

# MicroTCA.4 based laser pulse controller for the injector laser at FLASH and XFEL

LASER controller

FLASH

Controller

XFEL

Summary &  
Outlook.

Christian Grün  
and Torsten Schulz

4th MicroTCA Workshop  
10th December 2015





# Agenda

LASER controller

FLASH

Controller

XFEL

Summary &  
Outlook.

1 The Free-Electron Laser in Hamburg

2 Laser Pulse Controller

3 European XFEL

4 Summary and Outlook



# Free-electron laser FLASH

LASER controller

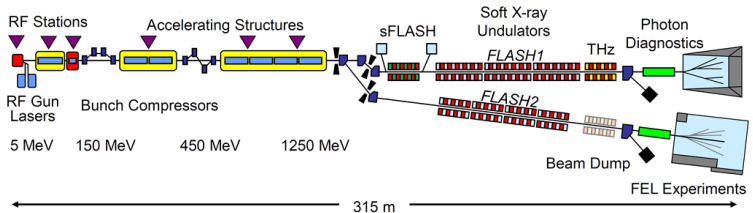
FLASH

accelerator  
bunch pattern

Controller

XFEL

Summary &  
Outlook.



- Multi-Beamline FEL: one LINAC drives two separated undulator beamlines
- two users with different parameter ranges
- three Injector Lasers (one for ultra-short pulses)
- central MicroTCA.4 based Machine-Protection and Timing-System
- Toroid-Protection-System with three modules (one for each beam line)

LASER controller

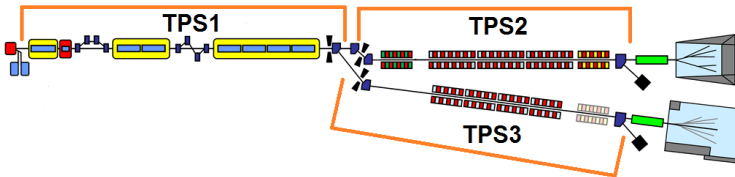
FLASH

accelerator  
bunch pattern

Controller

XFEL

Summary &  
Outlook.



- Multi-Beamline FEL: one LINAC drives two separated undulator beamlines
- two users with different parameter ranges
- three Injector Lasers (one for ultra-short pulses)
- central MicroTCA.4 based Machine-Protection and Timing-System
- Toroid-Protection-System with three modules (one for each beam line)



# bunch pattern structure for both beamlines

LASER controller

FLASH

accelerator  
bunch pattern

Controller

XFEL

Summary &  
Outlook.

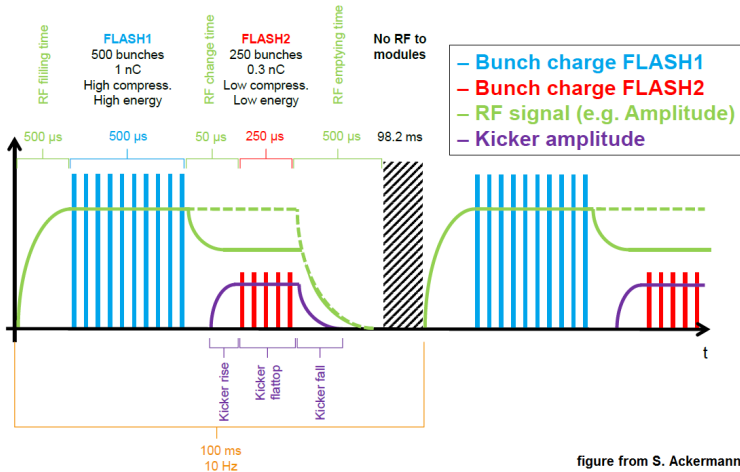


figure from S. Ackermann



# signal flow - crate inputs

LASER controller

FLASH

Controller

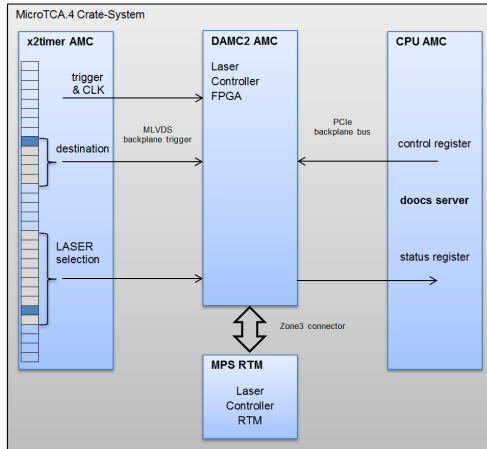
**overview**

hardware

software

XFEL

Summary &  
Outlook.



