

The *MOSES* Instrument

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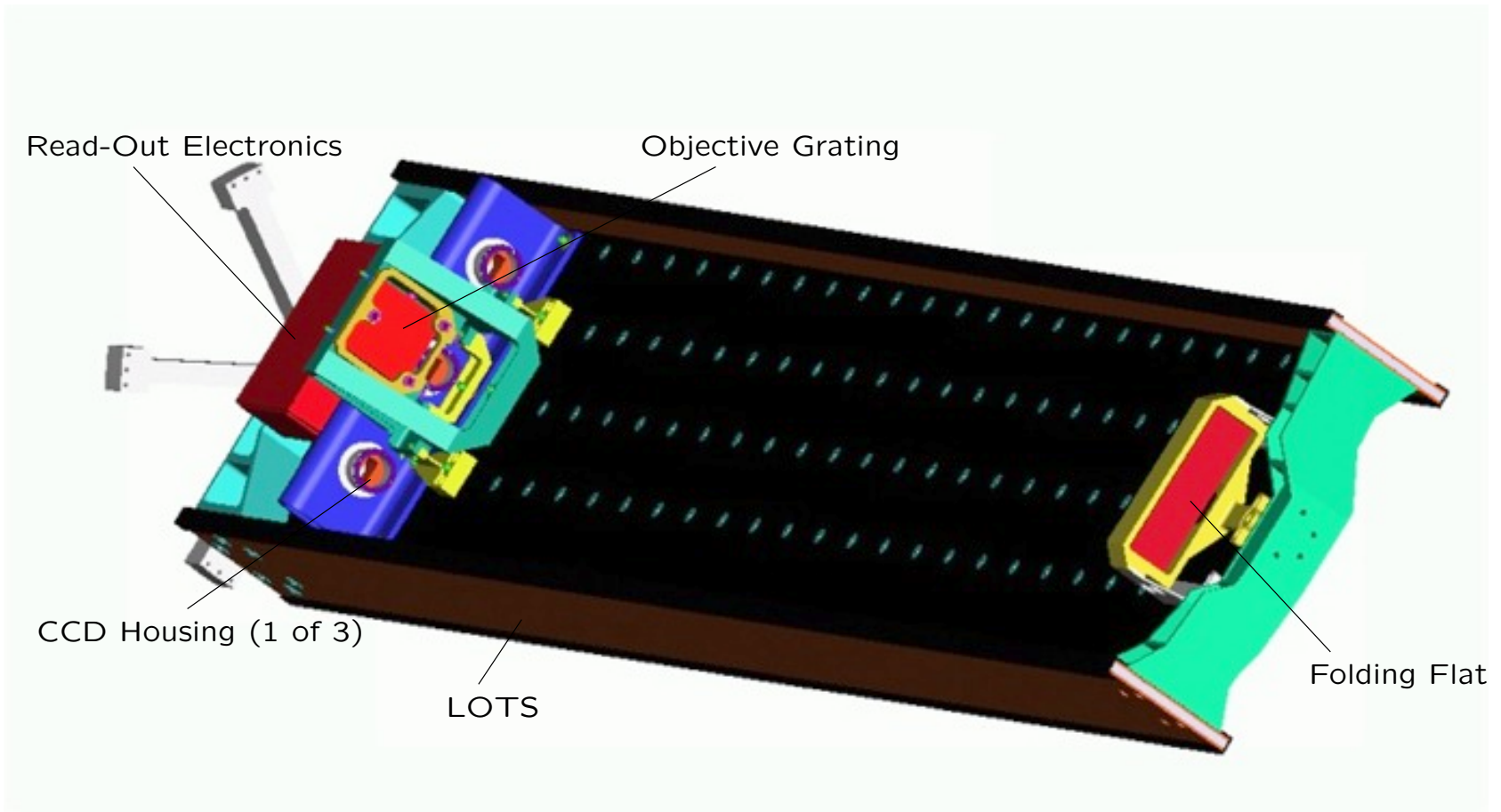
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Abstract

The *Multi-Order Solar EUV Spectrograph (MOSES)* is a rocket borne slitless imaging spectrograph with detectors at three spectral orders ($n = -1, 0, 1$). I will summarize the design of *MOSES* and touch on applications for Solar Orbiter.

The MOSES project is funded by NASA Grant NAG5-10997.

