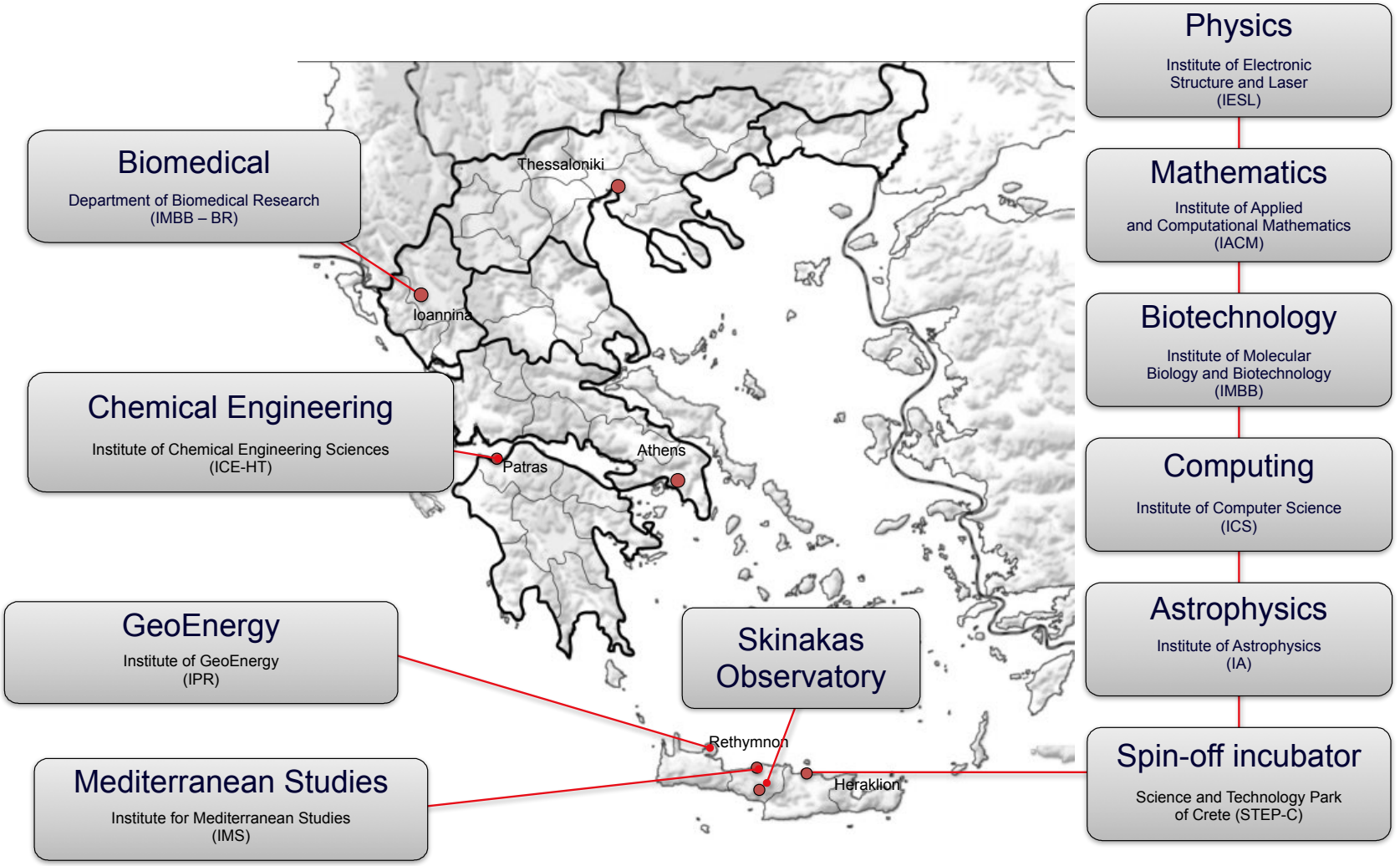
Space Related Research Groups

@ FORTH

Wolf von Klitzing

The eight institutes of FORTH



Space Related Research Groups

@ FORTH

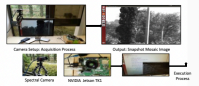
- **Data usage / augmentation**
- **Physical systems and simulation**

Wolf von Klitzing

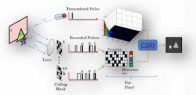
Data Usage & Data Augmentation

FORTH INSTITUTE OF COMPUTER SCIENCE — ICS
Signal Processing Laboratory

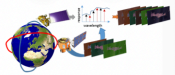
➢ Multispectral Imaging
Multispectral **video** processing & analysis
Low weight and size (cubesat-friendly)
Onboard data processing



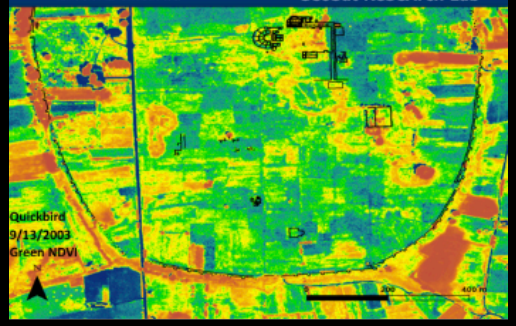
➢ LiDAR
Multiple depth encoding
Novel algorithmic framework



➢ Machine Learning in Big Data in EO
Deep Learning framework
Automated land cover estimation (NASA MODIS)
Accurate Soil Estimation (NASA SMAP & ESA Sentinel 1)
Galaxy redshift estimation (ESA Euclid)
Spatio-spectral enhancement (Sentinel 2)

