

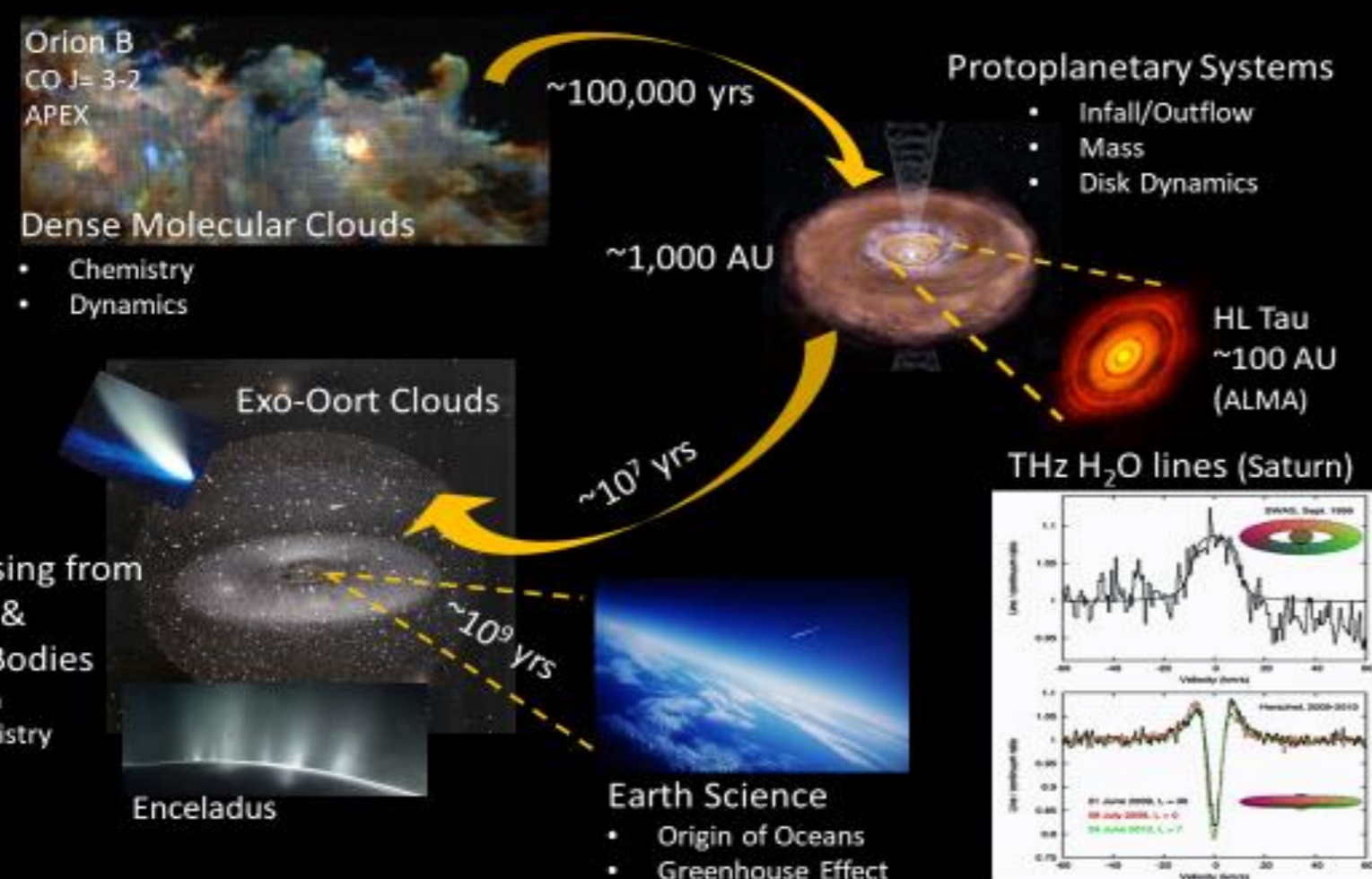
# Inflatable membrane reflectors for small satellite telescopes

