MCU status
(for astronomers)
LISA NL Community day March 2023

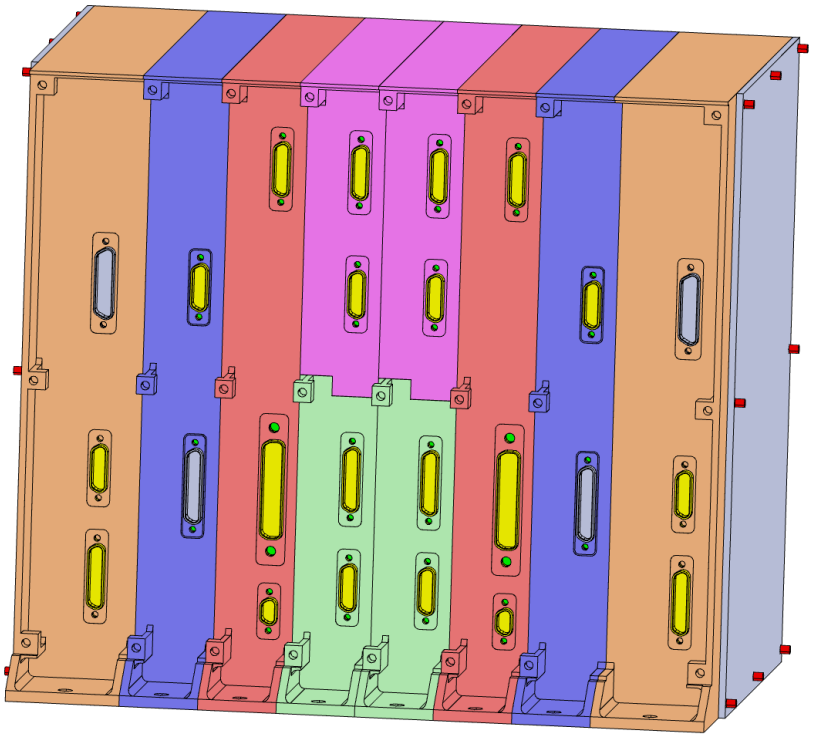
Pieter Dieleman, on behalf of the SRON MCU team

Dennis van Loon, Martin Frericks, Ad Nieuwenhuizen, Axel Detrain, Jens Johansen, Channah Vogel, Mark Leeman, Phillip Laubert