- table consisting of 7222 32bit-vectors (9MHz spacing)
- word defines laser and destination
- delivers triggers and clocks



# signal flow - ext. inputs and outputs

LASER controller

FLASH

Controller

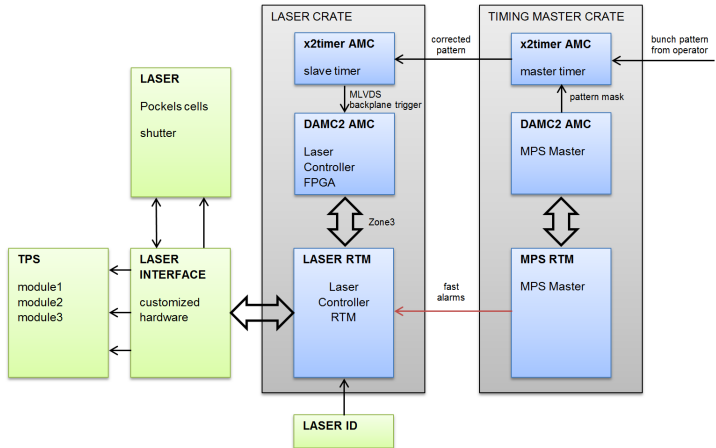
[overview](#)

[hardware](#)

[software](#)

XFEL

Summary &  
Outlook.



- MPS sends inhibit signals for each beamline (fast alarms)
- Laser ID defines specific settings for the different lasers



# MicroTCA.4 hardware

LASER controller

FLASH

Controller

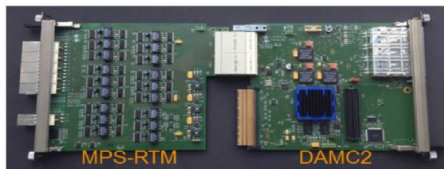
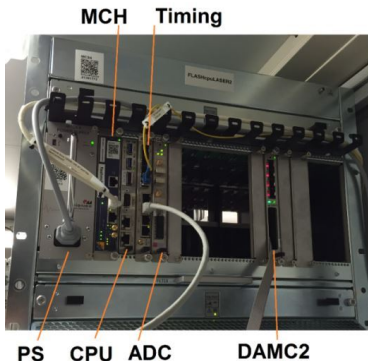
[overview](#)

[hardware](#)

[software](#)

XFEL

Summary &  
Outlook.







# LASER Interface

LASER controller

FLASH

Controller

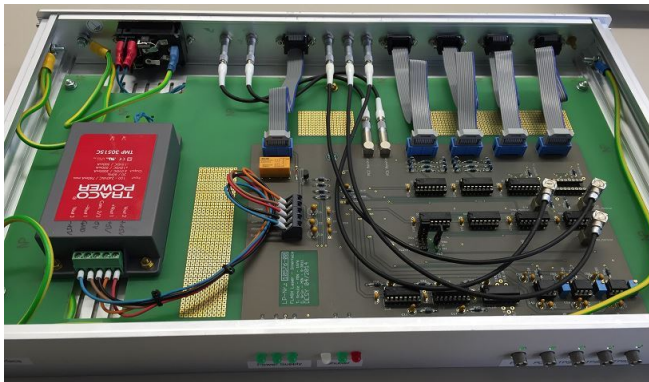
[overview](#)

[hardware](#)

[software](#)

XFEL

Summary &  
Outlook.



