simulated data, details of the current preliminary design tailored to the Hera use case, and show dynamically rendered examples that will trigger further design discussion primarily within the Hera Working Group 4 ("Data Analysis, Exploitation, Interpretation").

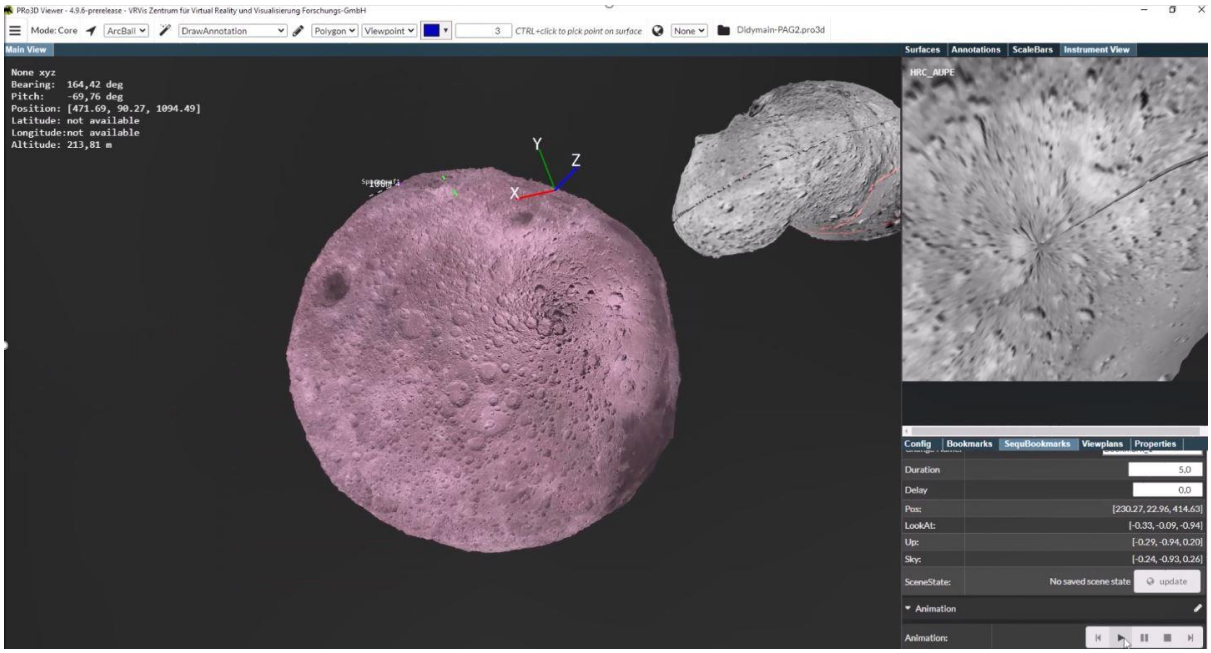

Figure 1: PRo3D, displaying simulated binary asteroid system (left) and instrument view (top right), as well as simple annotations such as a coordinate system and a scale bar.

References:

[Michel et al., 2022] https://iopscience.iop.org/article/10.3847/PSJ/ac6f52/meta
[Rivkin et al., 2022] https://iopscience.iop.org/article/10.3847/PSJ/ac063e/meta
[PRo3D, 2022] https://github.com/pro3d-space/PRo3D

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Comments: *(Alternative session, Time slot, Oral or Poster, Etc…)*
An alternative session could be Space Mission & Campaign Design – we are missing a session on "Methods" or "Data Processing and Visualization" or similar.
The preferred presentation method is Oral. It is possible to give demos on the mentioned technologies if the Conference offers a portal for such activities.