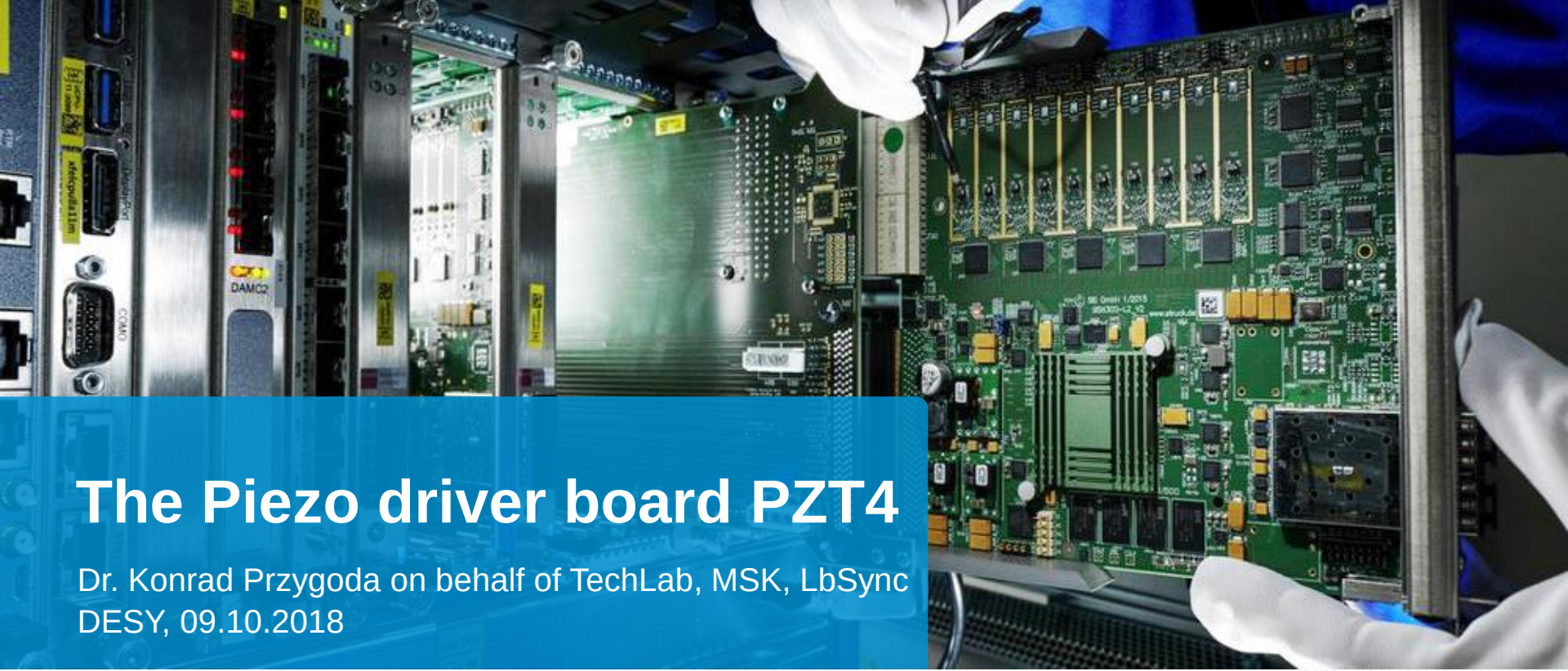


The Piezo driver board PZT4

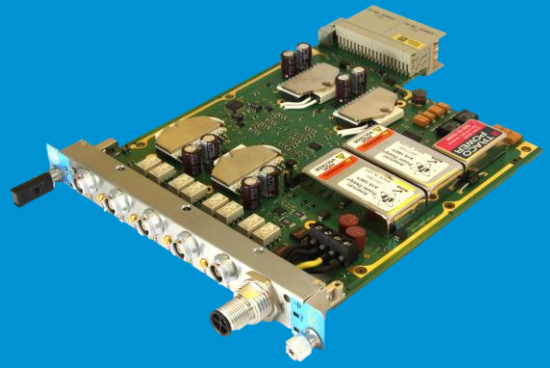
Dr. Konrad Przygoda on behalf of TechLab, MSK, LbSync
DESY, 09.10.2018

