

XUVLab - Università degli Studi di Firenze
Dip. di Astronomia e Scienza dello Spazio



**CCD cameras and Spacewire for
HERSCHEL/SCORE suborbital
mission**

Alessandro Gherardi

Overview

- The HERSCHEL suborbital mission
- The HERSCHEL/SCORE instrument
- The SCORE CCD cameras
- The SpaceWire interfaces

The mission

The HERSCHEL mission

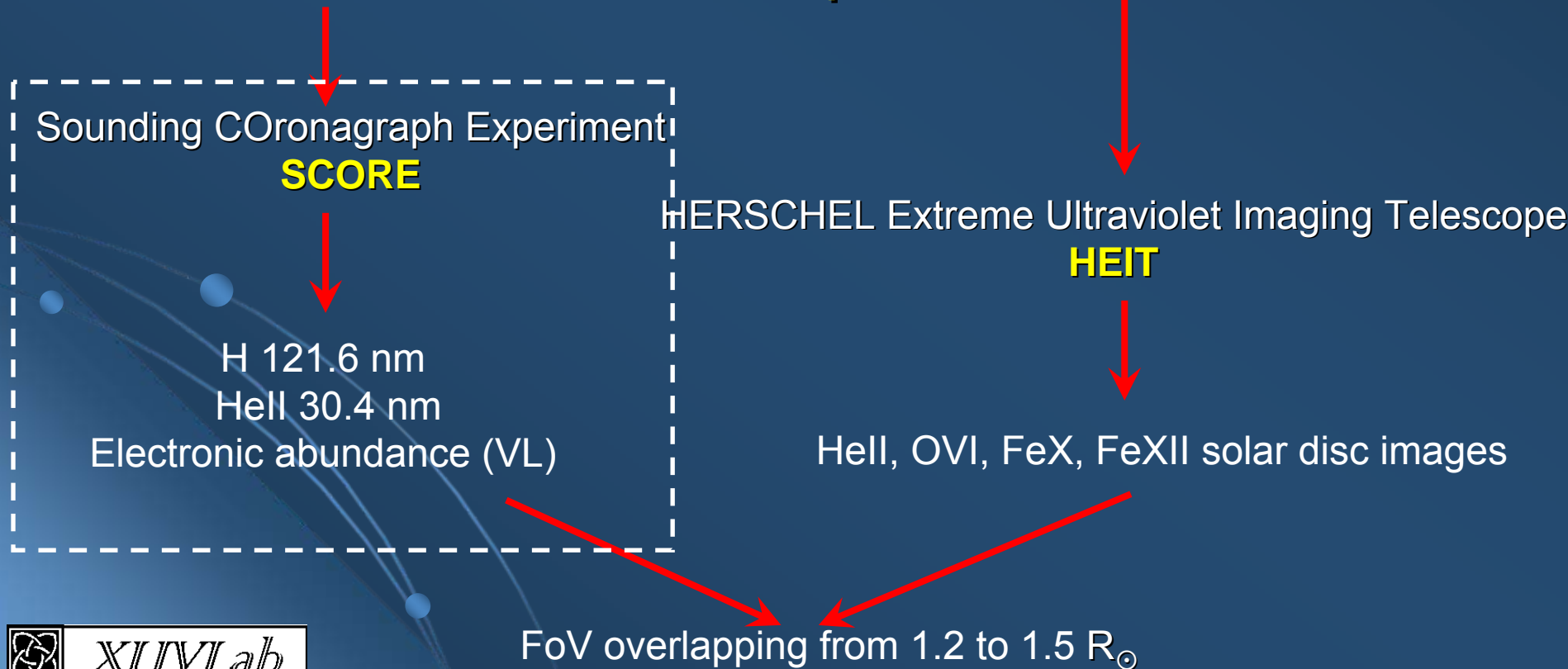


Goddard Space Flight Center
Wallops Flight Facilities



The HERSCHEL mission

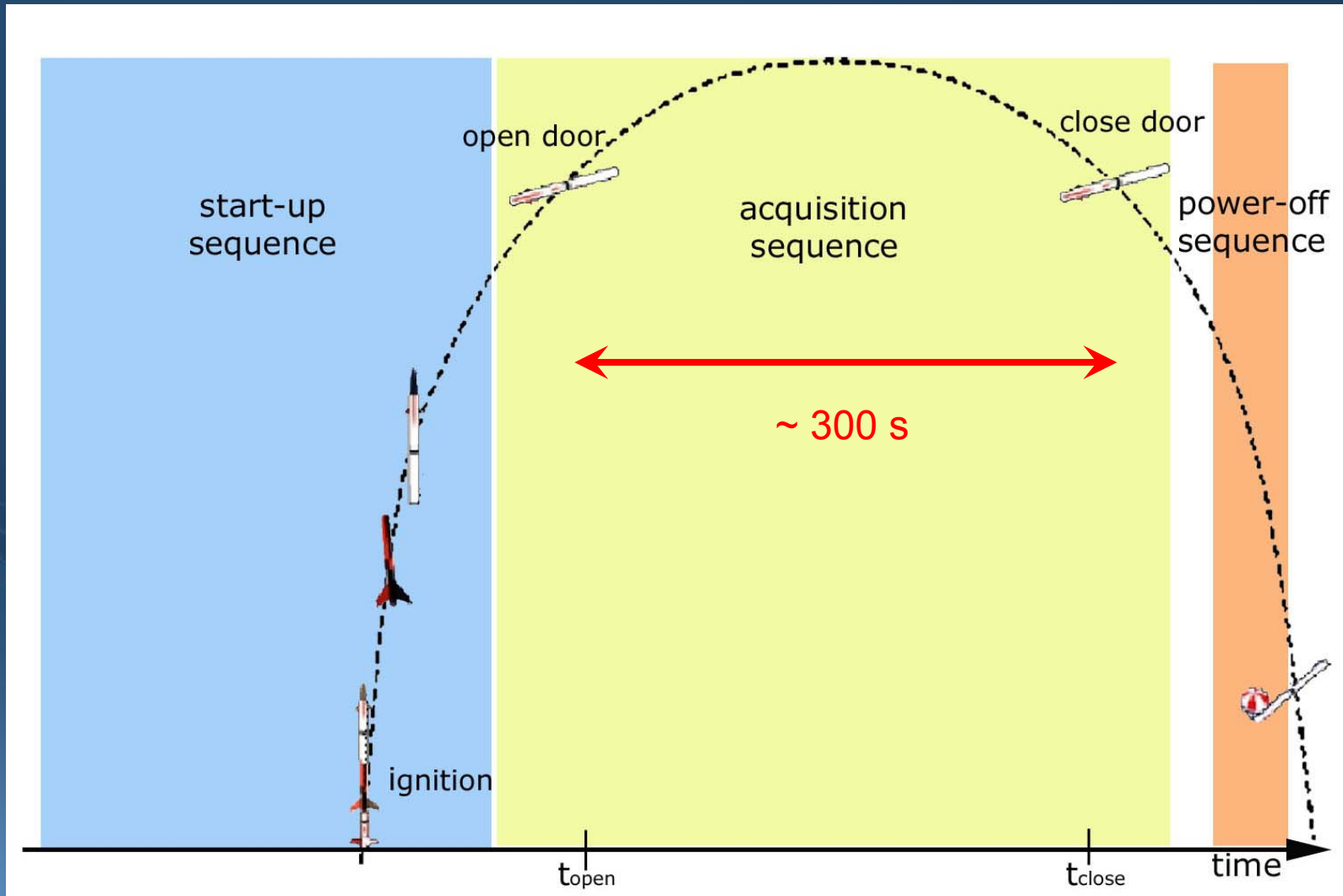
HElium Resonant Scattering in the Corona and HELiosphere



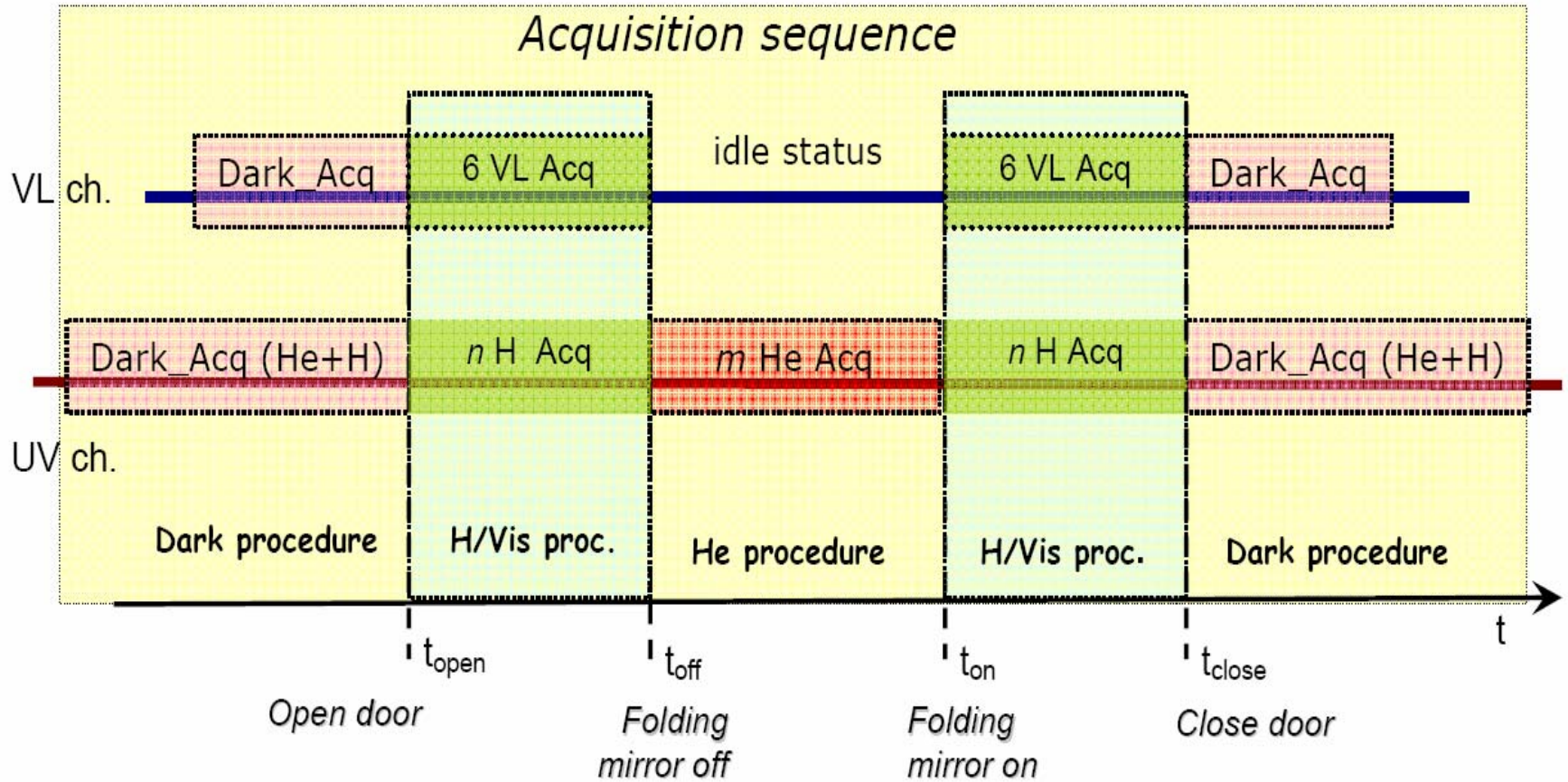
The HERSCHEL mission

- First He observation in the extended corona ($1\div 3 R_{\odot}$)
- First He and H EUV images in the corona
- He abundance measurement in the corona (He/H)
- Verification of solar wind models based on He abundance
- Test of instrumentation for future missions

