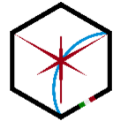# In orbit Demonstration and Technology Validation through student-based CubeSat project

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Project Overview - AlbaCubeSat

December 2019: Foundation

July 2020: Mission Definition Review
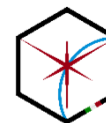
March 2022: Feasibility Study

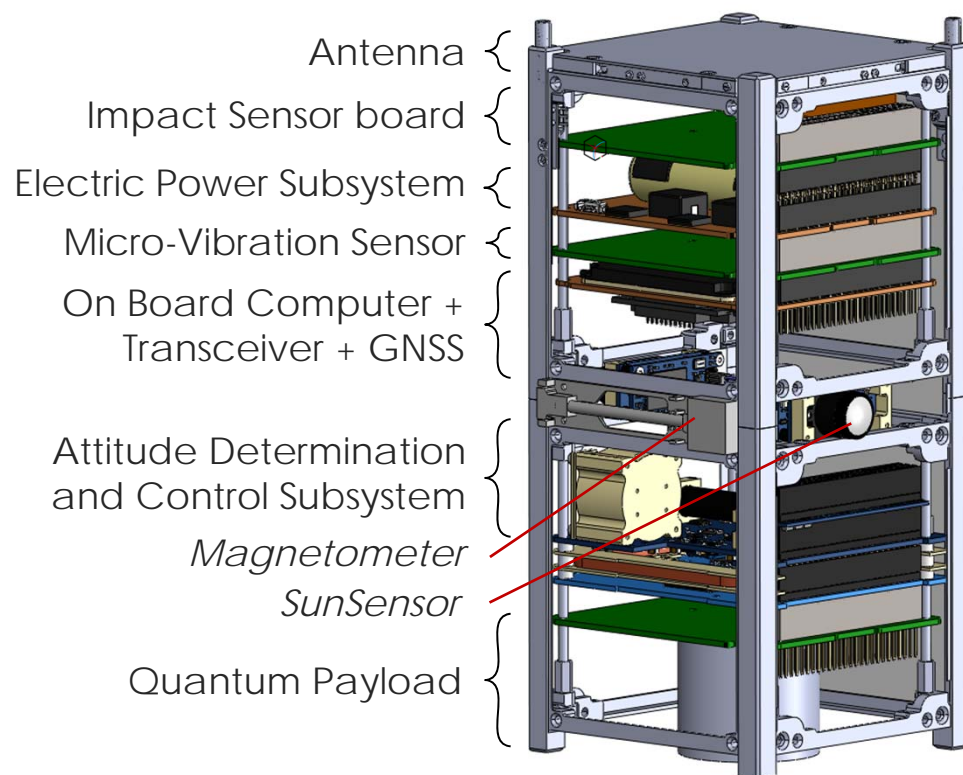**January 2023**: Fly Your Satellite! – Design Booster

March 2024: Fly Your Satellite! – Design Booster conclusion

Today: Preliminary Design Review

Launch for the first time
at the University of Padova
of a CubeSat
entirely made by students

System Design

Antenna

Impact Sensor board

Electric Power Subsystem

Micro-Vibration Sensor

On Board Computer +
Transceiver + GNSS

Attitude Determination
and Control Subsystem

Magnetometer

SunSensor

Quantum Payload

Quick facts table	
Communication protocols	CAN bus, I2C, UART
Regulated power busses	3.3V, 5V
Pointing accuracy	15 deg
Mass (with margins)	2.623 kg
Telecom frequency	435-438 MHz (UHF)

