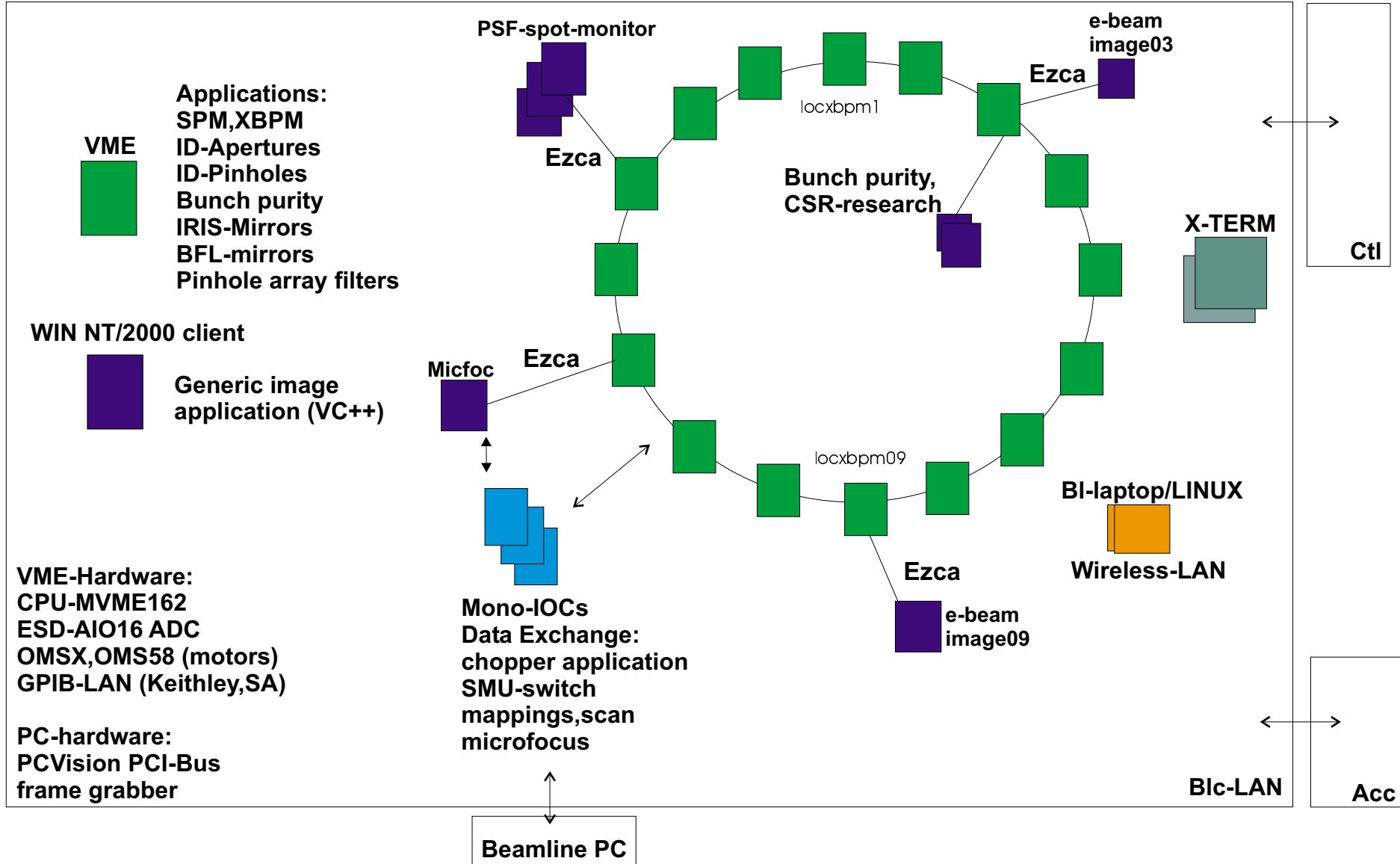




# Photon Beam Diagnostics at BESSY II



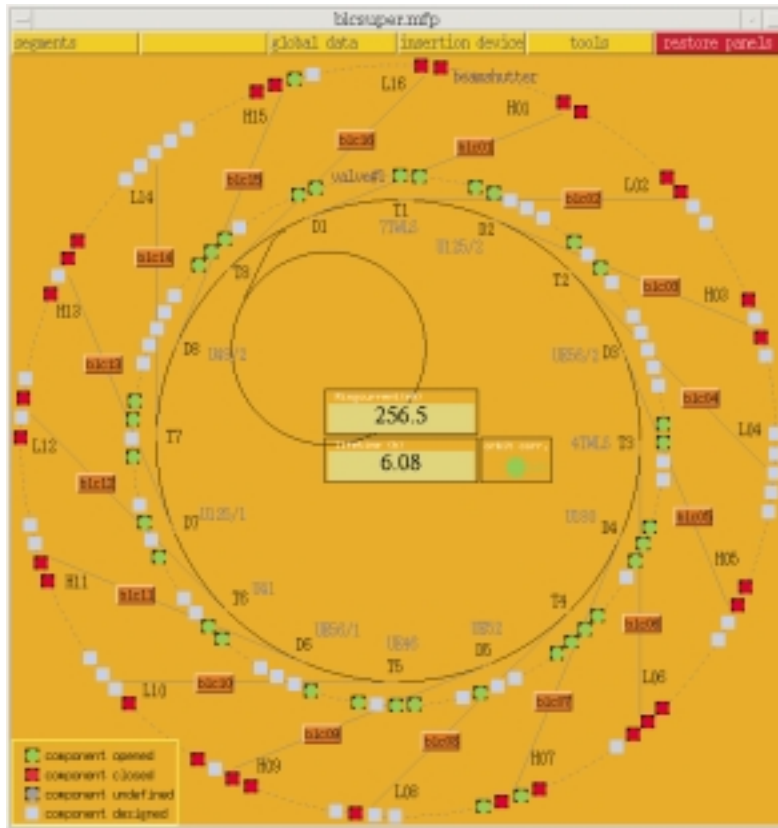
K.Holldack  
Overview



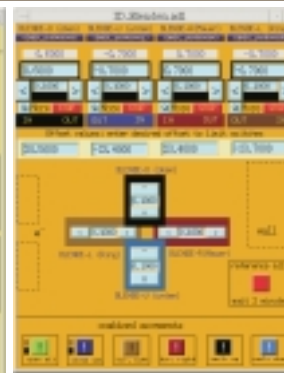
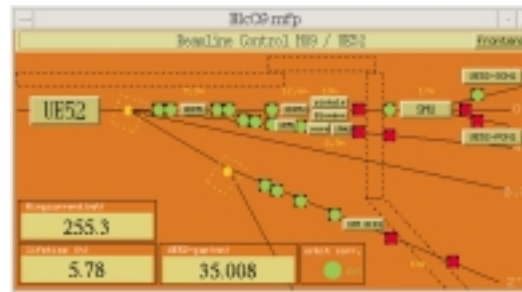


K.Holdack

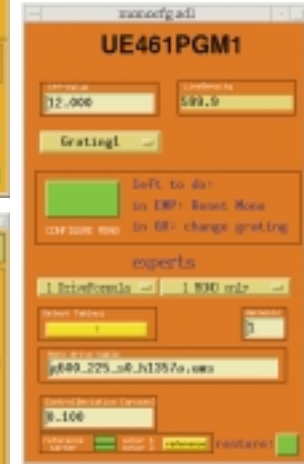
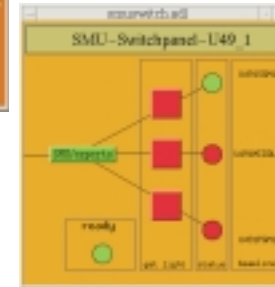
