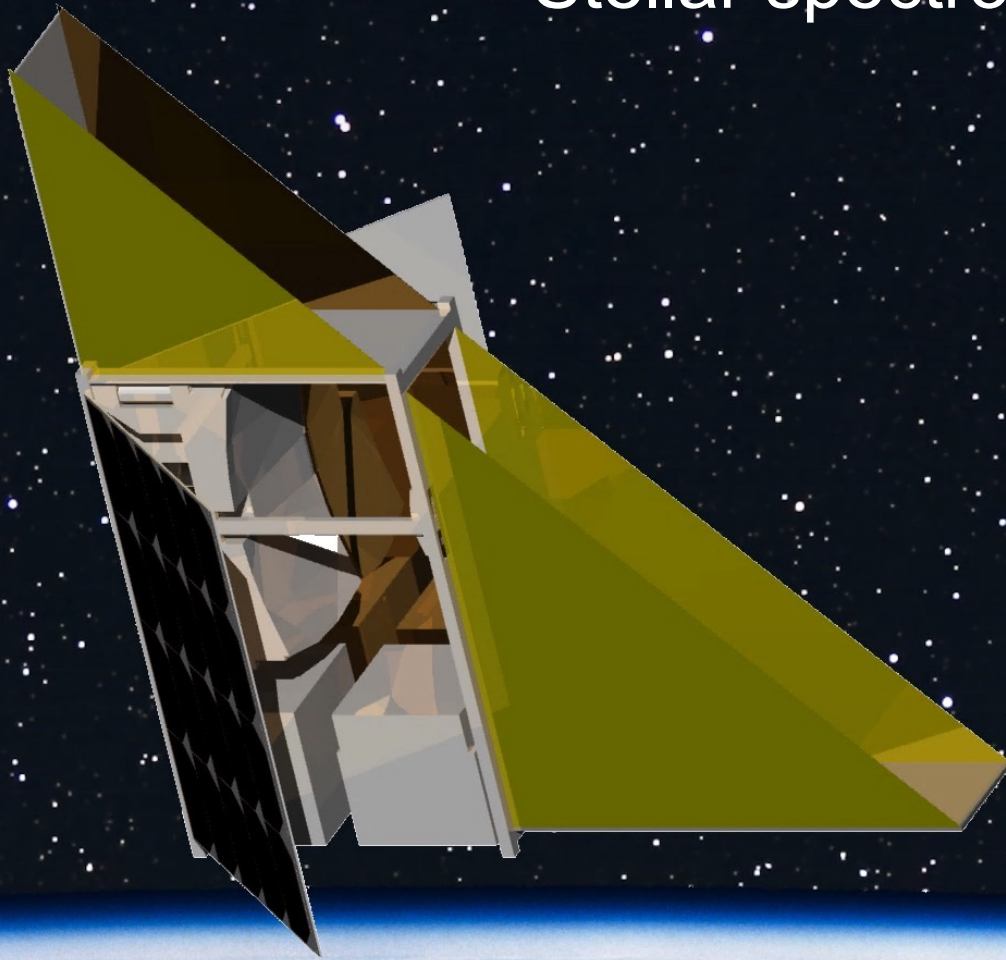


Stellar spectroscopy from a cubesat platform

CUBESPEC



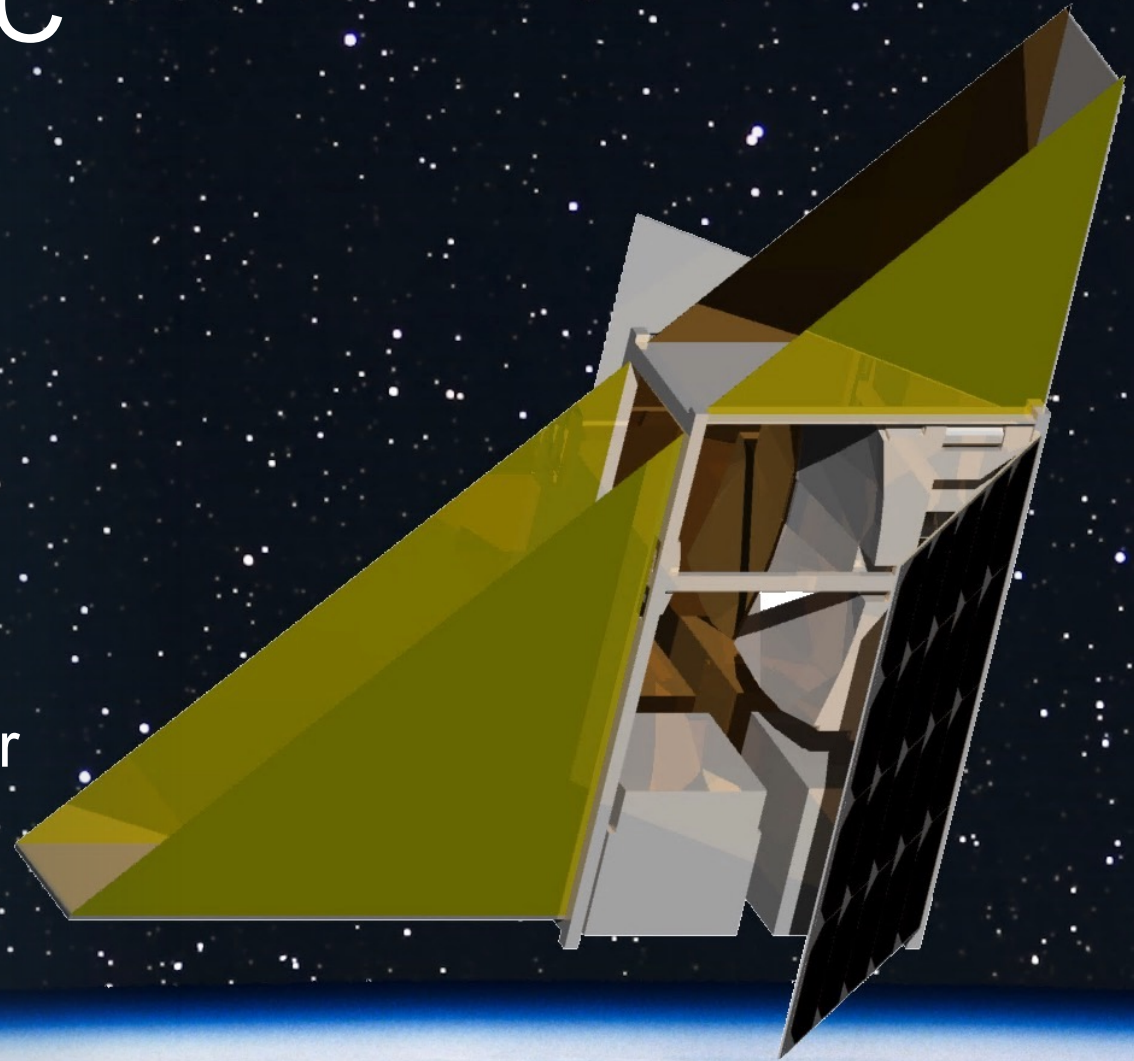
Bart Vandenbussche & the CubeSpec Team

Summary - CUBESPEC

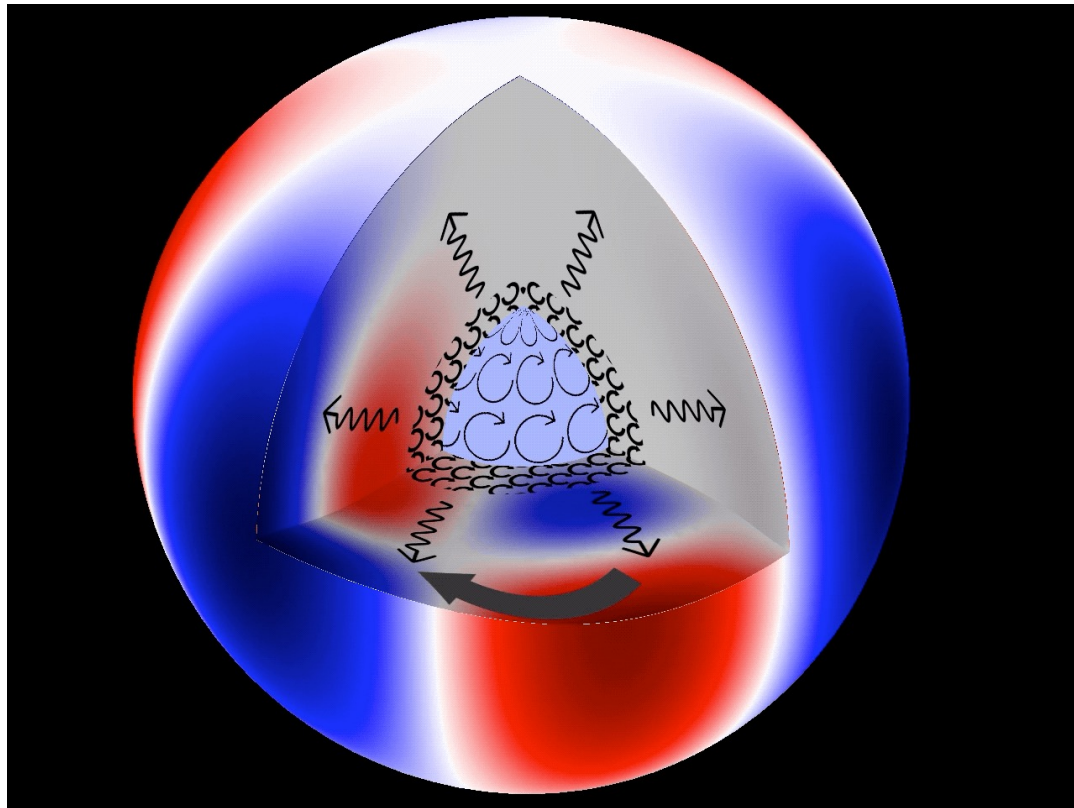
- Belgian ESA CubeSat mission
- Optical Spectroscopy of stars
- Generic design to fly again