Mission Objectives

1. Collect in-situ measures of the space debris sub-mm environment

2. Study the micro-vibration environment on the CubeSat

3. Perform orbit determination through laser ranging

4. Investigate alternative systems for validating Quantum Communication ground station
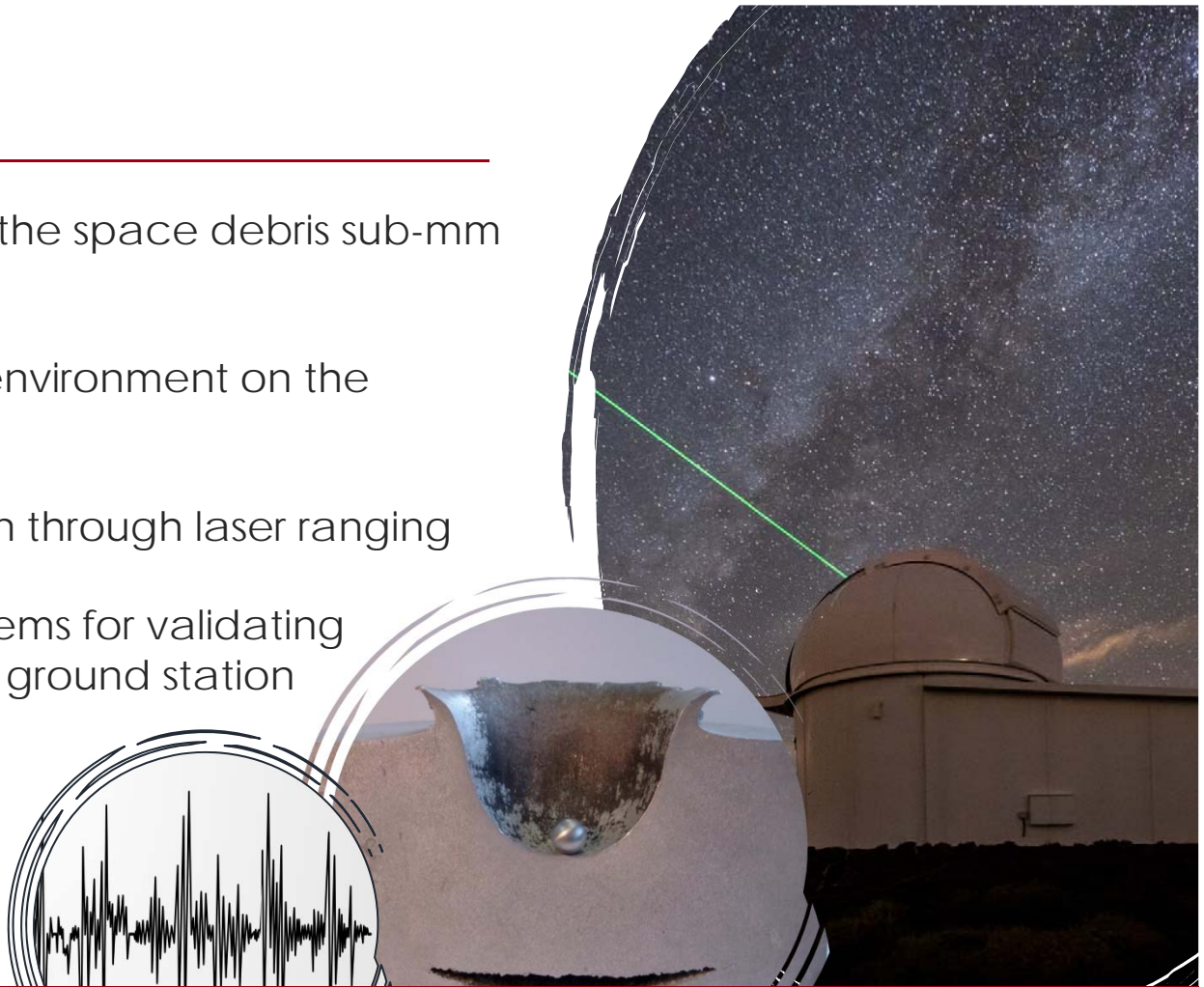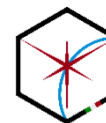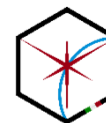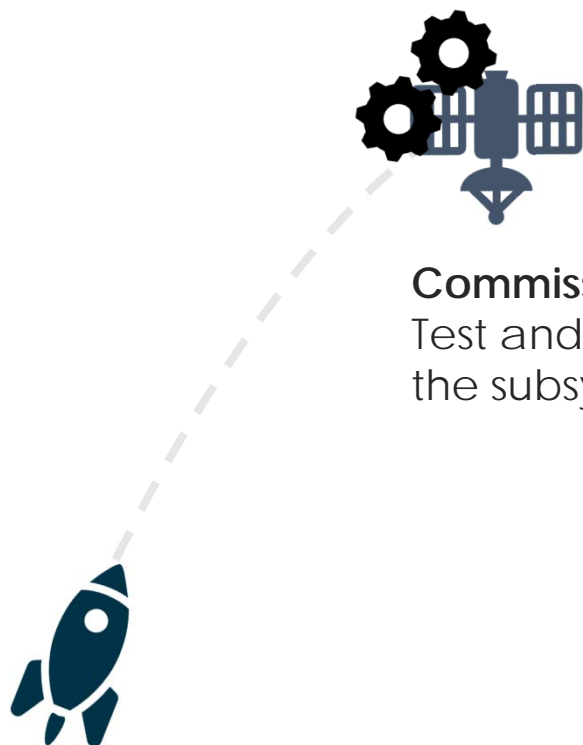
Mission Description

