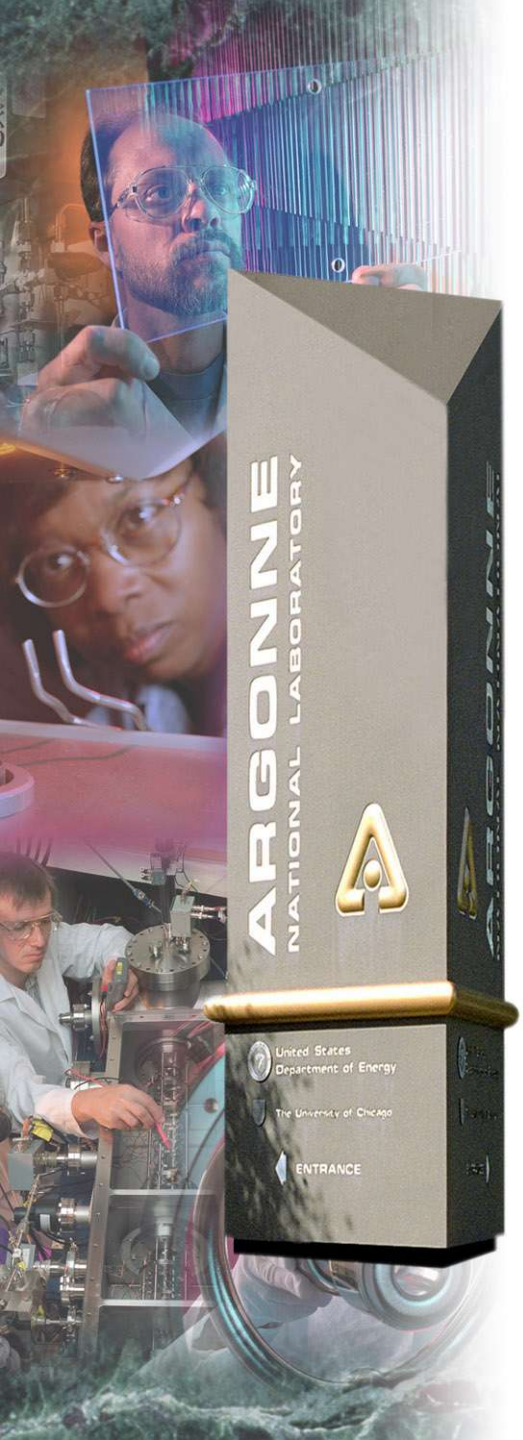

EPICS software for Turbo PMAC2 motion controller:

Provisions for much faster beamline.

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A U.S. Department of Energy
Office of Science
Laboratory Operated by The University of Chicago

Office of Science
U.S. Department of Energy

Outline

- Motion controllers by the Delta Tau Data Systems, Inc.
- EPICS driver for Turbo PMAC2-VME UltraLite motion controllers
- EPICS databases for motors and assemblies
- User interface
- Fast scanning – on-the-fly measurements

Motion Control is the key component

Motion Control is the key component of any beamline control system greatly affecting the capabilities of beamline automation and throughput. We have developed EPICS support for one of the most advanced controllers on the market -- the Turbo PMAC2-VME Ultralite motion controller by the Delta Tau Data Systems, Inc. Its key advantages include:

• the capability to synchronize on-the-fly motion of several drives thus allowing for fast on-the-fly scans of motor groups;

• modular design with fiber link greatly simplifying cabling and allowing to build distributed systems;