- 500km SSO orbit
- 10x20cm Cassegrain telescope
- R=50000 Echelle spectrometer
- Piezo-actuate beam steering mirror

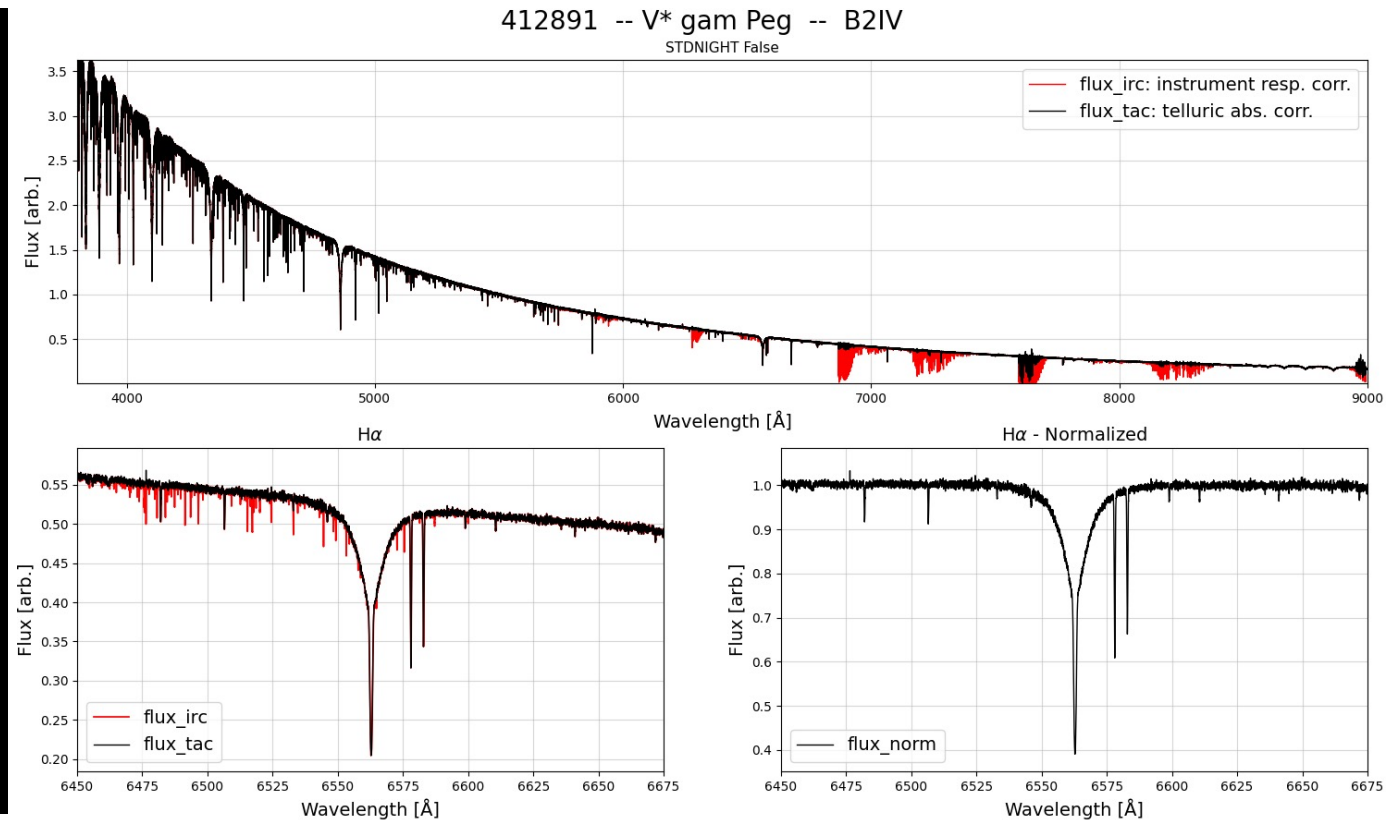
- Launch 2025



CubeSpec primary science case: Unravelling the interior of massive stars

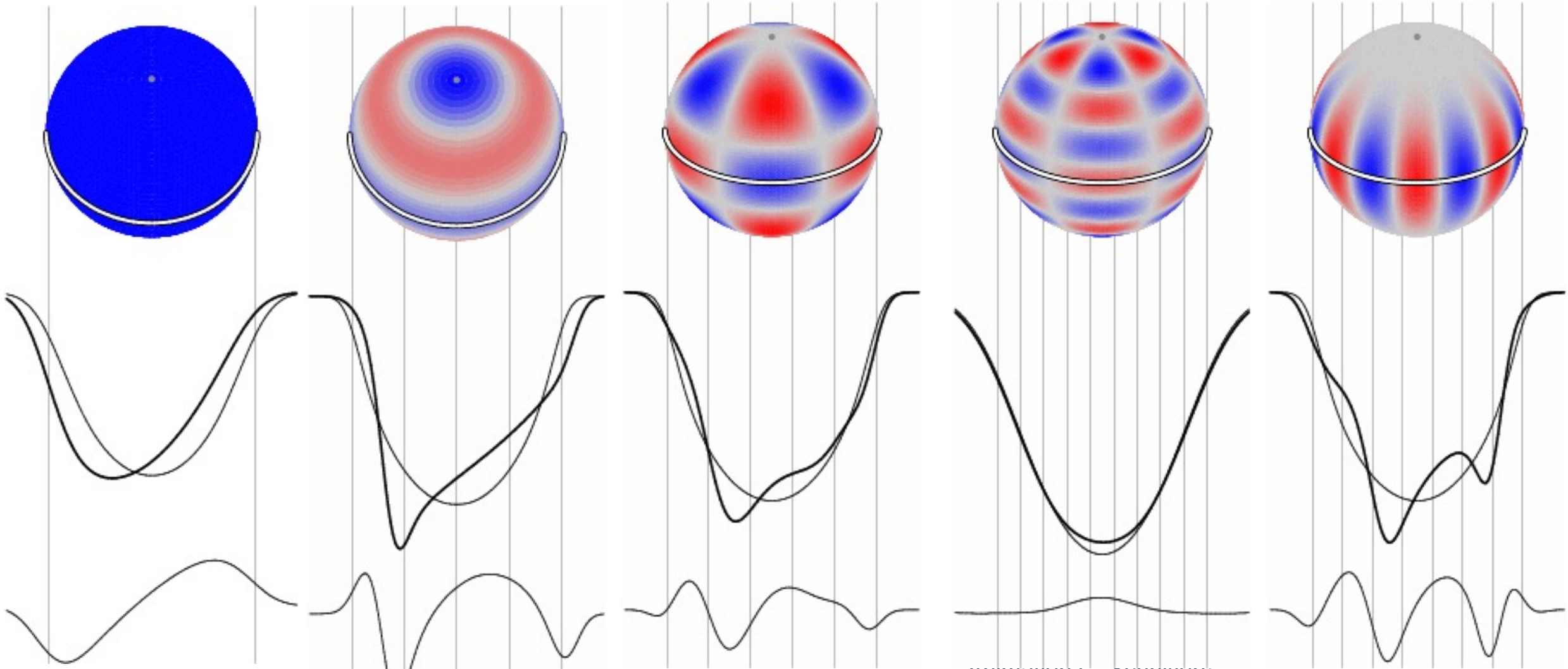


Animation P. Degroote



Royet et al. 2023

Pulsations : spectral line profile variations



Animation G. Schrijvers