Launch and Early Orbit Phase

1. Orbit insertion
   ALT: 500 km
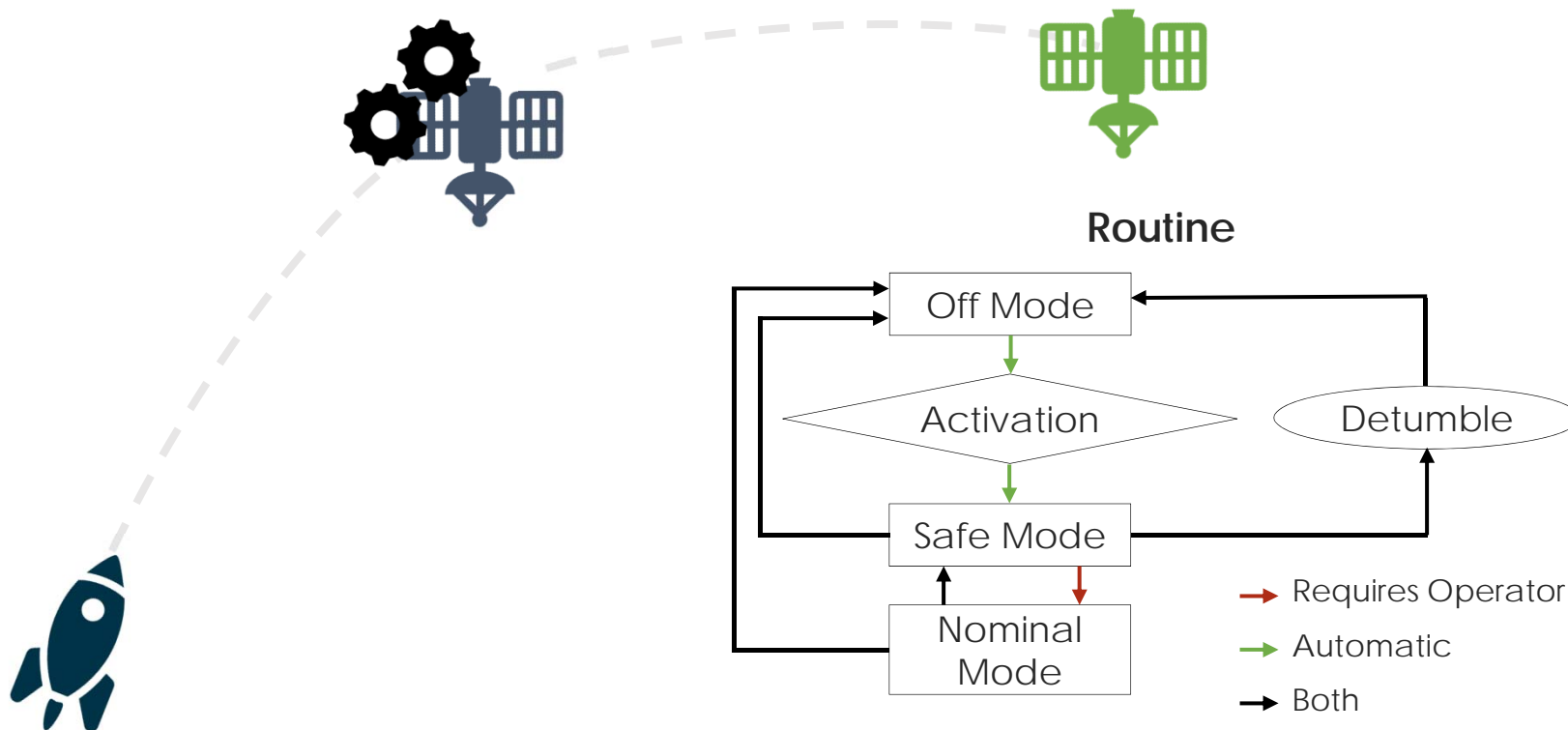   INC: 97.4 deg
