

Laser-Synchronization

Matthias Felber

MSK Collaboration Workshop

DESY

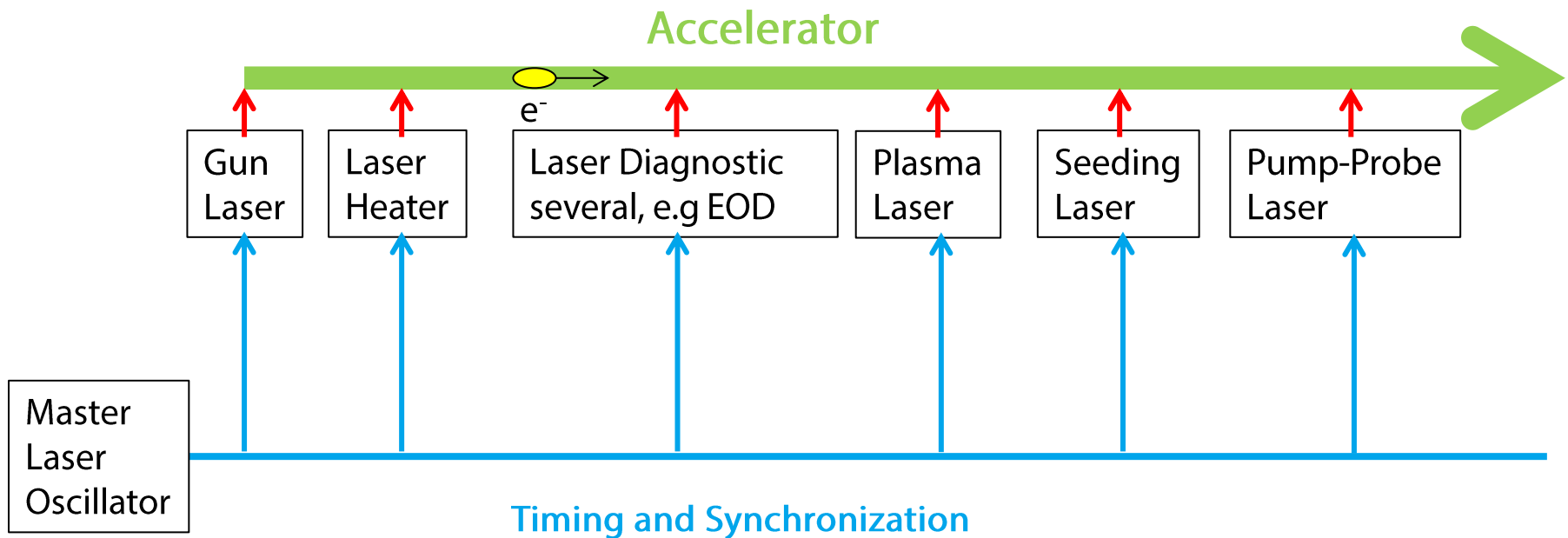
13th May, 2013

Outline

- Introduction
- Firmware
- Hardware
- Frequency Issues
- Status

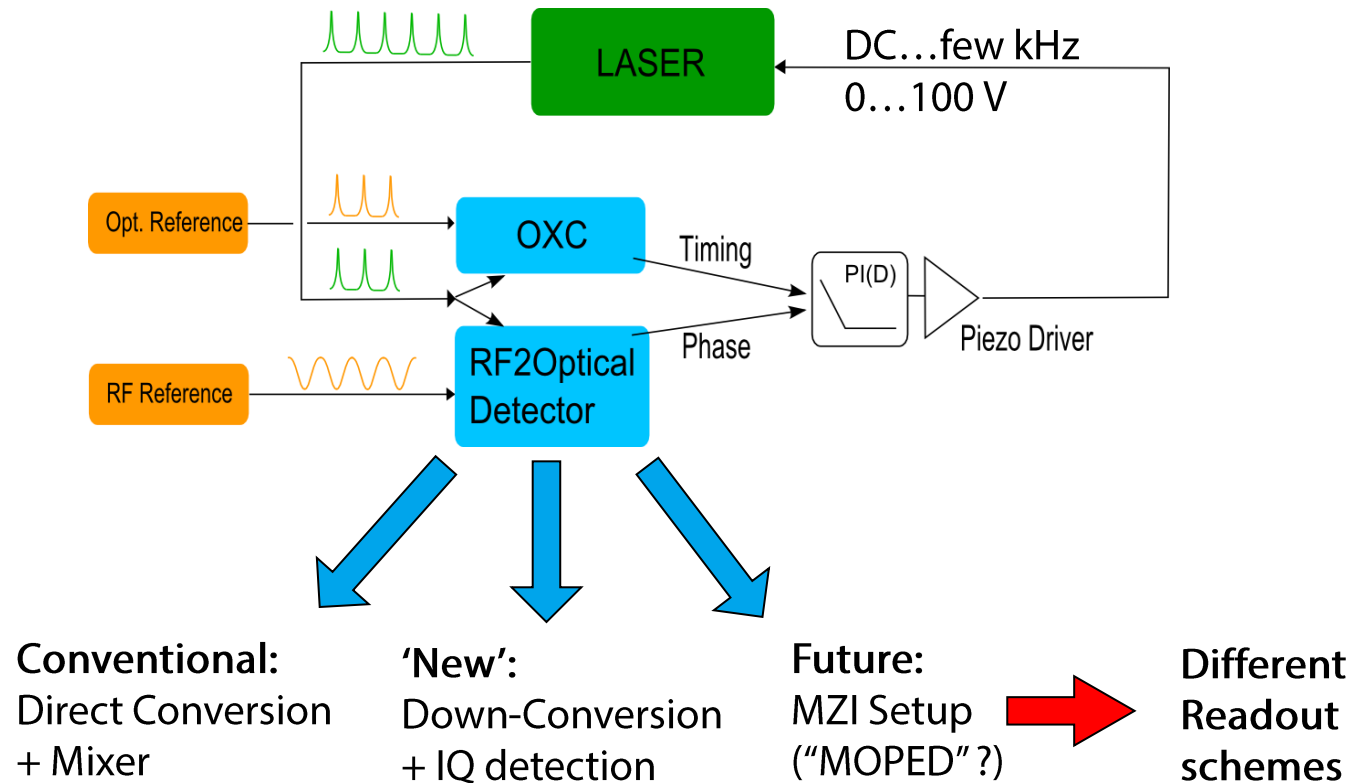


