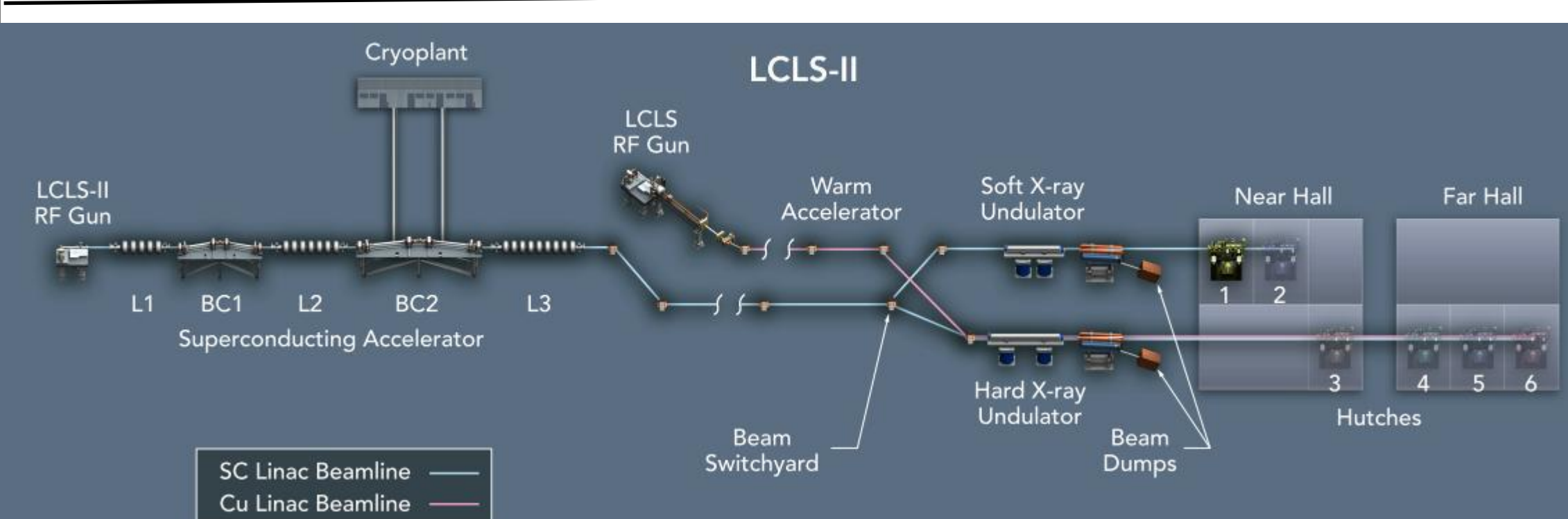


Roadmap for SLAC EPICS-based Software for the LCLS-I/II Complex

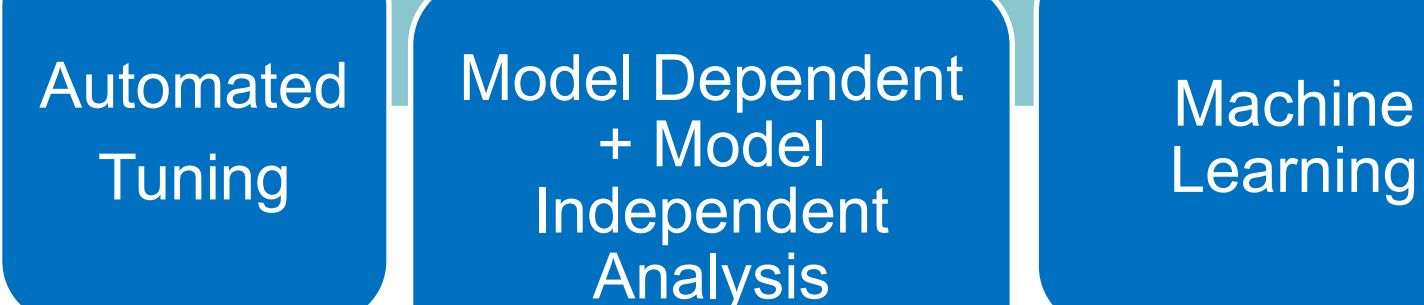
D. Rogind[#], J. Delong, D. Flath, M. Gibbs, B. Hill, T. Maxwell, A. Perazzo, M. Shankar, G. White, E. Williams Jr., M. Zelazny
SLAC National Accelerator Laboratory, Menlo Park, CA 94025, U. S. A.

