JÜLICH FORSCHUNGSZENTRUM

EUROPEAN SPALLATION SOURCE

Feedback

- Motion Control and Automation -

Thomas Gahl (ESS)

Guido Vehres (JCNS)

www.europeanspallationsource.se

February 18, 2016

Update on MCA Initiatives

EUROPEAN SPALLATION SOURCE

JÜLICH FORSCHUNGSZENTRUM

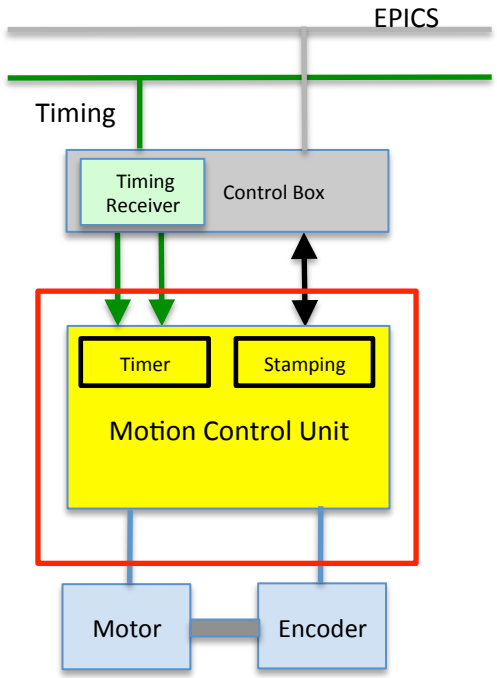
1 Evaluation for Generic Motion Control Unit in final stage

- Decision process
- Requirements
- Market survey
- Candidates
- Decision criteria
- First results
- Next Steps

2 Start on identifying radiation hard components

MCA Standard: Generic Motion Control Unit

- Standardised Motion Control Unit for most of the ESS applications
- Scope of standardisation:
  - Control Hardware (controller, driver, I/O, power supply, control panel etc.)
  - Control Software (controller firmware, EPICS IOC)
  - Cables, connectors, distribution boxes, field busses
  - Prototypes for different mechanical and electrical format factors (19”box, DIN-rail, 8-axes, 2-axes etc.)
  - Test environments (Control unit + EPICS)
  - Integration workflow
- Workshop April 2016
- Deployment of fully tested system August 2016