The HERSCHEL mission

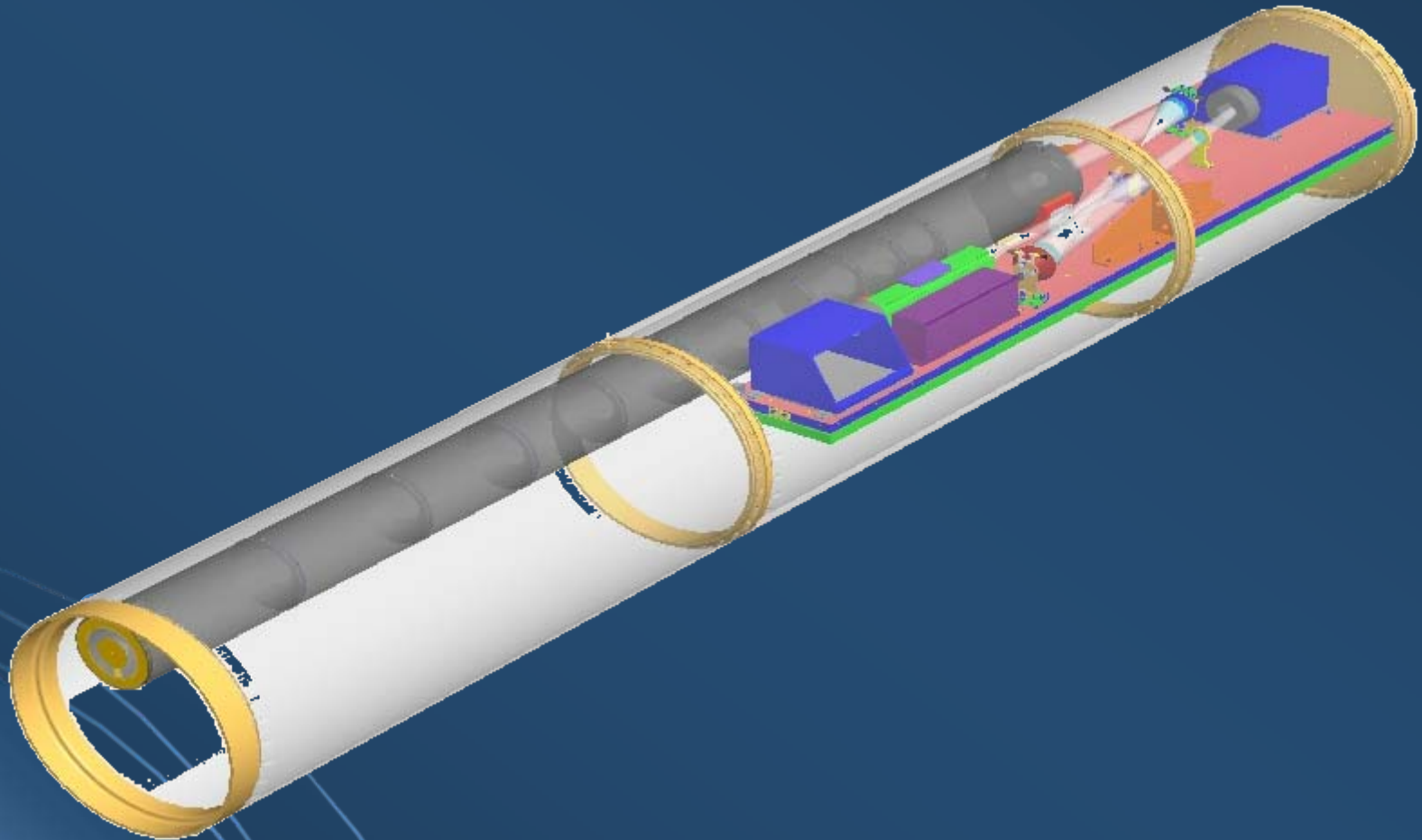


The HERSCHEL mission

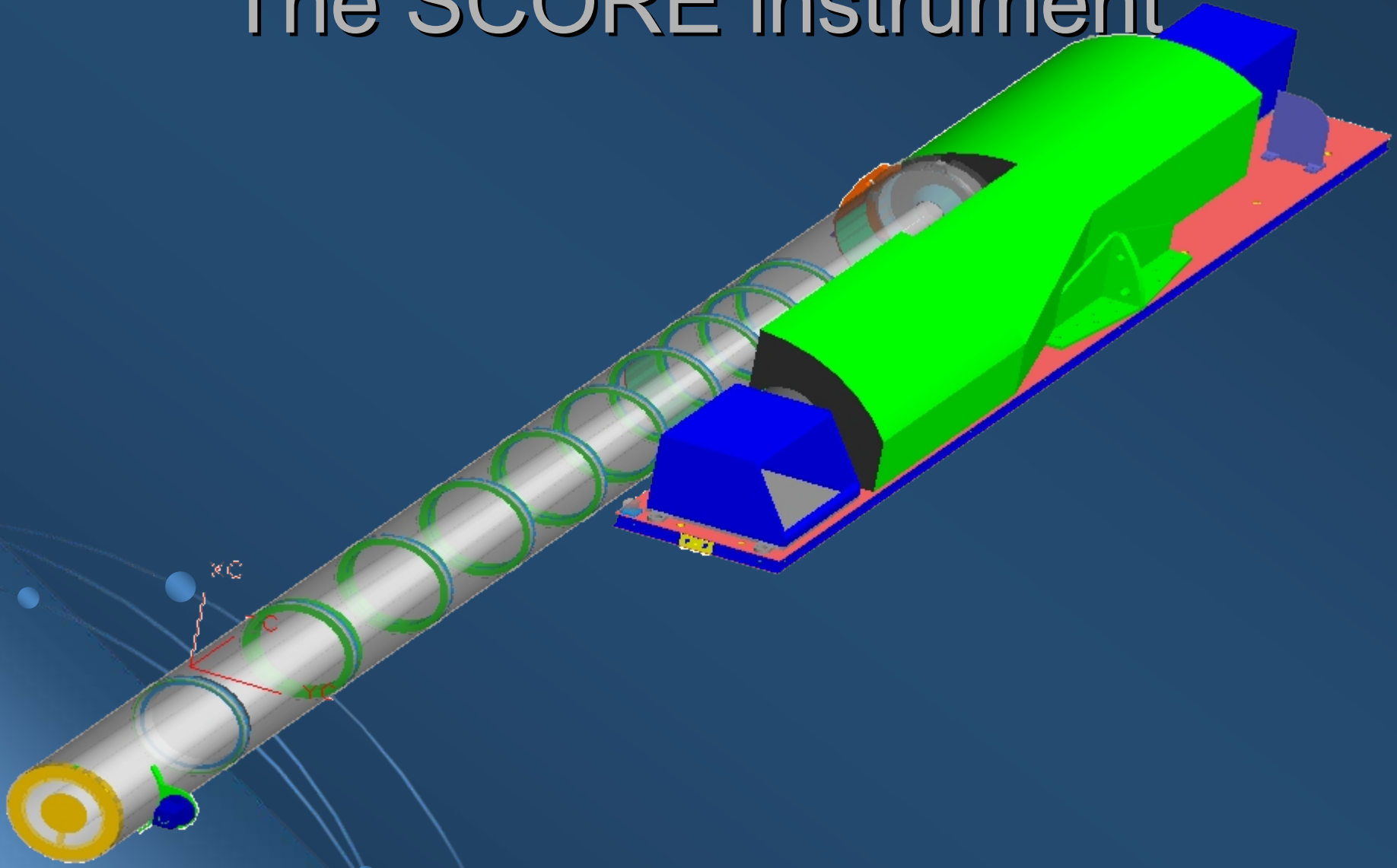


The instrument

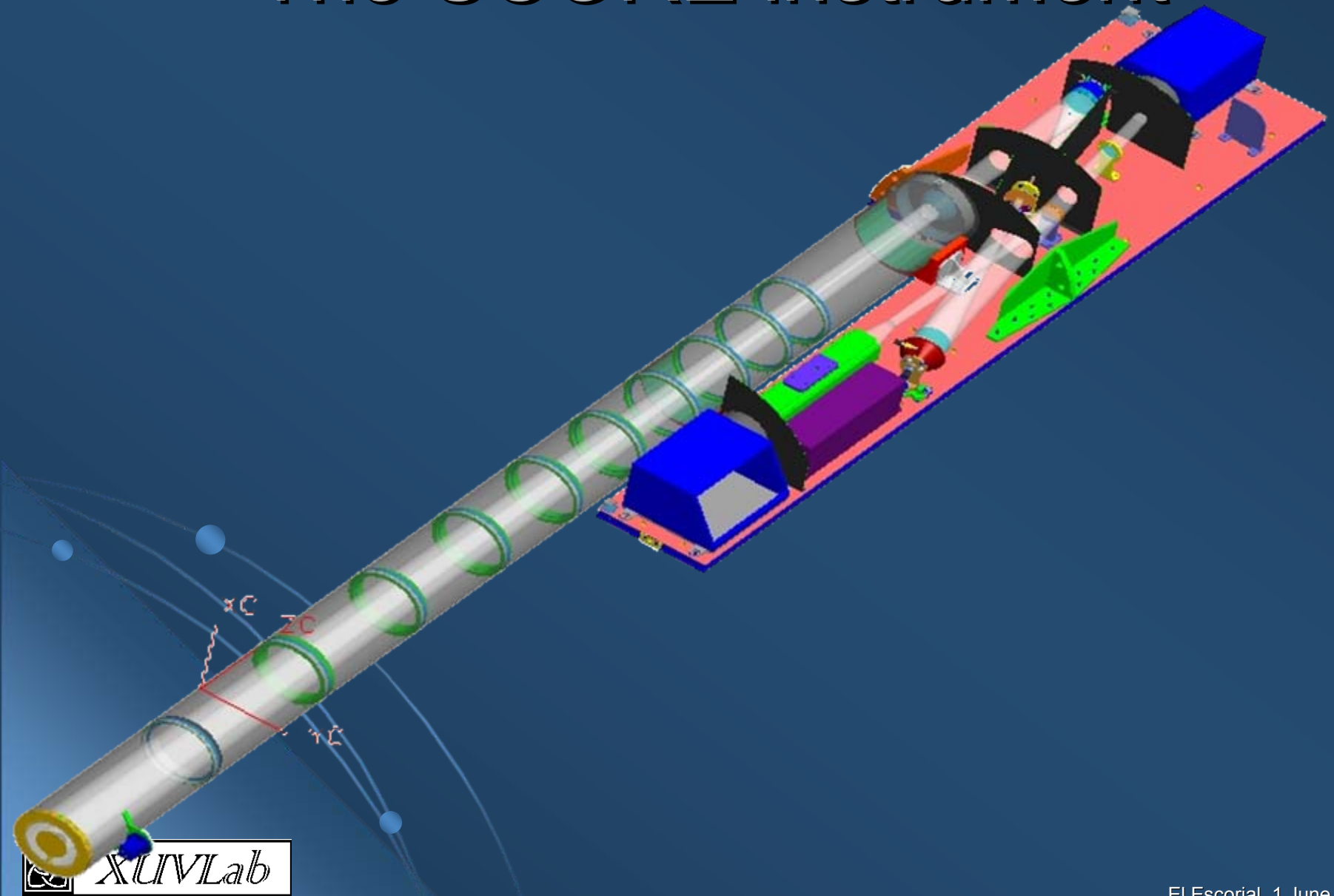
The SCORE instrument



