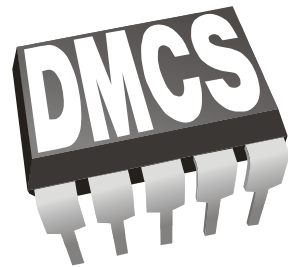




EuCard

WP10.6 - LLRF at FLASH

FLASH upgrade 2010 and roadmap for 2011-2012



FLASH

Free-electron LASer in Hamburg

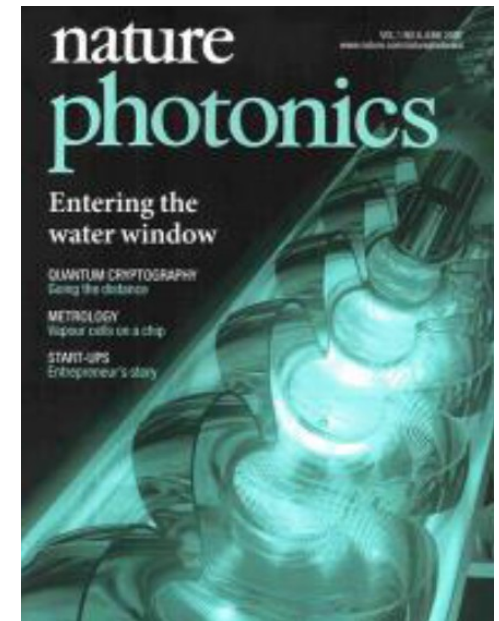
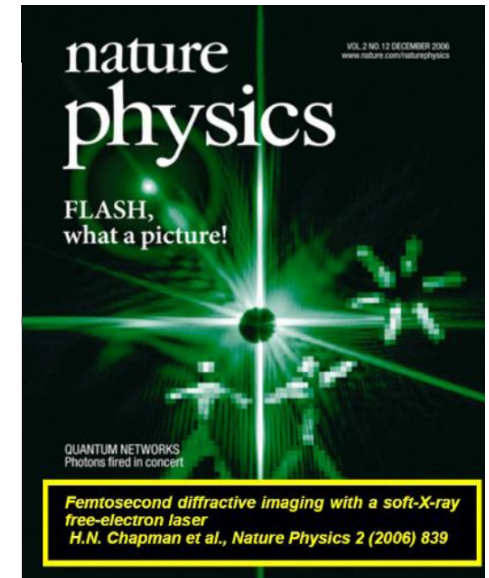
- Single-pass high-gain SASE FEL
SASE = self-amplified spontaneous emission
- Photon wavelength range from vacuum ultraviolet to soft x-rays
- Free-electron laser user facility since summer 2005
 - 1st period: Jun 2005 –Mar 2007
 - 2nd period: Nov 2007 –Aug 2009
 - 3rd period: Sep 2010 –Sep 2011
- FLASH is also a test bench for the European XFEL and the International Linear Collider (ILC)
- FLASH II, a second undulator beam line is in preparation