- interface between RTM and the specific laser electronic
- analog signal processing
- status LEDs and ADC monitoring signals
- planned to be integrated into new RTM development



# FPGA configuration - generating laser trigger

LASER controller

FLASH

Controller

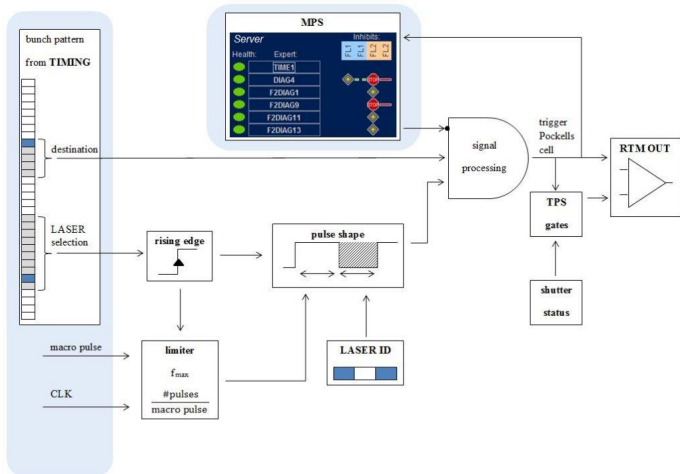
[overview](#)

[hardware](#)

[software](#)

XFEL

Summary &  
Outlook.





# FPGA configuration - generating shutter signal

LASER controller

FLASH

Controller

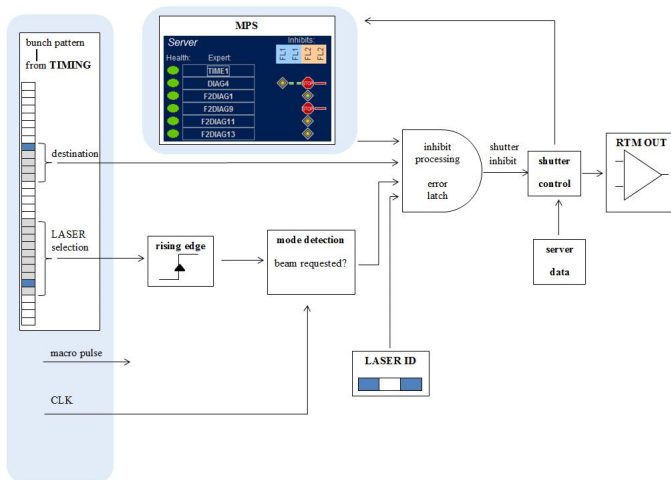
[overview](#)

[hardware](#)

[software](#)

XFEL

Summary &  
Outlook.





# first beam in XFEL (10th FEB 2015)

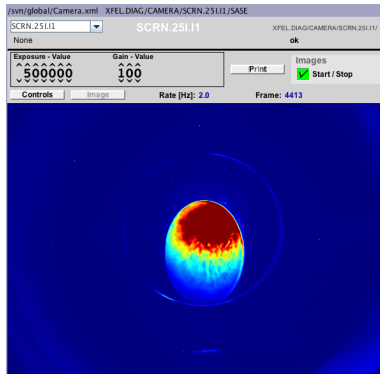
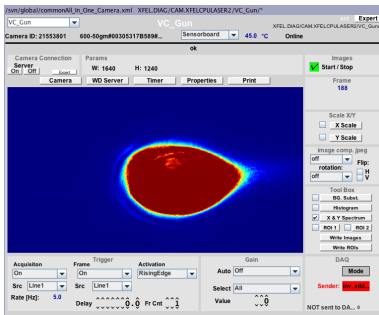
LASER controller

FLASH

Controller

XFEL

Summary &  
Outlook.





# The Laser Pulse Controller in a nutshell.

LASER controller

FLASH

Controller

XFEL

Summary &  
Outlook.

- Laser Pulse Controller is running 24/7 in FLASH.
- Controller has also been set up for XFEL (first beam in FEB-2015).
- First beam in the Injector will follow next week.
- It's planned to develop a new RTM for the controller AMC.
- Further upgrades: Laser3 RF-controller, FLASHforward migration, CW-operation, ...

Thank you for your attention!

**Inj.Laser**  
Free-Electron Laser FLASH