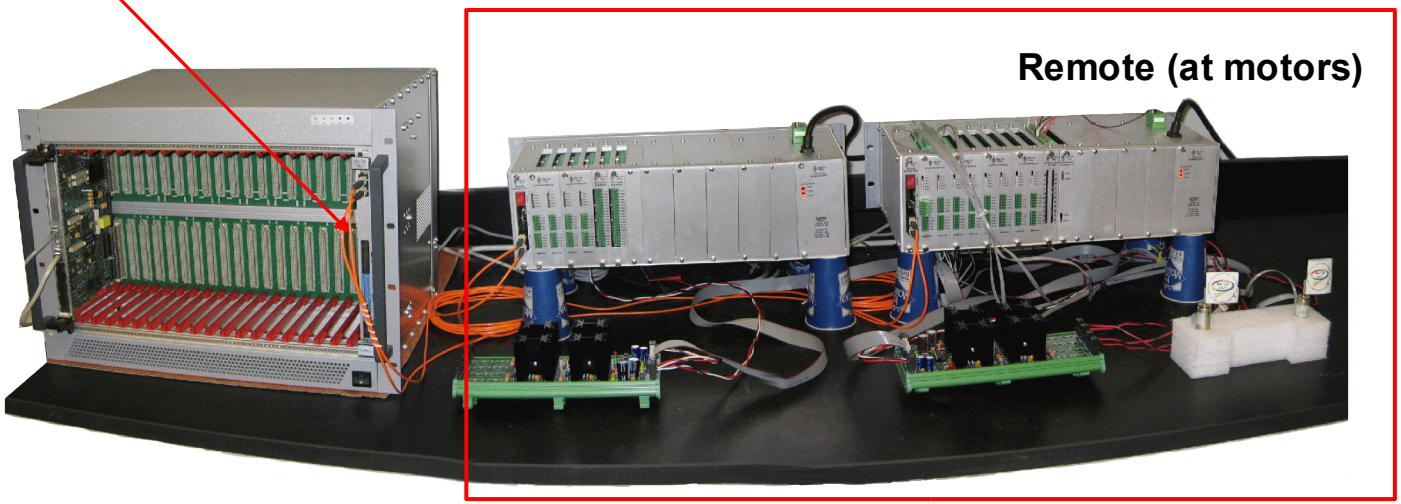
• capability to drive virtually any type of motors (DC brush & DC brushless servo, stepper, piezo, etc.) and control up to 32 axes;

• provisions to write custom motion programs, define custom servo cycles and generally tweak any motion parameter.

Turbo PMAC2-VME UltraLite

32-axis Turbo PMAC2-VME Ultralite motion controller.

2-3 cards can control the whole beamline!



Turbo PMAC2-VME UltraLite connected by optical fibers with two UMAC MACRO chassis. There is also a PCI version that may be supported with EPICS-3.14 and same set of EPICS DB.

EPICS support components

1. Driver for the Turbo PMAC2-VME UltraLite board (drvPmac)
2. Records (tsub, status)
3. Device support components:
   - “PMAC-VME ASCII” for the ai, ao, bi, bo, longin, longout, mbbi, mbbo, stringin and stringout records.
   - "PMAC-VME DPRAM“ for the ai, ao, bi, bo, longin, longout, mbbi, mbbo, and status records.

EPICS support features

• EPICS driver for Turbo PMAC2 UltaLite is derived from the PMAC1 prototype successfully used at several APS beamlines

• it was refined and made operational under two latest EPICS versions: 3.13 and 3.14.

• EPICS databases also derived from the ones for PMAC1.

• databases have been simplified and reduced by the factor of 10 in number of ERICS records.

