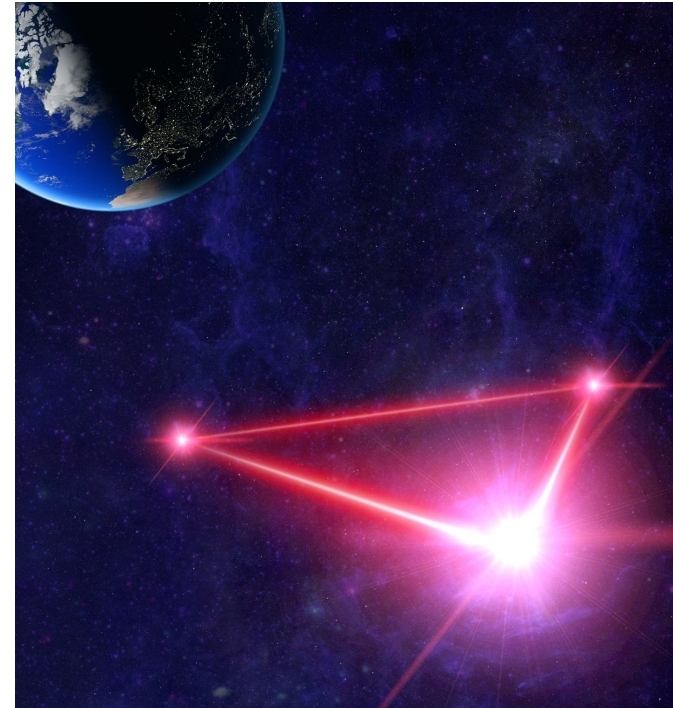# LISA MCU OMS
Mechanism Control Unit
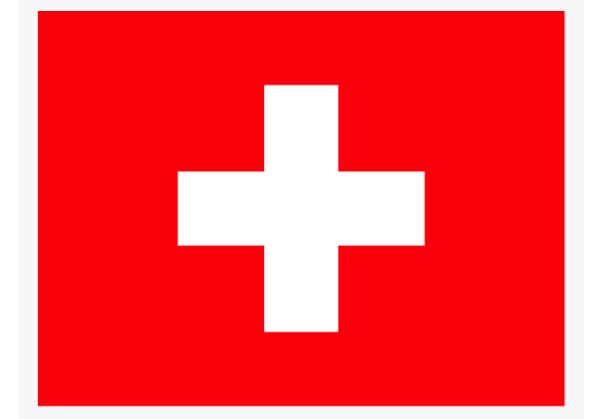# Optical Metrology System

