Status of Work on Permanent Magnets (PerMaLIC) and Harmonic Cavities (HarmonLIP)

Francis Perez

on behalf of

PerMaLIC and HarmonLIP collaborations

LEAPS League of European Accelerator-based Photon Sources

LEAPS WG2 Meeting
Nijmegen, October 23rd, 2024

PerMaLIC

What it is?

PerMaLIC is a ***LEAPS Internal Collaboration***,

i.e. a collaboration between the institutes of the LEAPS Consortium (https://leaps-initiative.eu),

about **development of Permanent Magnets for the future, ultralow emittance, light sources**.

Motivation

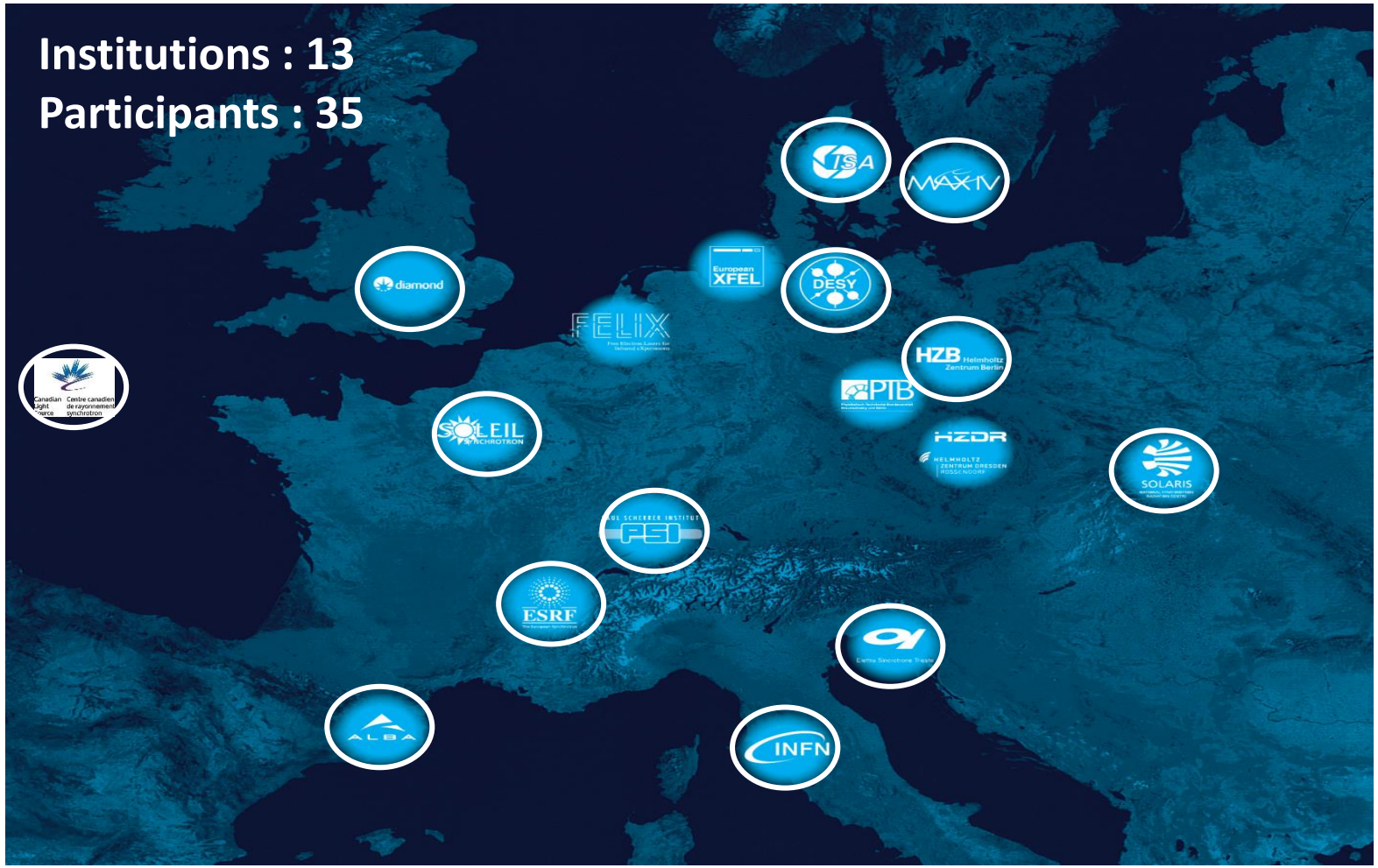
The **use of Permanent Magnets** in the new light sources has mainly two advantages: in the one hand, it allows a **more compact distribution of magnets**, since there is no need of coils and water cooling; in the other hand, it allows to **reduce the running costs and the carbon footprint** of the facility thanks to the removal of the power supplies associated to conventional electromagnets.