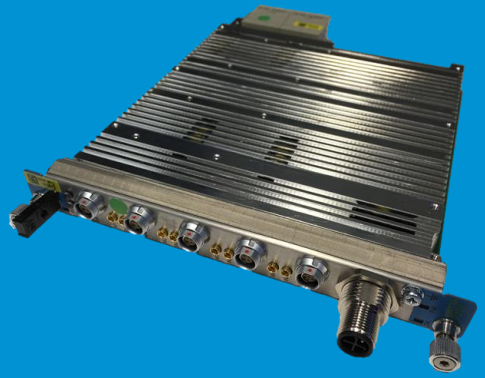
MicroTCA TECHNOLOGY LAB

DESY.

AGENDA

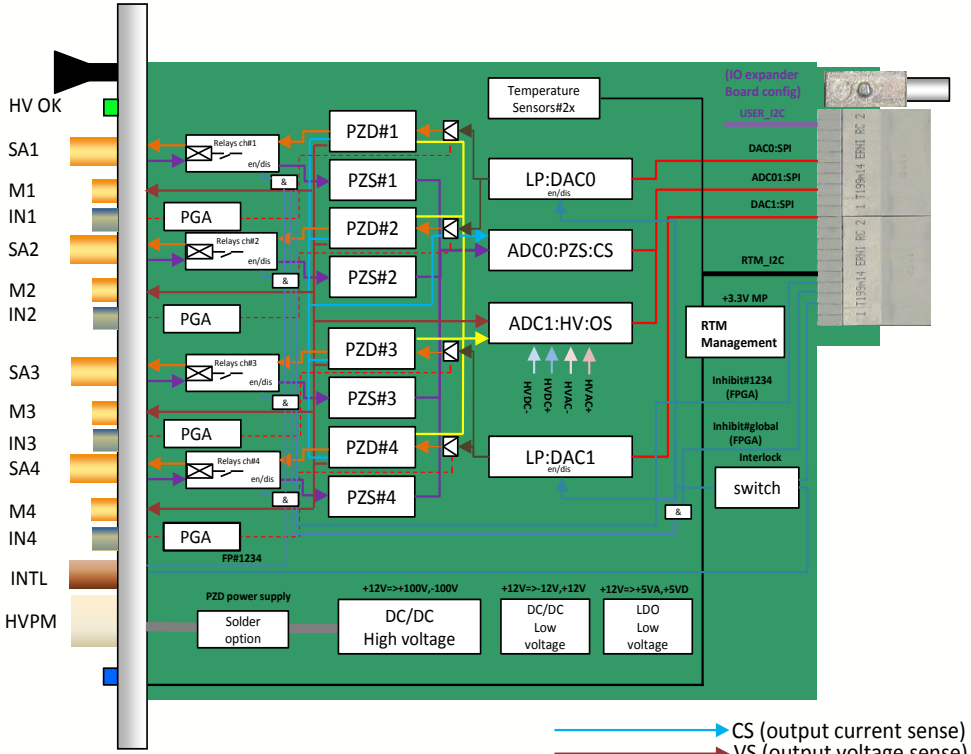
1. Hardware Overview
2. SRF Cavity Tuning Application
3. Laser Synchronisation Application
4. Links Stabilization Application





Hardware overview

Block Diagram & Features



HVDC-(high voltage negative:dc component)
HVDC+(high voltage positive:dc component)
HVAC-(high voltage negative:ac component)
HVAC+(high voltage positive:ac component)

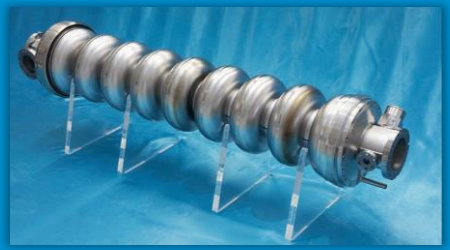
CS (output current sense)
VS (output voltage sense)
PZDO (piezo driver output)
PZS (piezo sensor input)
DAC output
external input