Motivation – Lasers at Accelerators

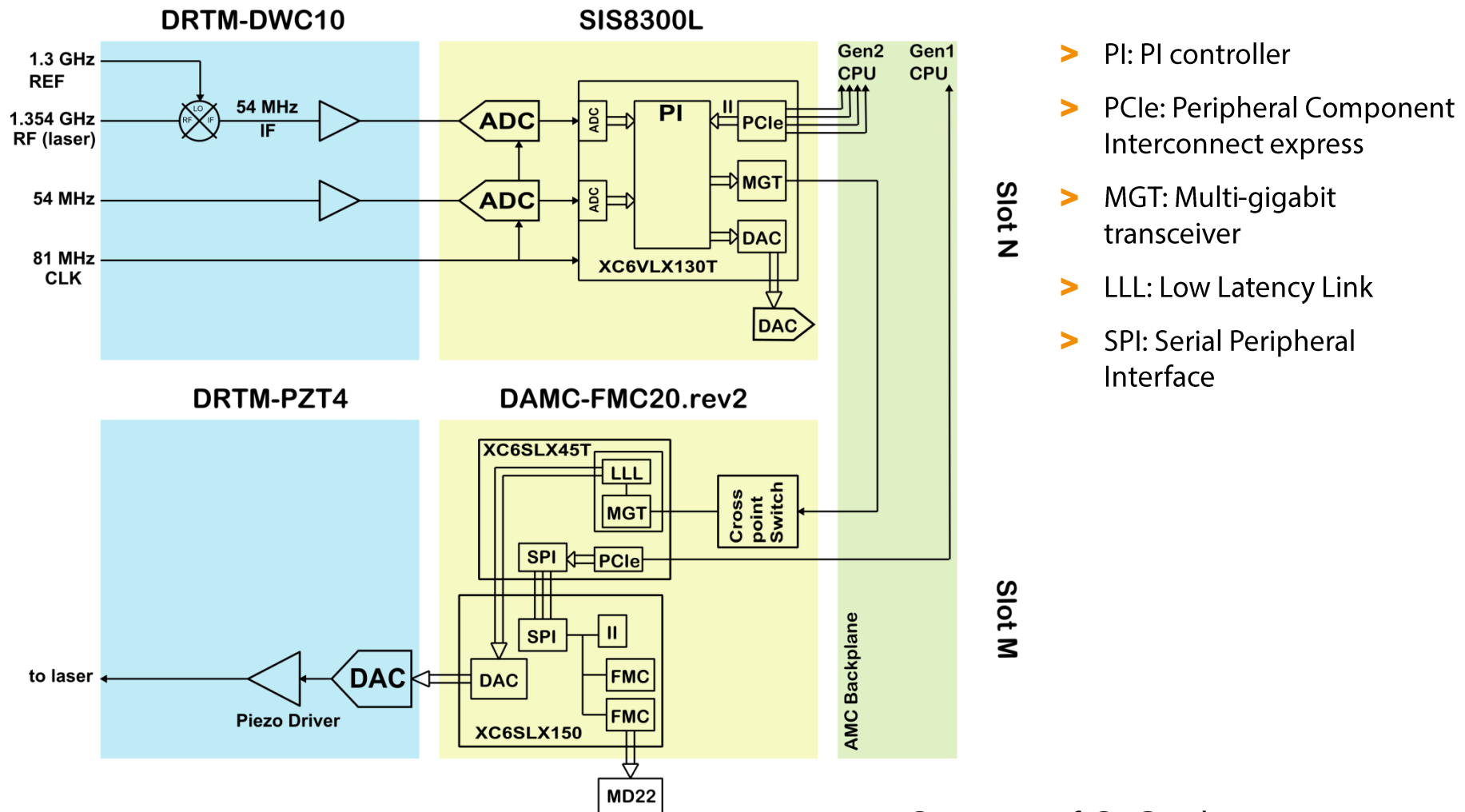


Laser Synchronization

- > PLL-like system
- > Reference is optical and/or RF
- > Different detection methods for RF vs. Laser Phase

