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PACIFIC2: a cost-effective solution for digital data acquisition and processing in PAC spectroscopy

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The γ-γ Perturbed Angular Correlation (PAC) spectroscopy's unique ability to probe atomic-scale phenomena makes it an exciting technique for studying structural, magnetic, and orbital phase transitions in solid-state physics, as well as investigating the intrinsic properties of radioactive nuclei. [1-3]
Historically, ISOLDE's PAC setups relied on aging analog equipment, some over 30 years old, or on expensive bulky digital systems. To modernize and streamline our PAC data processing capabilities, we embarked on a series of performance evaluations using the DT5730S desktop digitizer from CAEN S.p.A. [4] With 8 input channels, a 500 MS/s sampling rate, and a 14-bit ADC, this compact digitizer seamlessly integrates into both 4 and 6-detector PAC configurations. Given the challenge of managing and analyzing vast data sets our team developed the PACIFIC^2 suite—a collection of Python-based tools designed specifically for PAC spectroscopy data acquisition and processing.
In this talk, we will present our latest developments, explore new perspectives for digital data processing in PAC spectroscopy, and highlight key results from the recent ^{111m}Cd beam time. Additionally, we will discuss recent findings on the naturally layered perovskite system $Ca_3Ti_2O_7$, focusing on how the measurement of the Electric Field Gradient (EFG) has helped resolve longstanding controversies regarding the nature of its structural transitions and how the PAC spectroscopy offers a sensitive method for probing anomalous ferroelectric behavior in this system. [5]

References:

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[5] P. Rocha-Rodrigues, et al., Phys. Rev. B 109, 224101 (2024)

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