A THz source based on CALIFES

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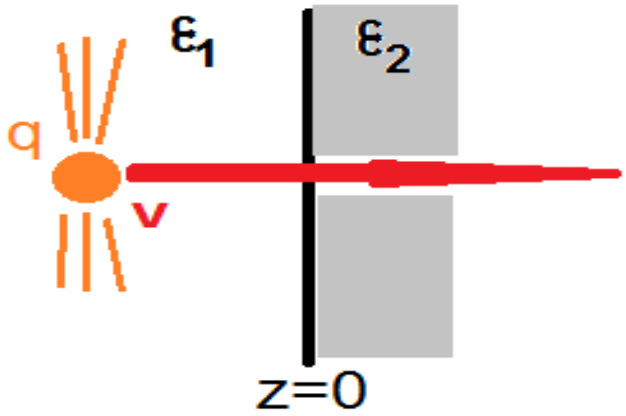
Summary

Introduction

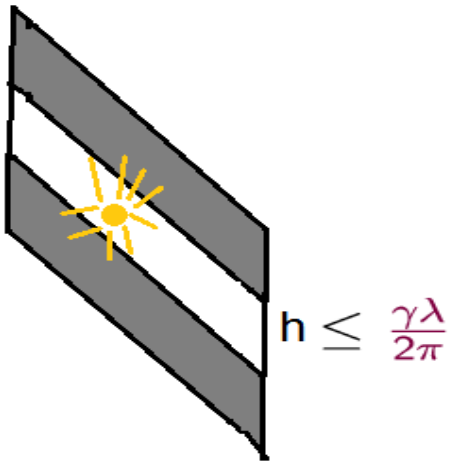
THZ source parameters

Possible experiments and conclusions

THz emission as Coherent Transition/Diffraction Radiation



CTR: radial polarization.



CDR: the polarization can be mainly linear.

Single particle radiation: $\frac{dI_{sp}}{d\omega d\Omega}$ depends on the material and/or geometry of the target/slit

Radiation from a bunch: $\frac{dI}{d\omega d\Omega} = [N_e + N_e(N_e - 1)F(\omega)]\frac{dI_{sp}}{d\omega d\Omega}$

Bunch form factor: $F(\omega) = \int S(\vec{r})e^{i\frac{\omega}{c}\vec{n}\vec{r}} \neq 0$ for pulse duration $\leq \lambda$

Impact parameter (only for DR) $h \leq \frac{\gamma\lambda}{2\pi}$

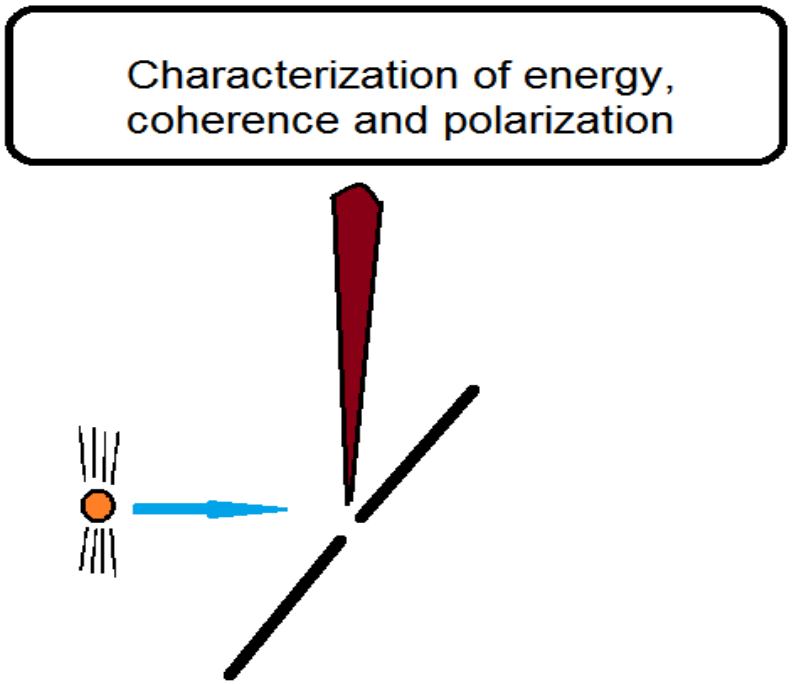
Short term activity: characterization of the THz source/1

