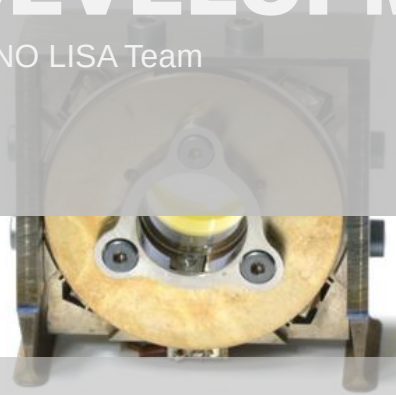
LISA PAAM DEVELOPMENT

Update on mechanism development | TNO LISA Team



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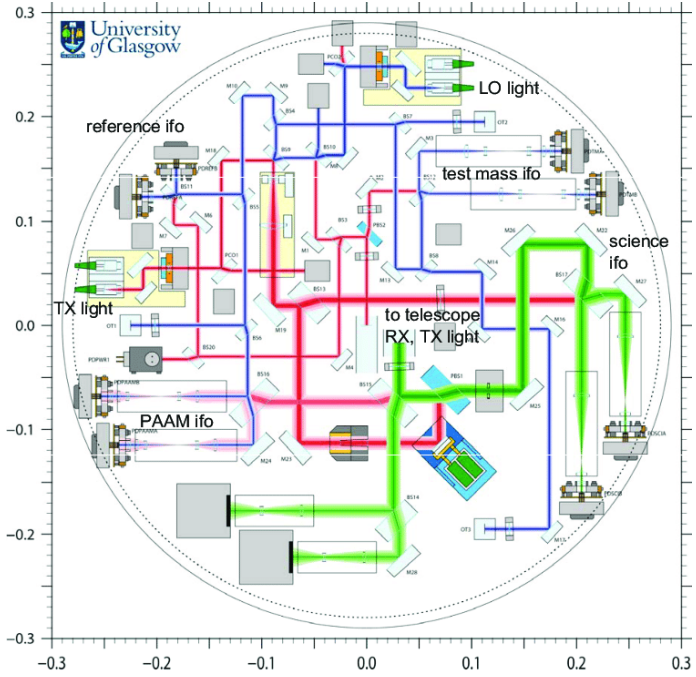
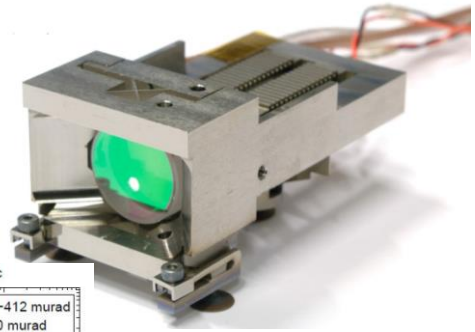
PRESENTATION CONTENTS

- Point Ahead Angle Mechanism
  - Main Function is to correct angle between Rx and Tx beams
  - Place in the system: on the OB in the IFM path
  - Simple mechanism, but extreme requirements
- Design & performances
  - PAAM 1.0
  - Update to PAAM 2.0 (supported by NSO)
- Experimental campaign
- Conclusions
  - Development is well underway

