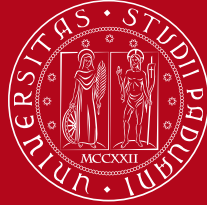


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# Development of a fine steering tip/tilt mechanism for space applications

Armando Grossi - 36th Cycle

*PhD Course in Science, Technologies and Measurements for Space*

Presentation of proposed research program - November 6th, 2020

- Industrial PhD
- Introduction
- Research Project Objectives
- The Mechanism
- The Actuators
- Methods
  - Finite Elements Analyses
  - Tests
- Work Activity
  - Main Steps
  - Gantt

- **Industrial PhD**



- **Officina Stellare S.p.A.**

an innovative SME active in the design and production of telescopes, optomechanical and aerospace instrumentation for Ground and Space based applications



## Space telescopes

- Earth observation;
- Outer space observation.



## Problem

Line-of-sight and image performances affected by:

- Thermal gradients;
- Misalignment due to launch vibrations;
- Platform jitter (due to reaction wheels);
- Fuel slosh;
- Ground errors (manufacturing, integration, ...)

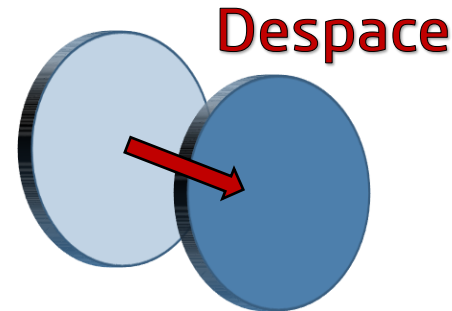
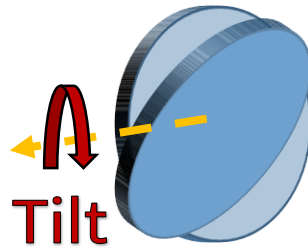
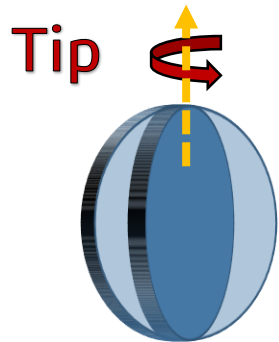
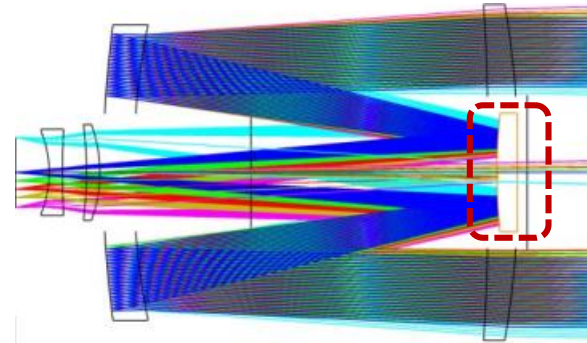


**Necessity to correct optical components position**

**A solution**  
active mechanism to adjust the position/orientation of optical elements

- **Design and Realization** of a fine steering mechanism equipped with piezoelectric actuators;
- **Space qualification** of the fine steering mechanism;
- Acquisition of know-how in the **piezoelectric actuators** field;
- Acquisition of experience in the **active optics** field.

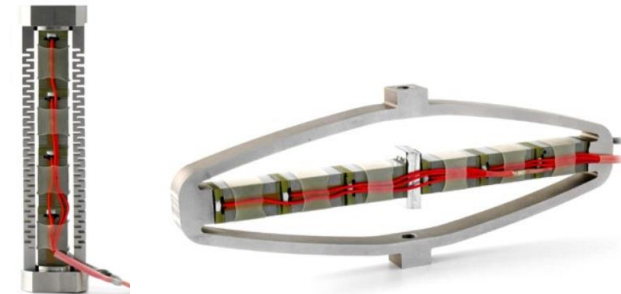
- Modify the position/orientation of a **secondary mirror**.
- **3 dof:**
  - Tip/tilt;
  - Despace.



- Movement generated by **piezoelectric actuators**.
- Piezoelectric **PRO**:
  - High resolutions;
  - No stick-slip;
  - No lubrications;
  - High vacuum operations;
  - Low power consumption;
  - Low heat dissipation.
- Piezoelectric **CONS**:
  - Limited stroke;
  - High voltage.