Abstract

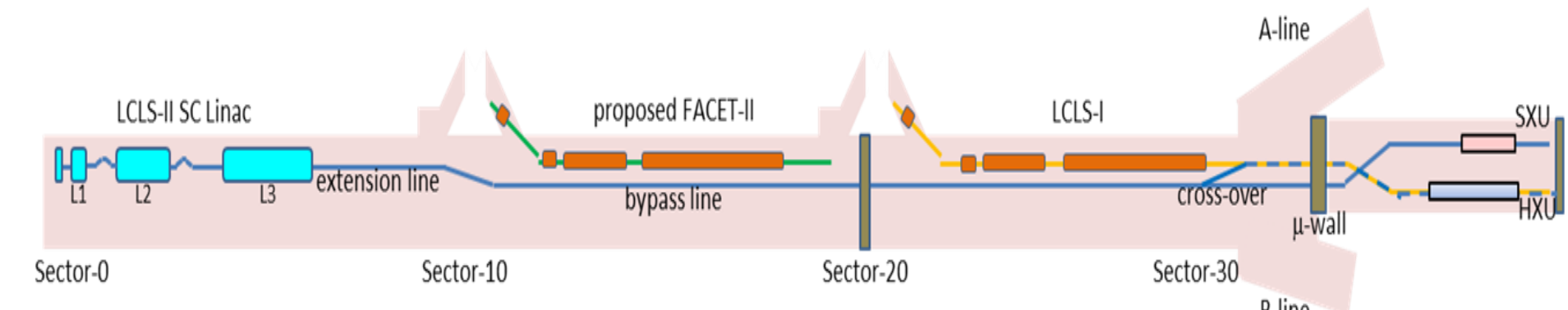


With the advent of LCLS-II construction, a SLAC-wide Software Roadmap was established. Complex bunch patterns and multiple beam paths require structured data and middle layer services motivating EPICS 7. Structured data flow will be leveraged for necessary improvements to middle-layer services required for the operation and modeling of multiple accelerators/beamlines.

