Searching for a Kuiper-belt flyby target for the New Horizons spacecraft

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The New Horizons spacecraft will fly past Pluto in July 2015 and then continue deeper into the Kuiper Belt, providing an opportunity to encounter one or more small (less than 50 km) KBOs. This first flyby of a typical small KBO would revolutionize our understanding of these bodies, providing information that can be extrapolated to hundreds of thousands of similar objects in the Kuiper Belt. Statistically, we expect several KBOs with ground based V magnitude less than 26.0 to be accessible with the delta-V available onboard New Horizons. At this point (spring 2014), however, no known KBOs are reachable by the spacecraft. For the past 4 years we have been conducting a dedicated search for suitable targets, using the Subaru, Magellan and CFH Telescopes. The search is complicated by the fact that targetable objects are currently in the Milky Way, so search depth is limited by confusion with background stars unless seeing is exceptional. We are now requesting 150 orbits with HST to continue our search to fainter limiting magnitudes. We have discovered dozens of KBOs near the spacecraft trajectory, none of which are accessible to the spacecraft. Several of the targets could be reached with less than twice the available delta-V, and much of the accessible volume has not yet been searched to sufficient depth. Several objects already discovered will be observable at long range from New Horizons, providing opportunities for (for example) searches for binarity with much higher spatial resolution than is possible from Earth.

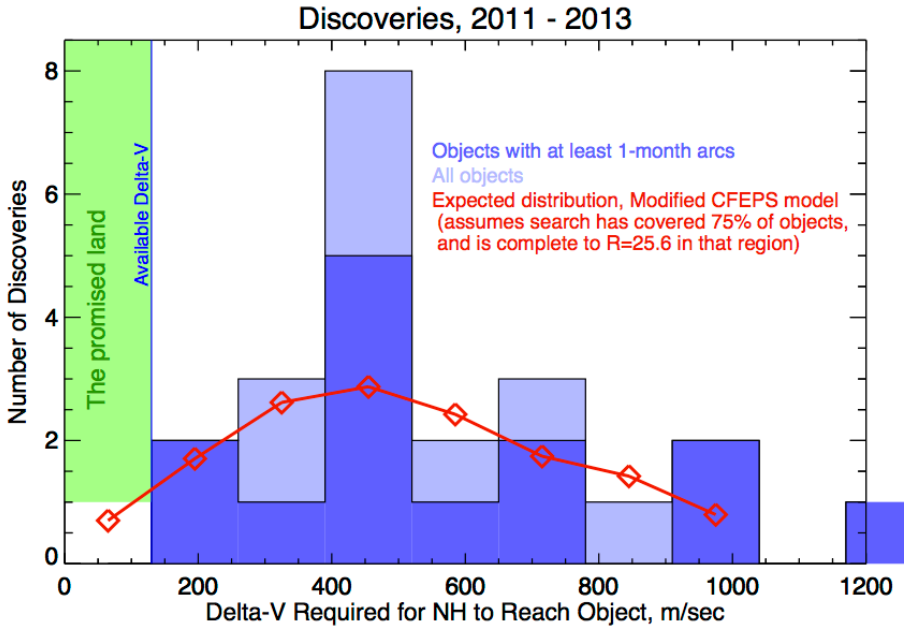

Figure: Delta-V statistics for the most nearly accessible KBOs discovered by our ground-based campaign from 2011–2013 (blue histogram). This is compared to predictions from the CFEPS model extended to small sizes, with the plausible assumption that our search is complete to $R = 26.5$ and has covered 75 % of potential targets (red curve). We have not yet reached the "promised land" (green box) of at least one object requiring less than the available 130 m/sec delta-V for targeting.