Accomplishable within 2017

⋆ Characterize the maximum delivered energy

⋆ Characterize the coherence band

⋆ Characterize the degree of polarization

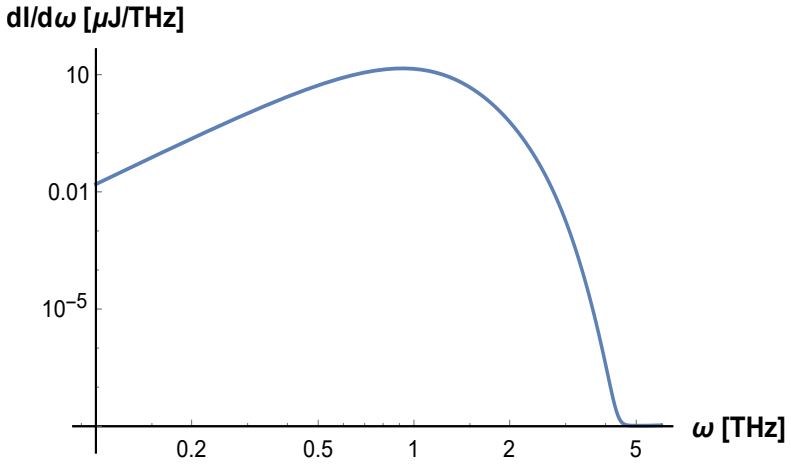


Bunch parameters

Bunch energy: 200 MeV

Bunch length: 500 μm

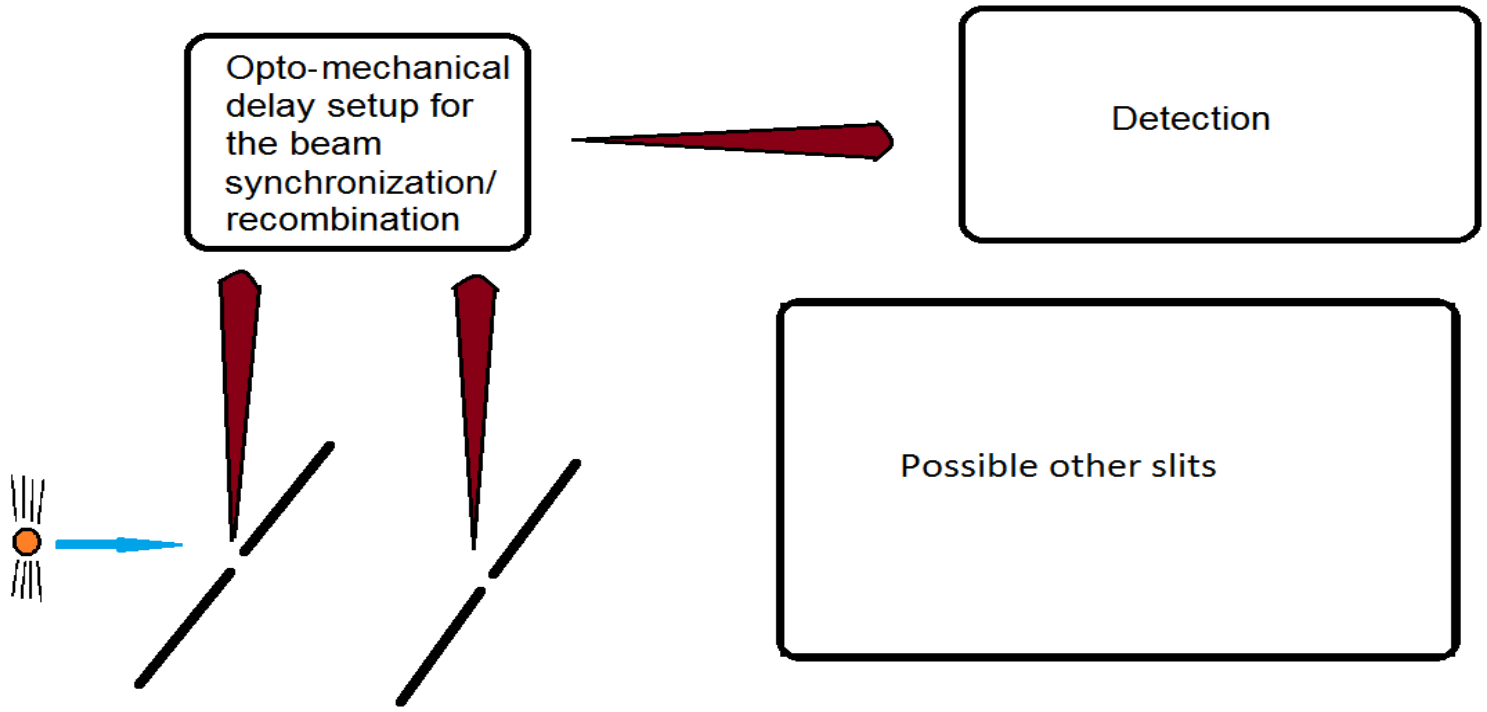
Bunch Charge: 1.5 nC



⋆Total irradiated THZ energy: *tens* μJ

⋆Bandwidth: 1 *THz*

