Hot Electron Bolometer at the ANKA Storage Ring

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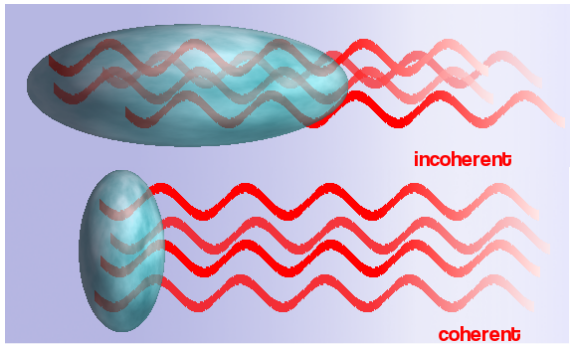
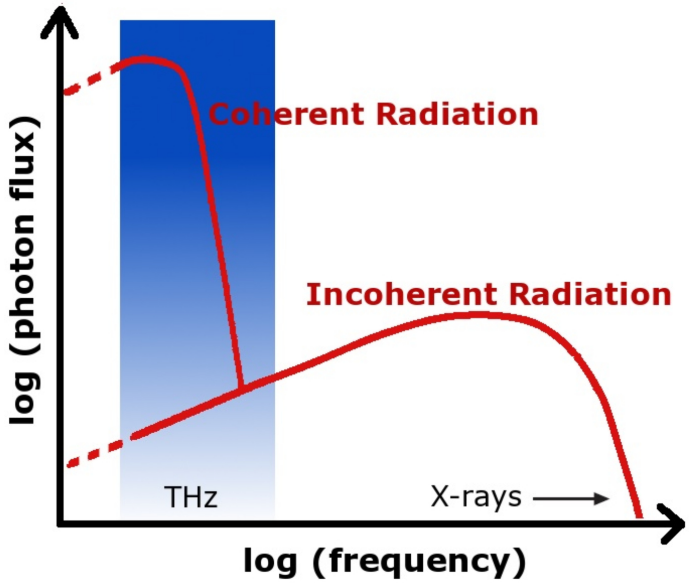
Outline

CSR at ANKA





(src.: ANKA-Archiv)

Low alpha mode

- $P_n = N_e \cdot P_1(1 + N_e g_\lambda)$

  $g_\lambda \propto e^{-\left(\frac{2\pi\sigma_s}{\lambda}\right)^2}$ for gaussian shape

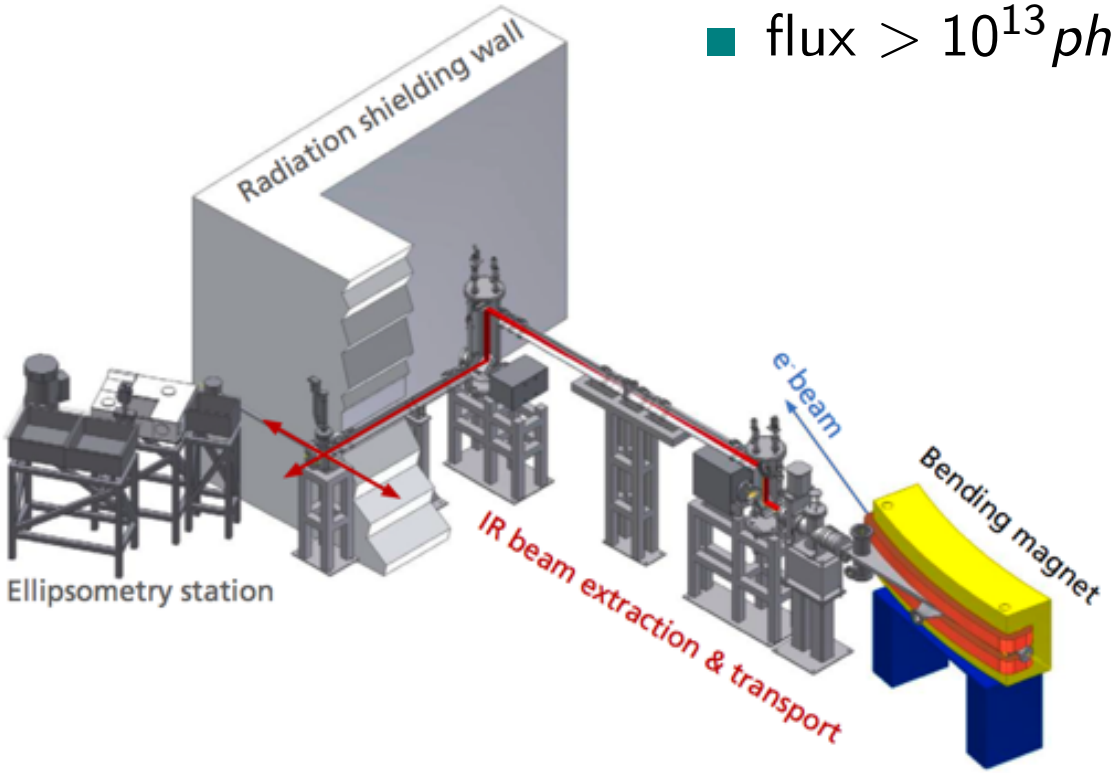
  typically $N_e = 10^9$

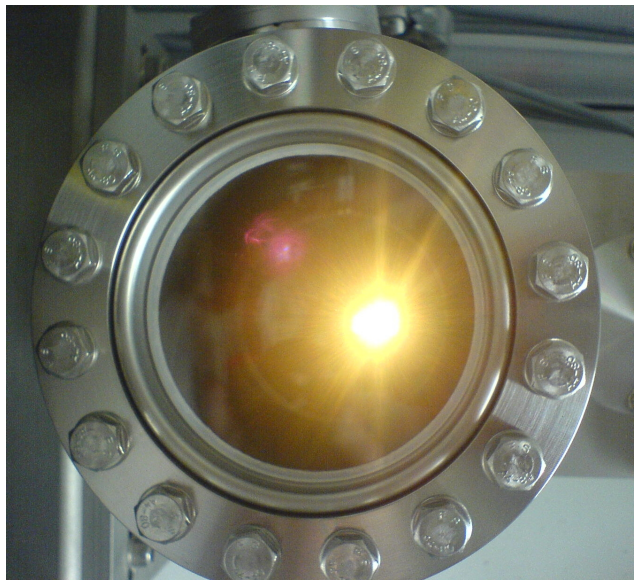
- beam energy 1.3 GeV
- multibunch mode (up to 150mA)
- singlebunch mode (up to 3.5 mA)
- bunch length down to 3 ps

THz Port at ANKA

IR1 - Diagnostic port

- source: entrance edge of a bending magnet
- flux $> 10^{13} photons/s/0.1\%bw$





(src.: ANKA-Archiv)