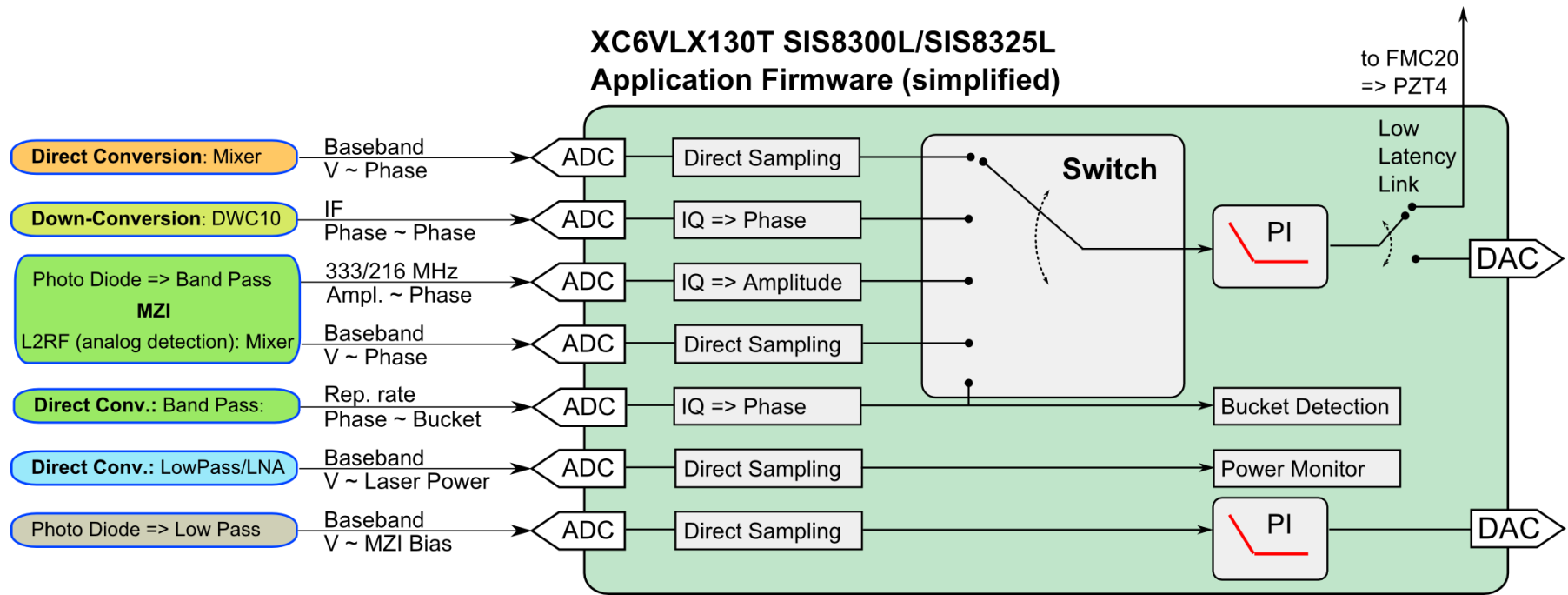


Blockdiagram of Signal Processing - Existing FW



Courtesy of C. Gerth

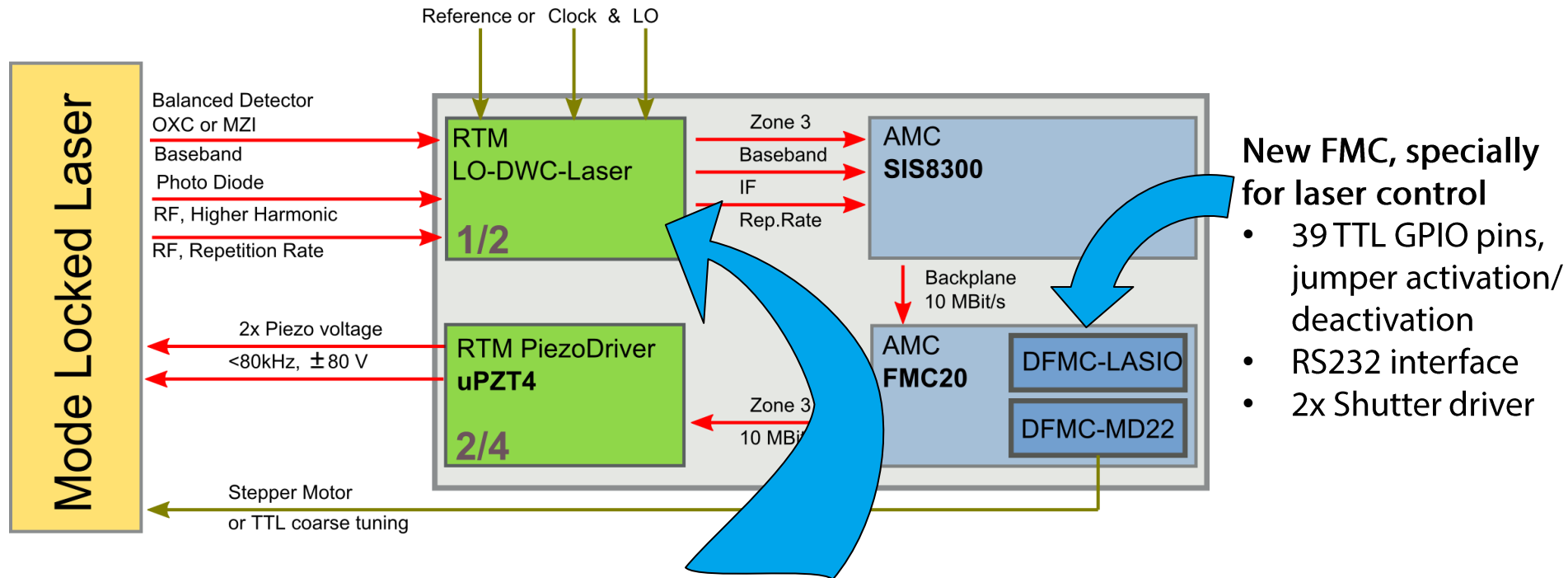
Future Application Firmware Signal Needs



To-do:

- Take newest base FW from Łukasz and combine it with Paweł's Simulink Interface
- Copy Uros' SysGen Model to other channels and provide switching between different inputs
- Debugging of application FW
 - In-loop drifts
 - Error clipping
 - ...

MTCA Setups - Laser Synchronization



New FMC, specially for laser control

- 39 TTL GPIO pins, jumper activation/deactivation
- RS232 interface
- 2x Shutter driver

New RTM, specially for laser synchronization

New FMC for Digital IO to be designed

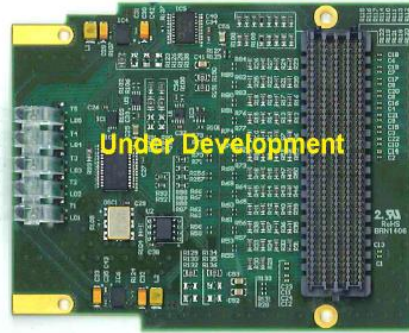
FMC Multi-Purpose I/O Board.