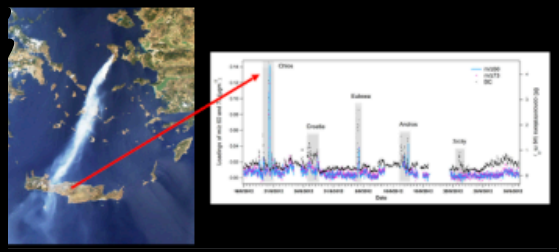


FORTH INSTITUTE FOR MEDITERRANEAN STUDIES — IMS
GeoSat ReSeArch Lab

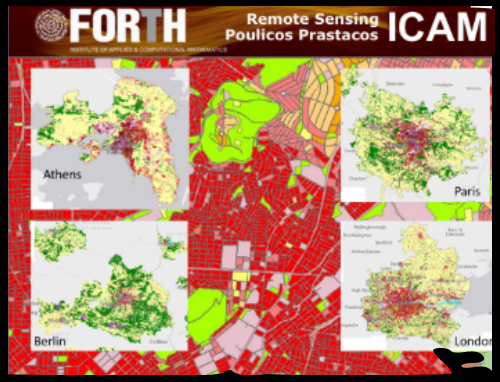


FORTH INSTITUTE OF CHEMICAL ENGINEERING SCIENCES — ICE-HT
Spyros Pandis, Athanasios Nenes

Augmenting Satellite Data:
Chemical Evolution of Air Pollutants



FORTH INSTITUTE OF APPLIED & COMPUTATIONAL MATHEMATICS — Remote Sensing ICAM
Poulicos Prastacos

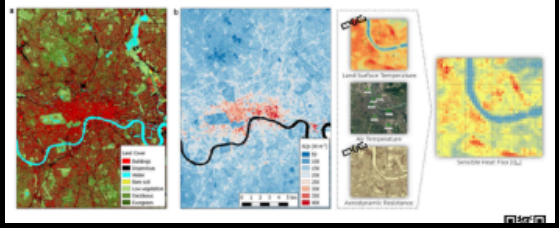


FORTH INSTITUTE OF APPLIED & COMPUTATIONAL MATHEMATICS — Remote Sensing ICAM
N. Chrysoulakis

Examples: URBANFLUXES Project

EO-based estimation of the net change in heat storage in buildings

EO-based estimation of turbulent sensible heat flux



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FORTH
INSTITUTE OF COMPUTER SCIENCE

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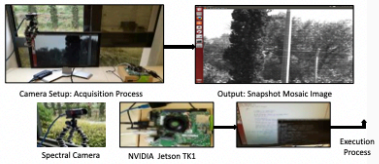

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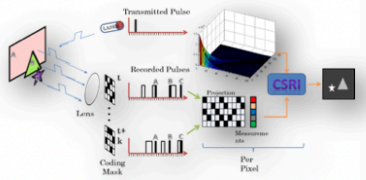

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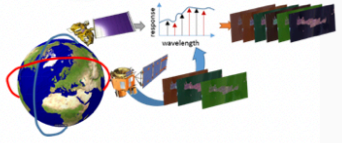
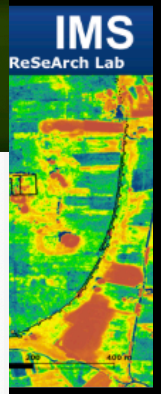


IMS
ReSeArch Lab



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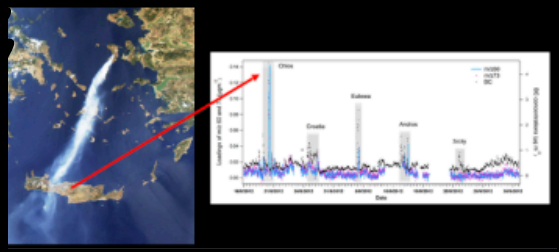

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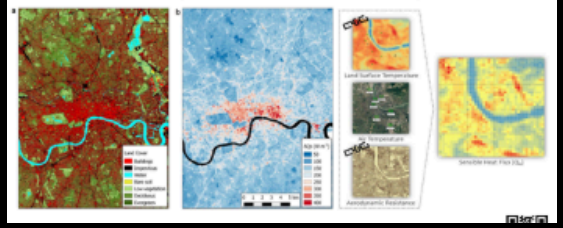
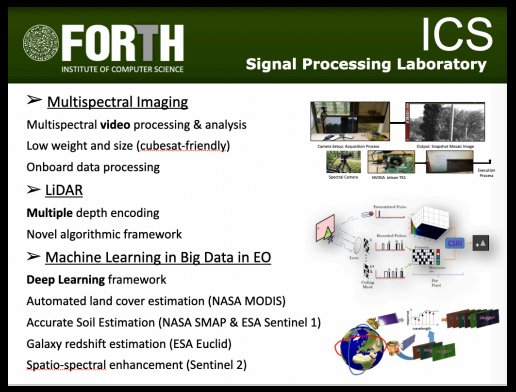
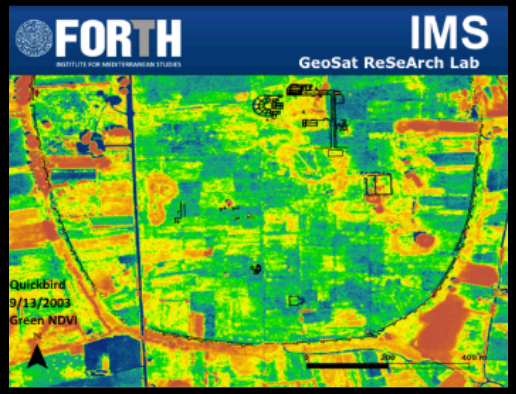
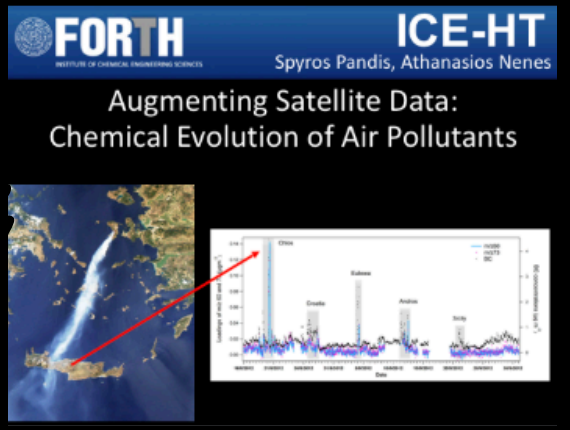
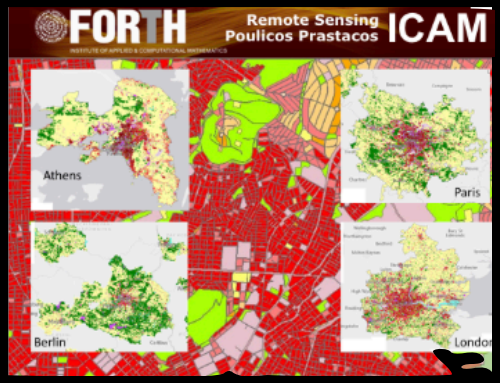