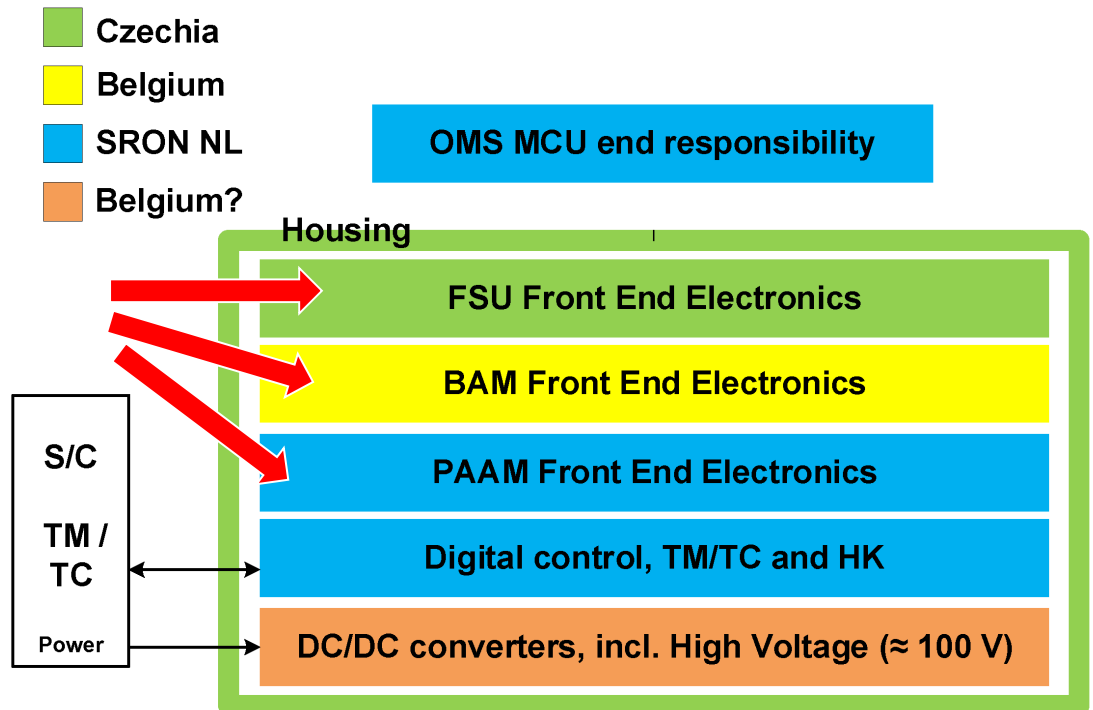Martin Frericks, System Engineer

SRON

LISA MCUs (Mechanism Control Unit)

- MCU GRS (Gravitational Reference Sensor)

- MCU OMS (Optical Metrology System)
  - Three mechanisms
    - PAAM   Point Ahead Angle Mechanism
    - FSU   Fibre Switching Unit
    - BAM   Beam Angle Mechanism
  - Need an electronic Control Unit
    - MCU OMS
    - End responsibility SRON

MCU, Mechanism Control Unit, 3 FEE boards

- FEE = Front End Electronics (Analog)
- LISA contains 3 mechanisms
  - FSU, Fiber Switching Unit, Czechia,   < - - - - > FEE Czechia
  - BAM, Beam Angle Mechanism, Belgium,   < - - - - > FEE Belgium
  - PAAM, Point Ahead Angle Mechanism, TNO,   < - - - - > FEE SRON

🟩	**Czechia**
🟨	**Belgium**
🟦	**SRON NL**
🟧	**Belgium?**

OMS MCU end responsibility

Housing

FSU Front End Electronics

BAM Front End Electronics

PAAM Front End Electronics

Digital control, TM/TC and HK

DC/DC converters, incl. High Voltage (≈ 100 V)

S/C

TM / TC

Power

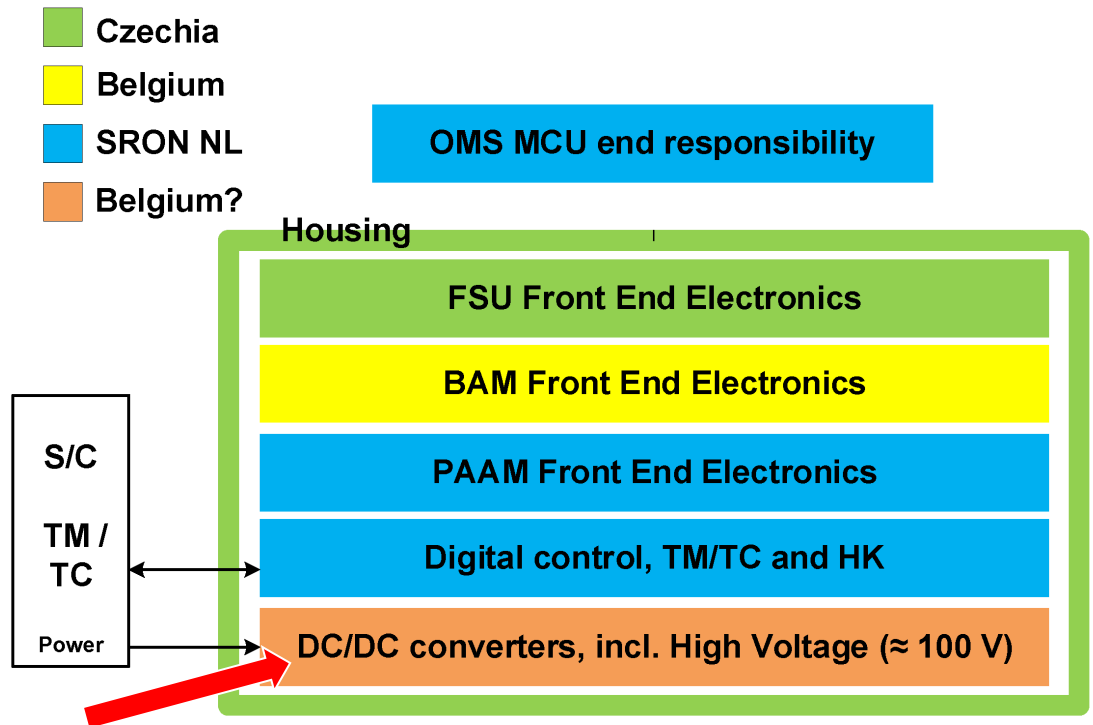# MCU, Mechanism Control Unit, dig control, TM/TC and HK

