Determination of coherent radiation spectra from interferograms

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Coherent synchrotron radiation spectra measurement on the FLASH beam

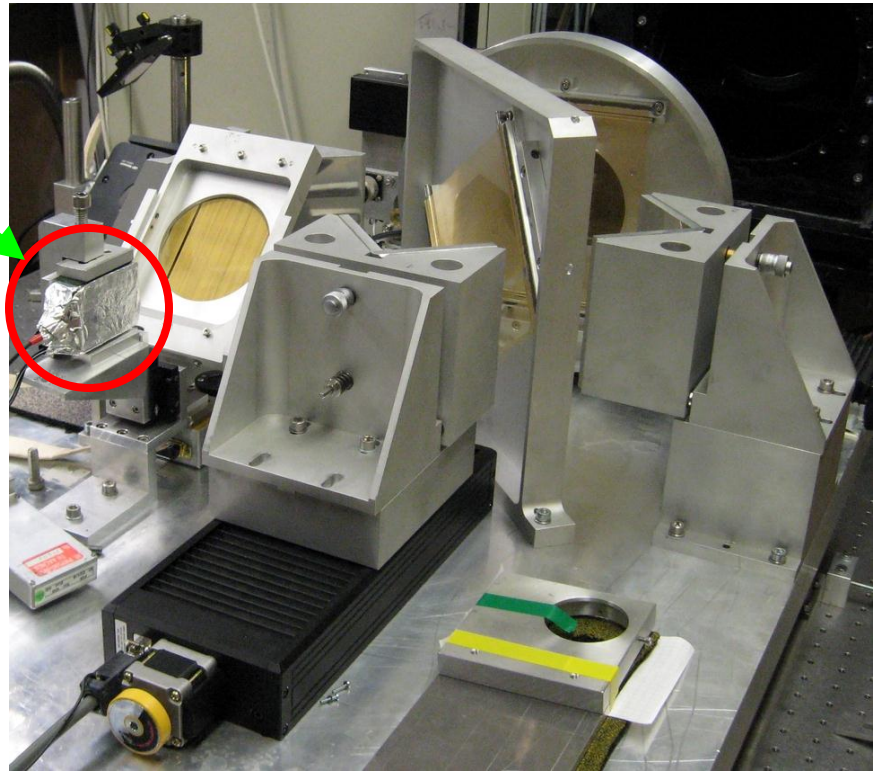
G. Naumenko, A. Potylitsyn, G. Kube, O. Grimm, V. Cha, Yu. Popov. NIM A 603 (2009) 35-37

FLASH experimental conditions

- **Single bunch charge: 0.6-0.9 nCb (≈$4 \cdot 10^9 e^-$)**
- **Single bunch length: 100 fsec**
- **Radiation energy from single bunch ≈ 50-100 nJ**
- **Lorenz-factor: 300**
- **A train consists of 1-100 single bunches**

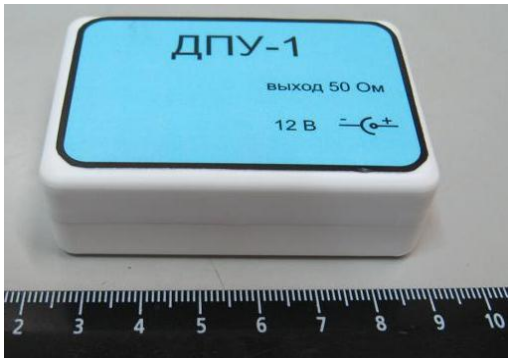
Martin-Puplett interferometer of DESY TOSYLAB