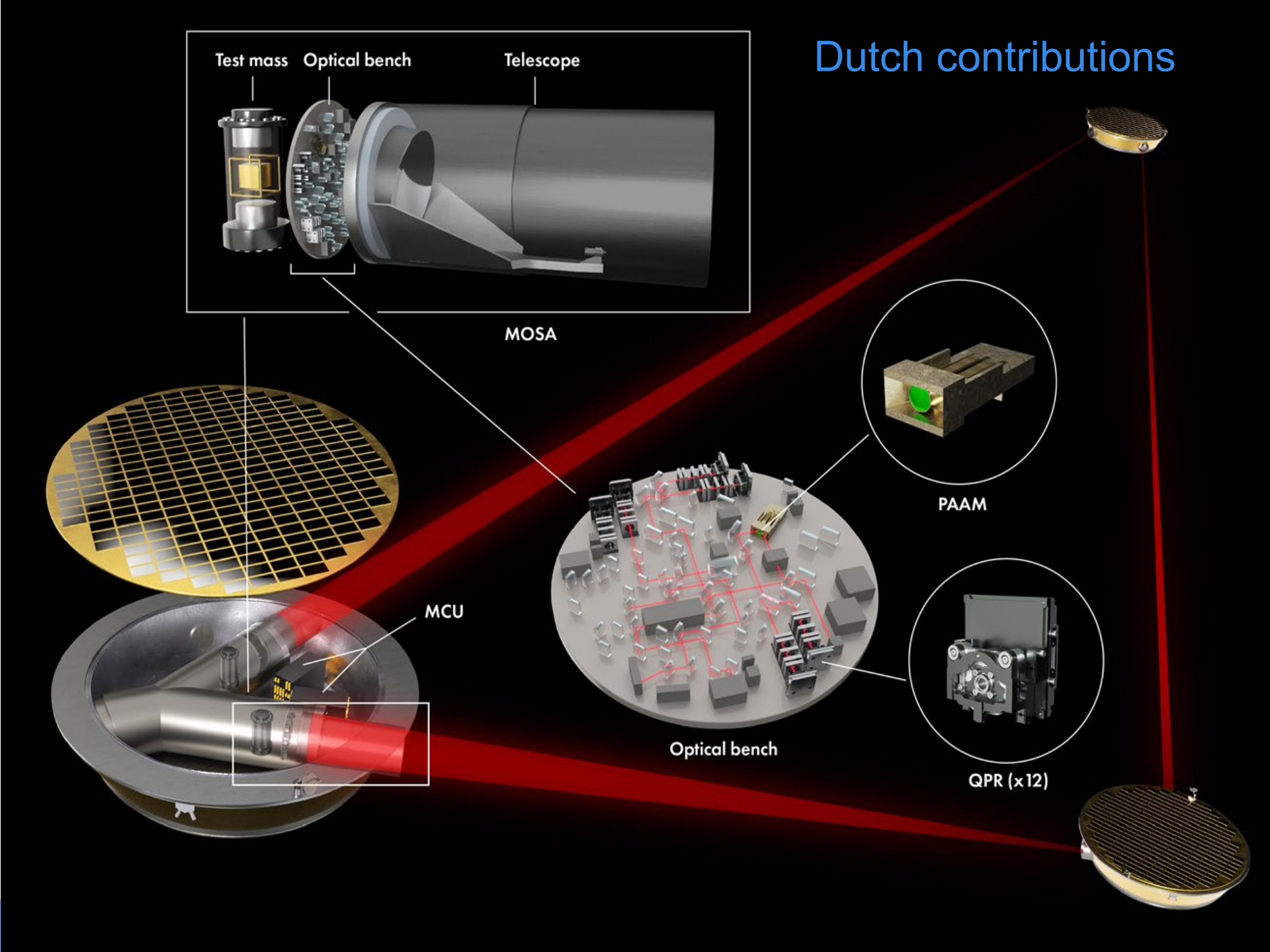
SRON
Netherlands Institute for Space Research

Contents

- What does the MCU do
- What does it look like
- Who contributes to it
- Which are the critical items
- How far are we (and should we be)