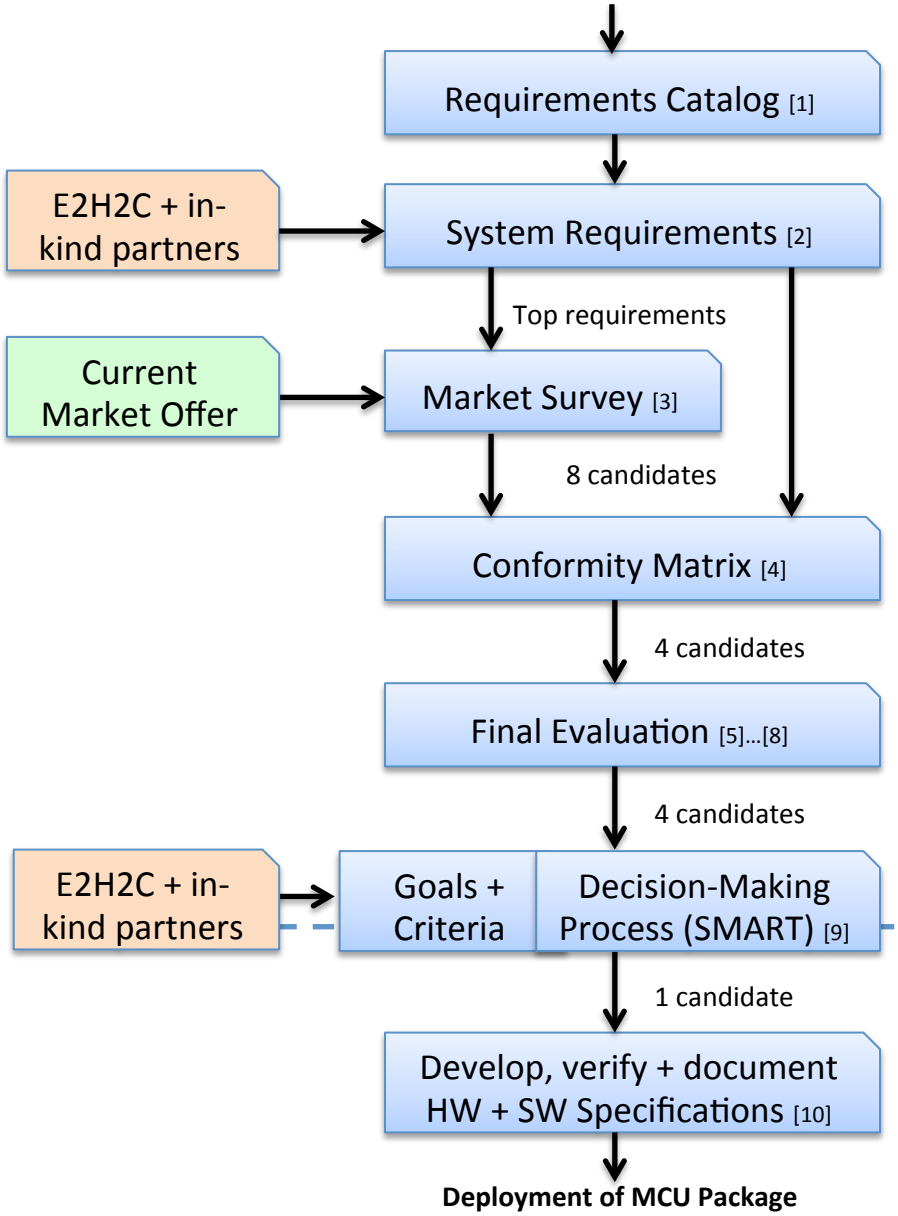


Responsibilities

Technology: MCA

Integration: MCA/ICS

Decision making process: Status now



Associated Documents

[1] MCU Requirements Catalog

[2] MCU System Requirements List

[3] Market Survey Report

[4] Conformity Matrix of MCU's

[5] .. [8] Evaluation Reports 1 to 4

[9] Decision-Making Report

[10] **MCU Specification Document**

MCU requirements catalog

- Standard positioning requirements
- Synchronisation of internal clocks with ESS timing system
- Decentralisation through field bus with real-time capabilities and synchronisation
- Multi-axes synchronisation
- Free configurable trajectories
- Modular and scalable (in terms of performance and price)

- Short intervention time (ACC): Diagnostics (preemptive maintenance)
- Short intervention time (ACC): Firmware and parameter management
- Multiple HW platforms (ICS): Open source controller

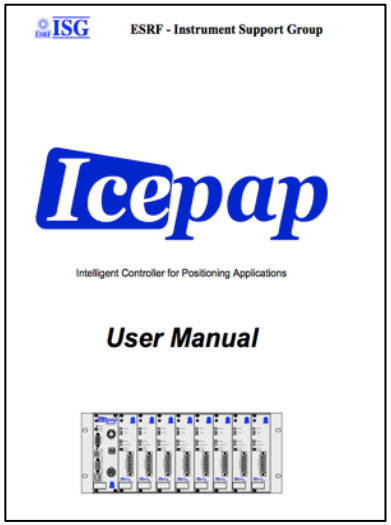
- Stepper motors, DC brushless, piezo
- Encoder inc. quad., abs. SSI, resolver, (analog), (BiSS-C)

Decision criteria

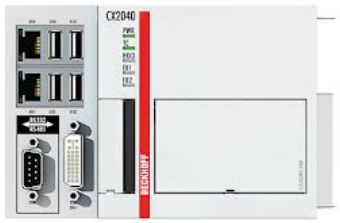
1. Performance against functional requirements
2. Performance against non-functional requirements
3. Wide used and popularity (ESS, in-kind partner, industry)
4. Installation
5. Maintenance
6. Compatibility (to ESS integration)
7. Costs (1ax, 8ax, 32ax)
8. Supplier assessment (competence, support, availability to partner, lifetime/obsolescence management)
9. Second-Source / Open-Source assessment
10. Flexibility / Modularity (design, maintenance, extensions)