Instrument / Mission requirements



Spectral resolving power

$$R = \lambda / \delta\lambda > 50\,000;$$



Signal to noise

$S/N > 200$ per resolution element



Temporal sampling

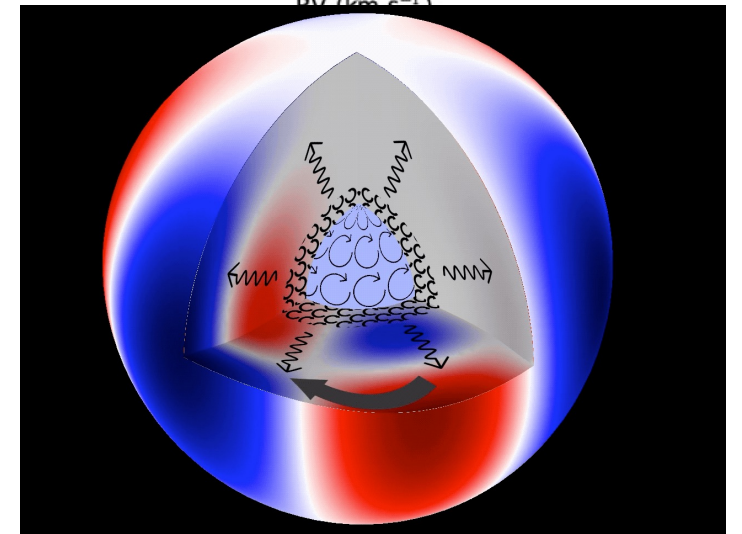
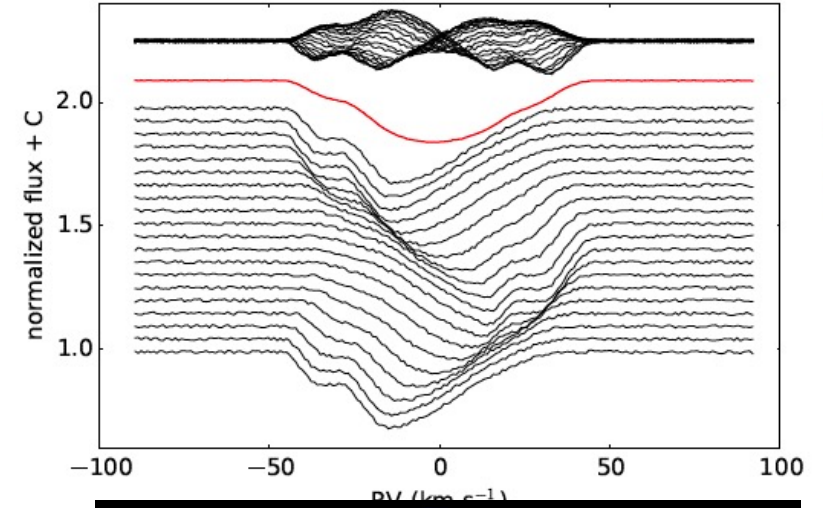
$P_{\text{pulsation}} \sim 8\text{-}24\text{h}$ (β -Cep pulsators)

→ 1 to 2 observations per 100 min

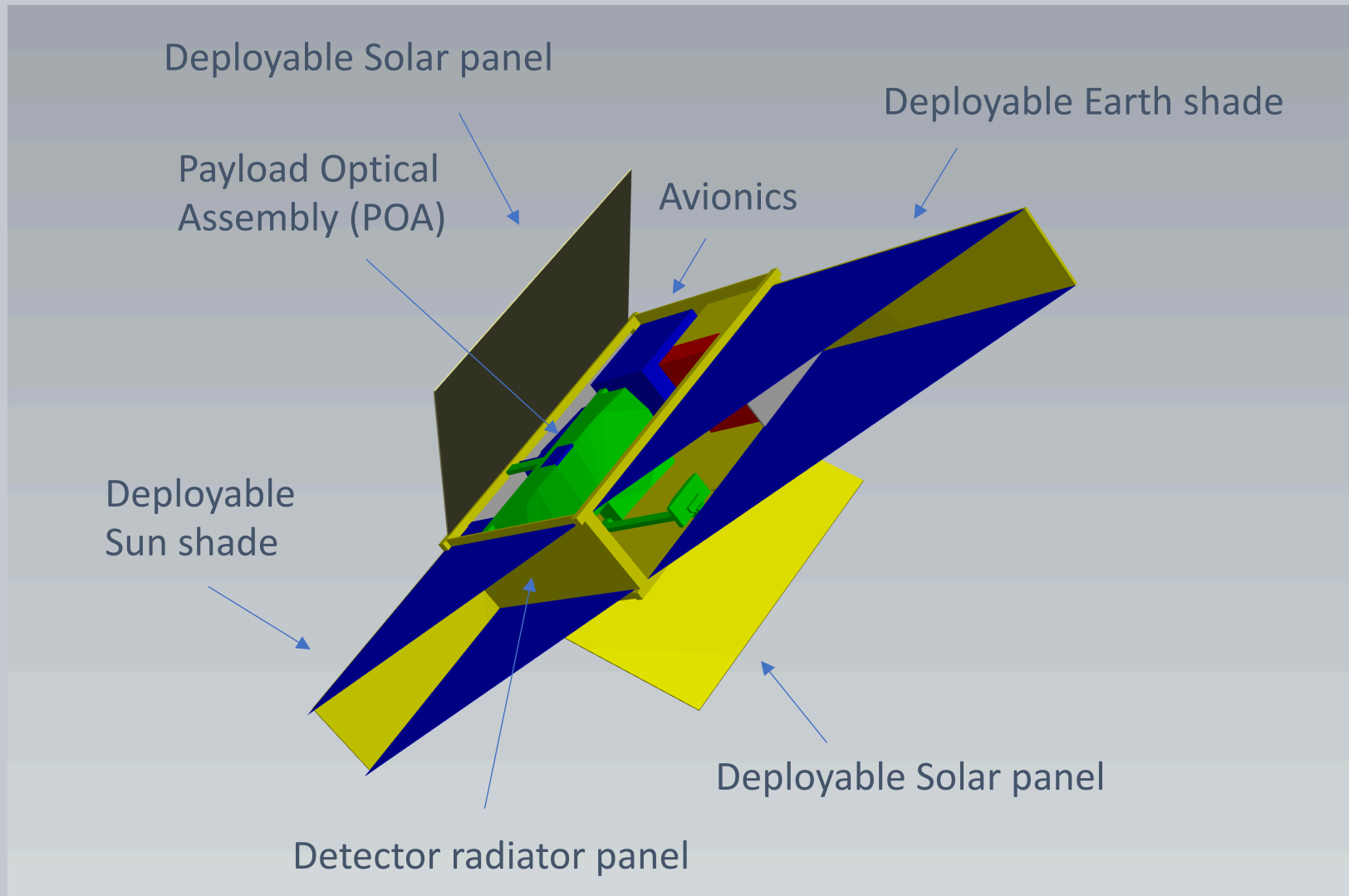


Length of time series (T)