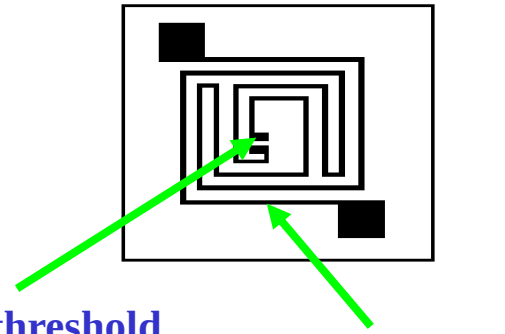
DPU-1



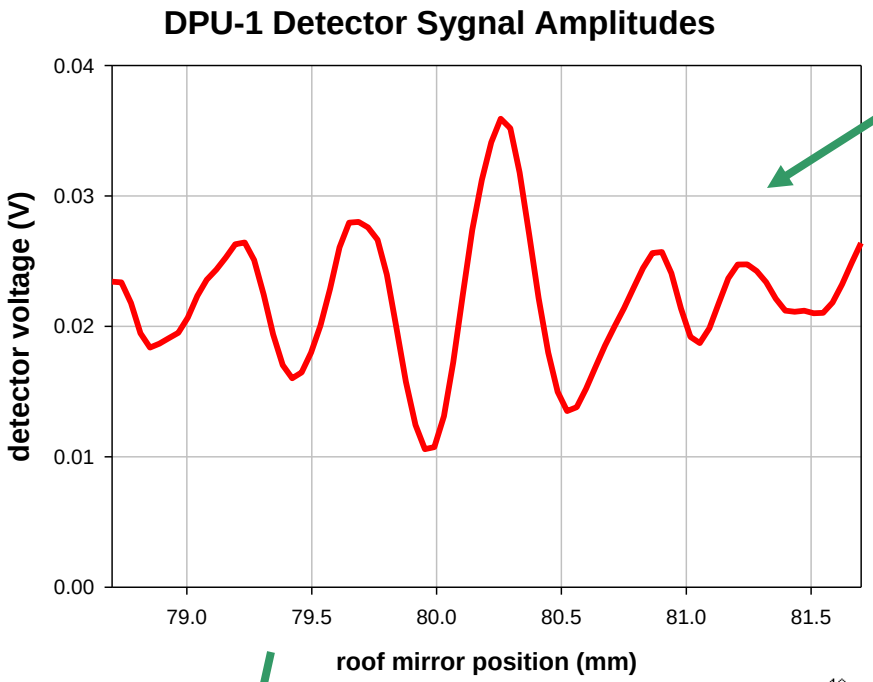
Detector DPU-1

(Tomsk Semi Conductive Devices Institute)





The time characteristics of detector allow us to measure radiation from choosed separate bunch in train.



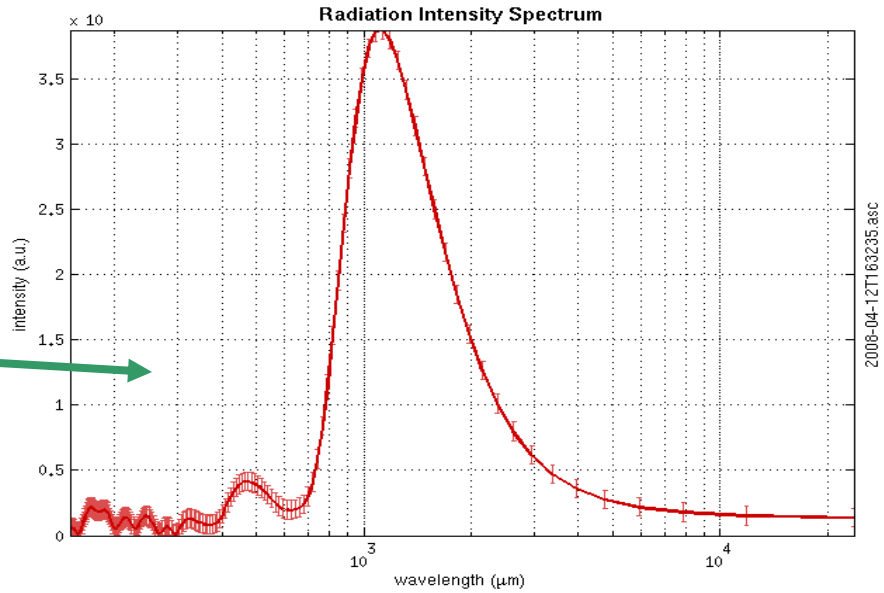
Sample of interferogram

of DESY TOSYLAB CSR beam

Spectrum reconstruction

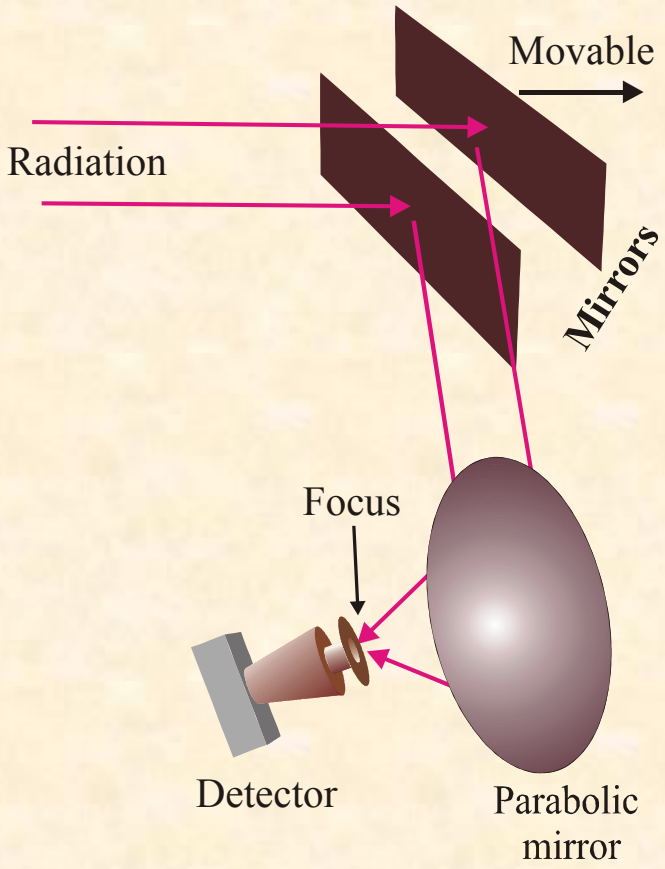
(Fourier transformation of interferogram)