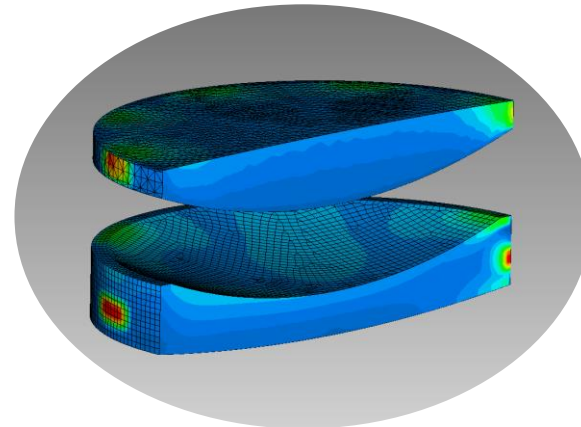
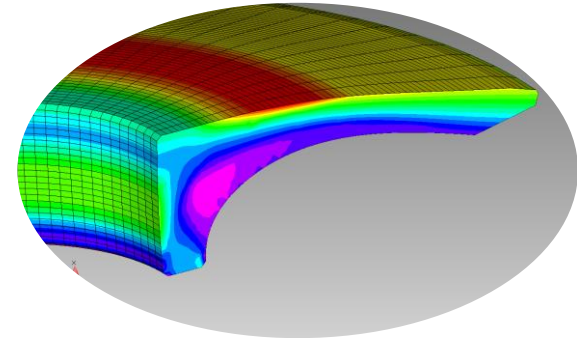


[from Physik Instrumente]



[from Cedrat Technologies]

- **Finite Element Model** in the design phase:
  - Static analyses;
  - Thermo-elastic analyses;
  - Dynamic analyses:
    - Modal;
    - Random vibrations;
    - Shock.





- Several **tests** will be performed:
  - Vibration tests;
  - Thermo-Vacuum test;
  - Functional test:
    - In vacuum;
    - In air.
- Space qualification of the mechanism.

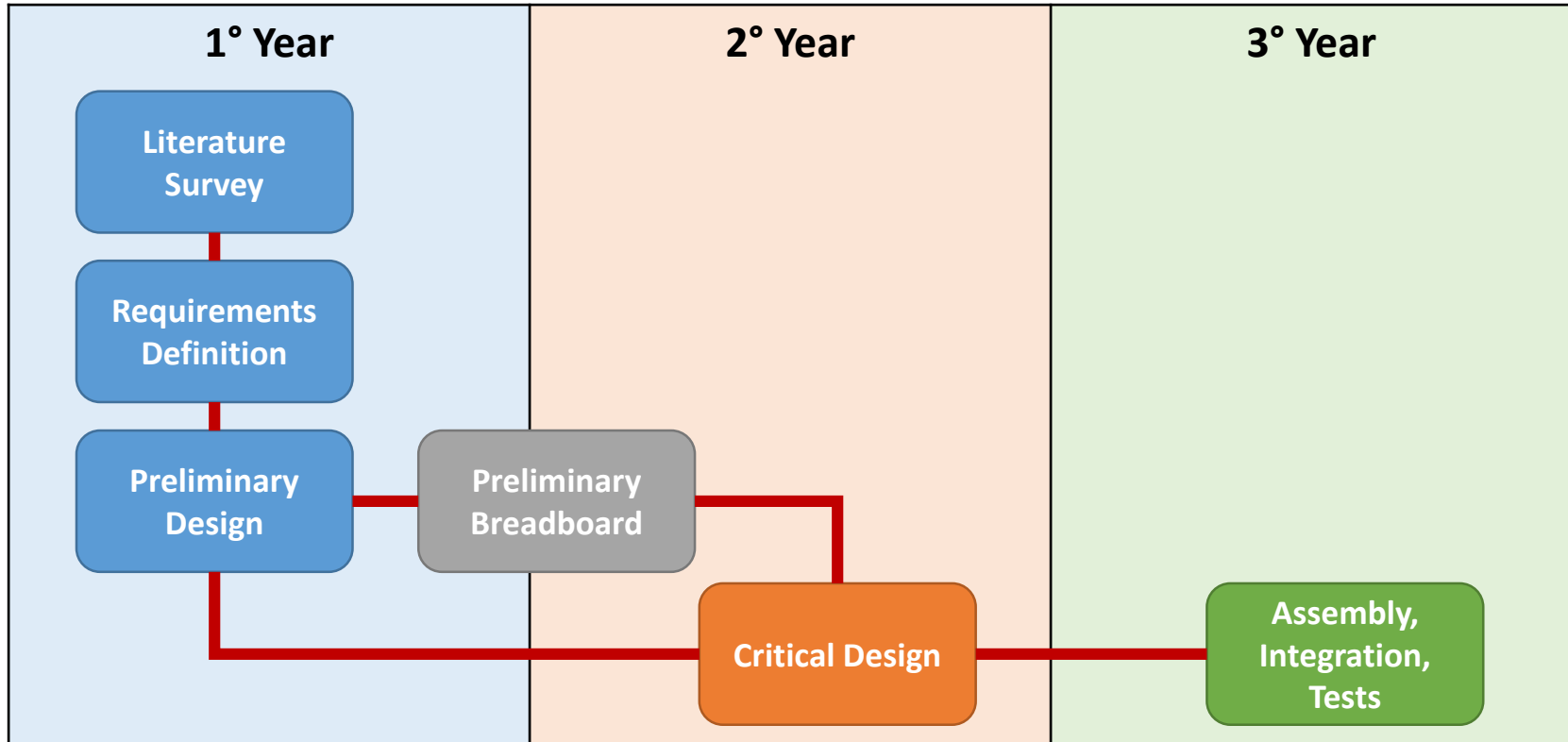


[Officina Stellare Shaker]