However, the use of Permanent Magnets also presents some **serious challenges**. These challenges include the **loss of flexibility** for the correction of errors, correction that it is needed to ensure the proper beam dynamics performance and stability, and the **long term stability** of the magnets themselves due to the risk of radiation-induced demagnetization.

LEAPS League of European Accelerator-based Photon Sources

PerMaLIC

PerMaLIC



LEAPS League of European Accelerator-based Photon Sources

Activities

Online seminars:

- **Permanent Magnets developments at STFC. Achievements and lessons learned**. By Ben Shepherd - STFC – Daresbury, on December 3rd, 2021.
- **Permanent Magnet Longitudinal Variable Dipole: Design, Construction and Test.** By Manuel Dominguez - CIEMAT – Madrid, on March 24th, 2022.
- **SIRIUS Superbend: Design, Construction, Instalation and Tests.** By James Citadine - SIRIUS – Brazil, on June 9th, 2022.
- **Radiation Effects of Permanent Magnets.** By Ben Shepherd - STFC – Daresbury, on March 31st. 2023.

Workshops:

- **1st PerMaLIC Workshop**, September 22nd, 2021. Remote. https://indico.cells.es/event/623/.

- **2nd PerMaLIC Workshop**, November 3rd-4th, 2022. ALBA. https://indico.cells.es/event/1229/.

- **Low Emmitance Ring – Permanent Magnets Workshop**, November 14th-15th, 2023. Trieste. https://indico.cells.es/event/1373/.

  Organized together ***LEAPS and iFAST***.

Activities

PerMaLIC

Low Emittance Ring - Permanent Magnets Workshop

November 14th-15th, 2023. Trieste.

42 participants
20 institutions
5 companies

LEAPS League of European Accelerator-based Photon Sources

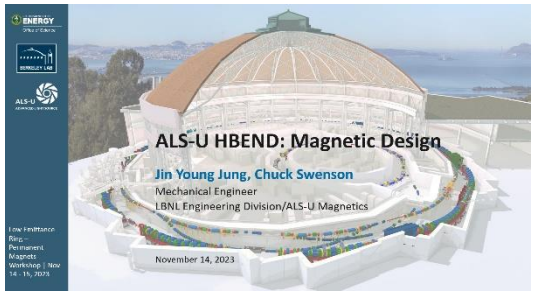
Activities

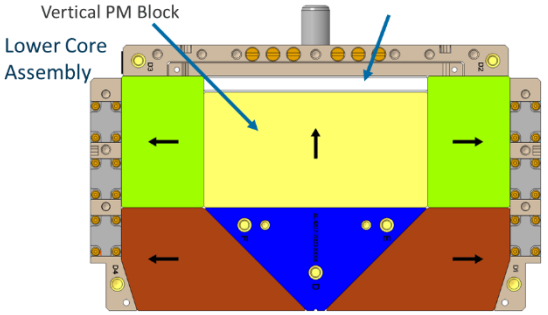
Low Emittance Ring - Permanent Magnets Workshop

PerMaLIC

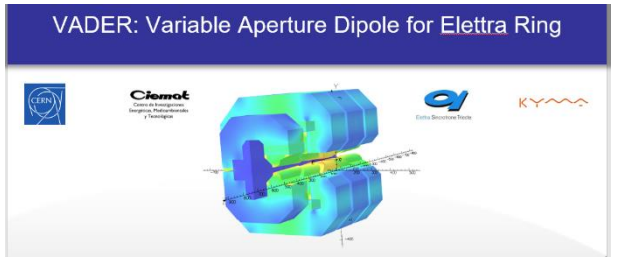
Sessions on:

Magnets design

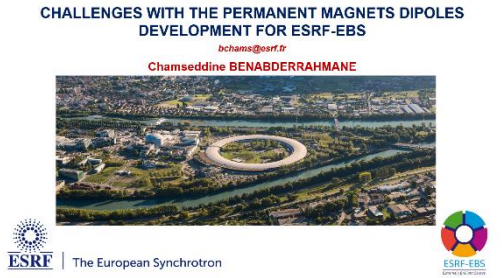




Magnets prototyping



PM Technical challenges



Industry and Projects

LEAPS League of European Accelerator-based Photon Sources

Proposals for activities

- **PermaLIC activities are a success.**
- **Active engagement of the participants in the intense discussions confirm that Permanent Magnets is a interesting topic.**
- **PMs are being important to the current upgrade projects, as well as to future generation storage rings, for saving energy concerns.**

- **Continue with remote seminars.**
- **Continue with Permanent Magnet workshops.**

  Proposed for Spring 2025

  After the successful workshop on November at ELETTRA, the intention is to organize it again together with iFAST. It is considered a very useful workshop by the participants, and there is a broad support to repeat it.