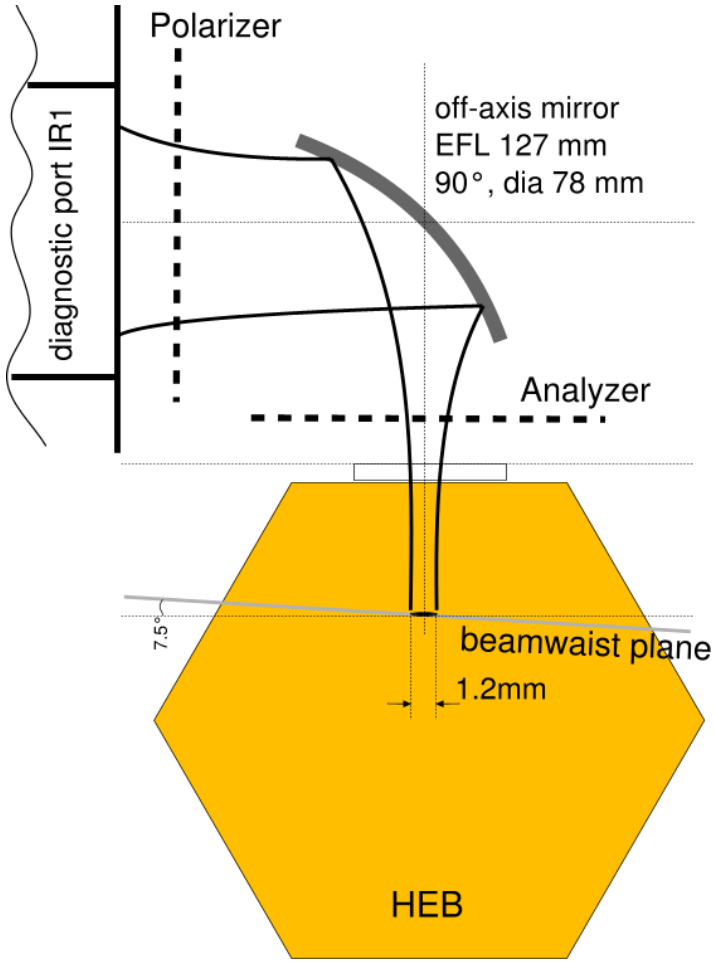
Experimental setup - THz detector

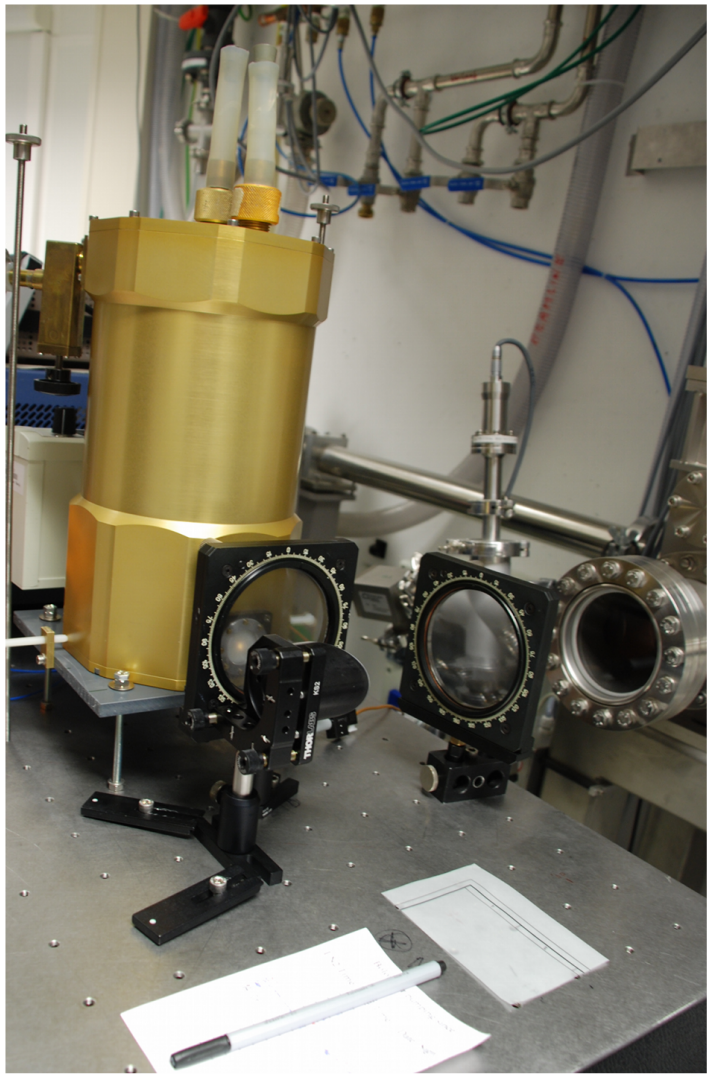
Hot Electron Bolometer

- response time $< 160\,\mathrm{ps}$
- spectral range $5 - 100.0\,\mathrm{cm}^{-1}$
- low noise detector
- saturation level at 0.4V
- SC niobium nitrid detector

Experimental setup

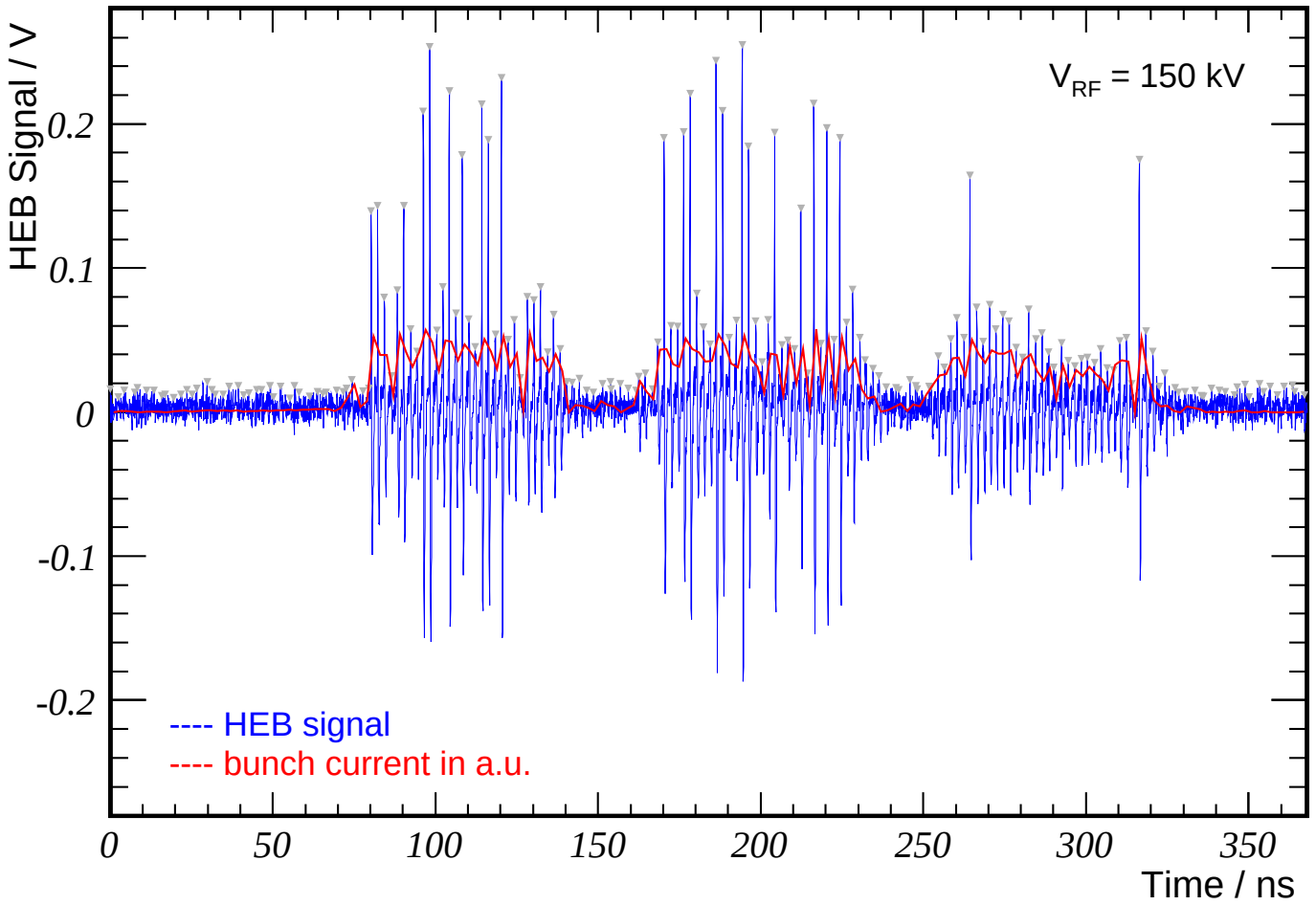
Setup with HEB/Si-Bolometer:





