

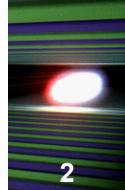


Status of the Control System for the European XFEL

Kay Rehlich

On behalf of the FLASH /XFEL Controls Group





Motivation and Outline

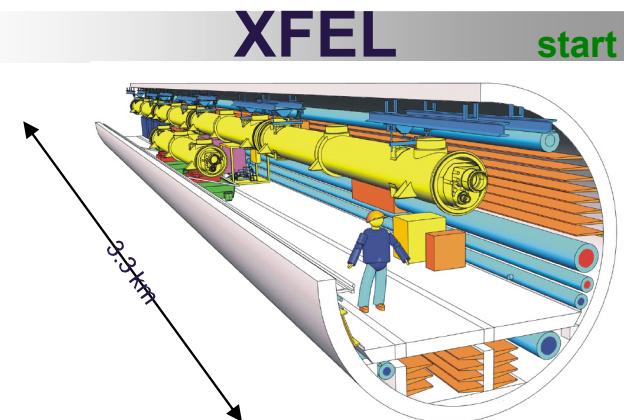


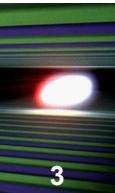
1993

FLASH

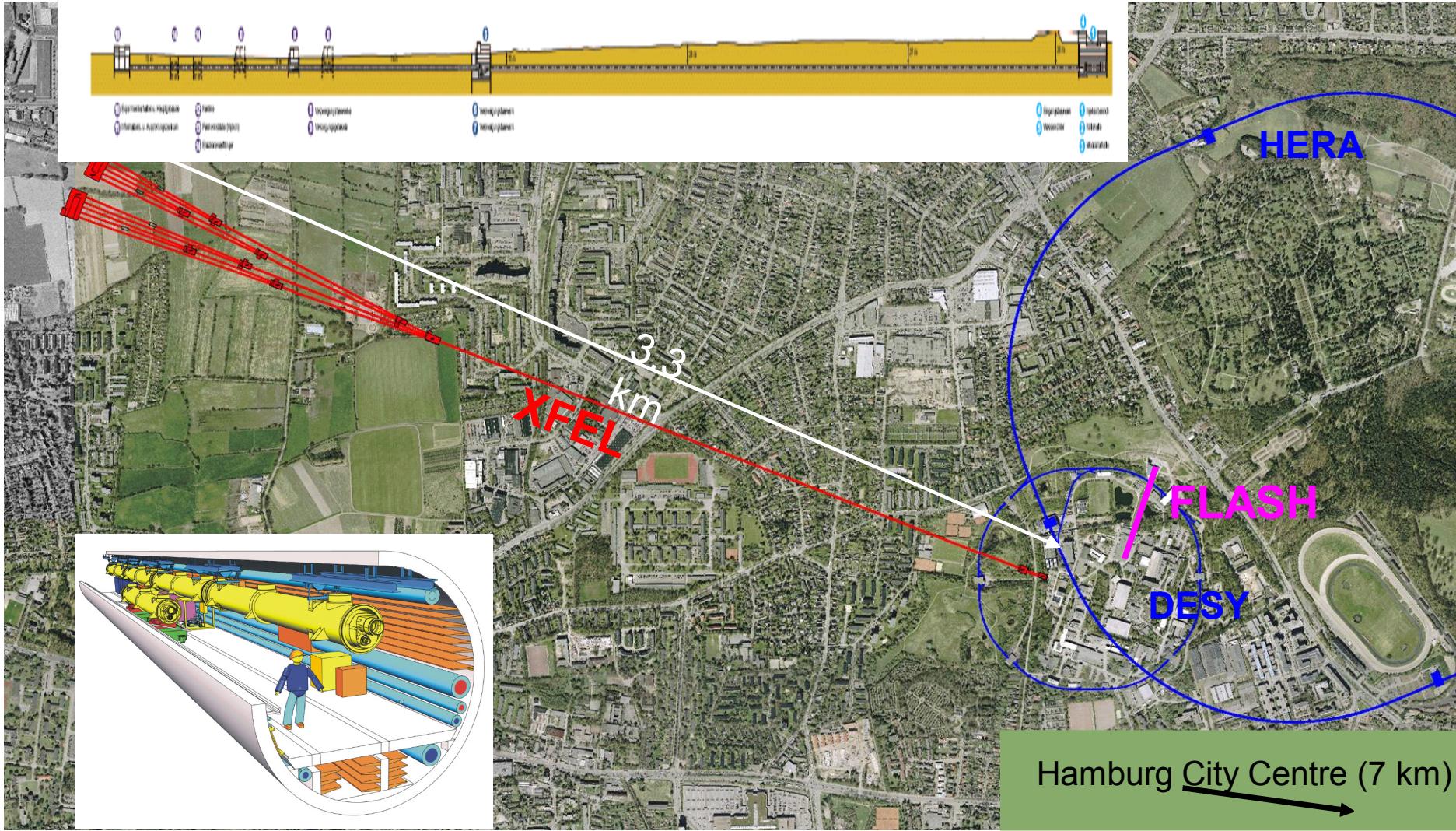
2015

- Hardware status:
 - μTCA: First results @ FLASH
- Software developments
 - μTCA integration
 - Middle layer services
- Conclusions