DFMC-LASIO

Data Sheet

Applications

- Laser and Shutter controls
- Industrial process control
- Manufacturing automation
- Research & development
- Accelerators



Features

- Low-Pin-Count FMC Module (Vita 57.1 compliant)
- Up to 39 general-purpose digital IO pins. Selectable 3.3V or 5V levels
- 40-pin 3M MDR connector with high density and easy ribbon cable connection
- Each pin can have following function: IO, GND or alternate function (selected with 0R resistor)
- Highly Flexible Alternate functions available:
 - 2 pins useable as 8-Bit DAC (0-5V, 50 mA drive)
 - 2 pins useable as 8-Bit ADC
 - 2 pins useable as two independent digitally controlled power supplies (1A, up to 18V)
 - 4 pins useable as standard UART (12V levels)
- Xilinx CPLD can control all IOs and options and can generate real-time patterns
- Adjustable FMC voltage (Vadj): 1.2 to 3.3V
- RoHS compliant

The DFMC-LASIO is a cost-efficient FMC board designed according to ANSI/VITA 75.1.

The card can be used in all applications where standard I/O channels with 3.3V or 5V levels are required. Additionally it offers analog functions needed for measurement and control tasks such as two programmable power supplies, two DACs and two ADCs and a true RS232 UART.

All IOs and all functions are routed to a CPLD where special supervision functions can be implemented and where special waveforms can be generated on the analog channels.

One use scenario of the card is the control of a laser system. The I/Os are used to for communication with a laser controller. The power source is used to drive a shutter with CPLD-generated pulse shapes. The DAC and ADC are used to drive and monitor the optocouplers in the shutters.

DESY offers the DFMC-LASIO for licensing to industry. DESY can modify this product to meet special customer requirements.



Beschleuniger | Forschung mit Photonen | Teilchenphysik

Deutsches Elektronen-Synchrotron
Ein Forschungszentrum der Helmholtz-Gemeinschaft

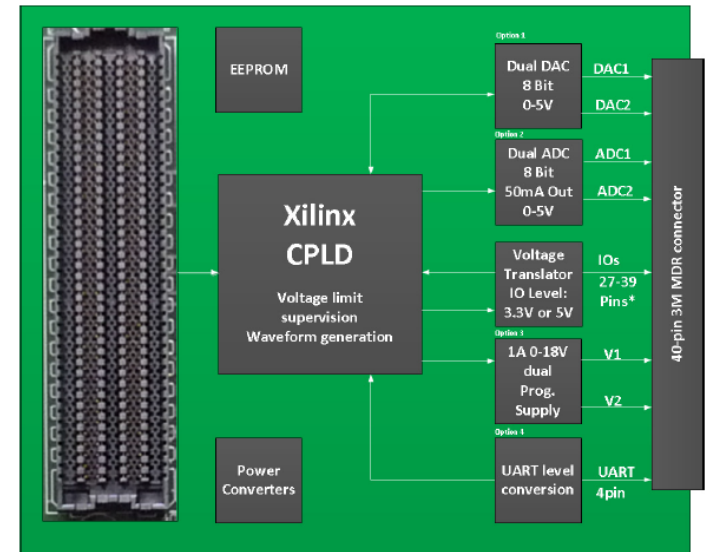
ber | La

FMC Multi-Purpose I/O Board.

DFMC-LASIO

Data Sheet

Functional Block Diagram



*All Options can be bypassed with 0R resistors.
Without all Options 39 IOs are available; With all functions 29 IOs are available