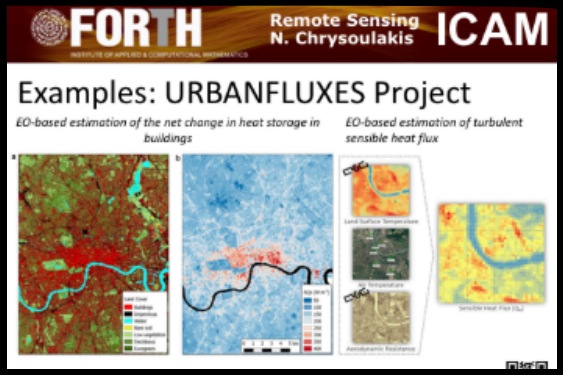
Data Usage & Data Augmentation



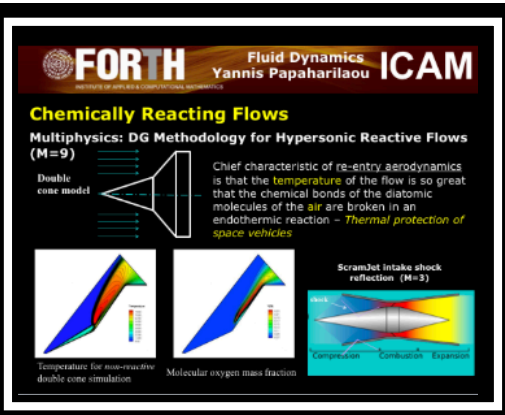


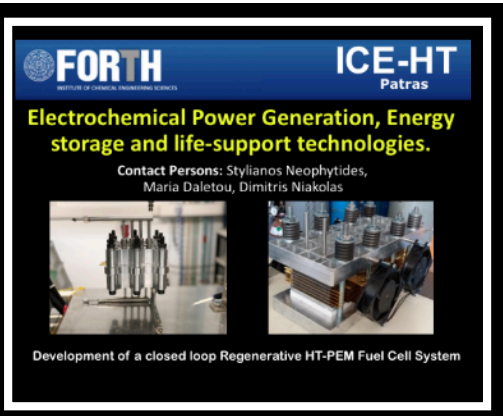


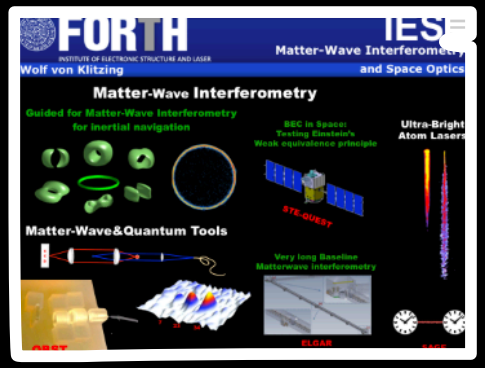


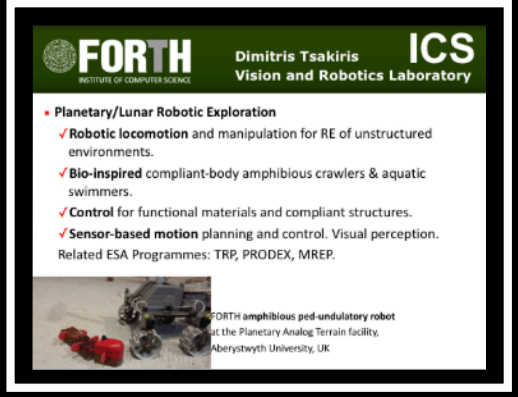


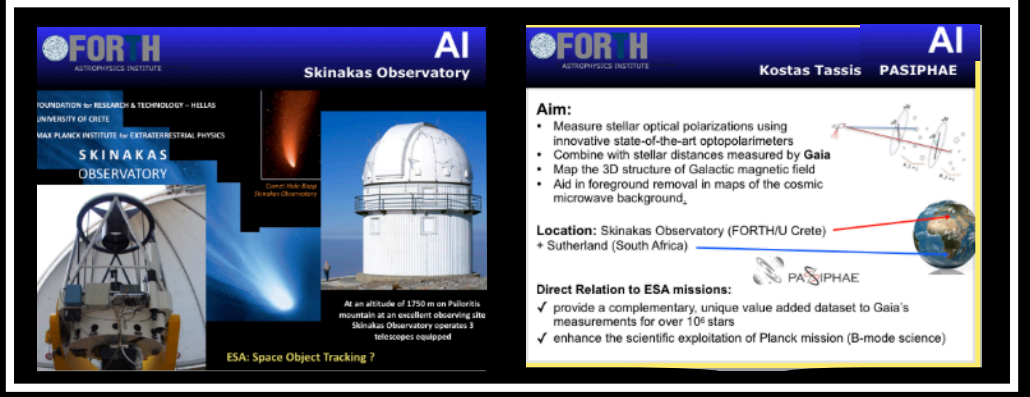
Physical Systems
(and simulations)