Lars Froehlich. DESY-THESIS 2005-011, FEL-THESIS 2005-02J

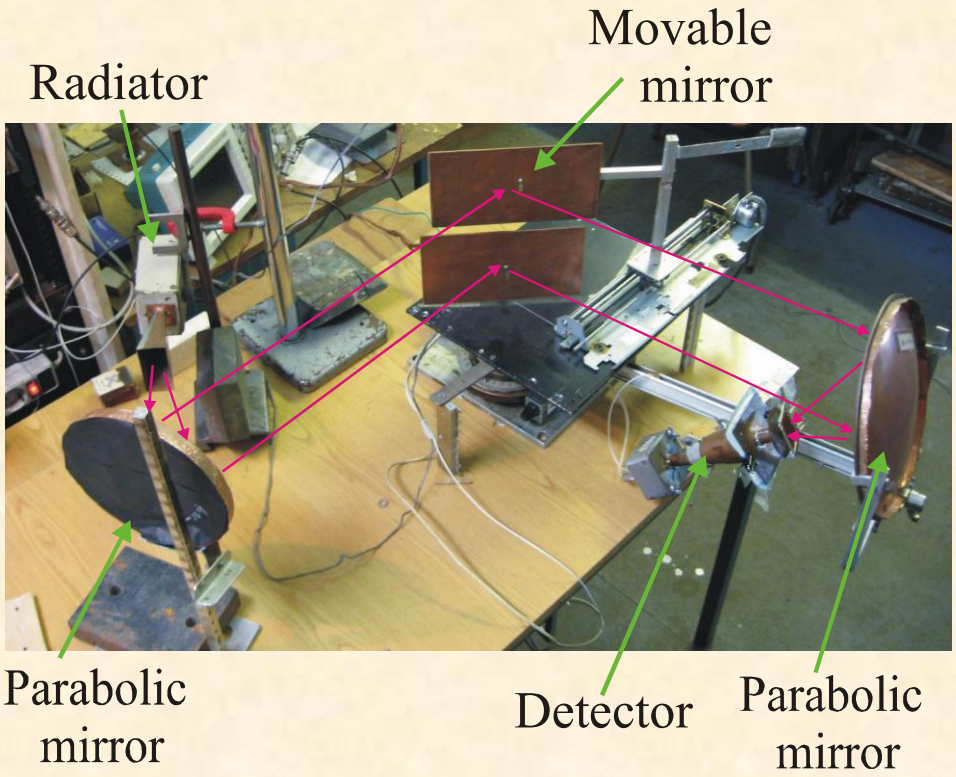


Divided wave front (DWF) interferometer

. G. Naumenko, A. Potylitsyn, M. Shevelev, Yu. Popov, L. Sukhikh. Russian Physical Journal. **11** 2 (2009) 254
G. Naumenko, A. Potylitsyn, M. Shevelev , V. Soboleva, V. Bleko. **IFOST-2012** proceedings (to be published)



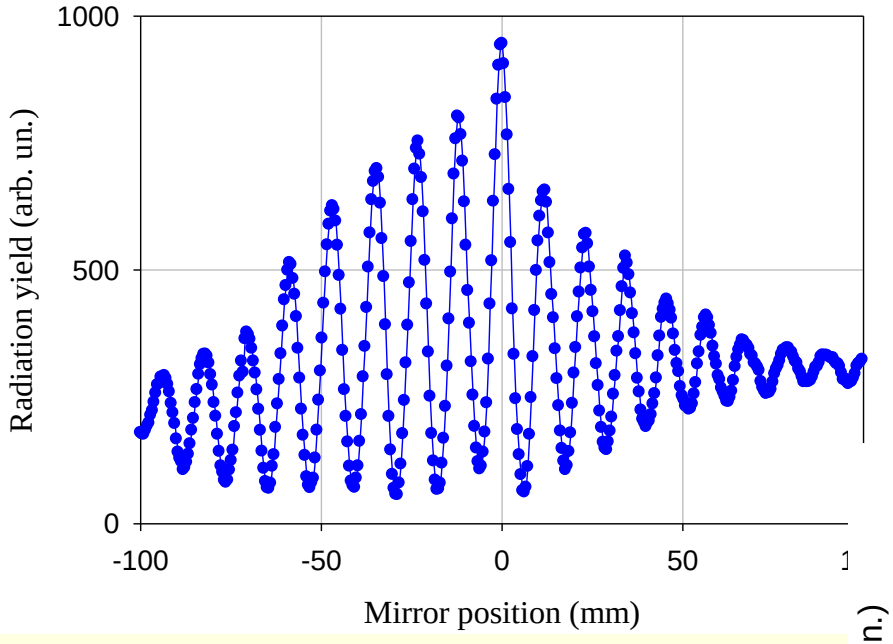
DWF interferometer for Tomsk microtron conditions