$T \sim 100\text{d}$ if $P \sim 1\text{d}$



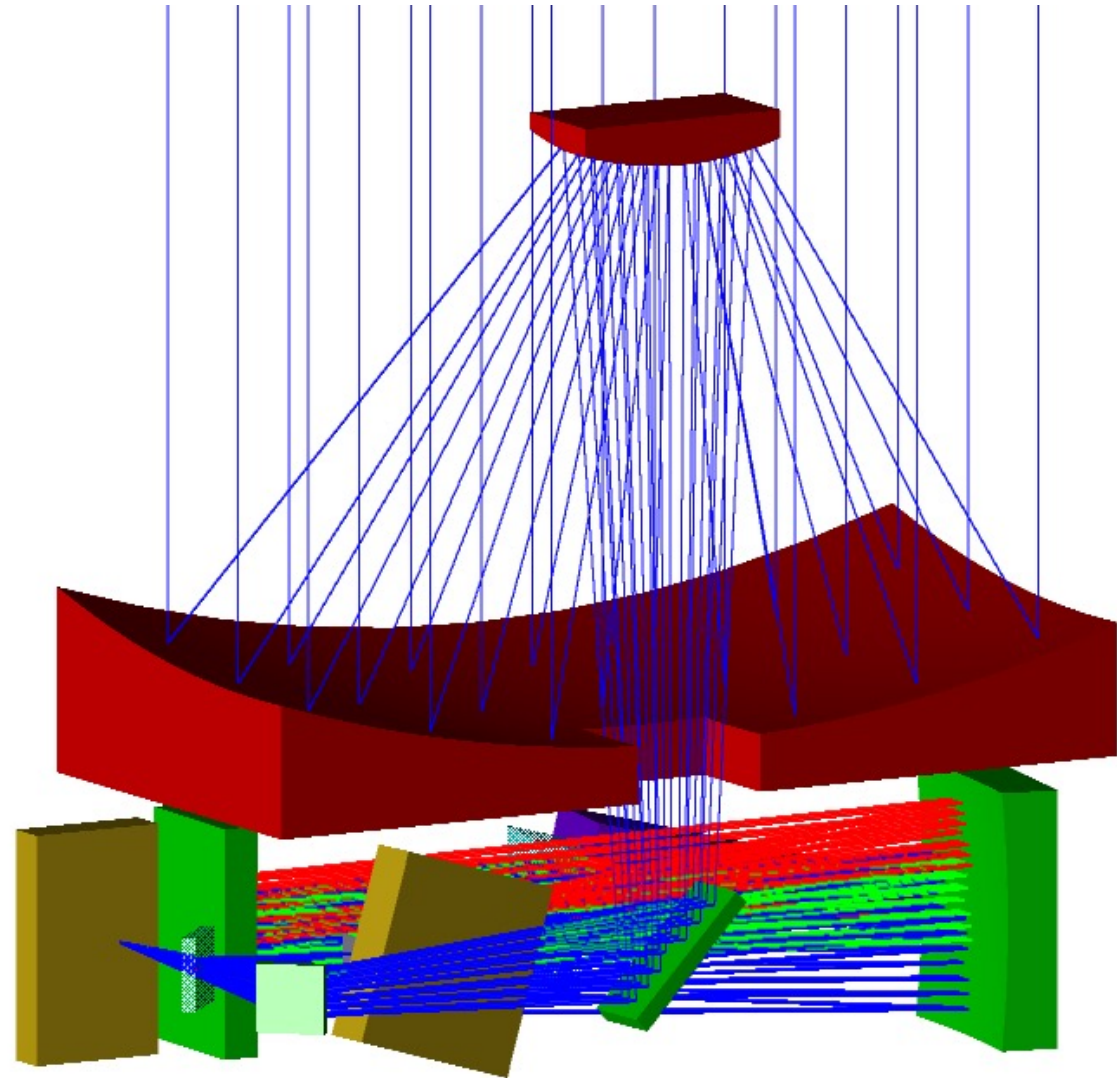
CubeSpec Spacecraft layout



CUBESPEC optical payload



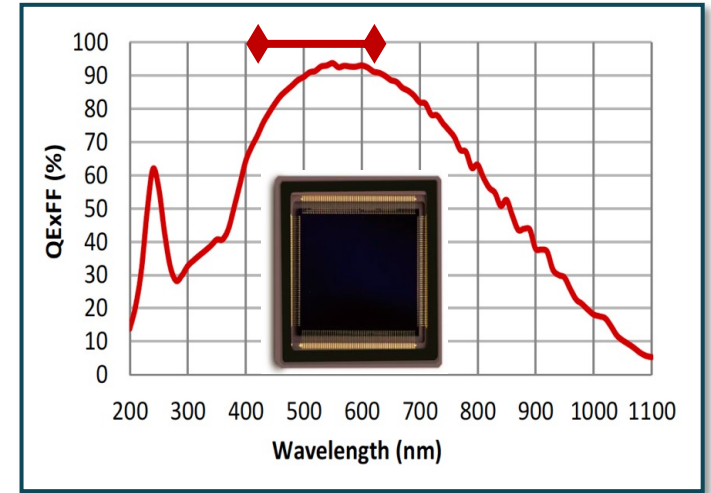
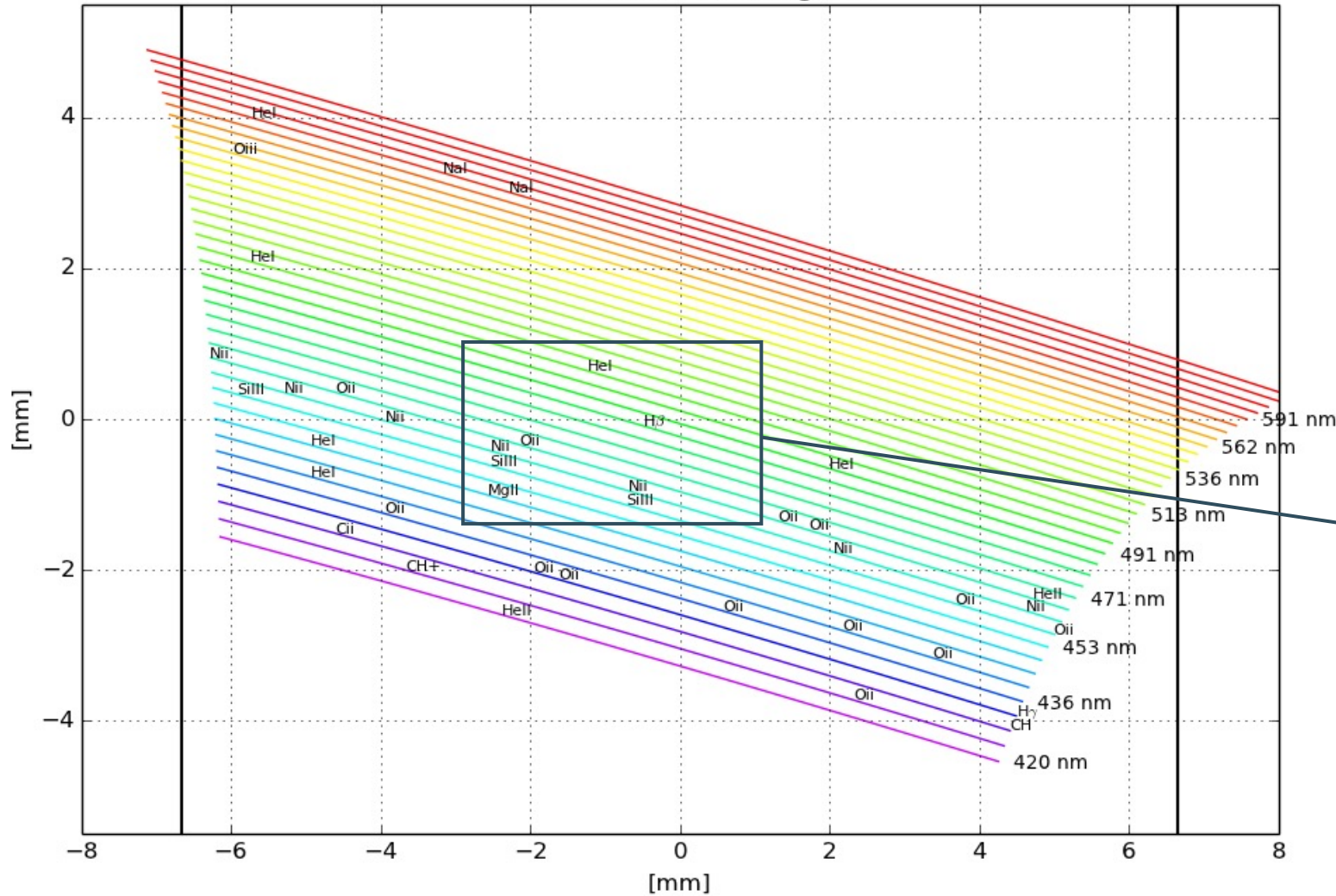
- Telescope and spectrograph in 4U volume
(10 x 20 x 20 cm³)
- Rectangular off-axis Cassegrain telescope
M1 : 83 x 190 mm², $f = 1600$ mm
- Spectrograph optics folded behind M1
- Fine guidance beam steering mirror



