PAUL SCHERRER INSTITUT

PSI

Wir schaffen Wissen – heute für morgen

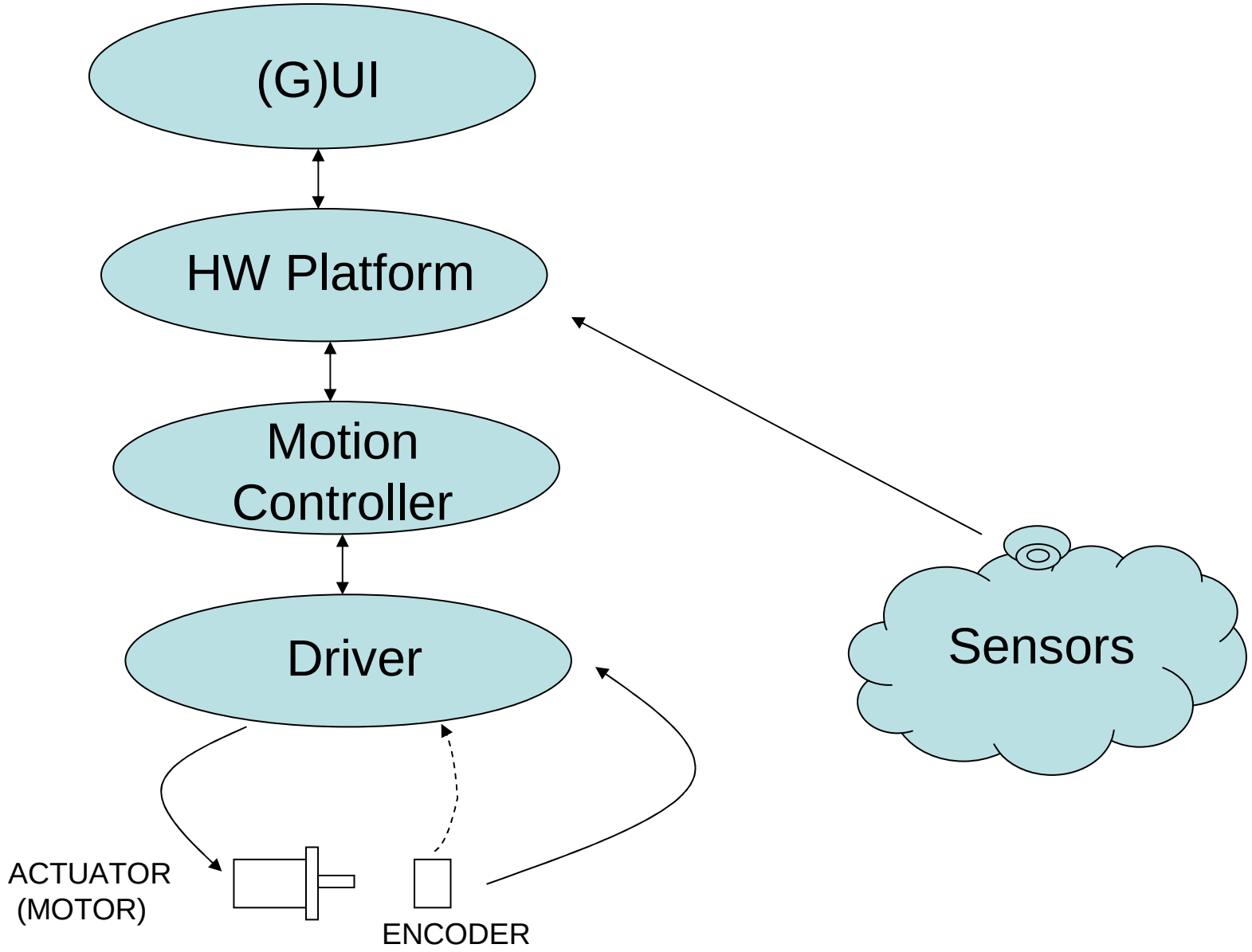
Paul Scherrer Institut

Claude Pradevand

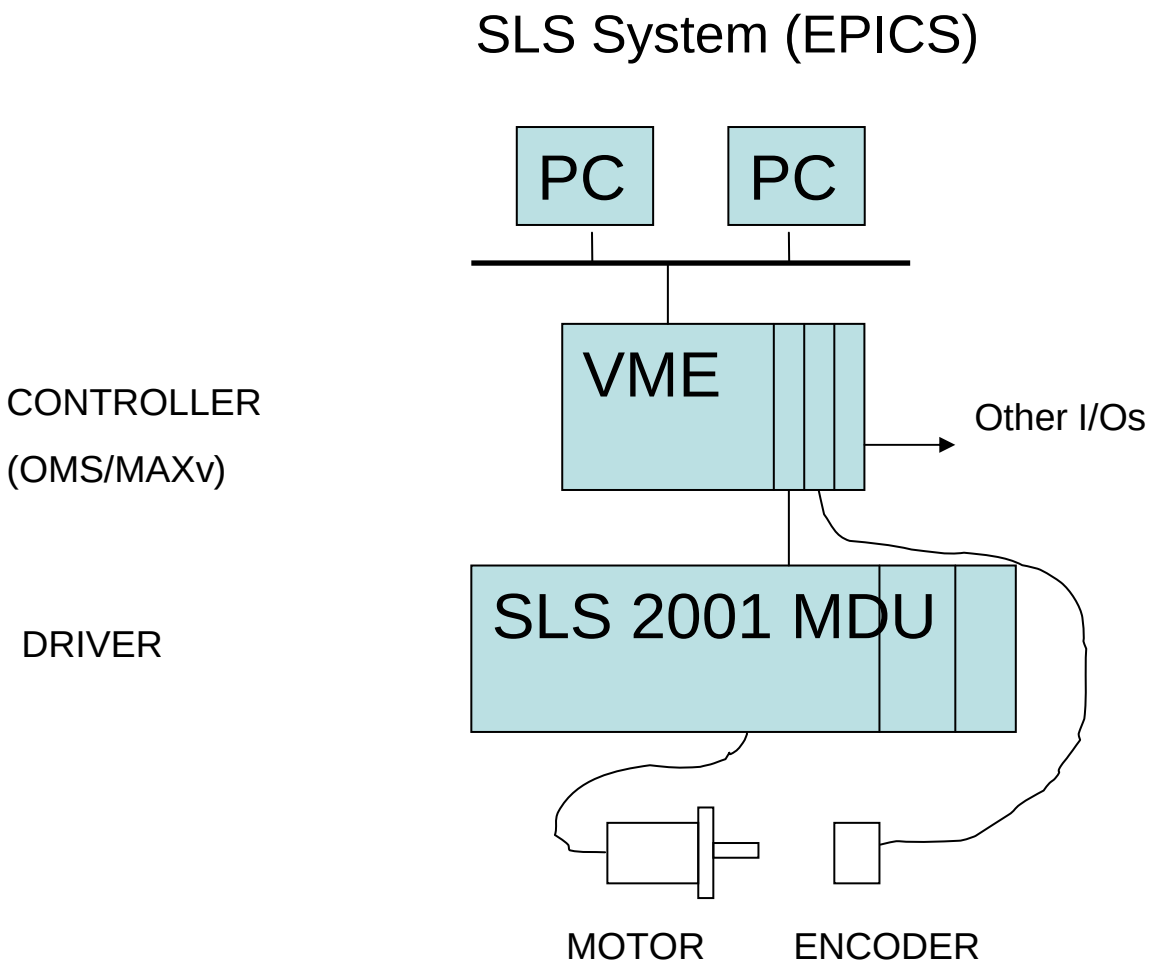
EPICS Collaboration Meeting fall 2011

Motion Systems Workshop