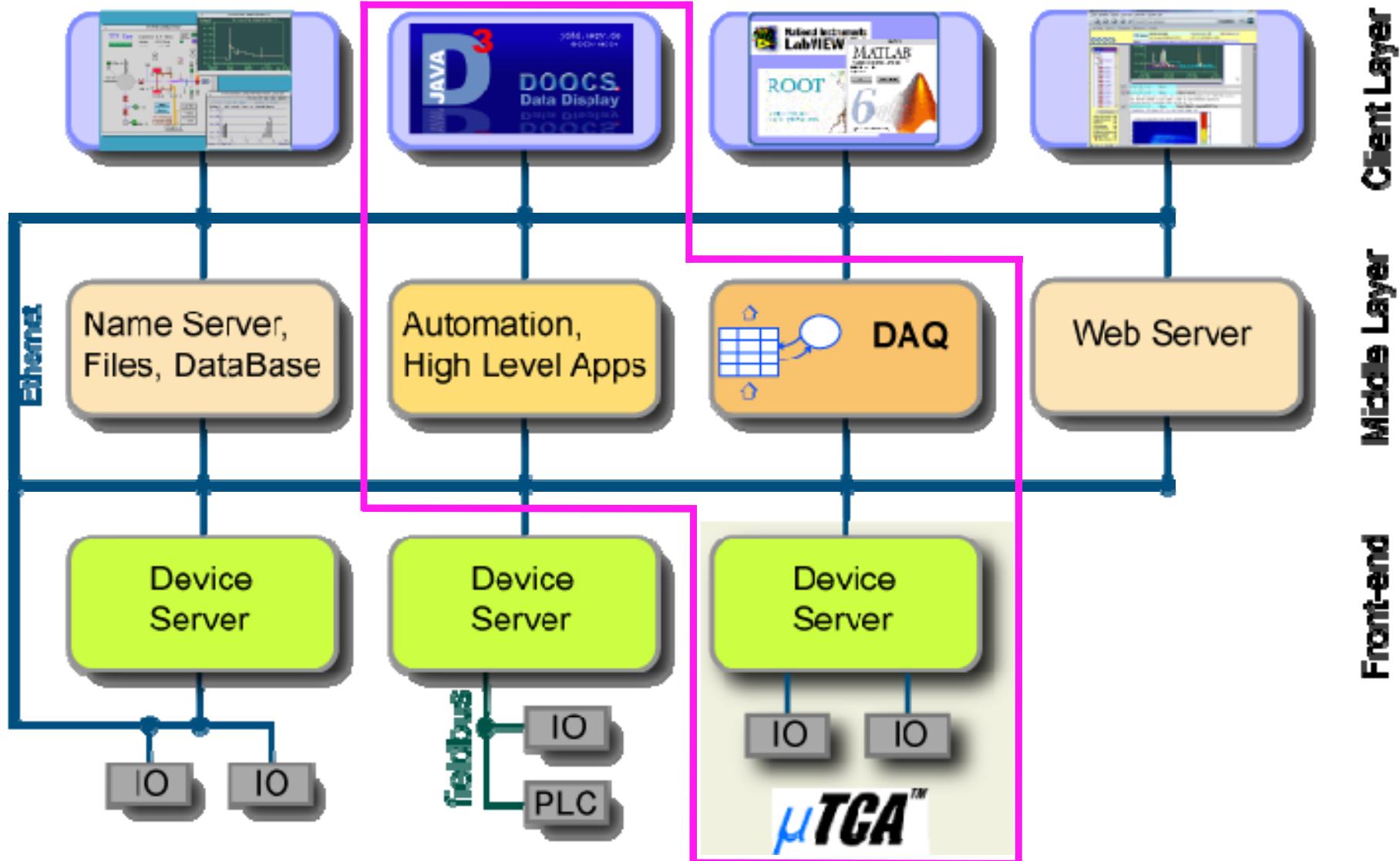




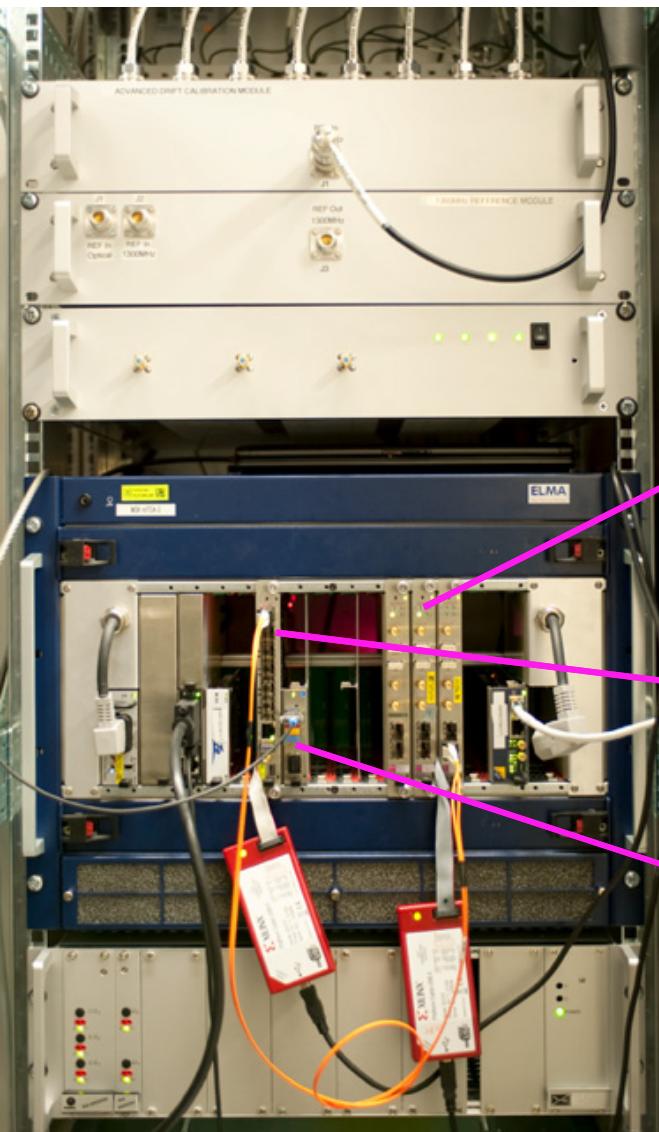
The European XFEL Project



DOOCS Control System Architecture



First μTCA System: LLRF Controller



- One accelerator module with 8 cavities was controlled by **μTCA™**
 - September 2011 (just before shut-down)
- System includes:
 - 3 slots with 16 bit ADCs, 81 MHz sampling (tot. 30 ADC channels)
 - Down converter 1.3 GHz → 54 MHz as RTM (Rear Transition Module)
 - Controller with FPGA, Giga links on backplane and front
 - Vector Modulator for 1.3 GHz as RTM
 - Timing AMC with trigger distribution on backplane
- Implements new **MTCA.4** standard

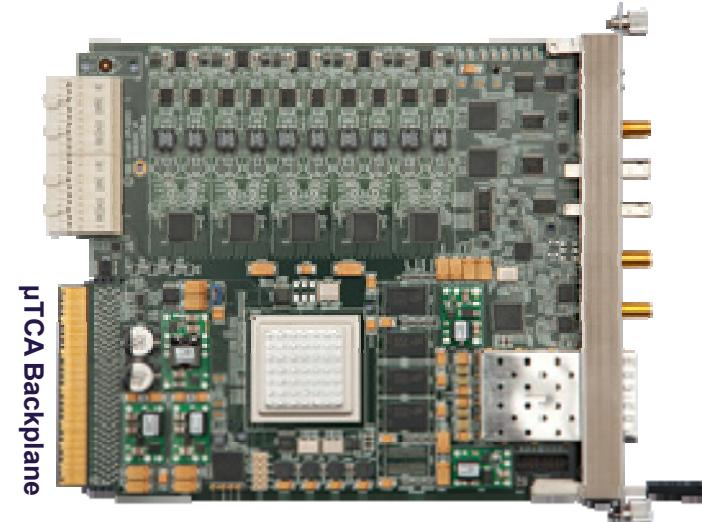
XFEL Hardware Standard

- XFEL will be based on the new MicroTCA.4 standard
 - Double size AMC modules with PCIe link to CPU
 - Rear Transition Modules for signal conditioning