Spectral image



CUBESPEC R4 Echellogram



Gpixel CMOS sensor



Sky visibility requirements

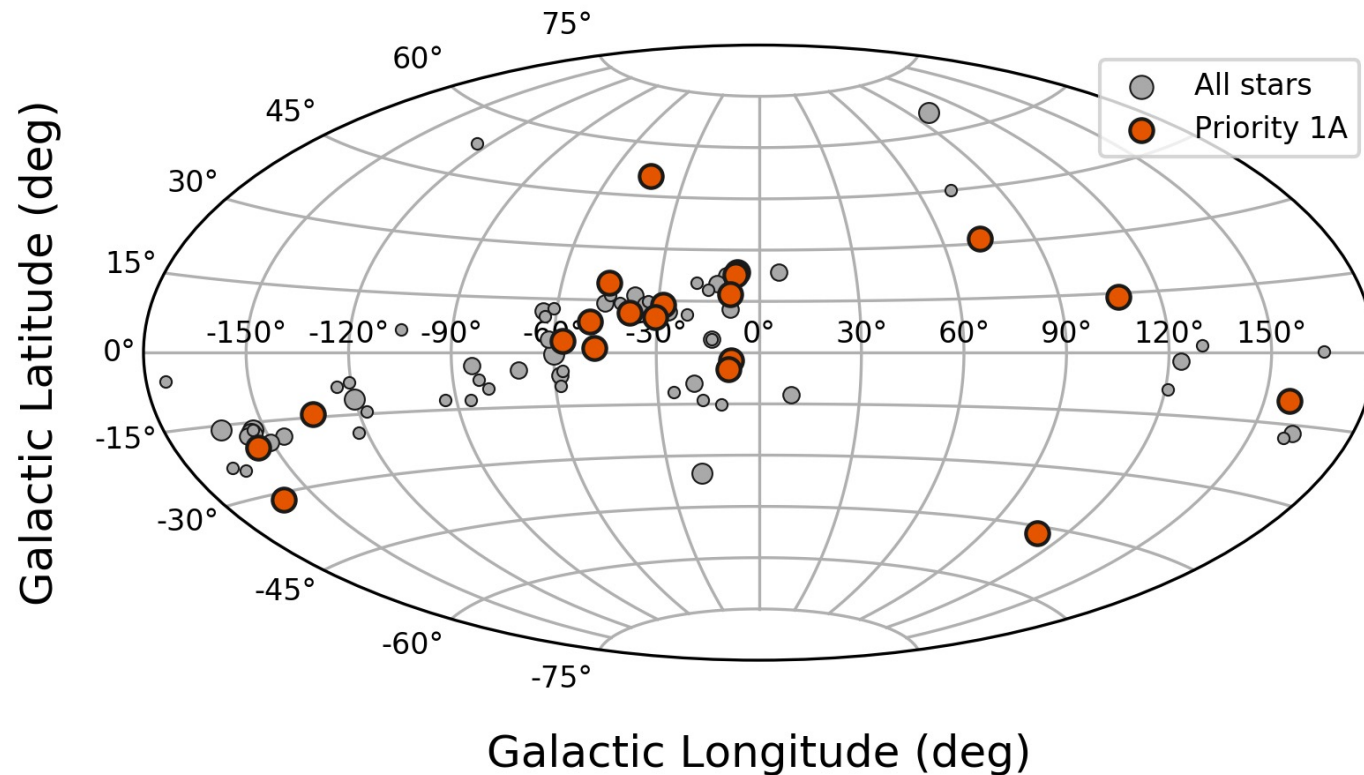
Input catalog

Slowly rotating bright ($V < 4$) Beta Cephei stars

Avoidance angles [deg]

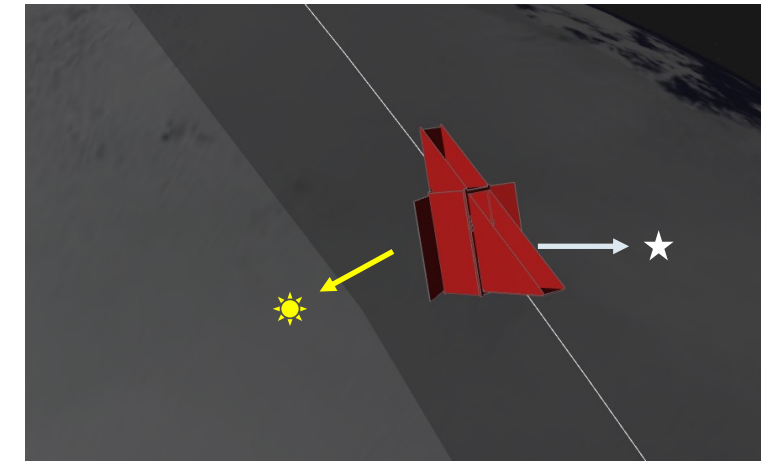
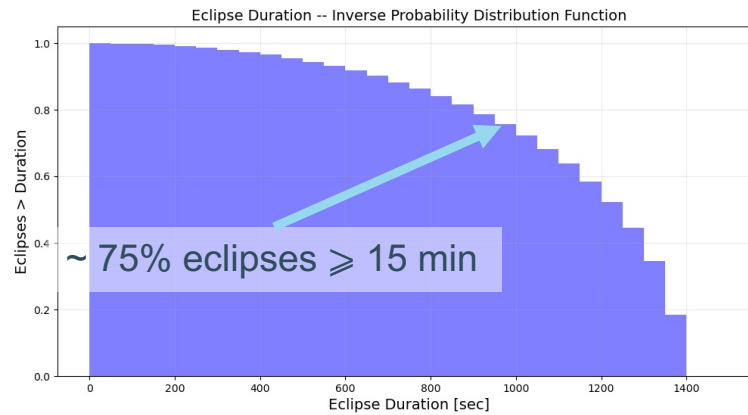
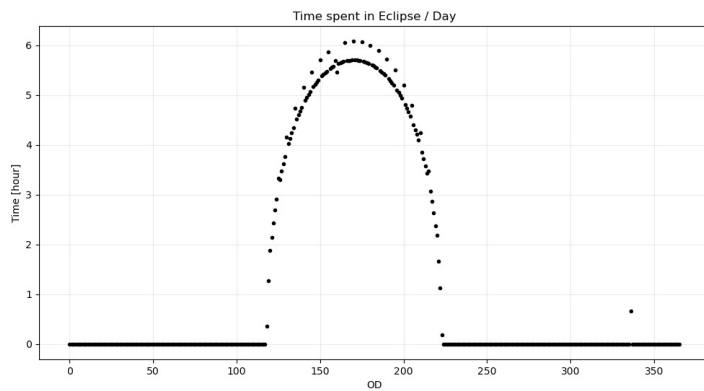
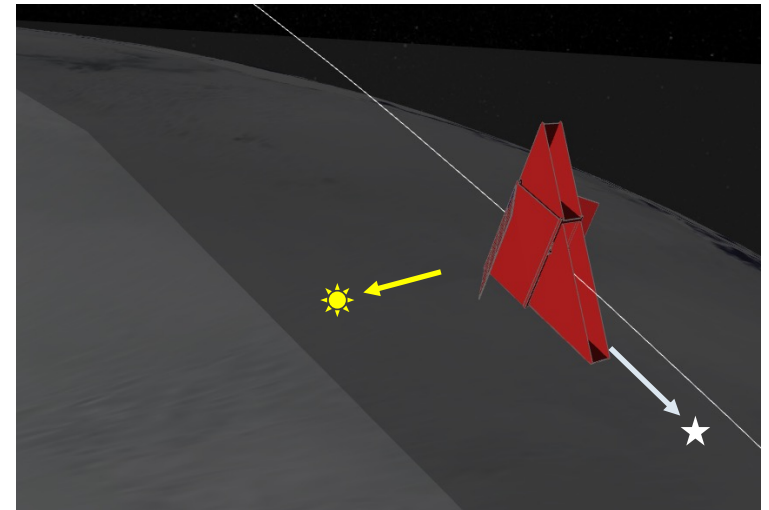
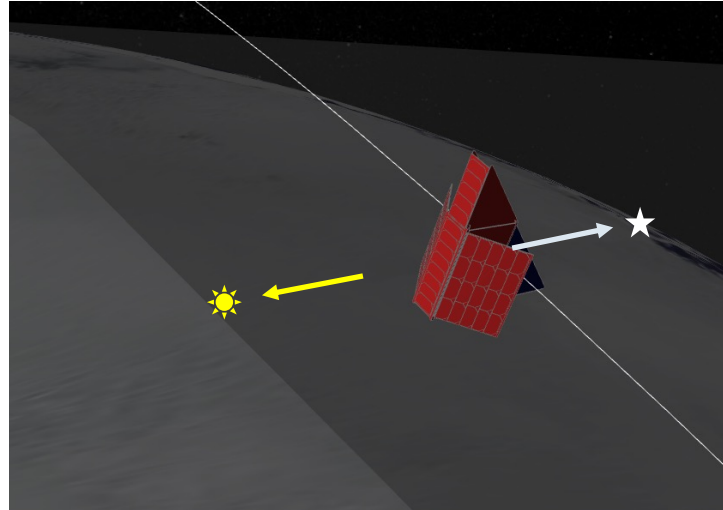
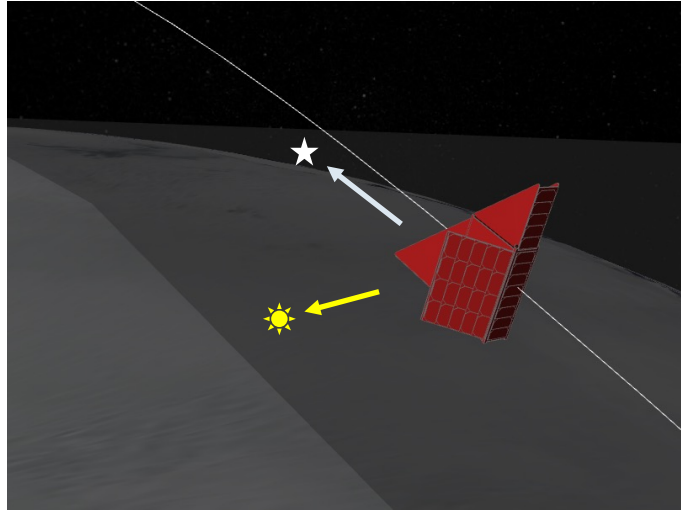
Priority 1A: known Beta Cep

