

Observation of Bursts using fast THz-Detectors at the ANKA Storage Ring

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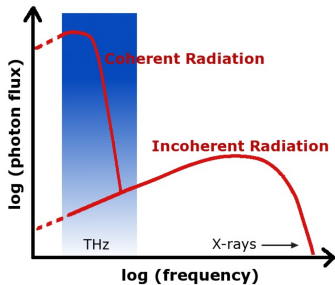
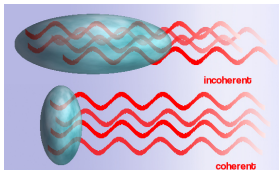
Joint QUASAR and THz-Groups Workshop on "Accelerator Science and Technology"

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- 1 Coherent Synchrotron Radiation**
- 2 Hot Electron Bolometer (HEB) detector system**
- 3 THz radiation as a tool to probe the beam dynamics**
- 4 Summary and outlook**

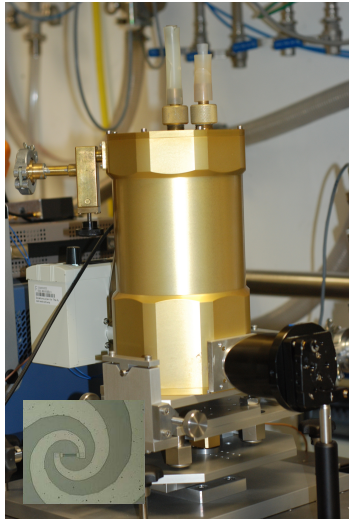
Coherent Synchrotron Radiation



(src.: ANKA-archive)

- $P_n = N_e \cdot P_1(1 + N_e g_\lambda)$
- g_λ is a form factor and define a spectral characteristics
- typically $N_e = 10^9$
Enormous increase in power in comparison to incoherent emission
- Intensity $\propto I_{\text{bunch}}^2$
- very short bunch is needed

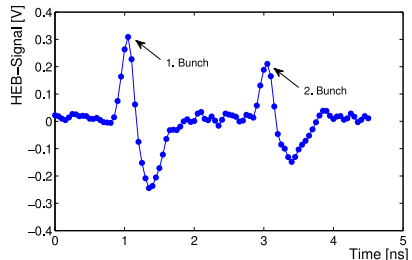
Hot Electron Bolometer (HEB)



(src.: THZ-group archive)

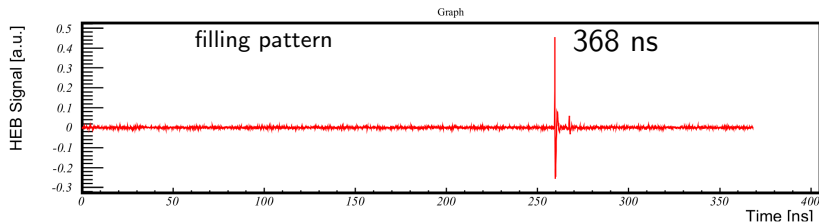
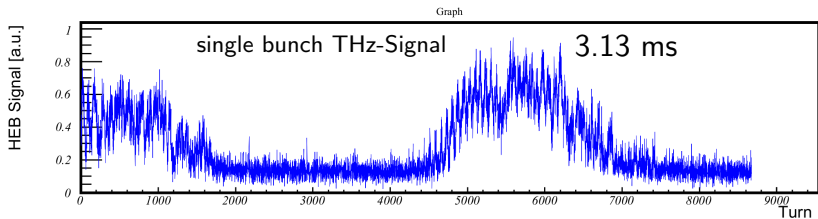
The HEB detector system

- joint development of IMS (Karlsruhe) & DLR (Berlin)
- SC niobium nitride detector
- spectral range 150 GHz - 3 THz
- response time < 160 ps



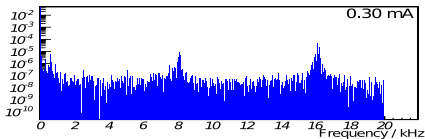
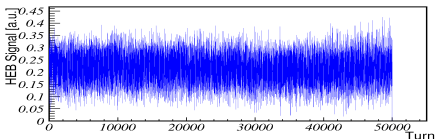
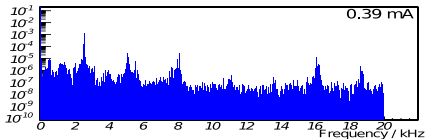
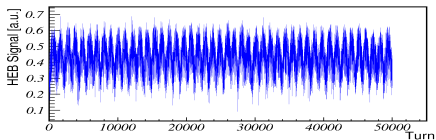
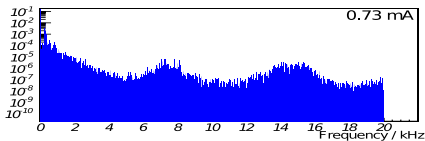
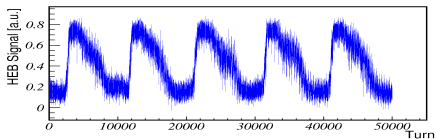
Observation of bursting