Positioning-System



SLS Motion Control System

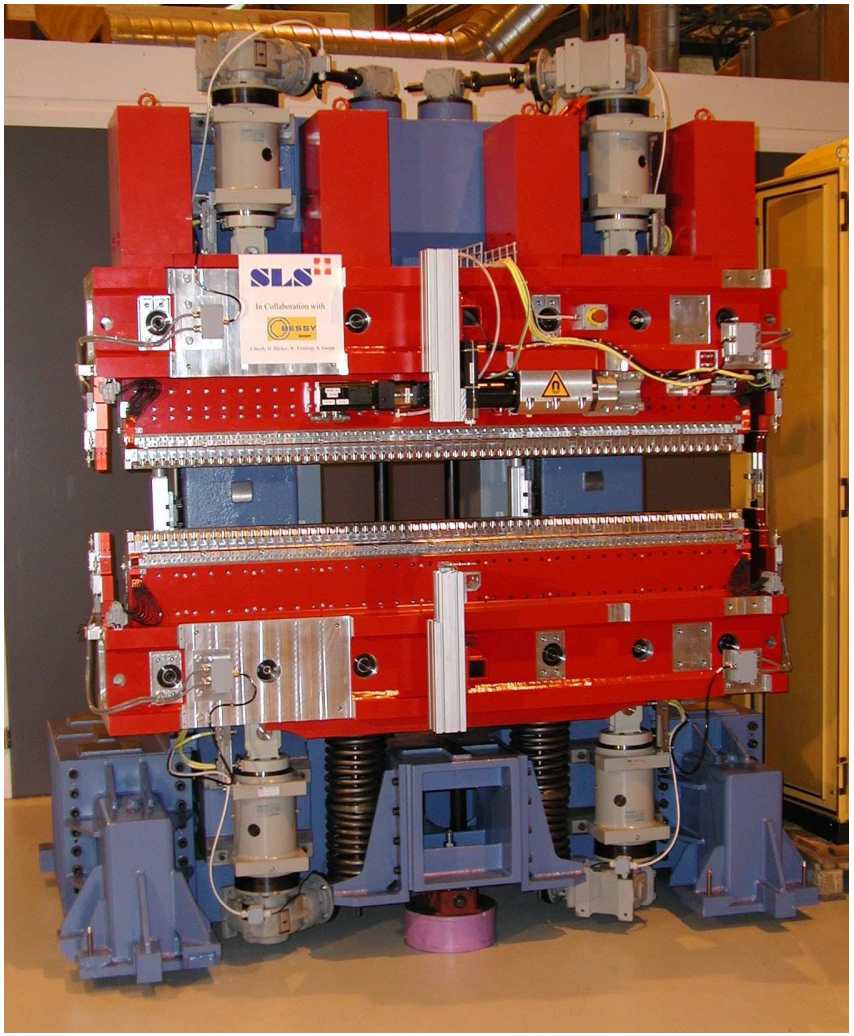


Advantages - Disadvantages

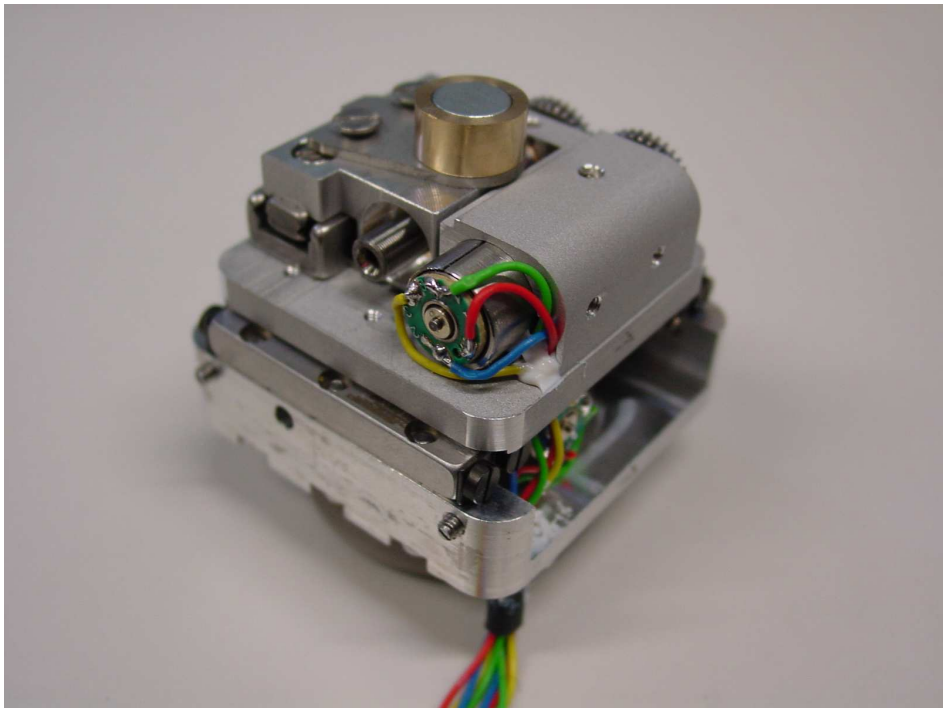
- Unified Hardware
- “Simple” Setup
- Very scalable
- “Distributed” System
- VME can be used as data acquisition system
- Expandable

- Expensive if only few axis are needed

Challenges - Extreme



Undulator
-several tons, 1µm resolution



Sample Stage
-several Gramm
-sub-µm resolution

The SLS 2001 Motor Drive Unit (MDU)

Keeping the beamline in motion.