The SCORE instrument



The SCORE instrument

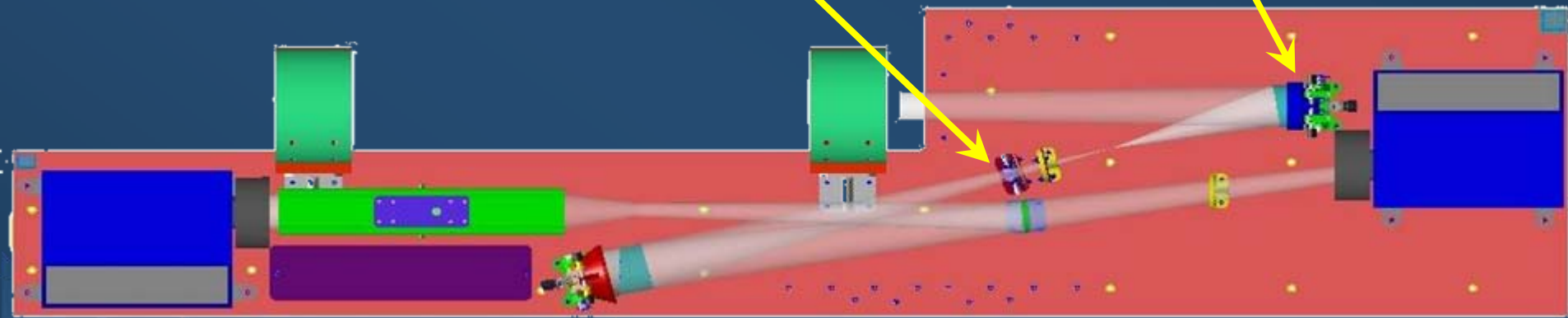


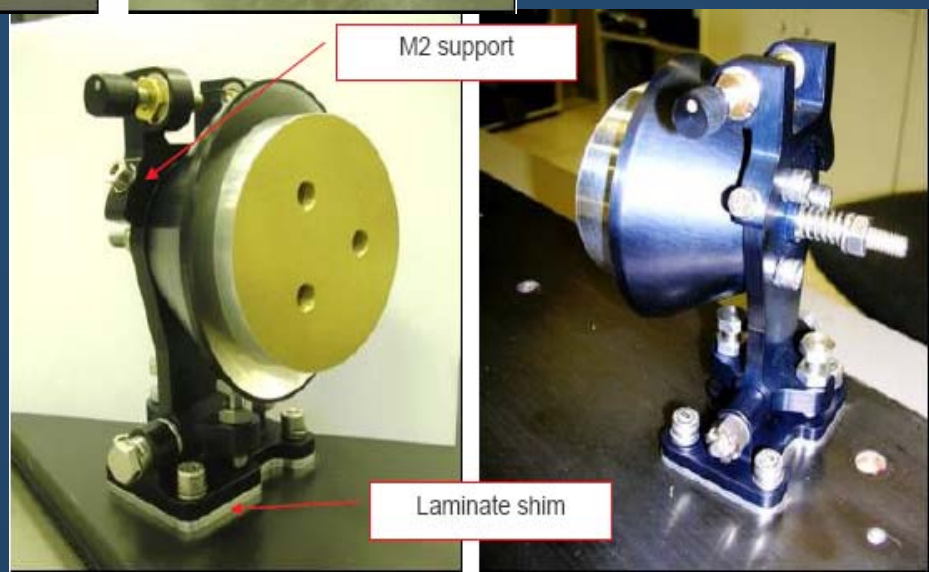
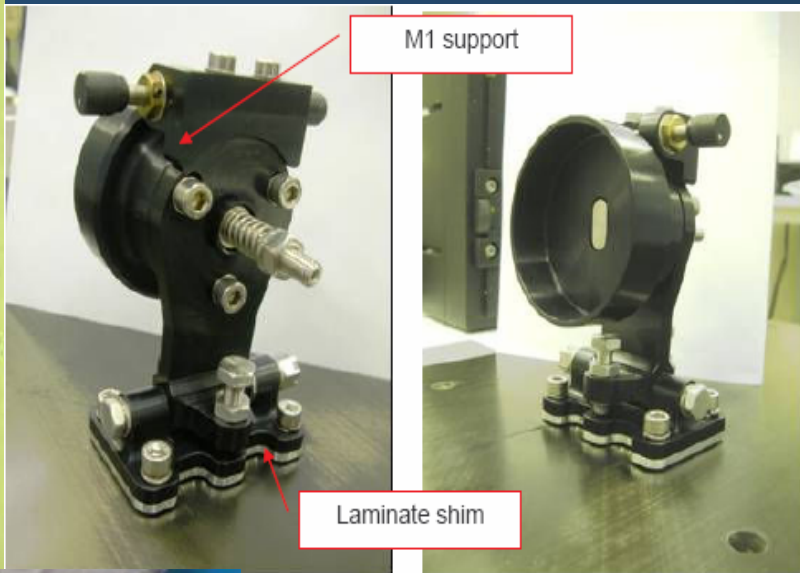
The SCORE instrument

