2020 HGF – GSI – OCPC – Programme

for the involvement of postdocs in bilateral collaboration projects

Title of the project:

Development and Evaluation of the Picosecond Frontend Electronics for the antiproton experiments at PANDA Barrel DIRC

Helmholtz Centre and institute:

GSI Helmholtzzentrum for Heavy Ion Research GmbH

Project leader:

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PANDA Detectors/HPD

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

This detector physics project offers the candidate the opportunity to make important contributions to an unique new high-energy physics detector system in the final stage of R&D and the start of component fabrication.

The PANDA experiment at FAIR in Darmstadt, Germany, will study anti-proton induced reactions in the charmonium energy region with unprecedented energy resolution and luminosity.
One major challenge is to identify the reaction products with dedicated detector systems. PANDA will use two Cherenkov detectors based on the DIRC (Detection of Internally Reflected Cherenkov light) principle for charged particle identification in the target spectrometer. The high interaction rate of up to 20 MHz needs a data acquisition which can cope with the time-tagged streams of data from the various front end electronics of the PANDA sub-detectors.

The innovative PANDA Barrel DIRC uses a front end electronic where the time of arrival of single photons from 8000 pixels of Microchannel-Plate PMTs is measured by FPGA-based TDCs and with FPGA-based discriminators on a highly-integrated backplane. The readout electronics were developed at GSI for the HADES/CBM and PANDA experiments and need to be optimized for the fast

Barrel DIRC signals. The experimental evaluation of the performance will take place in the DIRC electronics lab at GSI.
The challenge is to reliably measure small signals in the millivolt region with high efficiency and a timing precision of 100 picoseconds or better for a large number of channels. Procedures for determining the discriminator thresholds need to be developed and implemented in the existing software framework and tested with a picosecond laser pulser system. Walk corrections of the discriminator outputs have to be applied in order to achieve the best possible system timing resolution. Ultimately, the front end electronics has to work in a magnetic field of about 1 Tesla in a space-limited, actively cooled detector volume and has to survive radiation levels of 100 rad.

The candidate will be involved in the implementation and testing of the different front electronics components. The proper grounding scheme and prevention of noise pickup are required for maintaining excellent timing precision for a system with many channels. Software packages need to be developed to handle the efficient control and monitoring of the Barrel DIRC readout system.

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

None.

Required qualification of the post-doc:

- PhD in nuclear physics or particle physics
- Experience with C++, Perl programming, ROOT analysis framework
- Interest in detector physics
- Language requirement: English