FEL performance 2nd user period

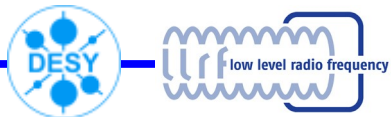
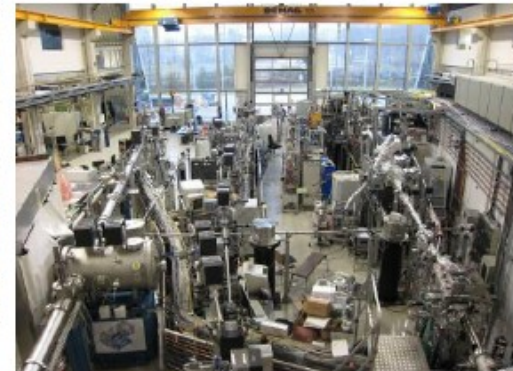
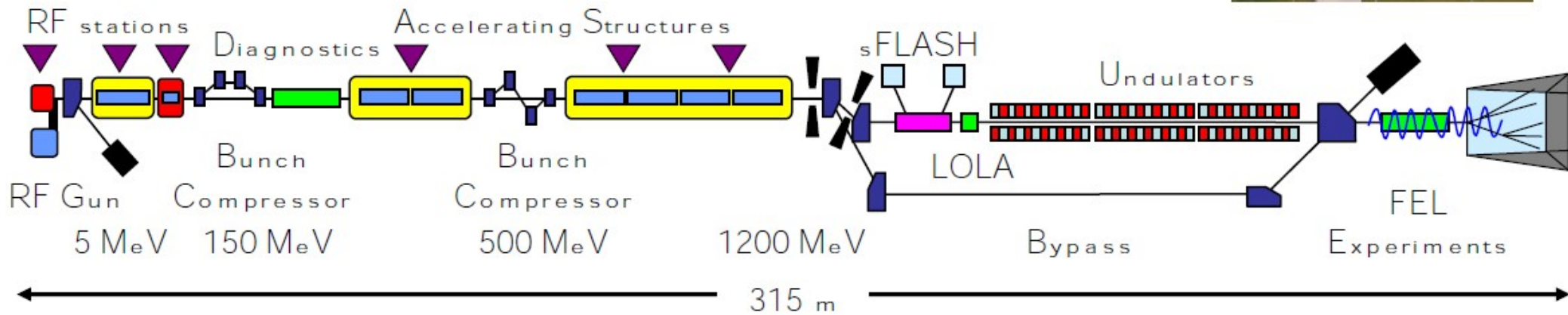
(Nov-2007 –Aug-2009)

- Typical user operation parameters 2nd user period
 - Wavelength range (fundamental) 6.8 –40.5 nm
 - Average single pulse energy 10 –100 μ J
 - Pulse duration (FWHM) 10 –70 fs
 - Peak power (from av.) 1 –5 GW
 - Average power (example for 500 pulses/sec) ~ 15 mW
 - Spectral width (FWHM) ~ 1 %
 - Peak Brilliance 10^{29} – 10^{30} *
* photons/s/mrad²/mm²/0.1%bw



more than 100 publications on photon science at FLASH in high impact journals
http://hasylab.desy.de/facilities/flash/publications/selected_publications