- Earth 88.02
- Moon 20.28
- Sun 90.0
- Jupiter 1.0
- Saturn 1.0



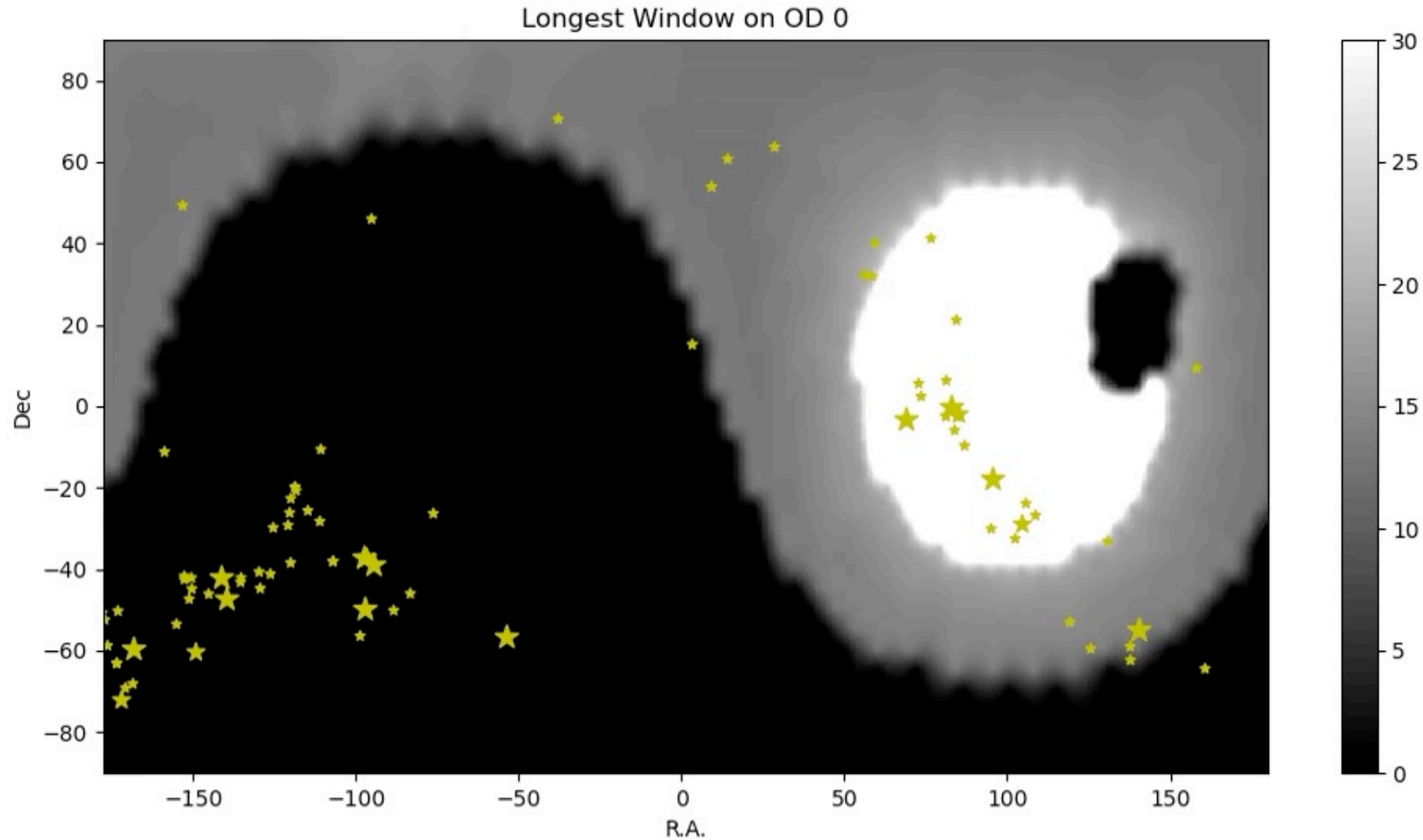
See poster Pierre Royer et al.

