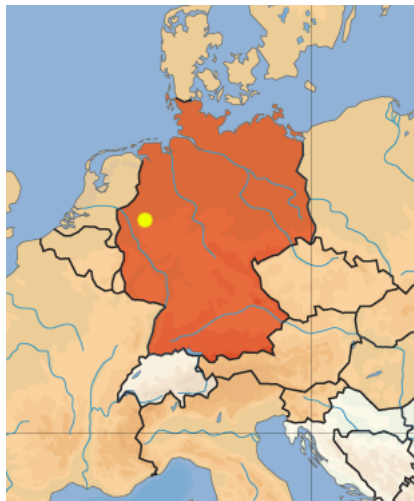




# Fast Local Orbit Feedback at DELTA

P. Hartmann, G. Schünemann, P. Towalski, S. Khan, D. Schirmer, T. Weis  
**DELTA**, TU Dortmund



## DELTA Parameters:

Beam energy: 550 MeV – 1.5 GeV

Beam current: 130 mA @ 1.5 GeV

Beam lifetime: 8 h @ 130 mA

Availability: > 90 %

Operational: 3000 h / year

## Personnel:

2 Professors

4 Accelerator physicists

2 Beamline scientists

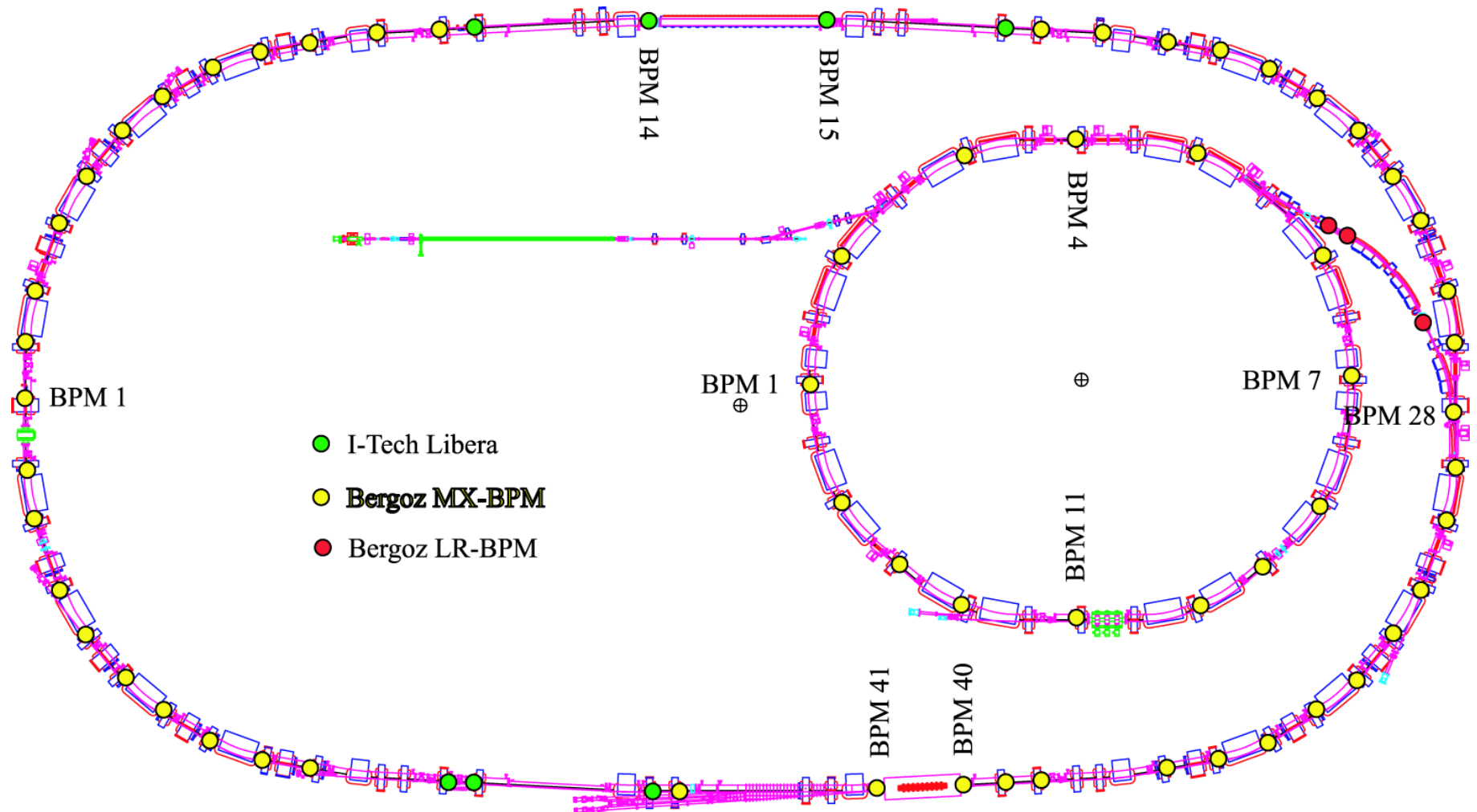