Upgrade 2009 / 2010

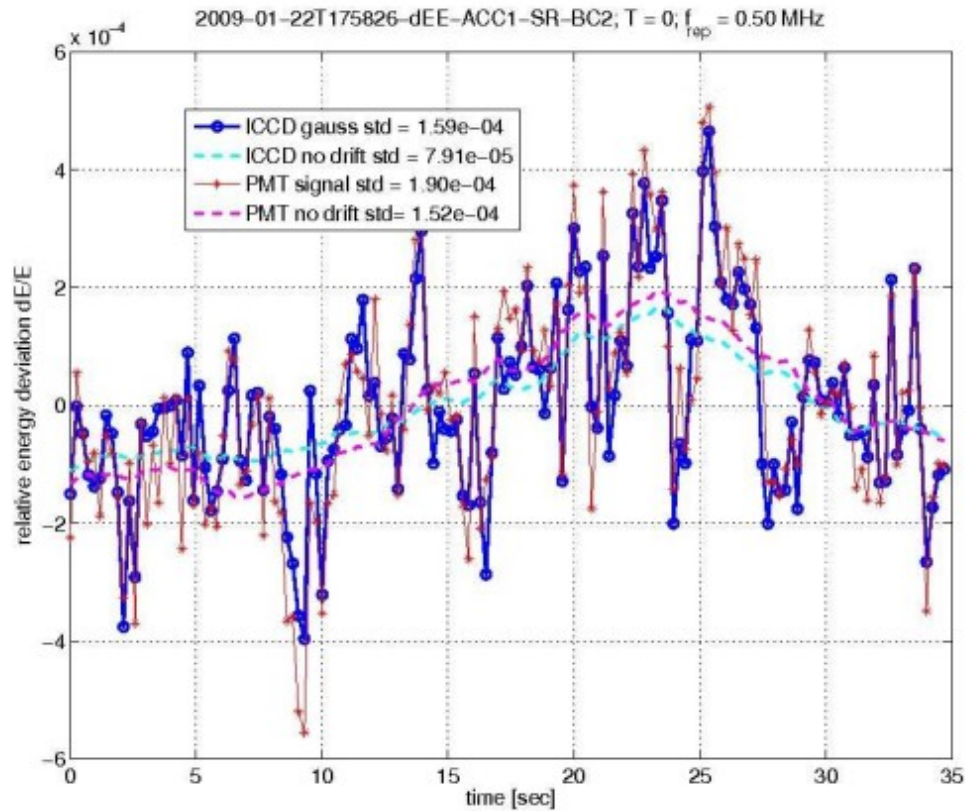


LLRF upgrade - hardware

- Master Oscillator
 - Redundant MO with distribution
 - Local distribution in Cryoannex
- Field control
 - Uniform SimconDSP based LLRF system at FLASH
 - New cabling in GUN, ACC1
 - Installation of ACC39 control
- Piezo control
 - Permanent installation at ACC1, ACC3, ACC5, ACC6, ACC7



Energy stability

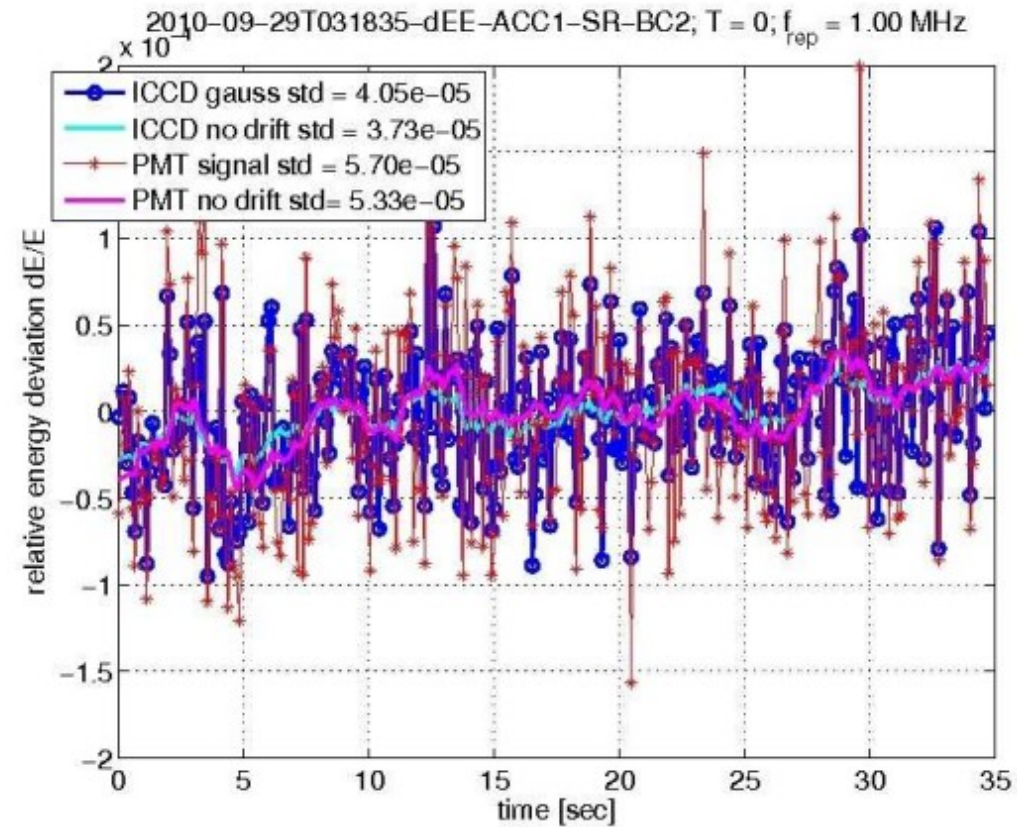


- FLASH elogbook 22.1.09 18.08h
- ACC1 off-crest
- Typical values of $dE/E = 1.5 \times 10^{-4}$