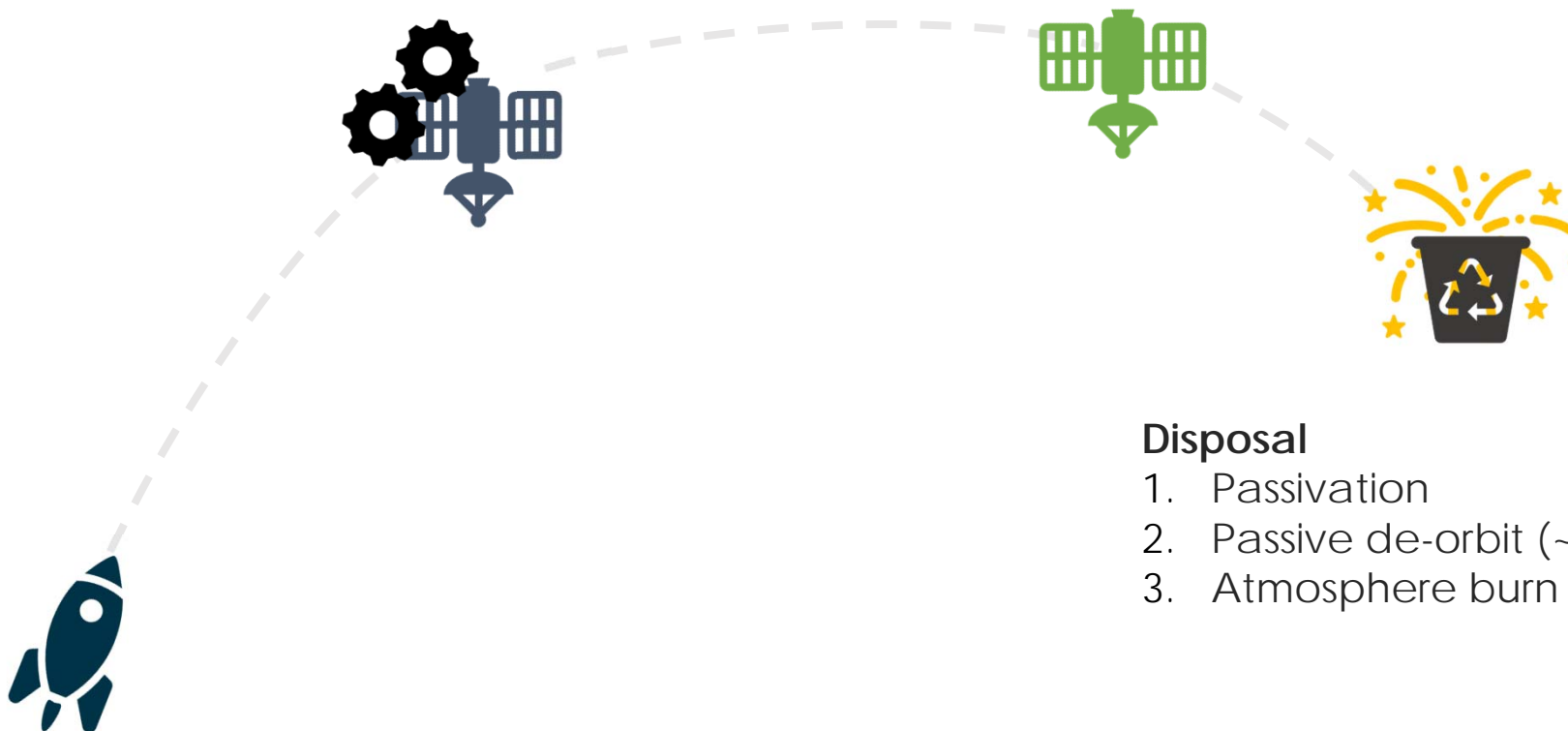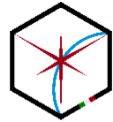2. Bring the satellite to nominal state