Sun synchronous dusk dawn orbit 500km



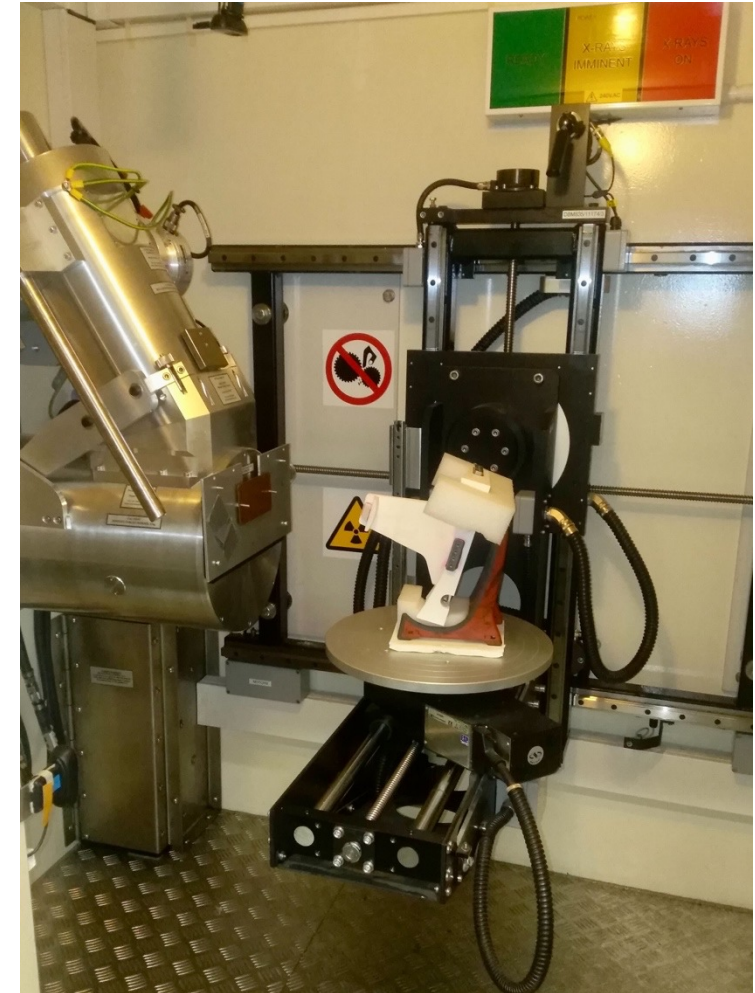
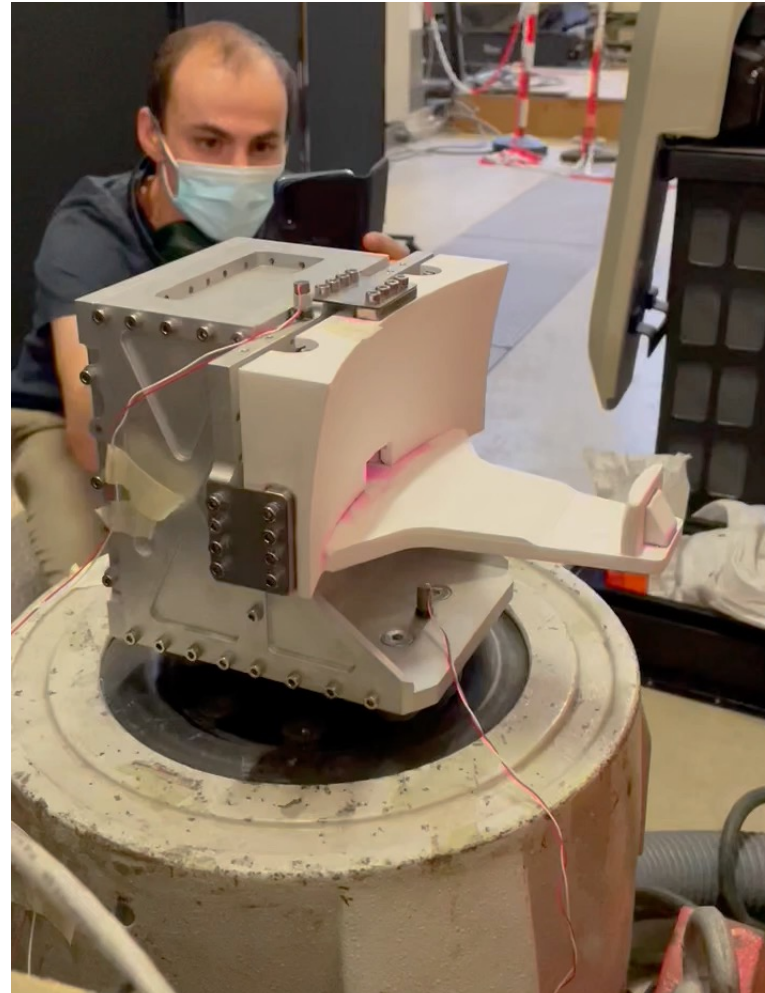
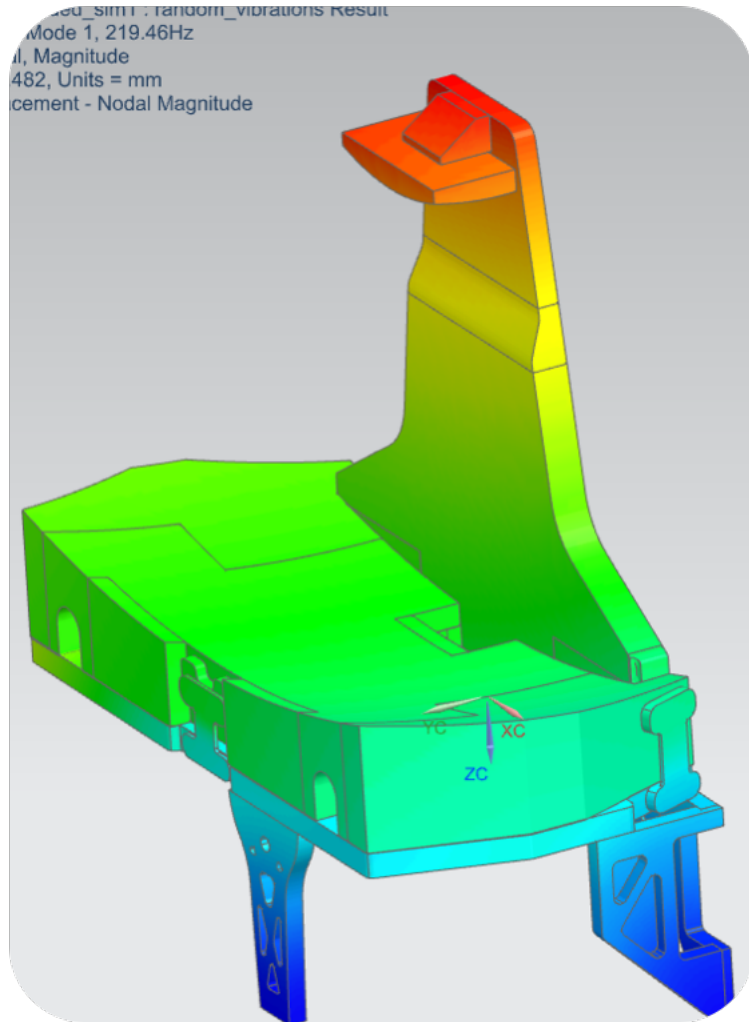


Reference mission observing schedule



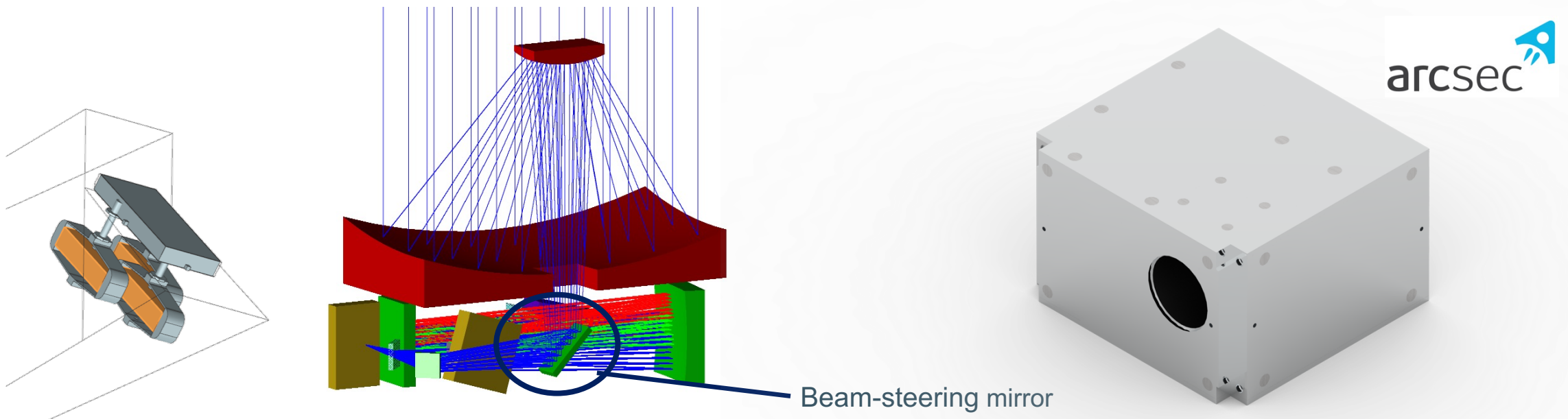
See poster Pierre Royer et al.

Cordierite telescope



Pointing

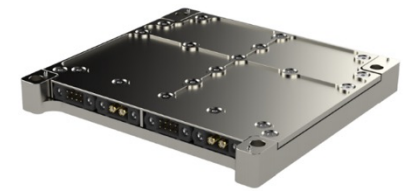
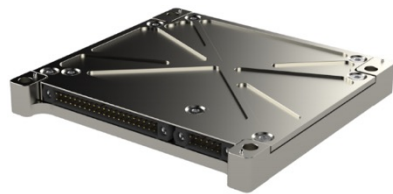
- Arcsec Attitude Control System to deliver stable pointing to arcminute level
- Payload closed loop fine guidance to reduce pointing jitter within 2.6" slit width
- Feedback fine guidance – attitude control system