$\lambda = 3 \div 20\,mm$

Sample from radiation source with wavelength 11.6 mm

Interferogram

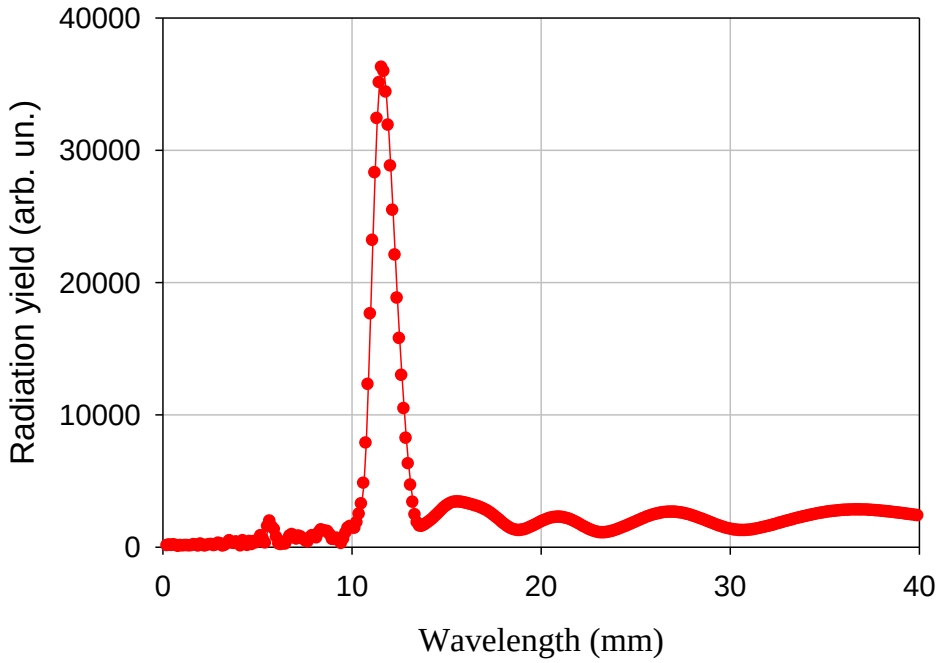


The spectral resolution depends on the quality of plane and parabolic mirrors and on the aperture of detector.

For this case the spectral resolution was

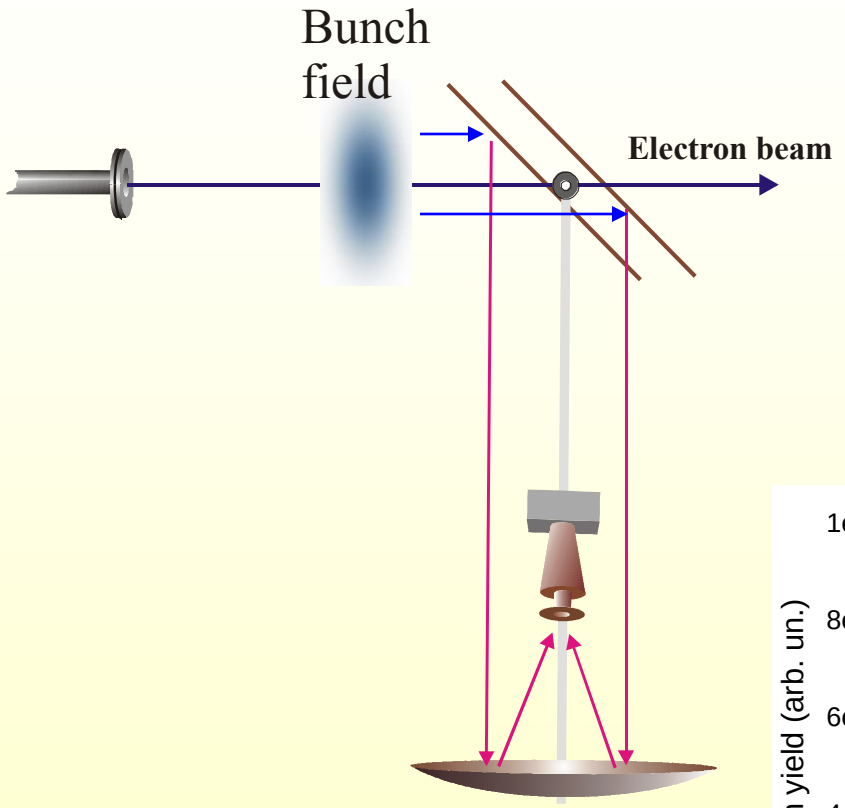
$$\sigma \leq 6\%$$

Spectrum reconstructed



The spectrum reconstruction procedure is similar to the previous one.

