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LISA AIVT Optical Ground Support Equipement technology developments

Jean-Pierre Baronick, Fabio Cortavarria, Stéphane Dheilly, Hubert Halloin,
Corinne Juffroy, Matthieu Laporte, Jean Lesrel, Guy Monier, Pierre Prat,
Aymeric van De Walle, et al.

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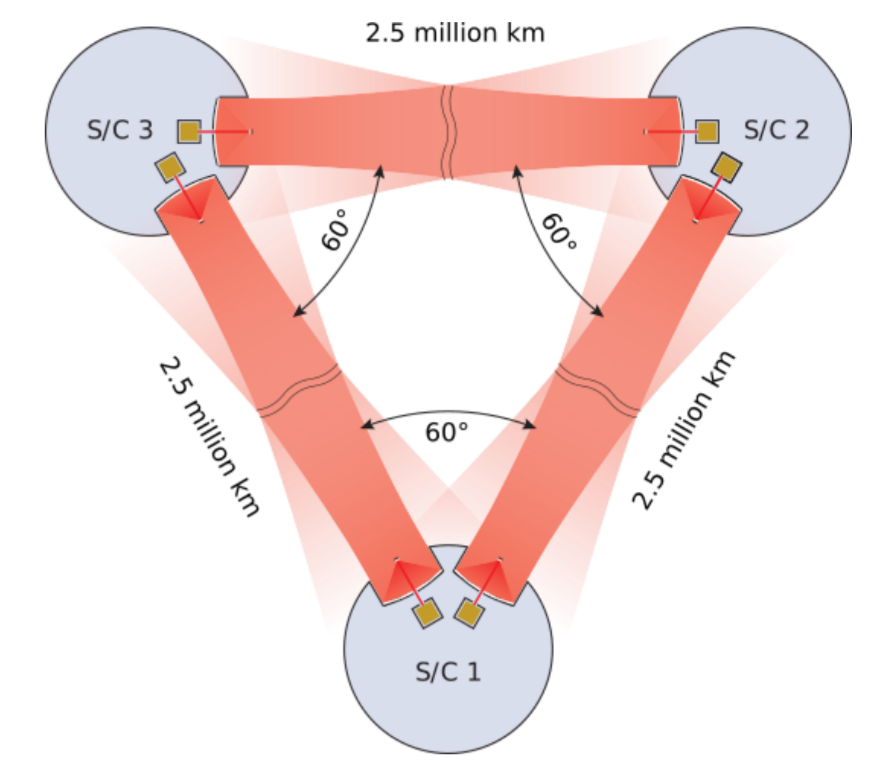
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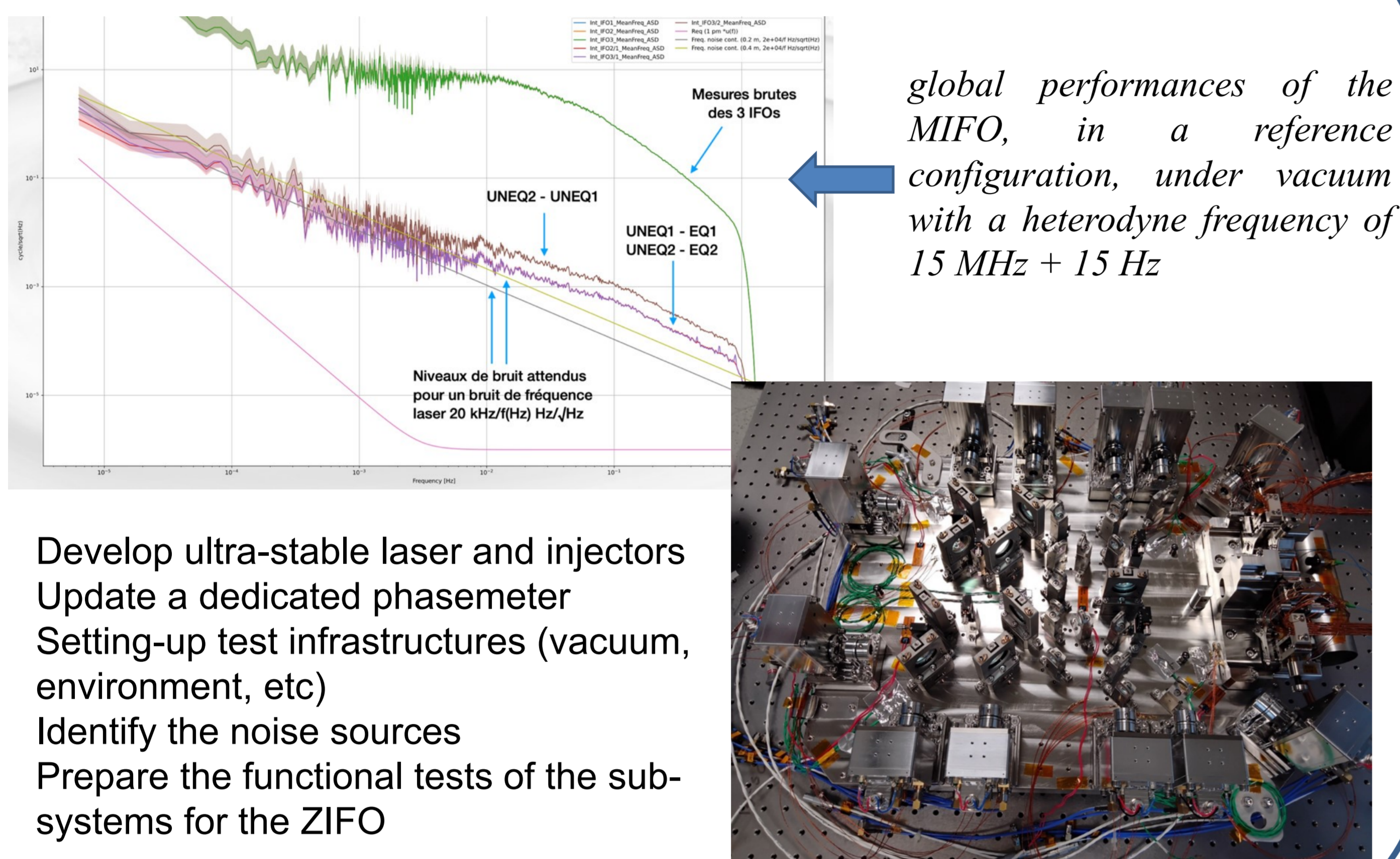
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Context