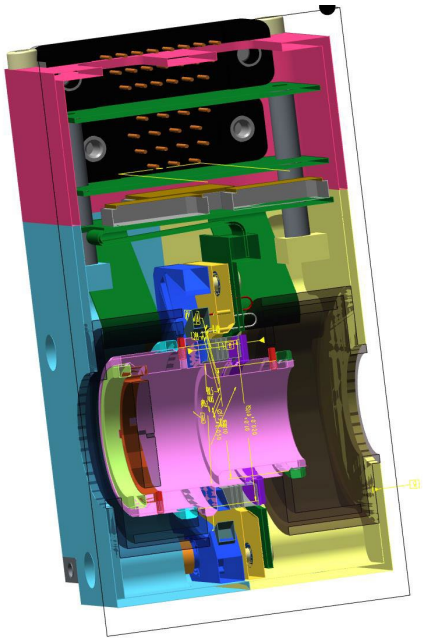


Dutch contributions

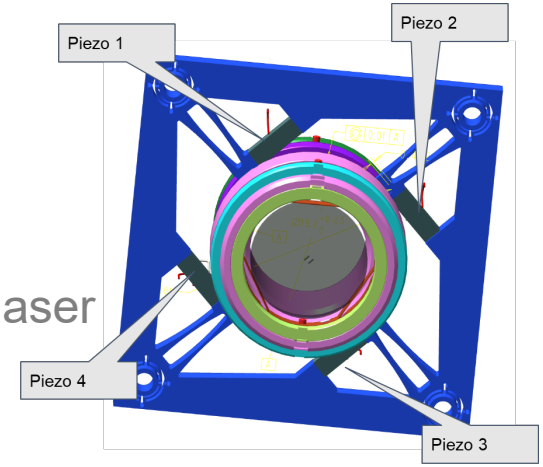


3 types of Mechanisms on the LISA optical bench

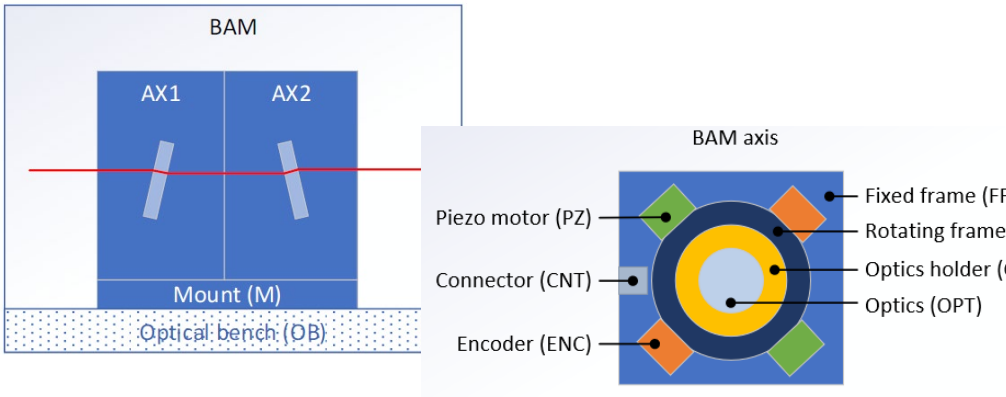
- PAAM Point Ahead Angle Mechanism
  - See presentation TNO



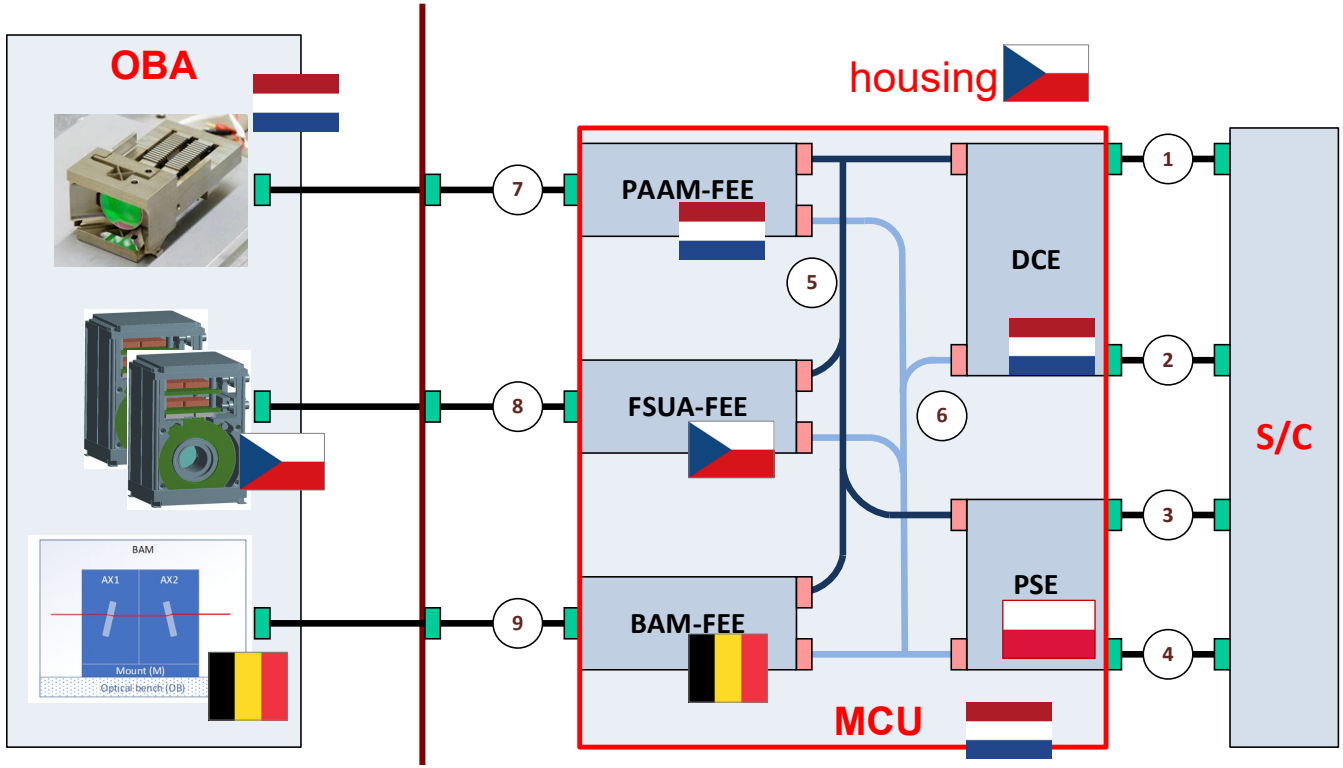
- FSU Fiber Switching Unit
  - Switches to redundant laser
  - By rotating a mirror