Internal occulter

Primary mirror M1

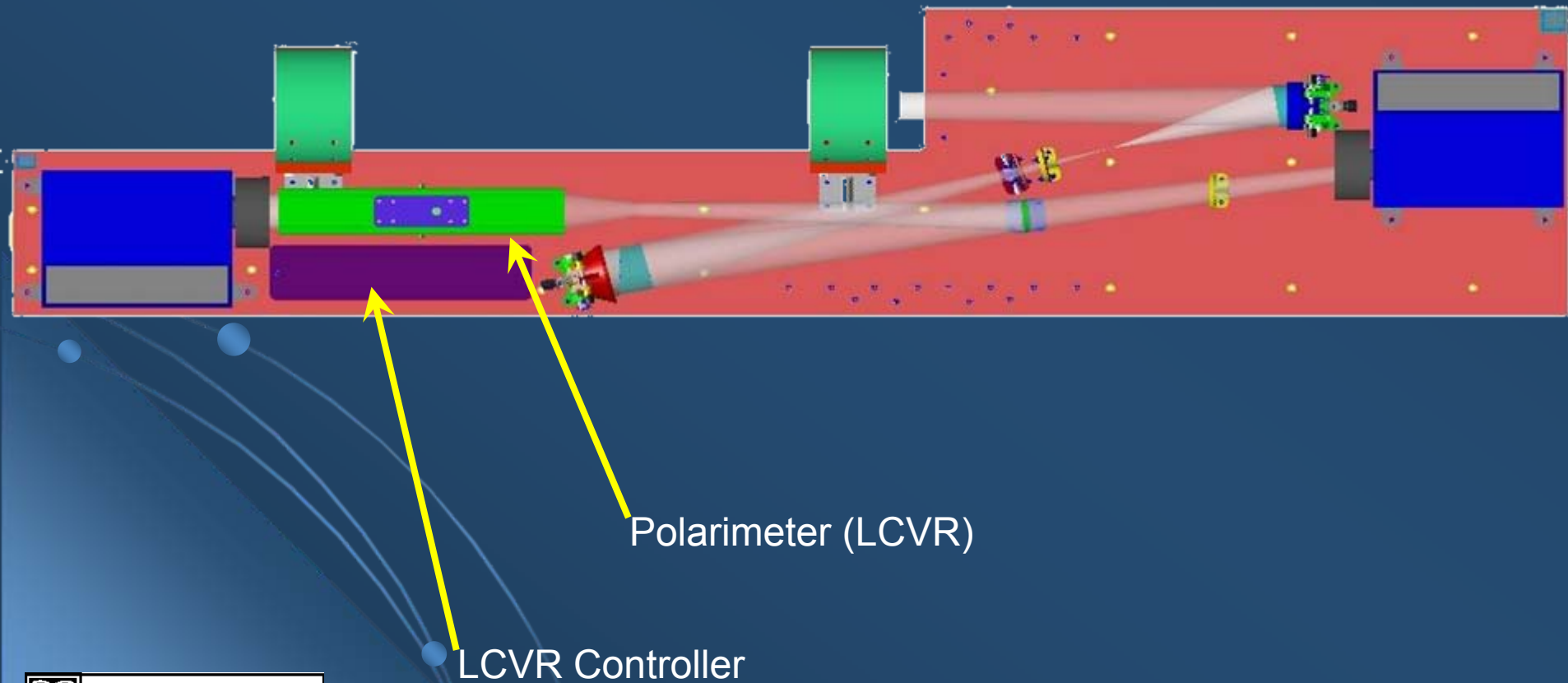
Secondary mirror M2



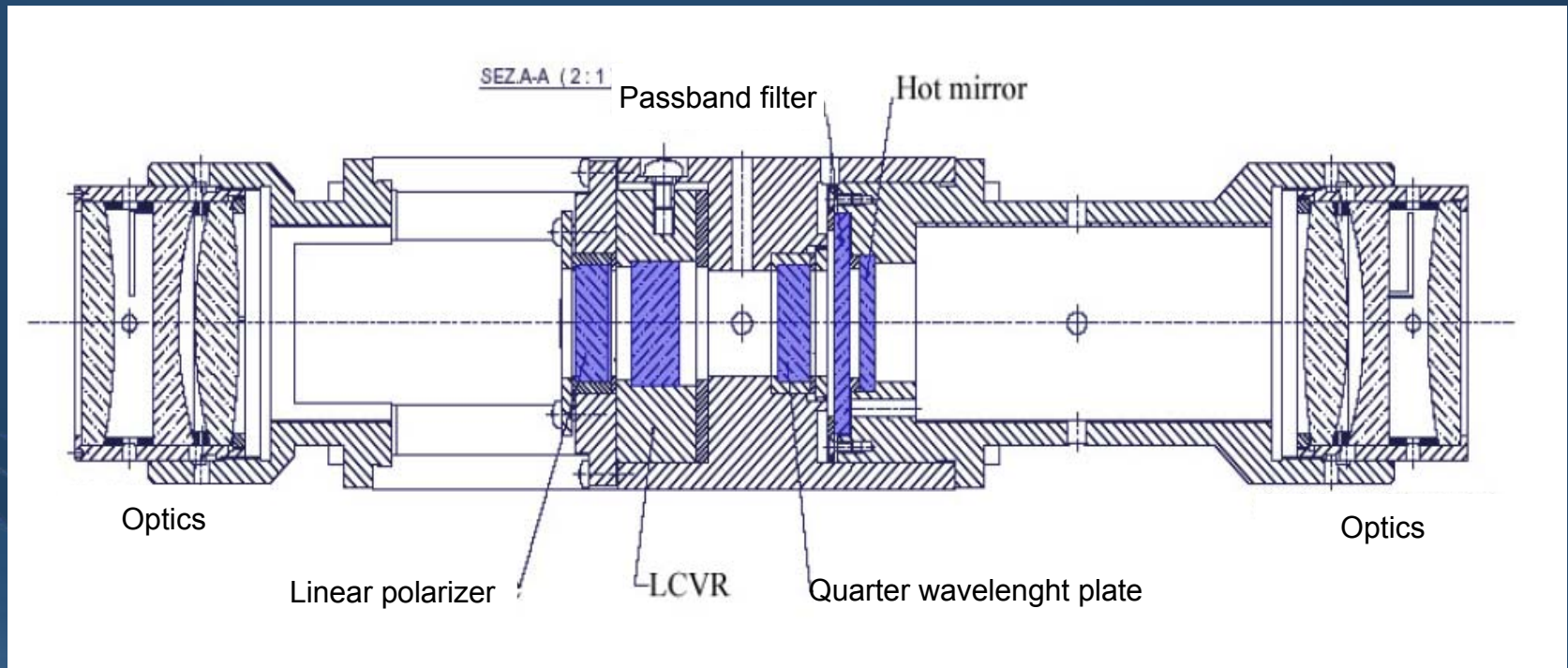


The polarimeter

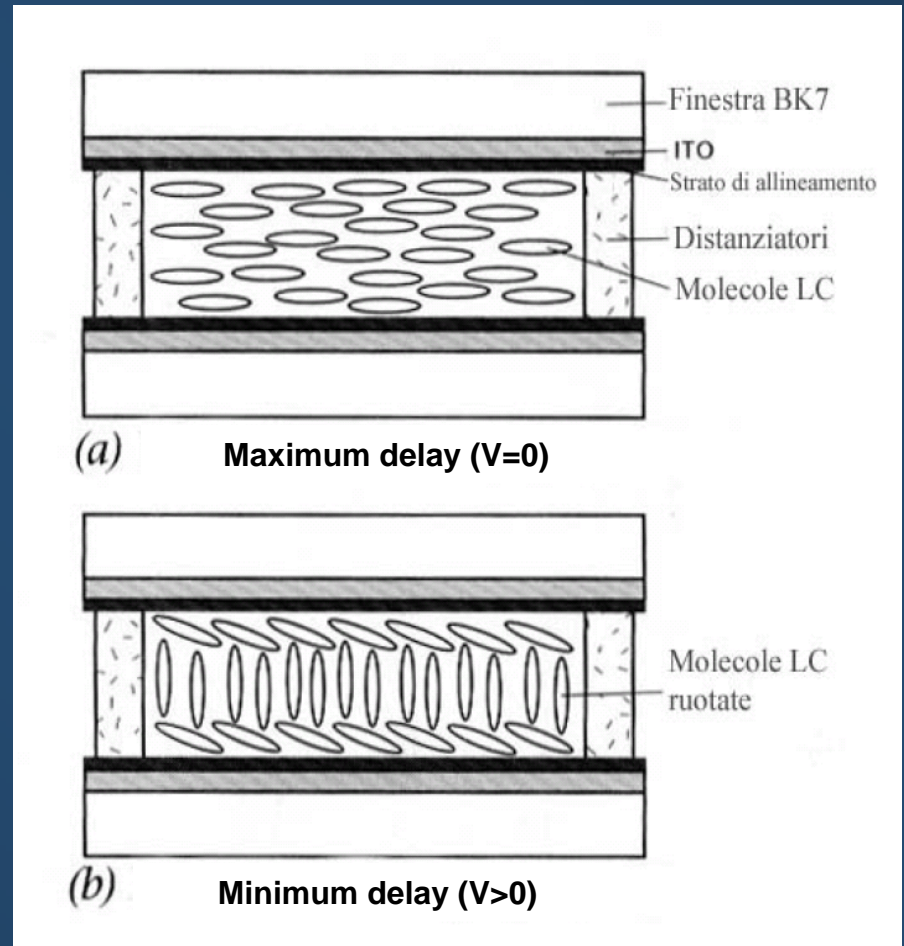
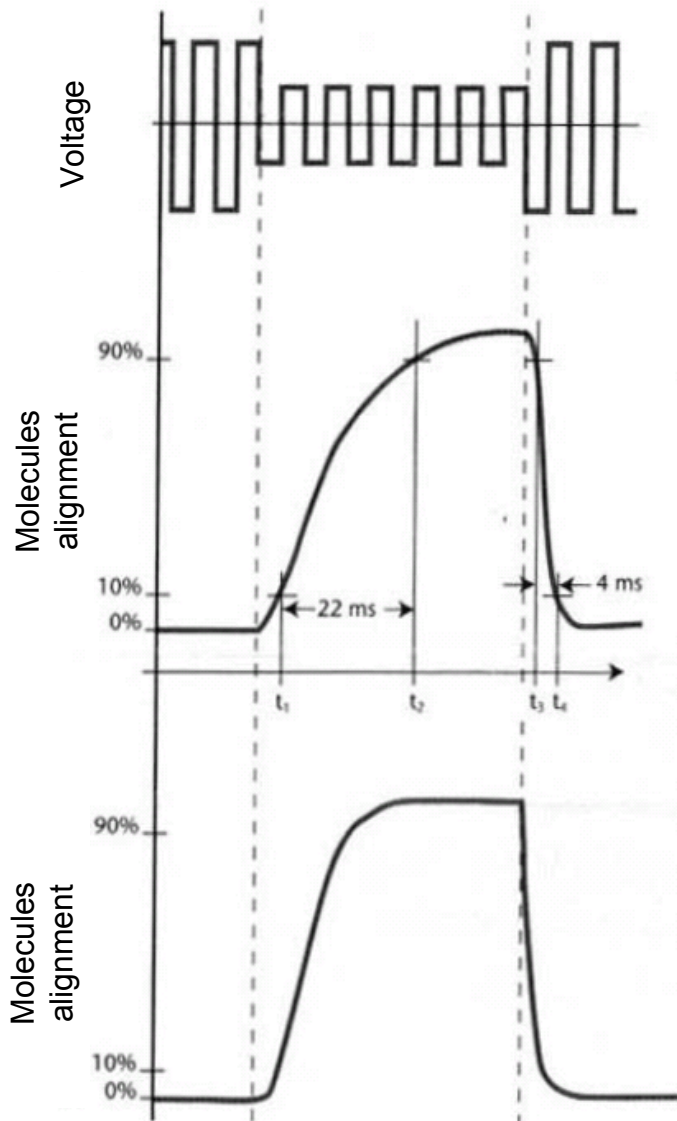
The polarimeter



The SCORE polarimeter



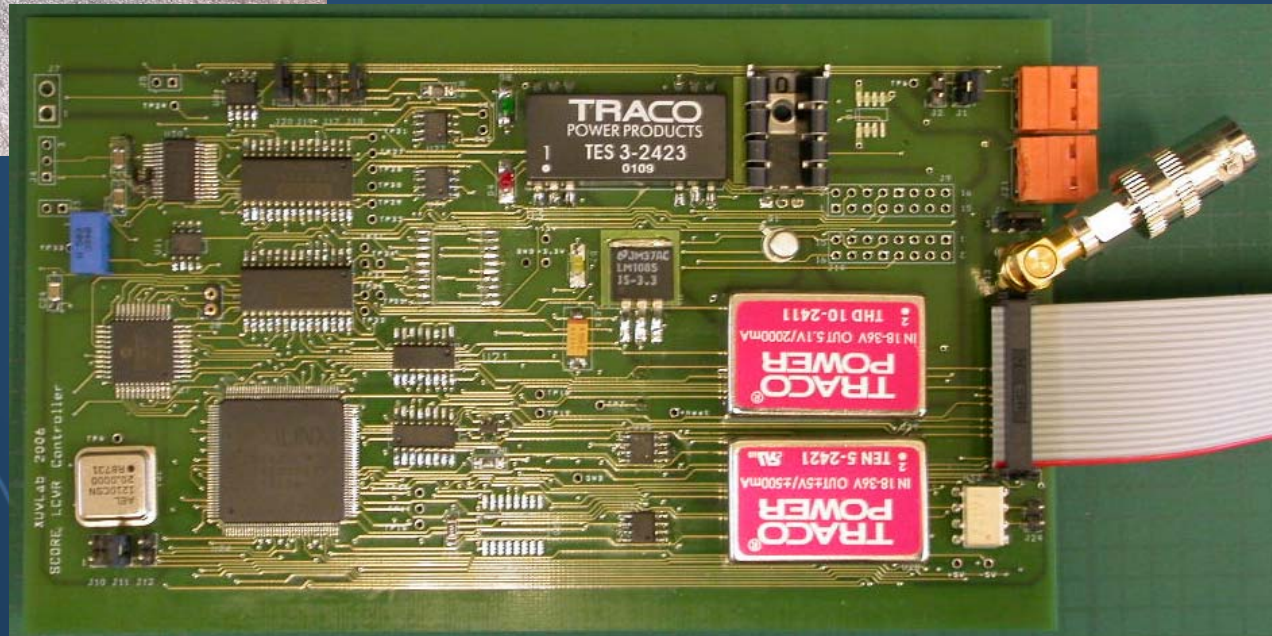
LCVR



LCVR Controller