1 Administration

8 Technicians

5 Students



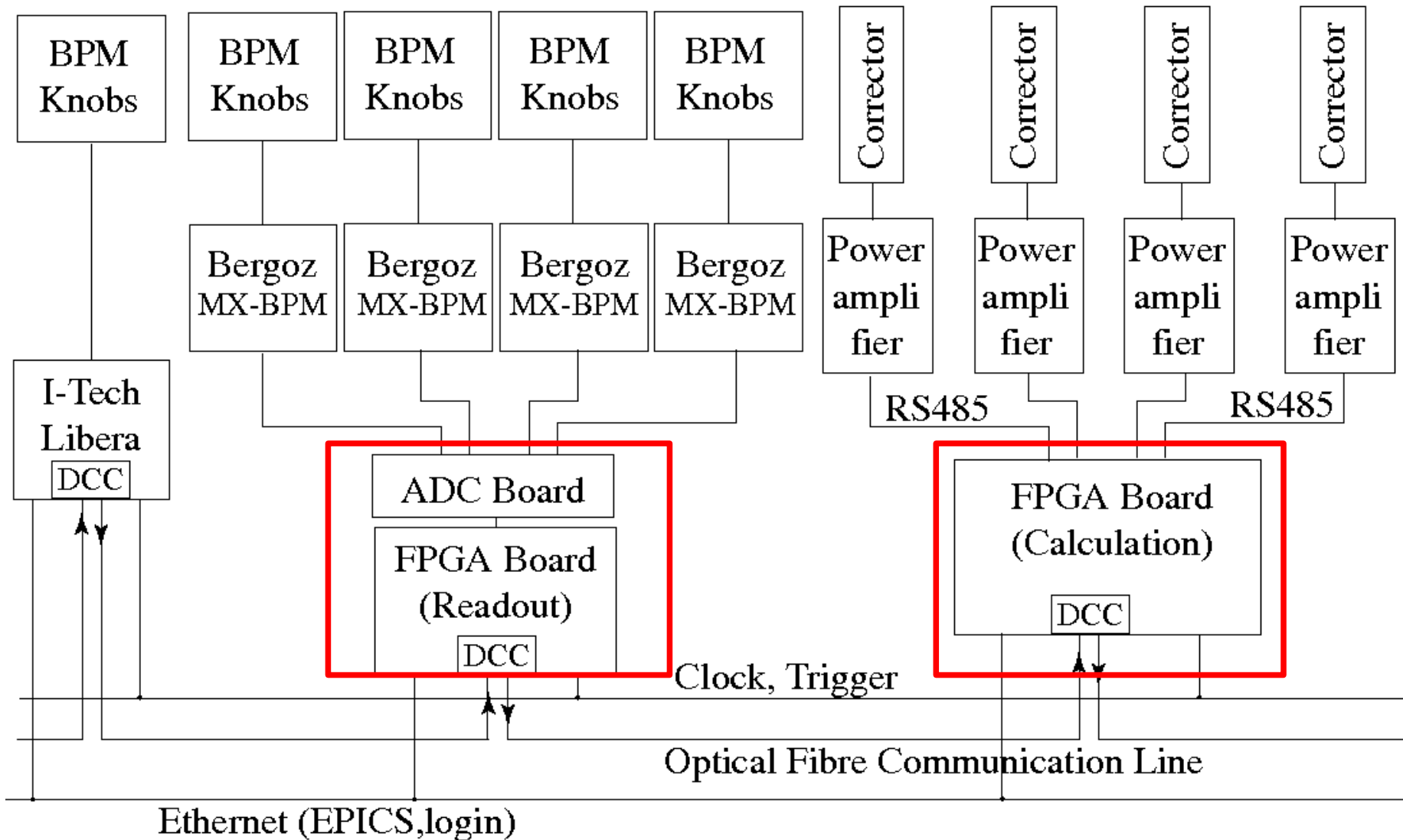
# BPMs in DELTA





# Delta's future fast global orbit feedback

## Beam

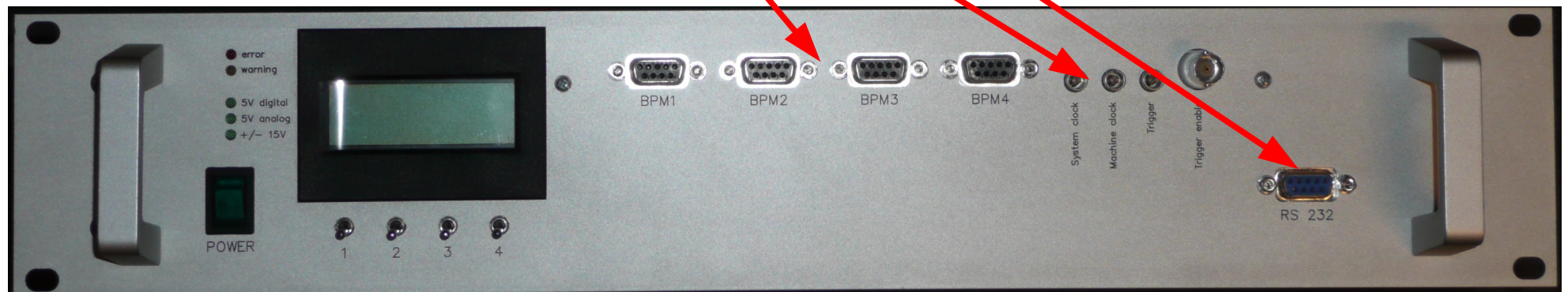
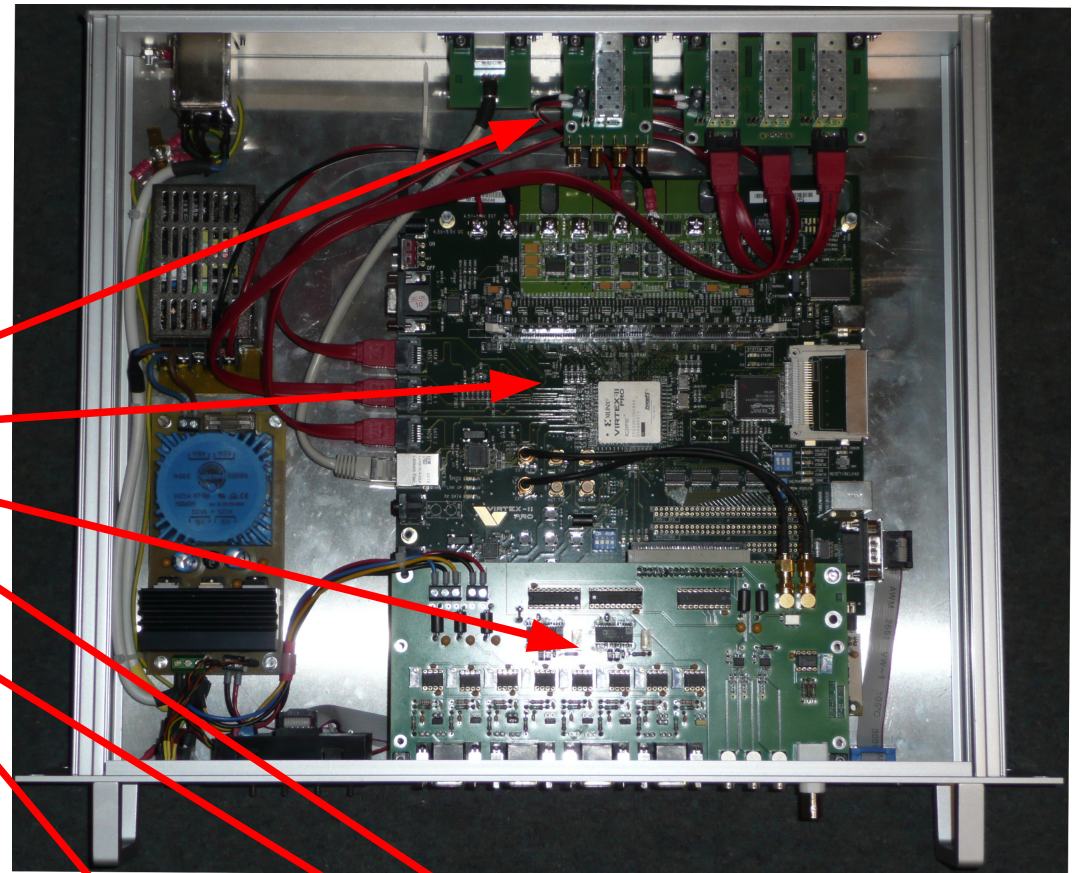




# 'BPM Extender'

(Diploma Thesis G. Schünemann)

- Ethernet, SFP connectors
- Xilinx XUP-V2P FPGA board
- ADC board
- RS 232 (diagnostic I/O)
- Clocks, Triggers
- Bergoz BPM connectors