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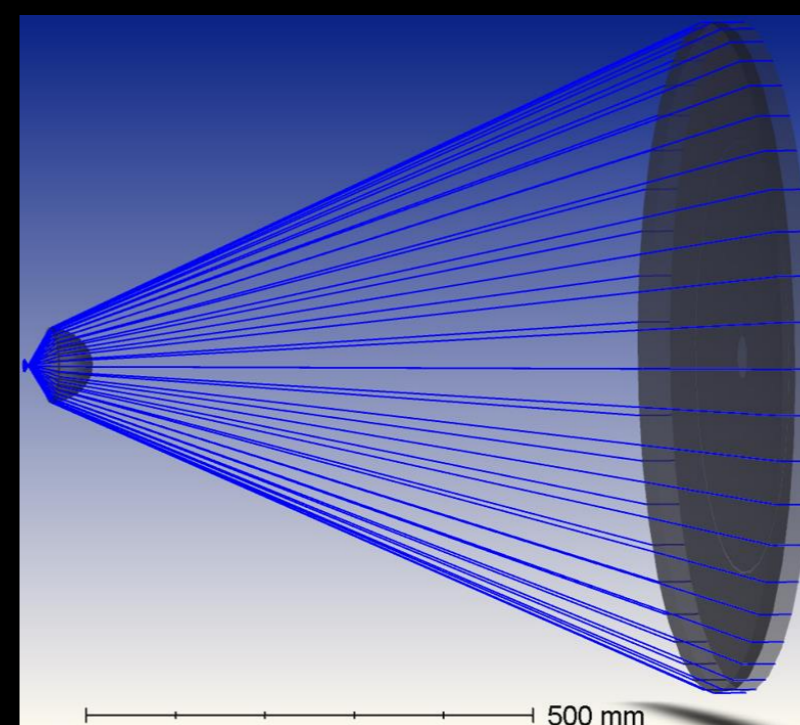
## Terahertz (THz) Imaging

- THz spectroscopy of  $H_2O$ ,  $H_2^{18}O$ , HDO, HD and  $^{13}CO$  resolves objects in velocity space. Powerful probe of object chemistry in deep space.

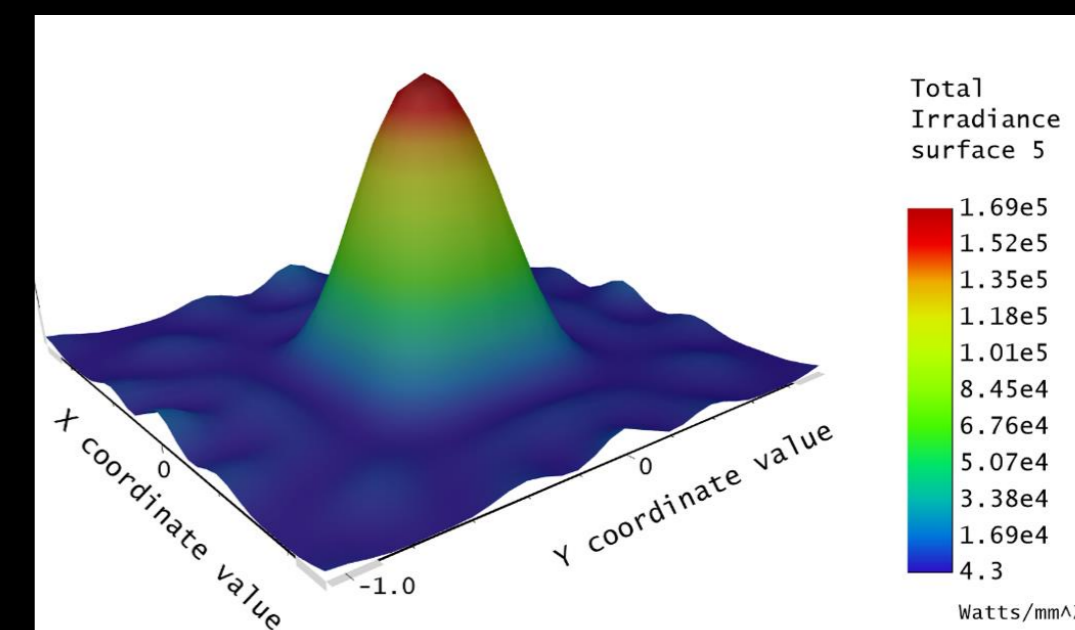


## Lens sizing

- Ray tracing simulations done to determine corrector size and location for membrane mirror feasible for a CubeSat form factor



