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Minimalist beamline control and experiment software

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This presentation reports the efforts at HEPS to systematically approach the complexity lower bounds both in beamline control and in experiment software:

- The former (Liu 2022a) is done by minimising repetitive work on multiple scales: single devices (with reusable, modular and minimal IOCs), devices on a single beamline (with minimalist package management for EPICS modules), and all beamlines at HEPS (with the comprehensive beamline services).
- The latter (Liu 2022b) is done in the Mamba framework by its command injection / RPC mechanism, the Mamba Data Worker to implement modular data-processing graphs, and experiment parameter generators (EPGs) to abstract irrelevant or repetitive details.

In addition to the contents already in the papers cited above, also presented are some examples which the presenter believes to have satisfactorily approximated the complexity lower-bounds in certain aspects:

- ADXspress3 (with a paper in progress to discuss the techniques used in its refactoring process, which has been successfully applied to numerous projects), in minimising efforts required to adapt the IOC to a different number of Xspress3 boxes or channels.
- ihep-pkg (with recent updates, and also supporting Rocky Linux 8 now), in minimising the efforts required to maintain reproducible RPM packages for EPICS modules (covering the full synApps collection) which also provide reusable modular IOCs.
- (With a paper in progress,) based on an ophyd module implementing full control of PandABox's TCP server, a backend EPG for fly scans providing automated configuration of "PandA Blocks" for constant-speed mapping of various dimensions, as well as generation of scans deliberately fragmented to overcome hardware limits.

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