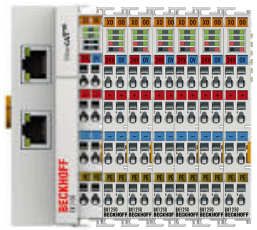
4 Final Candidates

DELTA TAU
EUROPA UK



BECKHOFF





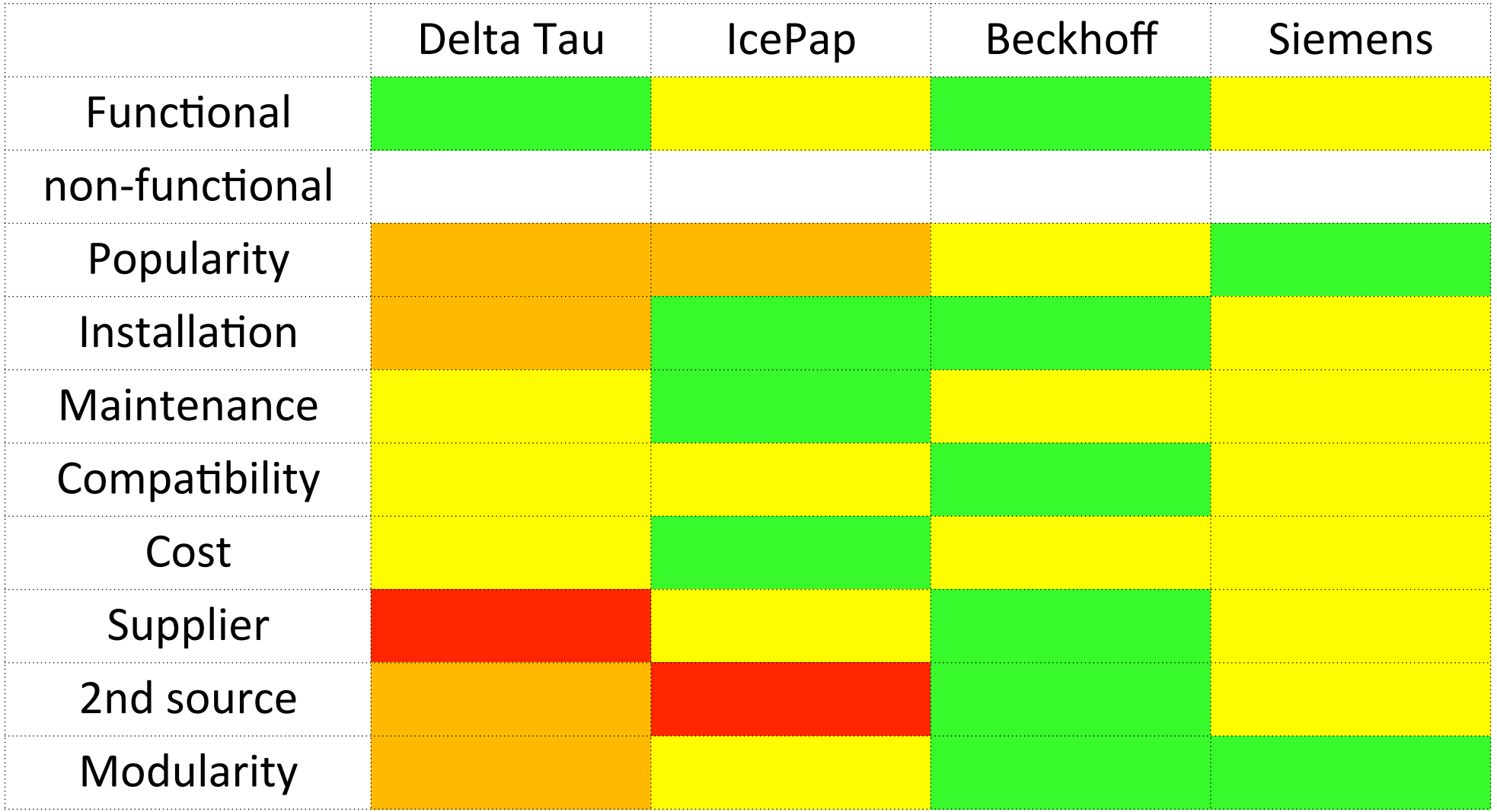
SIEMENS

1STEP

1STEP-Drive
- Phytron

FM357
-4 axes controller

First results



	Delta Tau	IcePap	Beckhoff	Siemens
Functional				
non-functional				
Popularity				
Installation				
Maintenance				
Compatibility				
Cost				
Supplier				
2nd source				
Modularity				

Next steps (1)

- Finalise evaluation documents
- Open call-for-tender
- Decision for supplier

- Motion Control Workshop (doodle poll)
  - EMI, cables, connectors
  - Zoning concept (detector group, sample env group)

- Finalise hardware +EPICS integration
- Develop deployment package (Hard- and Software)
- Issue Standard Documents, Manuals etc.
- Distribute templates to partners

- Extend Motion Control Components Standard

JÜLICH FORSCHUNGSZENTRUM

EUROPEAN SPALLATION SOURCE

Feedback

- Radiation Environment -

Thomas Gahl (ESS)