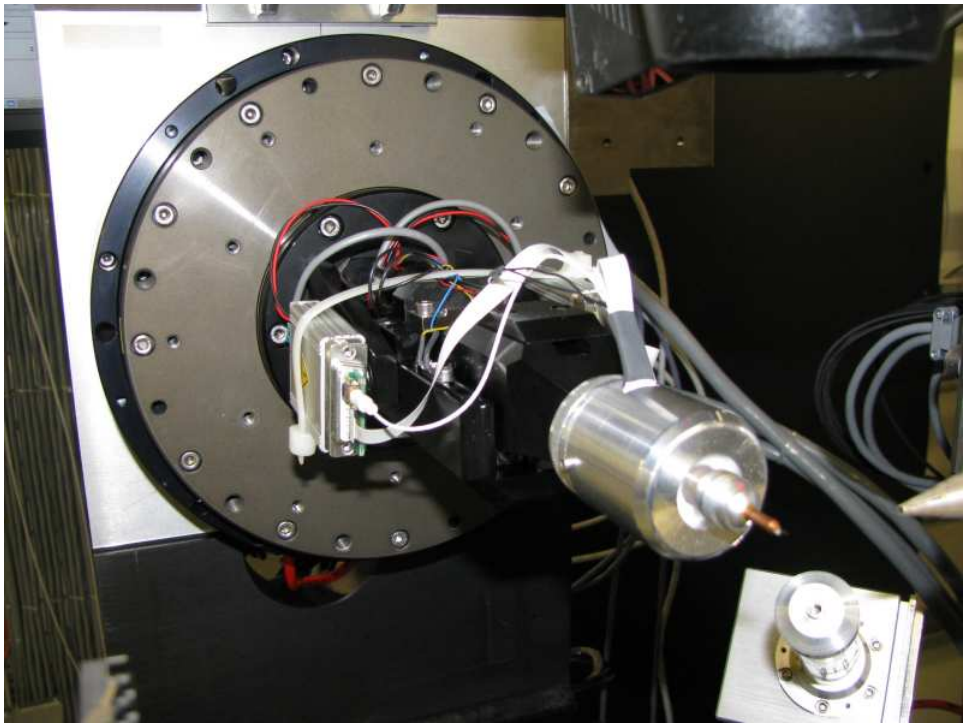
One rack
One cable
One GUI

Any kind of motor

Nano Positioners

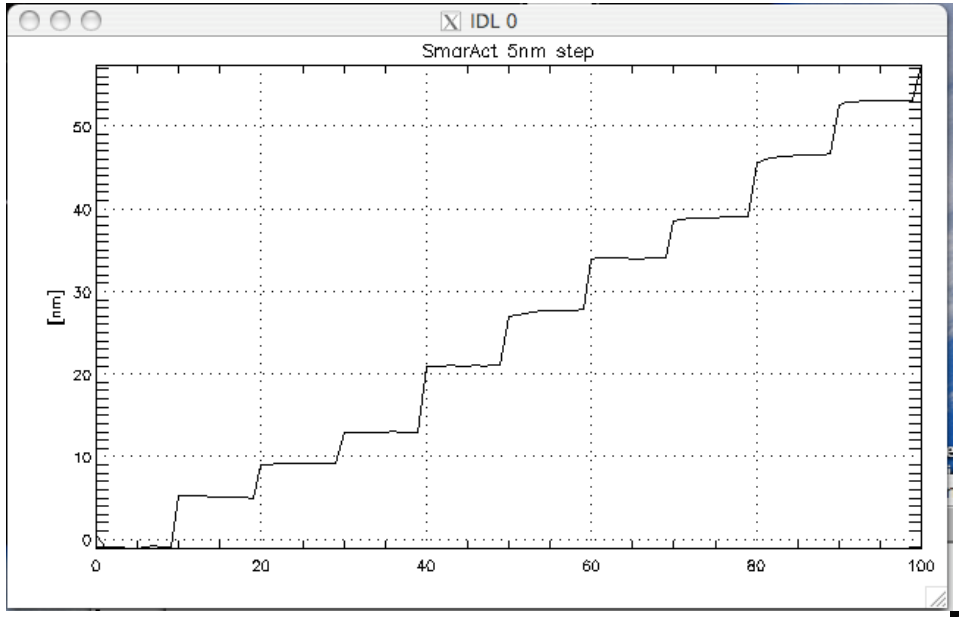
SmarAct Positioner

SLS Sample Stage with Smart Magnet for Robot mount