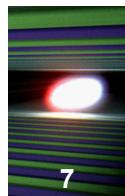
MTCA.4



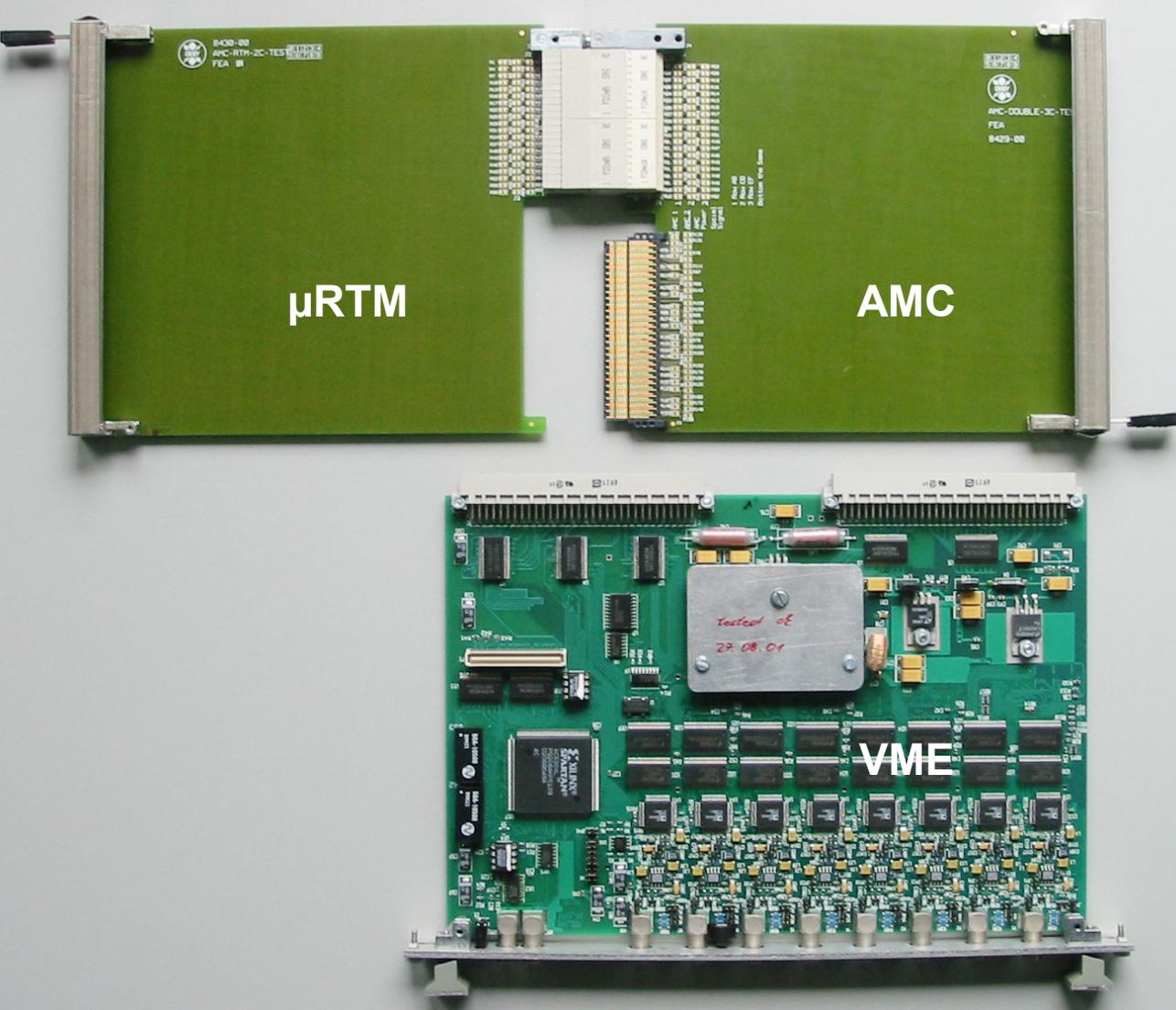
DWC8300 © DESY



SIS8300 © Struck Innovative Systems

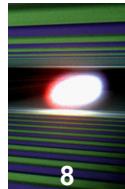


VME - μ TCA Board Sizes



AMC and RTM:
 $\sim 457 \text{ cm}^2$