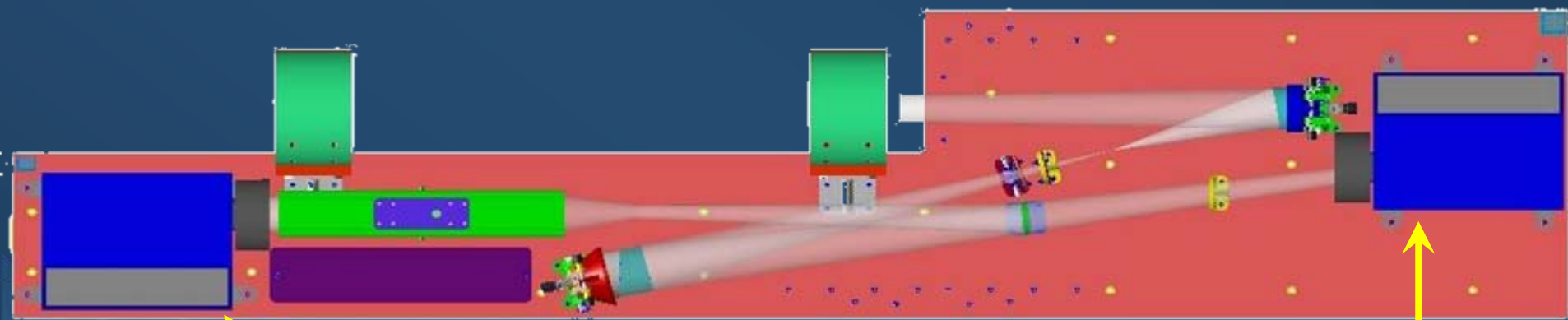


- Arbitrary pattern generation (time and pattern)
- Temperature control
- Totally reprogrammable



CCD cameras

CCD cameras



CCD detector

ICCD detector

CCD cameras

**Power supply
Peltier controller**

SpaceWire

Detector

**Signal analyzer
and converter**

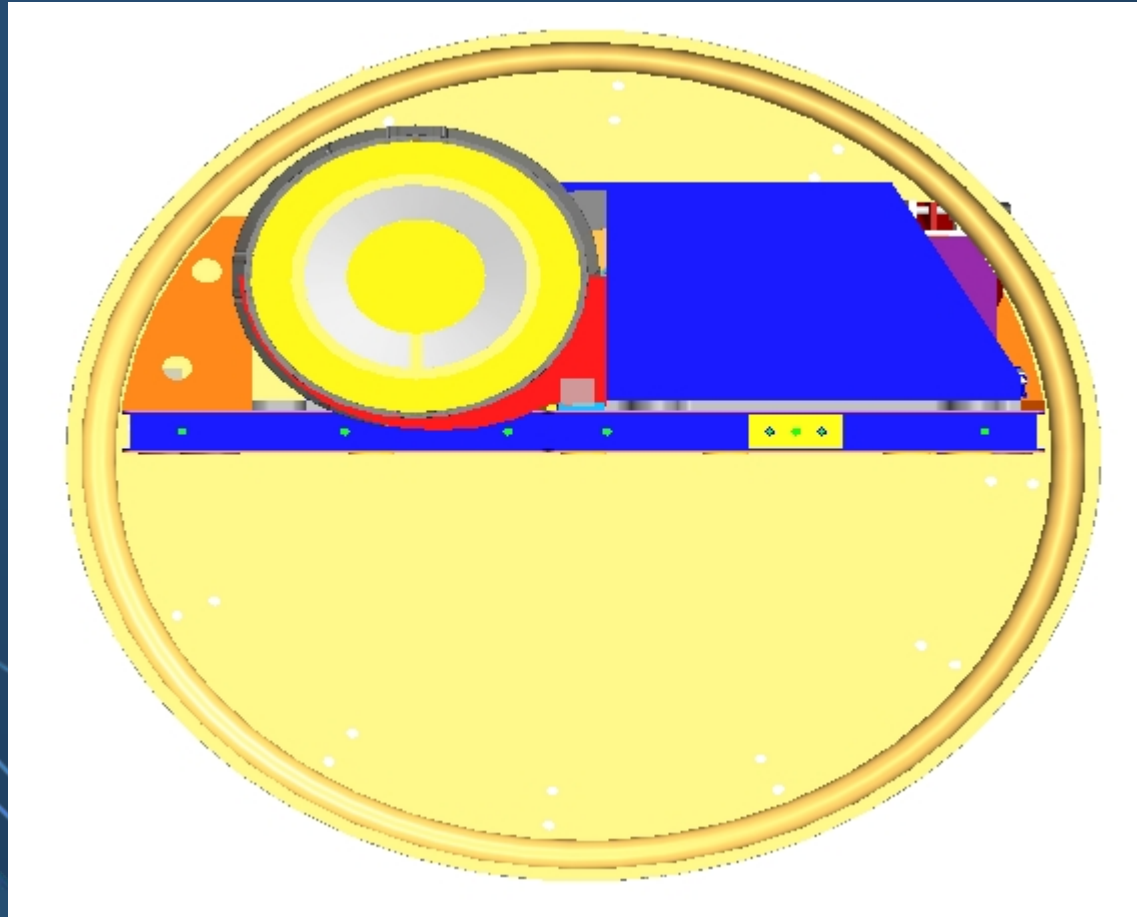


Clock generator

Why not commercial?