- LISA based on heterodyne laser interferometry -> measure tiny change distance between free-falling mirrors
- LISA strain sensitivity: $1 \cdot 10^{-20} \sqrt{\text{Hz}}$
- LISA displacement sensitivity: $10 \cdot 10^{-12} \text{ m} / \sqrt{\text{Hz}}$ over $2.5 \cdot 10^9 \text{ m}$
- France is in charge of the Interferometric Detection System (IDS) tests and Optical Test System (OTS)
- Specific test equipments to verify the requirements



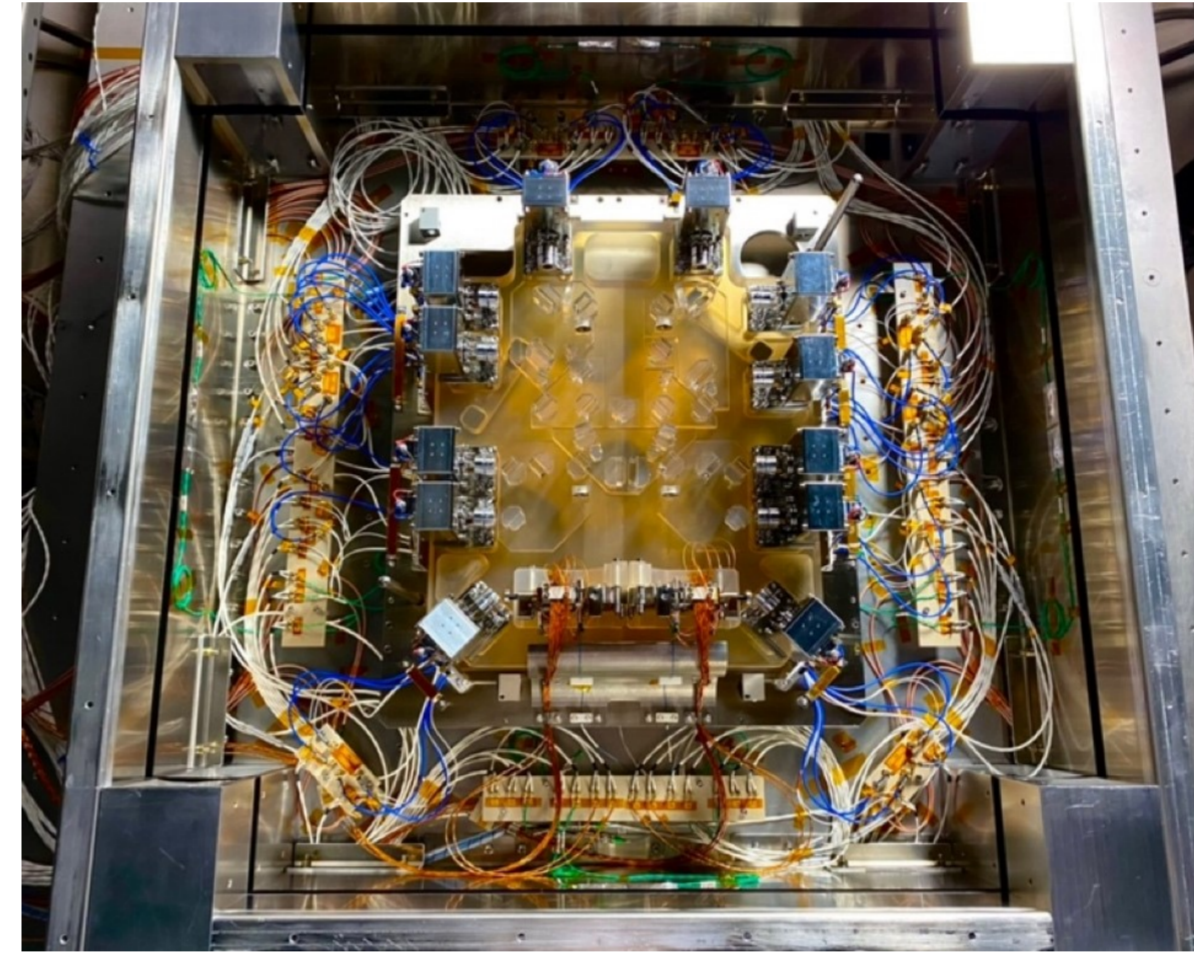
MIFO: Metallic InterFEROmeter



- Develop ultra-stable laser and injectors
- Update a dedicated phasemeter
- Setting-up test infrastructures (vacuum, environment, etc)
- Identify the noise sources
- Prepare the functional tests of the sub-systems for the ZIFO