Bursts of radiation in multi turn measurements



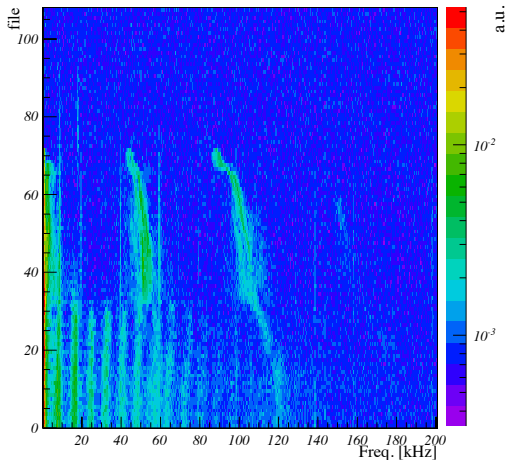
Observation of bursting

Bursts of radiation in multi turn measurements

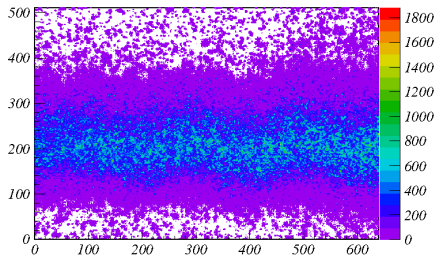
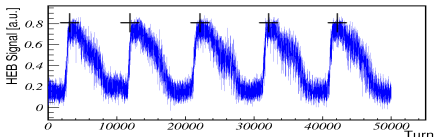


Observation of bursting

Bursting modes



HEB-triggered streak camera data acquisition scheduled



- averaging in bursting mode cause bunch lengthening and substructure blurring
- HEB trigger possibly allows to track only a certain state during bursting
- this could improve slice analysis

- combination of HEB with conventional methods like a streak camera or spectrometer opens up new possibilities for longitudinal diagnostics

Next steps:

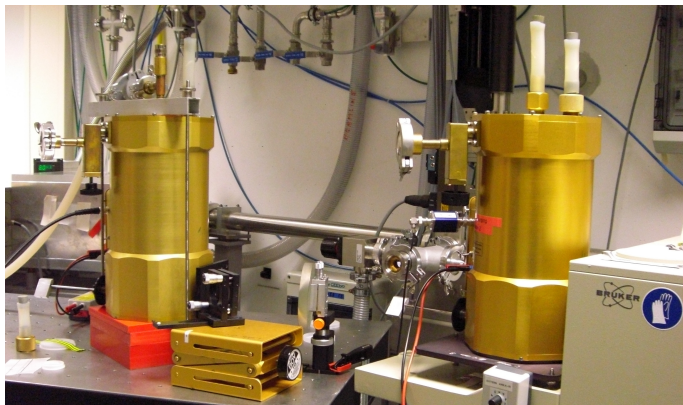
- we would like to trigger and control bursting radiation
→ more experiments in sb- and mb-mode are scheduled

Thank you for your attention!

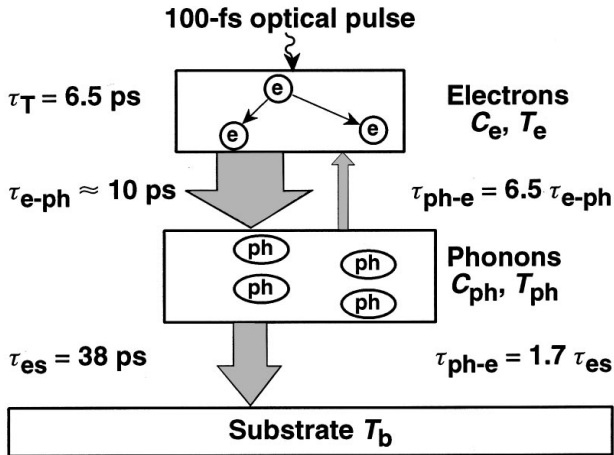
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1.8K/4.2K Si Bolometer

- response time ≈ 1 ms
- bandwidth 20 – 4000.0 cm^{-1}



Energy relaxation in NbN



(src.: A. Semenov)

Further evidence for coupling between adjacent bunches

- for impedance effect a linear dependence of signal on driver current is expected