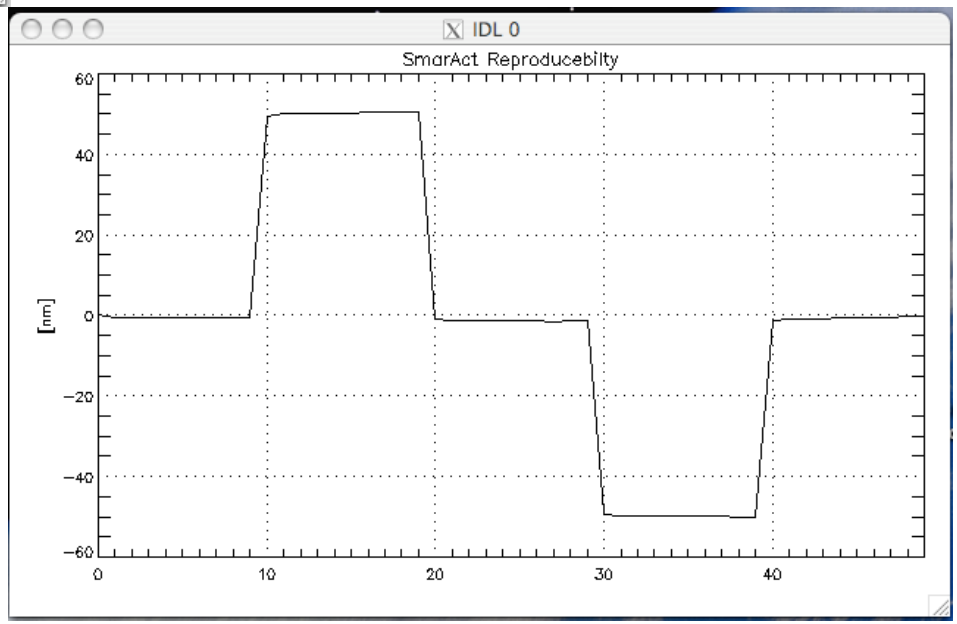
Installed at X06SA

SmarAct Piezo Positionierer

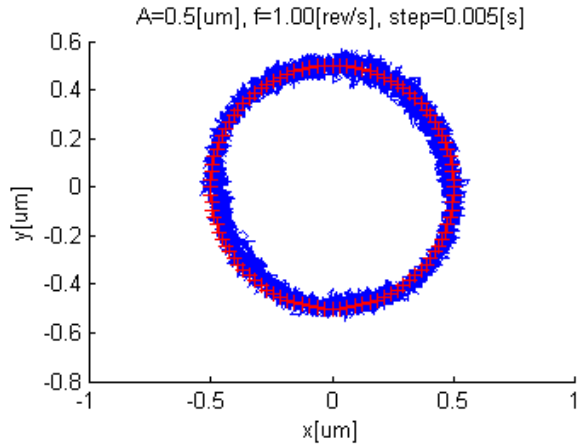


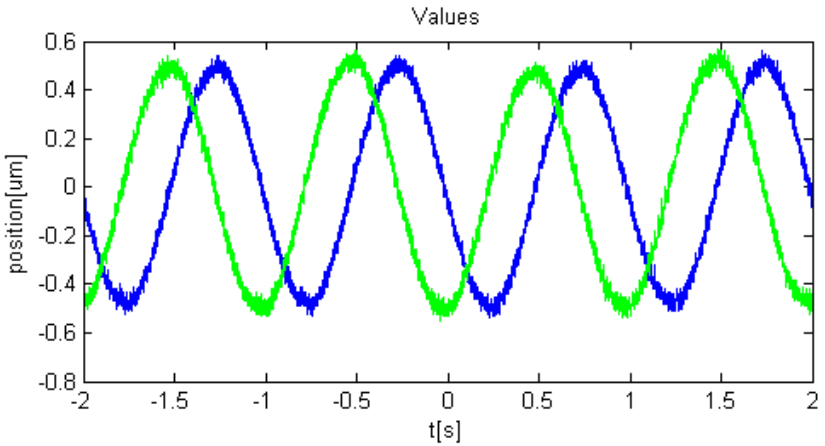
5nm Step

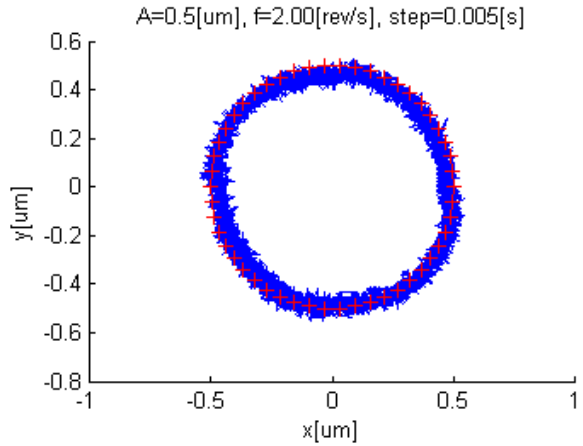