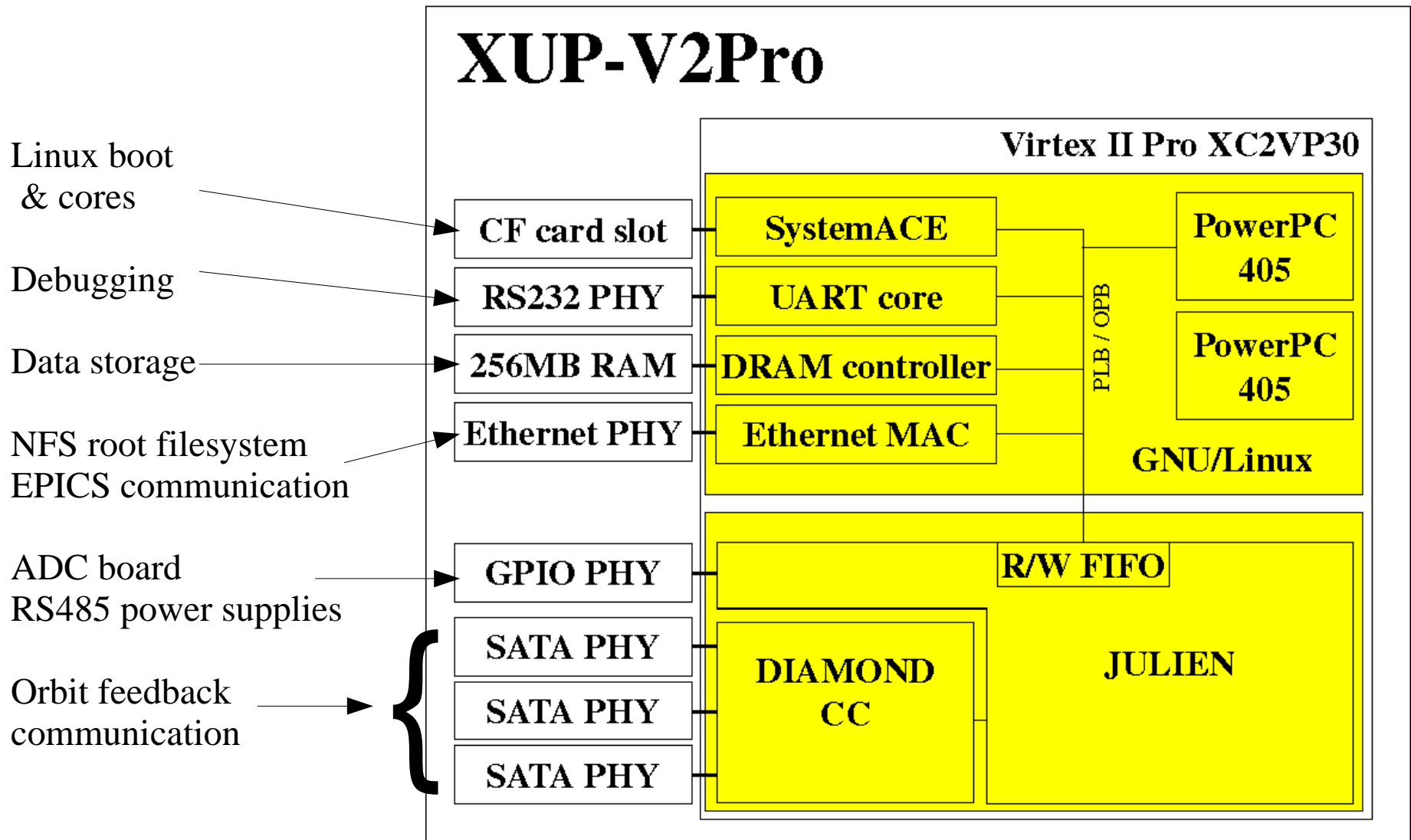






# XUP Board setup for DELTA

(Diploma Thesis G. Schünemann)

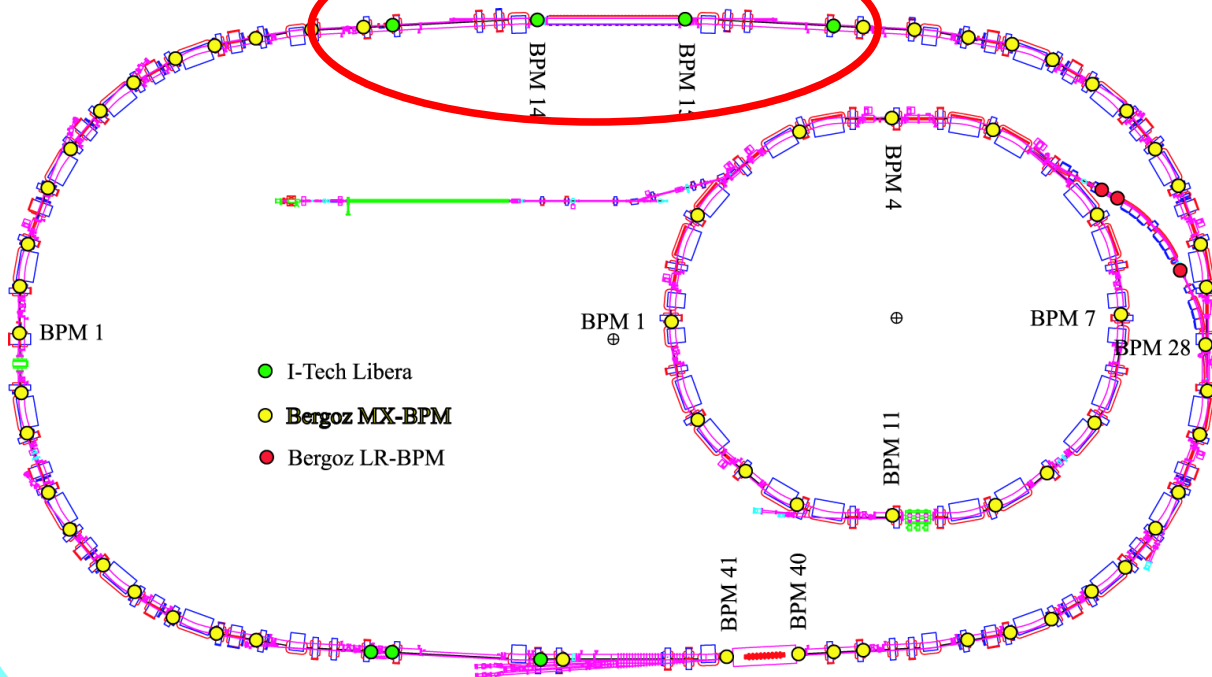
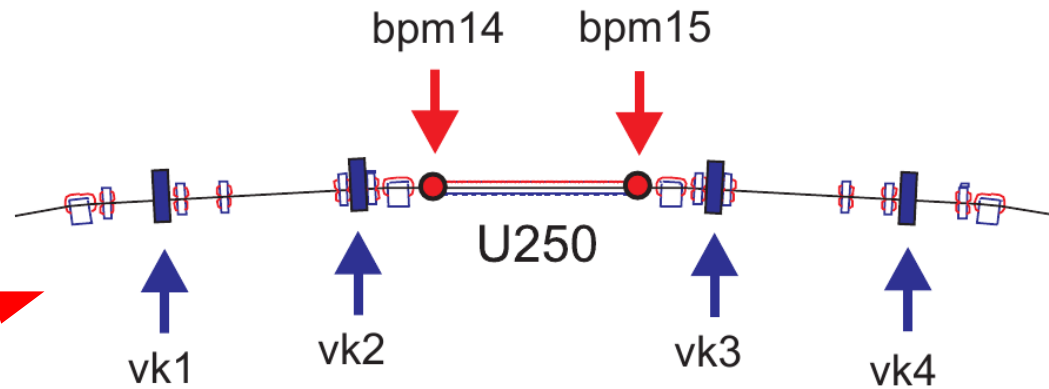




# DELTA's Local Orbit Feedback

(Diploma-Thesis P. Towalski)

