



## 2023 Helmholtz – OCPC – Programme for the involvement of postdocs in bilateral collaboration projects

### PART A

**Title of the project:**

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Development of lattice correction and optimisation methods for PETRA IV commissioning

**Helmholtz Centre, division:**

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DESY-M

**Project leader:**

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Dr. Lukas Malina

**Contact Information of Project Supervisor:** (Email, telephone)

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**Web-address:**

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[https://petra4.desy.de/index\\_eng.html](https://petra4.desy.de/index_eng.html)

**DESY Group:**

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DESY-MPY – Accelerator Physics

**DESY-OCPC Programme Coordinator** (Email, telephone and telefax)

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**Description of the project** (max. 1 page):

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DESY, with more than 2700 employees at its two locations in Hamburg and Zeuthen, is one of the world's leading research centres. Its research focuses on decoding the structure and function of matter, from the smallest particles of the universe to the building blocks of life. In this way, DESY contributes to solving the major questions and urgent challenges facing science, society and industry. With its ultramodern research infrastructure, its interdisciplinary research platforms and its international networks, DESY offers a highly attractive working environment in the fields of science, technology and administration, as well as for the education of highly qualified young scientists.

DESY is developing the ultimate X-ray microscope for nano research with outstanding potential for industrial users and socially relevant applications in energy research, information technology, mobility, environment and medicine.



With PETRA III, DESY operates one of the best storage ring X-ray radiation sources in the world. Research groups from all over the world use the particularly brilliant, intense X-ray light for a variety of experiments - from medical to materials research. But the 2300-metre-long storage ring PETRA has even more potential: DESY plans to expand it into a high-resolution 3D X-ray microscope for chemical and physical processes - the future project PETRA IV. PETRA IV is a planned fourth-generation synchrotron light source with an ultra-low emittance. It extends the X-ray view to length scales from the atom to millimetres. Researchers can thus analyse processes inside a catalyst, a battery or a microchip under realistic operating conditions and specifically tailor materials with nanostructures. PETRA IV also offers outstanding possibilities and optimal experimental conditions for industry. PETRA IV is expected to begin operations in 2029, two years after PETRA III shutdown. The achievable tolerances on lattice imperfections, such as equipment misalignments or magnet gradient errors, would, without correction, prohibit reaching the design parameters of PETRA IV. This project focuses on developing methods and preparing applications to efficiently commission the PETRA IV beam, starting from the first injection to reaching day-one operational parameters. In preparation for commissioning, the planned automated procedures should be benchmarked with simulations, incorporated into expert high-level control applications and experimentally verified in PETRA III before its shutdown.

**Description of existing or sought Chinese collaboration partner institute (max. half page):**

**Required qualification of the postdoc:**

- PhD in physics or engineering or equivalent qualification
- Knowledge of accelerator physics and technology
- Experience in the design or operation of storage rings or other accelerator facilities
- Experience with beam dynamics codes (such as MAD-X, Elegant, AT, and SAD)
- Extensive experience with Python programming language
- Experience with control systems and data analysis techniques
- Knowledge of modern software development techniques and principles
- Ability to work in a team and good communication skills
- Fluency in English