## Supervisor and user Controls



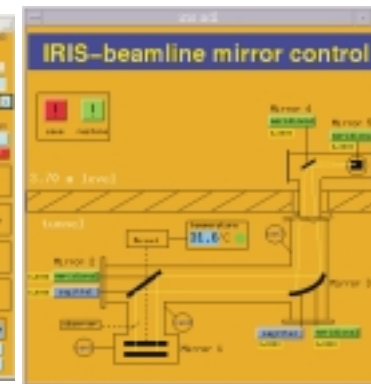
Superpanel-entry point to local controls



Diagnostic IOC applications



Mono-IOC-applications





K.Holldack

## Imaging monitors:

### hardware:

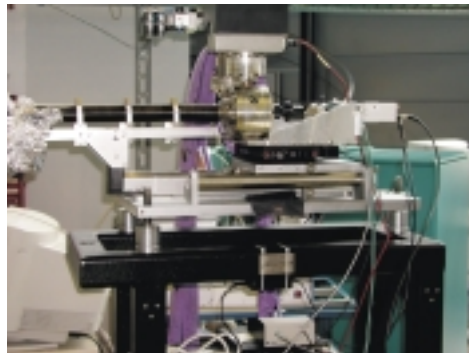
e-beam and/or x-ray beam imaged after conversion on a small grain size phosphor by visible light microscope optics.