Data from BPM 14/15

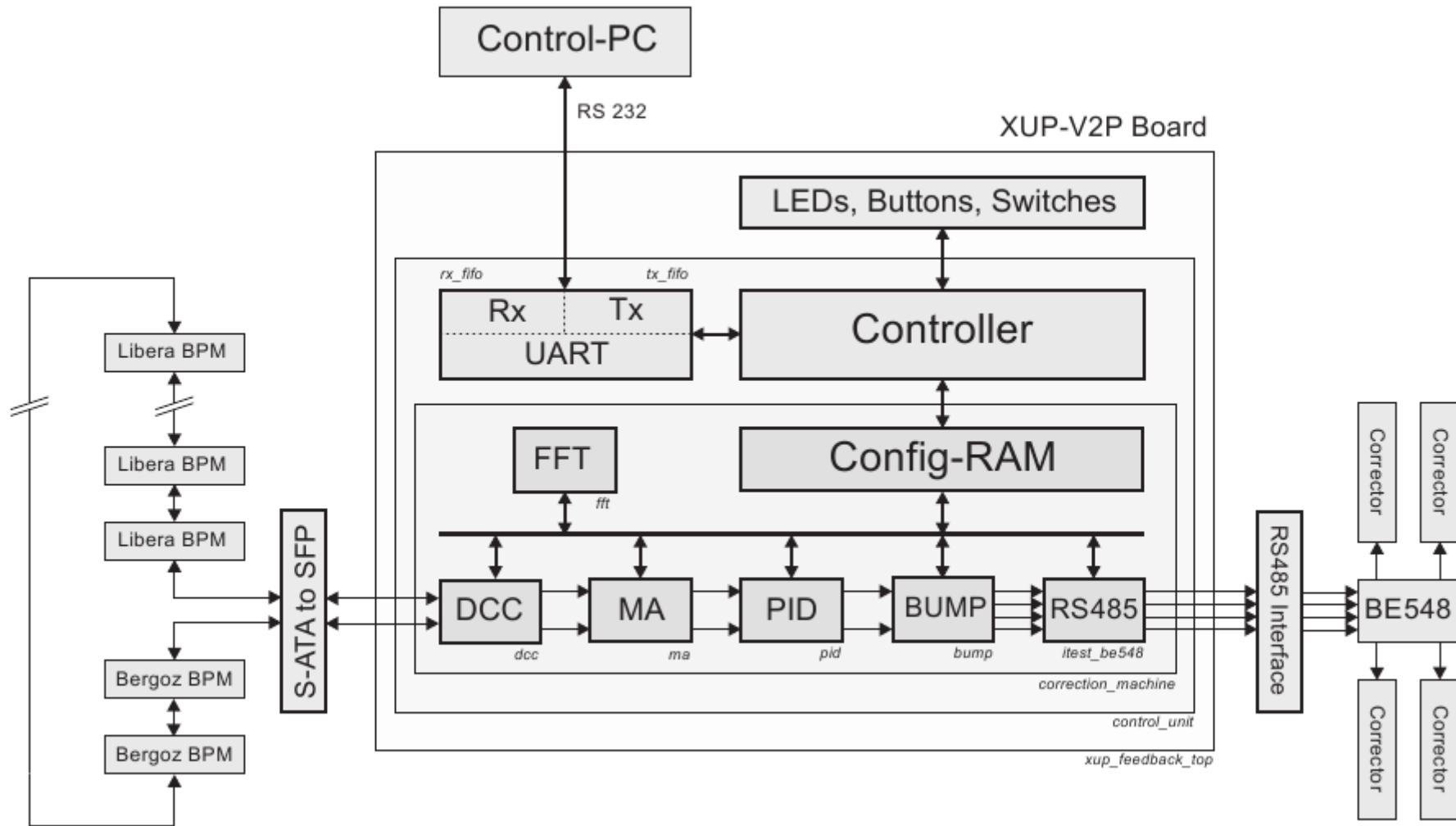


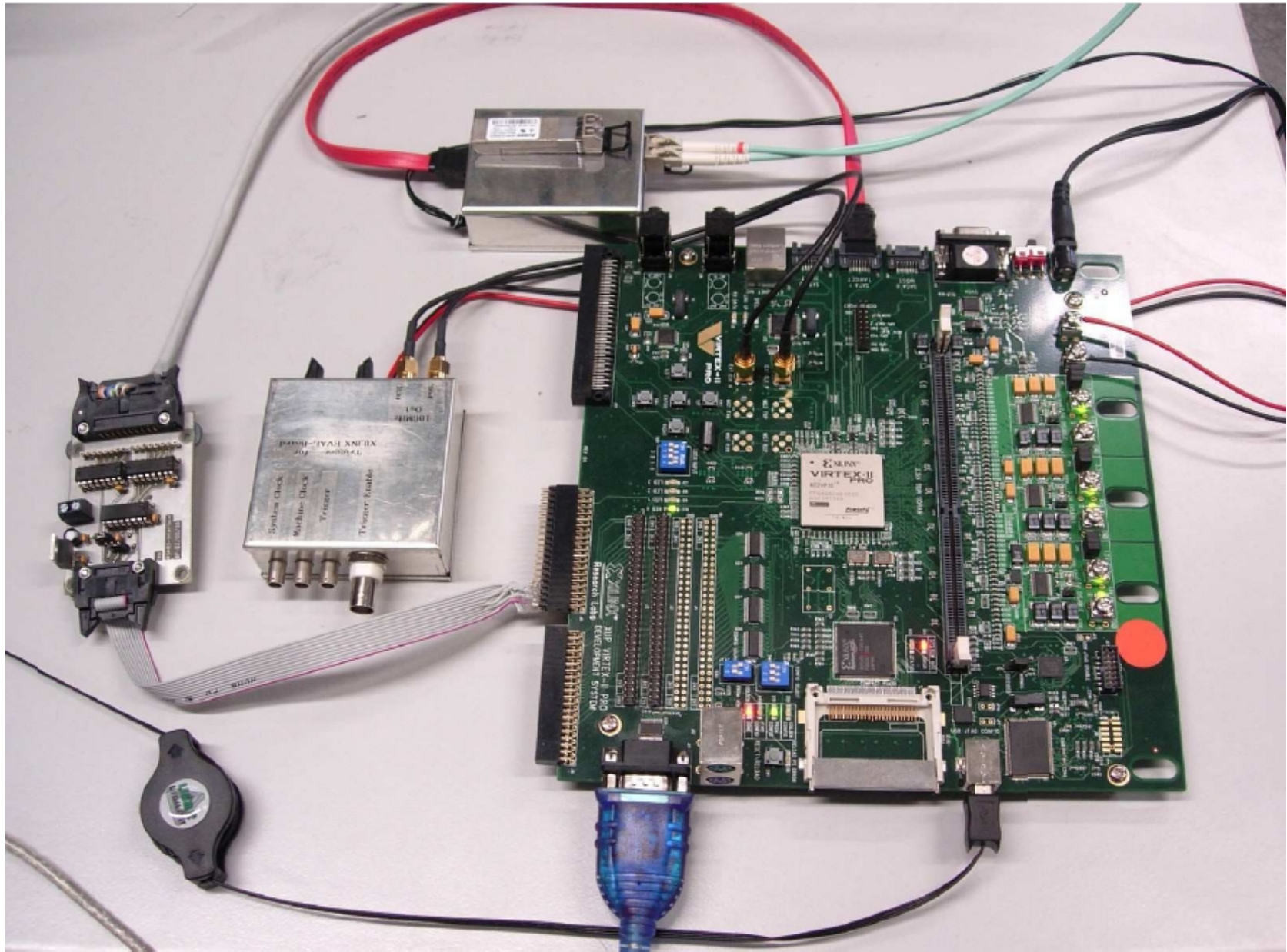
Spectator BPMs:  
13,16,43,44,45



# Local Orbit Feedback setup

(Diploma-Thesis P. Towalski)

