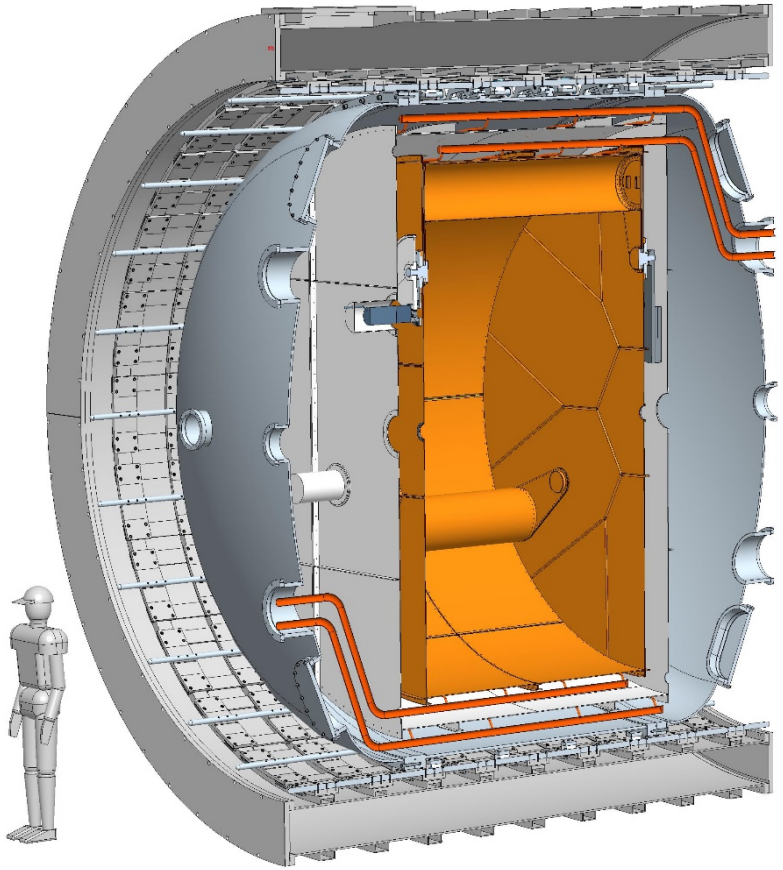


March 4 - 2024

FLASH - TDR

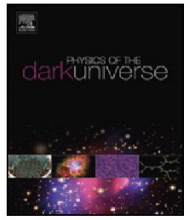
FLASH paper

Physics of the Dark Universe 42 (2023) 101370

Contents lists available at ScienceDirect

Physics of the Dark Universe

journal homepage: www.elsevier.com/locate/dark



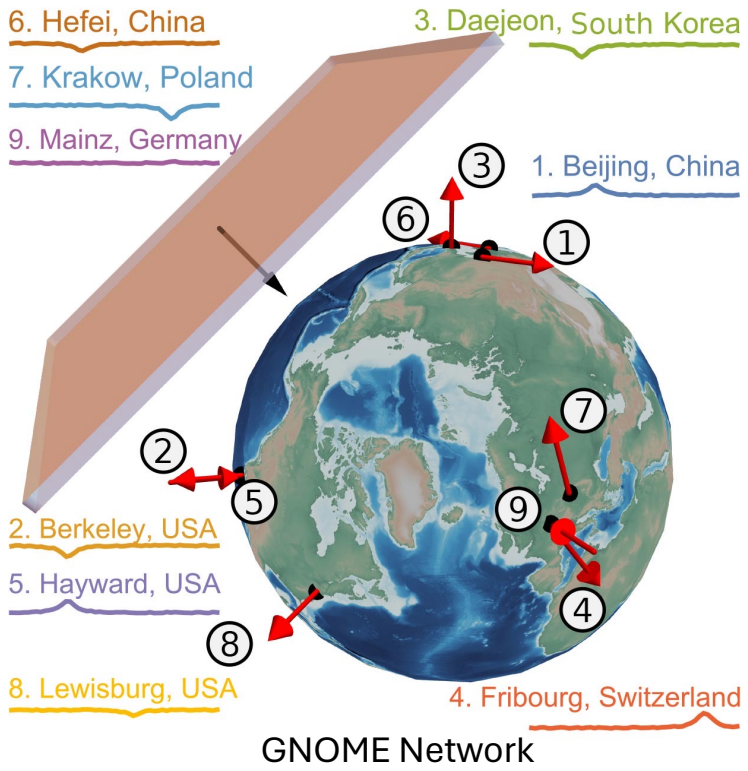
Full Length Article

The future search for low-frequency axions and new physics with the FLASH resonant cavity experiment at Frascati National Laboratories