- BAM Beam Alignment Mechanism
  - Moves beam in telescope focus
  - By rotating tilted optics



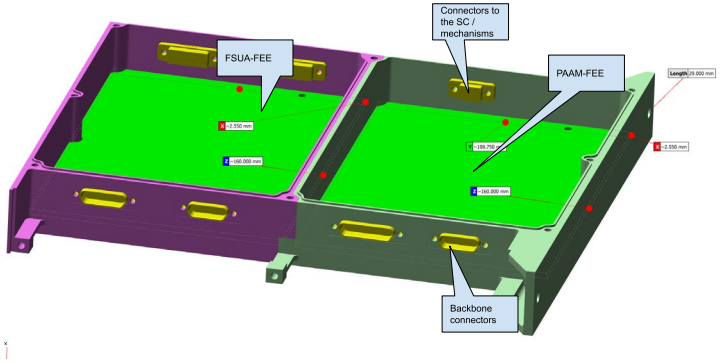
All electronics for the mechanisms in one MCU:

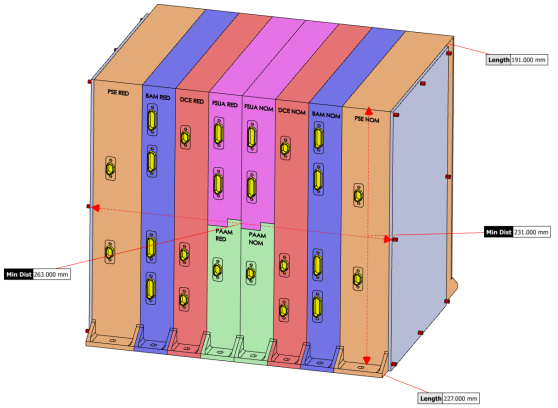


MCU – Mechanisms Control Unit
FEE – Front End Electronics: drives the mechanisms
DCE – Digital Control Electronics – controls the FEE currents sent to the mechanisms
PSE – Power Supply Electronics – converts the spacecraft voltage to the voltages needed
S/C - SpaceCraft: Supplies 50V and command interface