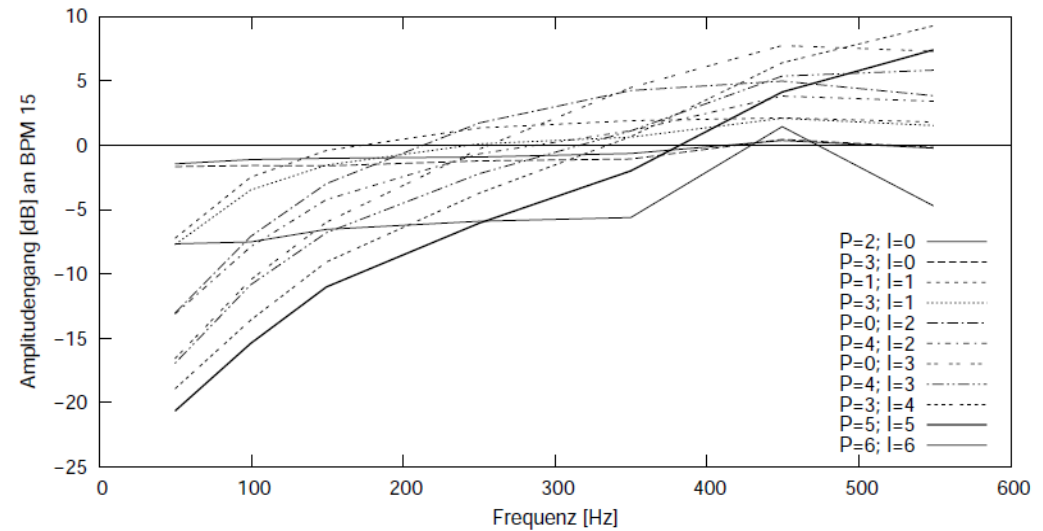
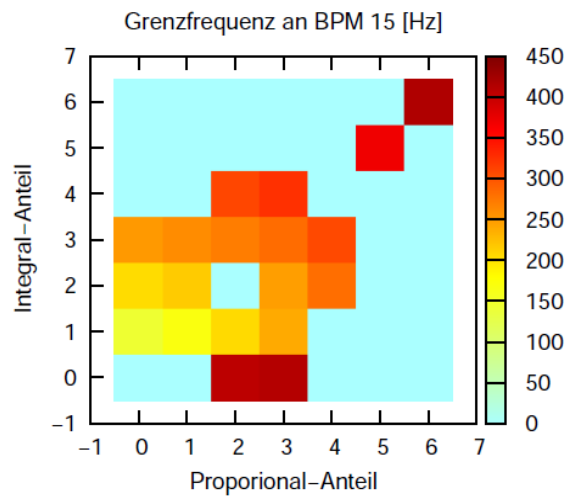
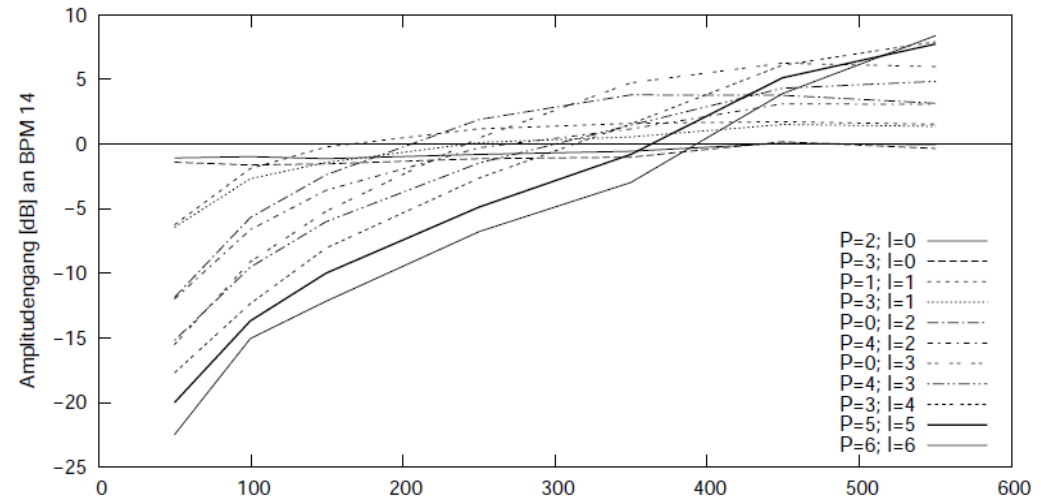
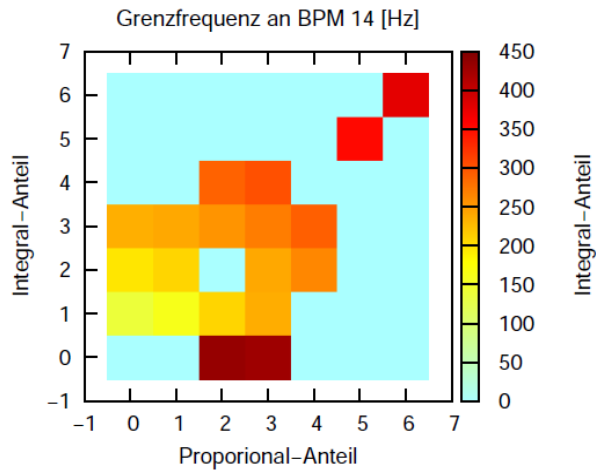