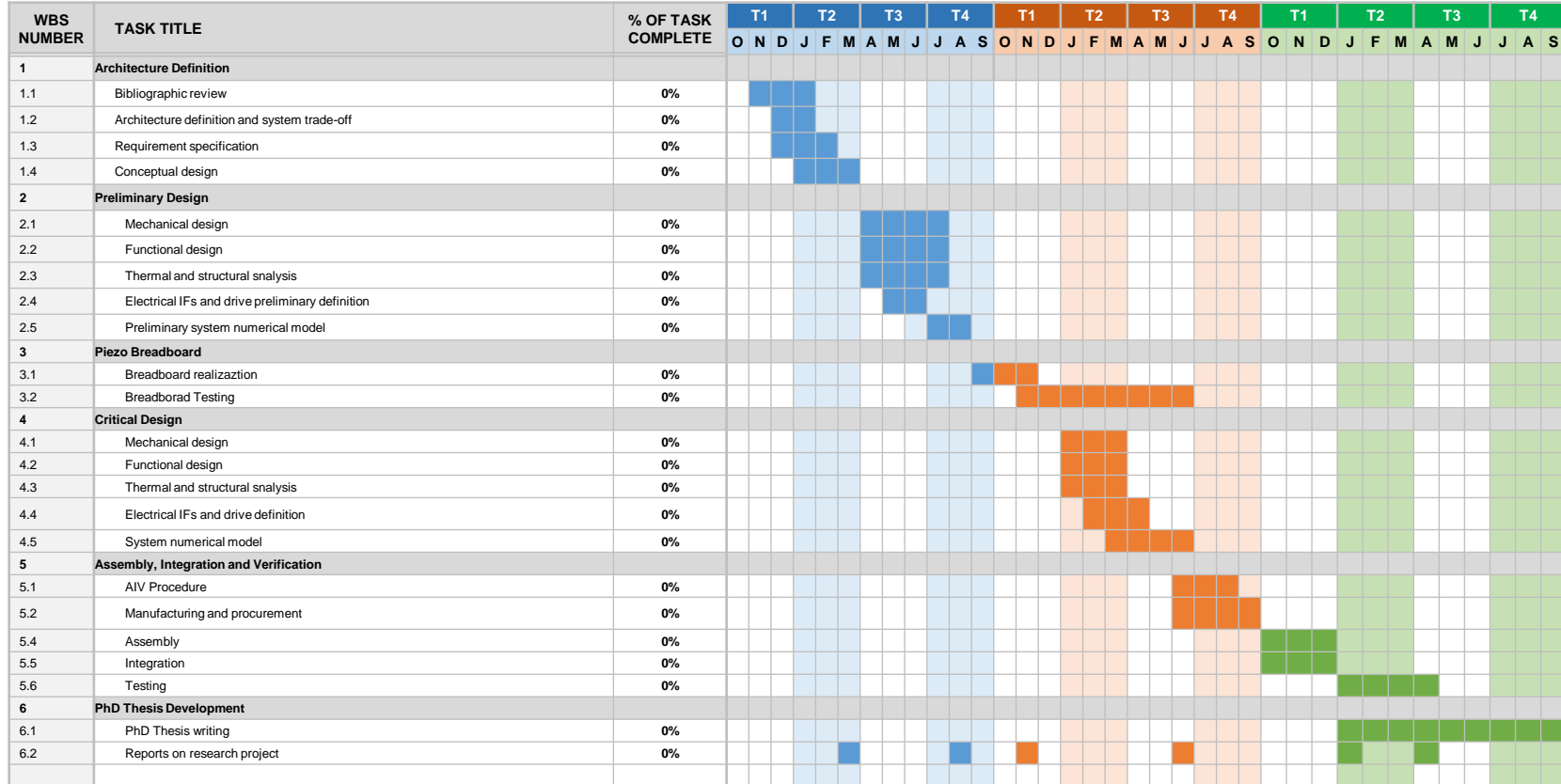


[Officina Stellare TVAC]

# Work Activity – Main Steps

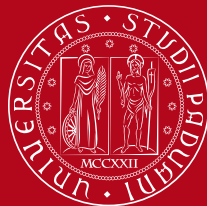


# Work Activity - Gantt



# Thanks for the attention

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