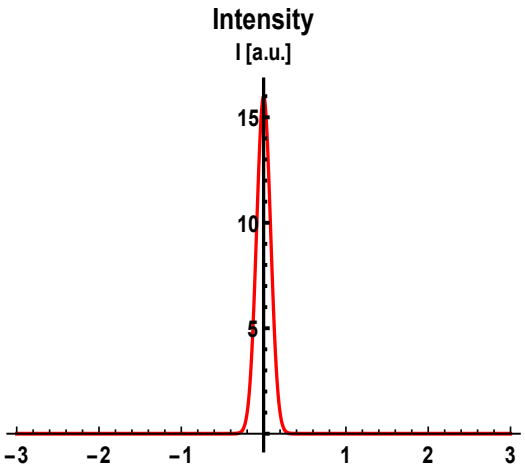
A simple scheme for the shaping of the radiation/1



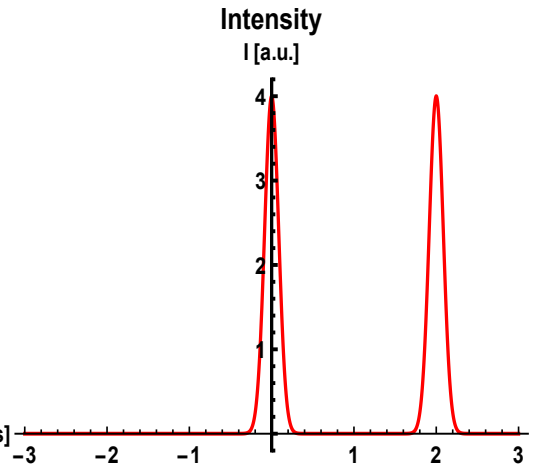
⋆ The CDR in the THZ region can be induced in a sequence of slits.

⋆ The detection can be performed via EOS techniques or with a Michelson interferometer

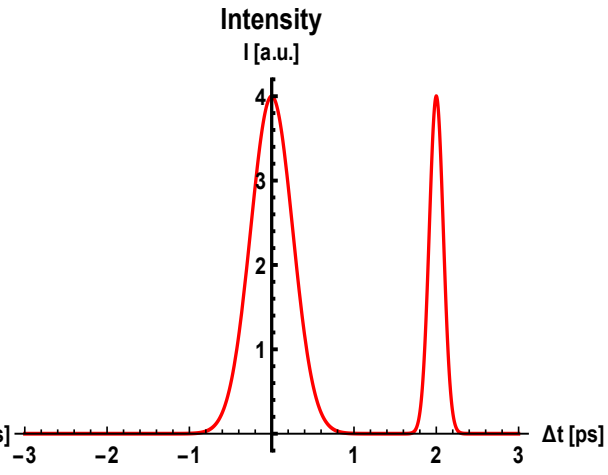
A simple scheme for the shaping of the radiation/2