David Alesini [a], Danilo Babusci [a], Paolo Beltrame [b], Fabio Bossi [a], Paolo Ciambrone [a], Alessandro D'Elia [a,*], Daniele Di Gioacchino [a], Giampiero Di Pirro [a], Babette Döbrich [c], Paolo Falferi [d], Claudio Gatti [a], Maurizio Giannotti [e,f], Paola Gianotti [a], Gianluca Lamanna [g], Carlo Ligi [a], Giovanni Maccarrone [a], Giovanni Mazzitelli [a], Alessandro Mirizzi [h,i], Michael Mueck [j], Enrico Nardi [a,k], Federico Nguyen [l], Alessio Rettaroli [a], Javad Rezvani [m,a], Francesco Enrico Teofilo [n], Simone Tocci [a], Sandro Tomassini [a], Luca Visinelli [o,p], Michael Zantedeschi [o,p]

GravNet: A Global Network for the Search for High Frequency Gravitational Waves

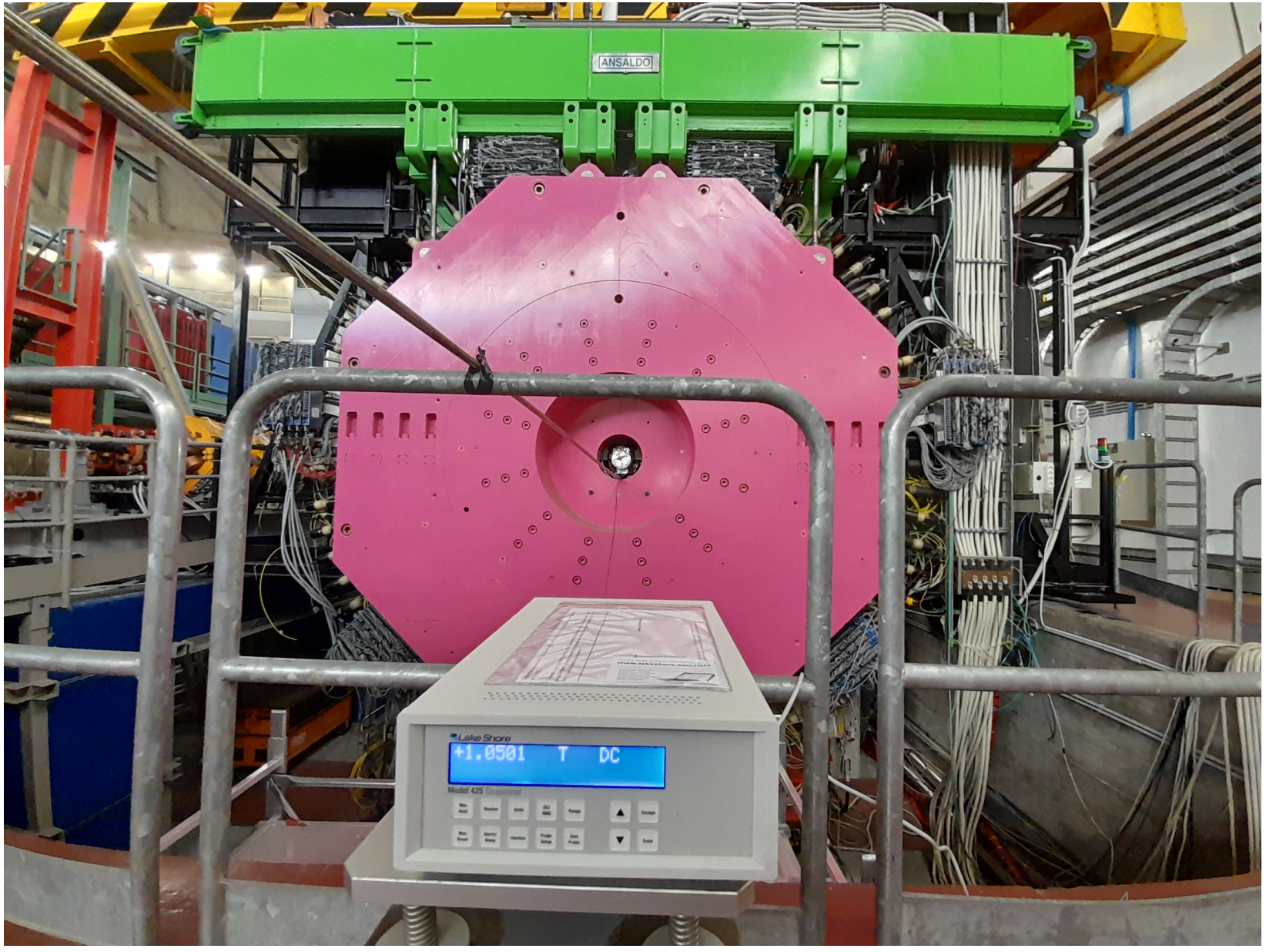
Matthias Schott (Uni Bonn)
Diego Blas (IFAE)
Dmitry Budker (Uni Mainz)
Claudio Gatti (INFN)