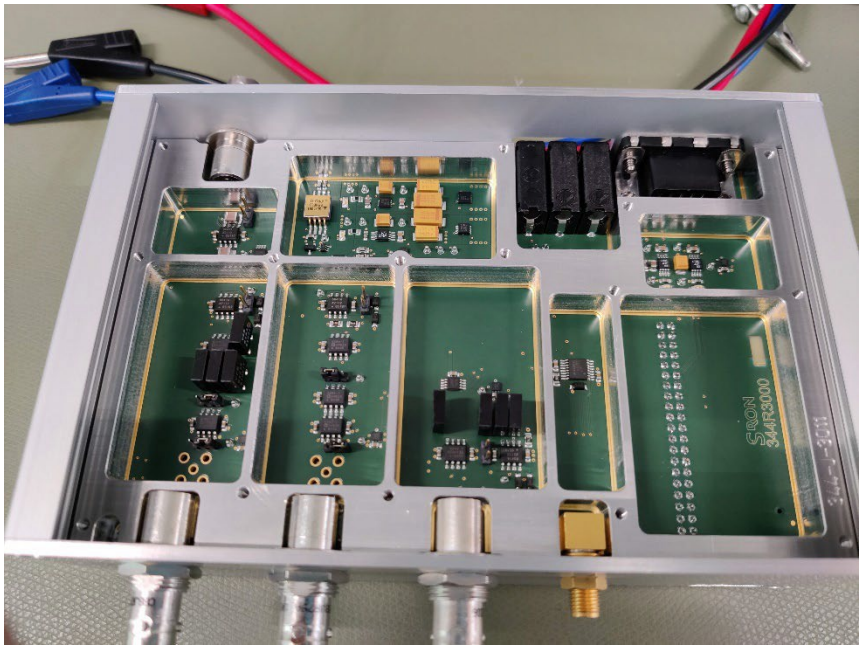
Putting the MCU together

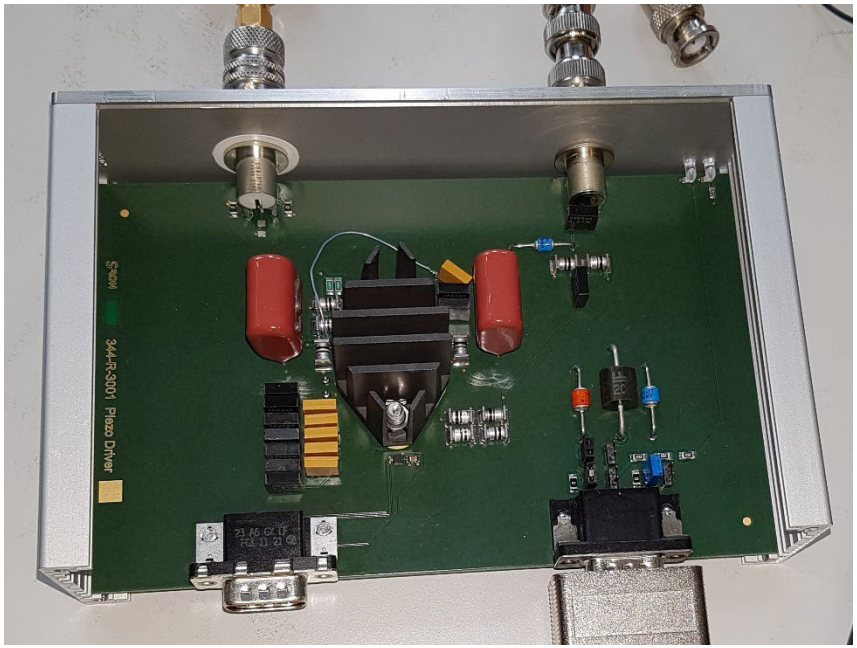
- Modular approach (Dutch sliced bread)
- All partners get mechanical frames from Czechia
- Electronic Boards are mounted in the frames, and tested
- Boards sent to SRON
- SRON to integrate into one box and test (functional, electrical)
- Ship to Czechia – vibration test and thermal vacuum tests
- And deliver to LISA