Contact

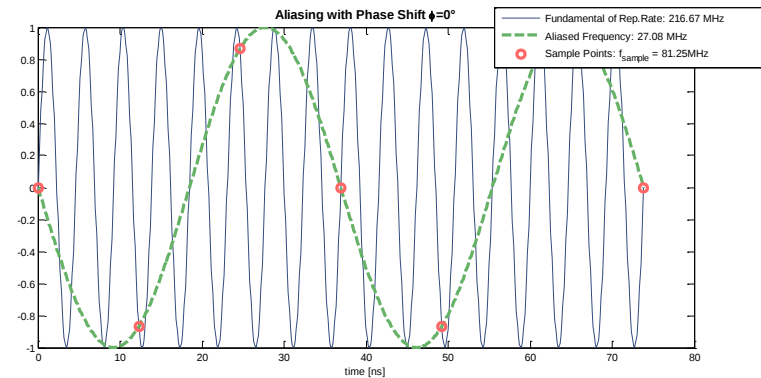
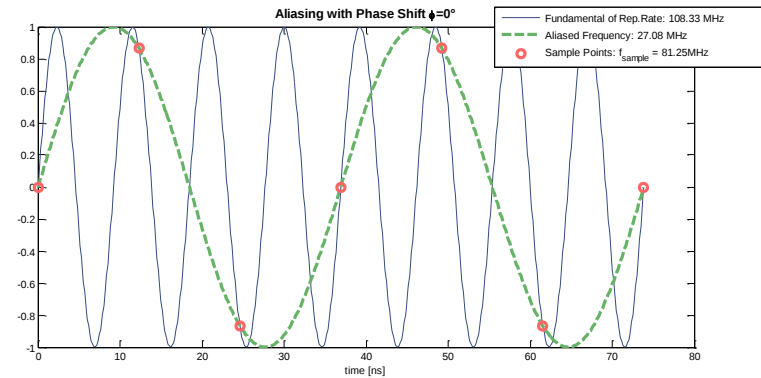
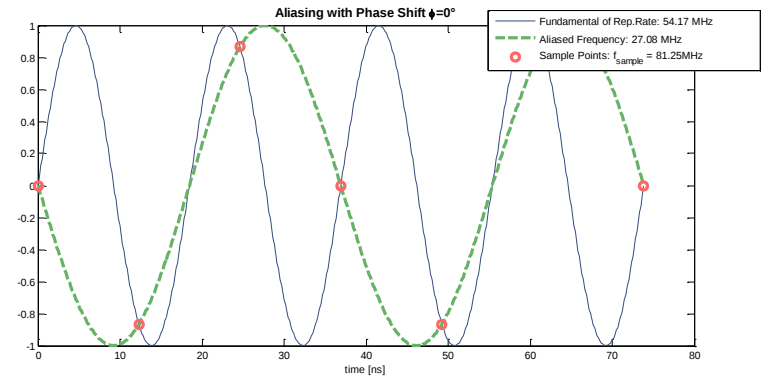
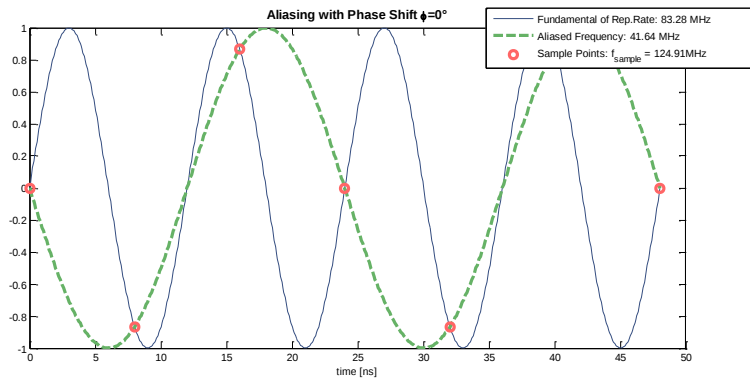
DESY-TT
Notkestraße 85
D-22607 Hamburg