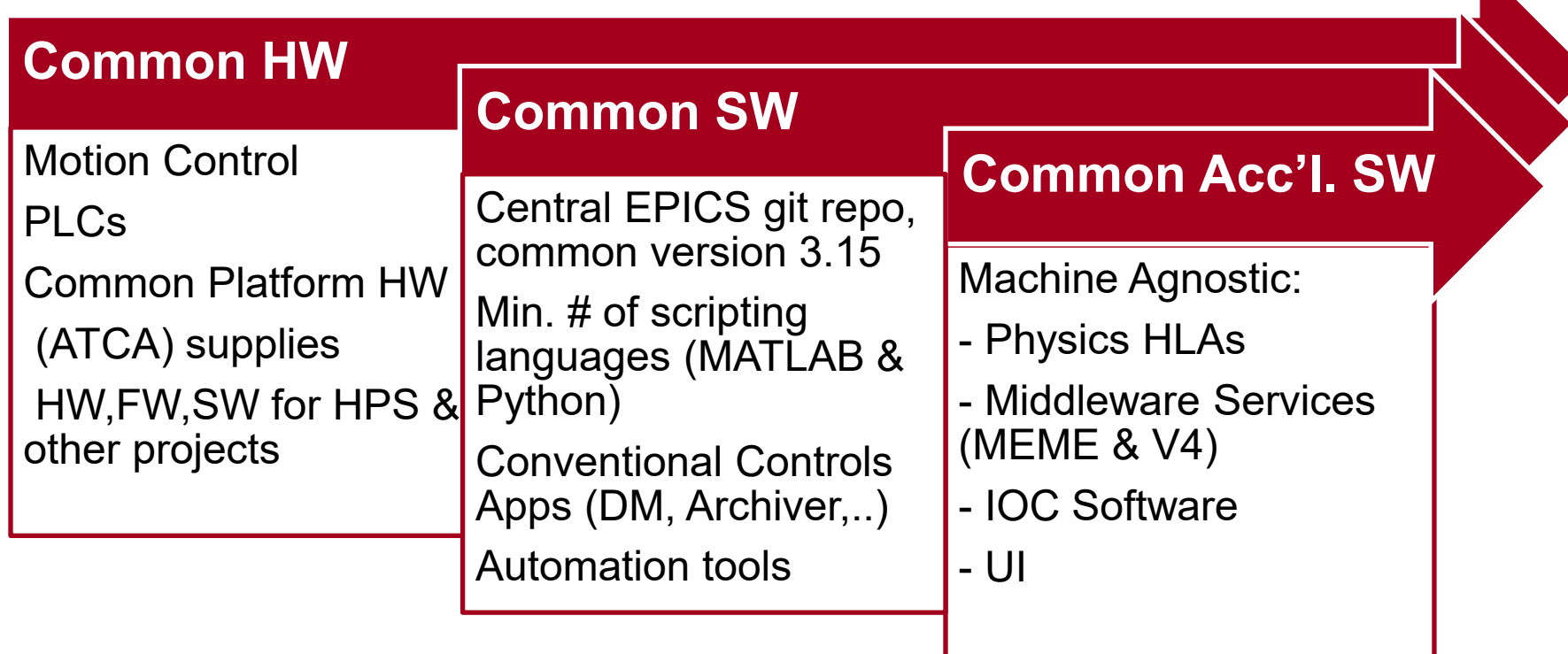
Long-term Goals



Principles



- SLAC has **multiple** facilities & multiple EPICS Controls Groups
- SLAC desires to reduce multiplicity, duplication, Non Recurring Engineering (NRE) development, support & maintenance efforts
- SLAC-wide working groups focus on standardization of implementations:



Plan

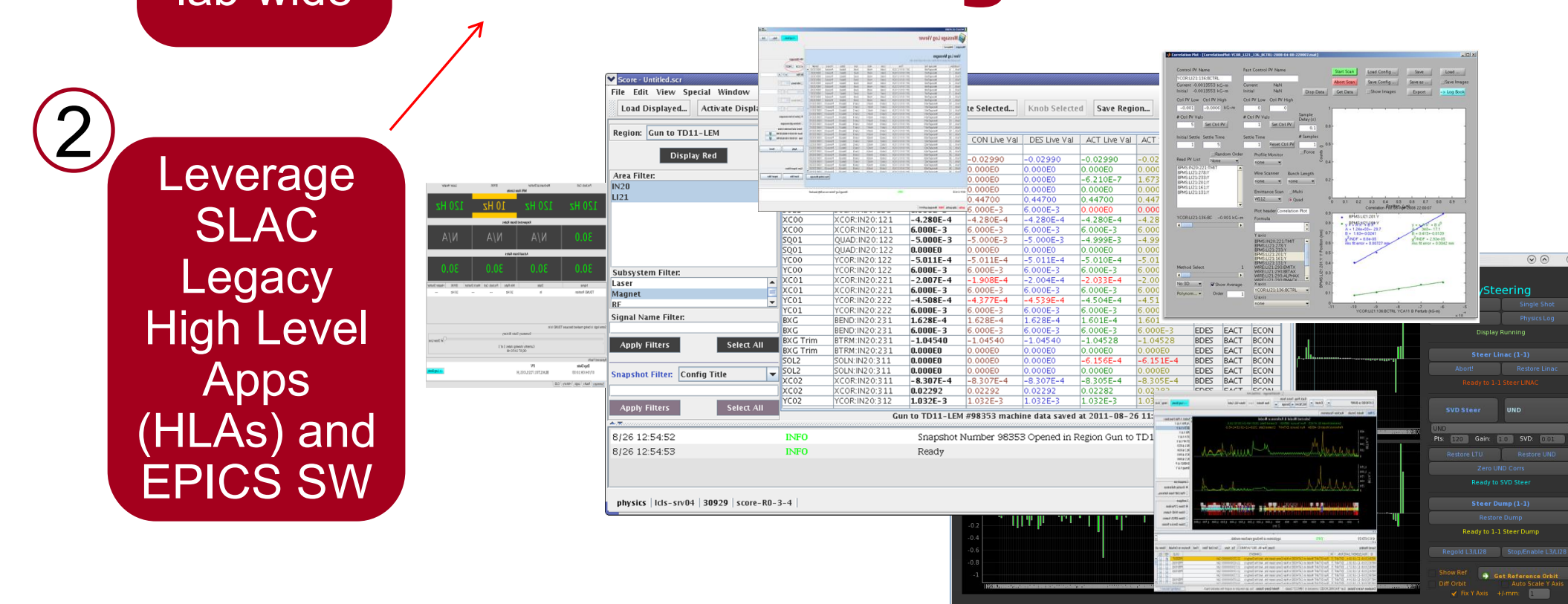
➔ ①, ②

Achieves effective software for a premier, production scientific facility...



① **SLAC EPICS repo & version**
 Unify on V3.15; upgrade to git from cvs/svn
 THPHA007 Git Workflow for EPICS Collaboration

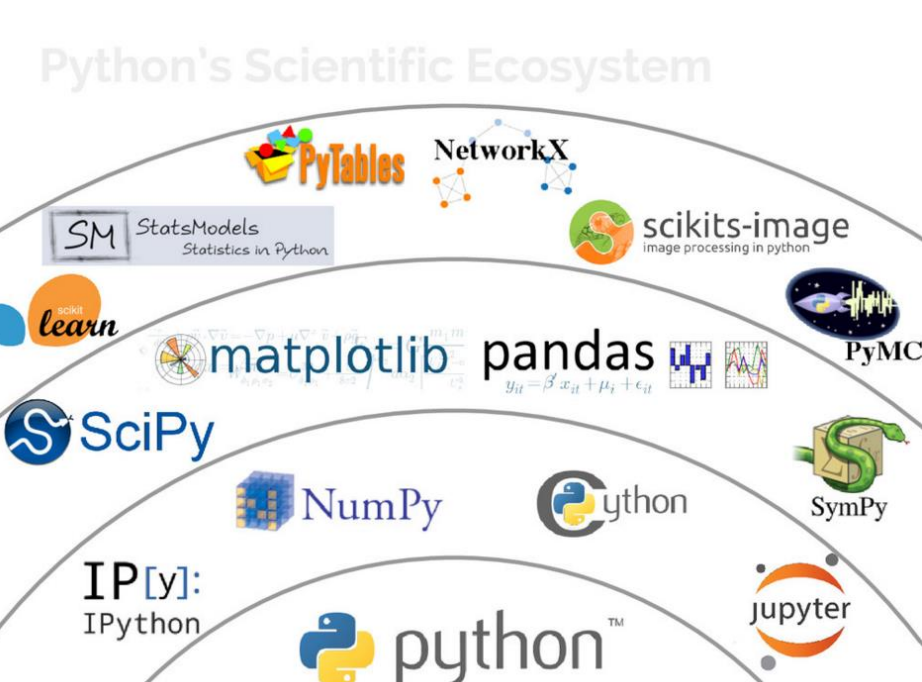
② **Machine Agnostic HLAs**



Plan ③, ④

③ Develop UI widget environment aligned with the modern scientific & programming community