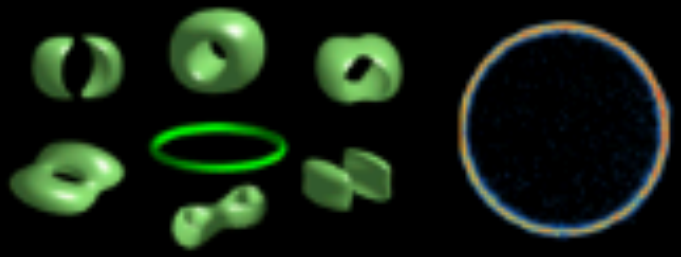
Physical Systems

(and simu

FORTH
INSTITUTE OF ELECTRONIC STRUCTURE AND LASER
IESL
Matter-Wave Interferometry
and Space Optics
Wolf von Klitzing

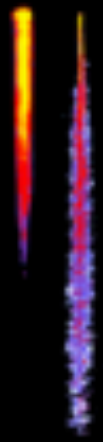
Matter-Wave Interferometry

Guided for Matter-Wave Interferometry
for inertial navigation

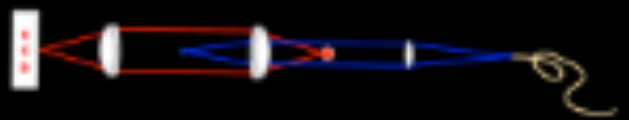


BEC in Space:
Testing Einstein's
Weak equivalence principle

Ultra-Bright
Atom Lasers



Matter-Wave&Quantum Tools



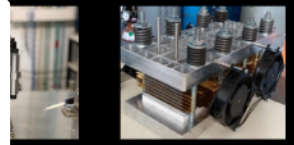
Very long Baseline
Matterwave Interferometry

FORTH Fluid Dynamics Yannis Papaharilaou ICAM

FORTH ICE-HT Patras

cal Power Generation, Energy
d life-support technologies.

ntact Persons: Stylianos Neophytides,
Maria Daletou, Dimitris Niakolas



osed loop Regenerative HT-PEM Fuel Cell System

AI
Kostas Tassis PASIPHAE

polarizations using
rt optopolarimeters
tances measured by Gaia
Galactic magnetic field
al in maps of the cosmic

rvatory (FORTH/U Crete)

PASIPHAE

issions:
ry, unique value added dataset to Gaia's
10^9 stars
xploitation of Planck mission (B-mode science)

FORTH
INSTITUTE OF ELECTRONIC STRUCTURE

Metamaterials: Structure
controllable properties
(e.g. negative or giant or
permittivity, permeability

ESA useful properties and

- Backwards phase advance ar
  Component miniaturization
- Unusual and "arbitrary" wave
  Communication applications
- Zero-reflection & Perfect Abs
  EM shielding, controlled impe
- Ultra-strong Chirality
  Polarization modulators and f

IMBB
MOLECULAR BIOLOGY & BIOTECHNOLOGY

Prof. Nektarios Tavernarakis: http://www.elegans.gr)

cular Mechanisms of and
s to Muscle Decline in Space

RIGHT NOW on the Space Station

Freeze-dried OP50 GOES TO SPACE

LabTIE

CRETANMATTERWAVES
www.bec.gr

GW-Detection using Photon and Atom Optics

FORTH
INSTITUTE OF ELECTRONIC STRUCTURE AND LASER

Wolf von Klitzing
Dimitris Papazoglou
Konstantinos Makris
Giorgos Vasilakis

Giannis Drougakis

Vinay Pareek
Vishnupriya Puthiya Veettil
Vidhu Catherine Antony
Apostolis Brimis
Pandora Examilioti
Mary Georgousi

FET
FUTURE & EMERGING TECHNOLOGIES scheme
NanoLace
Marie Curie-Excellence MatterWaves

FET
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MatterWave
Marie Curie-Excellence MatterWaves