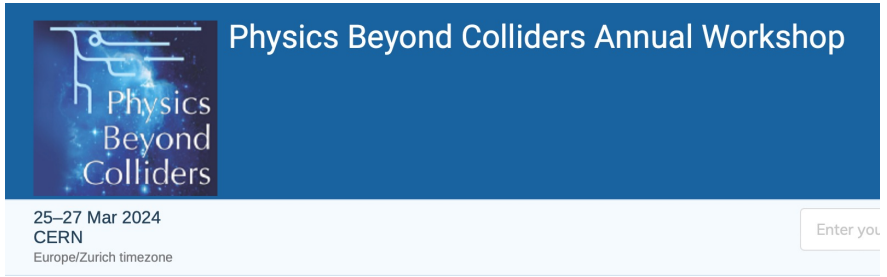
GNOME Network

Successful Test of the FINUDA Magnet

After a series of operations, the cryogenic plant was finally put back into operation. On Jan the 19th 2024, FINUDA was cooled down to 4 K and energized with a current of 2706 A, generating a magnetic field of 1.05 T.



Physics Beyond Collider



https://pbc.web.cern.ch

The main goal of the Study Group remains to explore the opportunities offered by CERN's unique accelerator complex, its scientific and technical infrastructure, and its know-how in accelerator and detector science and technology, to address today's outstanding questions in particle physics through initiatives that complement the goals of the main experiments of the Laboratory's collider programme. Examples of physics objectives include dedicated experiments for studies of rare processes and searches for feebly interacting particles. The physics objectives also include projects aimed at addressing fundamental particle physics questions using the experimental techniques of nuclear, atomic, and astroparticle physics, as well as emerging technologies such as quantum sensors, that would benefit from the contribution of CERN competences and expertise. The study group will primarily investigate, and, where appropriate, provide support to, projects expected to be sited at CERN. The study group may also examine ideas and provide initial support for contributions to projects external to CERN. The study group is also expected to act as a central forum for exchanges between the PBC experimental community and theorists for assessment of the physics reach of the proposed projects in a global landscape.

How CERN can help us

- Definition of the general layout in terms of both cryogenic and mechanic layout about all the components.
- Consultancy about the cryogenic design:
  - ✓ choice of the working T (4.5 or 2.2 K) and related components (pump)
  - ✓ cryo turret design
  - ✓ dimensioning of pipes
  - ✓ dimensioning of valves
  - ✓ choice of the right materials
- Help in fluidodynamic and thermo-mechanical simulations, if needed.
- Consultancy about the RF cavity mechanical and tuning design.