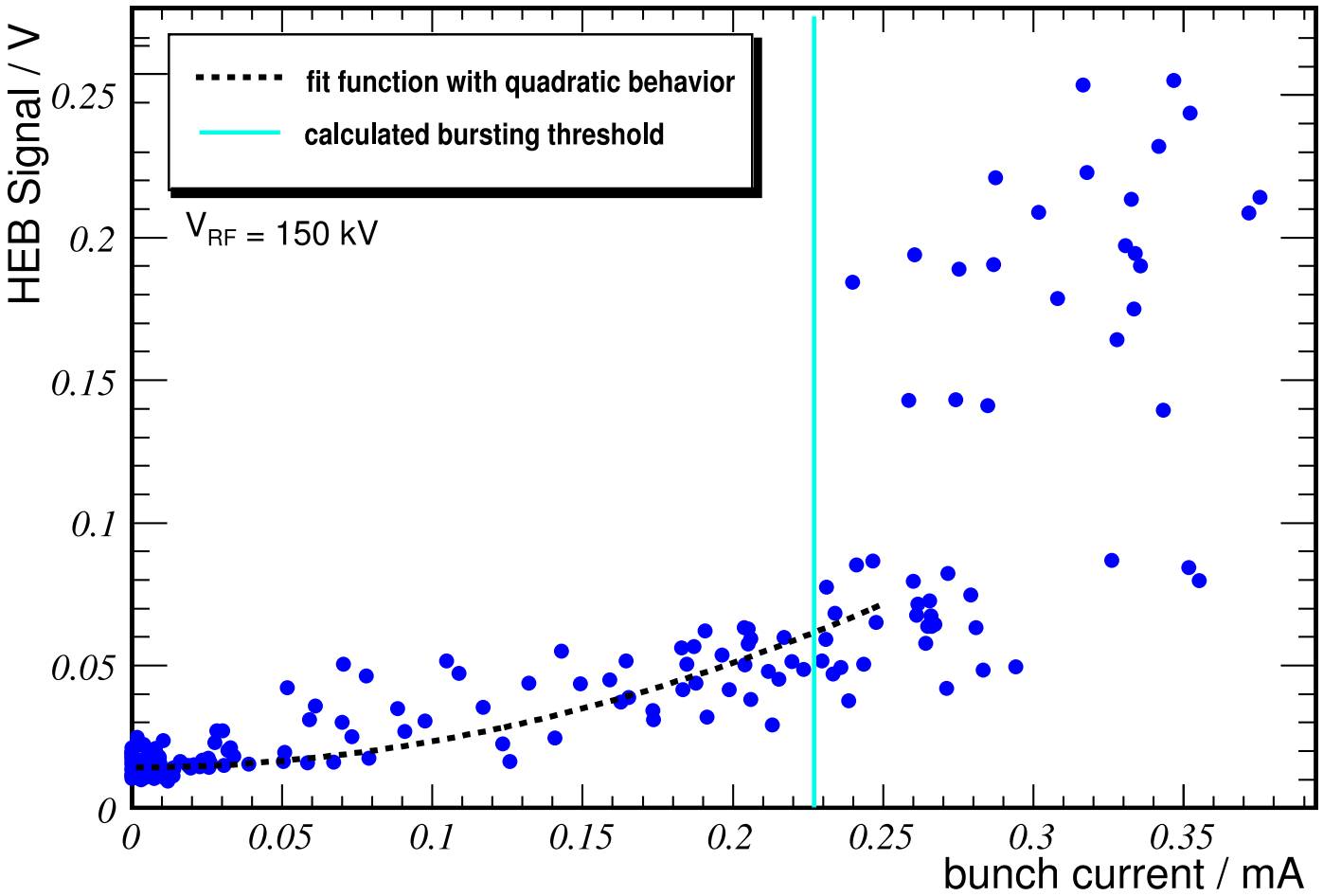
Results - multibunch measurements

Bursting state:



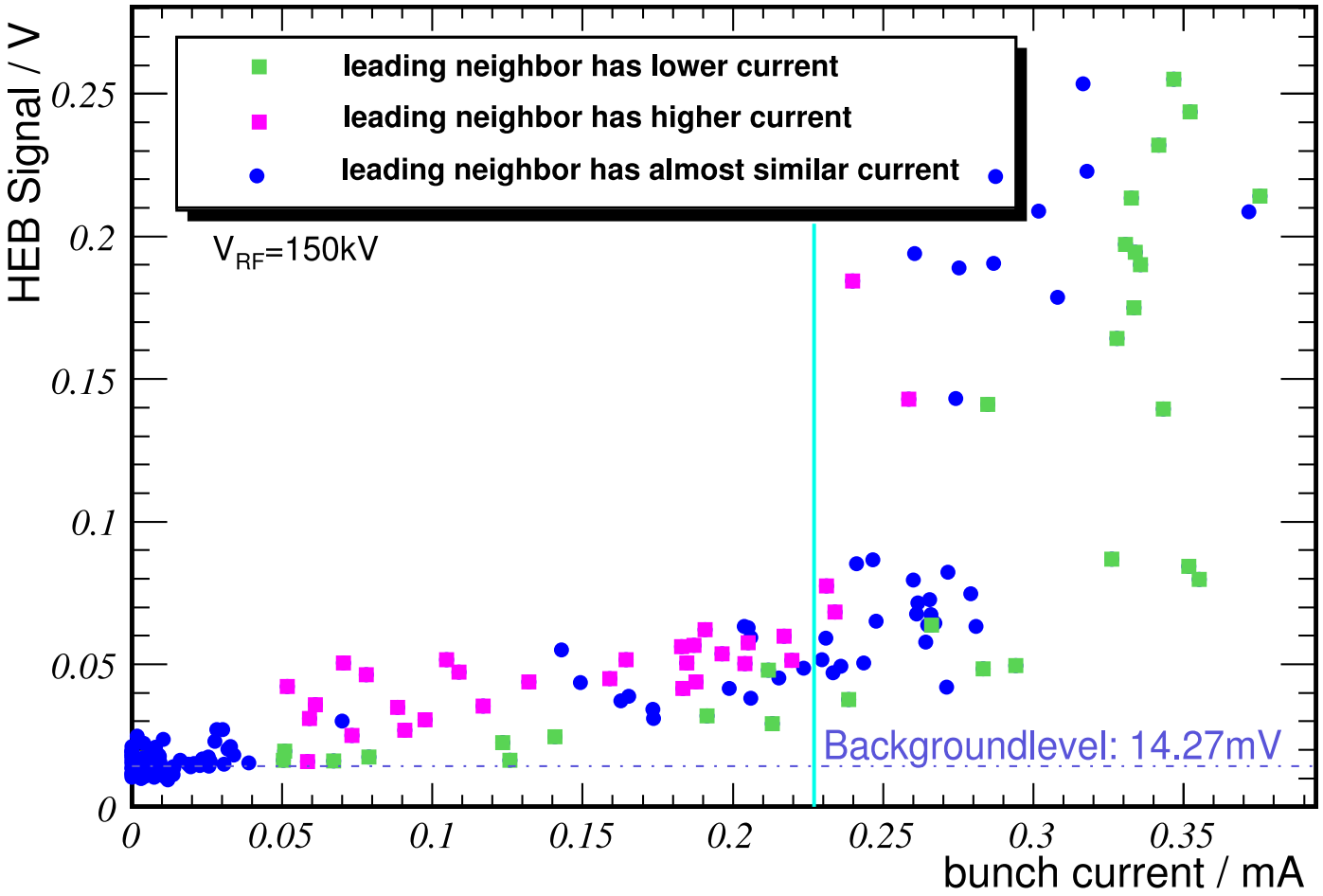
Multibunch measurements

Bursting threshold:



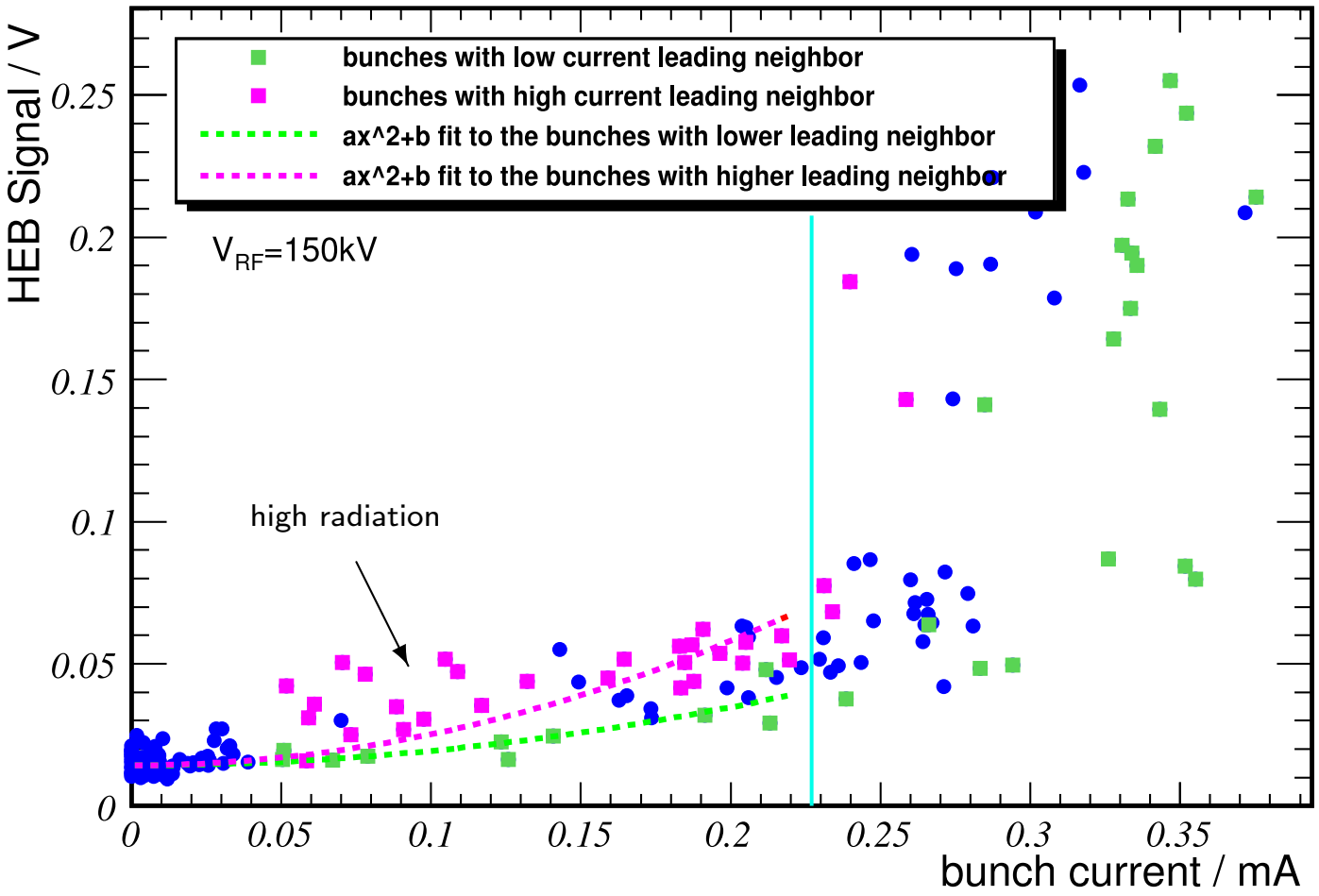
Neighbor interactions

Marking significant points shows systematical behavior:



Neighbor interactions

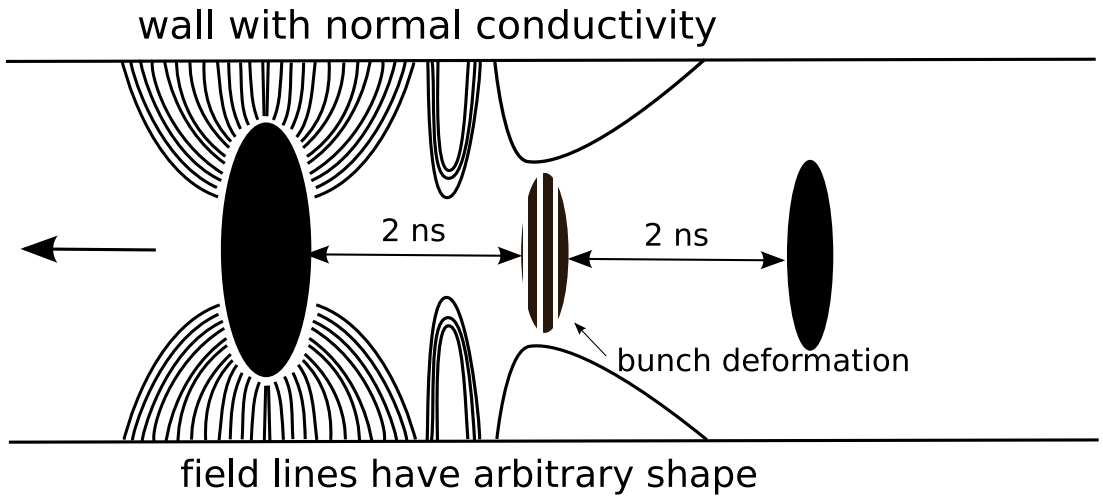
Fit $ax^2 + b$ to significant points:



Neighbor interactions - potential cause

Wakefields caused by mirror charge

- high current leading neighbor
  - $\longrightarrow$ higher wakefields
  - $\longrightarrow$ disturbance of longitudinal distribution
  - $\longrightarrow$ bursting radiation
  - $\longrightarrow$ higher HEB-signal