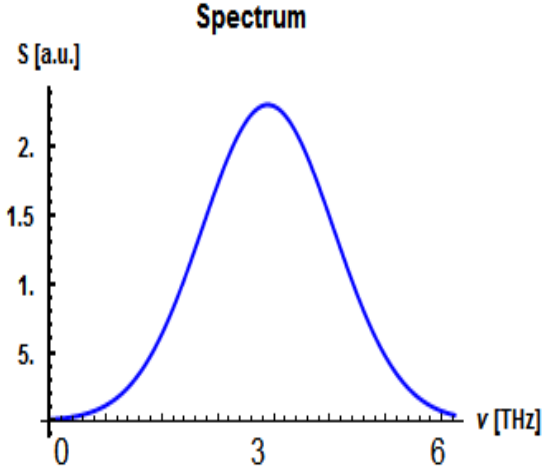
Delay 0 ps



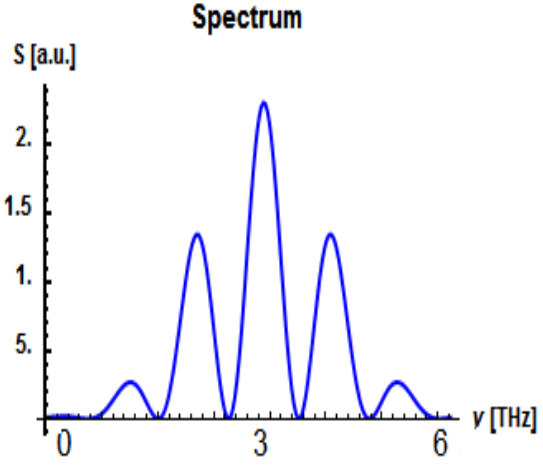
Delay 2 ps



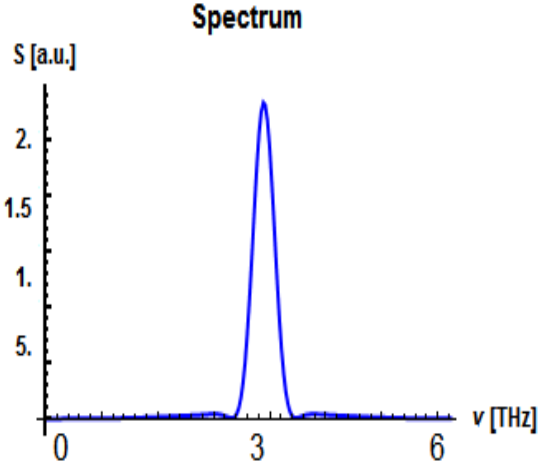
Different durations



Large BW



Modulations



Small BW

Long term activity: upgrades and experiments

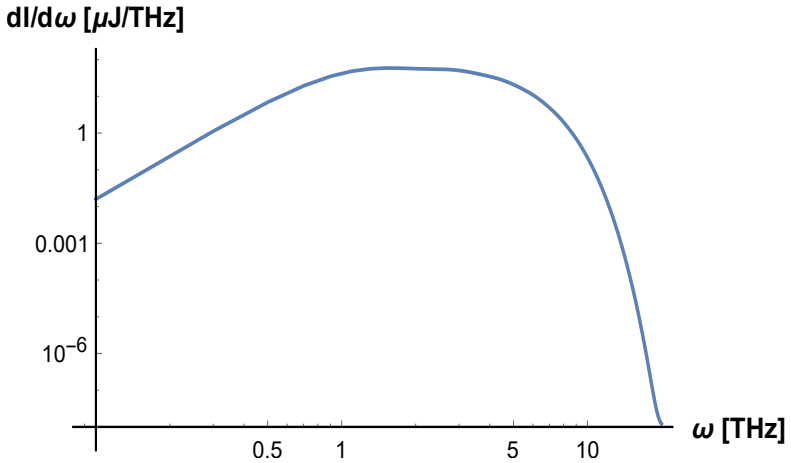
Starting from 2018

⋆ Bunch compression and charge increase

⋆ Design experiments with THz radiation

Example: compressed bunch

Bunch energy: 200 MeV
Bunch length: 150 μm - 0.5 *ps*
Bunch Charge: 1.5 nC



⋆Total irradiated THZ energy: *few hundreds* μJ

⋆Bandwidth: *few THz*

Conclusions

⋆Characterization of the THz source (energy, coherence band, polarization...)

⋆Temporal/Spectral shaping of the radiation for different applications.

⋆Upgrades: to increase the bunch charge and to shorten the bunch length.

⋆Design experiments with THz: for example electron acceleration.

Thanks for your attention

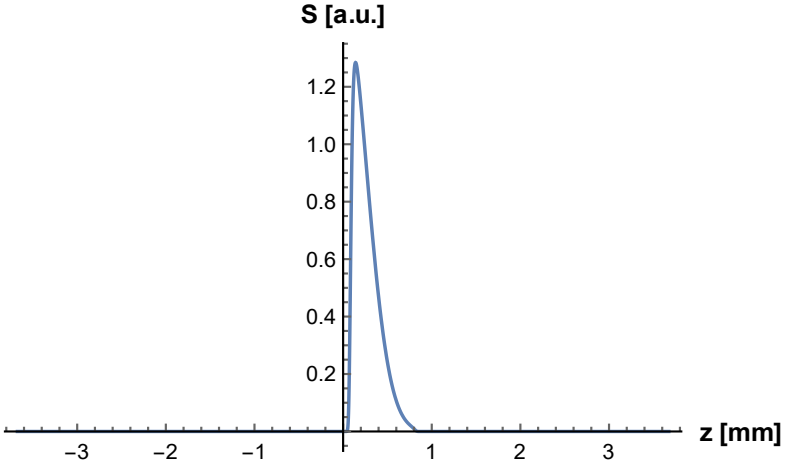
Broadband THz source: single temporal-shaped bunch