### Software:

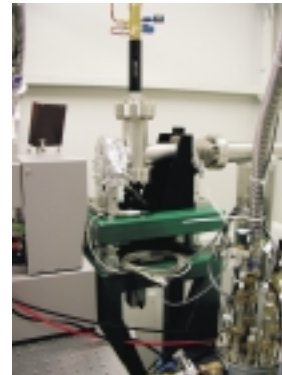
yields size, position and intensity in AOI and digital live image, EPICS channel access by EZCA (0.3 sec)

**Examples: Pinhole array cameras, Bragg Fresnel Telescope (e-beam)  
Microfocus at monochromators, spot size at Protein-beamlines**

Microfocus-Detector



PSF-spot-monitor



Electron beam images



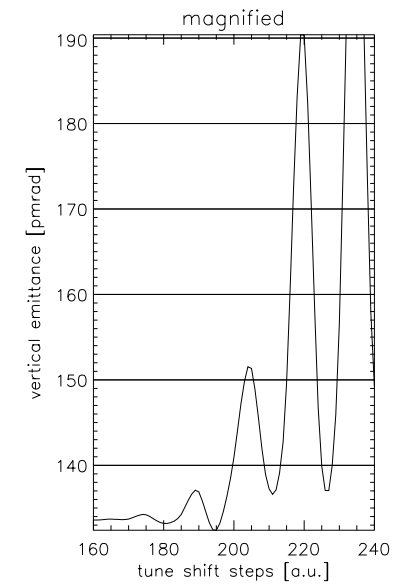
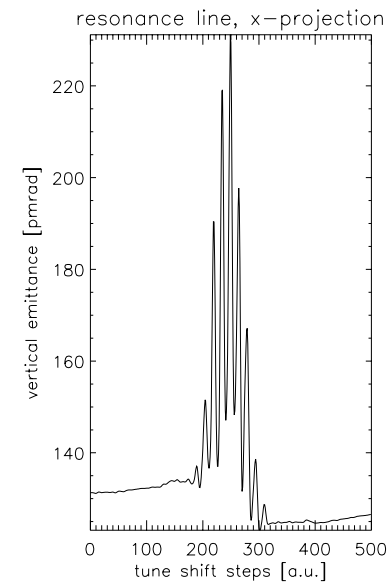
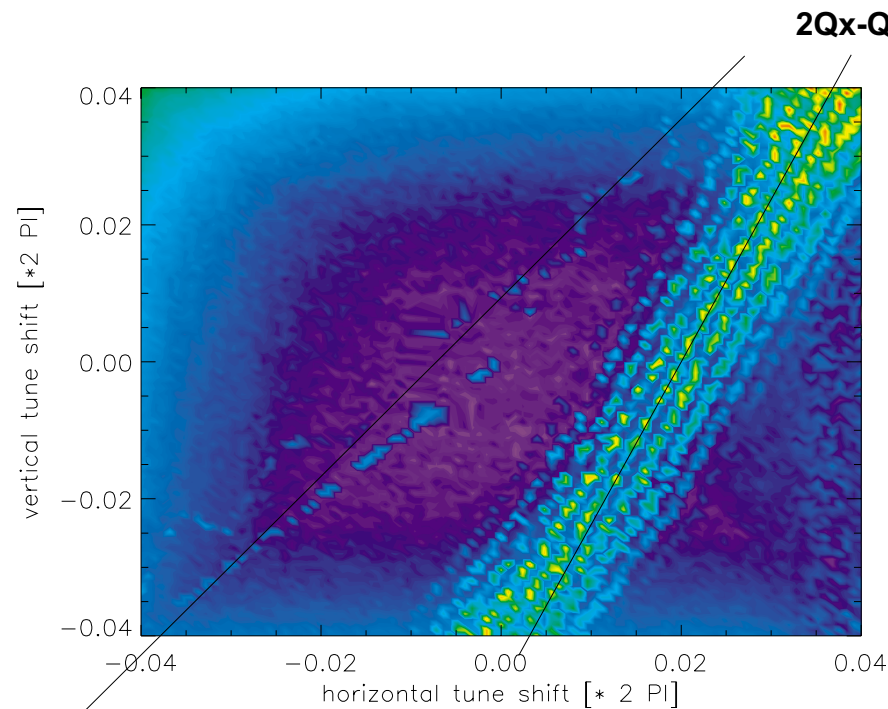