PyDM



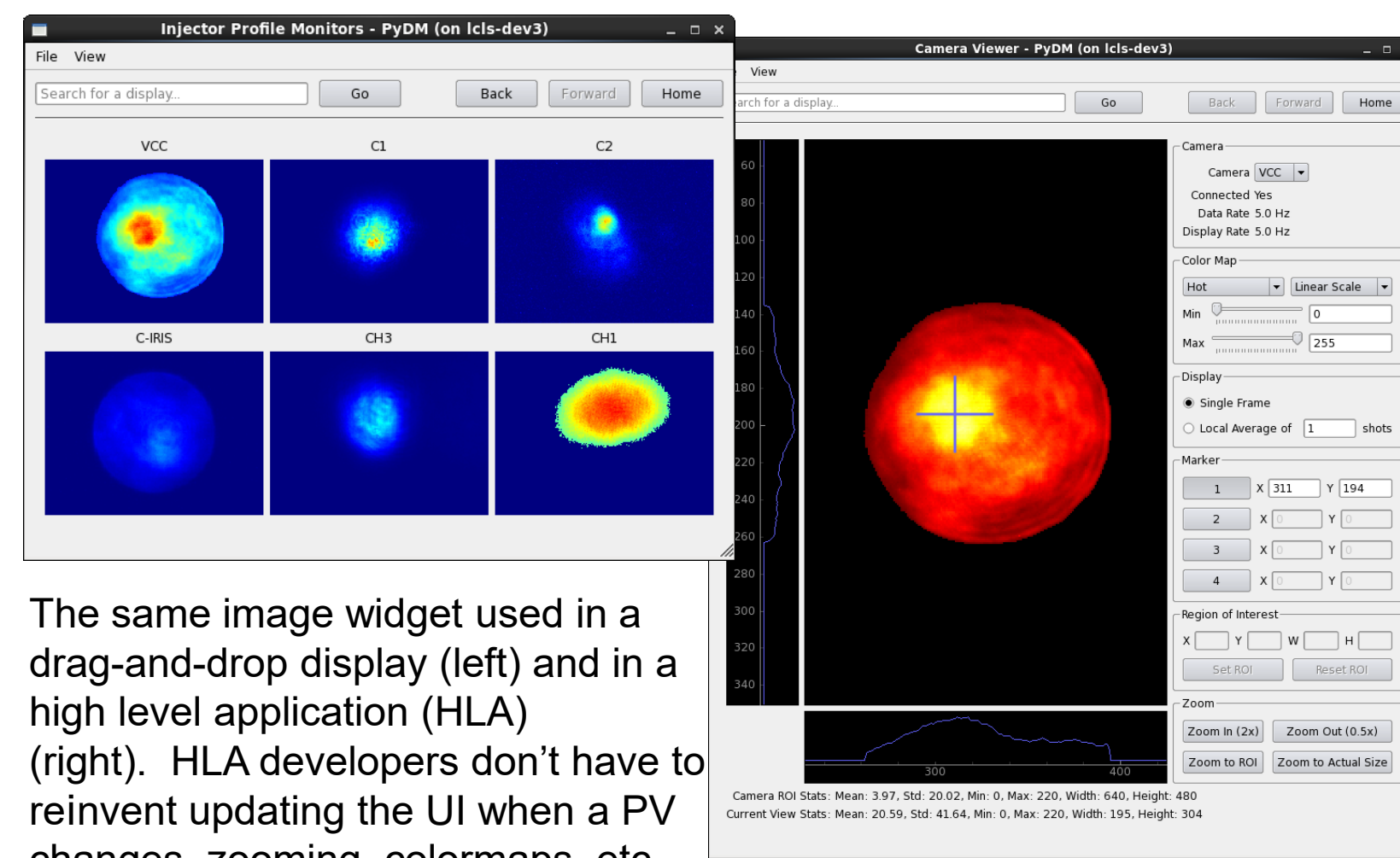
Why was PyDM chosen as a Display Manager over CSS BOY?