Next Steps

INFN-CSN2-QA-101: Guidelines for project submission and management in National Scientific Commission 2 (astroparticle)


Laboratori Nazionali di Frascati

INFN-18-09-LNF
September 18, 2018

The KLASH – Letter of Intent

D.Alesini[1], D.Babusci[1], F.Bossi[1], P.Ciambrone[1], G.Corcella[1], D.Di Gioacchino[1], P.Falferi[2], C.Gatti[1], A.Ghigo[1], G.Lamanna[3], C.Ligi[1], G.Maccarrone[1], A.Mirizzi[4], D.Montanino[5], D.Moricciani[1], A.Mostacci[6], E.Nardi[1], A.Paoloni[1], L.Pellegrino[1], A.Rettaroli[1], R.Ricci[1], L.Sabbatini[1],S.Tocci[1].

CDR → July 2024
Executive Summary → September 2024

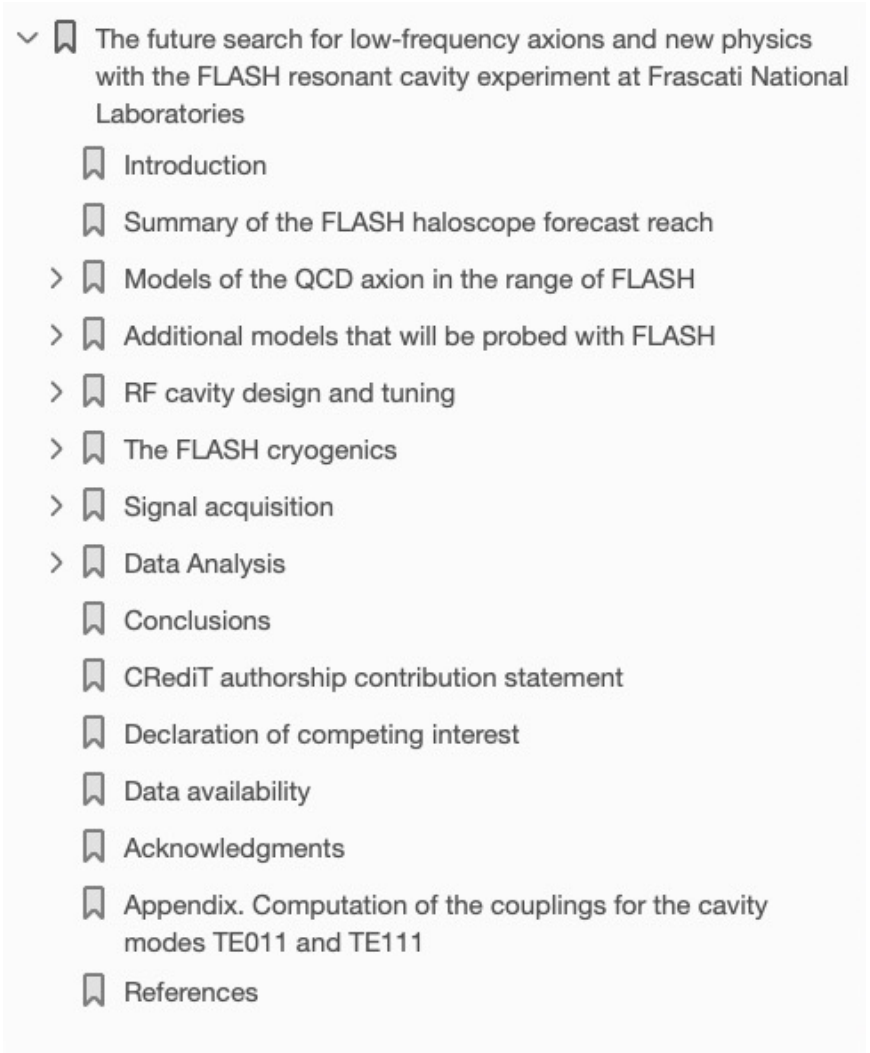
CSN2-FLASH-PM-QA-503-CDR + CSN2-FLASH-PM-QA-511-EXS

KLASH CDR arXiv:1911.02427
FLASH paper Phys. Dark Univ. 42 (2023)

CDR

Outline (from INFN-PM-QA-503)

1. Physics Case
2. Conceptual Design
3. Technology Readiness Level
4. Safety
5. Management (FTE and participants)
6. R&D



CDR

Outline (from INFN-PM-QA-503)