email: support-mtca@desy.de
www.desy.de

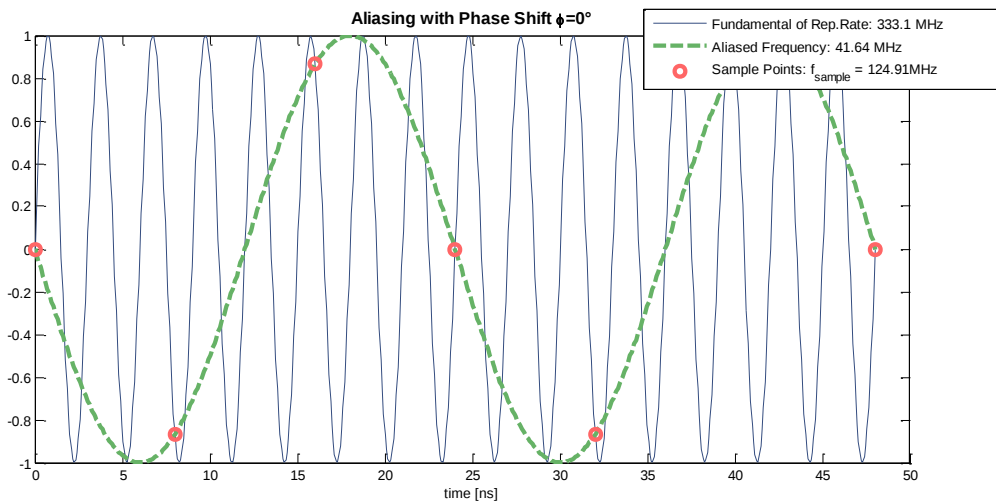
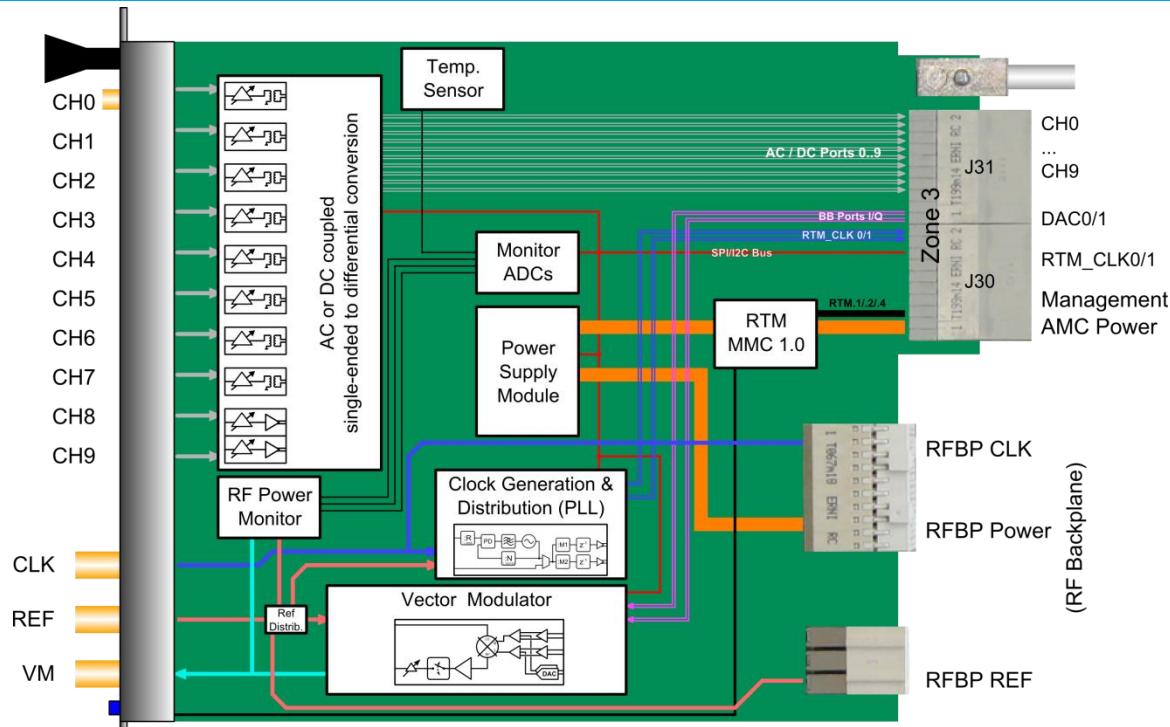
Deutsches Elektronen-Synchrotron DESY

Used/Needed Frequencies

Rep. Rate	LO [MHz]	RF [MHz]	IF [MHz]	Clk [MSPS]	IF/CI k
54 MHz	1300	1354	54	81	2/3
108 MHz	1300	1408	108	81	4/3
216 MHz	1300	1516	216	81	8/3
216 MHz	1354	1300	54	81	2/3
83 MHz	3000	3083	83	125	2/3
83 MHz	3025	3000	25	125	1/5