Mission Description

Commissioning
Test and verify the performances of
the subsystems and payloads

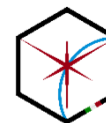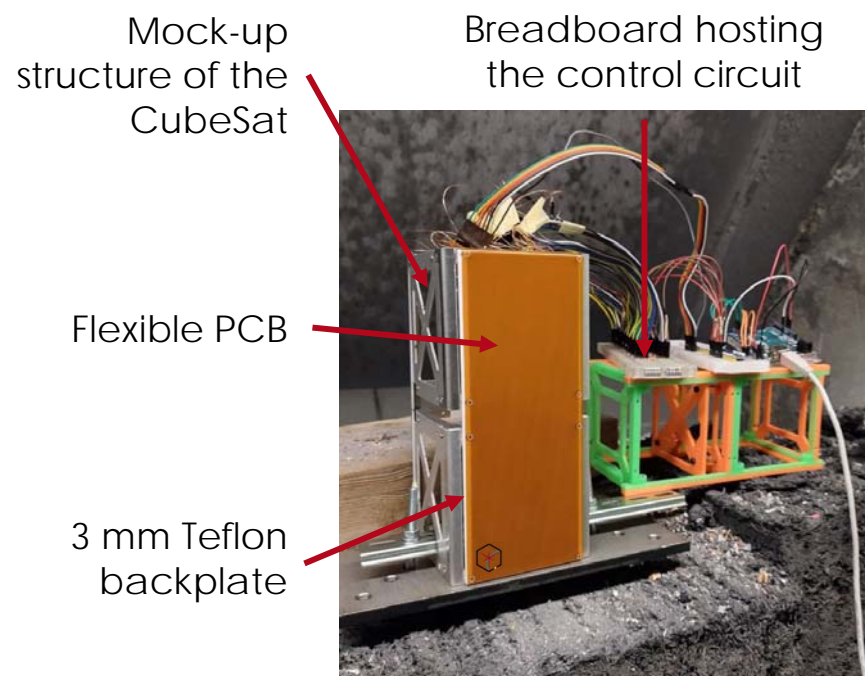# Mission Description

Routine

Mission Description

Disposal
1. Passivation
2. Passive de-orbit (~5 years)
3. Atmosphere burn

Impact Sensor

Mock-up structure of the CubeSat

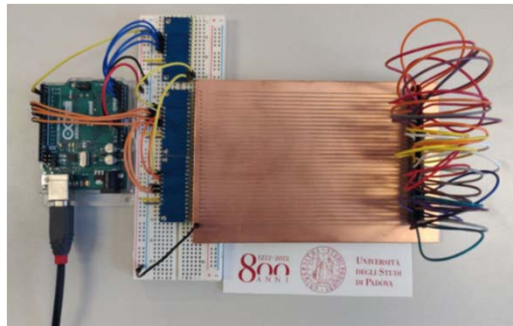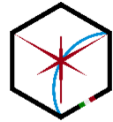Breadboard hosting the control circuit
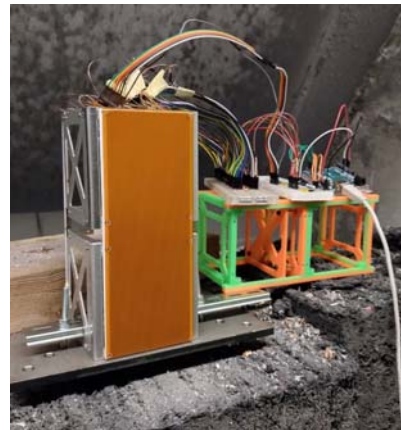
Flexible PCB