Future plans

Single-bunch analysis

- observation of bursting threshold
- investigation of bursting modes

Multi-bunch analysis

- theory of interactions between neighbor bunches
- preparation of trains with a maximum of CSR
- inverstigation of impedance dependences caused by stuctures

Summary

- successful validation of the HEB detector system
- development of analysis methods in multibunch mode
- neighbor interactions were observed
- singlebunch analysis method development in progress

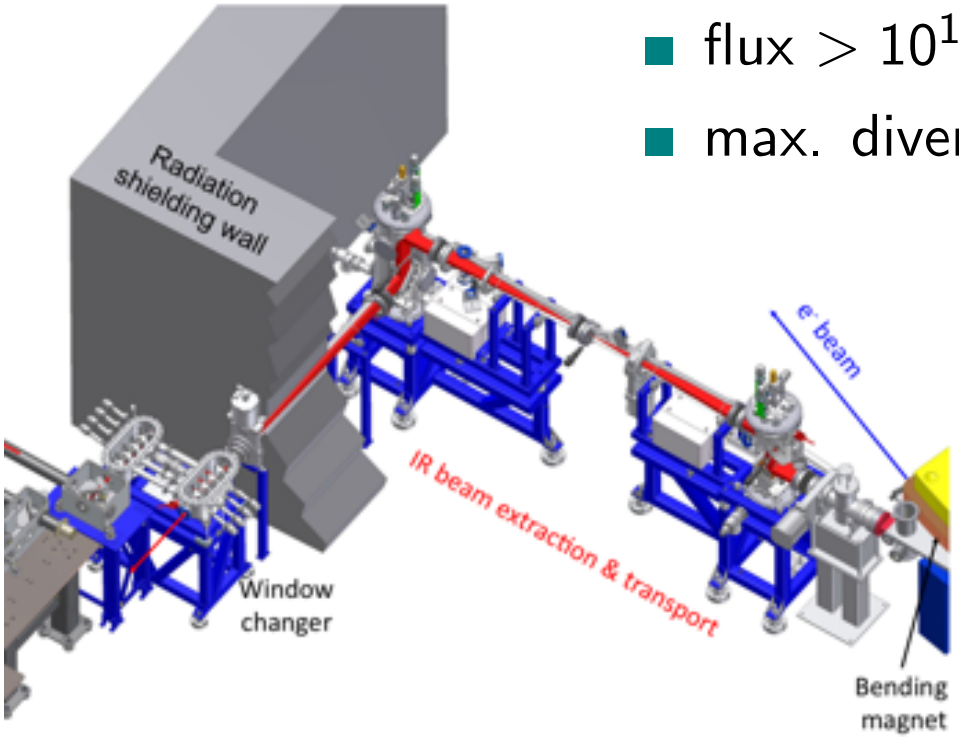
Karlsruhe Institute of Technology

Thank you for your attention!

THZ Port at ANKA

IR2 - Diagnostic port

- source: entrance edge of a bending magnet
- flux $> 10^{13} photons/s/0.1\%bw$
- max. divergence: 45mrad[h] x 15 mrad[v]



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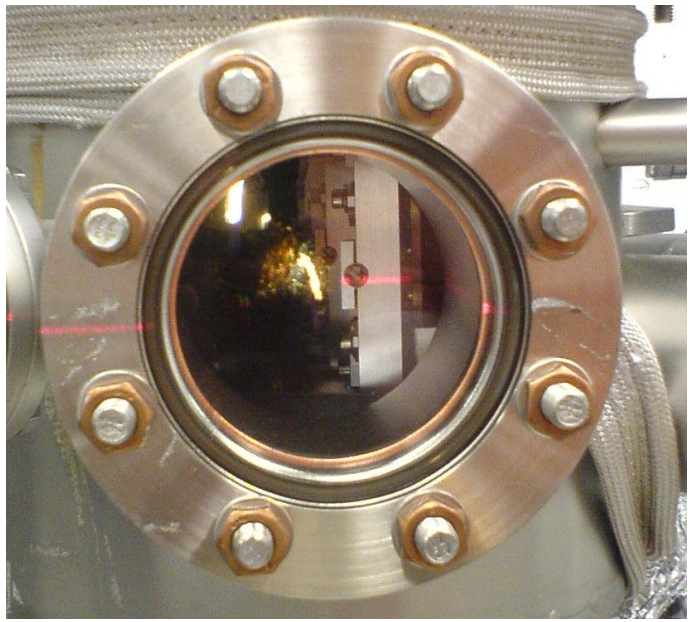