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Electron beam imaging example:

tune map around working point using source image at H03  
emittance sensitivity 0.001 nrad

Difference resonance only visible in source image  
splitting up due to longitudinal bunch oscillation



Energy measurement

With J.Feikes, J.Kuszynski, LabView application running in machine control system, source size data via gateway

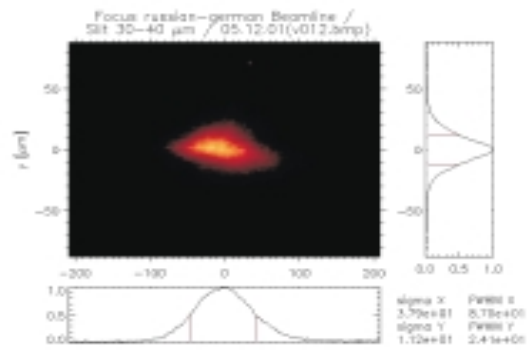




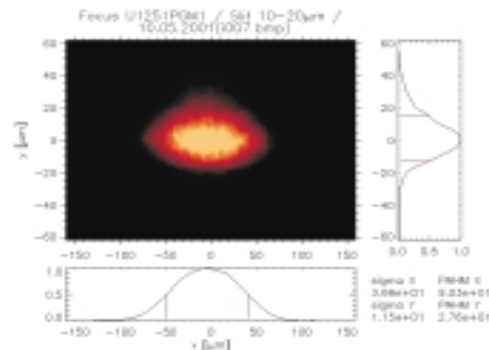
# Microfocus gallery of monochromators, $\sigma$ -values



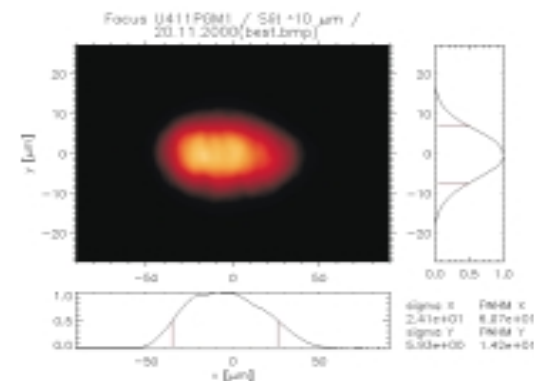
### German-Russian Beamline 38 $\mu$ m x 8 $\mu$ m