- Minimize # of languages & skill sets to maintain
- Dynamic displays can easily be built for LCLS-II, with complex, multi-e-beam destinations & multiple electron sources
- Fulfills SLAC-wide accelerator and beamline use cases
 - Beamline is developing PyDM
 - Operators, physicists, users, engineers widely script in python; low barrier to entry

Requires:

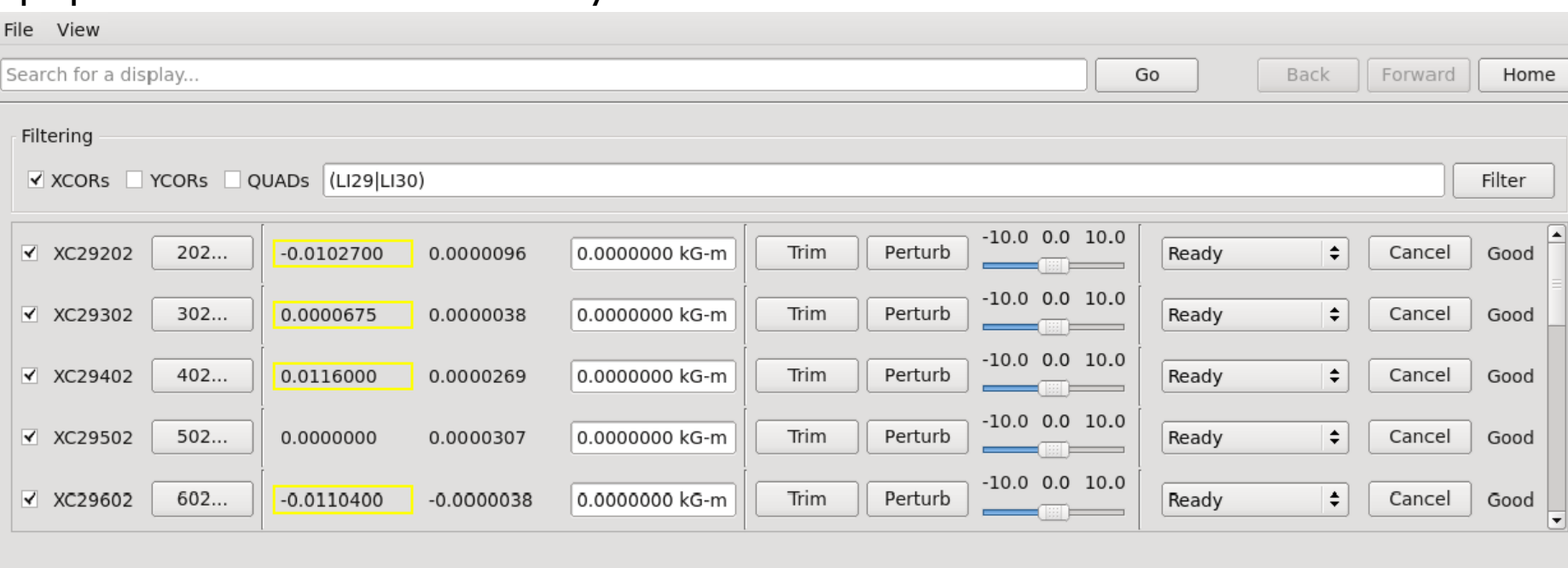
- pvaPy (for EPICS 7 enabled PyDM) evaluation; potential performance improvement
- Aggregation/throttling of PV monitor client callbacks
- EPICS 7 IOCs (requires a robust qSrv)
- EDM -> PyDM conversion utility (desired)

THSH102 PyDM: A Python-Based Framework for Control System Graphical User Interfaces



The same image widget used in a drag-and-drop display (left) and in a high level application (HLA) (right). HLA developers don't have to reinvent updating the UI when a PV changes, zooming, colormaps, etc.