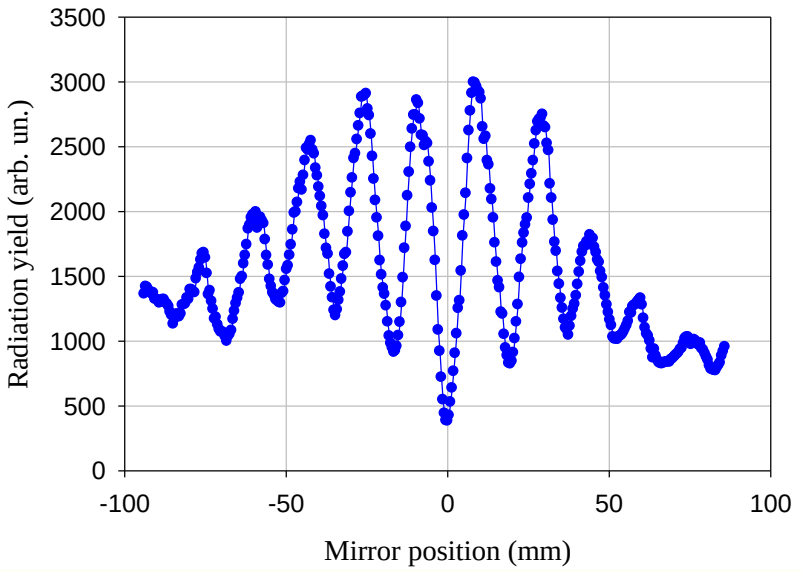
Sample of Tomsk microtron pseudo-photon spectrum measurement