3 mm Teflon backplate

- 2U detection area

- Conductive lines printed on Kapton

- Detection of debris as small as 80 um
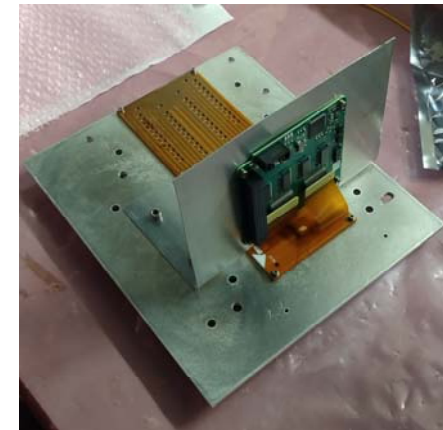
- Modular and scalable design

Impact Sensor

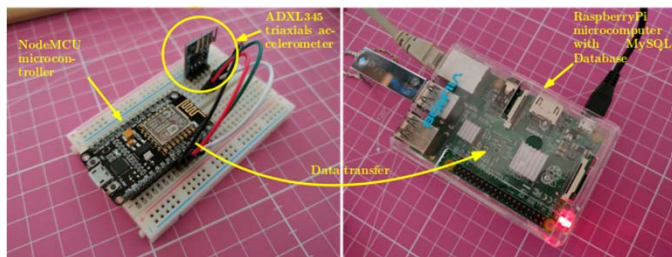**BBM**

- Firmware functionality check

DM

- Assembly verification
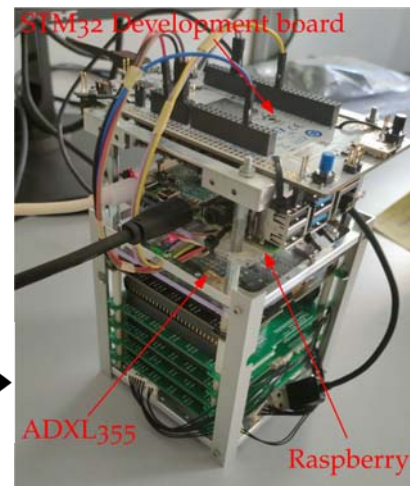- Functionality tests (TRL4)

EQM

- Environmental test campaign

Microvibration Sensor

BBM

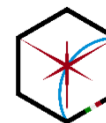- Firmware functionality check

DM

- Functionality tests (TRL4) using ESAT
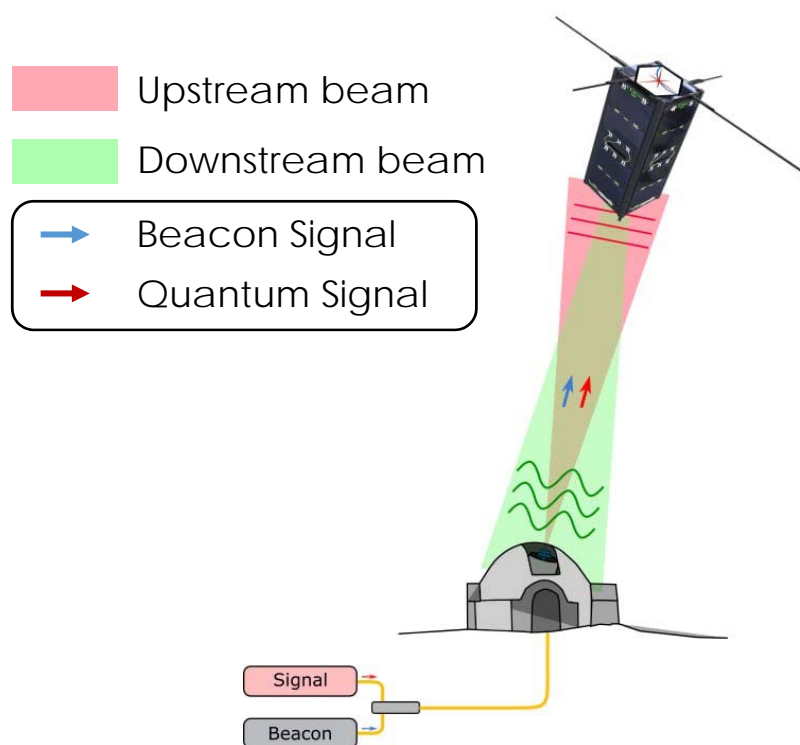- Verification of communication between STM32 and ADXL355