- Space application!
- High customization
- Automatic acquisition procedures
(only 5 min!!)
- Smart Electronics
- Customized geometrical requirements

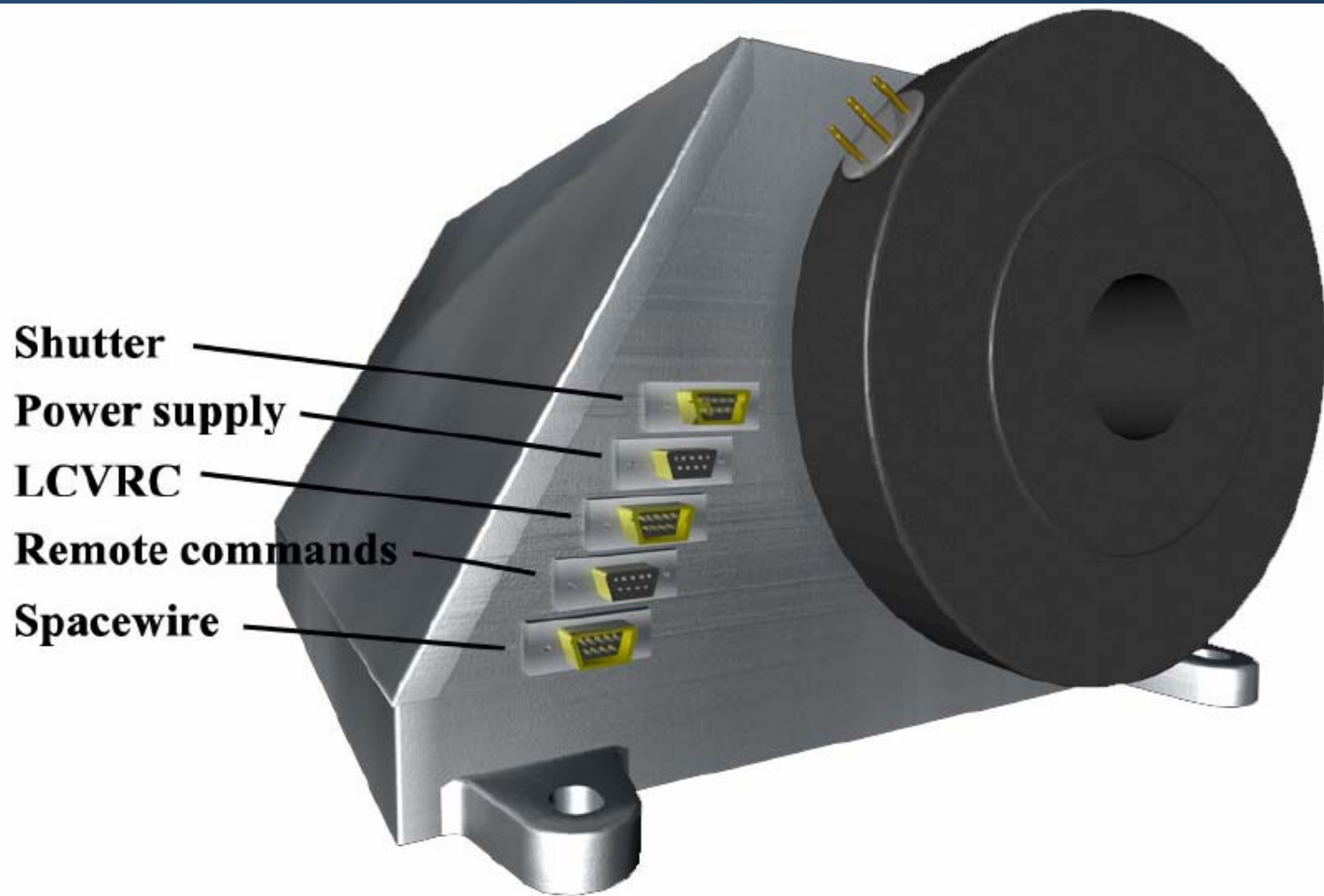
Geometrical constraints



Camera overview

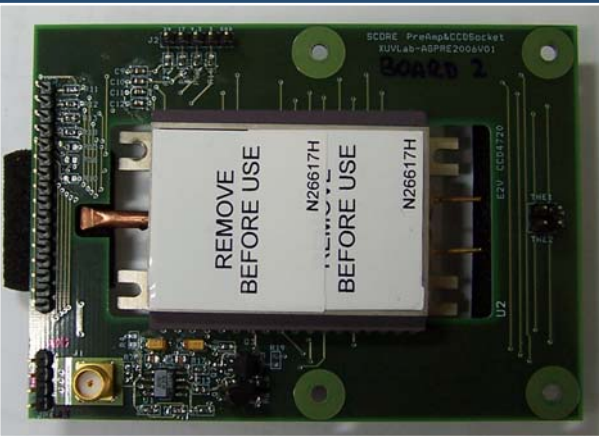


Camera overview



Boards

Socket & Pre



SpaceWire



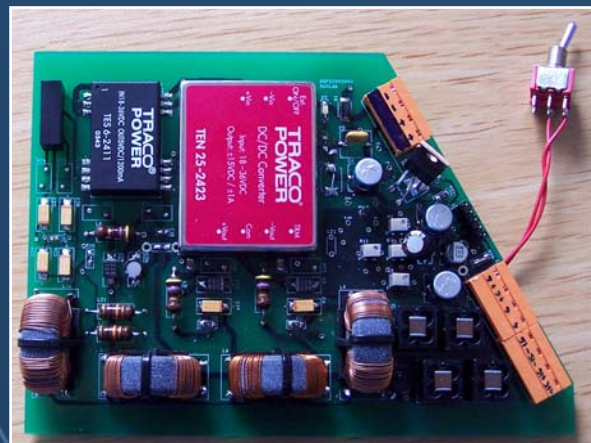
Peltier Power Supply



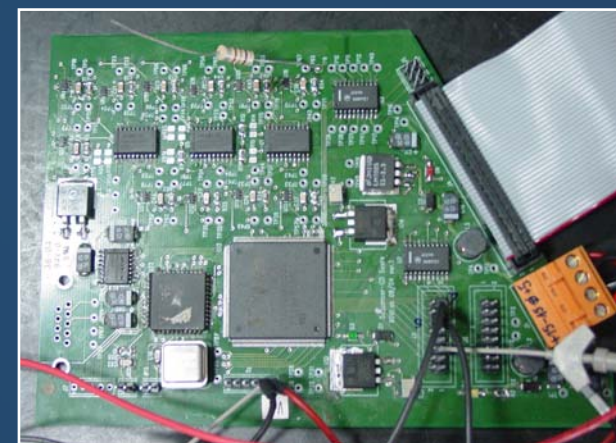
CDS & ADC



Power Supplies

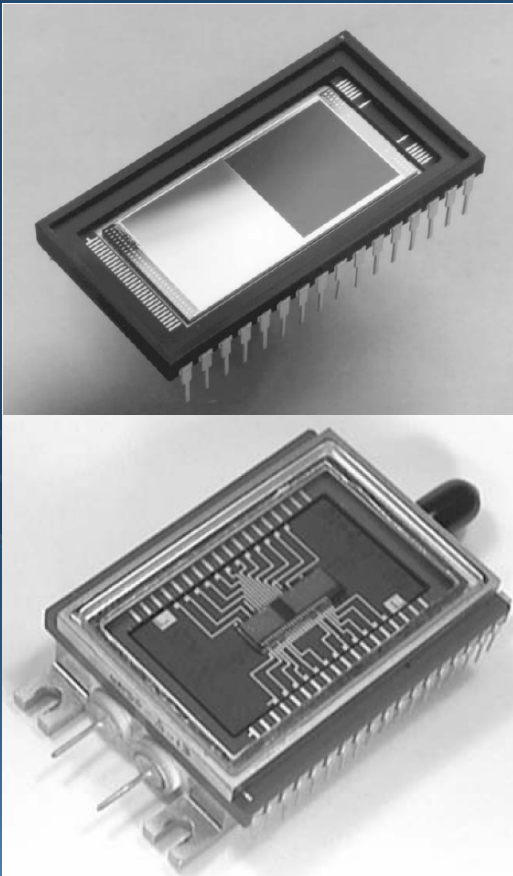


Sequencer & CD

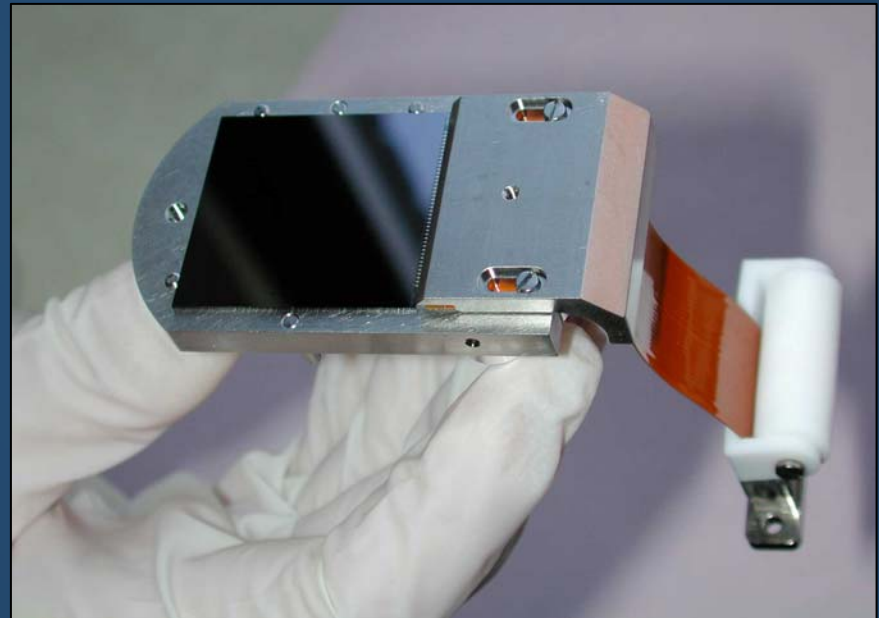


CCDs

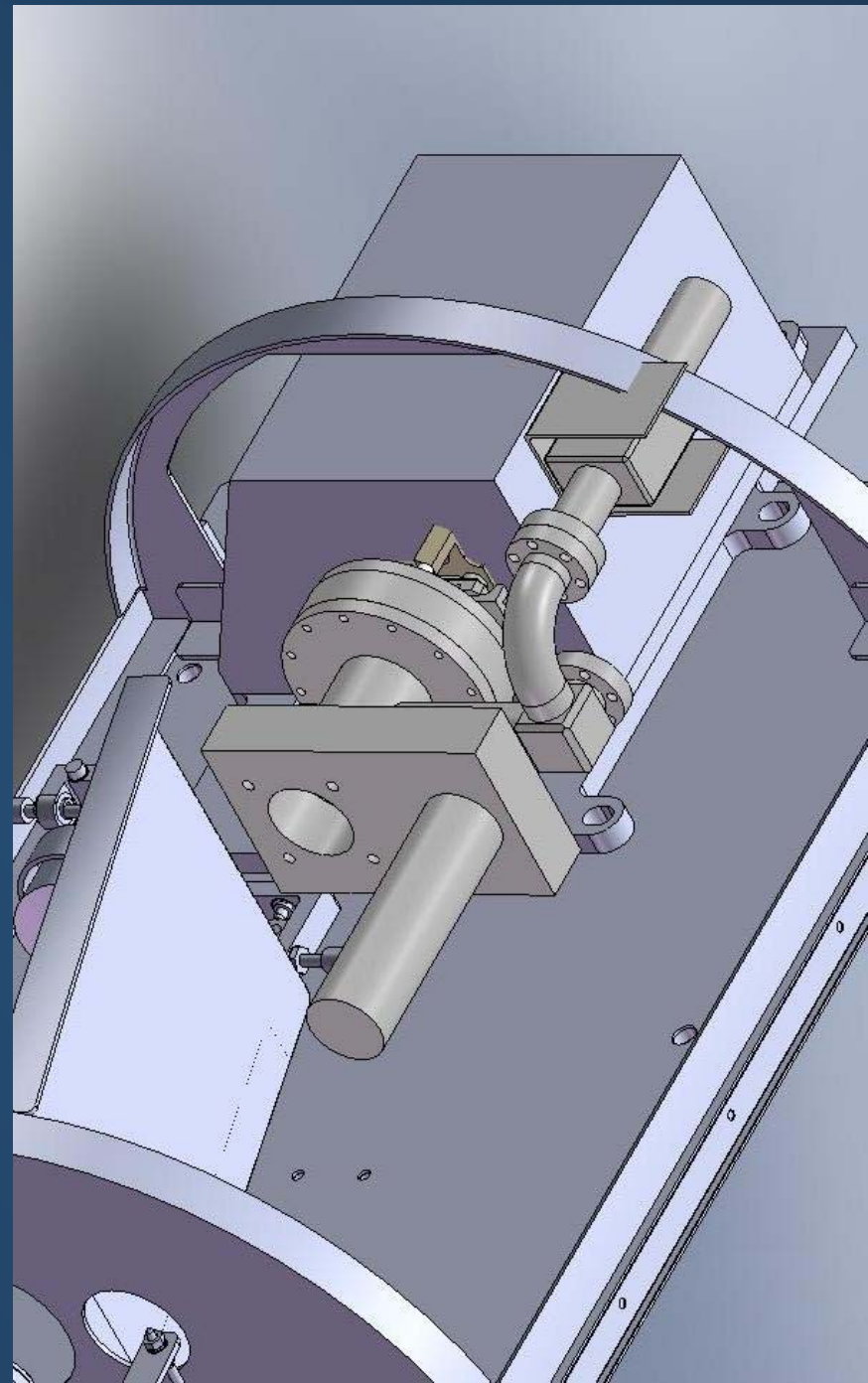
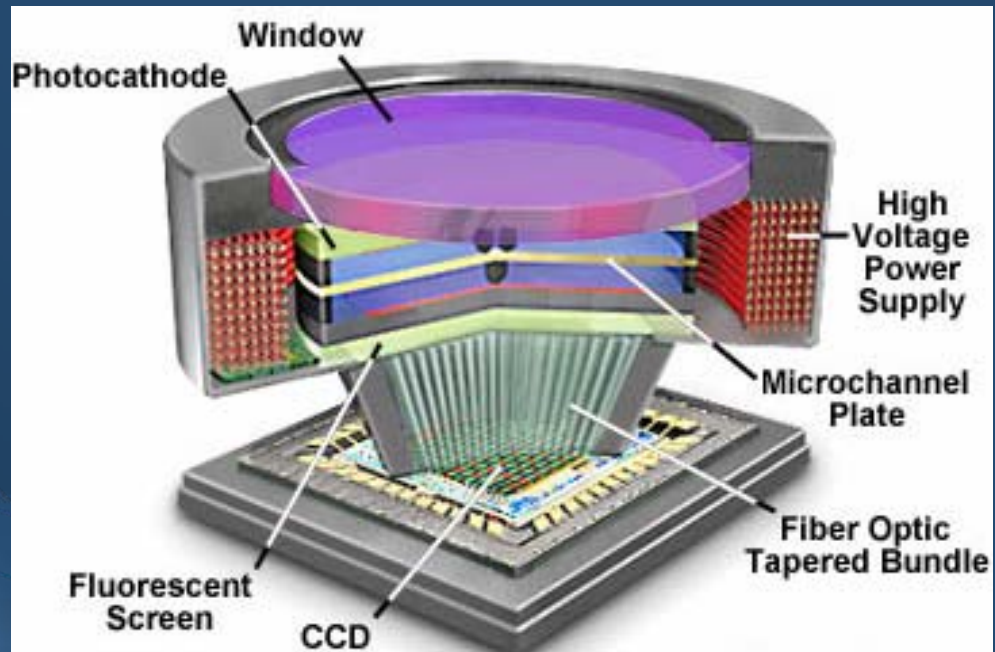
VLD E2V 47-20