VME:
 $\sim 345 \text{ cm}^2$

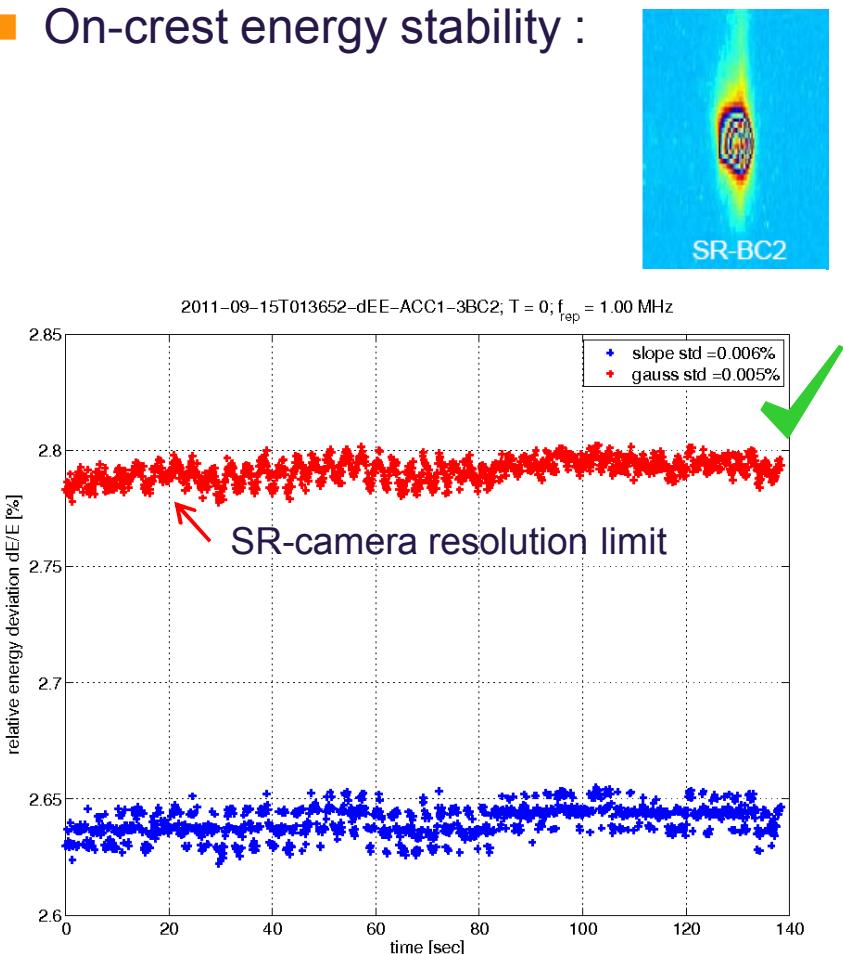


First Results @ FLASH

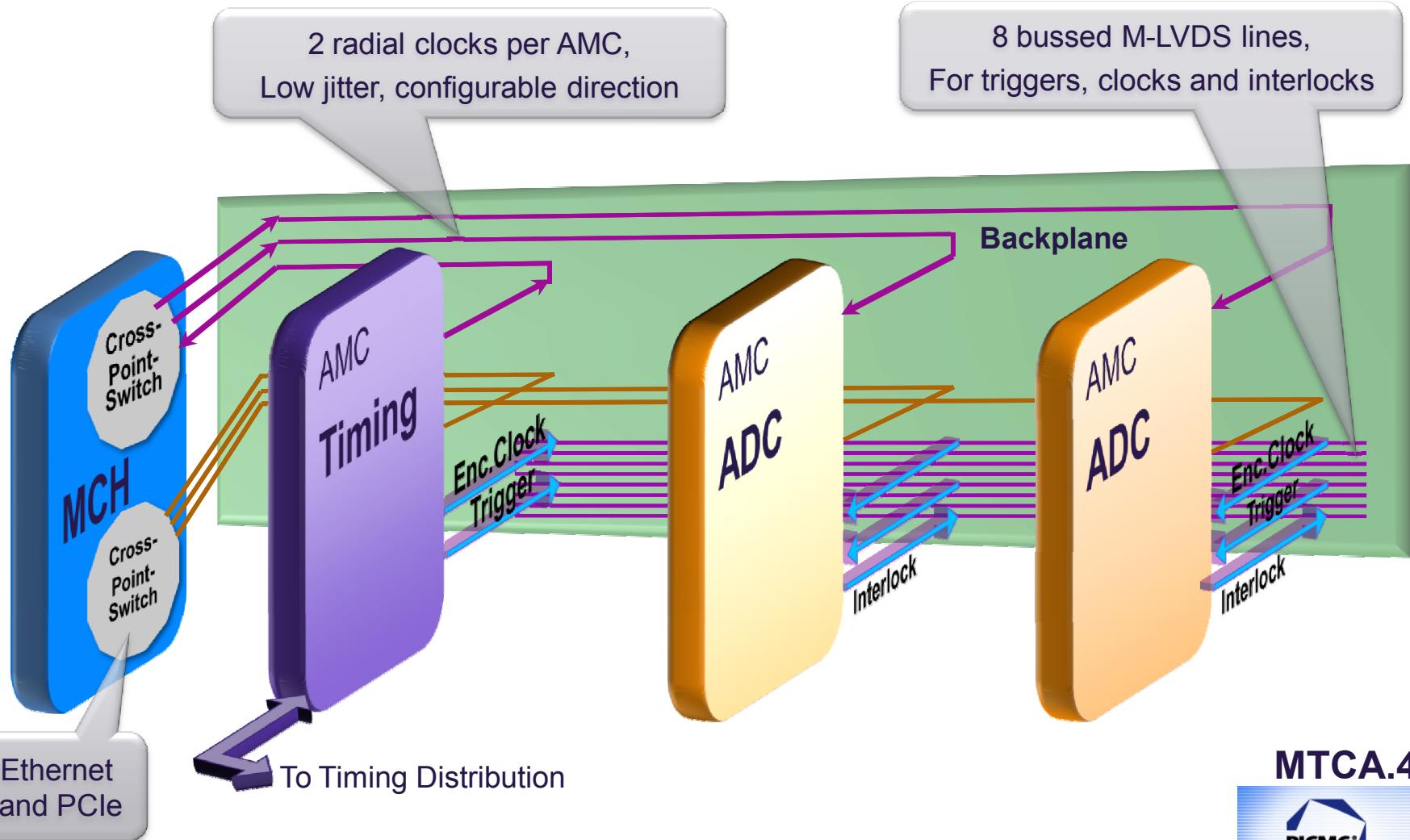
FLASH jddd panel:

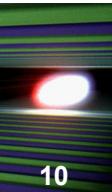


On-crest energy stability :