- MCU measures and changes position, via digital control
- MCU is commanded from the Spacecraft (TC = TeleCommand)
- MCU sends information to te Spacecraft   (TM = TeleMetry)
  - Mechanisms status (e.g. position)
  - Housekeeping (HK) of mechanisms and electronics
    - Voltages
    - Currents
    - Temperatures
- SRON

Legend:
- 🟩 Czechia
- 🟨 Belgium
- 🟦 SRON NL
- 🟧 Belgium?

OMS MCU end responsibility

Housing

FSU Front End Electronics	
BAM Front End Electronics	
PAAM Front End Electronics	
Digital control, TM/TC and HK	
DC/DC converters, incl. High Voltage (≈ 100 V)	

S/C

TM / TC
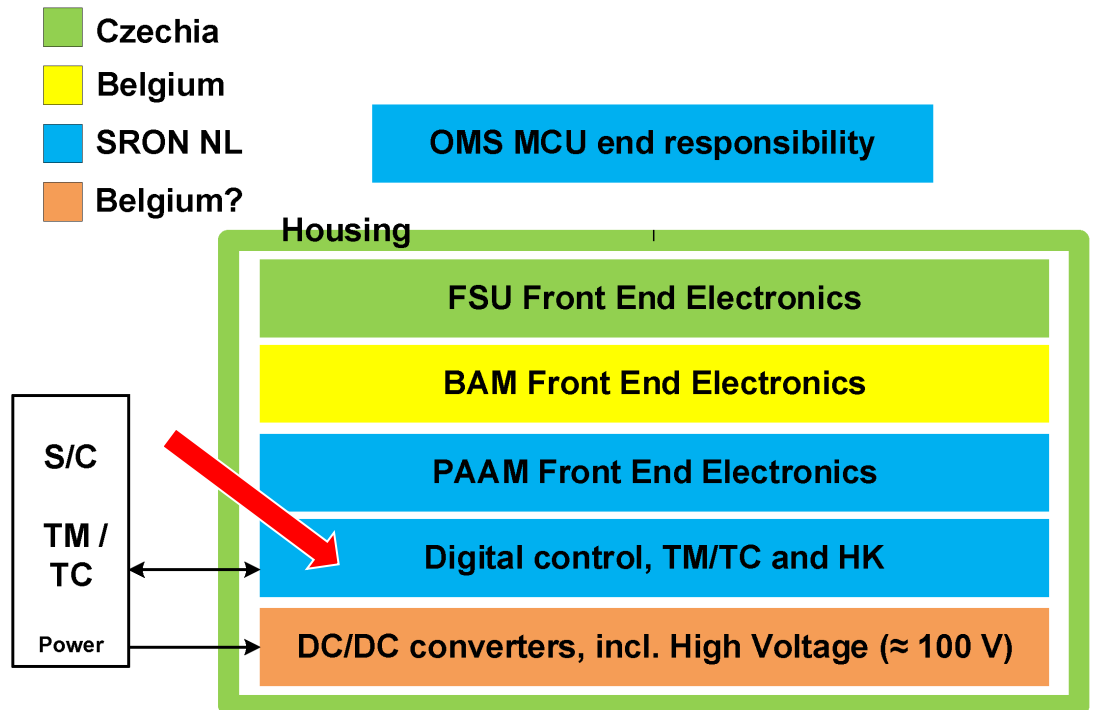
Power

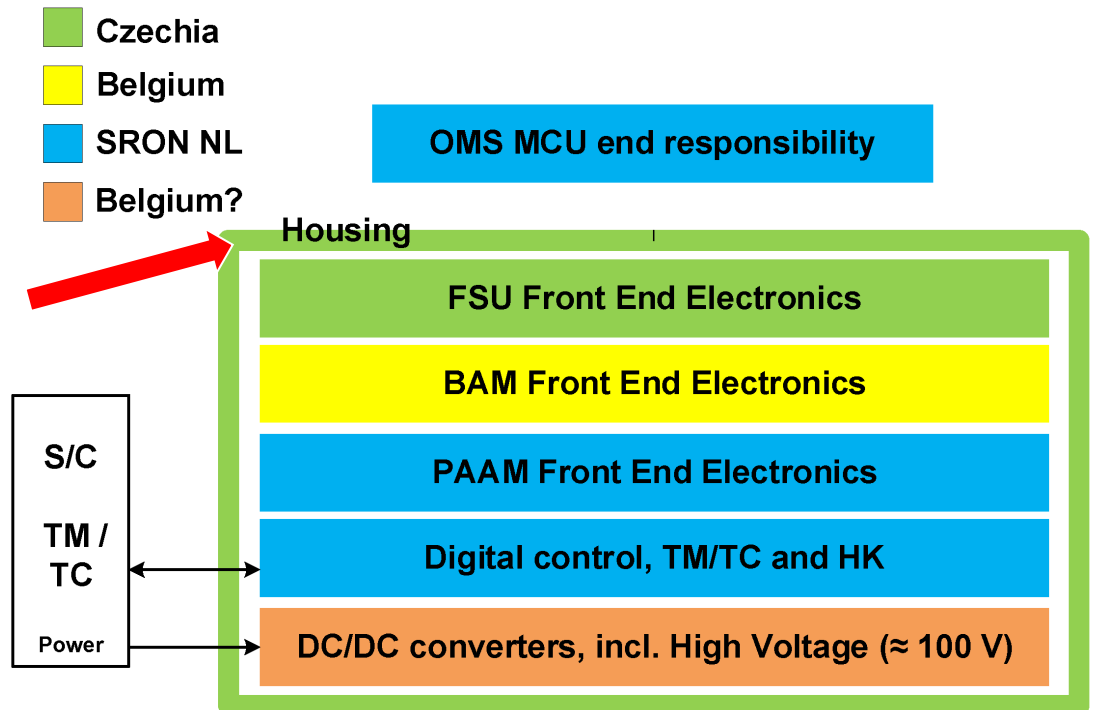# MCU, Mechanism Control Unit, DC/DC converters

- MCU is powered from the Spacecraft with 50V
  - This volage needs to be converted by DC/DC converters to
    - 100 V for Piezo drivers of the mechanisms
    - + and - ~ 10V for FEE
    - 1.5 and 3.3 V for dig

- Belgium is investigating funding for this part.
- Germany is back-up

🟩	**Czechia**
🟨	**Belgium**
🟦	**SRON NL**
🟧	**Belgium?**

OMS MCU end responsibility

Housing

FSU Front End Electronics

BAM Front End Electronics

PAAM Front End Electronics

Digital control, TM/TC and HK

DC/DC converters, incl. High Voltage (≈ 100 V)

S/C

TM / TC

Power

SRON

MCU, Mechanism Control Unit, Housing

- MCU electronic boards need to be contained in a housing