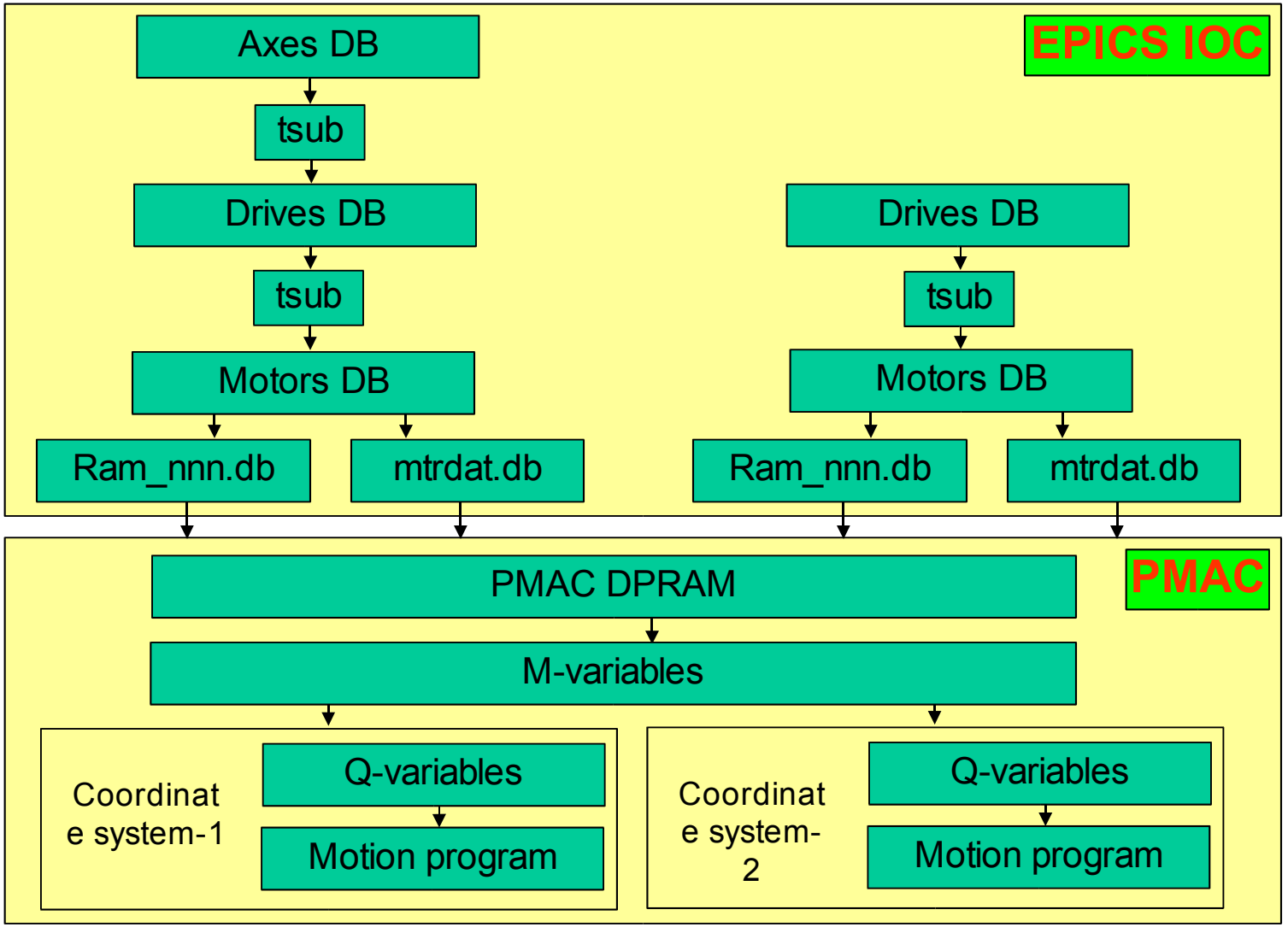
This resulted in easily maintainable and configurable control system. It is important to point out that the user interface part of the databases was essentially preserved and the capabilities were extended; for example the speed controls were added.

EPICS Databases

Unlike e.g. EPICS support for OMS-58 controller the databases for PMAC motors cannot be based on EPICS Motor Record. This is because one controls not individual motors, but assemblies of 1,2,3,4,5… motors. Besides, PMAC has much greater number of parameters than OMS-58.

The size of databases has been reduced from ~800 records per motor in the SBC and BioCAT version to less than ~100 for the cost of parameters not used in daily operations. This allowed to reduce the load on both the VME host computer and the PMAC controller as well as make much cleaner user interface.