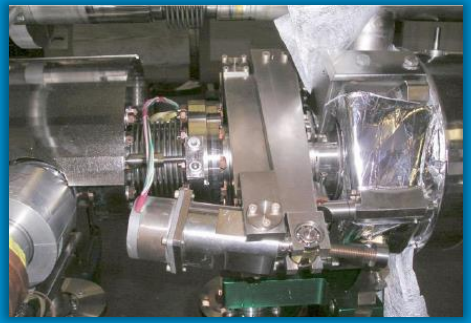
LP(programmable analog low pass)
Relays ch#(Relay ACT/SENS, Relay load disconnection)
PGA(Programmable gain amplifier with protection)

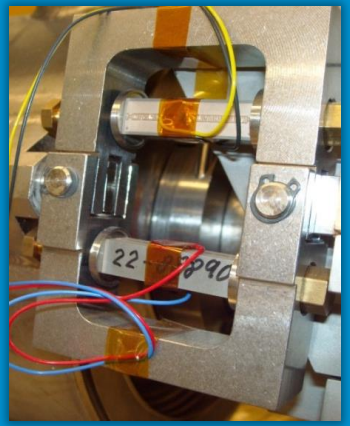
MicroTCA.4 Rear-Transition Module (RTM)

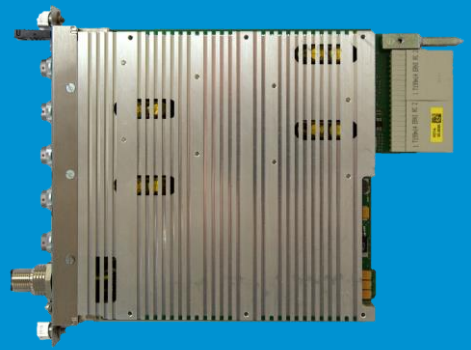
- Typical bandwidth of DC÷50 kHz with 0.1 µF piezos
- Digital output sampling with 500 kSPS
- Switchable actuator and sensor functionality
- Unipolar: 0 ...+80 V and bipolar: ±160 V operation
- External high-voltage input for up to 120 V/ 500 mA
- Interlock signal support via Zone 3 or Front Panel
- Analog low-voltage monitor outputs on front Panel
- Overcurrent & overvoltage protections

Applications: Cavity frequency tuners, synchronization of pulsed lasers, fiber link stabilization, precision object positioning, laser mirror steering, etc.



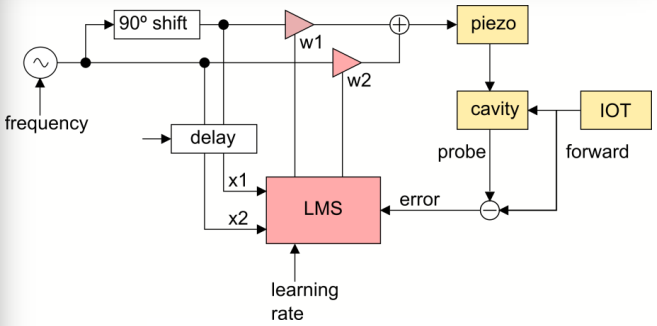






SRF Cavity Tuning Application

LLRF System for CW at CMTB in DESY



Courtesy R. Rybaniec

ENVIRONMENT:

- 1.3 GHz 9-cell SRF cavities
- Q_L~1.5 e7 ÷6 e7
- Bdw. ~ 86 Hz ÷21 Hz
- CW operation up to 20 MV and above
- High voltage power source: 120 kW IOT tube
- Cavity mechanical tuner (Saclay II model):