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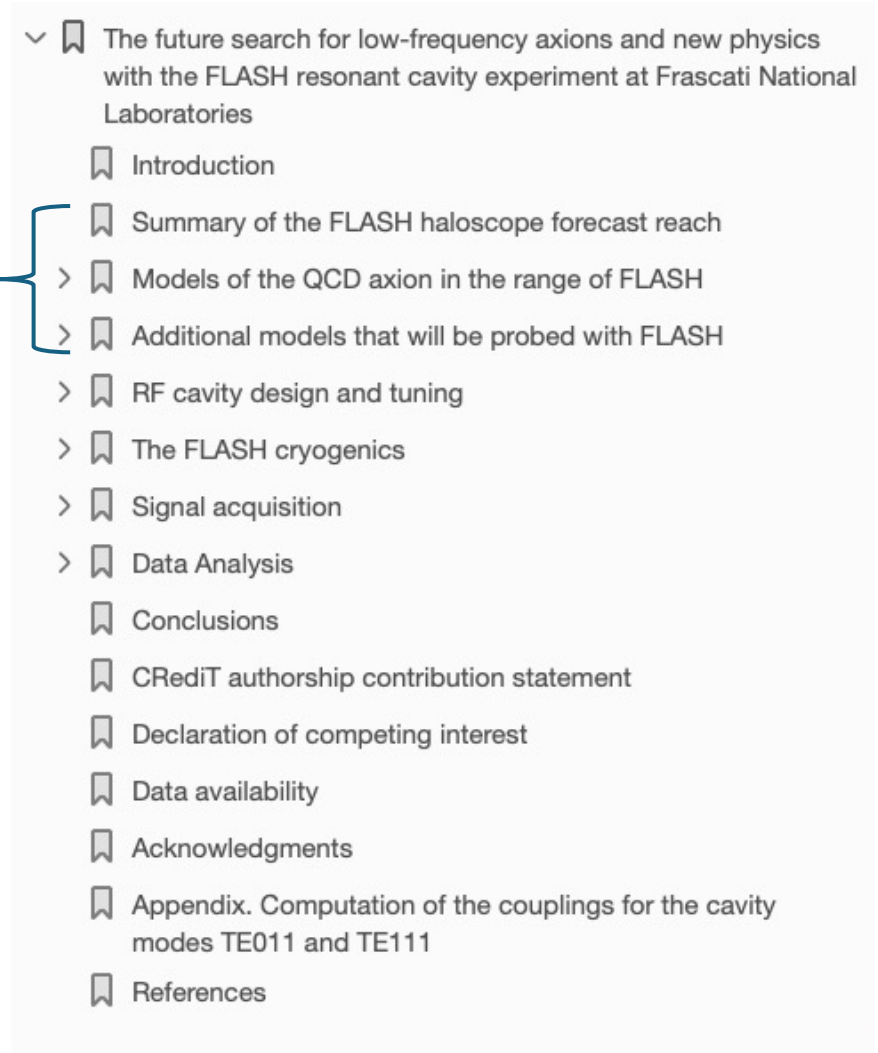