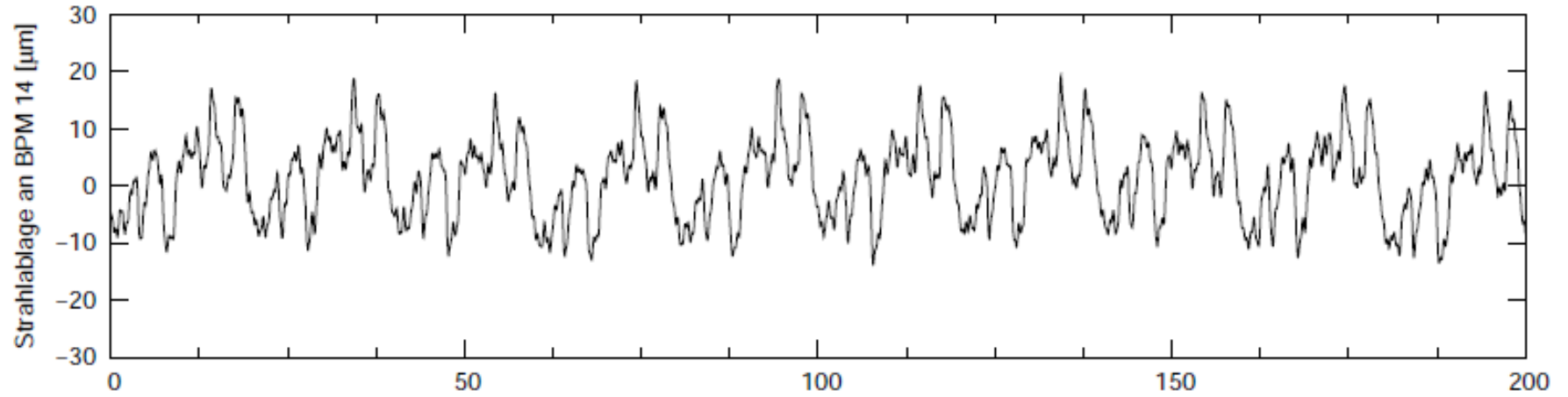
# PI Parameter Optimization



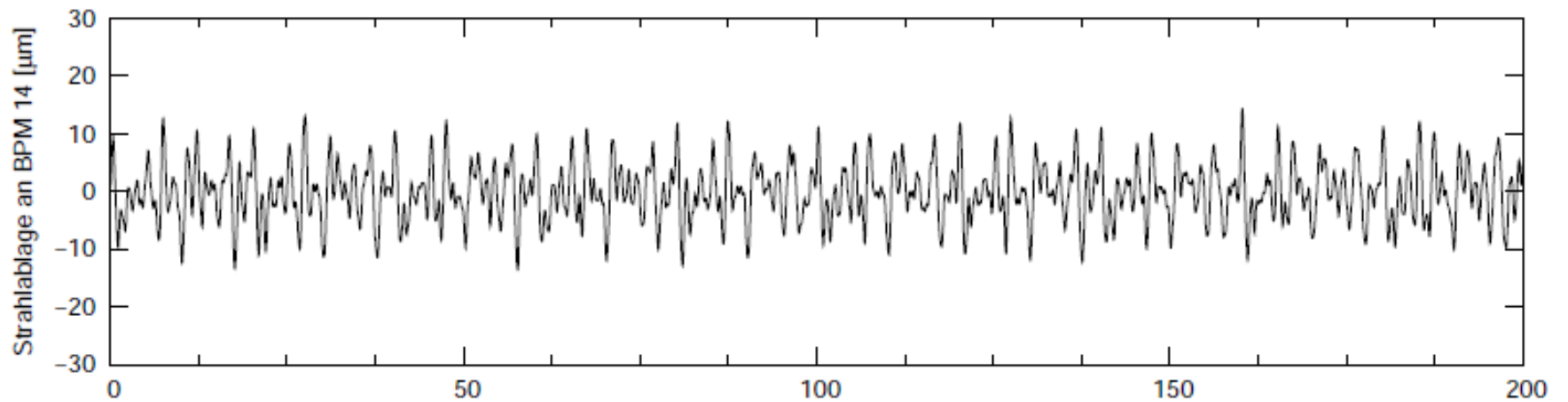


# Results

$P=0$   
 $I=0$

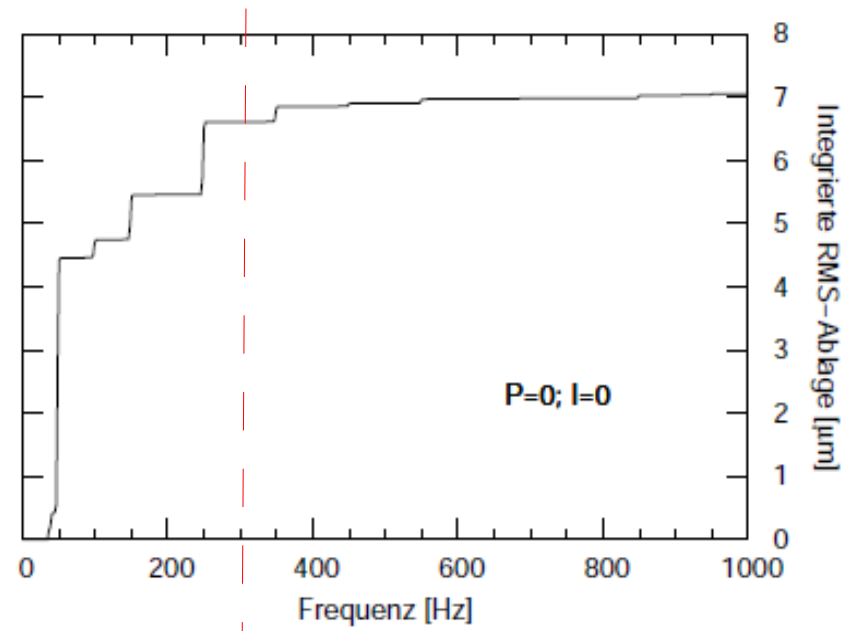
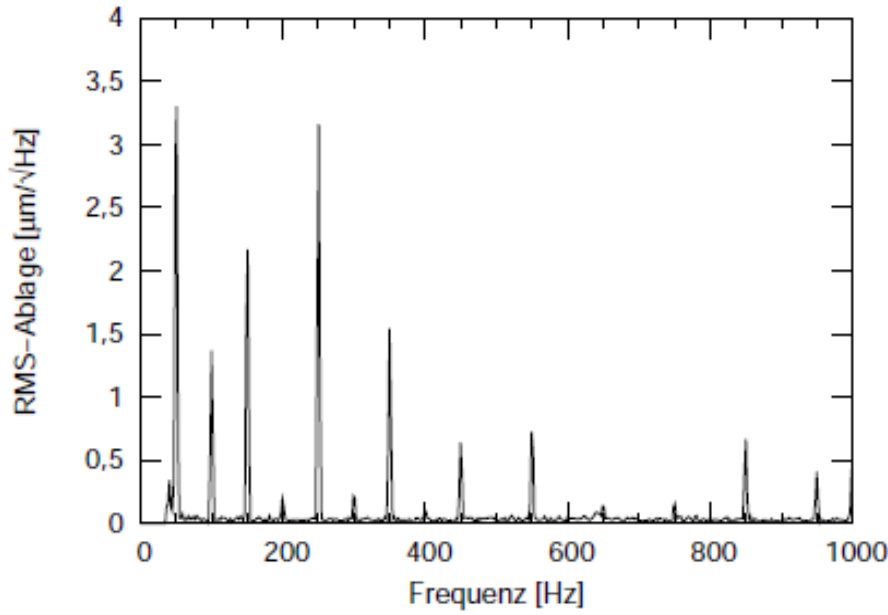


