Intra bunch train arrival time and compression feedback

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Agenda

1. Installation
2. Implementation
3. Results
Beam Based Feedback at FLASH

- Aims to stabilize bunch arrival time and beam phase
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- Work done in cooperation of two groups: MSK and FLA
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Beam Based Feedback at FLASH

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Beam Based Feedback at FLASH

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1. Installation

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Installation at FLASH

Hardware:
- Two ACB 2.1 boards in the Laser Hut
- One Simcon DSP in the Injector Area (ACC1 crate)
- Fiber optic link between Laser Hut and Injector Area

Software:
- New DOOCS server for ACC1 control (based on Simcon DSP)
- DOOCS server for ACB 2.1 boards
- Adaptive FF server (by Florian)
Installation layout

- GUN
- ACC1
- ACC23
- PYRO
- BAM
- ACC456
- BAM
- UND
- FEL

- Laser Hut
- Injector Area
- Digital Fiber Link

- SIMCON
- DSP
- ACB 2.1
ACB 2.1 board

- VME form factor
- FPGA: Xilinx Virtex II Pro (xc2vp30)
- Optical SFP transceiver
- 8x 16 bit input channels (from ADC)
- 3x AD9510 clock managers
- One ICS83940D clock manager
Crate in the Laser Hut (vmesynch3)
Simcon DSP

- Xilinx Virtex II Pro FPGA (xc2vp30, xc2vp50)
- AD TS-201 DSP
- 2x optical SFP transceivers
- 10x 14 bit ADC
- 4x 14 bit DAC
- 32 MB SDRAM
- 36 Mb SRAM
ACC1 Crate (vmedsp1)
Agenda

1. Installation
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ACB 2.1 board

- Analog signal
- Clock
- Trigger
- AD9510
- ICS83940D
- ADC
- FPGA
- SFP
- Correction (to Simcon)
Implementation of bunch arrival time feedback

SAMP1.2
SAMP1.1
SAMP2.2
SAMP2.1
ADC2
ADC1
PID
RocketIO
SP
Correction (to Simcon)
Implementation of bunch arrival time feedback

Diagram showing the implementation process with

- SAMP1.1
- SAMP1.2
- SAMP2.1
- SAMP2.2
- ADC1
- ADC2
- PID
- RocketIO
- SP

Connections indicating the flow of information and correction to Simcon.
Implementation of bunch arrival time feedback

Diagram:
- SAMP1.1, SAMP1.2, SAMP2.1, SAMP2.2
- ADC1, ADC2
- PID
- RocketIO
- Correction (to Simcon)
Implementation of bunch arrival time feedback

SAMP1.1 SAMP1.2
ADC1

SAMP2.1 SAMP2.2

PID

RocketIO

Correction (to Simcon)
Implementation of bunch arrival time feedback
Implementation of bunch arrival time feedback

Diagram: SAMP1.2 >> SAMP1.1 >> SAMP2.2 >> SAMP2.1 >> ADC2 >> ADC1 >> PID >> RocketIO >> Correction (to Simcon)
Implementation of bunch arrival time feedback

SAMP1.2
SAMP1.1
SAMP2.2
SAMP2.1
ADC2
ADC1
PID
RocketIO
SP
Correction (to Simcon)
Implementation of beam phase feedback

- Trigger
- First Bunch
- Second Bunch
- start_len
- peak_len
- bg_start
- period_len
- bg_len
- PYRO signal
Implementation of beam phase feedback

- ADC1
- peak_sum
- bg_sum
- PID
- RocketIO
- SP
- Correction (to Simcon)
Implementation of beam phase feedback
Implementation of beam phase feedback

Diagram:
- ADC1
- peak_sum
- bg_sum
- PID
- RocketIO
- Correction (to Simcon)
Implementation of beam phase feedback
Implementation of beam phase feedback

- ADC1
- peak_sum
- bg_sum
- PID
- RocketIO
- Correction (to Simcon)
Amplitude and phase control in Simcon DSP
Agenda

1. Installation
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Bunch arrival time stabilization

Courtesy of Florian Loehl
Beam phase without stabilization

 Courtesy of Florian Loehl
Beam phase with stabilization

Courtesy of Florian Loehl
SASE intensity

Courtesy of Florian Loehl
SASE fluctuations

Courtesy of Florian Loehl
Thank You