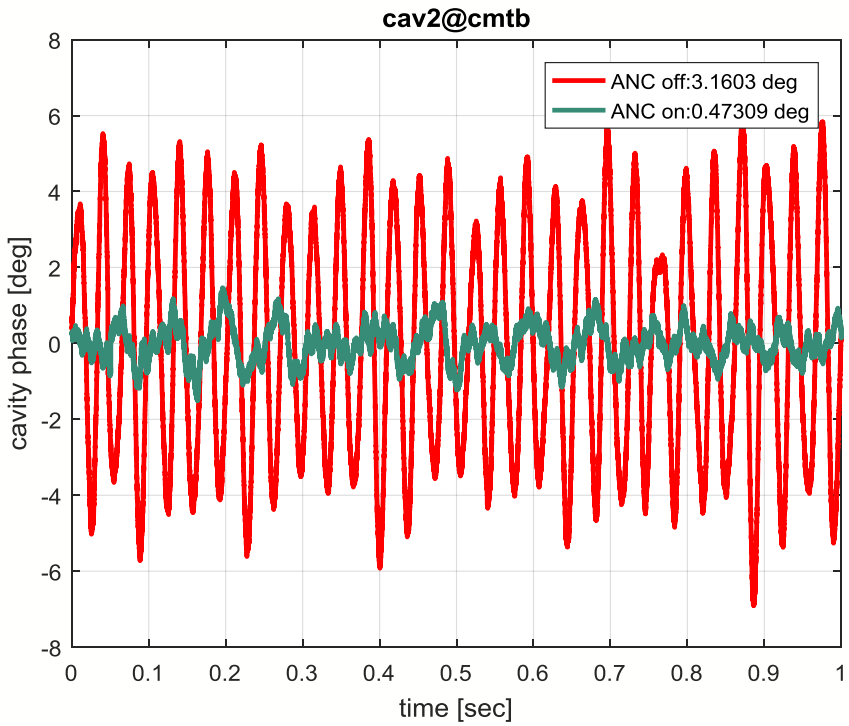
  Sanyo motorized stage for cavity coarse tuning

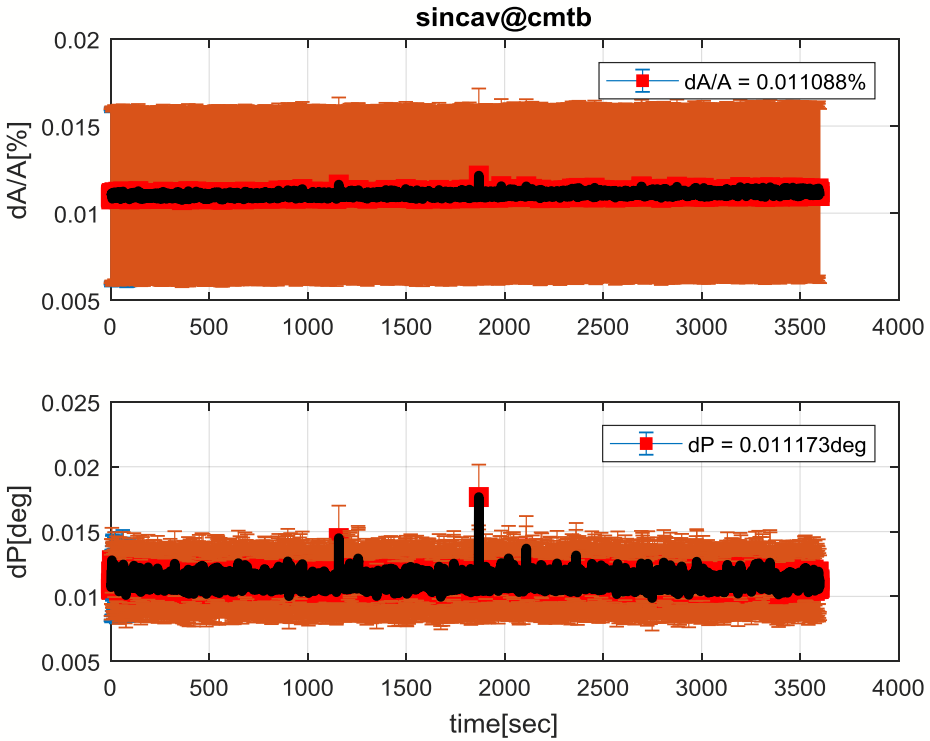
  Physik Instrument piezo elements (~4 µF@2K) for cavity fine tuning