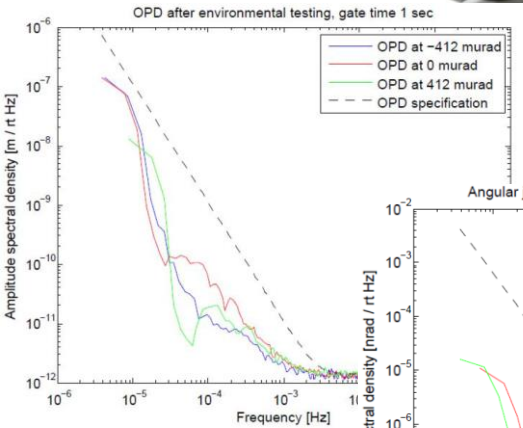


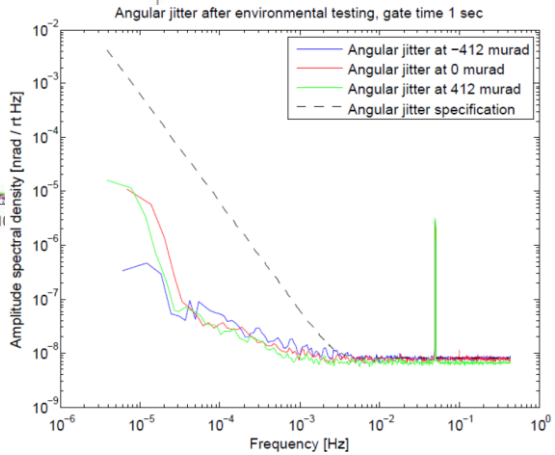
Optical Bench overview (old from 2013, by UGL)

PAAM 1 DEVELOPMENT

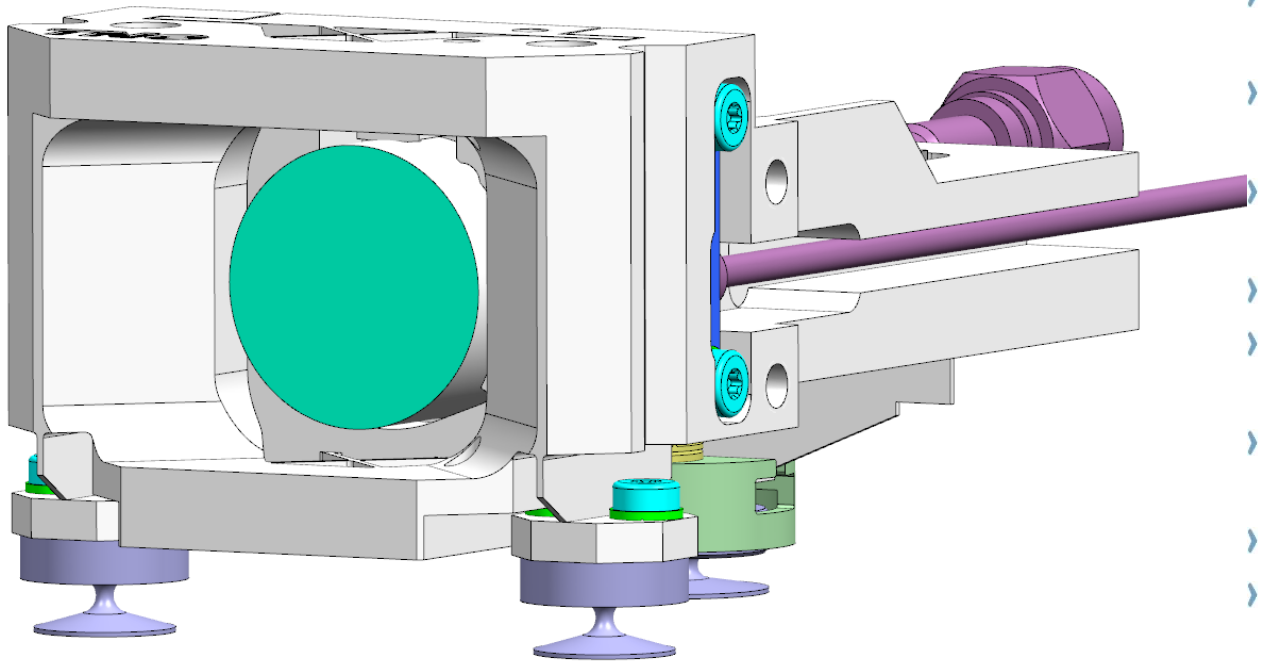


- Design and operation
  - Rotation guided by elastic hinge: Non-magnetic, no contamination, stable, no friction
  - Bonded isostatic mirror mount
  - Monolithic structure (TiAlV): High yield stress & High dimensional stability
  - Feedback-controlled on internal extremely accurate capacitive sensor
- Performance and environmental tests:
  - Both angular and OPD jitter compliant with extreme requirements (tested at AEI-Hannover)
  - Thermal cycling between +80 ºC and -10 ºC (Tested at Airbus Defence and Space Netherlands)
  - 20g RMS random vibration testing