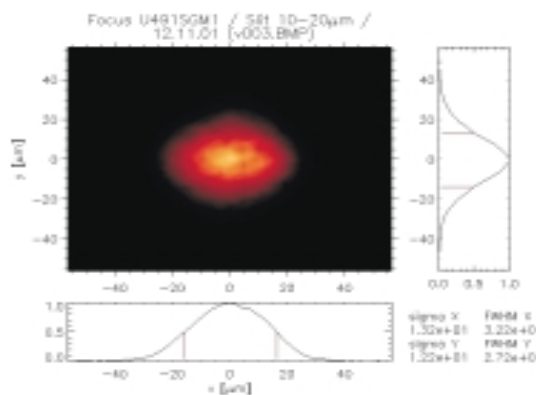
### U125 SGM 1 36 $\mu$ m x 15 $\mu$ m



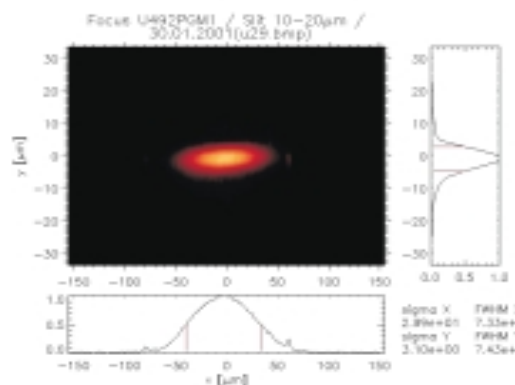
### U41 PGM 24 $\mu$ m x 6 $\mu$ m



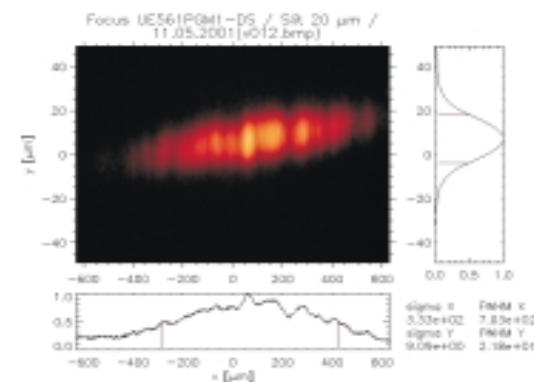
### U49/1 SGM1 13 $\mu$ m x 12 $\mu$ m



### U49/2 PGM 1 29 $\mu$ m x 3 $\mu$ m



### UE 56/1 PGM1 US 330 $\mu$ m x 9 $\mu$ m



With R.Follath, F.Senf, Th.Zeschke, J.Schmidt



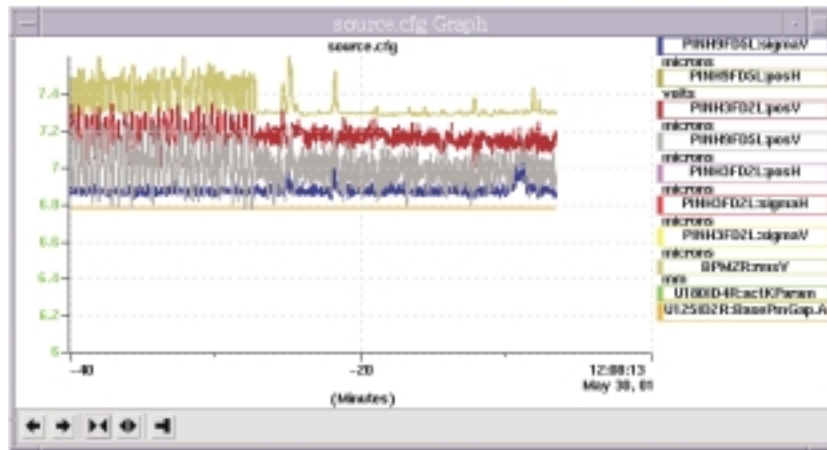


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Global correlation example: Detection of orbit distortion caused by a 1T superconducting magnet outside the shield wall (users: G.Schütz, MPG)

First only a sine oscillation 4μm peak detected at source point and SPMs (vanished at lunch time and weekend)  
-> localization by phase analysis (J.Feikes)-> location checked ->switching magnet found 0.033 Hz, +/- 1T field  
-> just below acceptance threshold of global orbit feedback

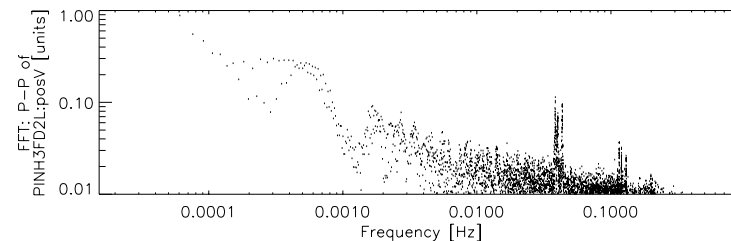
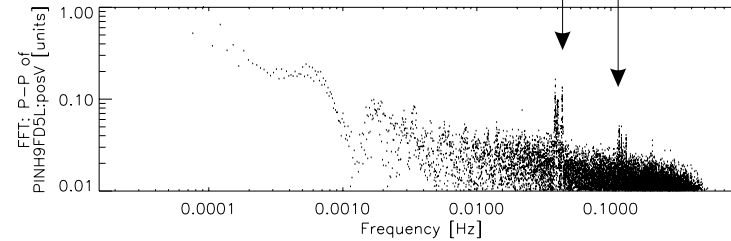
Magnet ON Magnet OFF