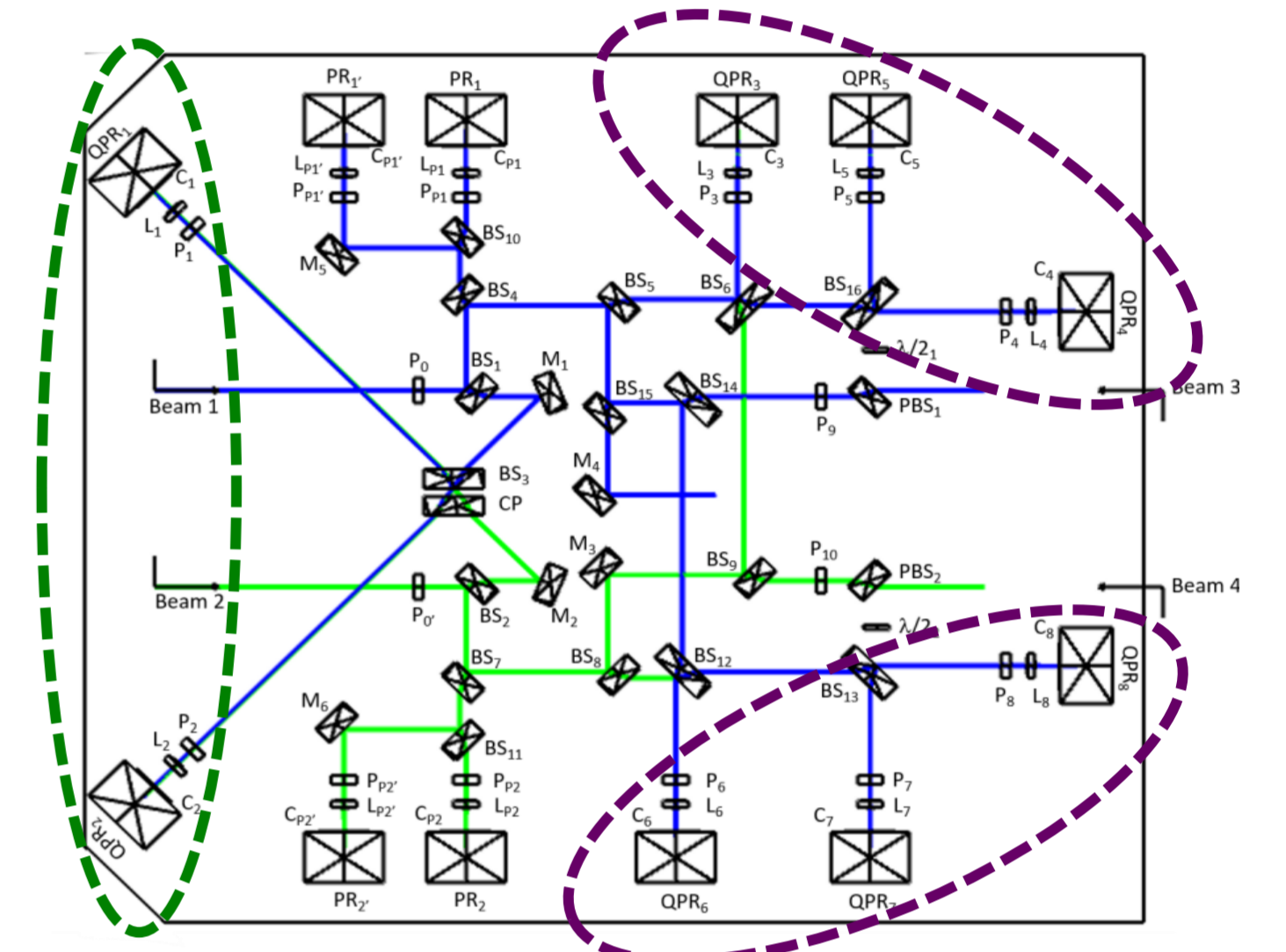
ZIFO: Zerodur InterFEROmeter

Dimensions: 530 x 450 x 47 mm

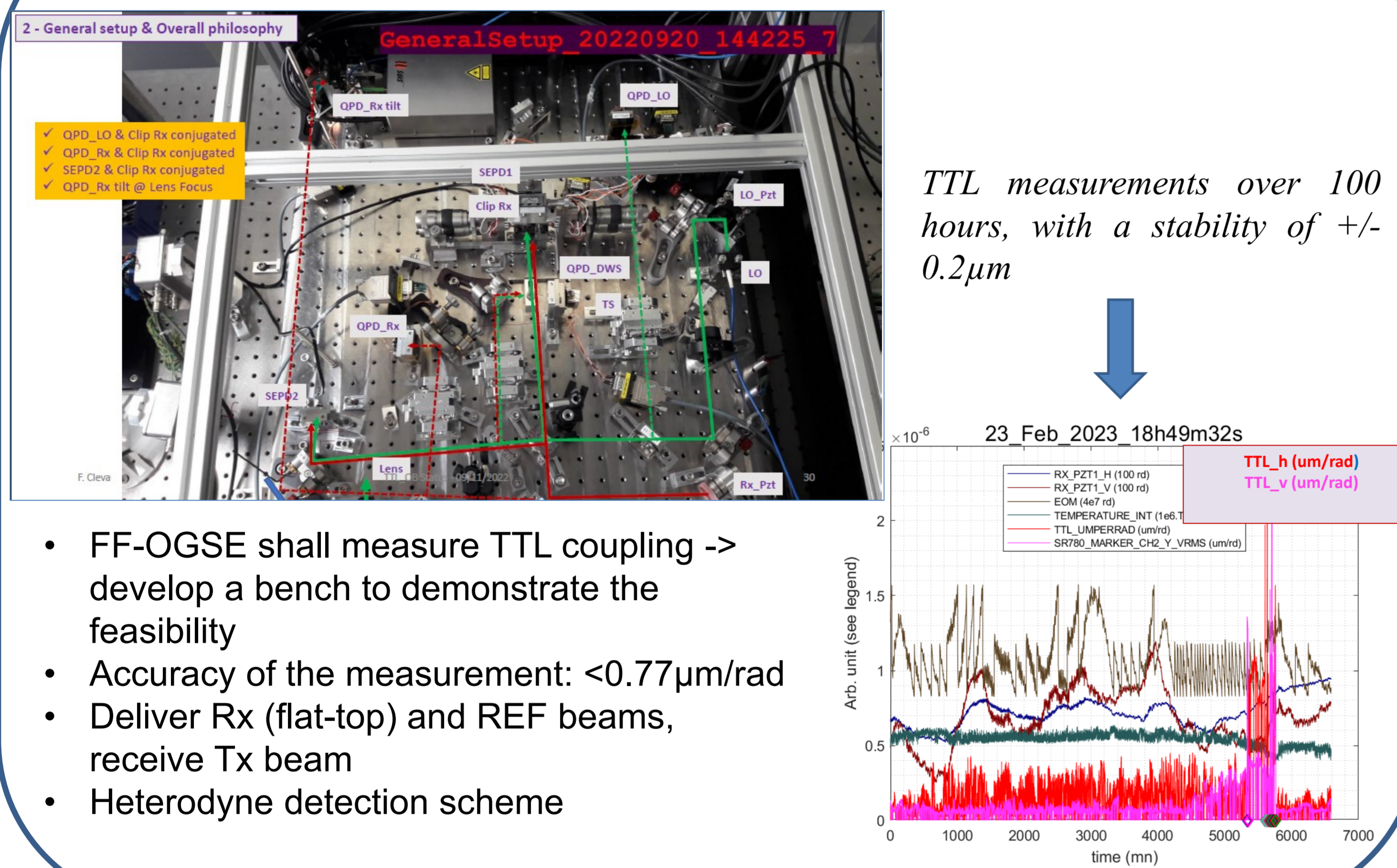


- Develop a demonstration bench
- Determine the excess level of metrology stability -> objective $5\text{-}10 \text{ pm} / \sqrt{\text{Hz}}$ in the band 1-10mHz
- Evaluate the performance limits achievable with the optical contacting