Database block diagram



Distributed Motion Control

Turbo PMAC2-VME UltraLite connected by optical fibers with two UMAC MACRO chassis

GEO Drive MACRO

The Geo Drive family of brushless motor drive amplifiers consists of one and two axis 3-phase servo drive amplifiers that support a wide variety of motor types, power ranges, and user interfaces.

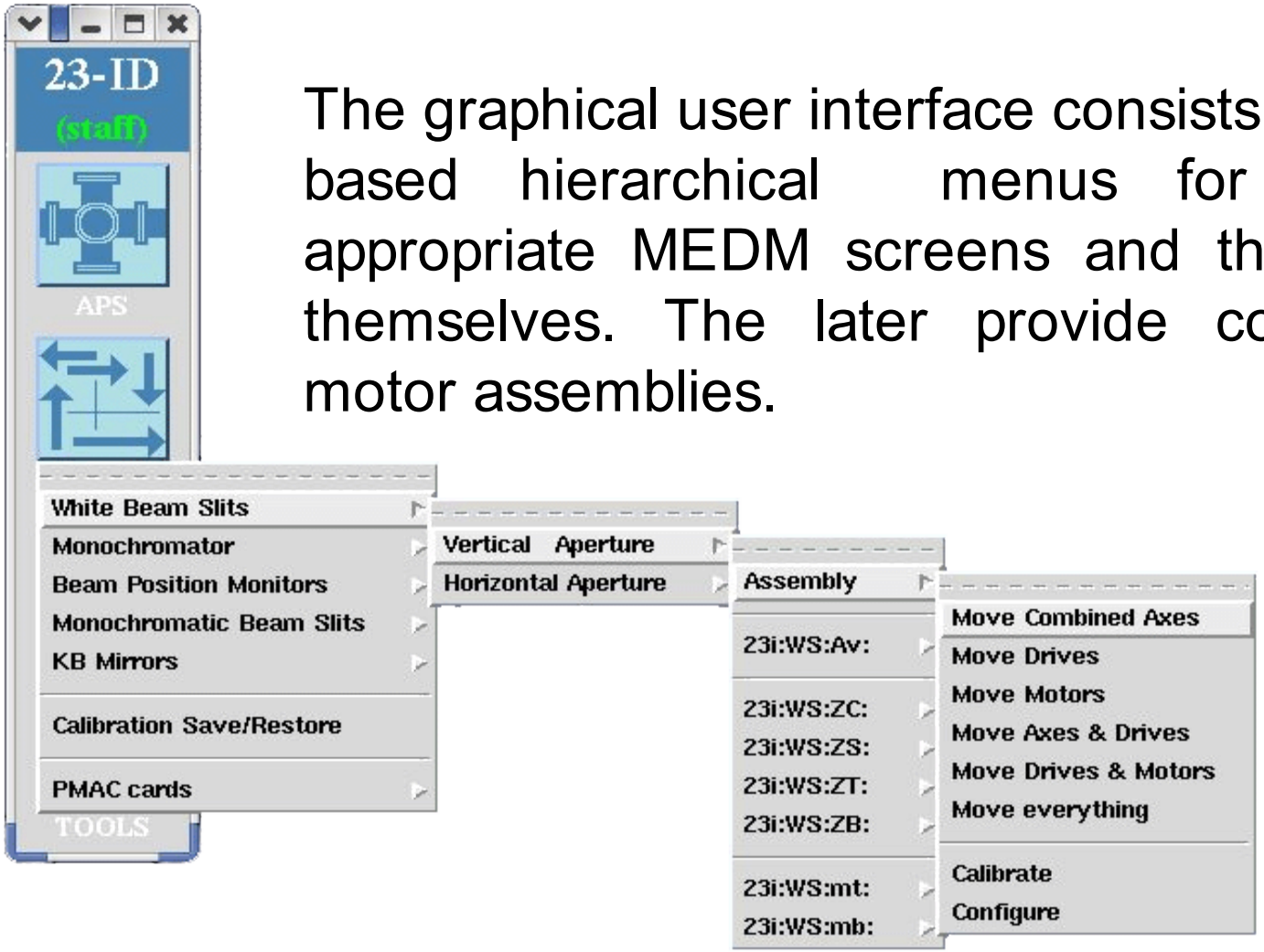
Motor Amplifiers/Drives

Linear Servo Amplifier by Windward Automation, Inc.