before

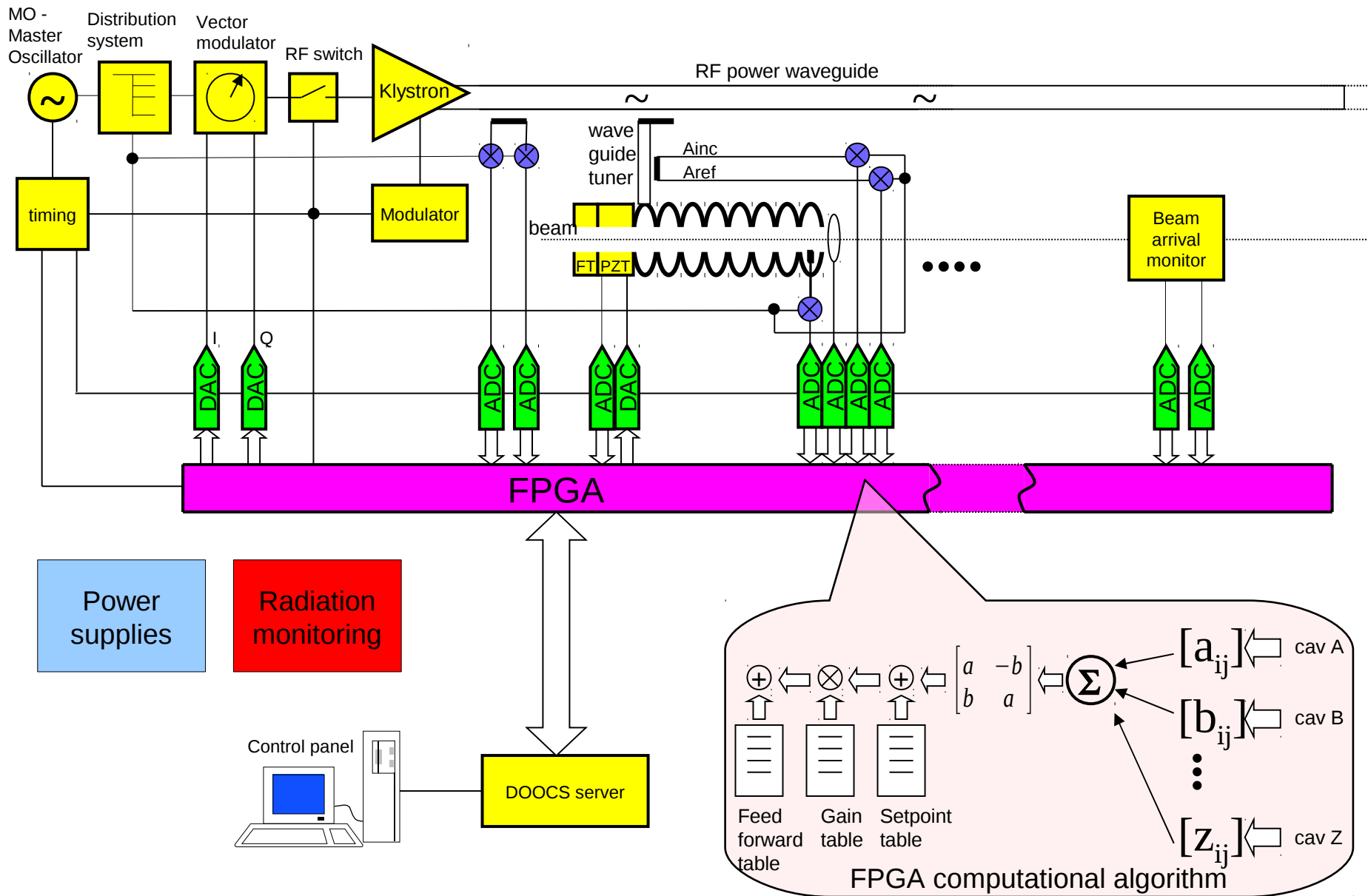
Christopher Gerth, et al.

after



- FLASH elogbook 29.9.10 03.21h
- ACC1, ACC39 on-crest
- Best results: $dE/E = 0.5 \times 10^{-4}$

LLRF system architecture



Milestones

Milestone Description/title	Delivery Month
10.6.1.Design and manufacturing of the carrier board prototypes	M18
10.6.2 Design and manufacturing of the AMC modules with fast analogue and digital IO	M24
10.6.3 Design and manufacturing of the AMC board with ultra fast ADC	M24
10.6.4 Design and manufacturing of AMC radiation dosimeter	M18
10.6.5 Report on tests and calibration of the radiation dosimeter	M36
10.6.6 Designed and manufactured Frequency Synthesizer Board (AMC)	M24
10.6.9 Design and fabrication of AMC, modules for controlling step motors, piezo and waveguide tuners	M24