+/- 50nm step size
Error 0

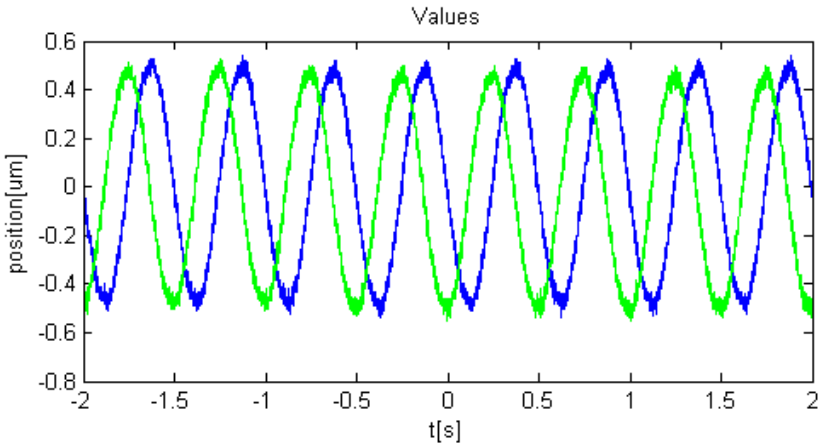


SmarAct Measurements



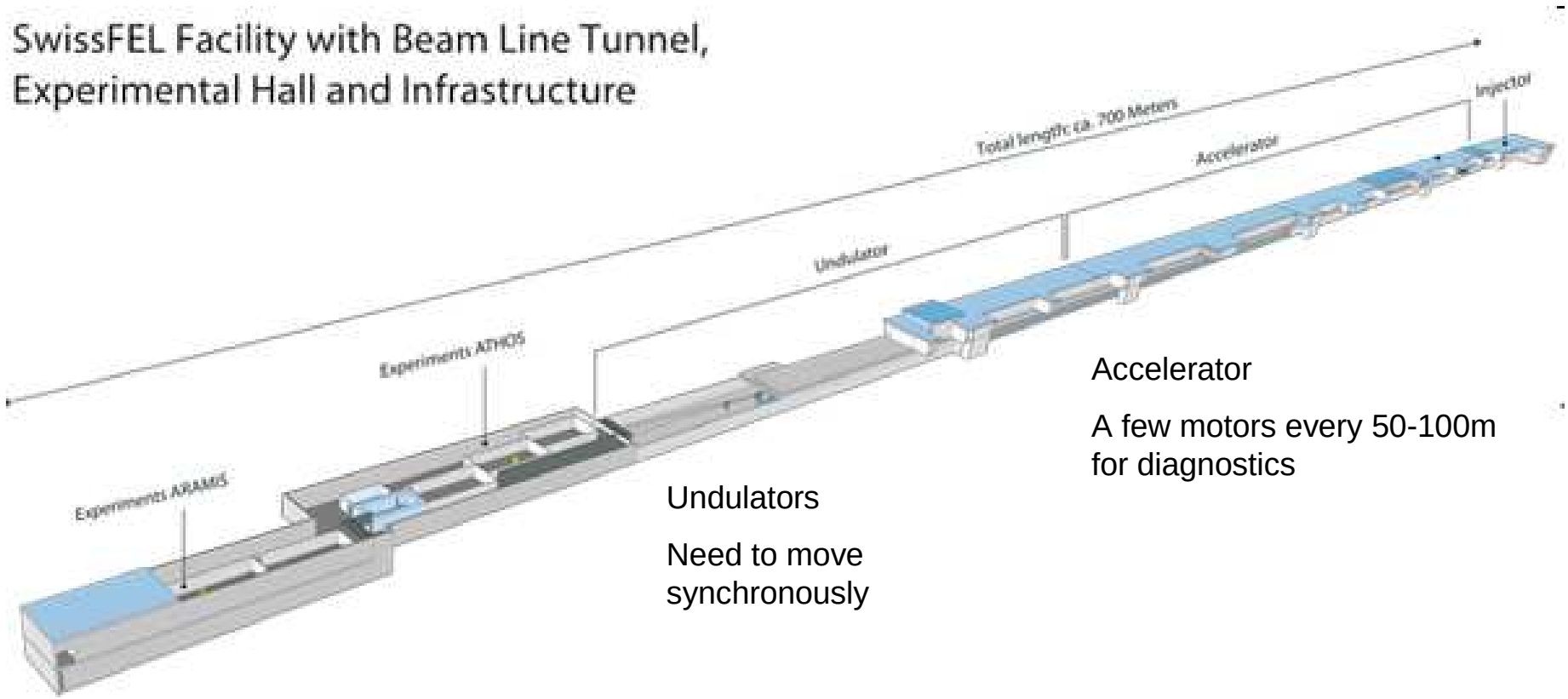






Measurements
Wayne Glettig

New Challenges (SwissFEL)