Guido Vehres (JCNS)

www.europeanspallationsource.se

February 18, 2016

Strategy

- Define critical (bunker, cave) and non critical areas (hall)
- Avoid electronics and optics (made of plastics) in critical areas
- Use supplier certification wherever appropriated (reactor technologies)
- Gamma/thermal neutrons: Compare to reactor applications
- Fast neutrons: Use experience from CERN and ITER project

Components

- Motors
  - Radhard stepper motors (PHYTRON, Empire Magnetics)
  - Radhard BLDC motors (Wittenstein)
  - Other companies
- Encoders
  - Resolver
  - LVDC
- Switches
  - Radhard Hall sensors
  - Optical sensors with fiber
  - Inductive (with separated elctronics)
  - capacitive

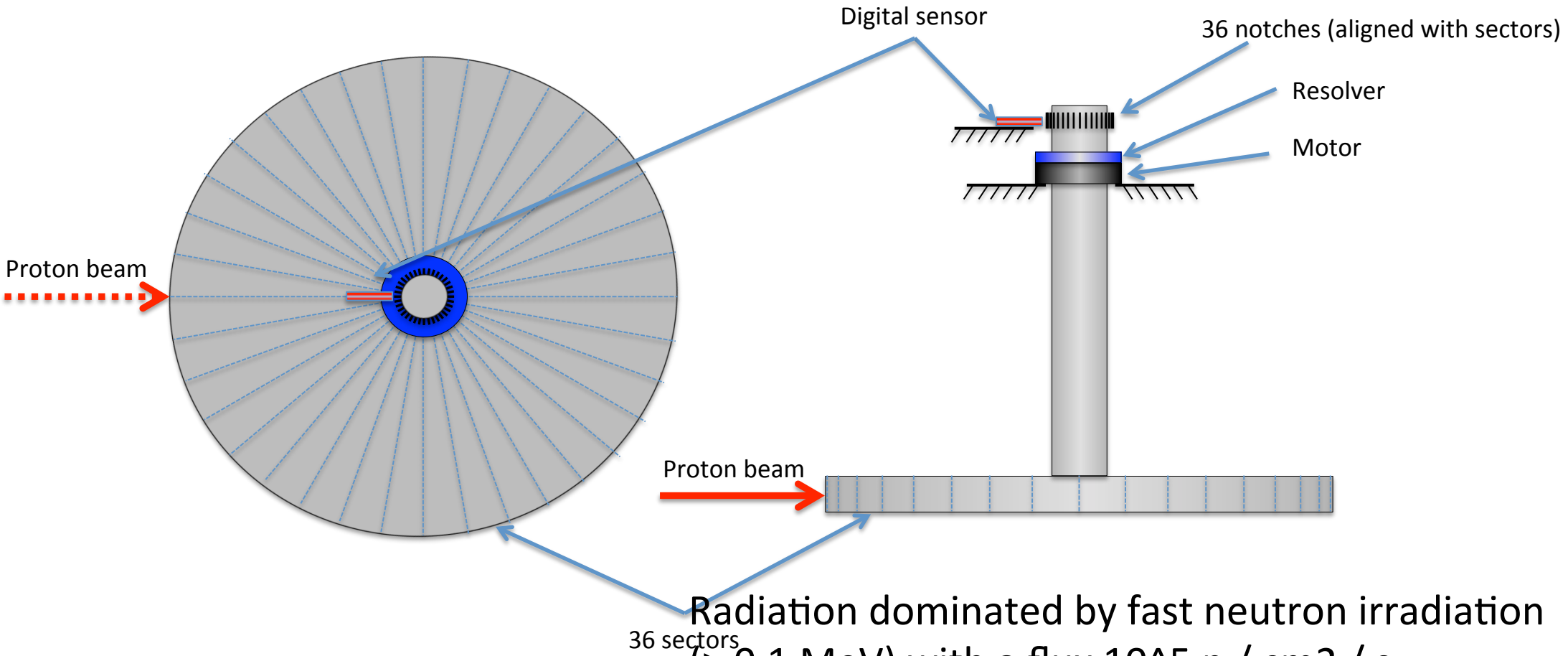
Top Requirements Target Wheel Control

- Radiation hard solution
- Phase accuracy +-2mm on circumference (diameter 2.5m)
- Park position accuracy = +-2mm
- Nominal speed = 14/36 ≈0.39Hz
- Startup time (0-0.39Hz +phasing) = 20 minutes
- More requirements in CHESS…

Concept Overview

Target wheel top view

Target wheel side view



Radiation dominated by fast neutron irradiation (> 0,1 MeV) with a flux 10^5 n / cm2 / s.

