



## 2020 HGF – OCPC – Programme

### for the involvement of postdocs in bilateral collaboration projects

**Title of the project:**

Analysis of long term electron orbits and their correlation to environment parameters at PETRA III

**Helmholtz Centre, division/group:**

DESY, Accelerator division

**Project leader:**

Rainer Wanzenberg

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**Department/Group: (at the Helmholtz centre or Institute)**

Accelerator physics group / MPY

**Programme Coordinator (Email, telephone and telefax)**

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

Analysis of long term electron orbits and their correlation to environment parameters at PETRA III

DESY is one of the world's leading research centres for photon science, particle and astroparticle physics as well as accelerator physics. More than 2400 employees work at our two locations Hamburg and Zeuthen in science, technology and administration.

As part of DESY's strategy for its large scale facilities, the PETRA III storage ring, which is currently one of the world's brightest synchrotron light facilities in the hard X-ray range, is planned to be upgraded to PETRA IV. The new storage ring will be operated with an ultra-low emittance providing diffraction-limited hard X-ray beams with more than two orders of magnitude increase in brightness and coherence compared to PETRA III. In December 2019 the conceptual design report (CDR) for the planned upgraded facility PETRA IV was published. The CDR demonstrates that it is possible to build a synchrotron light facility with an ultra-low emittance within the existing infrastructure of PETRA III. PETRA buildings are based on tunnels and halls from different construction periods which are planned to be

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reused and extended for PETRA IV.

The risk mitigation strategy for planned new storage ring will cover investigations at PETRA III related to long term orbit stability and its correlation to environment parameters including the tunnel temperature and the mechanical movement of different tunnel segments with respect to each other. Orbit data, set points of corrector magnets and several environment parameters in the PETRA tunnel are monitored and archived via the accelerator control system. A detailed analysis of the archived data orbit data and the set points of corrector magnets will reveal the long term stability of PETRA III orbit and give indications for potential sources of orbit distortions. An important further step is to correlate the orbit data with environment parameters in the tunnel which are also monitored and achieved. Recently, several heaters have been installed in one part of the PETRA III tunnel to stabilize the tunnel temperature. Correlations to the mechanical movements of the tunnel segments have been recognized but the influence on the electron orbit has not yet been investigated. A correlation analysis of these data will be an important part of the proposed project.

The results of the project will be beneficial for PETRA III since one can gain a further understanding of the stability of the orbit which may even include measured movement of the photon beam at the beam lines in the Ada Yonath hall. Furthermore, the results will be also important for PETRA IV since one can get indications for planned improvements of the mechanical stability of the tunnel.

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

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**Sought institute:**

University with a department on accelerator physics with a strong interest in storage rings / synchrotron radiation facilities

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Accelerator physics department of a synchrotron radiation facility

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**Required qualification of the post-doc:**

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<Sample text below>

- PhD in physics
- Experience with accelerator physics including a good understanding of electron beam optics
- Additional skills in data analysis and programming skills in MATLAB are an advantage
- Language requirement: very good knowledge of English including the ability to write scientific papers