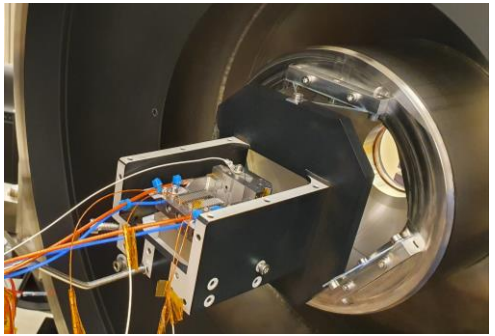
PAAM 2.0 DESIGN UPDATES

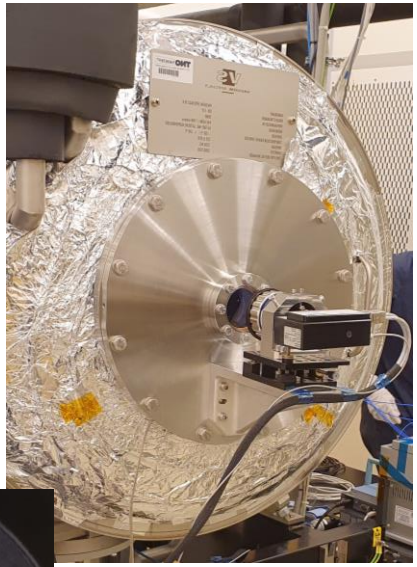


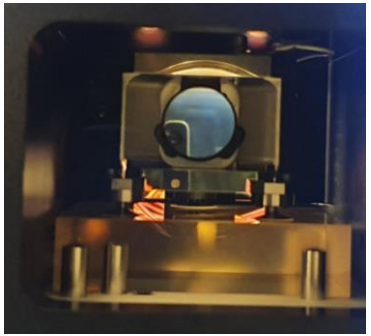
- Increased stiffness of structure
- Further optimized mechanism
- Increased symmetry structure
- Added sensor redundancy
- Increased sensor accuracy
- Reduced volume for integration
- Improved load handling
- Collaborate with SRON for electronics development

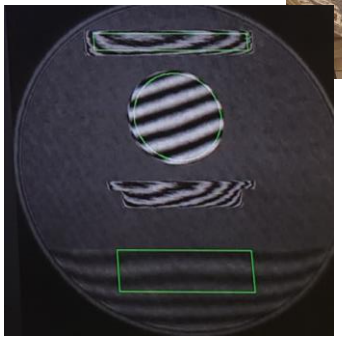
EXPERIMENTAL CAMPAIGN

- Integration and Sample tests
  - Adhesive interface strength and loads
  - Sensor, actuator and control
- Running test on EBB
  - IFM angle alignment and operation
  - Thermal cycling in vacuum chamber
- Next step
  - Operational load testing









PAAM CONCLUSIONS

- Already in 2008 a mechanism was designed, realised and tested that
  - Provides the angular adjustment over the ±412µrad angular range
  - While having less than 1pm/√Hz ·n(f) OPD jitter and
  - Less than 10nrad/√Hz ·n(f) angular jitter
  - Capable of withstanding environmental loads of 20g RMS and thermal cycling -10˚C to +80˚C
- In 2019/2020 the design was updated to accommodate updated needs/requirements
  - Provide redundancy and higher resolution on the angular measurement
  - Increased stiffness of the structure
  - Require less volume for integration/removal
  - Currently the PAAM 2.0 Elegant Breadboard testing is ongoing: 1st results EBB are promising
- Development well underway for integration on the Optical Bench!


THANK YOU FOR YOUR ATTENTION
Take a look:
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