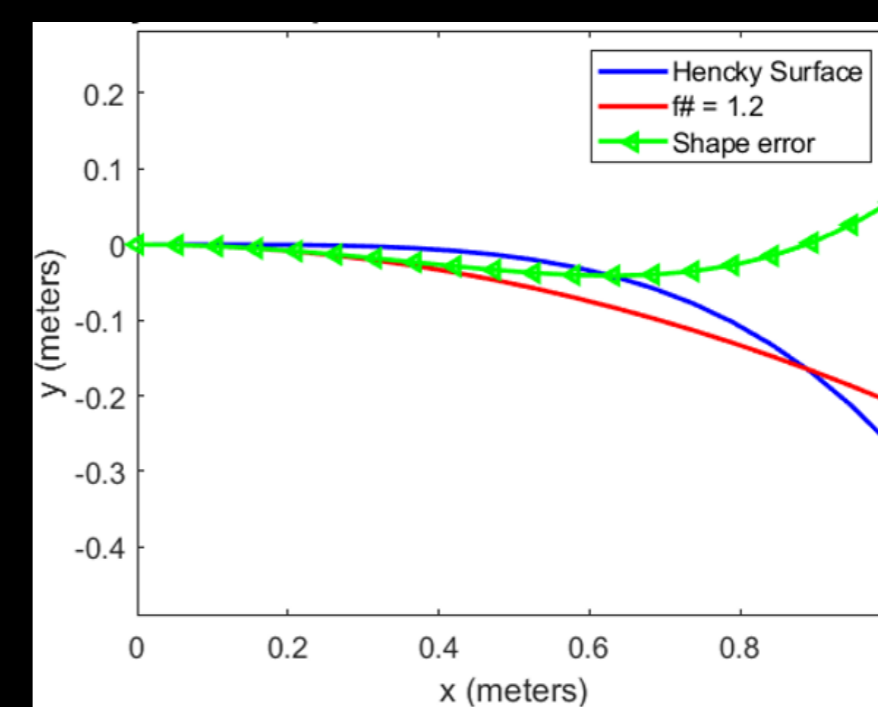
Membrane and lens ray tracing model



Irradiance plots

## Membrane surface shape

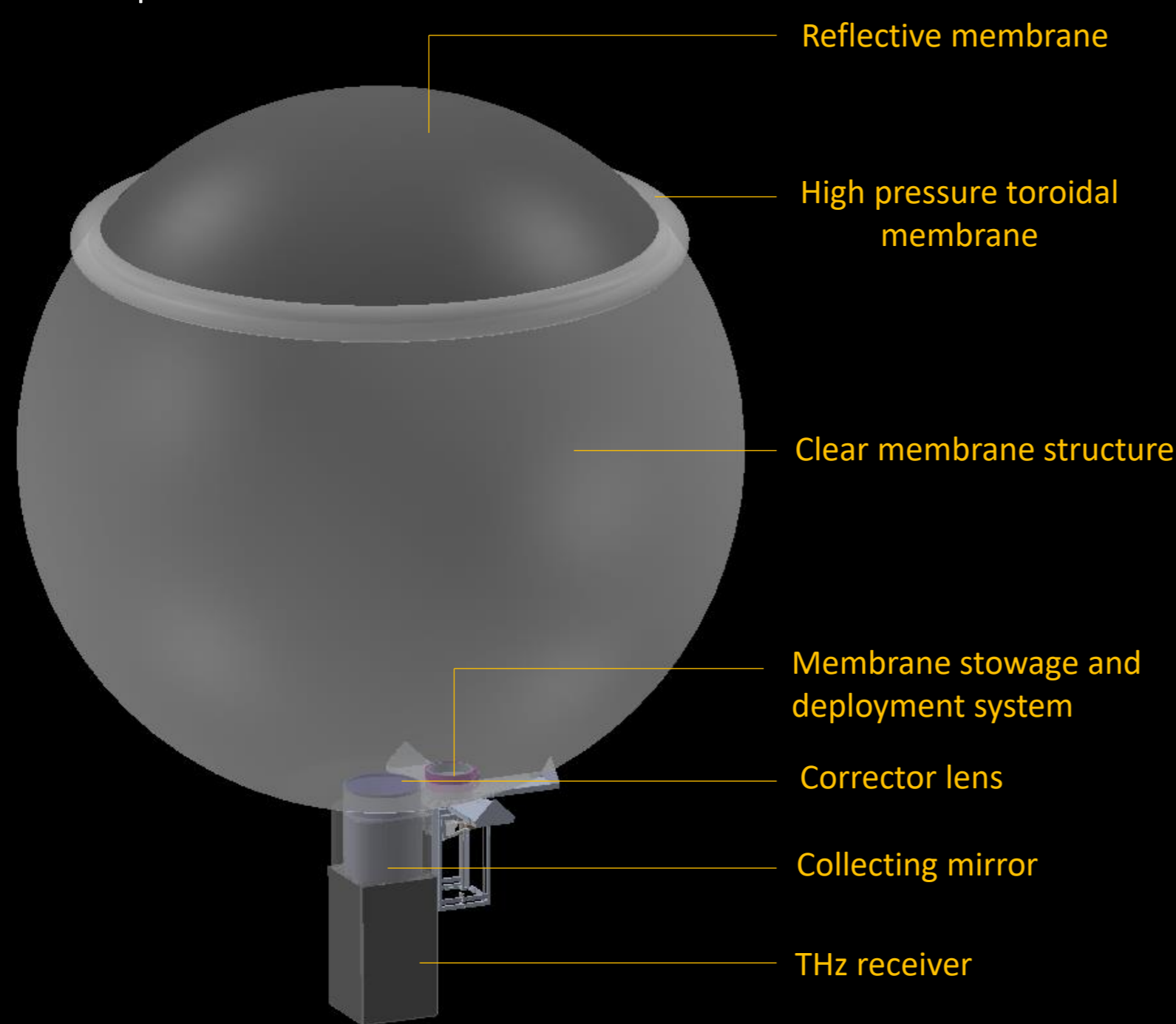
- Internal pressure and gore geometry modified to minimize surface shape error.
- High pressure toroidal ring added to provide increased radial stress during deployment. This improves surface precision reduces wrinkle formation.