ΕΣΠΑ 2014-2020
ανάπτυξη - εργασία - αλληλεγγύη

esa
ESA-OBST1
ESA-OBST2

AtomQT
cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

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Space Optics Group

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FORTH
INSTITUTE OF ELECTRONIC STRUCTURE AND LASER

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group leader

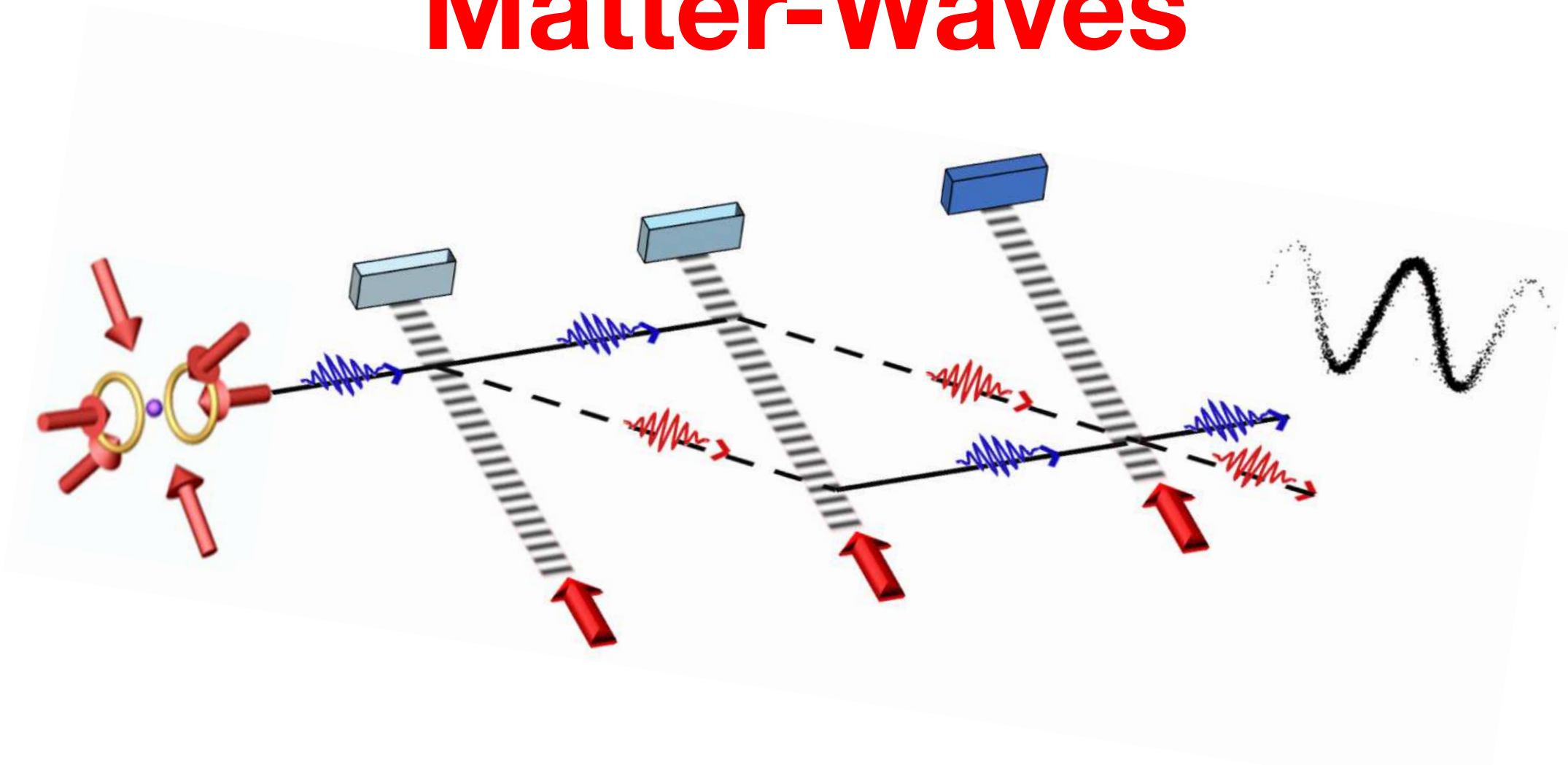
Dimitris Papazoglou,
PI Optics

Giannis Drougakis
Post Doc / Engineer

Pandora Examilioti,
PhD Student

Mary Georgousi,
MSci Student

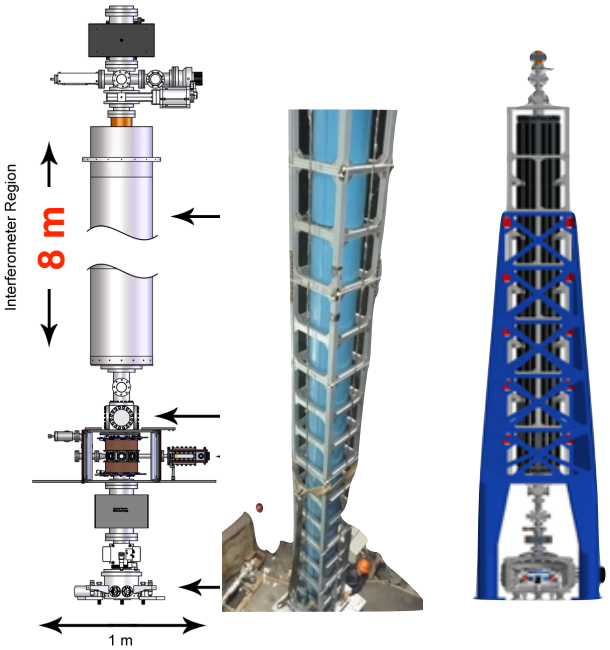
Matter-Waves



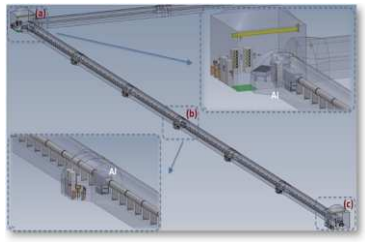
Matter-Wave Interferometry

CARIOQA SAGE

Large Tubes



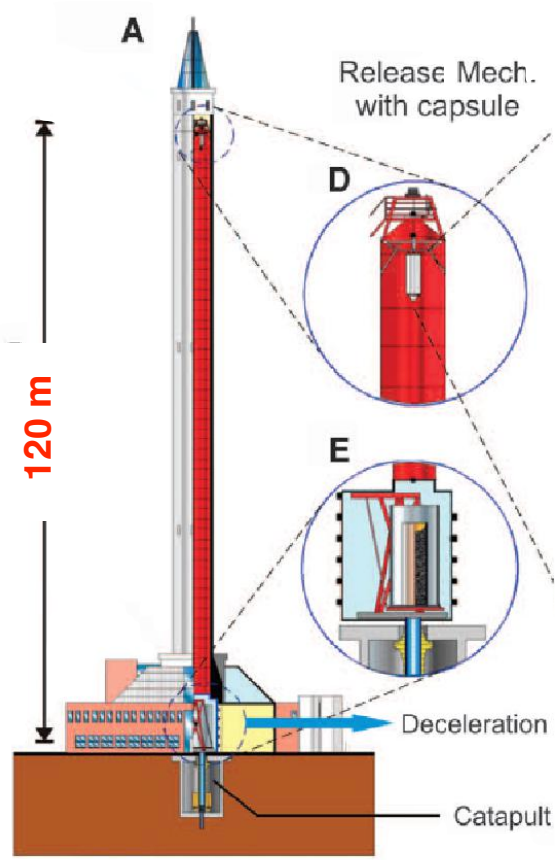
Stanford / Wuhan / Hannover



ELGAR

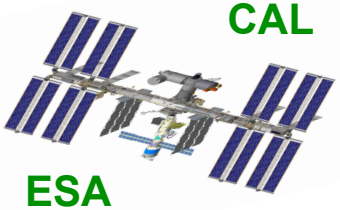
Free Fall

ZARM
drop Tower



Space

NASA
CAL

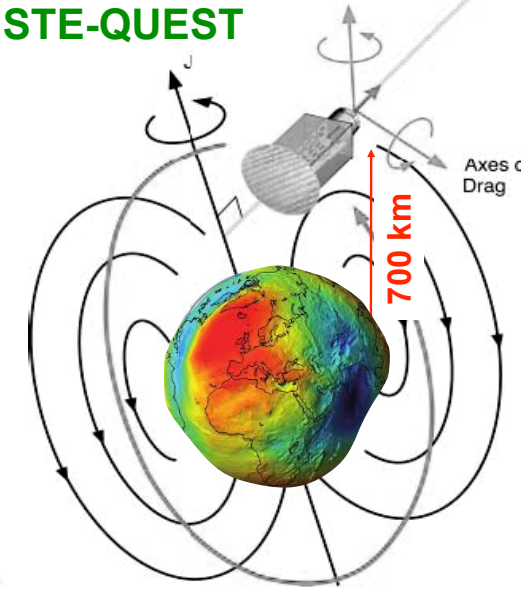


ESA
C-COOL

muQuans

AEDGE

STE-QUEST



Parabolic
Flights

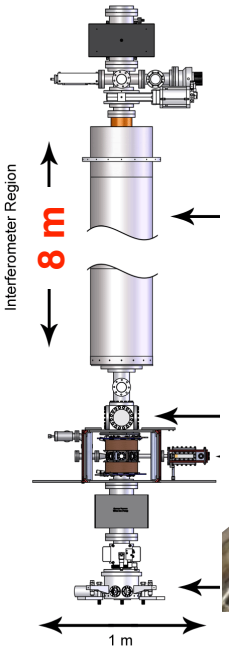
