



## 2026 Helmholtz – OCPC – Programme

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

#### PART A

**Title of the project:**

Precision Detector Design: Optimising ILD for a Circular Electron-Positron Collider

**DESY Division & Group:**

FH-FTX

**Project leader/supervisor:**

Thomas Madlener, [thomas.madlener@desy.de](mailto:thomas.madlener@desy.de)  
Frank Gaede, [frank.gaede@desy.de](mailto:frank.gaede@desy.de)

**Web-address:**

<https://ftx.desy.de>

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

Martin Sandhop; [martin.sandhop@desy.de](mailto:martin.sandhop@desy.de); +49 40 8998 4172

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

The International Large Detector (ILD) is a state-of-the-art detector concept originally designed for the International Linear Collider (ILC), a proposed linear electron-positron collider. ILD is also a leading candidate for circular colliders such as the Circular Electron Positron Collider (CEPC) in China or the Future Circular Collider (FCCee) at CERN. However, circular colliders operate at lower center-of-mass energies (e.g., 91–365 GeV for CEPC vs. 250–500 GeV for ILC) and feature significantly higher bunch-crossing frequencies, necessitating a dedicated optimization of the ILD layout to fully exploit their physics potential.

The transition from a linear to a circular machine introduces critical differences in operating conditions that demand a tailored optimization of the ILD detector layout. Key adjustments include reducing the yoke thickness due to a lower magnetic field while maintaining luminosity, thinning the hadronic calorimeter to exploit lower particle energies without compromising jet energy resolution, and reconfiguring the tracker and vertex detector geometries to balance momentum resolution, material budget, and background rejection. This project will systematically explore these layout variations through detailed simulations, evaluating their impact on critical performance metrics such as tracking efficiency, jet energy resolution, flavour tagging, and vertex reconstruction with relevant physics benchmarks. The possibility of applying machine learning techniques replacing classical reconstruction and pattern recognition tasks for this study could be an interesting option.

The studies will be carried out using the Key4hep software ecosystem that is jointly used and developed by the international community for future collider studies.

DESY is one of the leading institutes in developing the Key4hep stack and a key player in detector development.



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

IHEP is the flagship institute of Particle Physics Research in China and the potential host institute of the Circular Electron Positron Collider. IHEP leads the CEPC detector design, including the baseline detector concept. IHEP develops the CEPC-specific simulation tools in CEPCSW as part of Key4hep and DESY and IHEP already have an established collaboration in this direction.

While IHEP is a natural partner for this activity, there are also many other Chinese Particle Physics groups being active on future collider programs, that would be very suitable partners for this project.

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**Required qualification of the postdoc:**

- PhD in Particle Physics
  - Experience with programming in modern C++ and python
  - Language requirement: excellent English language skills (oral and written)
  - Experience with event reconstruction software for particle detectors
  - Knowledge of key4hep software stack including DD4hep would be an asset
  - Knowledge of modern machine-learning tools such as *PyTorch* would be an asset
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