MCU - PAAM FEE Breadboard 1 status

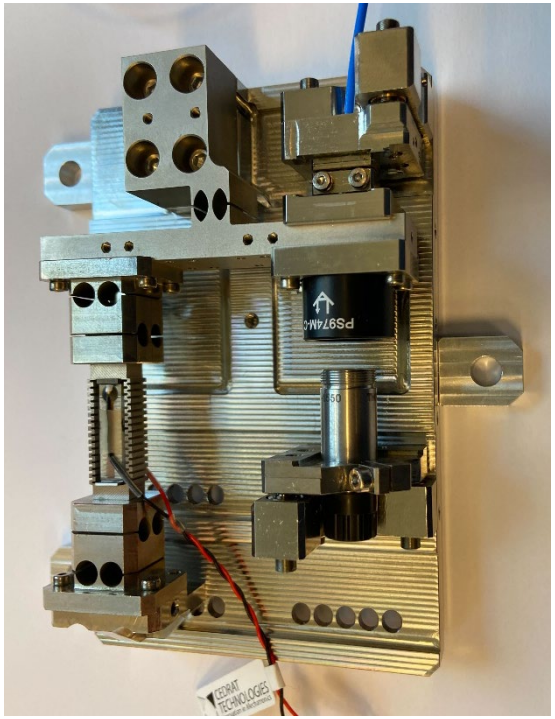




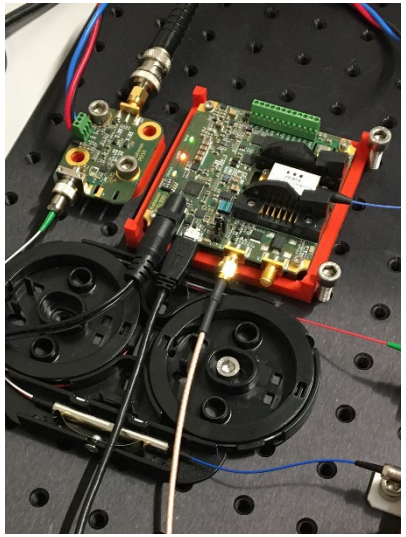
- Both boards produced and being tested
- Digital test board used (not visible here)
- Dummy loads used for test.
- Continuous improvement in signal / noise ratio

MCU - PAAM FEE test setup

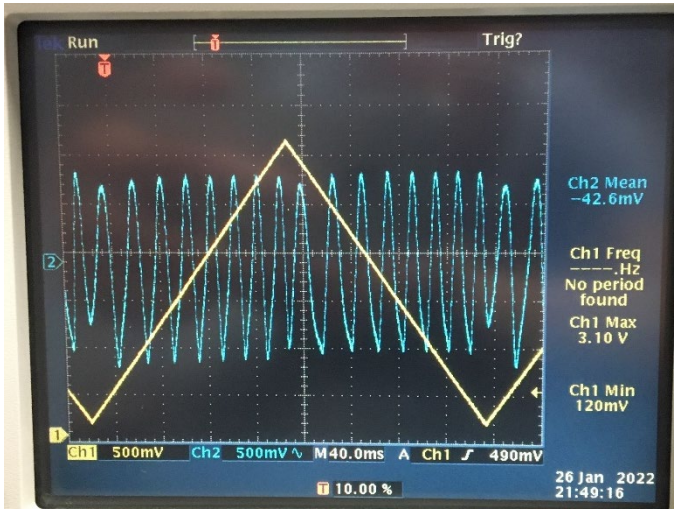
PAAM FEE connected to PAAM simulator with additional position readout:



SRON PAAM simulator with position sensor and built-in interferometry setup



SRON interferometer processor



Interferogram (blue) vs
Piezo voltage (yellow, ~displacement)

Setup is fully automated now: Ready to calibrate the PAAM position sensor / SRON electronics combination

Status MCU

Risks

- No supplier yet for the PSE (DCDC converter); Prodex Poland insufficient
- BAM FEE: Belgian ITT just finished; late start but experienced team

Milestones

- Preliminary MCU design: mass, volume, power presented to ESA (and ok)
- LISA review (April; IDS ISRR) documentation delivered (mostly)

Schedule

- EM (Engineering Model) MCU due early 2026 (Tough, partners/we started late)
- FM's due medio 2030 – medio 2031 (Ok for now)

-> EM schedule optimization needed (e.g. omit 2nd breadboard and go for EM)

- But excellent collaboration with LISA and our partners

SRON

Thank you