μTCA: Clocks, Triggers and Interlocks

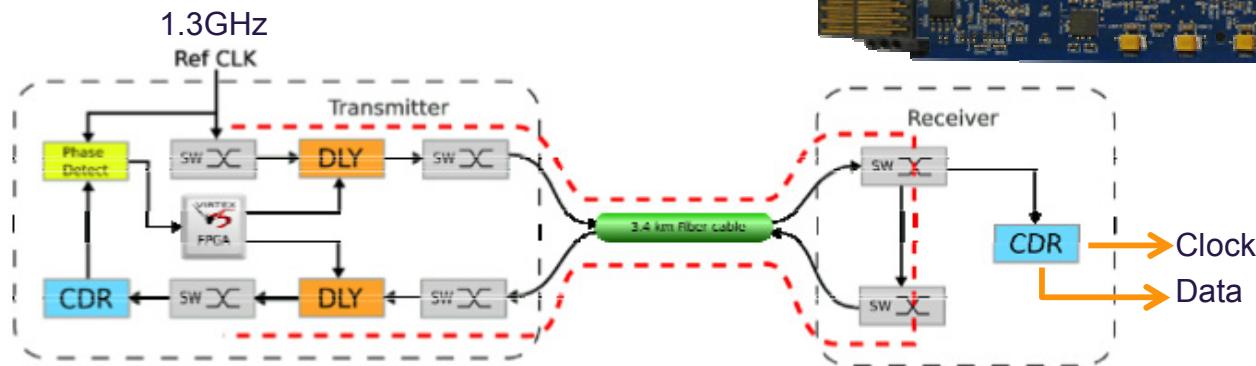
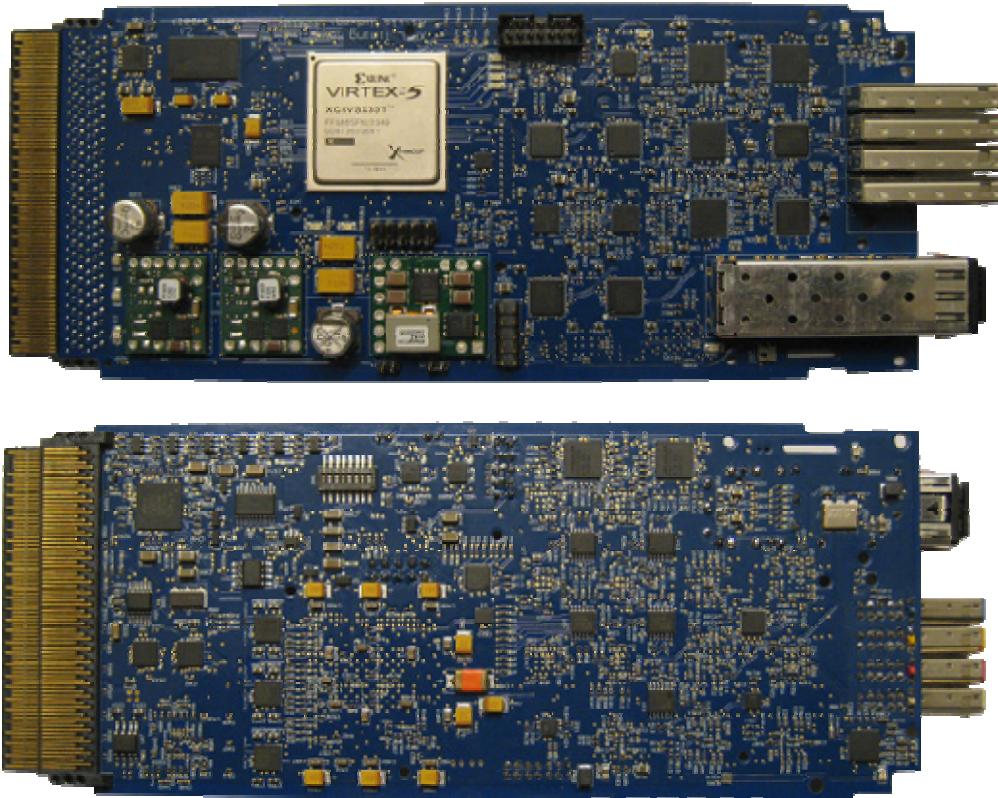




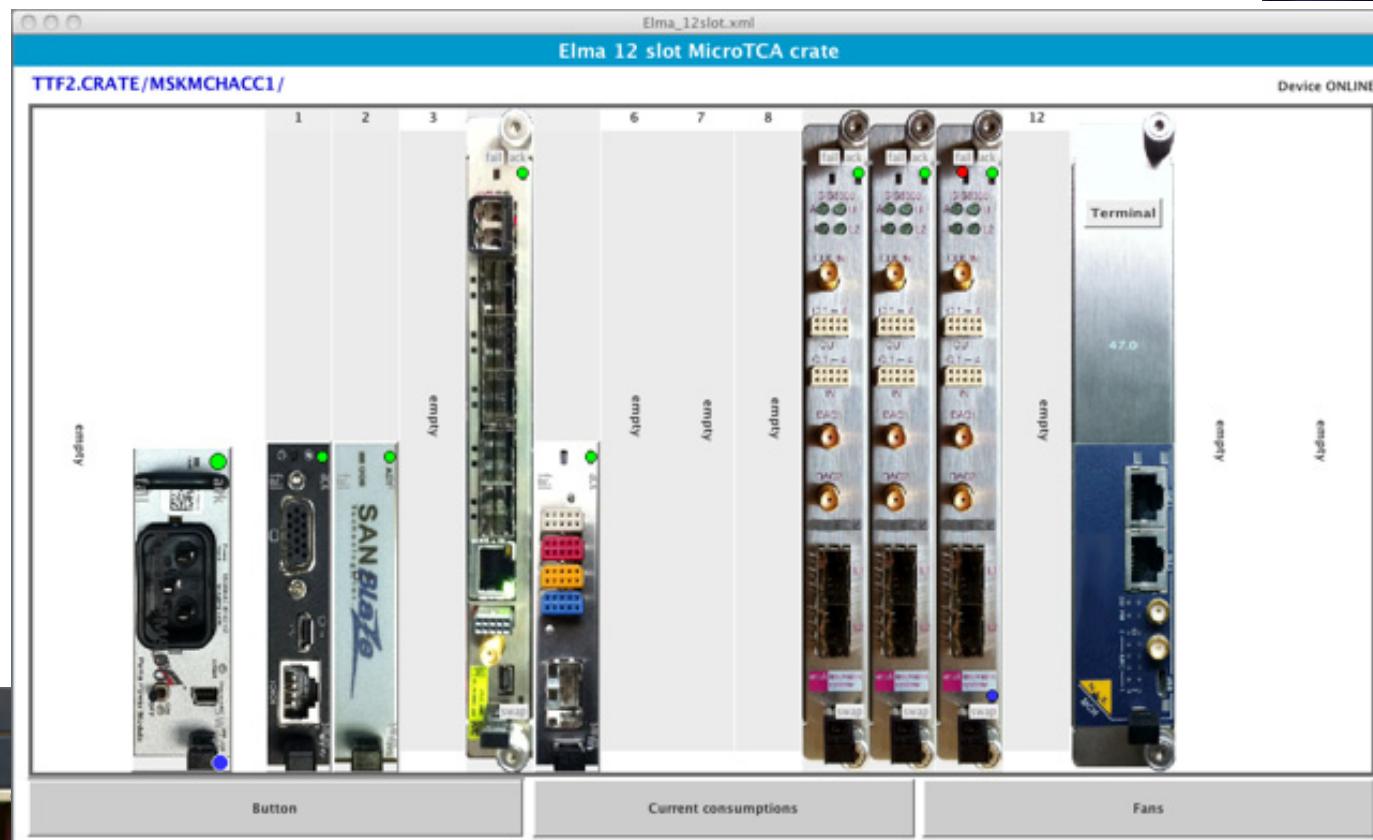
XFEL Timing System

■ New timing system

- Fiber optic links 1.3GHz
- with drift compensation
- AMC prototype is receiver and transmitter
- ps stability (< 5ps RMS)
- Clock, trigger and event distribution