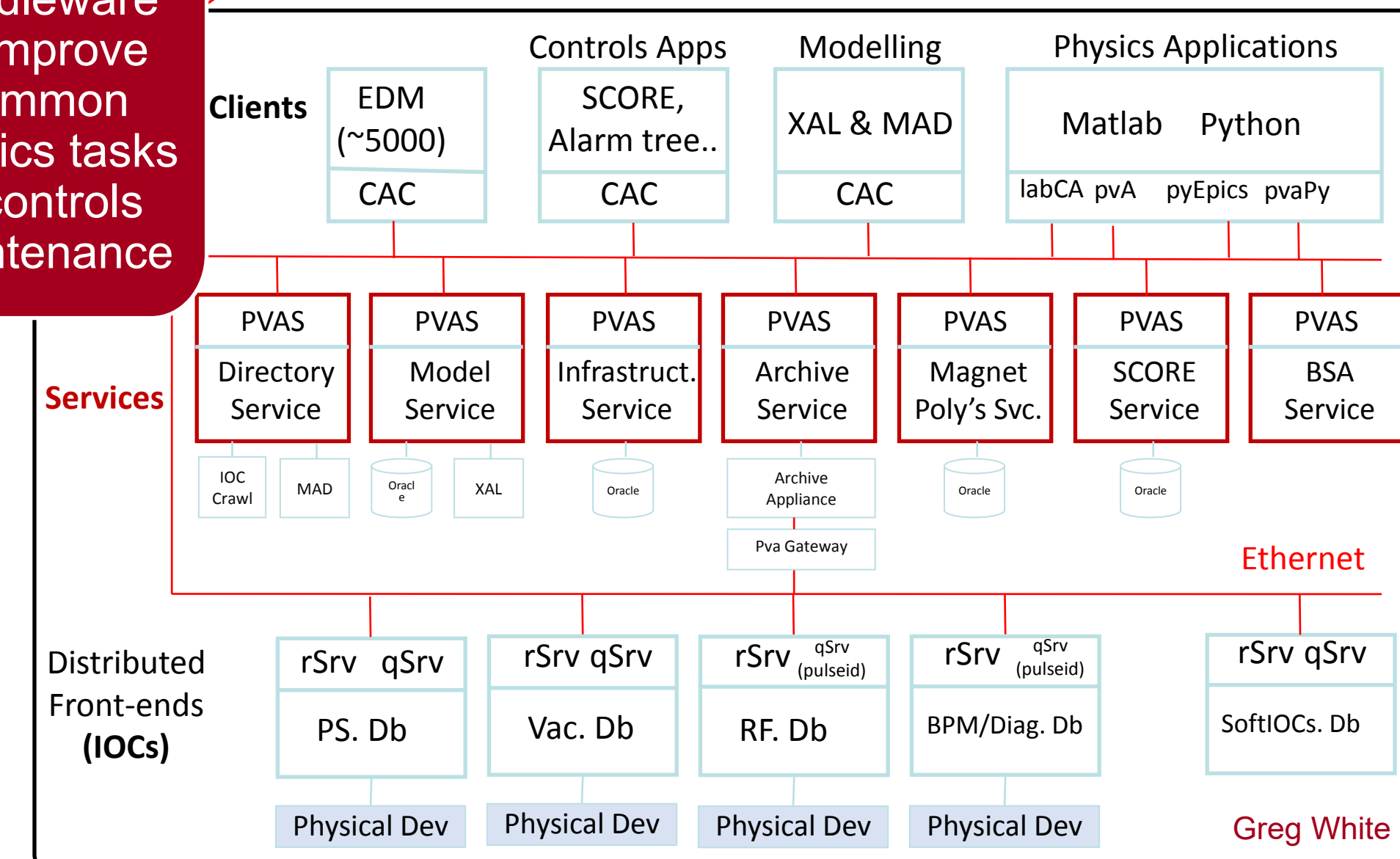
Dynamic displays are easy to build in PyDM. This magnet panel is filterable at run-time by magnet type and location. The scrolling list of filtered magnets is populated from the directory service.



Each row of magnet controls comes from a single, custom 'magnet item' widget, which is easy to reuse across many displays. This pattern (a custom widget for a type of device, paired with a list of devices gathered from a service) reduces development time and maintenance effort.