Layout of the *MOSES* instrument

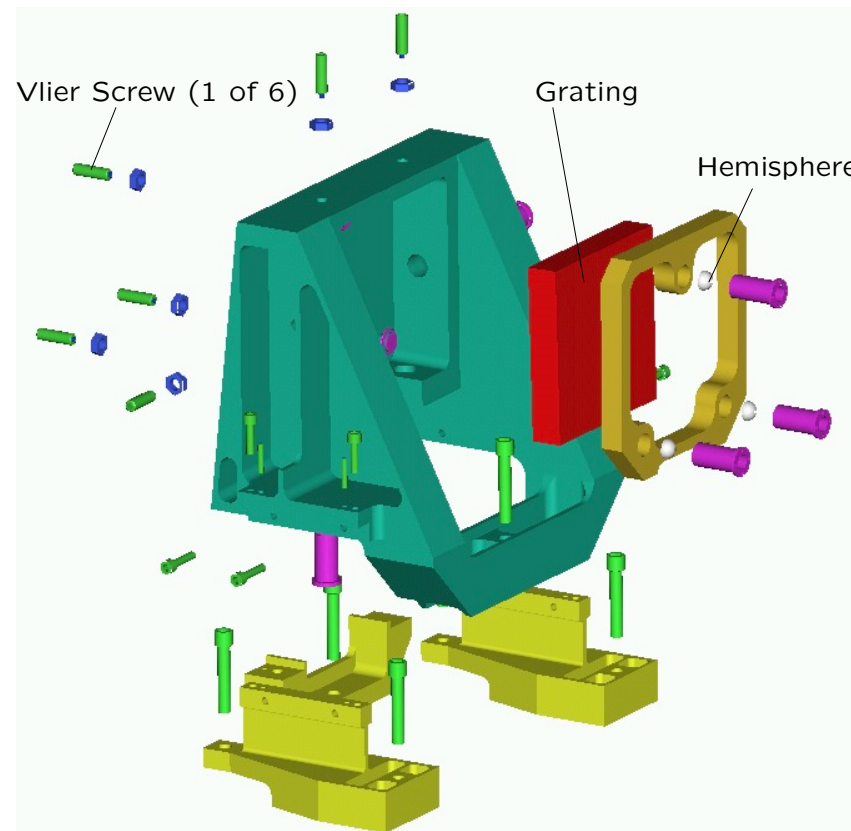


Primary Mirror/Grating Design

- Zerodur 8 cm square (ruled area).
- 4.74 m focal length.
- Spherical figure (minimizes aberrations at $n = \pm 1$).
- 1100 lines/mm laminar ion beam etched grating.
- Groove depth chosen to maximize flux to orders $n = -1, 0, +1$.

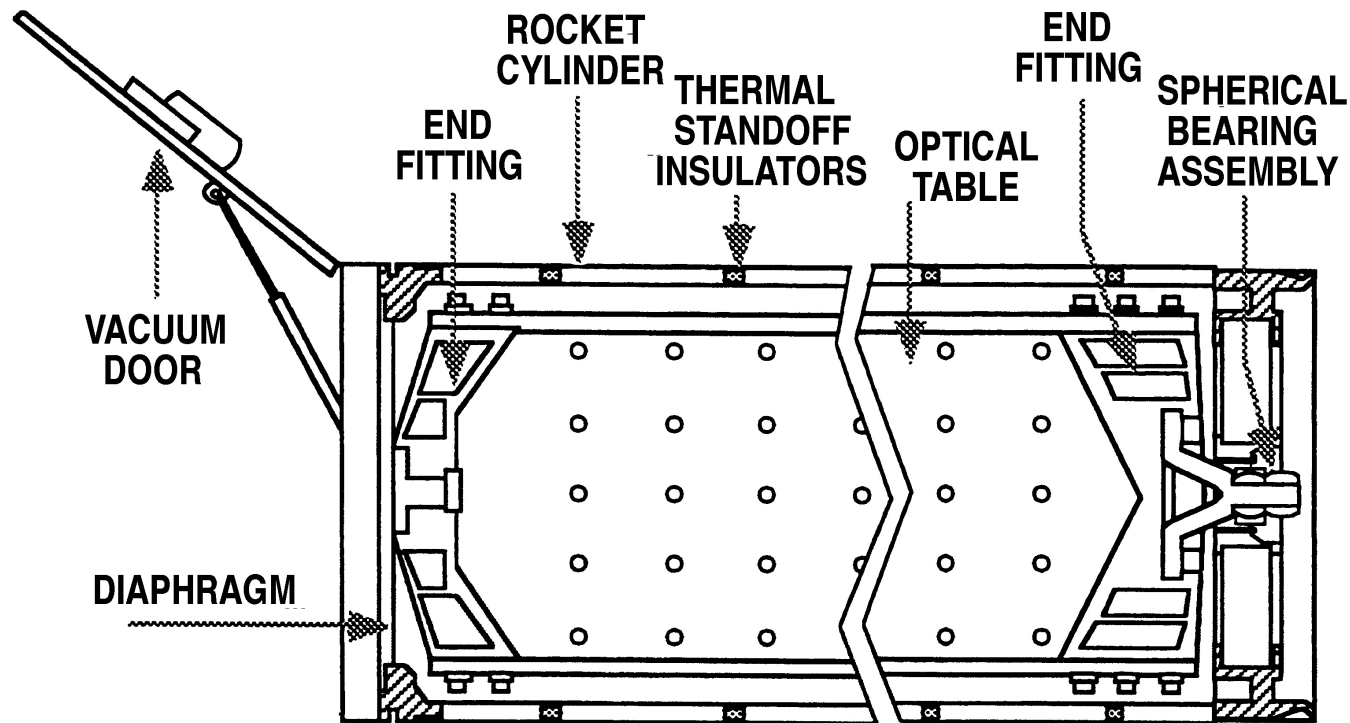
Optomechanics

The mirror mounts use hemispherical pads and opposing spring-loaded fasteners to achieve a robust, repeatable kinematic mount. This technique was perfected at LMSAL by M. Bruner.