Questions?

JÜLICH FORSCHUNGSZENTRUM

EUROPEAN SPALLATION SOURCE

Feedback Extras

- Motion Control and Automation -

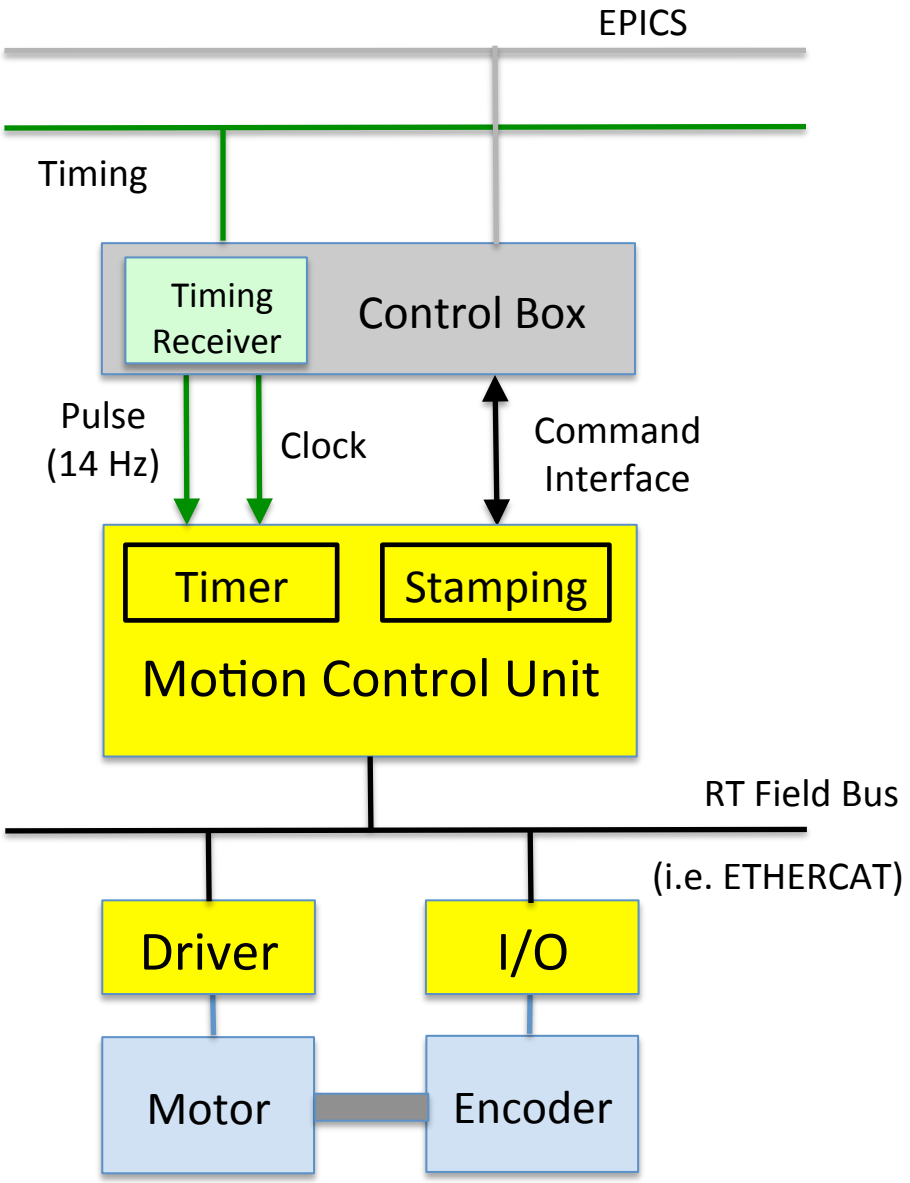
Thomas Gahl (ESS)