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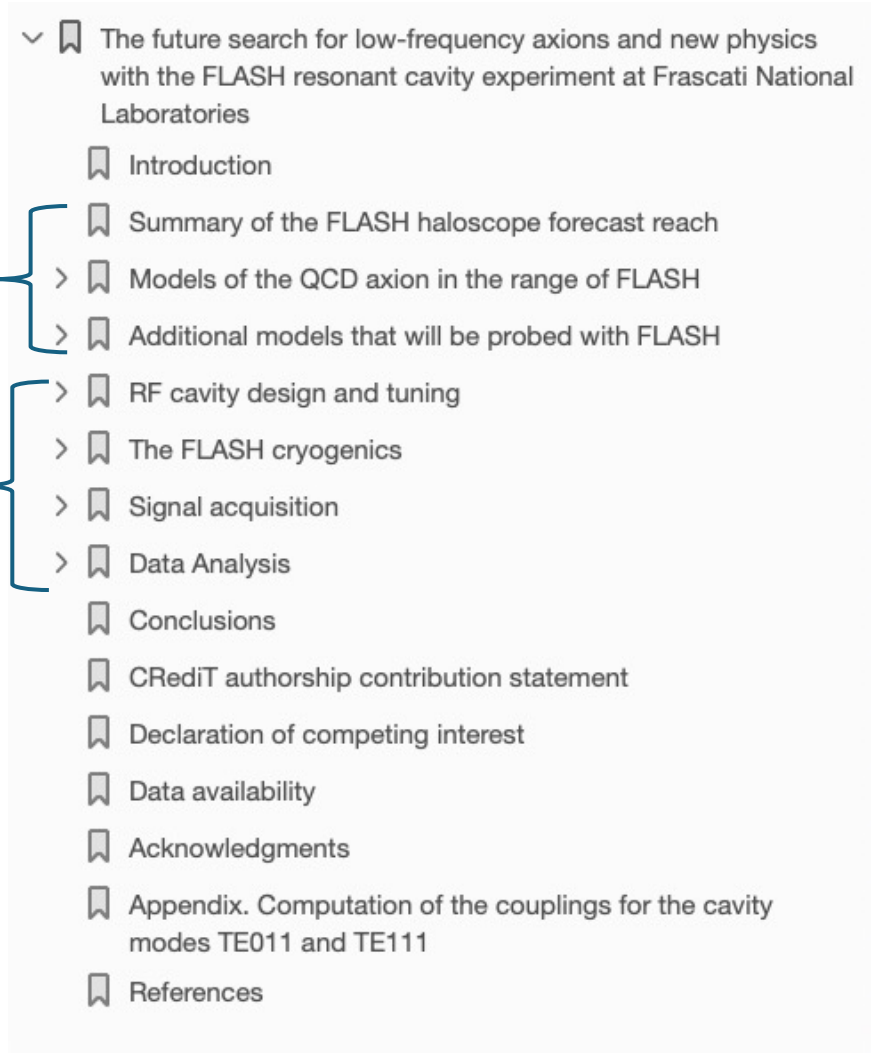


CDR: Technology Readiness

Referring to the baseline configuration, the technological maturity of the proposed solutions must be verified. For the main and most critical systems it is necessary to indicate those already created at an industrial level; alternatively, for the components whose feasibility and performance have already been demonstrated, appropriate bibliographical references must be included. Likewise, it is necessary to clearly indicate the performances not yet demonstrated and which R&D programs you want to complete to demonstrate the feasibility of the project.

CDR: Safety

A brief analysis must be provided on the compatibility of the project with the safety and radiation protection requirements to analyze whether, at least from the design phase, factors do not emerge that make its final implementation critical or completely impossible.

CDR: Management

A summary version of the Project Management Plan must be provided which includes:

1. the project management practices that will be used in the project phase;
2. the description of the work packages and activities;
3. a preliminary analysis of the resources necessary for the realization of the project. A preliminary indication of the costs of the components of the apparatus and any services required (logistics, transport, insurance…) is required. It is also required to provide an estimate of the staff needed in FTE and the consequent description of the profile of the human resources to be employed;
4. a first version of high-level planning;
5. a preliminary version of the risk analysis;
6. the participants (INFN structures and external partners) and their roles.

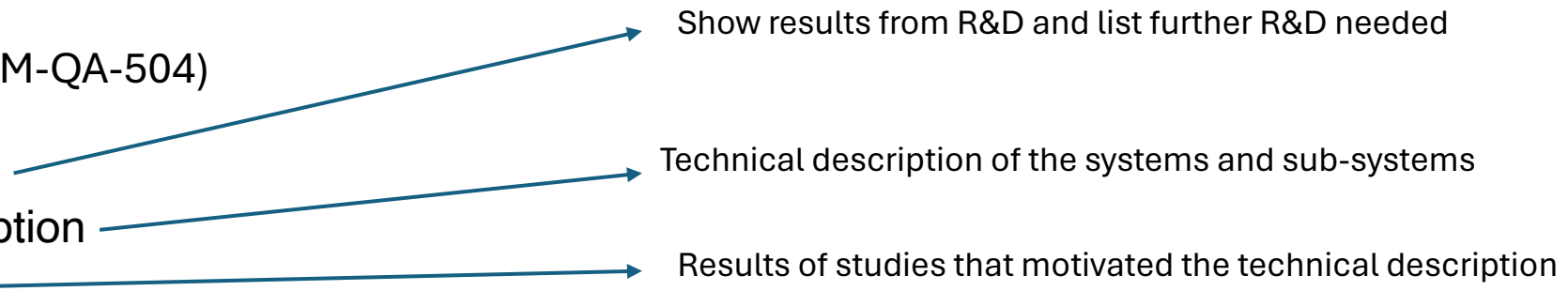
CDR: R&D

This paragraph must clearly indicate the resources necessary to carry out the R&D programs identified in paragraph 3 (TRL). The necessary resources must be defined both from a budget and personnel point of view and the necessary implementation times. Detailed timetables must be included, where any intermediate deadlines can be clearly identified. It is also necessary to provide a description of how the R&D phase will be managed, and with which tools, from a project management point of view.