④ Middle Layer Services

Middleware to improve common physics tasks & controls maintenance



- Add to existing suite with pulse Beam Synchronous Acquisition (BSA) Service to synchronize data across devices (z) & deep time (phase) from LCLS-I & II timing data (diff. timing systems)
- Embed timing metadata (pulseID, charge, destination...) in NTScalar usertag

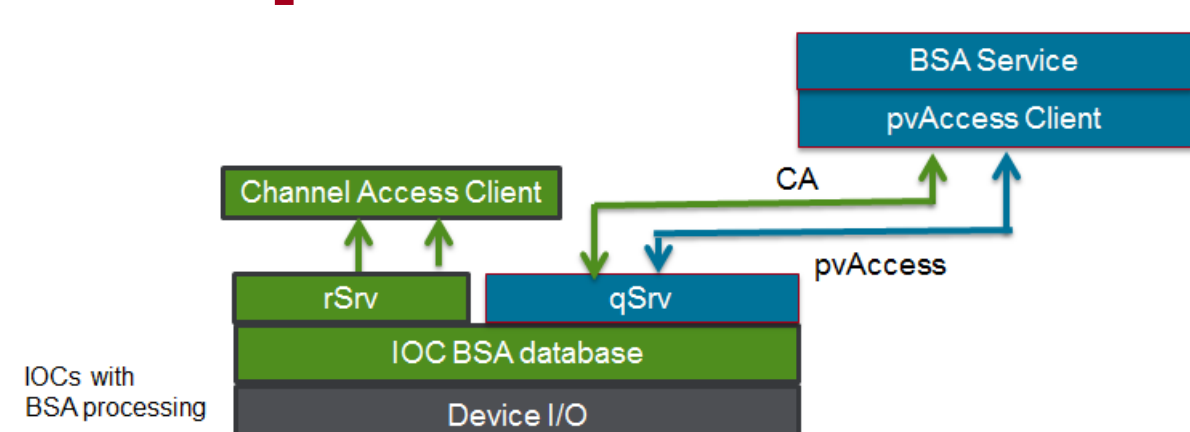
Requires:

- Timing metadata in NTScalar usertag, qSrv (equivalent of V3 rSrv), pvAccess Clients
- Archiver requires pvAccess Gateway

Plan ⑤

⑤ **Integrate EPICS 7 Components**

EPICS 7 Services need Structured Data



Component	Status & Plan
PyDM	In dev; contribute to EPICS community; collaborate
qSrv	From collaboration; make robust & contribute back
pvaPy	From collaboration; improve performance & contrib. back
Archive Appliance	Already EPICS 7-enabled; further enhance to embed timing frame; store/view complex data; contribute back
MAD model & new model Services	MEME framework in place; switch to MAD from XAL; merge LCLS-II with LCLS/FACET/ Devices DB RDB; Add other modeling services
BSA Service	Beam Synchronous Acquisition Service for LCLS & LCLS-II. Engage EPICS community for timing metadata incorporation
pvAccess Gateway (pva2pva)	From collaboration; make robust; add functionality; contribute back;
Data Aggregator	Evaluate options and develop to throttle pvAccess client callbacks

SLAC EPICS-based Software Roadmap



LCLS-II early injector commissioning (EIC) (FY18 Q1 – FY18 Q4) uses EPICS V3.15 IOCs, EDM, Channel Access (CA)

From now to FY20 (LCLS-II First Light) the following will be developed, as guided by the SLAC Software Working Group:

- PyDM Display Manger adds features; will be productized
- Timing metadata will be embedded in NTScalar
- qSrv is made robust & incorporated into V3 IOCs, producing EPICS 7 IOCs; pvAccess & CA co-exist
- Structured data (w timing metadata) served via EPICS 7 IOCs & pvAccess is served to EPICS 7-aware clients
- pvAccess Gateway further tested, developed, integrated
- Structured data archived to EPICS 7-enabled Archive Appliance and viewable by enhanced Archive Viewer
- LCLS BSA Service incorporates LCLS-II BSA data

Note: MAD model will replace XAL model in parallel