Stripgraph record of orbit distortion caused by user magnet (located at 1 m distance from shield wall, switched with 30 sec period)

User magnet 0.033 Hz

0.13 Hz (global orbit feedback)



FFT of a stripgraph record of the whole day at different locations (electron beam images, vertical center of gravity)





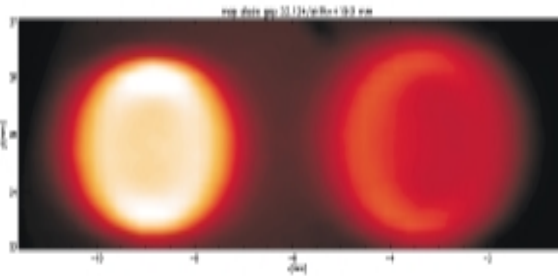


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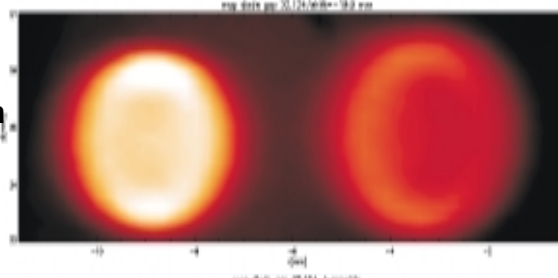
Scanning diagnostics example: pinhole maps at UE561

Polychromatic maps

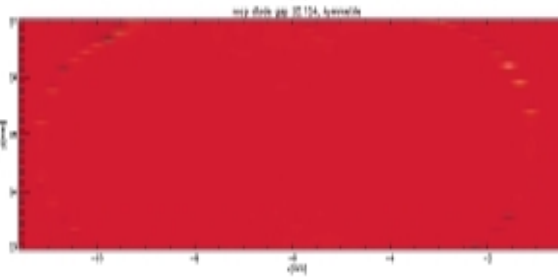
Shift -28mm



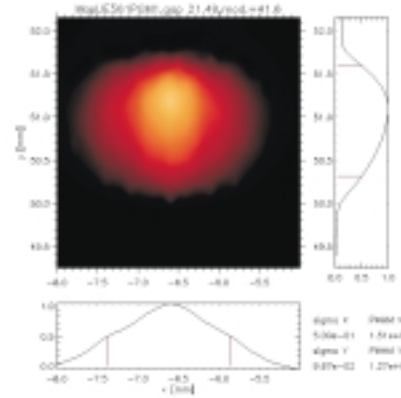
shift +28 mm



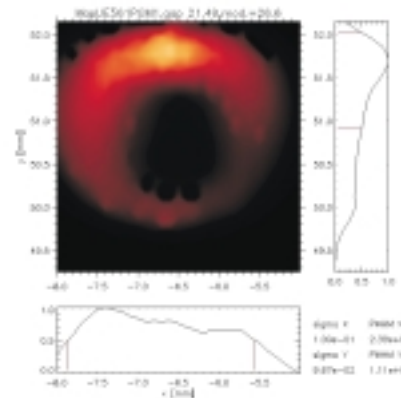
Asymmetry



Monochromatic maps (varying modulator magnets)