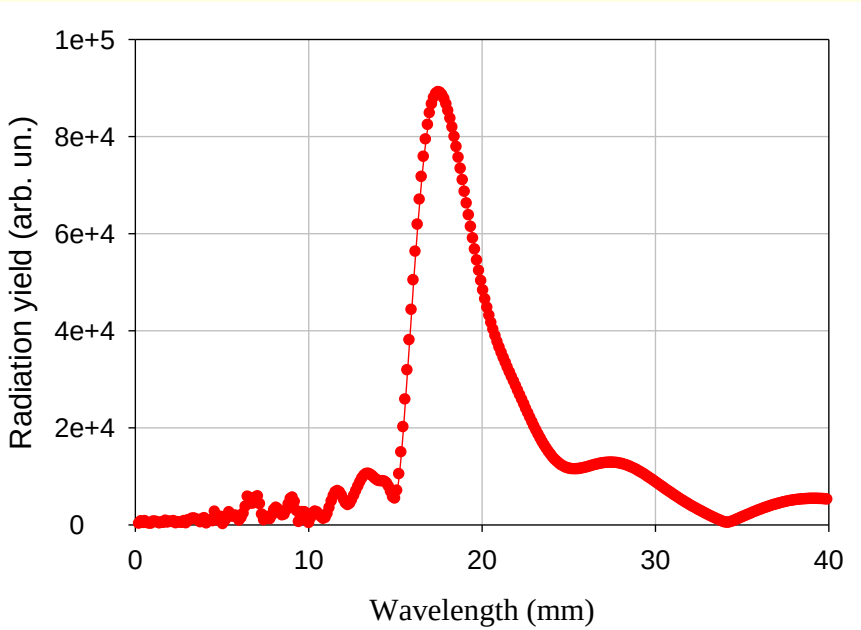
$$Electron\ energy = 6.2 MeV$$

$$Bunch\ length \quad \sigma \approx 2.3 mm$$

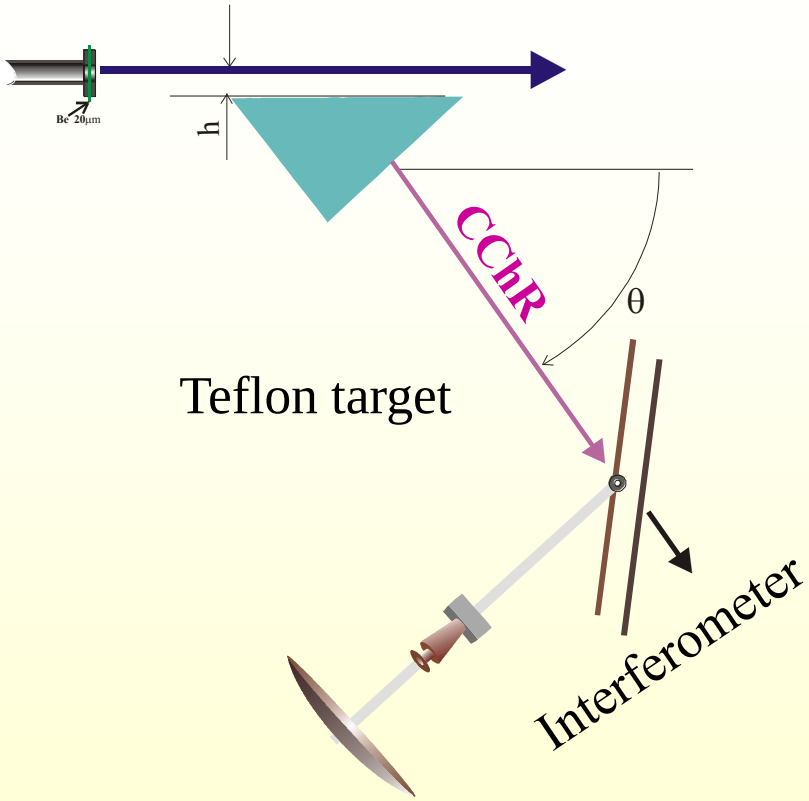
Interferogram



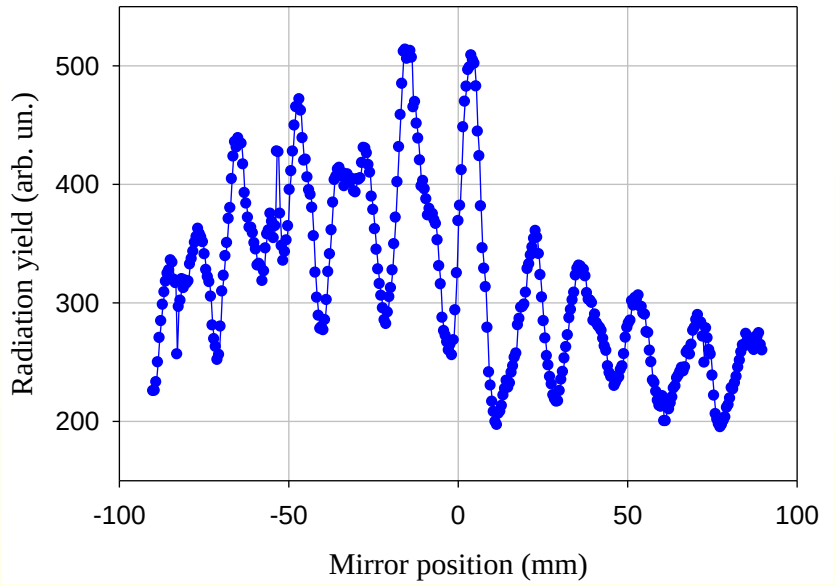
Spectrum reconstructed



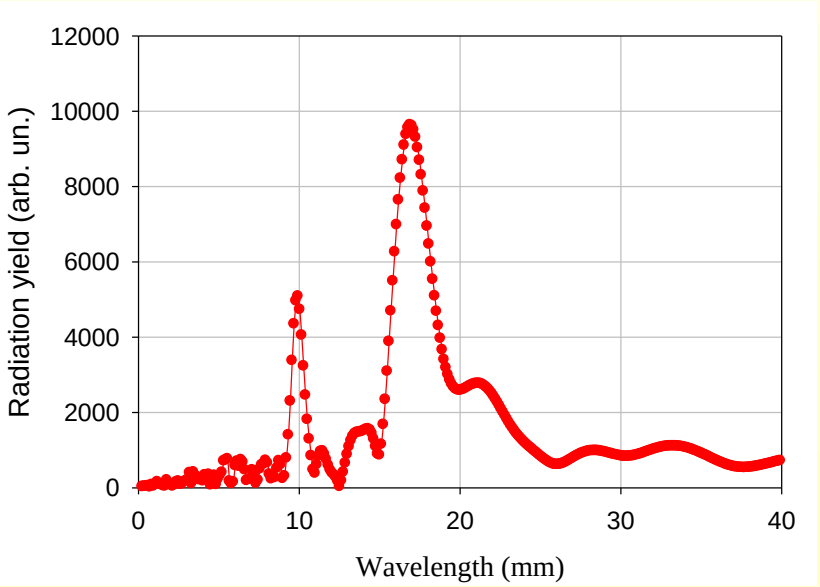
CChR spectrum measurement



Interferogram

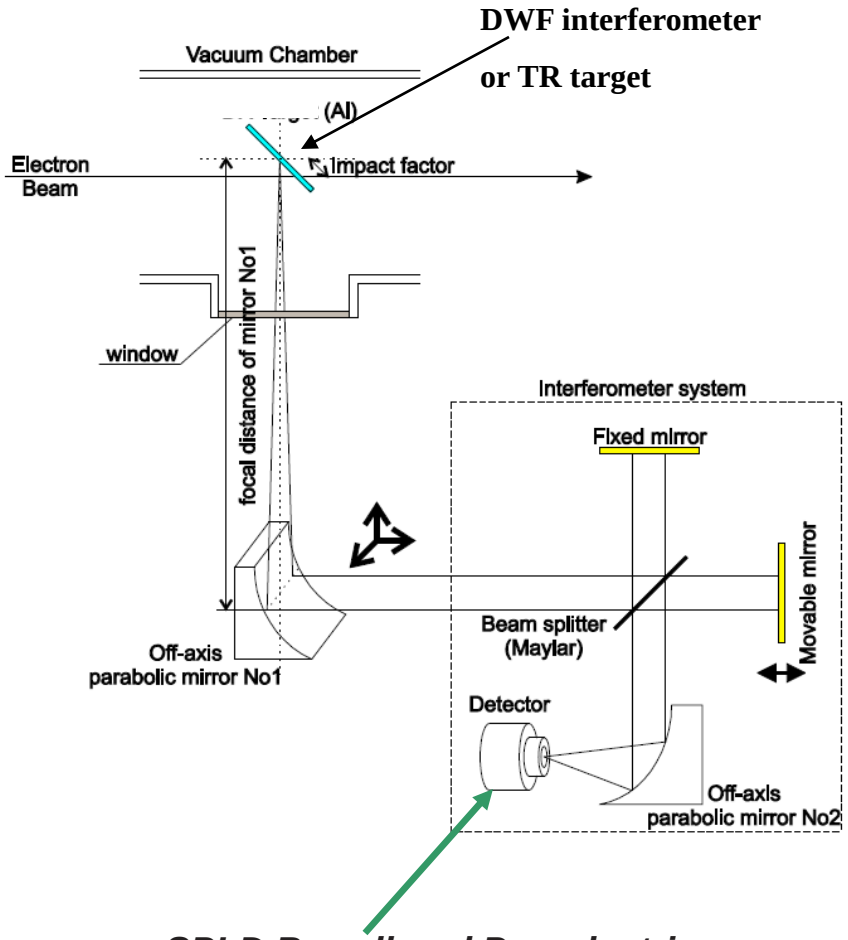


Spectrum