  - To shield from Elektro Magnetic Interference
  - To withstand vibrations during launch
  - To withstand shocks when rocket stage is repelled

- Czechia is responsible for this part.

Legend:
- Czechia
- Belgium
- SRON NL
- Belgium?

OMS MCU end responsibility

Housing

	FSU Front End Electronics
	BAM Front End Electronics
	PAAM Front End Electronics
	Digital control, TM/TC and HK
	DC/DC converters, incl. High Voltage (≈ 100 V)

S/C

TM / TC

Power

Mechanisms and MCU: total numbers needed

- One Optical Bench (OB) contains
  - 1 PAAM,
  - 2 FSUs
  - 2 BAMs
- Per OB 1 MCU is used, to control those 5 mechanisms

- One satellite contains 2 OBs so
  - 10 mechanisms
  - 2 MCUs

- LISA consists of 3 satellites so
  - 30 mechanisms
  - 6 MCUs

- Including Flight Spares 8 flight MCUs are needed

Redundancy of MCU

- If function or part in MCU fails
  - Satelite should still perform as before (no single point failures allowed)

- Therefor all functionality in the MCU is doubled
  - One part is on (warm)
  - One part is off (cold)
  - In case of failure, the system switches from one system to the other

LISA MCU comparable box

Team

- MCU NL:
    - Project Manager   Pieter Dieleman
    - System Engineer   Dennis van Loon, Martin Frericks
    - Product/Quality Assurance   Phillip Laubert
    - Analog designer   Ad Nieuwenhuizen, Axel Detrain, Channah Vogel, Frans Zwart
    - Layout   Rob de la Rie

QUESTIONS?