Matter-Wave Interferometry

CARIOQA SAGE

Large Tubes **Free Fall** **Space** **AEDGE**

Atom Interferometric

- Constraints on Dark Matter
- Limits on chameleon fields
- Confirmation of Einstein's Equivalence Principle
- Precision measurements of the fine-structure Const.
- Gravitational Waves (?)



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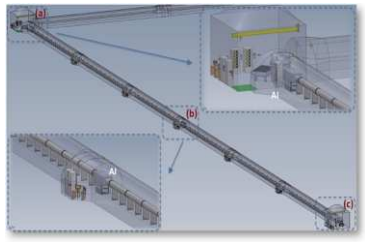

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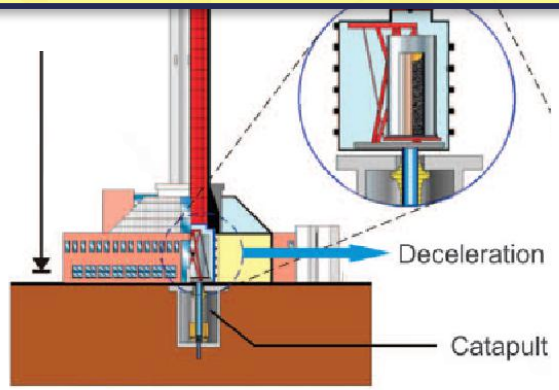
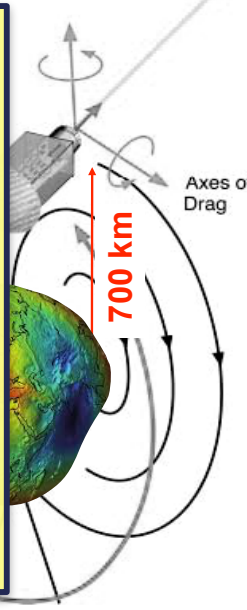


Parabolic Flights



Google: "AEDGE quantum" (or DOI: 10.1140/epjqt/s40507-020-0080-0)

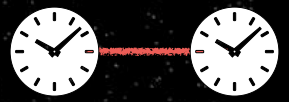
CRETANMATTERWAVES

Waves at IESL-FORTH and Beyond

FORTH
INSTITUTE OF ELECTRONIC STRUCTURE AND LASER

Guided Matter-Wave Interferometry

Space Clocks: SACE

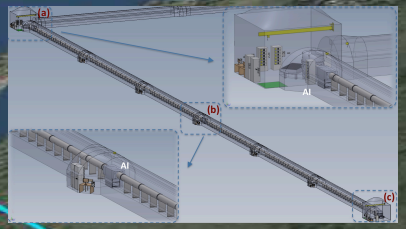


STE-QUEST

BEC in Space: Testing Einstein's Weak equivalence principle

AEDGE

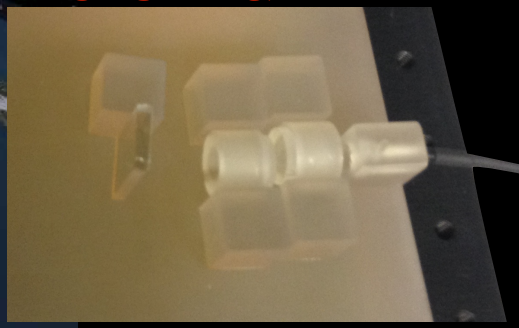
Very long Baseline Matterwave interferometry