MicroTCA Remote Management



MicroTCA Remote Management

Online status of modules:

- Is-inserted, fault, ...
 - Temperatures, voltages
 - Reset, power on/off
 - Act. Power consumption

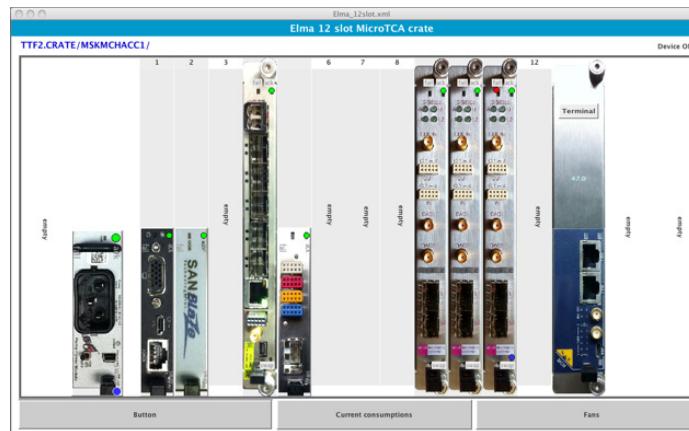


The screenshot shows the Elma 12 slot MicroTCA crate software interface. The left panel displays the configuration for the AMC Module SIS8300, including its DOOCs Address (TTF2.CRATE/MSKMCHACC1/AMC9), Slot (9), IPMB Address (130), FRU ID (13), Manufacturer (Struck Innovative Systeme GmbH), Production Date (Wed Jul 27 02:00:00 2011), Serial Number (021), and Version (v2.0). It also lists three sensors: SENSOR1, SENSOR2, and SENSOR3. Below these are two line graphs: 'Temperatures' (green line) and 'Voltages' (blue line). The 'Temperatures' graph shows a sharp peak reaching approximately 55°C on September 30, 2011. The 'Voltages' graph shows a constant value of about 11V. The right panel shows the physical hardware slots, with slots 1 through 8 populated by modules and slot 12 empty. A pink arrow points from the 'Temperature' graph in the software to the physical module in slot 8. The bottom of the interface includes buttons for 'Cold Reset', 'Warm Reset', and 'Reboot', and a switch labeled 'Switch Payload Power (12V)' with 'ON' and 'OFF' options.

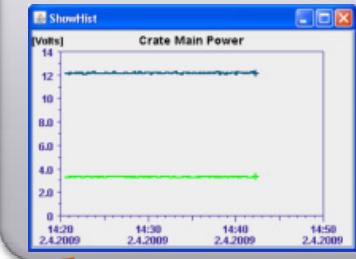
DOOCS Integration: Software Architecture

Runs on CPU:

- DOOCS device server
- Linux driver
- Hot-swap support:
remove a module in
a running system



