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PACBIT — Third-Generation TDPAC Data Acquisition and Analysis

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With its unique combination of an external magnetic field of up to 8.5 tesla and the ability to heat and cool samples during measurements, the MULTIPAC Time-Differential Perturbed Angular Correlation (TDPAC) setup creates new possibilities for studying materials and their phase transitions. Building on this advanced instrumentation, the dedicated control and analysis software PACBIT enables high-performance data acquisition, streamlined experiment control, and efficient post-processing. A brief outline of the detector configuration is given, followed by an exposition on how the system increases the effective resolution beyond the 10-bit limit of the U5310A digitizer through advanced signal processing techniques. Operating in streaming mode with parallel HDF5, the data acquisition (DAQ) delivers high throughput and allows the collection of more data than in previous setups. This increased data rate enables the application of stricter coincidence selection rules while maintaining a large number of events, thereby improving statistical accuracy, reducing background noise, and enhancing measurement reliability. Post-processing features include signal smoothing, precise timestamp calculation, and automatic removal of secondary pulse signals. Finally, a coincidence search algorithm is presented that exploits the increased dataset to deliver more accurate event correlations, paving the way for better experimental results and new opportunities in high-resolution TDPAC spectroscopy.

Authors: MOKHLES GERAMI, Adeleh (School of Particles and Accelerators, Institute for Research in Fundamental Sciences (IPM)); PINHO DOS SANTOS SOUZA, Alexandre (Instituto de Pesquisas Energéticas e Nucleares IPEN-CNEN/SP); ALVES MIRANDA FILHO, Arnaldo (Instituto de Pesquisas Energéticas e Nucleares IPEN-CNEN/SP); DÖRSCHER, Björn (University Duisburg-Essen); SANTOS CORRÊA, Bruno (Instituto de Pesquisas Energéticas e Nucleares IPEN-CNEN/SP); LUPASCU, Doru (Universität Duisburg-Essen); YAP, Ian Chang Jie (University of Duisburg-Essen); HEINIGER-SCHELL, Juliana (CERN); LAURIN BALTENSBERGER, Lars (Eidgenössische Technische Hochschule Zürich (ETHZ)); HEGELUND STEGENBORG, Magnus (Aalborg Universitet, Department of Materials and Production); PEREIRA DE LIMA, Nicole (Instituto de Pesquisas Energéticas e Nucleares IPEN-CNEN/SP); DANG, Thien Thanh (University of Duisburg-Essen)

Presenter: DÖRSCHER, Björn (University Duisburg-Essen)

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