Lockheed Optical Table System (LOTS)

The optical table is fastened to a flexible metal diaphragm at one end and a spherical bearing at the other end. The design provides a robust but strain-free support for the optical table.



Detectors

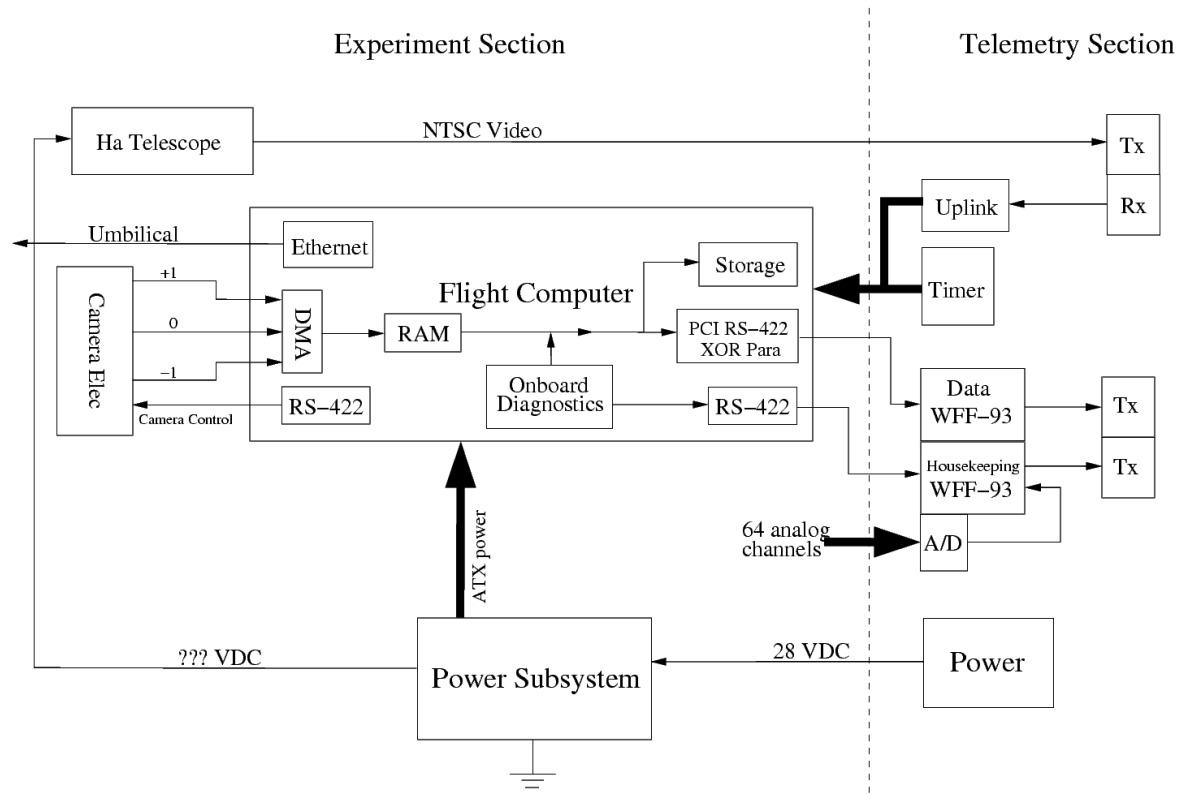
- Three E2V (formerly Marconi) 42-40 back-illuminated CCDs.
- Format 2048×1024 , $13.5 \mu\text{m}$ pixels.
- Quantum efficiency $\sim 80\%$.
- Operating temperature -30 K ; thermoelectric coolers dump heat to a precooled Al block (chilled with LN2 until launch).
- Read noise ~ 2 electrons RMS.
- Read out electronics from MSSL, essentially the *Solar-B*/EIS design.

Electronics

The *MOSES* electronics subsystem. The flight computer is a modified COTS single-board PC running Linux.

Moses Electronics Block Diagram

12/05/01 — JLF
Modified 07/29/02 — JLF



Application to Solar Orbiter

The *MOSES* approach offers several advantages for Solar Orbiter:

- Fast, high resolution imaging.
- Truly simultaneous spectral information over the whole image.
- Light and simple.
 - No moving parts (except shutter).
 - Only 1-2 optics, high throughput.

Disadvantages:

- Narrow wavelength range.

Issues for SO Application

- What line or lines? Preferably isolated—by nature, multilayers and/or dispersion.
- Tailored dispersive element?—get exactly the orders we want.
- Field stop to minimize edge effects (Gregorian?).
- Minimize aberrations (a grating per order?).
- Thermal at 0.2 AU (optically transparent EUV reflector?).