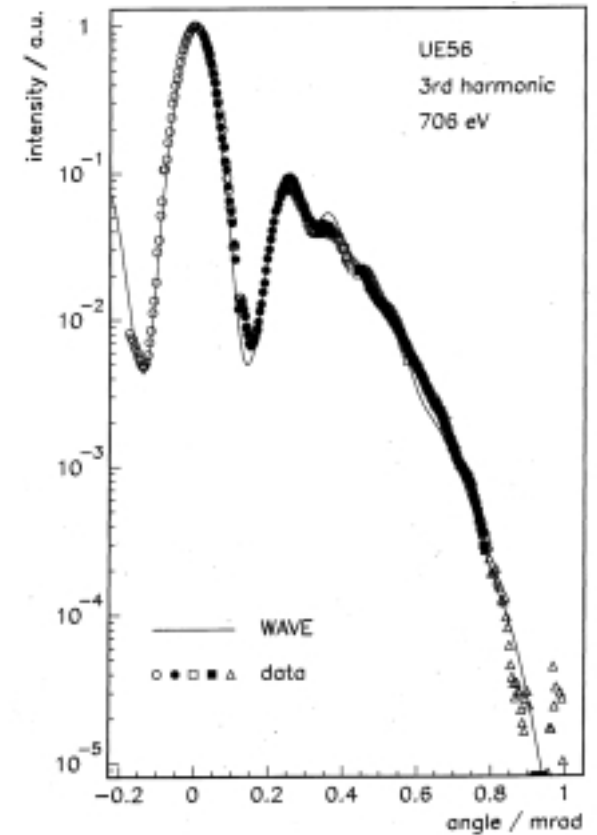


Constructive



Destructive

Recent results: investigation of off-axis radiation with high dynamics

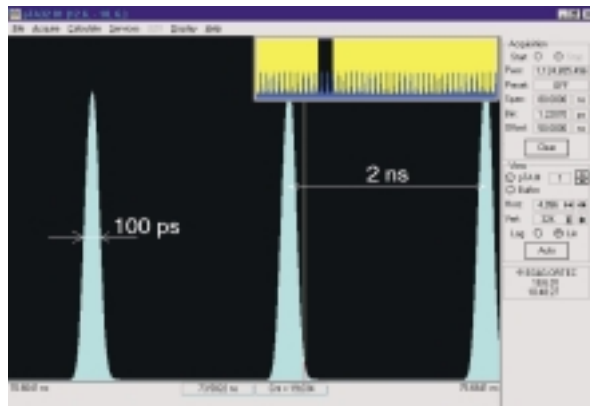




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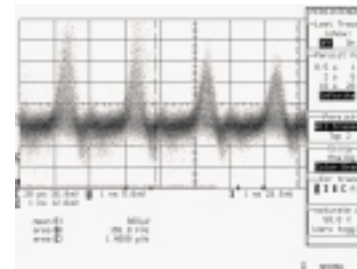
## Fast diagnostics: examples

Bunch purity/ fill pattern monitoring using in-vacuum x-ray avalanche-diode detector

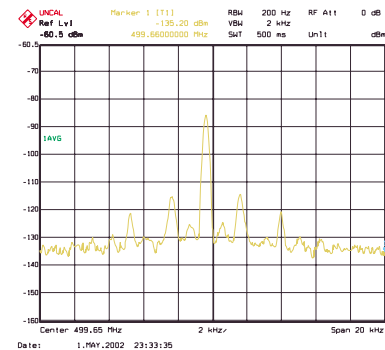


Developed together with:  
M.Hartrott,K.Ludwig,D.Ponwitz

Research on longitudinal bunch dynamics using Steady State Coherent Far infrared Radiation (THz, mm-wavelength)



Scope data from Hot Electron Bolometer (4GHz,DLR) resolving single buckets



Spectrum Analyzer Data showing longitudinal bunch oscillations (beam externally shaken on quadrupole mode)

With BESSY CSR-working group,  
see also:

“Steady State Coherent FIR detected at BESSY II  
M.AboBakr,J.Feikes,K.Holldack,H.W.Hübers,G.Wuestefeld  
Phys.Rev.Letters, in press, accepted 4/2002