HarmonLIP

HarmonLIP
Workshops on Harmonic Cavity Systems at Fourth and Future Generation Storage Rings

HarmonLIP

Workshop Objectives

– To foster **information exchange and joint research efforts** amongst the LEAPS members for the further development of harmonic cavity/bunch lengthening systems for present and future ultralow emittance storage rings.

– Provide a **forum for communications** amongst various already existing multi-lab collaborations on the topic.

LEAPS League of European Accelerator-based Photon Sources

Acitivites

Workshops:

HarmonLIP

- **HarmonLIP 2022 Workshop**, October 10-12, 2022. MAX IV. https://indico.maxiv.lu.se/event/5098/.

- **HarmonLIP 2024 Workshop**, May 18-20, 2024. ESRF. https://indico.esrf.fr/event/122/overview.

LEAPS League of European Accelerator-based Photon Sources

Acitivites

2024 Workshop:

HarmonLIP

54 registered
17 in person
15 institutions

LEAPS League of European Accelerator-based Photon Sources

Acitivites

2024 Workshop:

HarmonLIP

Sessions on:

Project Overview

Status and development of harmonic-cavity project at KEK

Naoto Yamamoto,
Shogo Sakanaka, Daichi Naito, Takeshi Takahashi (KEK)

25 minutes, including questions

KEK

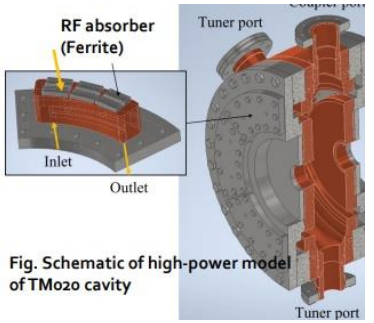


Fig. Schematic of high-power model of TM020 cavity

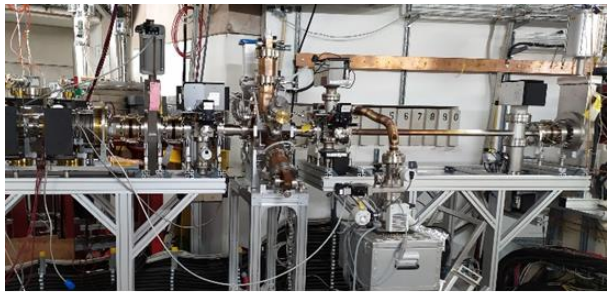
TM020 type
Harmonic Cavity

Beam Dynamics

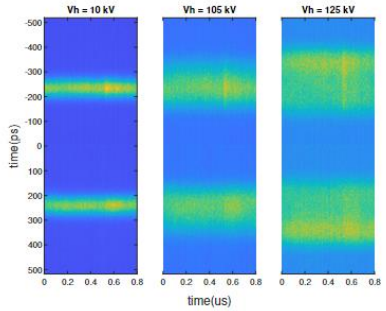
ALBA SYNCHROTRON

P. Solans on behalf of ALBA, HZB and DESY

3rd Harmonic Active EU-HOM damped cavity commissioning results



Cavity installed in BESSY-II



Engineering R&D

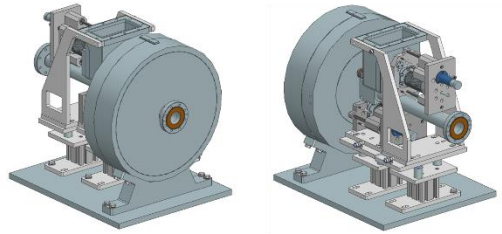
PETRA IV. NEW DIMENSIONS

PETRA-IV

Development of a Single Mode Cavity for the Third Harmonic RF-System of PETRA IV

HarmonLIP Workshop 2024

Peter Hülsmann – DESY - MHF
Grenoble, March 19-20, 2024



DESY type
Shintake Cavity
Prototype

HELMHOLTZ

DESY.

LEAPS League of European Accelerator-based Photon Sources

Proposal for activities

HarmonLIP

- HarmonLIP 2022 & 2024 were a success.
- The active engagement of the participants in the intense discussions confirm that Harmonic Cavity Systems is indeed a very hot topic, crucial to the current upgrade projects as well as to future generation storage rings.

- The HarmonLIP community **wishes the project to be continued**.
- The next proposed event is **HarmonLIP 2025, to be help in autunm 2025, at ALBA.**

LEAPS League of European Accelerator-based Photon Sources

PerMaLIC

HarmonLIP

Conclusions

Both collaborations are active and very useful to the community.

Both will greatly benefit by a continuation of the finantial support by LEAPS.

LEAPS League of European Accelerator-based Photon Sources

HarmonLIP

Thanks!

LEAPS League of European Accelerator-based Photon Sources