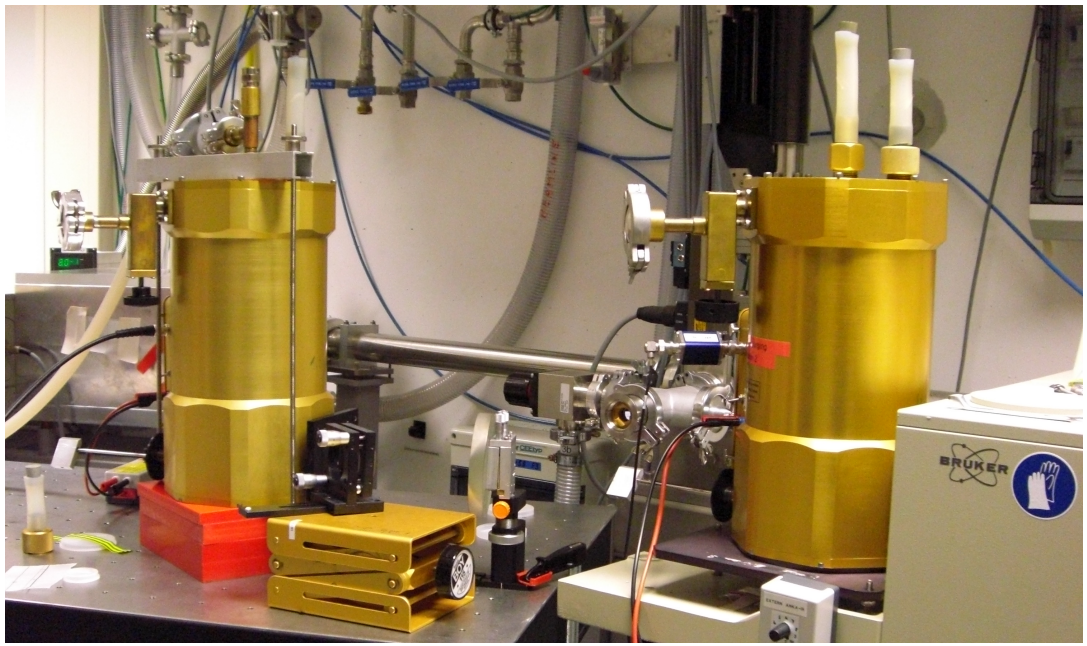
Experimental setup - THz detectors

Hot Electron Bolometer

- response time $< 160\,\mathrm{ps}$
- SC niobium nitrid detector

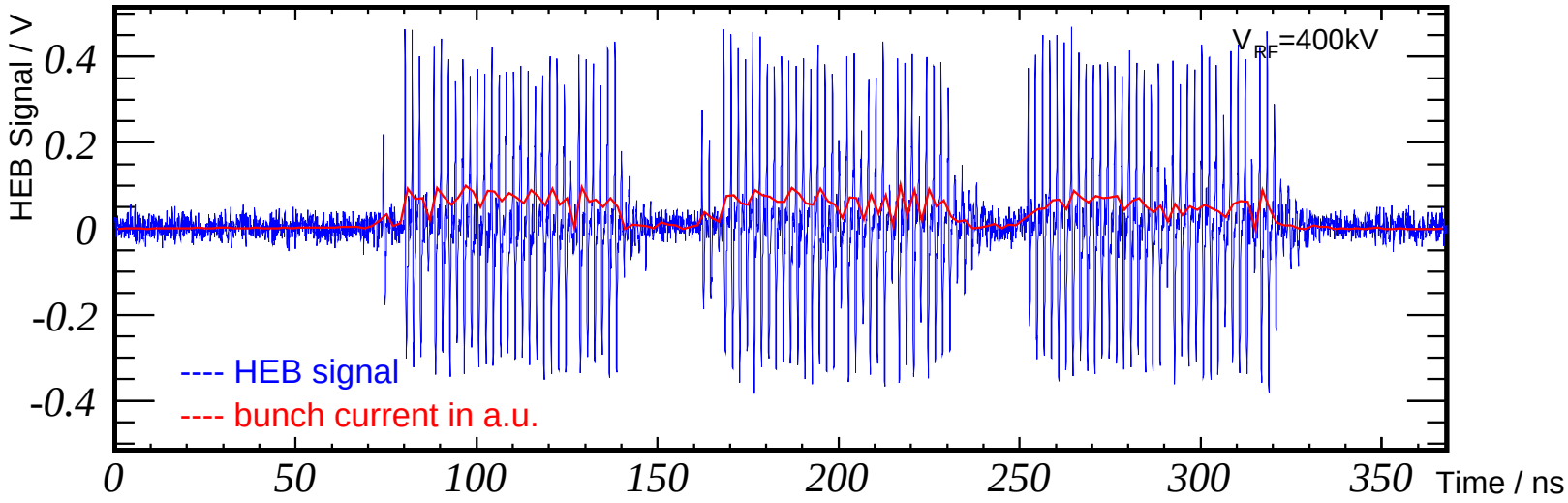
1.8K/4.2K Si Bolometer

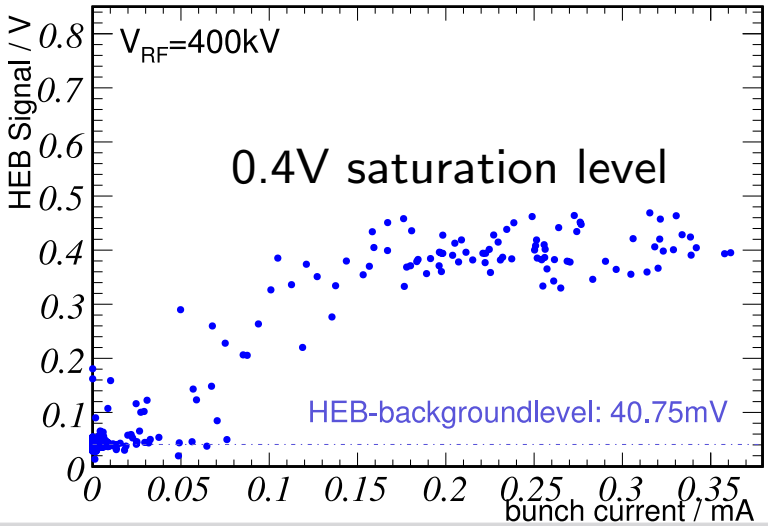
- response time $\approx 1\,\mathrm{ms}$
- Si 1.8K/4.2K detector