Goal:

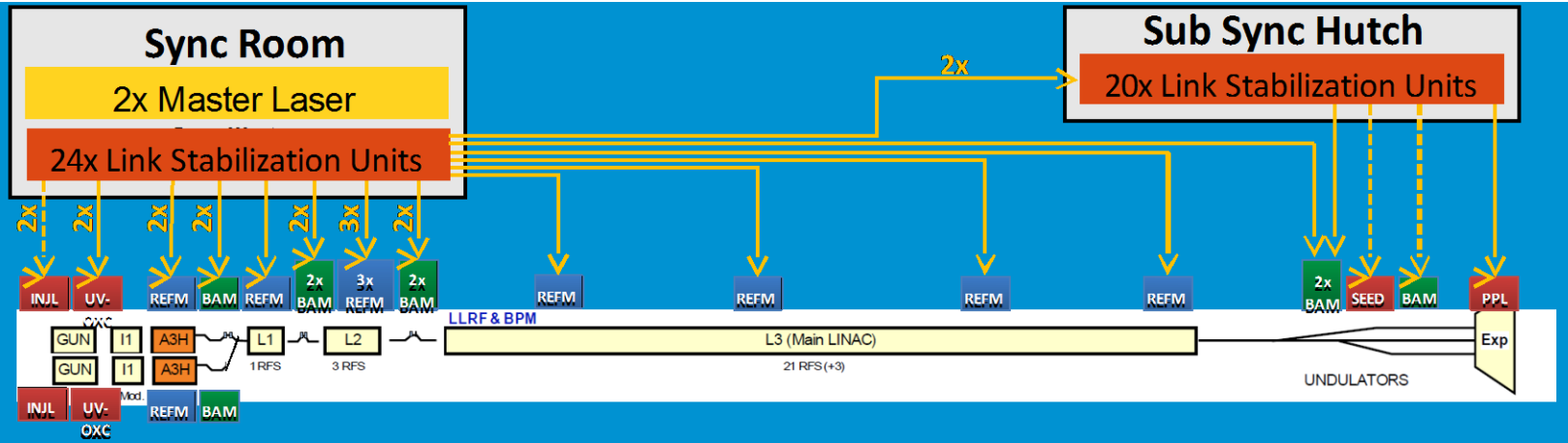
- Stabilize RF field amplitude and phase
- Minimize microphonics effect