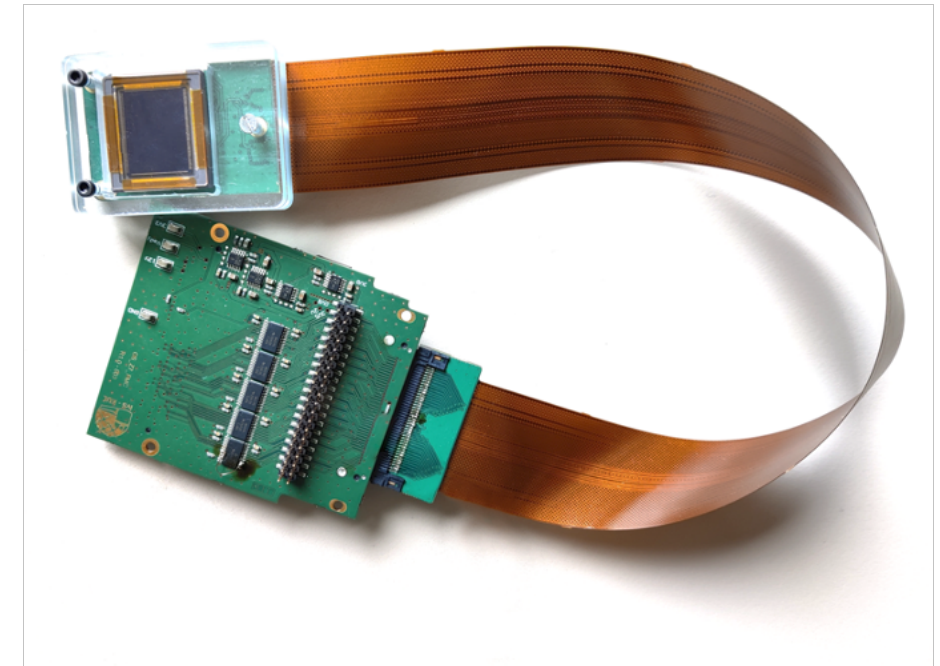
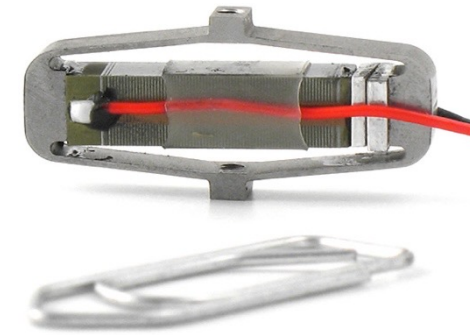
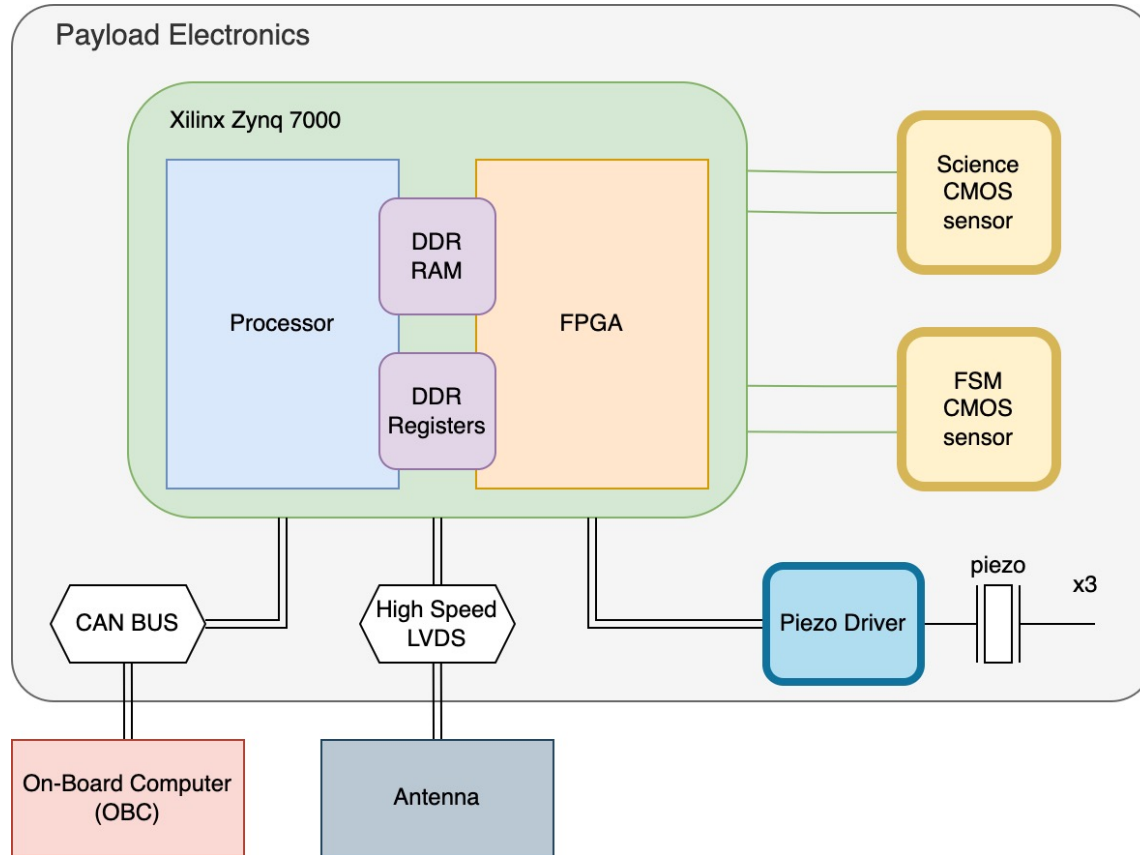


Spacecraft bus

- Onboard Computer
- Power Conditioning & solar panels
- Communications (S up&down, X-band down)



Payload Electronics

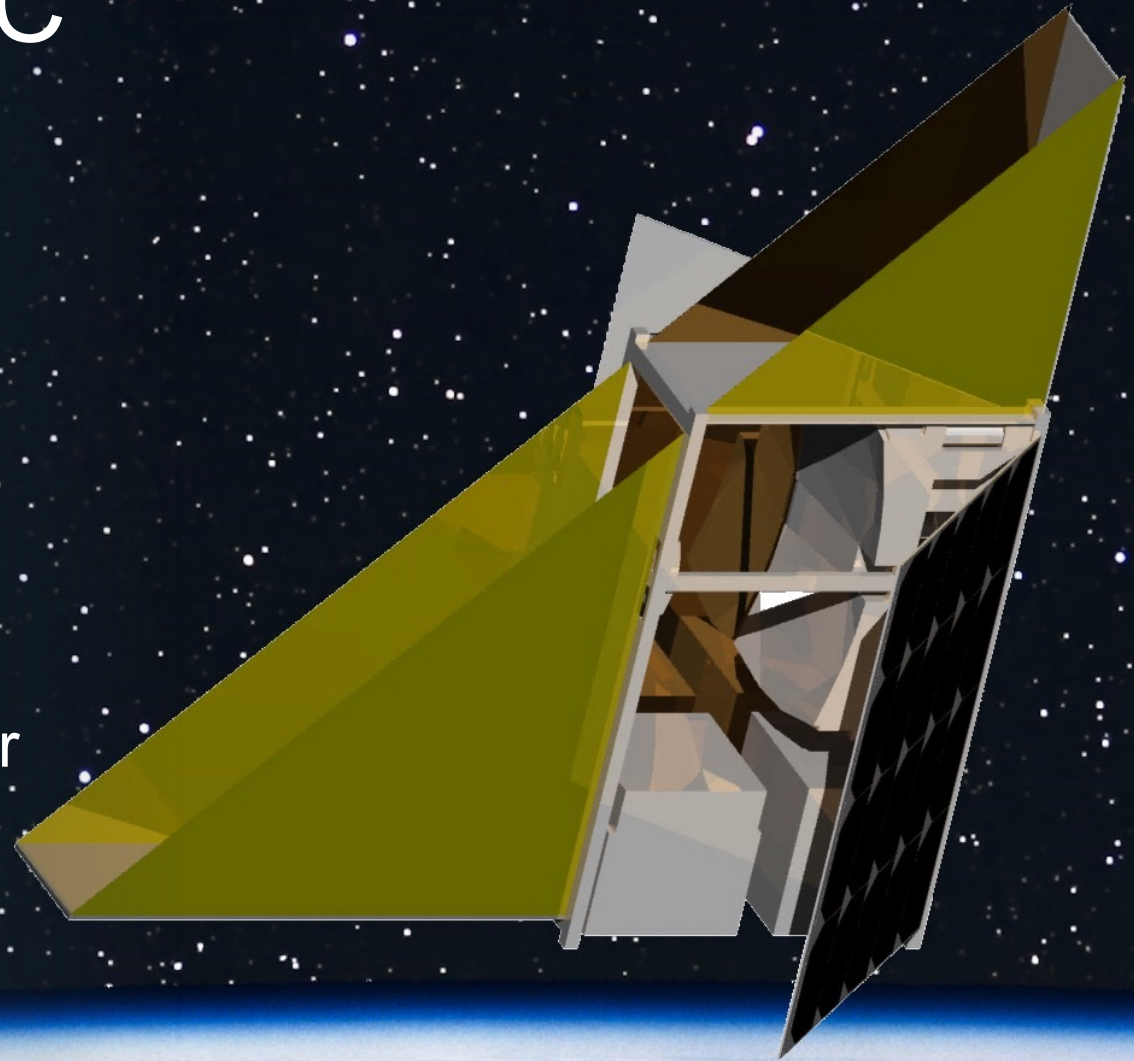


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The CubeSpec Team

KU Leuven Institute of Astronomy

- Bart Vandenbussche
- Gert Raskin
- Hugues Sana
- Pierre Royer
- Dominic Bowman
- Johan Morren
- Philippe Neuville
- Jake Pember
- Maddalena Reggiani
- Andrew Tkachenko
- Sibon Van Gool
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- Jeroen De Maeyer
- Wim De Munter
- Maarten Kempnaers
- Leonardo Peri

KU Leuven ESAT ELECTA Gent

- Philippe Saey
- Arne Verhoeven

Arcsec

- Bram Vandoren
- Tjorven Delabie