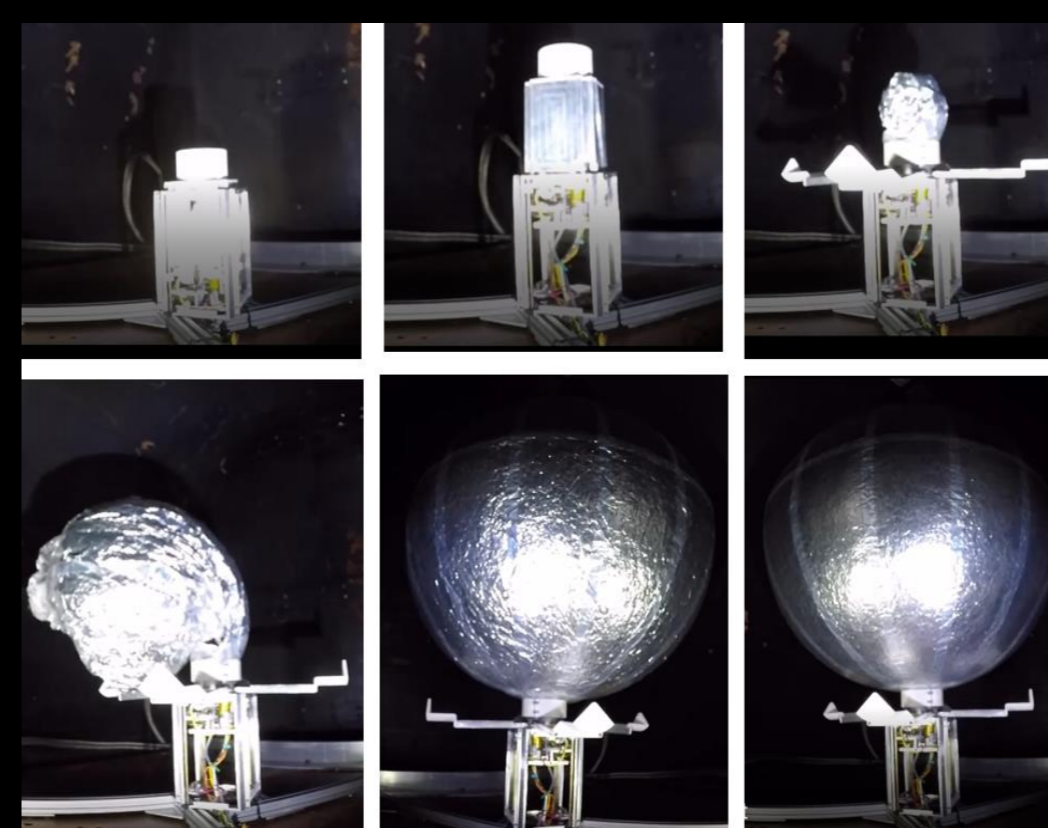
Expected surface error for proposed design

## Membrane mirrors

- Large collection surfaces (~20 meters) for high resolution THz imaging of exoplanets and distant systems, membrane mirrors can be a possible solution.
- Pressurized membranes yield characteristic 'Hencky' surfaces.
- Repeatable and reliable Hencky surfaces can be used as reflectors in conjunction with corrective optics