Accelerator

A few motors every 50-100m for diagnostics

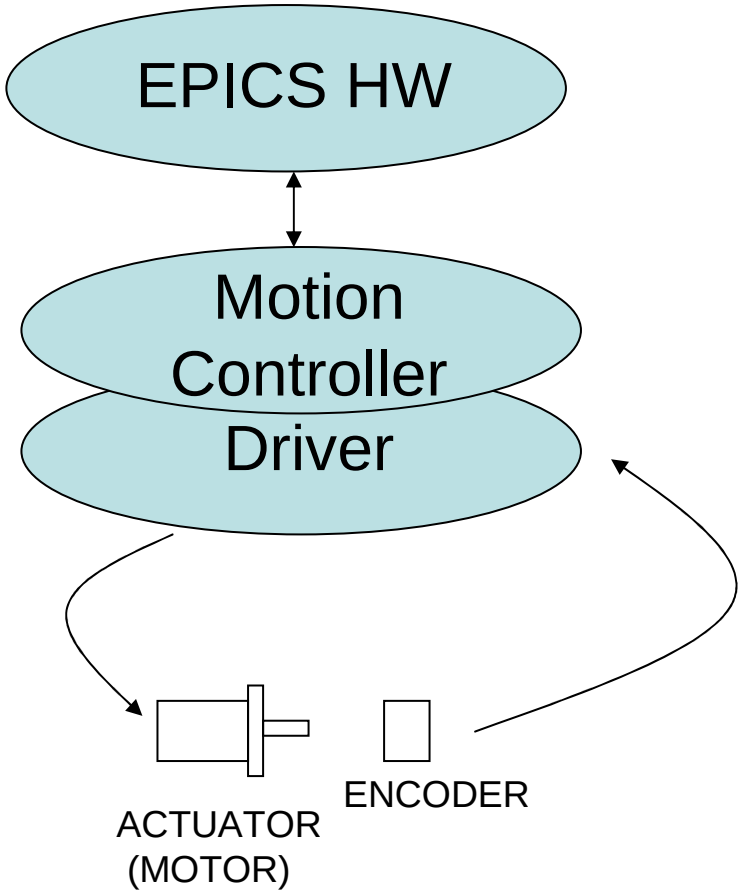
Undulators

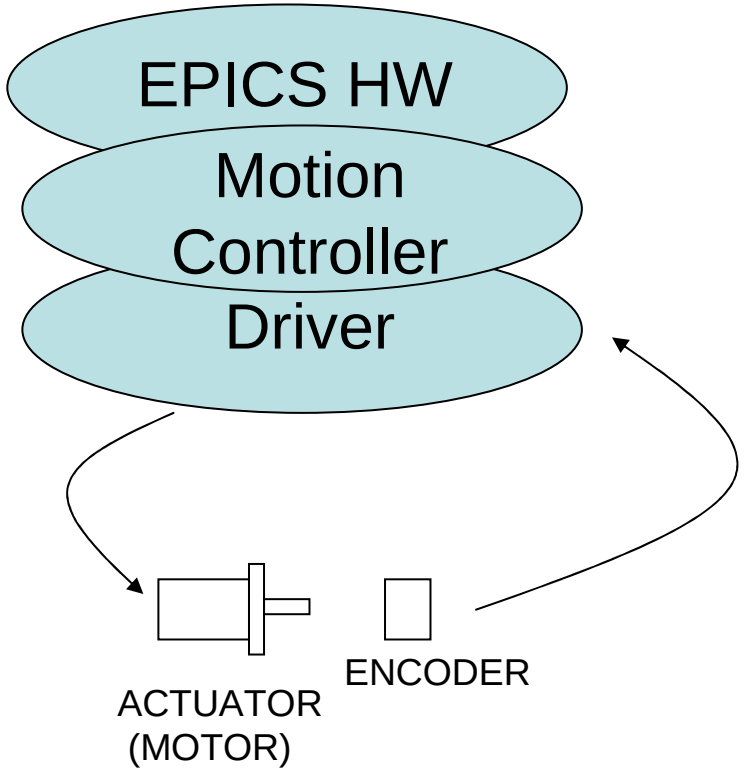
Need to move synchronously

Experiments

Similar to Synchrotrons

Scenarios


EPICS HW
Motion Controller
Driver
ACTUATOR (MOTOR)
ENCODER


EPICS HW
Motion Controller
Driver
ACTUATOR (MOTOR)
ENCODER

Possible Solutions

Driver/Controller on the Motor

- Schneider Electric
  - MDrive 23 Plus
  - Motion Control with Ethernet

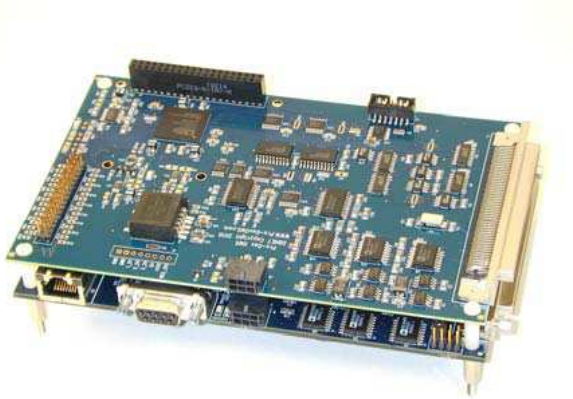
Distributed Systeme

- Wago Systems
  - Steppercontroller 750-670
- Beckhoff (see ID control)