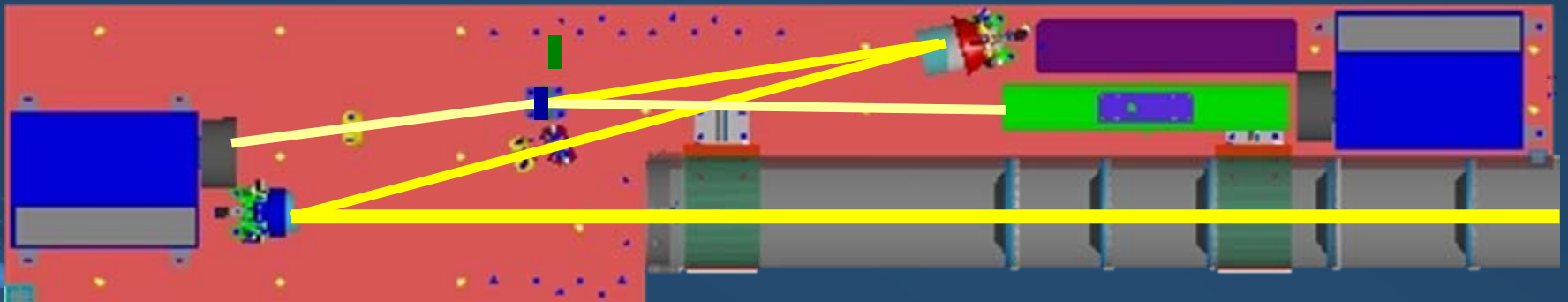
UVD E2V 42-40



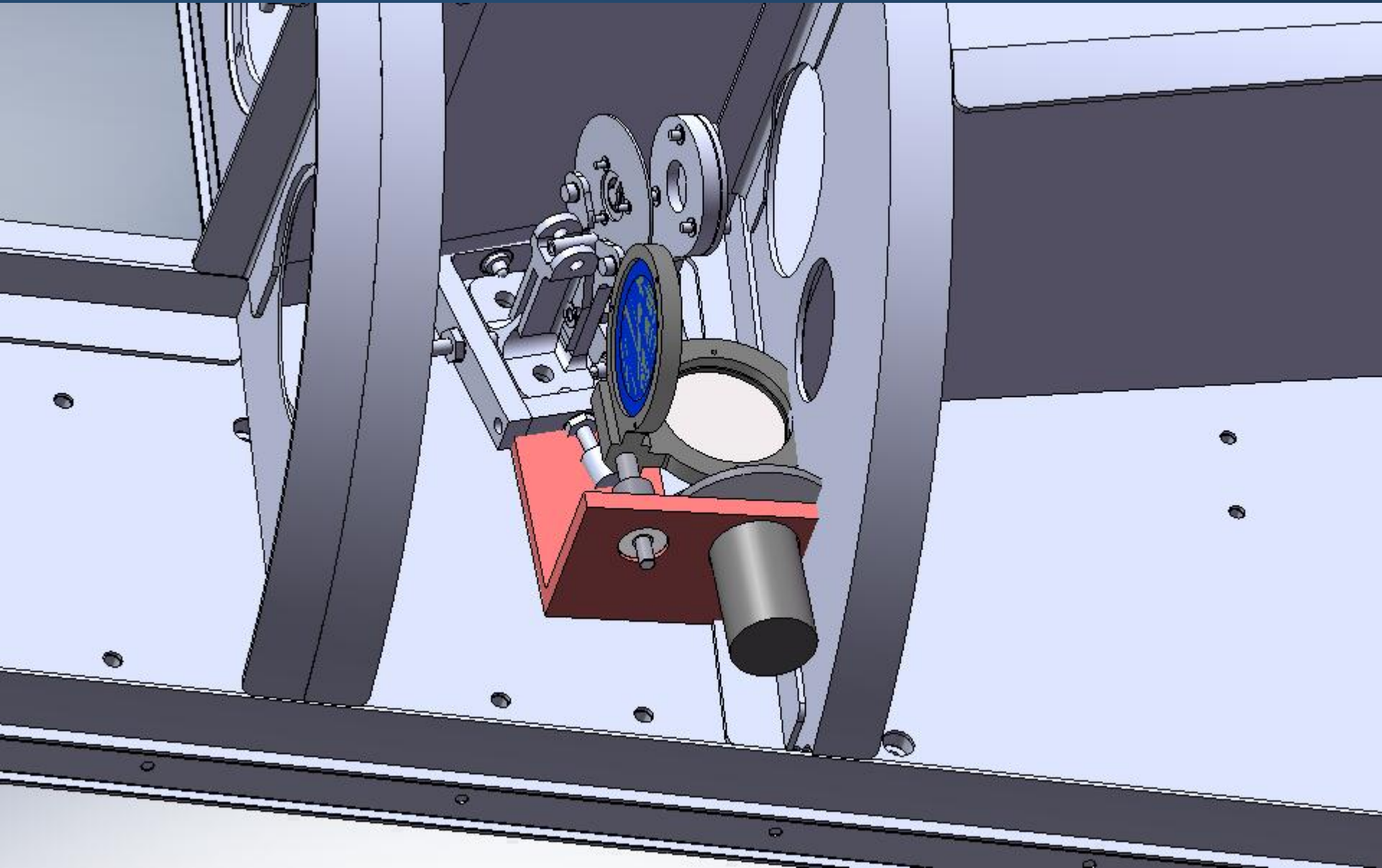
UVD - ICCD



Simultaneous observations



Filter mechanism



Spacewire interface

SpaceWire interface

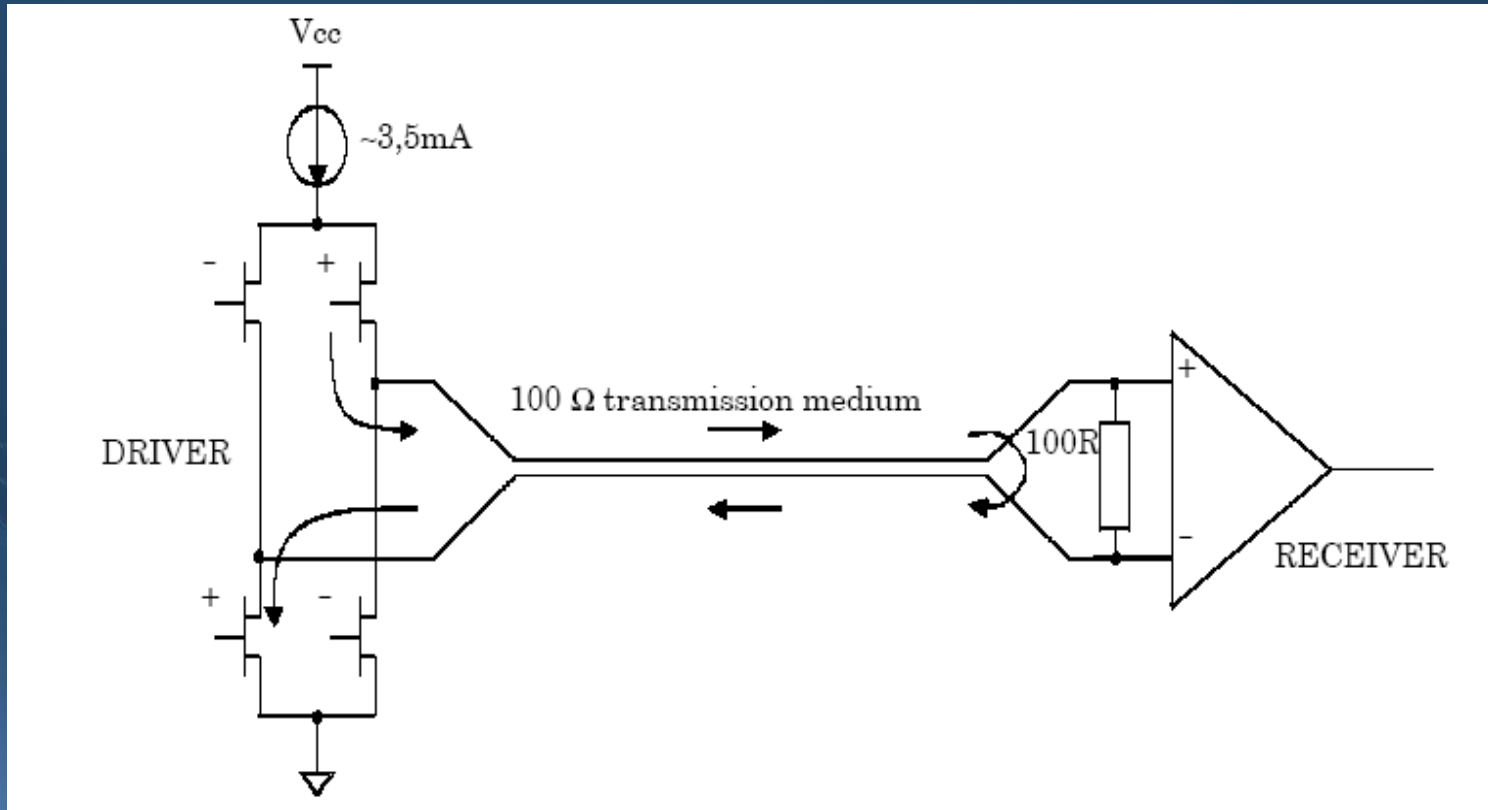
- Why SpaceWire?
- The SpaceWire protocol
- Why “custom” interface?
- Characteristics of our circuit

Why SpaceWire?

- ESA Standard
- Rocket interface
- Fast transmission protocol (200 Mbps) and low power consumption (LVDS)
- Coded data

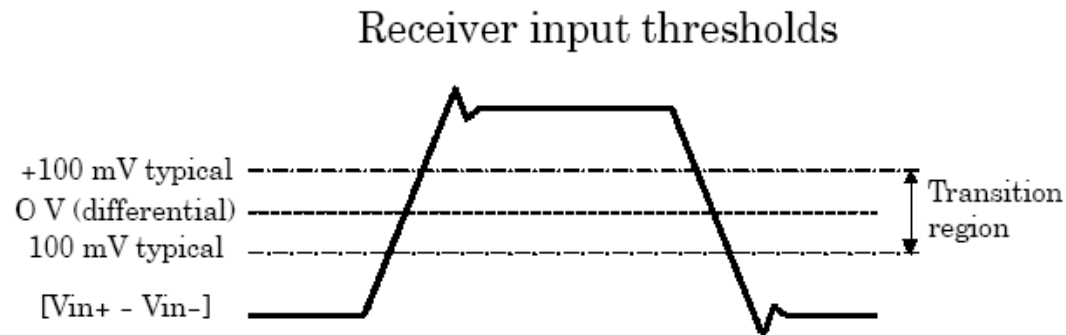
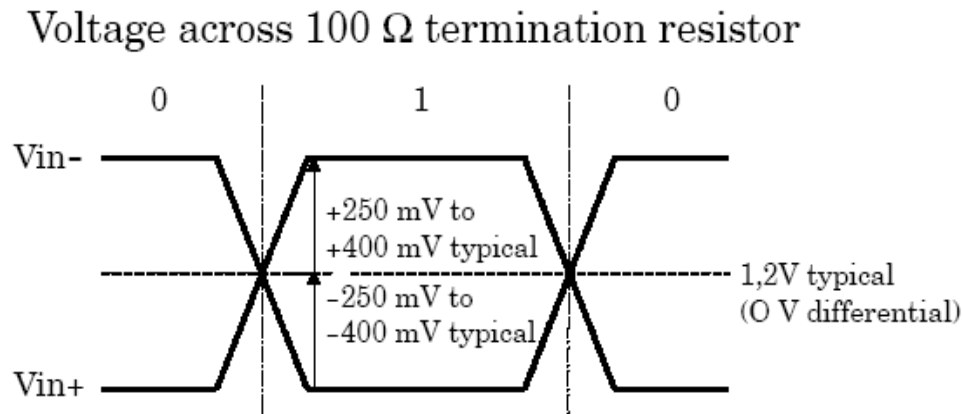
SpaceWire features

Signals



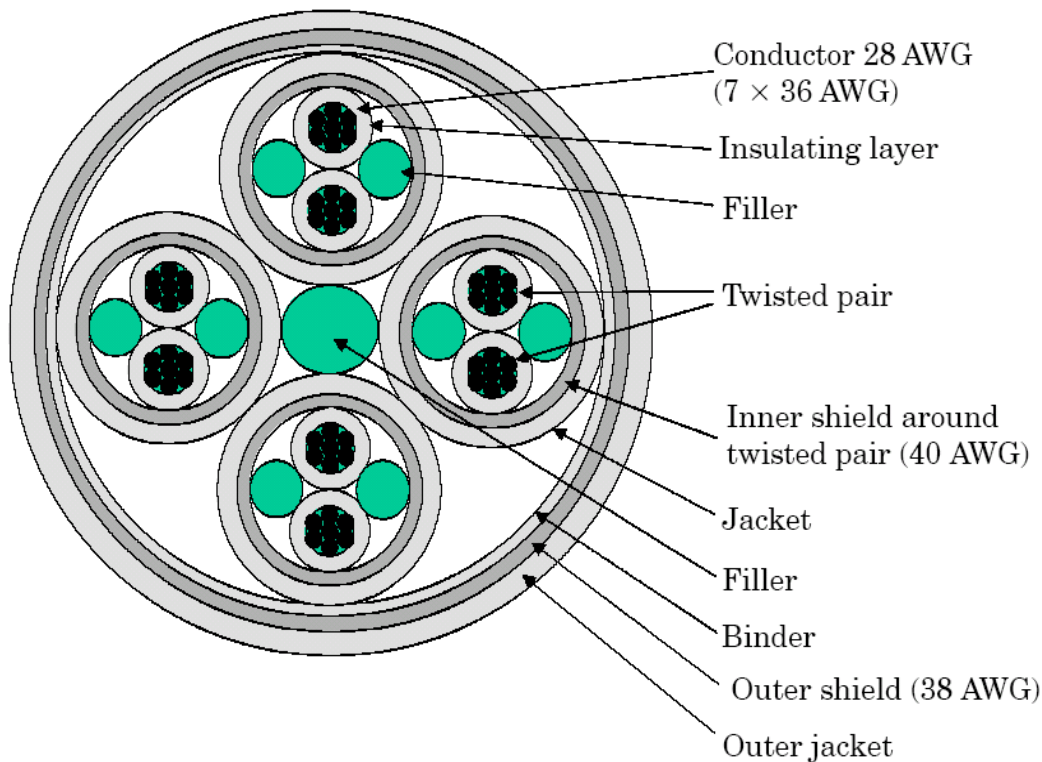
SpaceWire features

Signals



SpaceWire features

Wires



Micro D 9 poles



Why a custom interface?

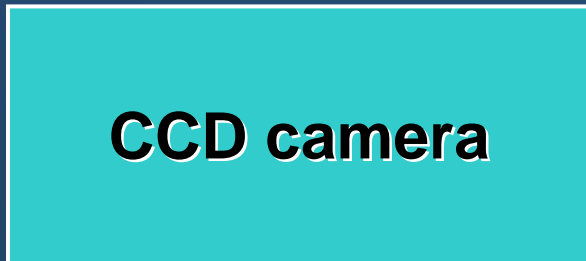
1. Not a common interface
2. High level of automation (only 300 s!!)
3. Recovery procedures
4. Handshake
5. Custom data transmission and protocol

Why a custom interface?