- 3 interferometers:
 - 1 with equal arms
 - 2 with unequal arms

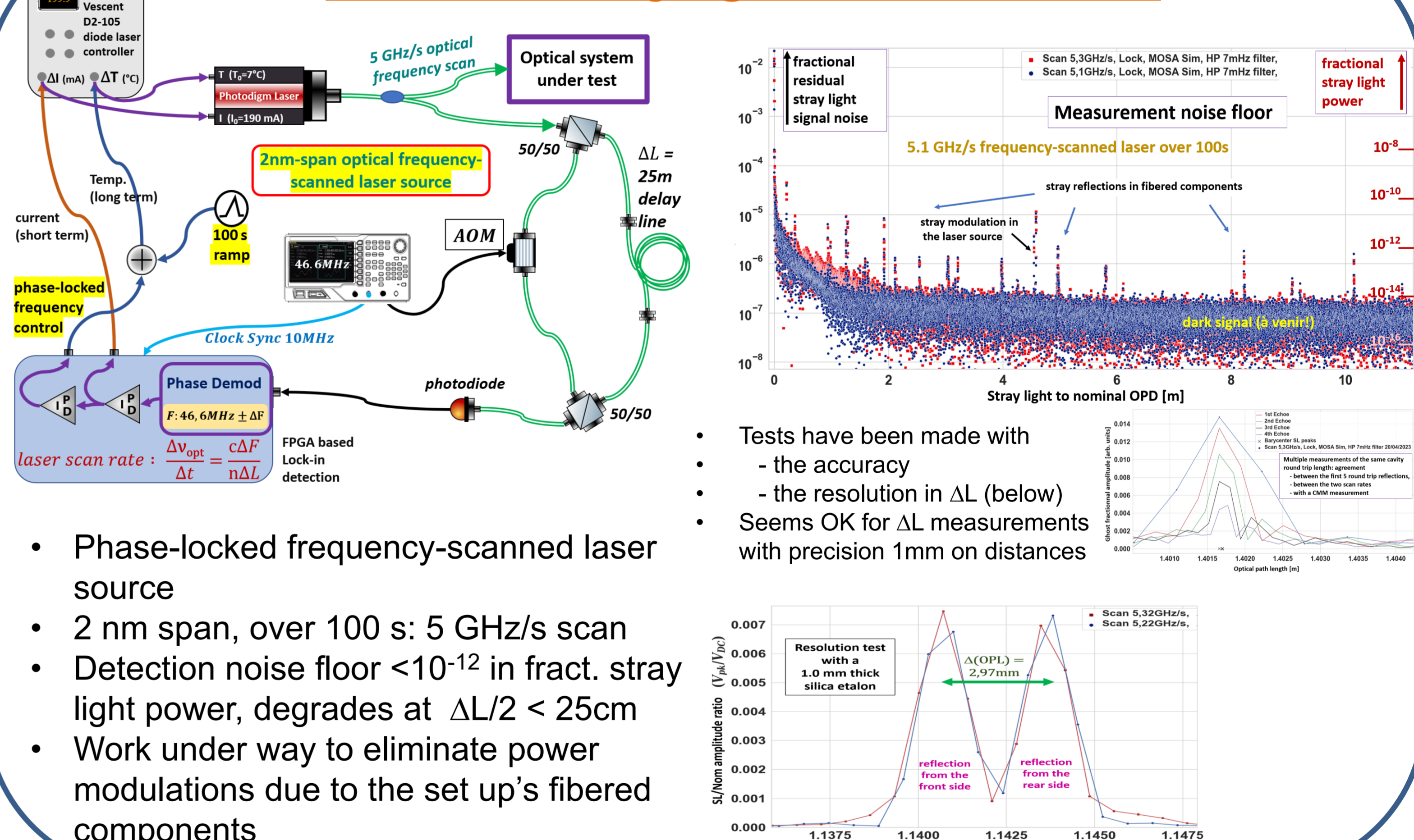


TTL-OB: Tilt-To-Length measurements



- FF-OGSE shall measure TTL coupling -> develop a bench to demonstrate the feasibility
- Accuracy of the measurement: $< 0.77 \mu\text{m}/\text{rad}$
- Deliver Rx (flat-top) and REF beams, receive Tx beam
- Heterodyne detection scheme

SLOGSE: Stray light measurements



Conclusions & prospects

- France is in charge of the IDS tests and OTS
- Several OGSEs are needed to test the IDS and the MOSA
- First prototypes are under development to test:
 - The sub-systems as laser, injectors, phasemeters, control/command
 - Assess the limits on sensitivity of the set-up and the precision of the path length measurements achievable on ground
 - Identify the noise sources
 - Measure the TTL coupling
 - Measure the straylight at system level, component by component
- Further investigation are ongoing to validate all the objectives
- Preparation of the final OGSE are in progress

Contributors

- APC:** J-P. Baronick, F. Cortavarria, S. Dheilly, H. Halloin, C. Juffroy, M. Laporte, J. Lesrel, G. Monier, P. Prat, A. Van De Walle, M. Vincent, T. Zerguerras
- ARTEMIS:** S. Bruhier, F. Cleva, J-P. Coulon, N. Dinu-Jaeger, T. Friess, D. Huet, B. Lefevre, M. Lintz, M. Merzougui, M. Nardello, M. Pichot, A. Pouzolles, A. Roubeau-Tissot, I. Thiellement, J-Y. Vinet
- CEA:** N. Arab, A. Arhancet, D. Bachet, M. Besançon, N. Besson, R. Granelli, M. Lacroix, A. Petiteau, C. Pitte, S. Sube
- CNES:** R. Arguel, E. Courau, J-C. Damery, F-X. Esnault, O. Grosjean, R. Llorca-Cejudo, E. Rivière
- CPPM:** M. Dupont, L. Guevara, E. Kajfasz, O. Llido, Ch. Meessen, A. Rivière, J. Royon, A. Secroun, J. Zoubian
- L2IT:** C. Buy
- LAM:** M. Carle, C. Fabron, B. Foulon, J.L. Gimenez
- SYRTE:** O. Acef, A. Mehlman, P. Wolf

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