Linear Servo Amplifier by Trust Automation, Inc.

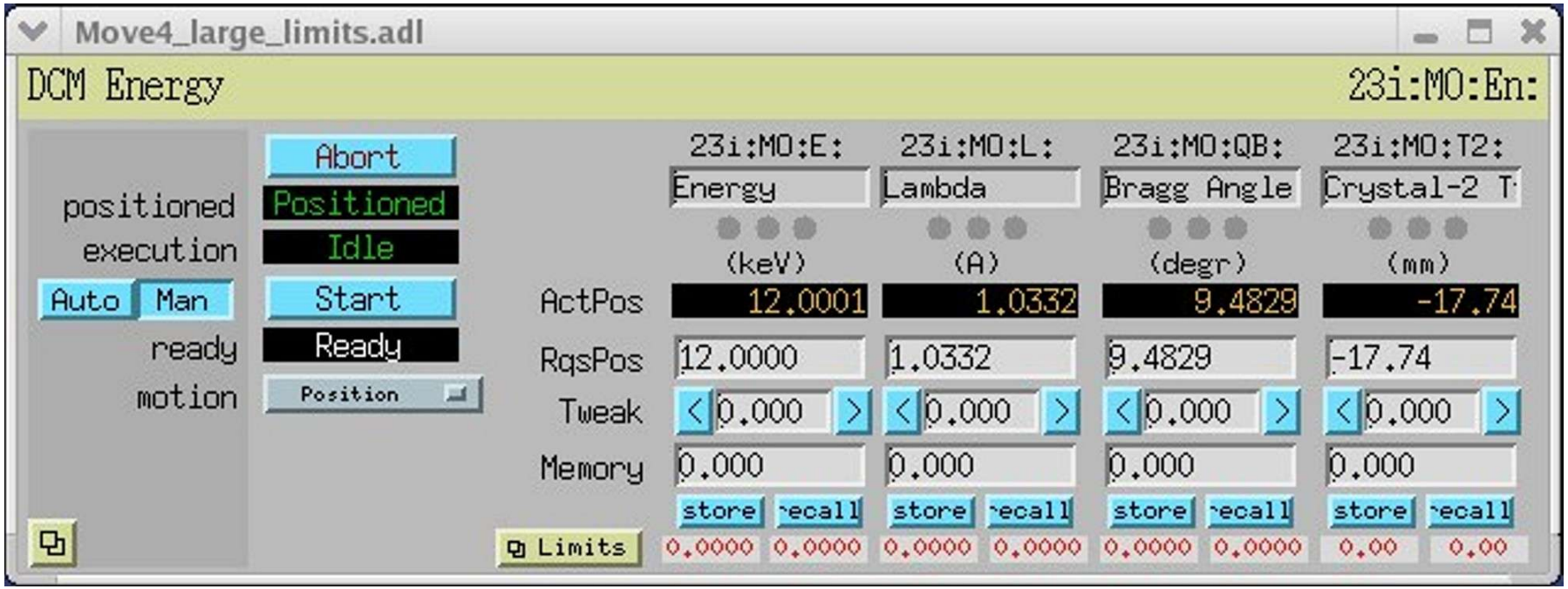
Step Motor drives by GFK Electronic GmbH

Upper level GUI



The graphical user interface consists of Tcl/Tk–based hierarchical menus for selecting appropriate MEDM screens and the screens themselves. The later provide controls for motor assemblies.