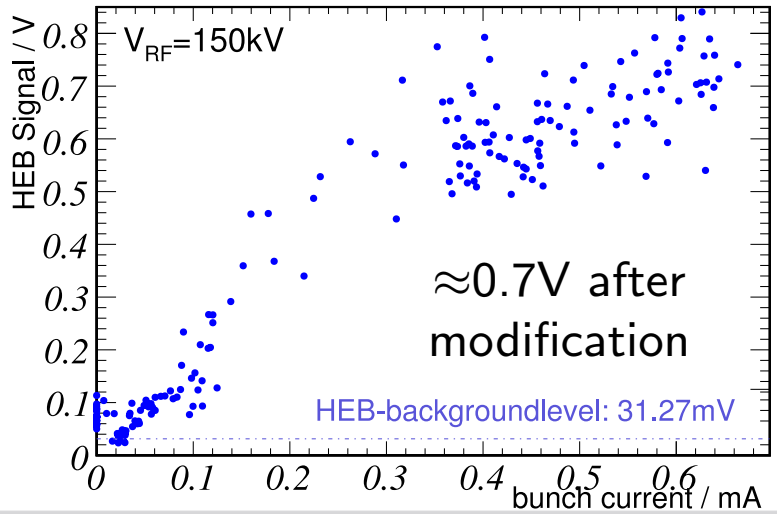


Results - multibunch measurements

Fill patterns measured with the HEB

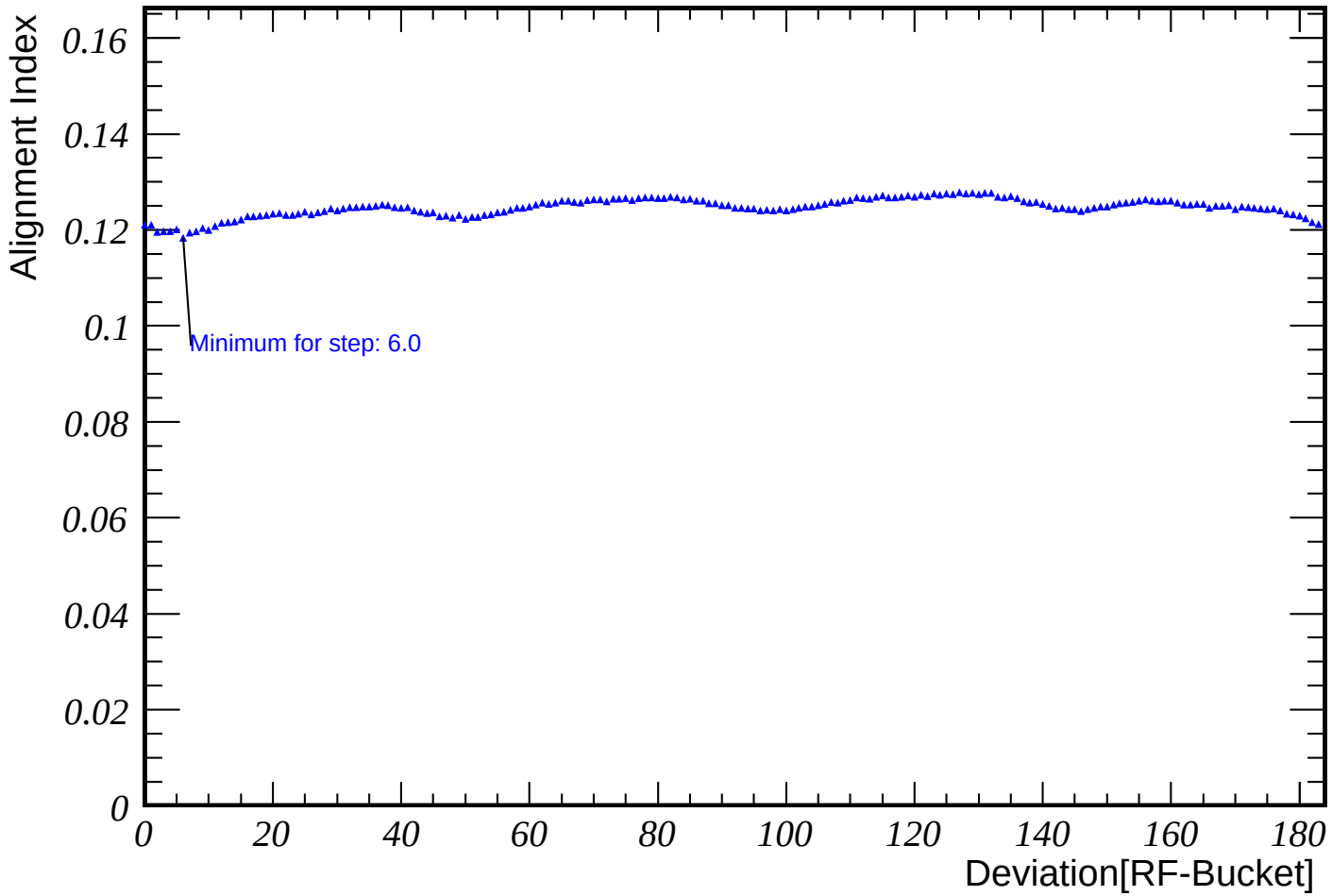






Multibunch measurements

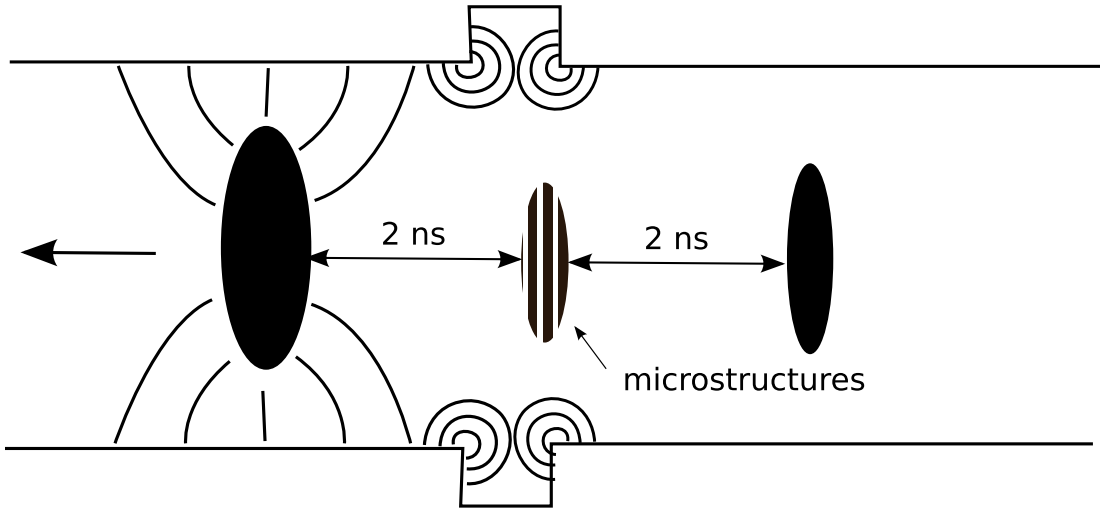
Libera alignment to HEB data



Neighbor interactions - potential causes

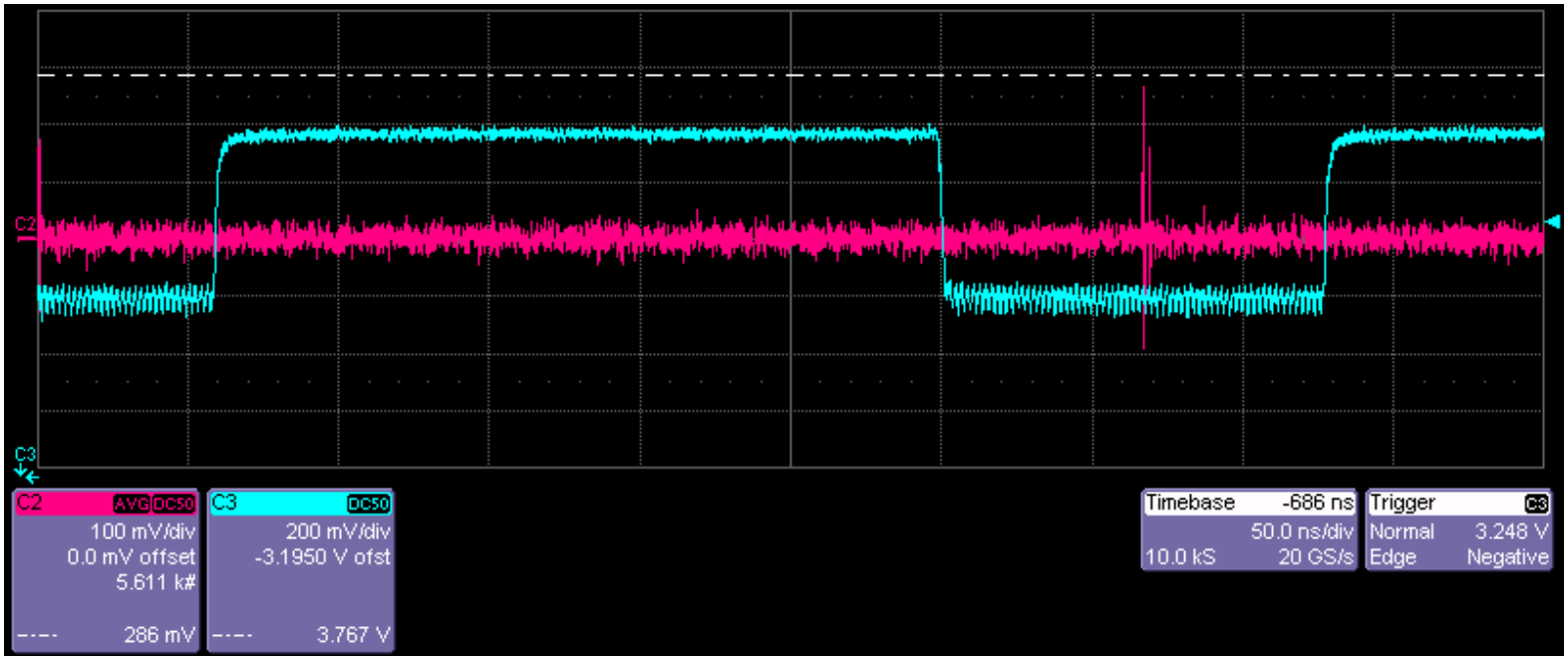
Wakefields caused by change of boundary conditions

- Wakefields on sturctures caused by previous bunch interact with the following bunch.