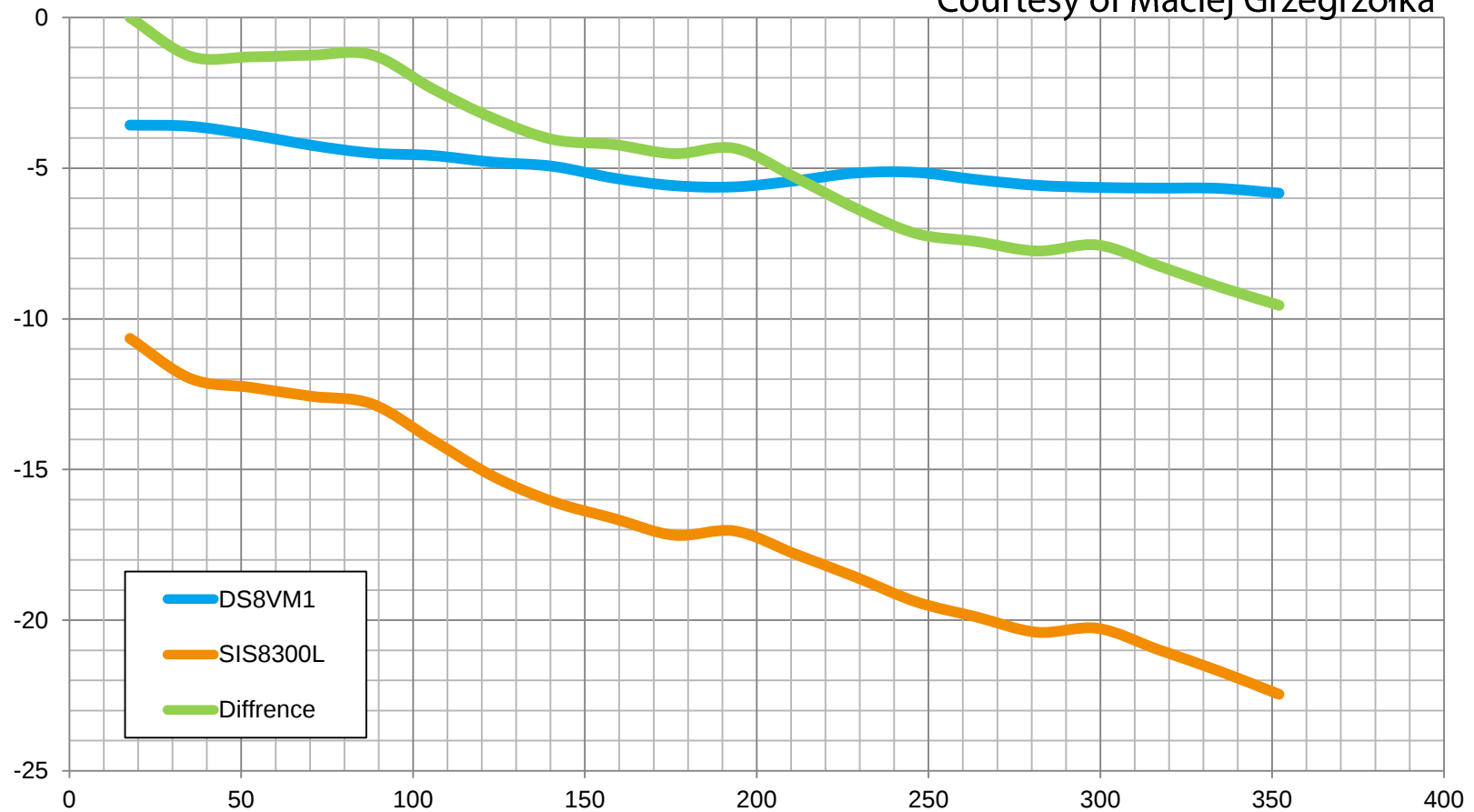
Direct Sampling of MZI Modulation Frequency



Phase is fixed: only amplitude readout
 Don't need IQ $\rightarrow$ Amplitude conversion
 At the right phase I or Q are amplitude!

SIS8300L ADC bandwidth

Courtesy of Maciej Grzegorzówka



➔ Need SIS8325L

Board Status

> SIS8300L/SIS8325L

- Waiting for no-split version (~2 month)

> LASY

- Under development, for now use DWC (and DS8), how many available?

> FMC20

- 2x prototype in use, 5x (10x) V2.0 produced

> PZT4

- 2x prototype in use, 3x (5x) V2.0 produced

> LASIO

- Under Development

> MD22

- 10x V2.0 produced, works with FMC20, needs redesign for other carriers



Synchronization of EOD Laser

