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The Mamba Data Acquisition Software Project for HEPS

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Advancements in synchrotron methodology have long been limited by both hardware instrumentation and software. While hardware limitations are gradually being lifted with the emergence of next-generation light sources and beamline instrumentation, high (data) throughput, multimodal, time-resolved, in-situ and dynamic experiments performed at future beamlines are expected to impose tremendous challenges on the software end [1]. Even today, data acquisition software performance has become a key factor hindering advancements in synchrotron methodology.

To address pressing software challenges at High Energy Photon Source (HEPS), the data acquisition team launched the Mamba project in 2020, aiming to develop a systematic Python-based software framework on top of Bluesky (NSLS II) and complete ecosystem for the cutting-edge and data-intensive experiments carried out at the Phase I beamlines of HEPS. After nearly two years of R&D, Mamba's framework design was published online in the Journal of Synchrotron Radiation in May 2022 [2], laying a firm foundation for development of experimental applications at HEPS. During BSRF's first dedicated user operation period in 2022, Mamba-based data collection software applications were made available to experiments at multiple beamlines of a first generation synchrotron source (BSRF). This talk will present the progress of Mamba projects after two years development and our developing plans towards 2025.

References:

[1] Dong, Y., Li, C., Zhang, Y. et al. Exascale image processing for next-generation beamlines in advanced light sources. *Nat Rev Phys* 4, 427–428 (2022)

[2] Liu, Y., Geng, Y., Bi, X., Li, X., Tao, Y., Cao, J., Dong, Y. & Zhang, Y. Mamba: a systematic software solution for beamline experiments at HEPS. *J. Synchrotron Rad.* 29, 664-669 (2022)

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