Guido Vehres (JCNS)

www.europeanspallationsource.se

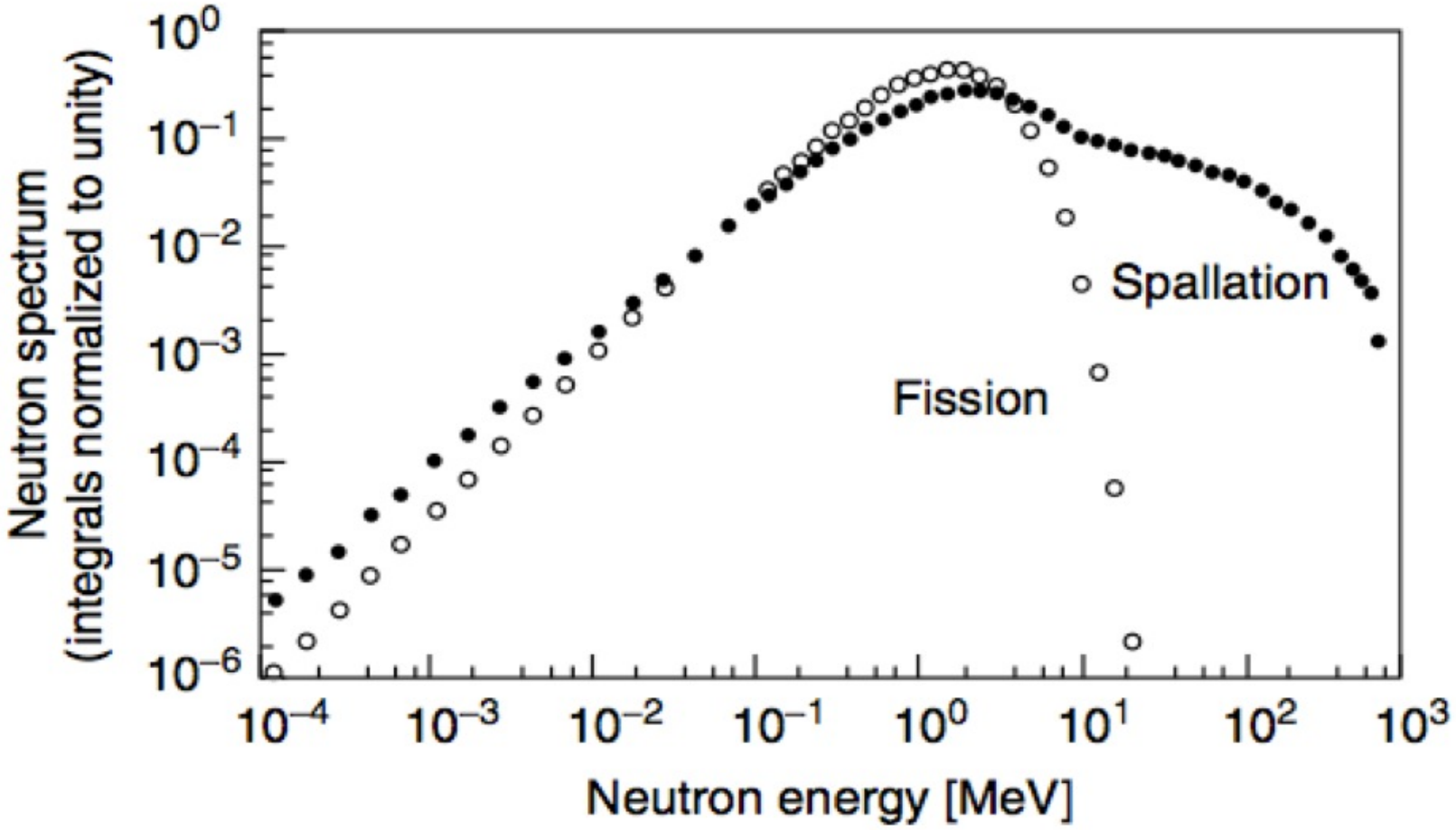
February 18, 2016

Motion Control Concept



- Transfer absolute timing information from Control Box to the local HW control unit:
- Synchronise a timer on the control unit
- Timestamp in the control unit direct readings of the sensor with minimal latencies
- Transfer the sensor readings through the Control Box into EPICS
- Synchronously vs. asynchronously
- Local distribution of control unit functionalities with real time field busses

Spectrum reactor vs. spallation



Synergies / comparison

- Motion control components in bunker
- Chopper components
- Target wheel control

	Gamma	Thermal n	Fast n
ILL	10^{-1}	1	10^{-5}
ESS	1	1	1
Space			10
CERN			10
ITER			10^{3}

Update on MCA Initiatives

1 Evaluation for Generic Motion Control Unit in final stage
- Decision process
- Requirements
- Market survey
- Candidates
- Decision criteria
- First results
- Next Steps

2 Start on identifying radiation hard components

3 Motion Control Components Standard issued (ESS-0037290)

4 Guidelines for MCA in Phase 1 issued (ESS-0049514 draft)