$P=5$   
 $I=5$

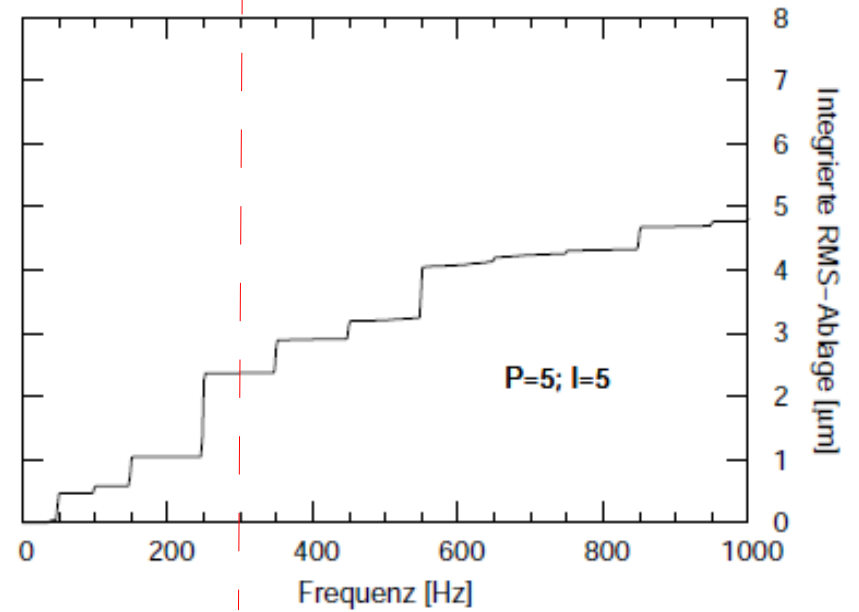
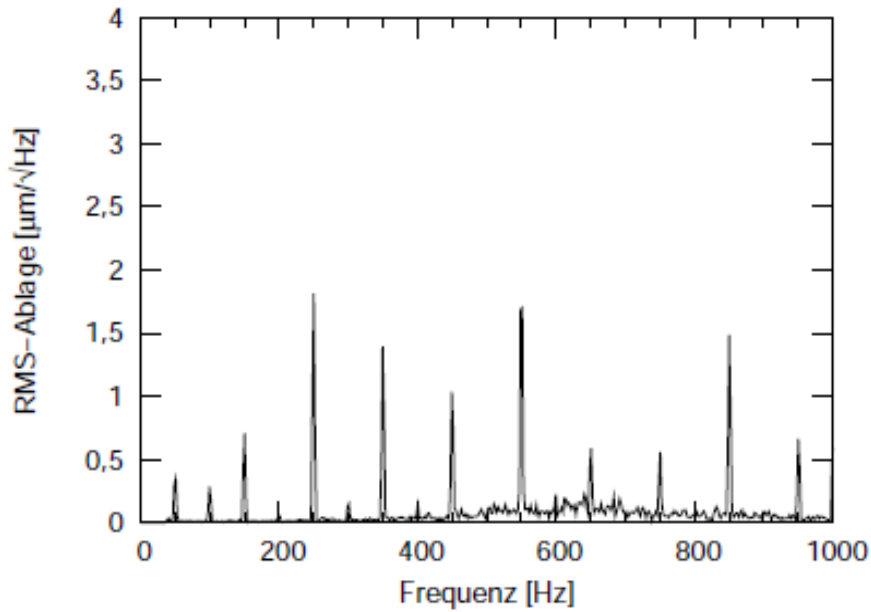


