**2018 Helmholtz – OCPC – Program**

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

**DESY\_OCPC\_2018-16**

**PART A**

**Title of the project: High Precision Time Projection Chambers**

**Helmholtz Centre and Research Group: DESY**

**Project leader: Ties Behnke**

**Web-address:** http://flc.desy.de/

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

Large volume gaseous detectors are attractive options for three-dimensional imaging detectors. Over the past 10 years large advances have been realised in the underlying technologies. A major step was the move towards readout with micro-pattern gas detectors. More recently, marrying time projection chambers with silicon pixel readout chips promise yet another major step forward in imaging granularity. DESY has been working on developments of advanced time projection chambers since many years, and has access to both prototypes and data from prototype experiments. In China activities for advanced time projection chambers have recently seen in increased interest in connection with the CEPC project.

A major challenge to be met by these systems is the alignment and the calibration to the required accuracy. Calibration is needed to correct for imperfections in the readout system, to correct for field distortions and other effects. Alignment effects are relevant between different modules, and relative to other, external detectors.

We propose to do a comprehensive study of the alignment and calibration of a modern time projection chamber as proposed for example for experiments at colliders or for neutrino experiments. In this project alignment methods should be developed for these advanced systems based on simulation models. The usefulness of different approaches – internal alignment, comparison to external reference systems, or dedicated calibration systems for example based on laser systems or similar systems, should be understood and compared. Using the available data from prototypes the simulation models should be confronted with data and the assumptions tested.

During the time of the proposed project the TPC prototype setup at DESY will be extended by the inclusion of a high precision silicon tracker, which can be used as an external reference. Data from this setup will play a central role to validate the methods developed earlier.

A powerful tool for internal alignment of such systems can be laser beams. Part of the study therefore should be a study to explore the optimal way to use laser beams for alignment purposes, and to study potential limitations.

**Ongoing or planned Cooperation**

Recently in the context of the CEPC project time projection R&D has become a renewed topic of interest at IHEP, Beijing, in China. Connections between DESYs and the Chinese group at IHEP have recently been re-intensified. We intend to further develop this over the coming years. The IHEP group is particularly interested in the design and operation of a laser calibration setup for time projection chambers, which could provide a perfect connection point for the project described here. However cooperation in a broader range of topics connected to the development of time projection chambers are anticipated.

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

* PhD in experimental particle physics or nuclear physics
* Experience with modern detectors in particle and/or nuclear physics
* Experience with modern simulation systems for experiments in particle physics

**PART B**

**Documents to be provided by the post-doc, necessary for an application to OCPC via a postdoc-station:**

* + Detailed description of the interest in joining the project (motivation letter)
  + Curriculum vitae, copies of degrees
  + List of publications
  + 2 letters of recommendation
  + Proof of command of English language

**PART C**

**Additional requirements to be fulfilled by the post-doc:**

* Max. age of 35 years
* PhD degree not older than 5 years
* Very good command of the English language
* Strong ability to work independently and in a team