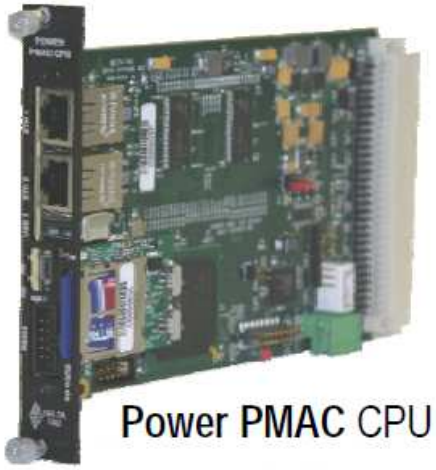
Possible Solutions

Motion Controller for Integration in to Driver Unit

- Pro-Dex
  - MAXnet w/DBnet
  - Ethernet 10-Axis Motion Controller



- Delta Tau
  - Power PMAC



ID-control concept

Touchpanel 6,5"
CP6909-0001-0000

TCP/IP

CX1020-0112 Zykluszeit 1ms	CX1100 -0004	EL 1008	EL 2008	EL 5001 SSI	EL 5001 SSI	EL 6900	EL 1904	EL 2904
		I/O Zentral		Drehgeber Up	Drehgeber Dn	Safetycontroller	Not-Aus Taster	Safety Outputs

EtherCat

max 100m
Takt 1ms

EK1100	EL 1008	EL 2008	EL 1904	EL 1904
	I/O Up		Kammer-schutzschalter	Endschalter

max 100m
Takt 1ms

EK1100	EL 1008	EL 2008	EL 1904	EL 1904
	I/O Down		Kammer-schutzschalter	Endschalter

max 100m
Takt 1ms

Kompakte Abmessungen
Dezentraler Peripherieaufbau
Flexible Schnittstellen
Schneller Datenaustausch (100Mb/s)
Kurze Zykluszeiten (1ms)
Mehrere Achsen synchronisierbar

EtherCat

max 100m
Takt 1ms

Drive U AX5000

Drive D AX5000

EnDat

EnDat

max 50m

max 50m

MU

MD

Heidenhain LC483

Heidenhain LC483

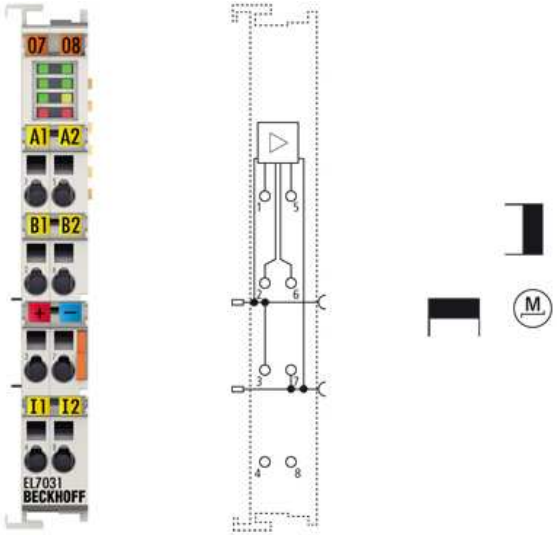
Achsen Positionssynchron verfahren

BM61 M.Bruegger
14.9.2009

Beckhoff Hardware for EtherCat

Motion-control:

- EL7031 Schrittmotorklemme,Imax = 1,5 A, 24 V
- EL7332 DC-Motor-Endstufe, 24 V DC, 1,0 A
- EL7041 Schrittmotorklemme, Imax = 5,0 A, 50 V,Inkremental-Encoder-Interface
- EL7342 DC-Motor-Endstufe, 50 V DC, 3,5 A,Inkremental-Encoder-Interface
- Different Servo Motors and Drives



Requirements - Challenges

- Dedicated Hardware – System can be matched “perfectly” to application
- Scalability
- (Truly) Distributed System

- Multiple Systems → need to communicate with each other
- Need to maintain several HW systems
- Need for EPICS support for every new hardware

Requirements - Challenges

- Synchronized movements
- On-the-fly scans

- Lifecycle of product
- Cost (over lifetime)

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The problem is not finding the right hardware,

the problem is the additional work required to control it through EPICS

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Thank you for your attention - open for discussion