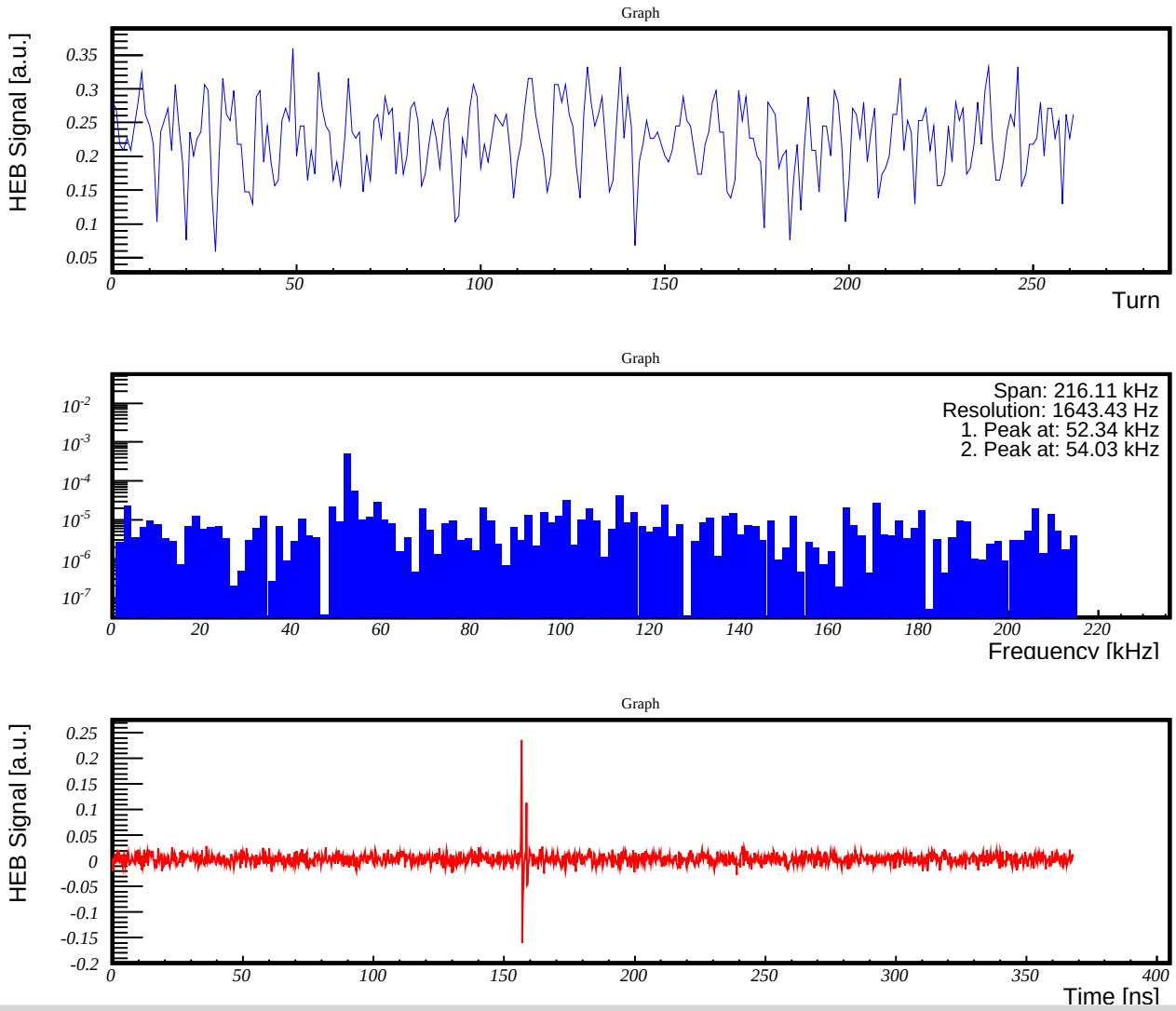
Single bunch observations

Single bunch mode was realized at 1st July '09



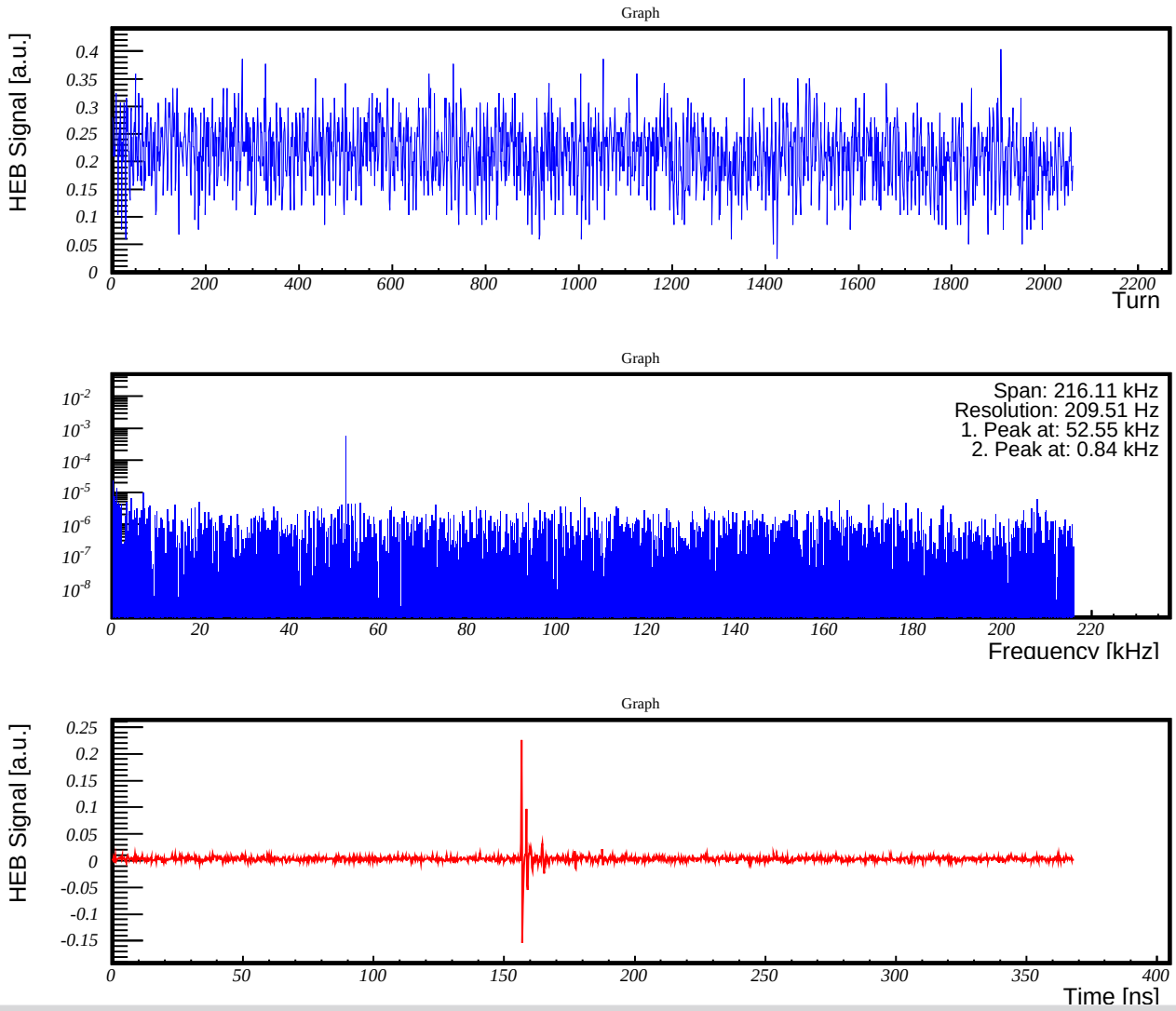
Single bunch observations

Multi-turn single bunch evolution - 5GS/s



Single bunch observations

Multi-turn signal - higher resolution - 5GS/s



Single bunch observations

Single bunch with 0.425mA during RF-Voltage changes