Test in Shanghai Institute of Applied Physics

Zhang J.B., Shkitov D.A., Lu S.L., Shevelev M.V., Yu T.M., Potylitsyn A.P.,Ye K.R., Naumenko G.A., Deng H.X. Proceedings IBIC-12 (to be published)



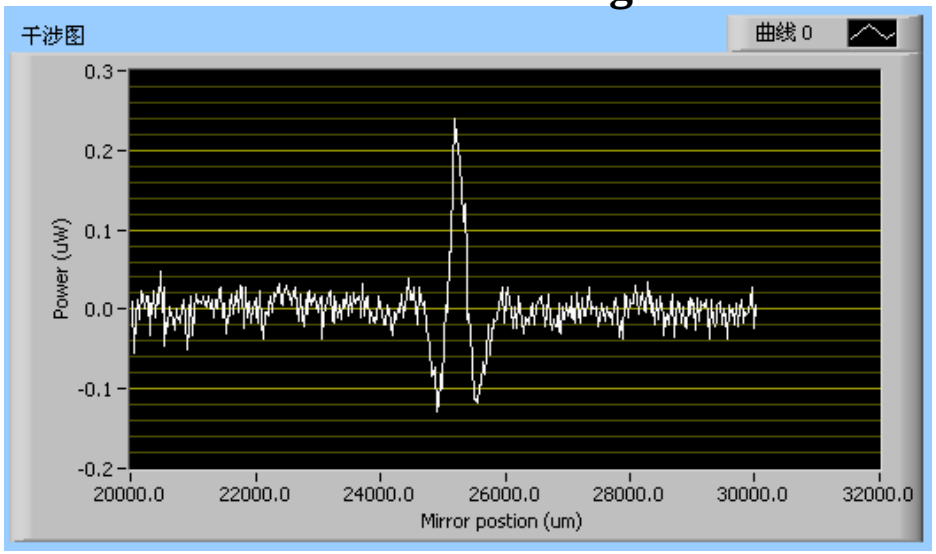
SPI-D Broadband Pyroelectric THz Radiometer

$$Electron\ energy = 20 MeV$$

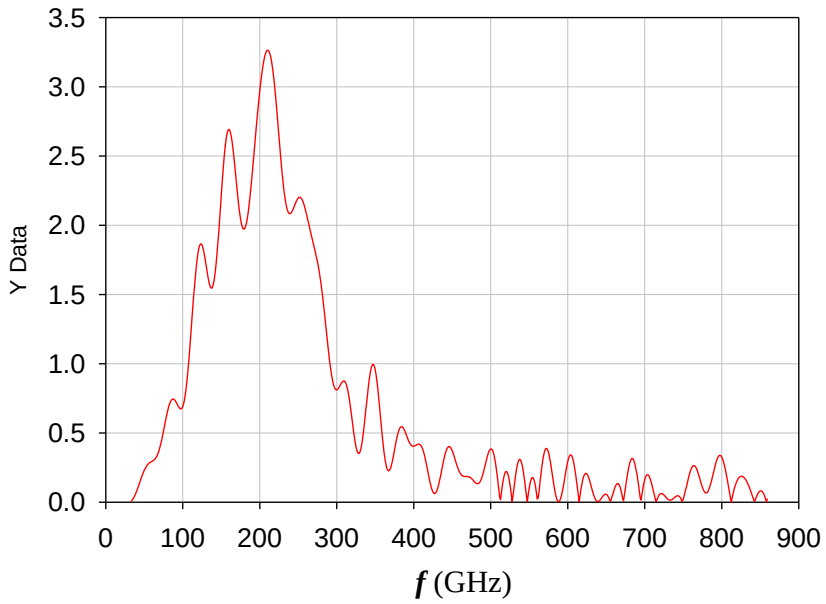
$$Bunch\ length \quad \sigma \approx 0.19\, mm$$