Bunch parameters

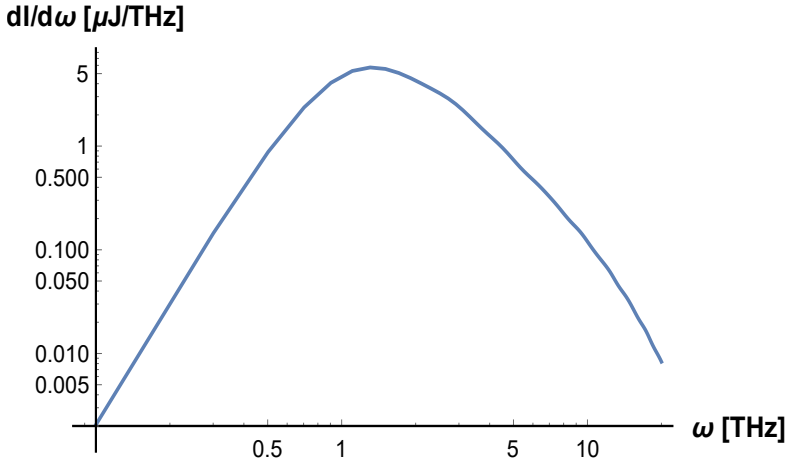
Bunch energy: 200 MeV

Bunch length: 300 μm - 1 *ps*

Bunch Charge: 1.5 nC



Calculated Radiation



⋆Total irradiated THZ energy: 15μJ

⋆Bandwidth: 3 *THz*

Narrowband THz source: multi electron bunch

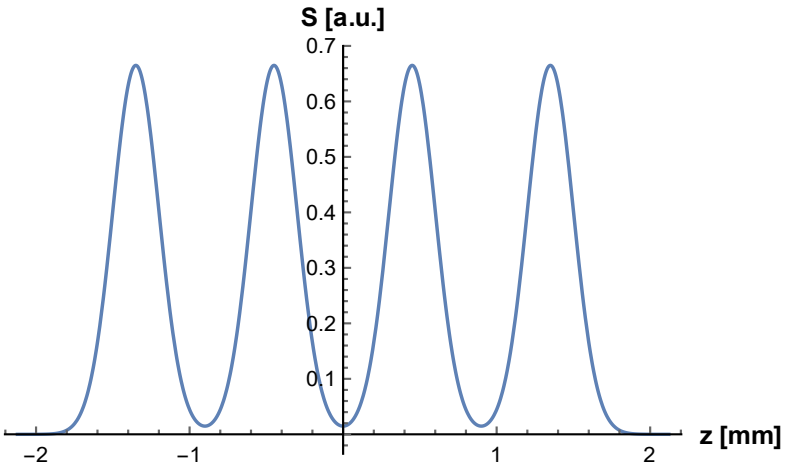
Bunch parameters

Bunch energy: 200 MeV

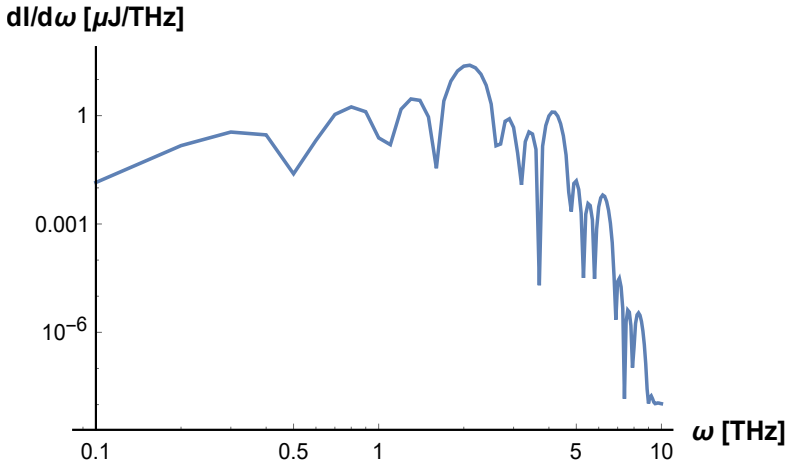
Bunch length: 300 μm - 1 *ps*

Bunch Charge: 1.5 nC

Bunch Spacing: 2 ps



Calculated Radiation



⋆Total irradiated THZ energy: 15μJ

⋆Bandwidth: 0.5 *THz*