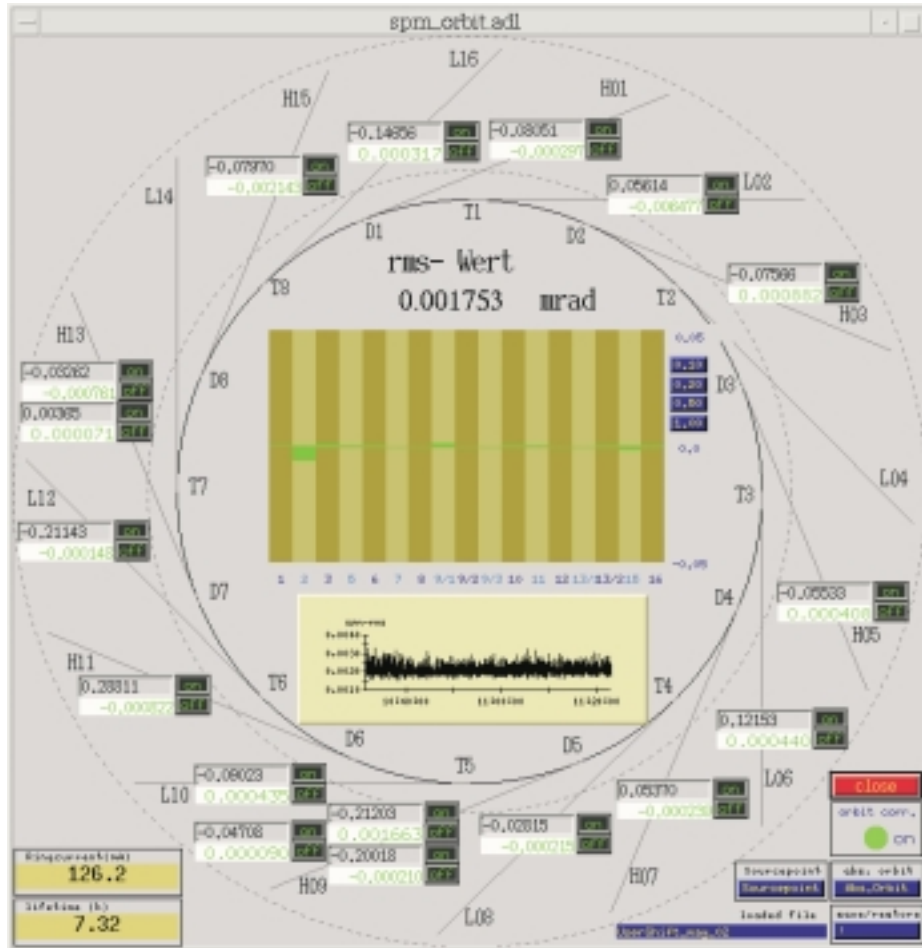






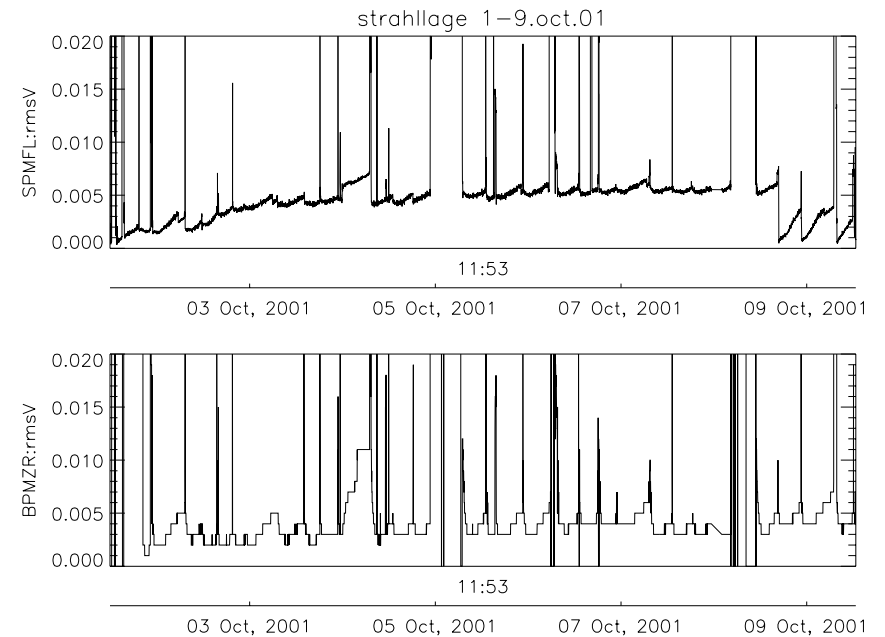
K.Holldack

## Global orbit monitoring using SPM-monitors



Panel by A.Pohl, monitoring vertical angular beam jitter as detected at dipoles, WLS and wigglers

## SPM-BPM(e-beam) correlation(archiver data)



Orbit correction malfunction may lead to local problems-> fast fixing possible by joint work of EXP- and M- operator



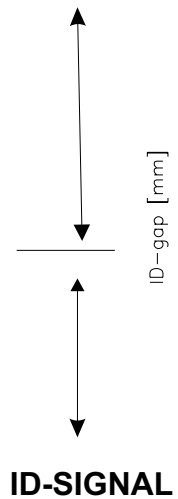


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## Challenge of ID-XBPMs:

- Response matrix measurements with ID-XBPMs (U49)
- horizontal response changes sign when ID-signal sinks into background of downstream dipole
- vertical response less sensitive to gap (dipole-fan remains)

DIPOLE



Wiggler mode

