Design considerations for a dust collector on mesospheric rocket

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Meteors ablation is a source of dust particles in the upper atmosphere. The remnants of meteor ablation that prevail in the mesosphere condense to nm-sized particles, denoted as Meteoric Smoke Particles (MSPs). Theory suggest that MSPs act as condensation nuclei for ice particles in the summer mesosphere, which form during summer months around the mesopause at high and mid latitudes. They are related to mesospheric phenomena such as the Noctilucent Clouds, Polar Mesospheric Summer and Winter Echoes (PMSE/PMWE). However, due to their altitude location, the only means of in situ measurement is with rocket experiments. There have been several attempts to collect these MSP particles with probes on rockets over the years, but no conclusive results have been reported so far.

UiT have proposed a new sample collector, the MEteoric Smoke Sampler (MESS). We report on the progress of the work that has focused on the design of the detector and simulation of the entry and impact of dust onto the detector. The focus of the planned measurements is on collecting ice particles, since the airflow affect them less than smaller MSPs. Estimations of the collection surface properties and impact energy are presented. An estimate of the expected mass in the traversed volume of one collecting plate, diameter of 3 mm diameter over 1 km, suggest that the volume contains ~1e8 particles. This corresponds to a mass of 7e16 amu. These estimates are made assuming spherical particles with average density 2.8 g per m$^3$ and radius 1 nm, and an MSP density of 1e10 per m$^3$. 