ELGAR

CARIOQA

Atom Space Technologies: OBST 1 & 2



CRETANMATTERWAVES

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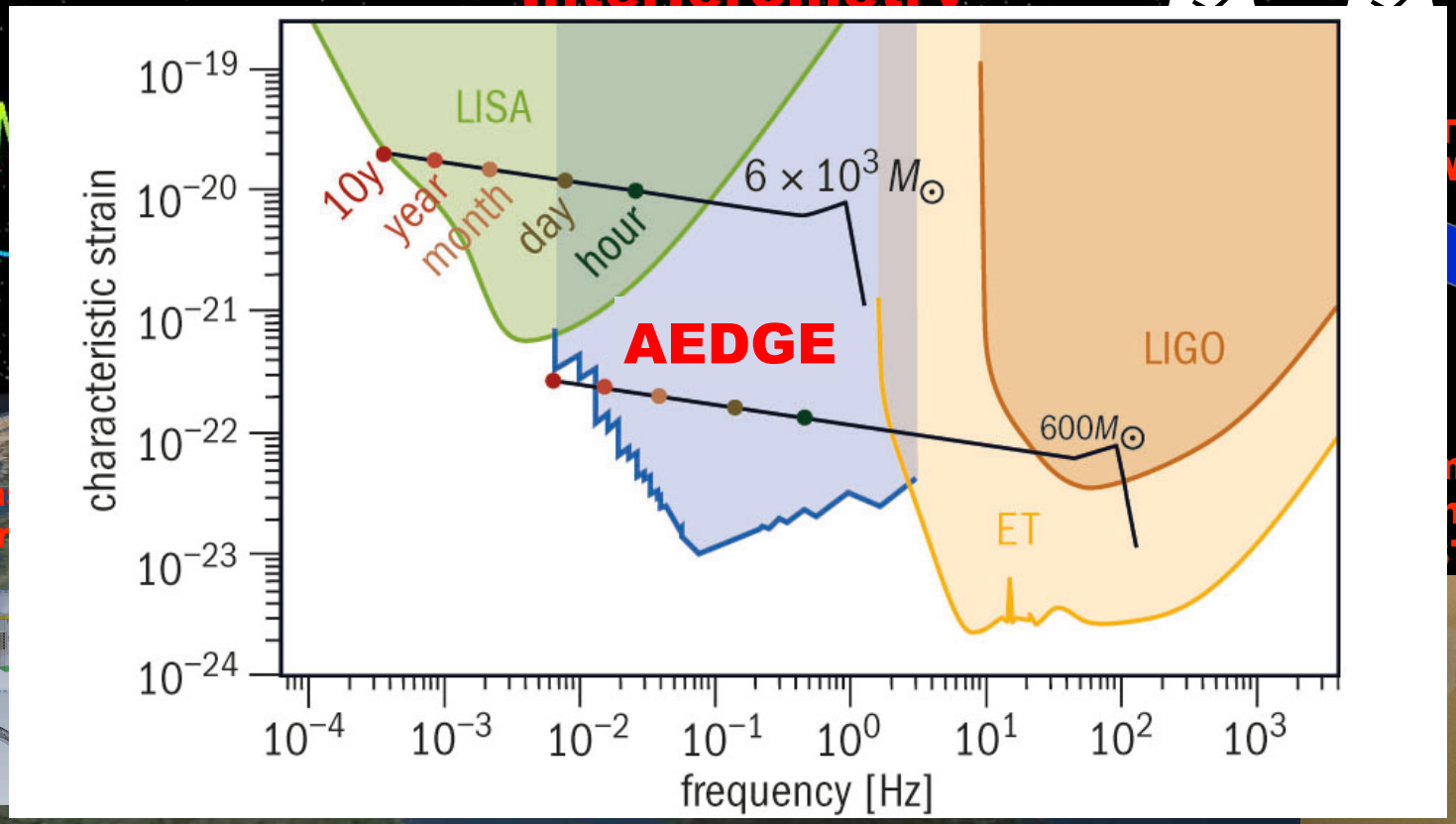
INSTITUTE OF ELECTRONIC STRUCTURE AND LASER

Guided Matter-Wave Interferometry



Space Clocks: SAGE

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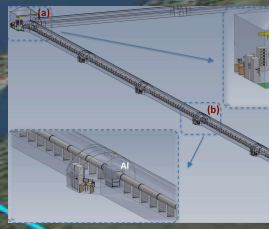
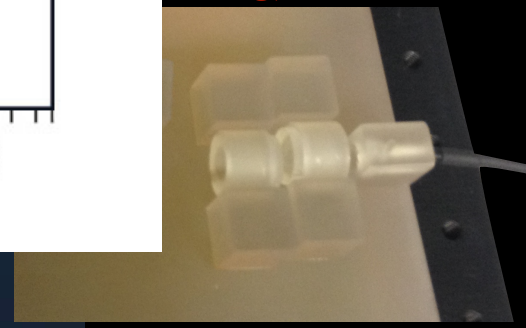
Very long Ba
Matterwave inter