CTR spectrum measurement using Michelson interferometer

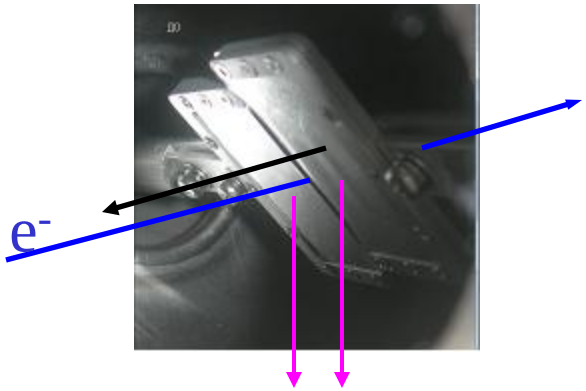
Interferogram

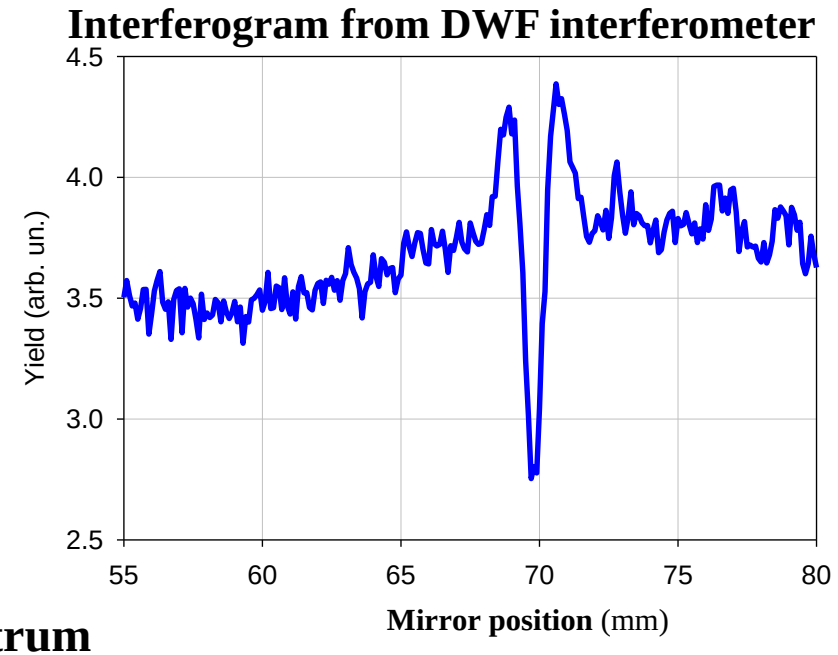


Spectrum

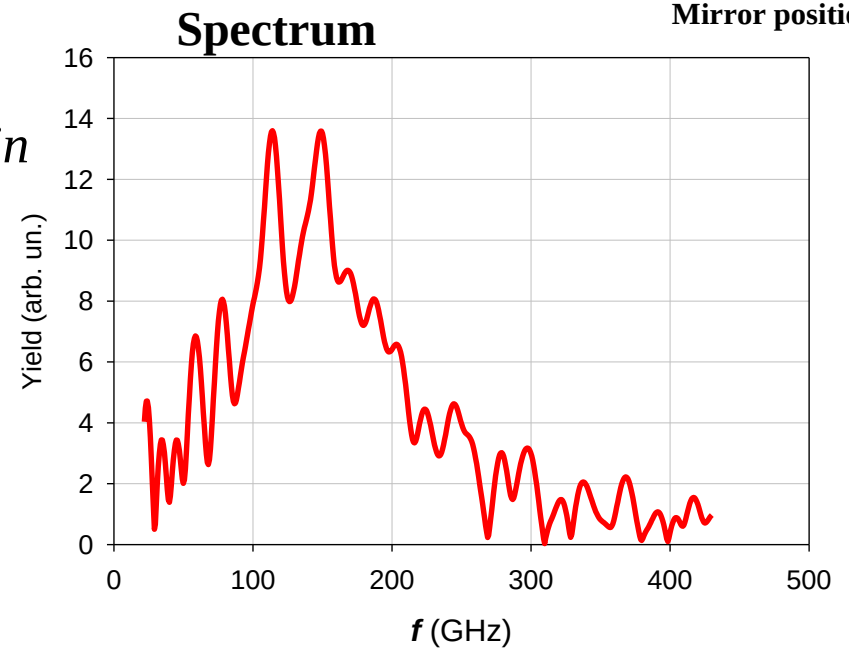


Pseudo-photon spectrum measurement using DWF interferometer





The same scheme was used, but the mirror of Michelson interferometer was installed in the center of interferogram.



Possibility for spectral measurement on LUCX

For bunch length= 10 ps we may have a coherent radiation in millimeter wavelength region. So the DWF interferometer with parameters used in Tomsk may be applicable for LUCX.

Michelson interferometer

Min. Order: 1 SetFOB Price: US $3500/ Set

The DWF interferometer approximately two times cheaper.

In addition, this interferometer provides the possibility to measure not only real photon spectra, but also the spectra of pseudo-photons.

Thank you for your attention