Management Data
is available in
all applications

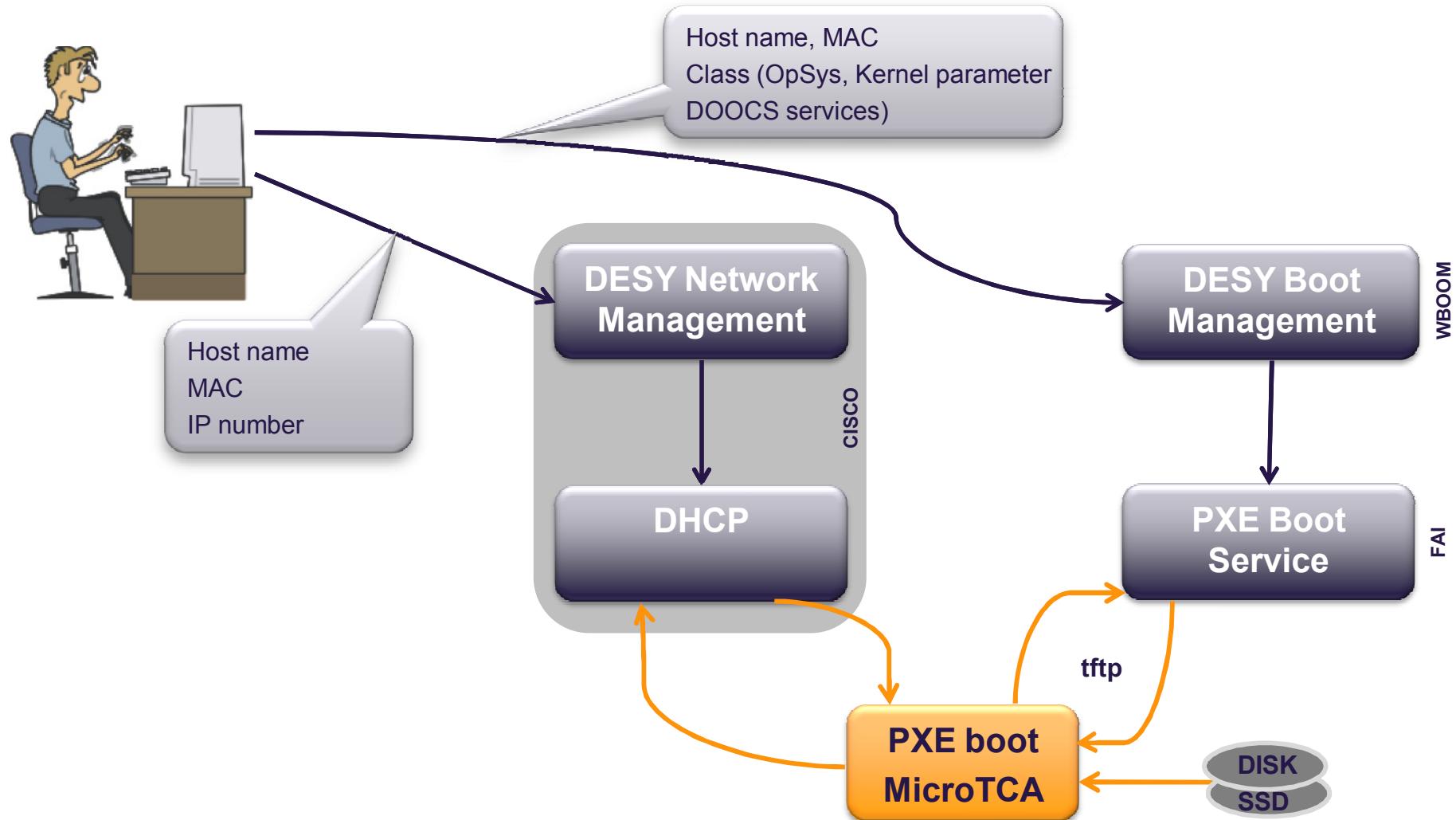


DOOCS_{xTCA IPMI Server}

IPMI

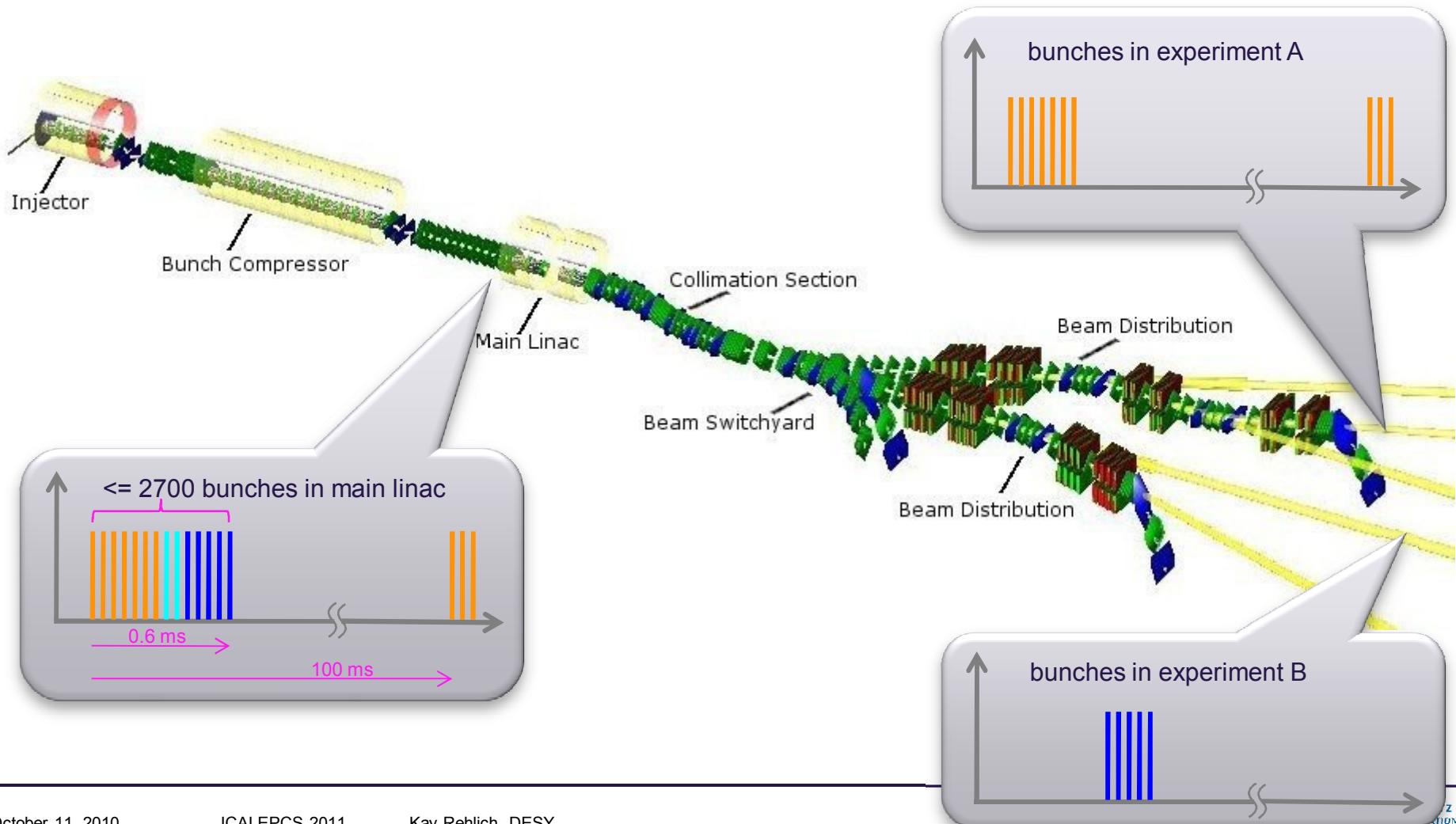


Automatic Linux + Control System Installation



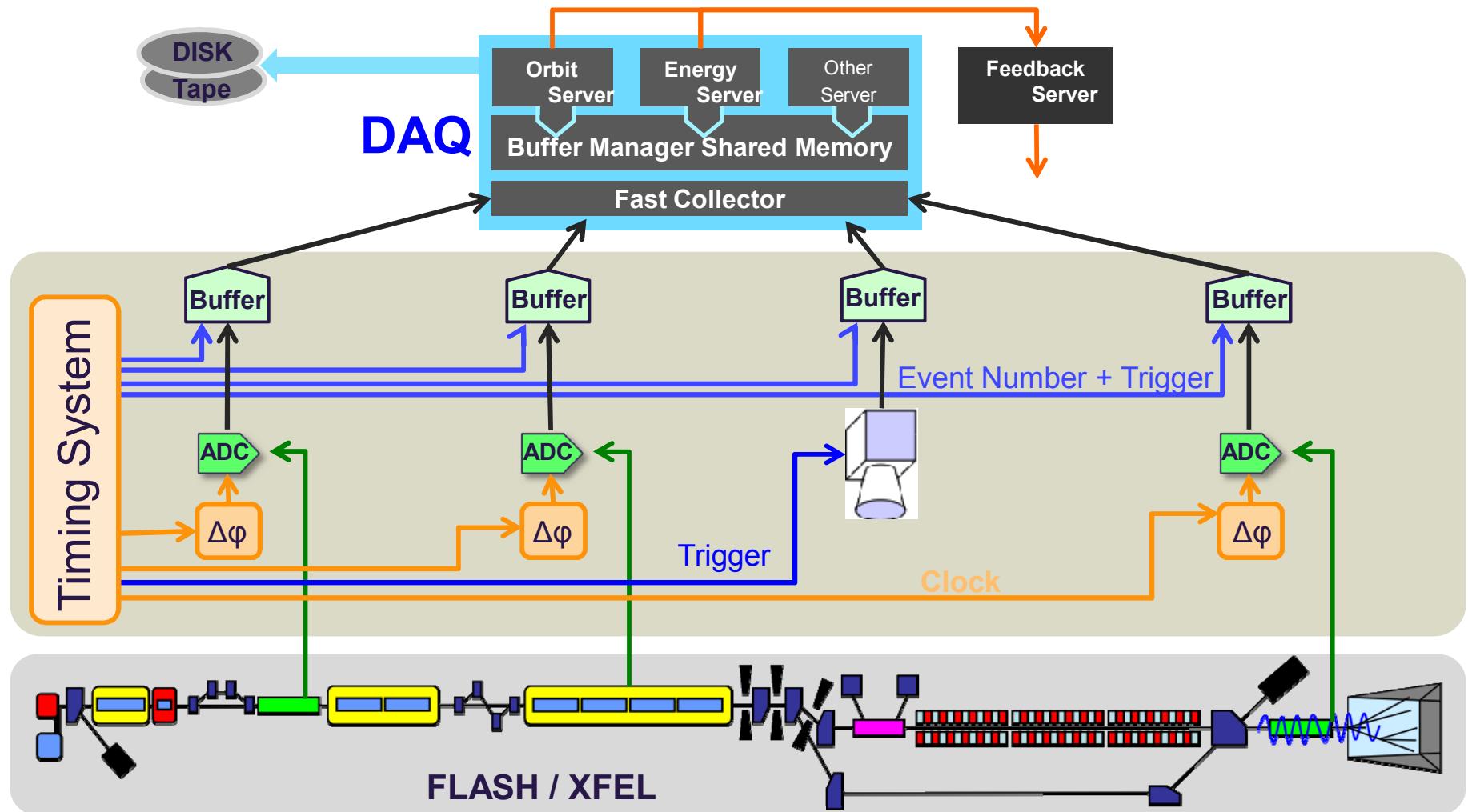
Bunch Patterns

- The XFEL can produce 27 000 bunches per second

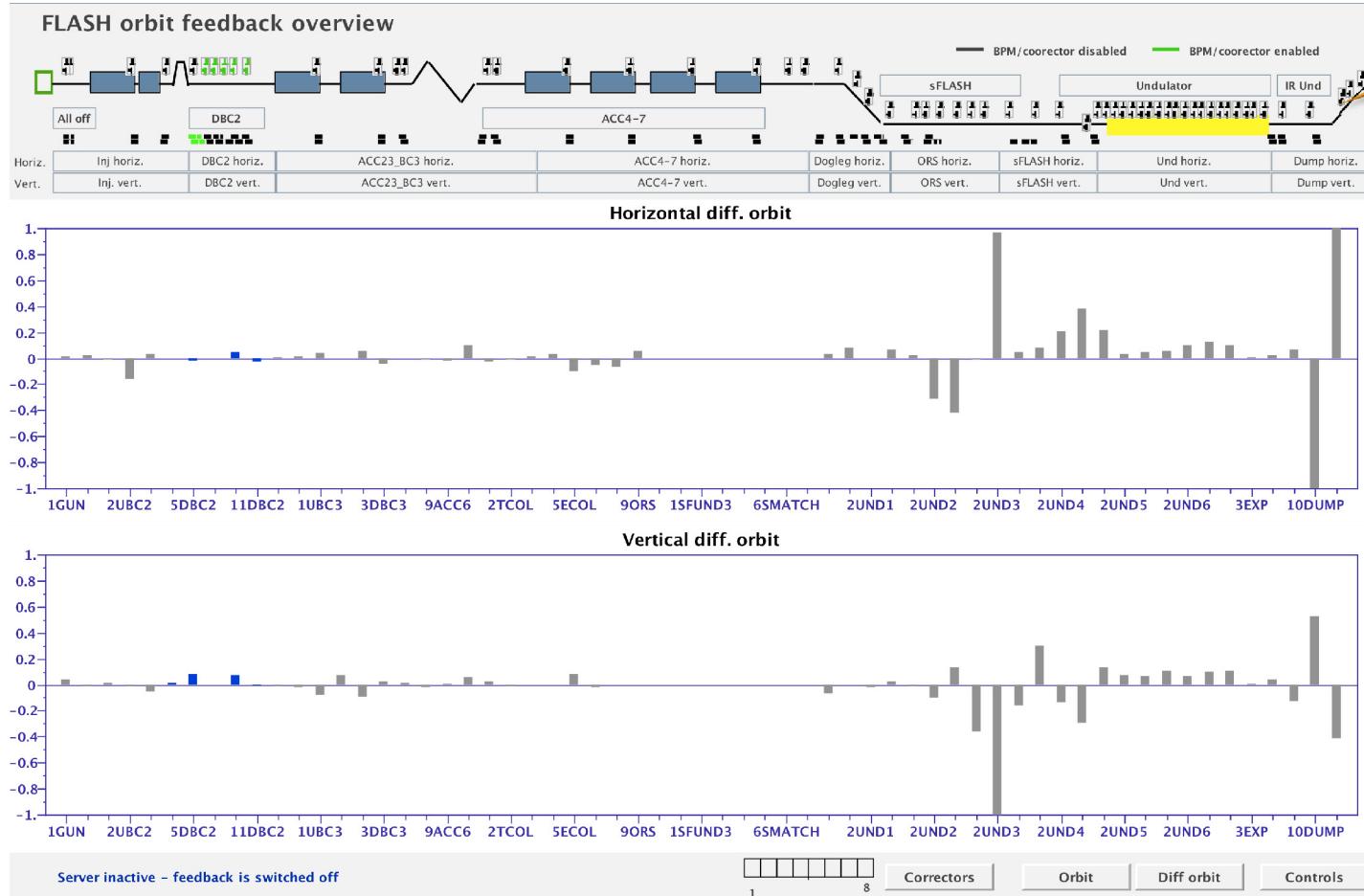


The DOOCS Data Acquisition Concept

Console Applications: access to all components



jddd: Orbit Feedback Display @ FLASH



Dynamically placed elements

jddd workshop
Talk:
THBHAUST04
E. Sombrowski

Conclusions

- XFEL fast diagnostics and controls will be based on **μ TCA™**
- Successful **system test** of key MicroTCA modules (incl. 16 bit ADC) based on MTCA.4 standard
- **MicroTCA integration** in DOOCS demonstrated:
 - Hardware management
 - Hot-swap, Linux driver with DMA, device server
- **Middle Layer Software**:
 - DAQ system to collect distributed data
 - Slow orbit feedback attached to DAQ
- Applications created with **jddd editor**
- Test of XFEL Hardware and Software in FLASH

Thank You for Your Attention!

More Info:

<http://doocs.desy.de>



Oct. 2011

Oct. 2009