MVS FIRST PCB PROTOTYPE

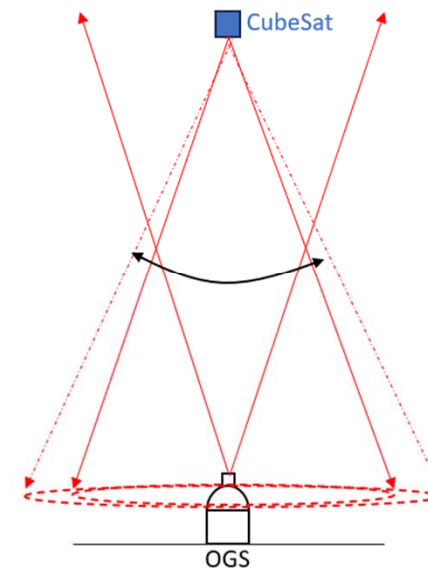**EQM**

- Environmental test campaign

Quantum PayLoad

Legend:
- Upstream beam (pink)
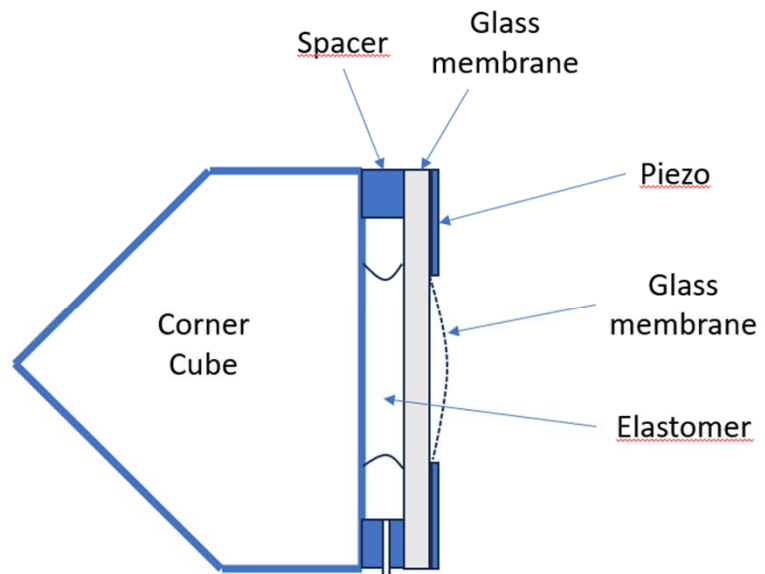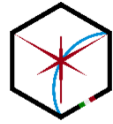- Downstream beam (green)
- → Beacon Signal
- → Quantum Signal

- On-board optical modulator, tested up to 300 MHz

- Custom Anti-Reflection Coating @ 980nm and 1550nm

- GS connected to SNSPD in order to work at single-photon level

Quantum PayLoad

Conclusions

- AlbaSat is a **2U CubeSat** under development at the **University of Padova** by a student team

- The team has participated to the ESA **Fly Your Satellite! – Design Booster** programme

- Currently, about **60 students** are involved in the project

- Four payload are being developed and tested, with a minimum technology readiness level (TRL) 4

Thank you for your attention

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