TDR

Outline (from INFN-PM-QA-504)

1. Physics Case
2. Results from R&D
3. Technical Description
4. Validation
5. Installation and Commissioning
6. Safety
7. Management



WPs

I. Physics Reach
II. Mechanical Design
    i. Cryostat and Vacuum vessel
    ii. Cryostat Support
    iii. Cavity
    iv. Tuning System
    v. Shield
    vi. Installation
III. Cryogenic Design
    i. Cryogenic plant
    ii. Service turret (consider both 4K and 2K)
    iii. Cryostat Cryogenics
    iv. Control and Diagnostic
IV. Radiofrequency
    i. Cavity and tuning RF design (Axion)
    ii. Antenna couplings for Axions GW etc.
    iii. Cavity design for HFGW
V. Signal Amplification and Acquisition
    i. SQUID (resonant (Axion) and broad band (GW))
    ii. Secondary Amplification
    iii. B Shielding
    iv. Calibration
VI. DAQ, Computing and Data Analysis
VII. Safety

R&D

SQUID:

- Tnoise vs Tbath
- Wideband amplification
- Shielding

Cavity prototype:

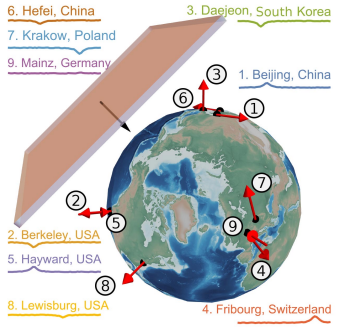
- Q0
- Tuning
- Thermalization
- Vibrations

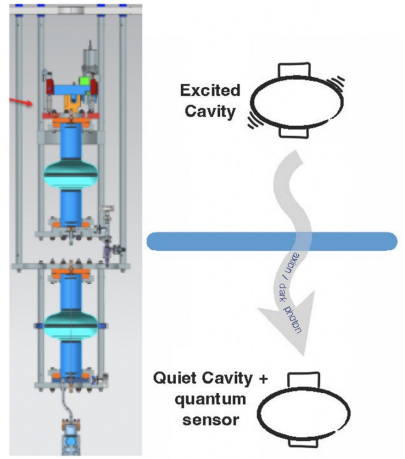
DAQ:

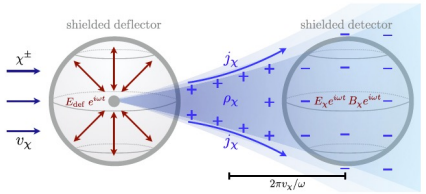
- FPGA multimode acquisition

Perspectives for future uses of the cryostat

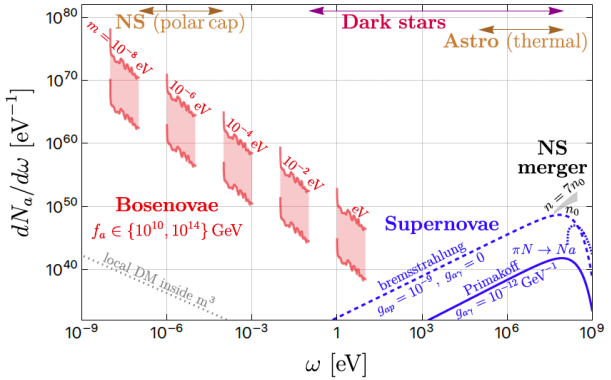
1. FLASH 100 mK (quantum metrology at 100 MHz)
2. HFGW antenna in network
3. DM Deflector experiment
4. LSW experiments
5. Axion Astronomy
6. …







PHYSICAL REVIEW LETTERS 124, 011801 (2020)



arXiv:2402.00100