RF Amplitude and Phase Stabilization @ 25 MV





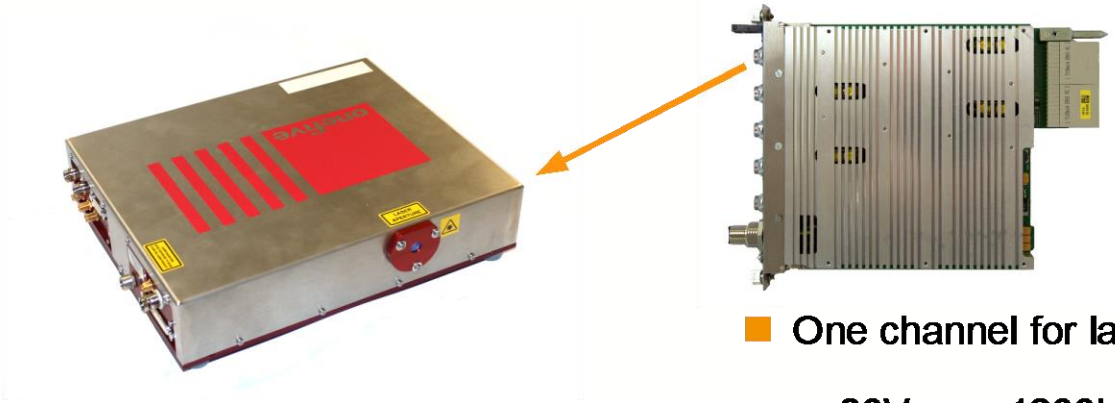
Active Noise Cancellation using Piezos

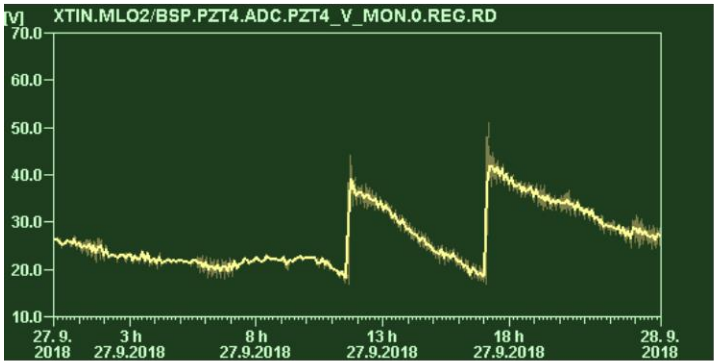


Laser/link Applications

@ European XFEL

Laser locking: Master-Laser-Oscillator

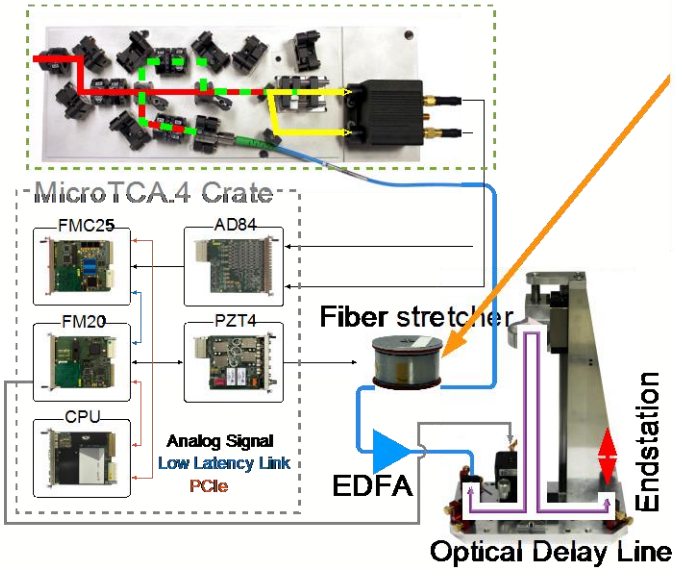


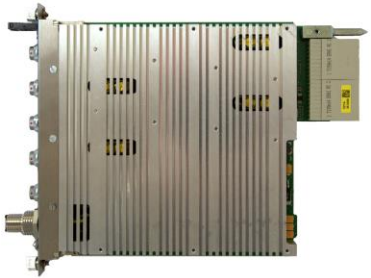


- One channel for laser lock
  - 80V$_{pp}$ => 1200Hz$_{pp}$ with 5mHz stepssize
  - 3.2 fs rms (10Hz-850kHz) jitter
- Second channel for MZM control
  - Drift-free RF-2-Laser phase
  - Needs feedback with -40 to +40V

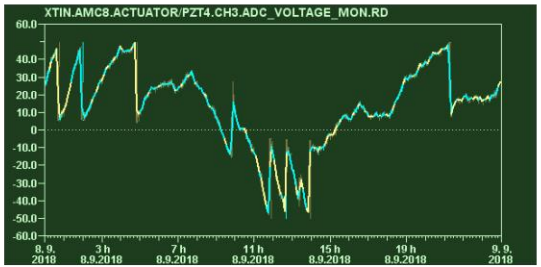
Courtesy C. Sydlo on behalf of LbSync

Femtosecond timing distribution @ FLASH & Eu XFEL





- One PZT4 handles 4 links
- 160V_{pp} => 8ps_{pp} with 30as stepssize
- > 200as rms (10Hz-100kHz) in-loop



Courtesy C. Sydlo on behalf of LbSync

Thank You For Your Attention