System design for 1m inflatable and 4U optical and deployment system

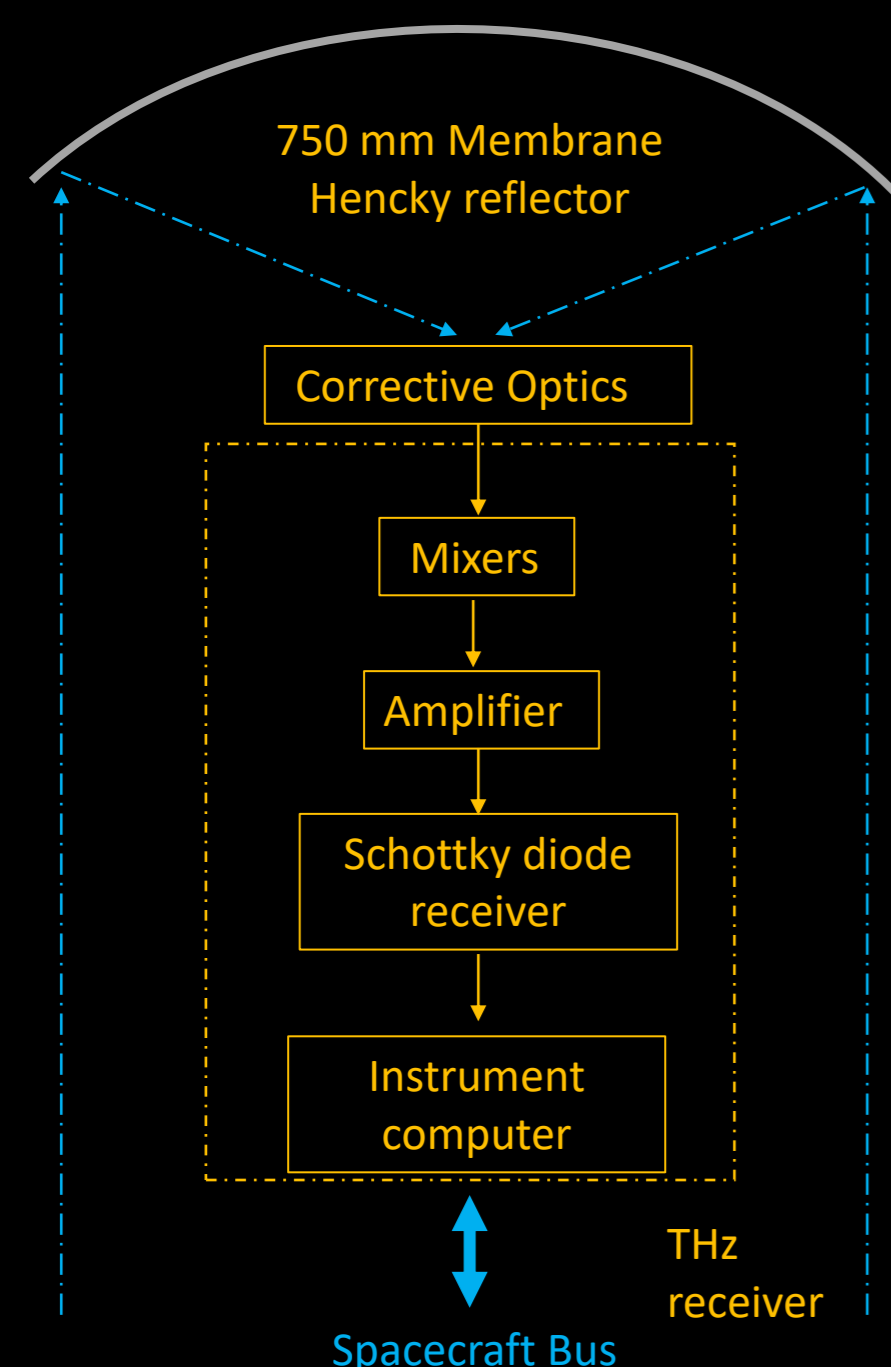


## Packaging and deployment system

A 1.5U membrane packaging and deployment system has been developed and tested in thermal vacuum environment.

## CubeSat membrane mirrors

- Provide path to scale up in mirror size.
- Can be used to validate membrane mirror technology in space.
- Target emission/ absorption line is the 557 GHz water line
- Can be used for water surveys on planets and asteroids



## Surface metrology

Calibration and measurements are underway on a 1-meter test setup

## Conclusion and future work

- Preliminary of packaging a membrane mirror in a CubeSat form factor has been demonstrated.
- Further work includes developing reliable surface geometry using manufacturing methods such as thermal forming and strain hardening.
- Optical design requires refined for a better sizing and power consumption estimate