ELGAR

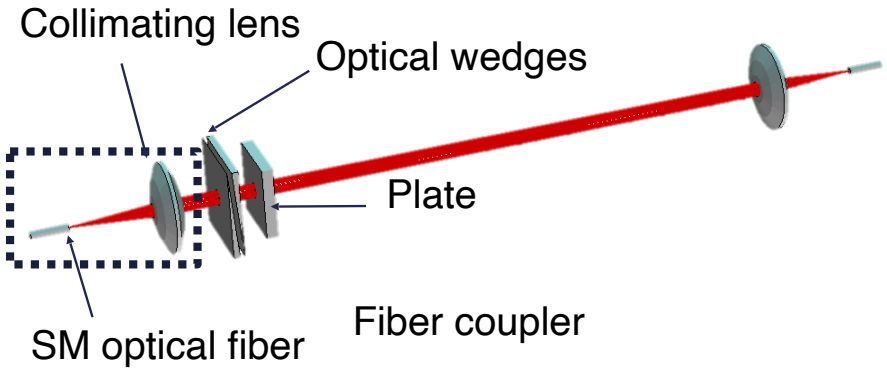
n Space
nologies:
T 1 & 2

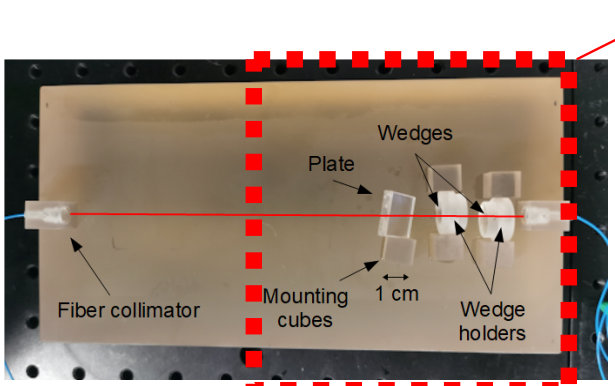


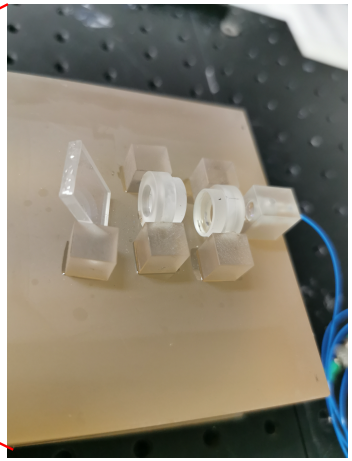
Optical Beam Steering Technology (OBST)

- Nearly monolithic design of components
- **Simple, fast and low-cost** manufacturing using COTS components (Assembly with standard laboratory equipment)
- **Extreme Stability**: Fluctuations : 0.1%$_{RMS}$ in 5 Days
  Even under Temperature variations, shocks and vibrations Fluctuations < 1%
- **Coupling Efficiency 94%**

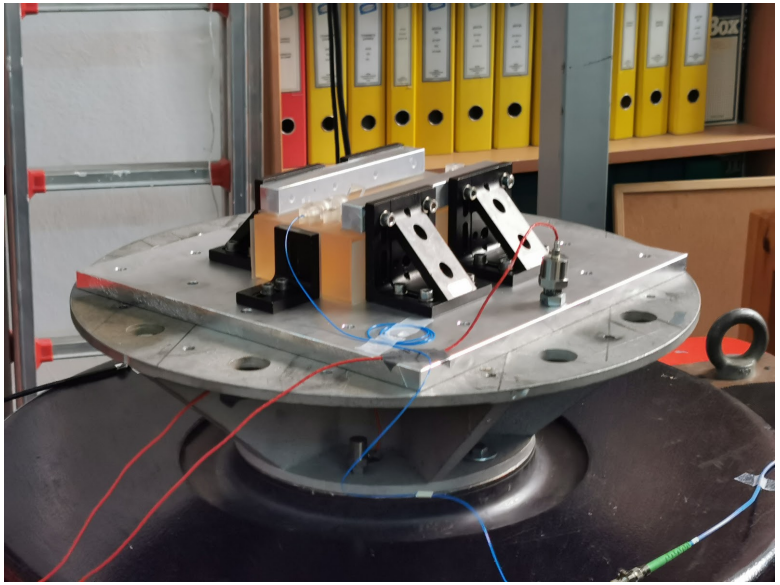
Fiber- free space-fiber optical link using a pair of optical wedges and a plate to perform the fine steering of the beam



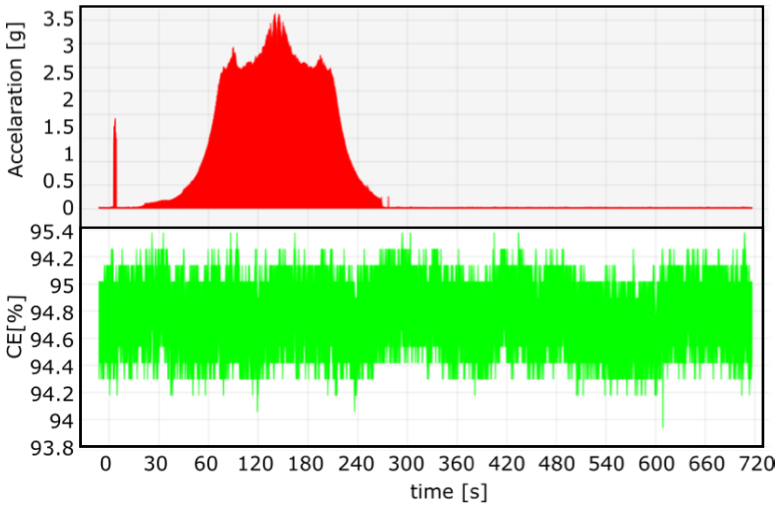




OBST stability under Launch Conditions



Vibration Tested according to the standards:
EN 60068-2-6:2008 (IC 60068-2-6:2007),
EN 60068-2-64:2008 (IC 60068-2-64:2008),
ISO 20780:2018.



Results

- Sine sweep, 3.5 g, 5 → 100 → 5 Hz
  RMS fluctuations of CE = **0.15%**
- Max 8.3g RMS at a random spectrum between 20 – 2000 Hz
  RMS fluctuations of CE = **0.28%**
- Shock tested at 89.4g for 1ms

OBST 4
LISA ?

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