DCM Energy Control

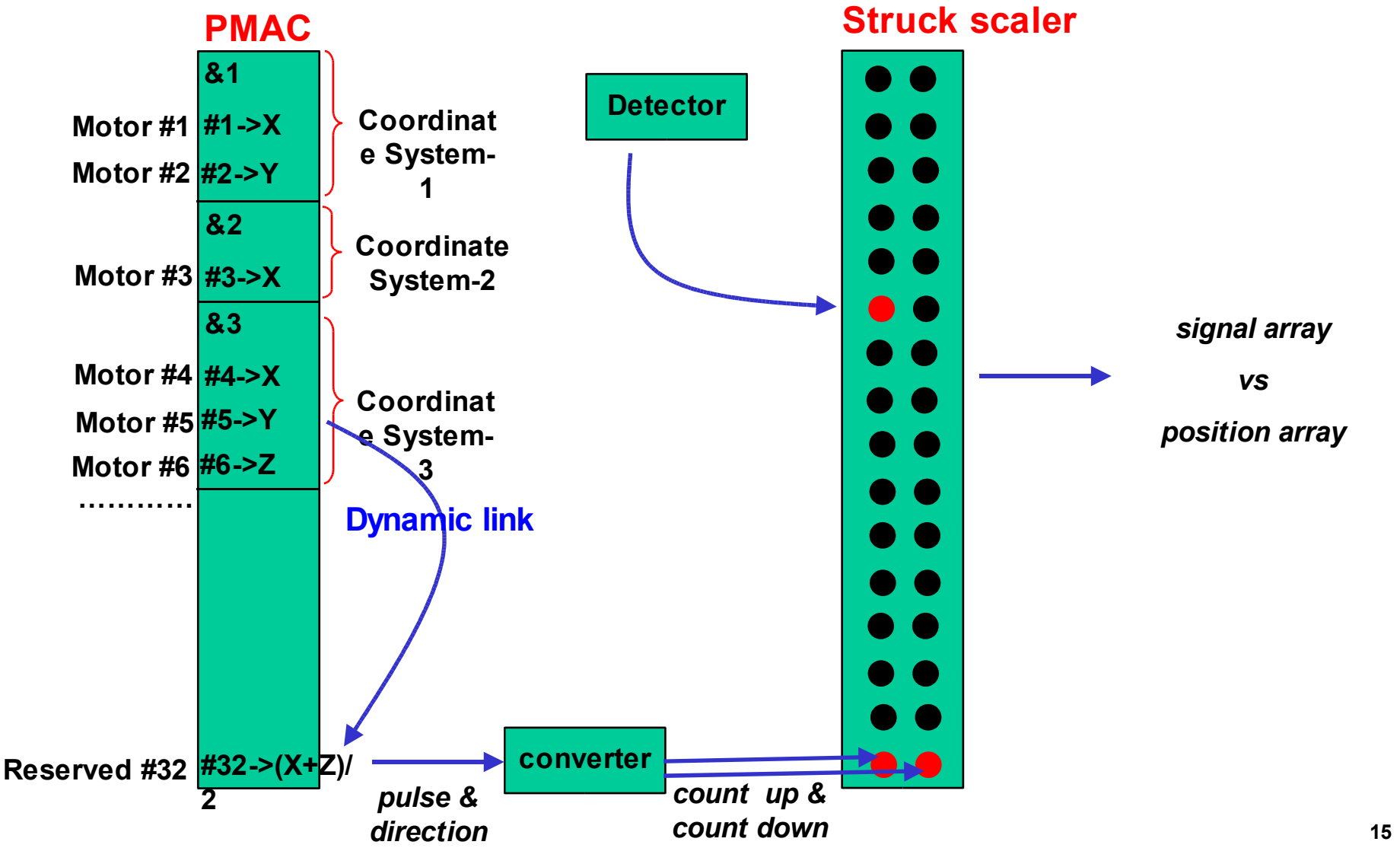


An example of the MEDM screen for monochromator energy assembly

Fast scanning

A capability of fast scanning with mapping any motor position to the output of one reserved PMAC channel that can be feed into a scaler has been demonstrated. This allows for scan times under one minute greatly improving beamline throughput.

Fast scanning algorithm



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