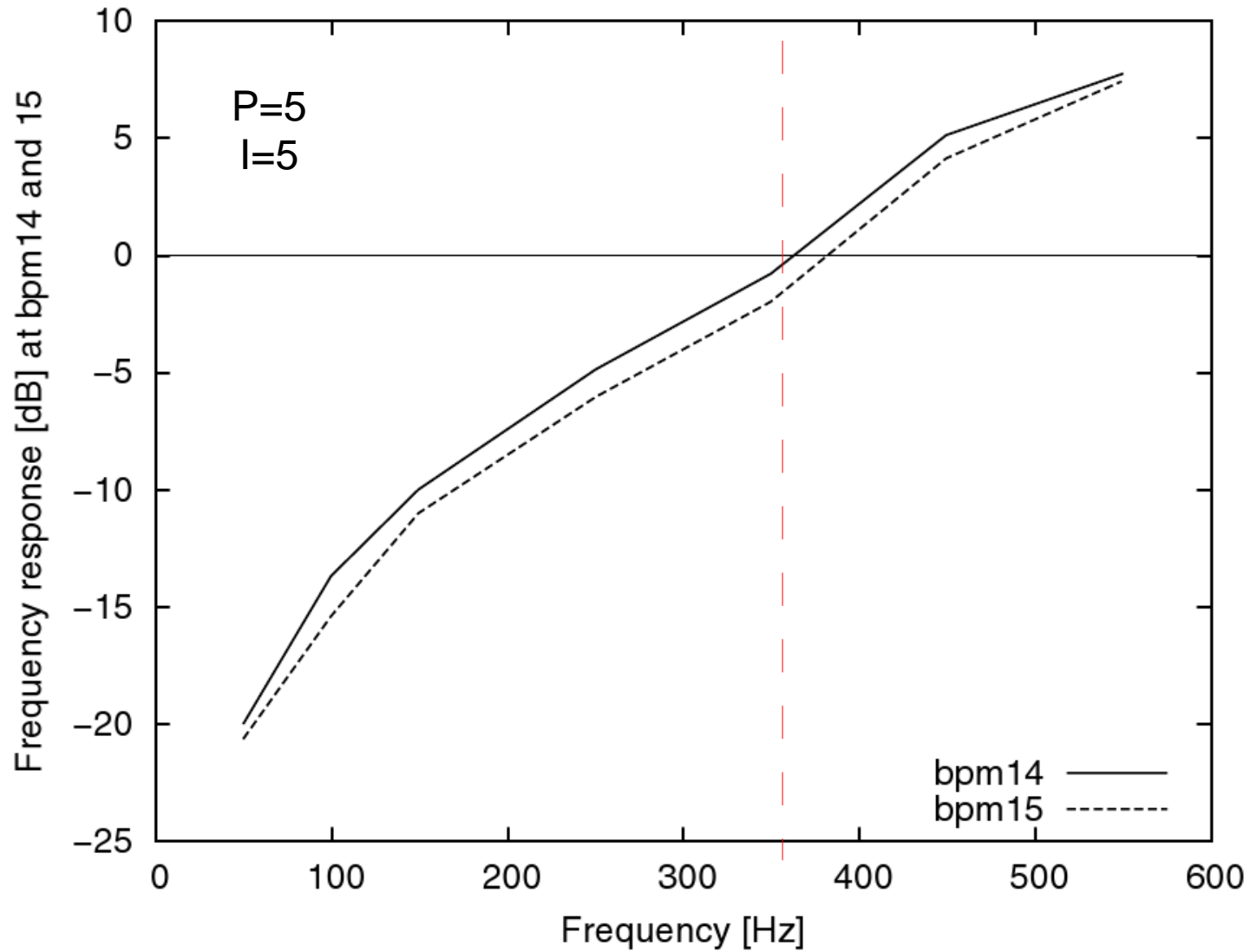


$P=0$   
 $I=0$



$P=5$   
 $I=5$

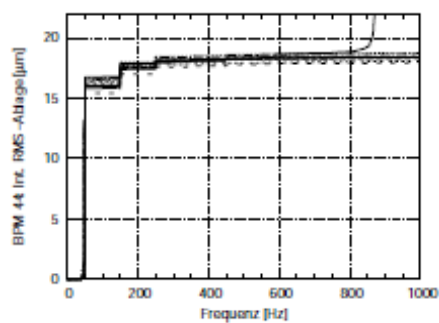
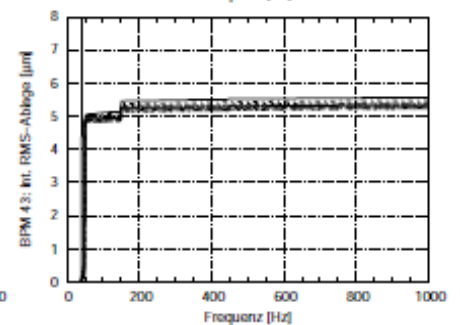
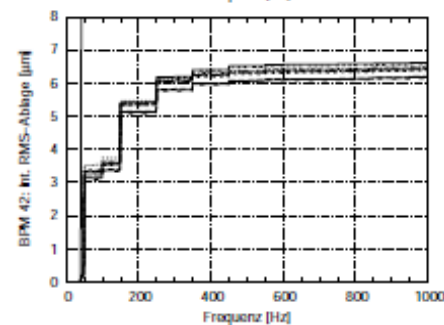
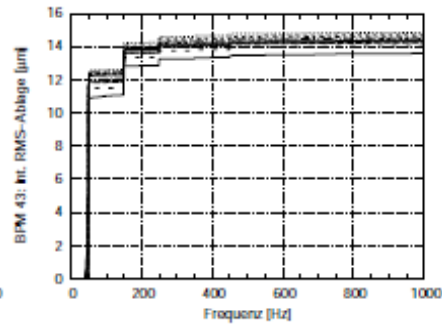
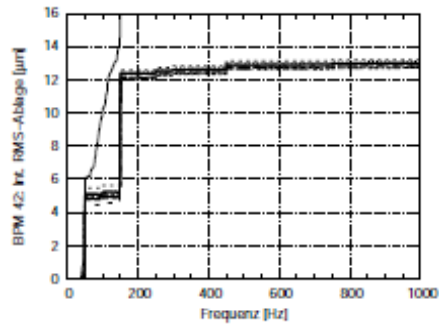
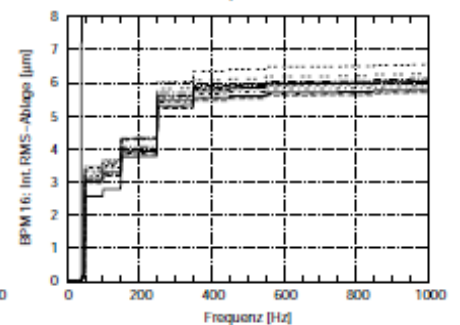
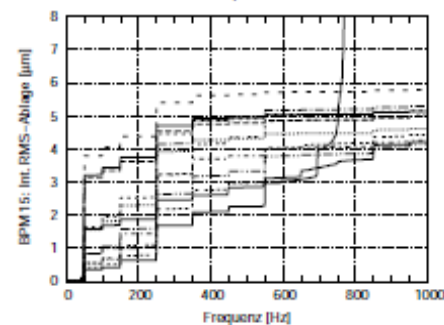
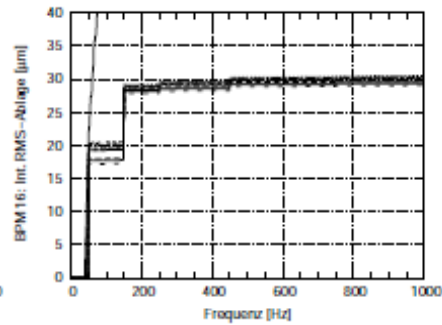
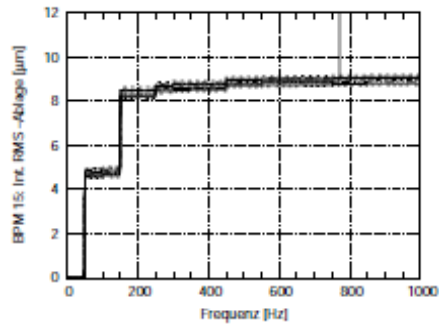
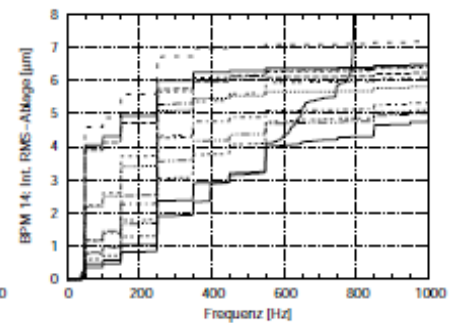
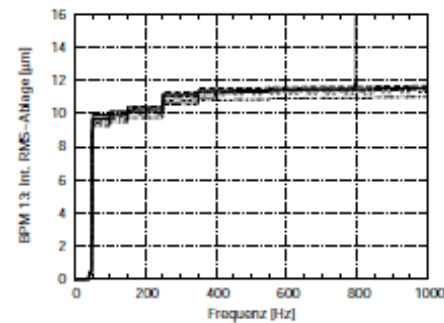
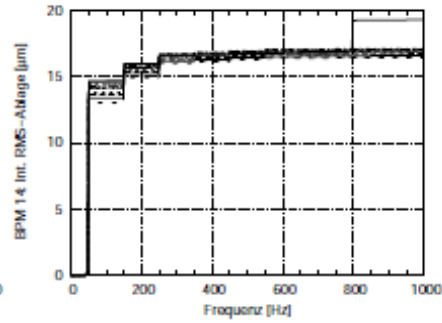
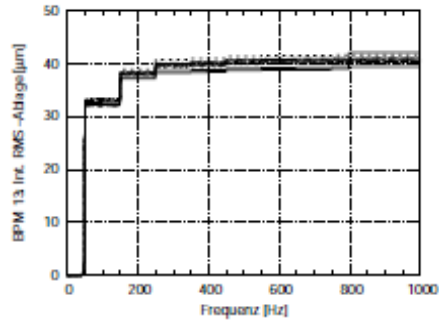




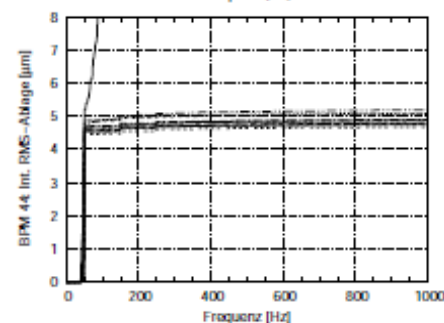




# Impact on spectator BPMs



- P=0: 1-0 - - - -
- P=2: 1-0 ———
- P=3: 1-0 - - - -
- P=1: 1-1 - - - -
- P=2: 1-1 - - - -
- P=0: 1-2 - - - -
- P=4: 1-2 - - - -
- P=0: 1-3 - - - -
- P=4: 1-3 - - - -
- P=2: 1-4 - - - -
- P=5: 1-5 - - - -
- P=6: 1-6 - - - -



- P=0: 1-0 - - - -
- P=2: 1-0 ———
- P=3: 1-0 - - - -
- P=1: 1-1 - - - -
- P=3: 1-1 - - - -
- P=0: 1-2 - - - -
- P=4: 1-2 - - - -
- P=0: 1-3 - - - -
- P=4: 1-3 - - - -
- P=3: 1-4 - - - -
- P=5: 1-5 - - - -
- P=6: 1-6 - - - -



## Summary

Noise reduction at 50 Hz:                    -20 dB  
Frequency limit (best):                    > 350 Hz  
Impact on other BPMs in the ring:      < 10%

## Outlook

Check frequency limit with Bergoz BPMs instead of Liberas  
Realize global orbit feedback at DELTA  
Use phase locked harmonic generators for 50Hz and harmonics  
Transfer software to Virtex5 board  
Realize feedbacks for COSY, SIS18, HESR (BMBF contract)



# Acknowledgements:

## **Electronics development:**

N. Koch, B. Krumm & Electronics workshop, TU Dortmund

## **Linux Implementation:**

Prof. P. Marwedel, Embedded Systems, TU Dortmund

VPOWER project group 'Embedded systems' SS 2007

B. Heine, J. Geldmacher, Inst. Electr. Engineering, TU Dortmund

## **FPGA Implementation details:**

G. Rehm, Isa Uzun, DIAMOND Light Source

N. Hubert, J.-C. Denard, Synchrotron SOLEIL

The I-Tech team

The DELTA team