16 bits DATA + header

Check

Housekeeping
Commands

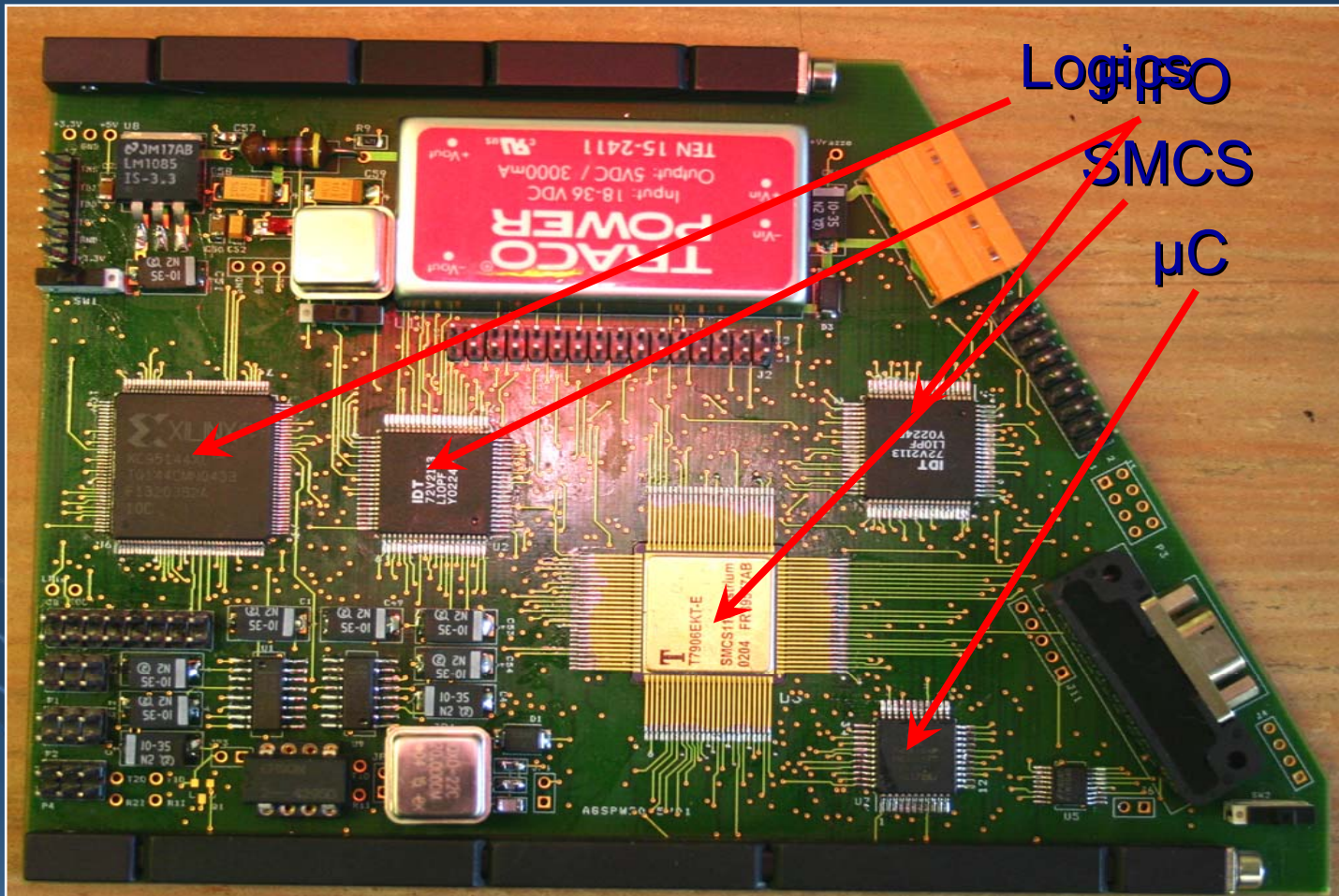


Housekeeping
Commands

16 bits coded DATA
commands
handshake



Spacewire board



Schedule

- Vibrational tests at WFF – August 2007
- System integration – September 2007
- Launch – October 2007, White Sands

Working group in Florence

Marco Romoli

Emanuele Pace

Alessandro Gherardi

Federico Landini

Gianni Corti

Maurizio Pancrazzi

Guglielmo Rossi

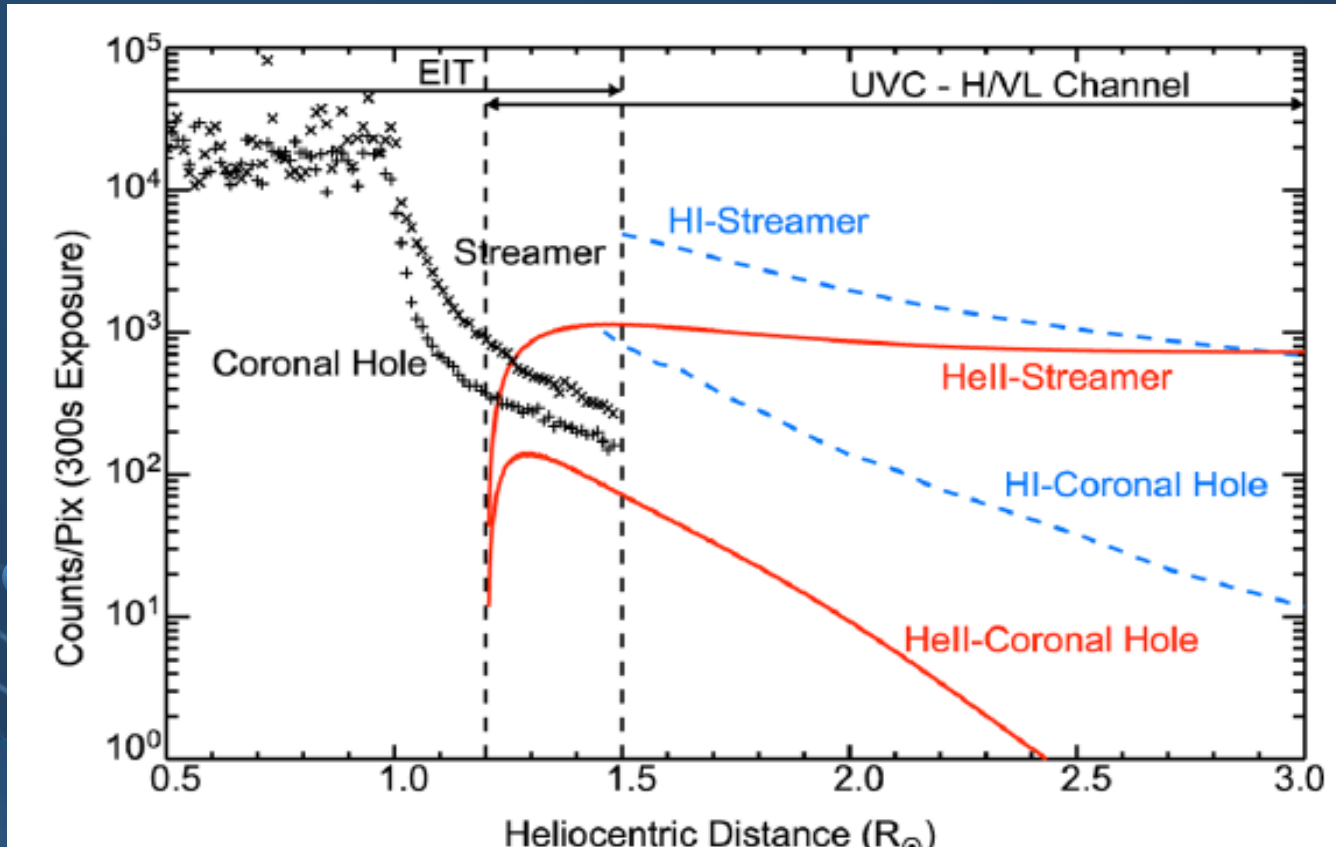
Mauro Focardi

Dario Paganini

Mauro Sozzi

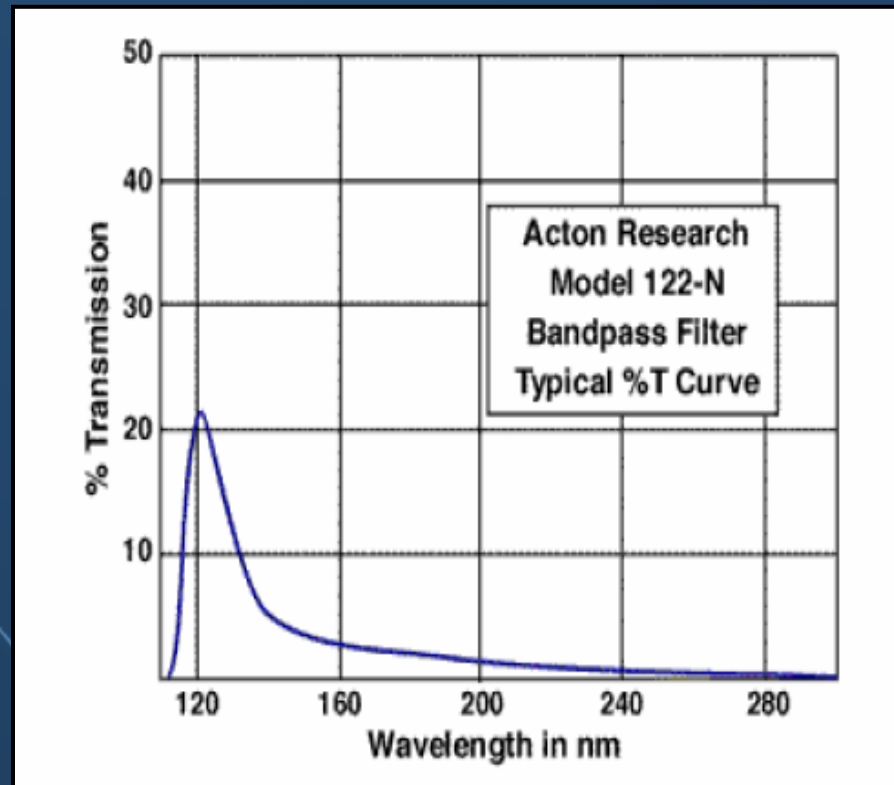
Thank you!

Count rate estimation



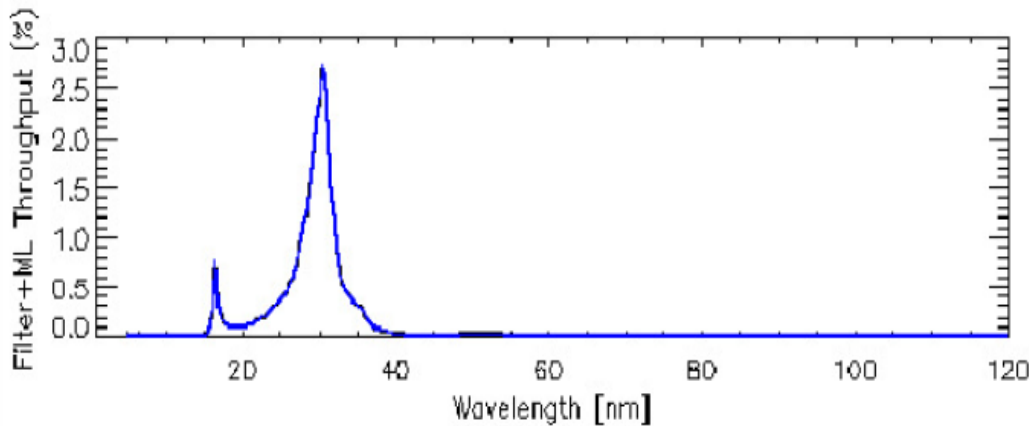
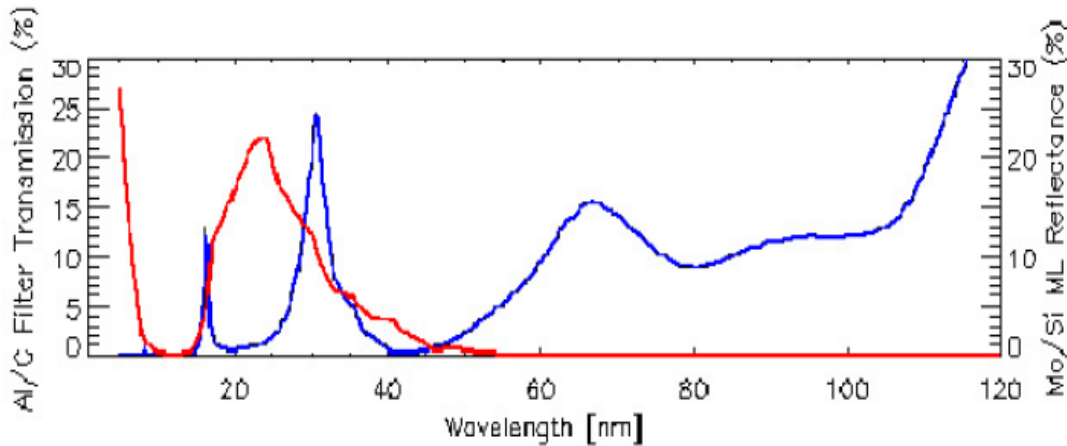
Filters

- VL and H Ly α : interferential filter MgF and Si



Filters

- He II Ly α : 2 low pass Al filters



er coating of M1 and M2

Reflectivity of SiMo mirror (blue)
Transmissivity of Al filter (red)

Total bandwidth