

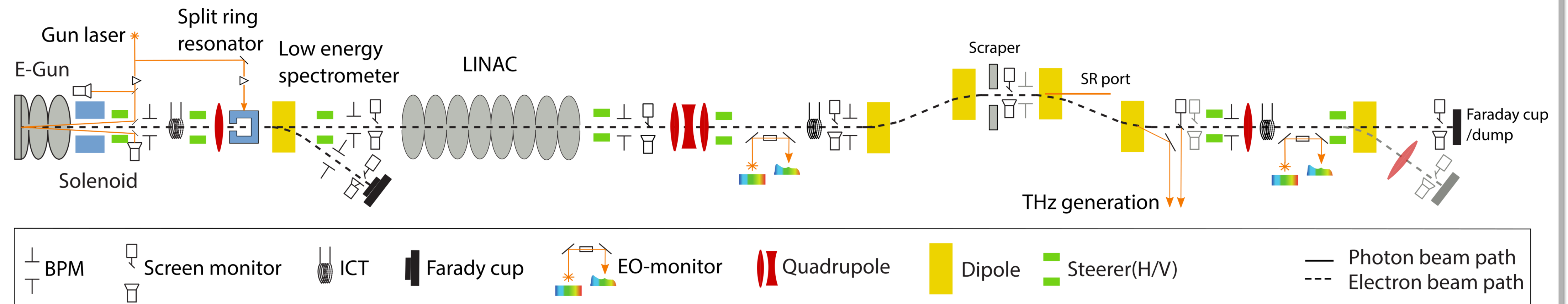
Status of FLUTE

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Ferninfrarot Linac- und Test-Experiment (FLUTE)

FLUTE design parameters

Final electron energy	41	MeV
Electron energy after RF gun	7	MeV
RF gun accelerating field	100	MV/m
Electron bunch charge	1 – 3000	pC
Electron bunch length	1 – 300	fs
Spectral bandwidth	0.1 – 100	THz
THz pulse power	Up to ~5	GW
Pulse repetition rate	10	Hz



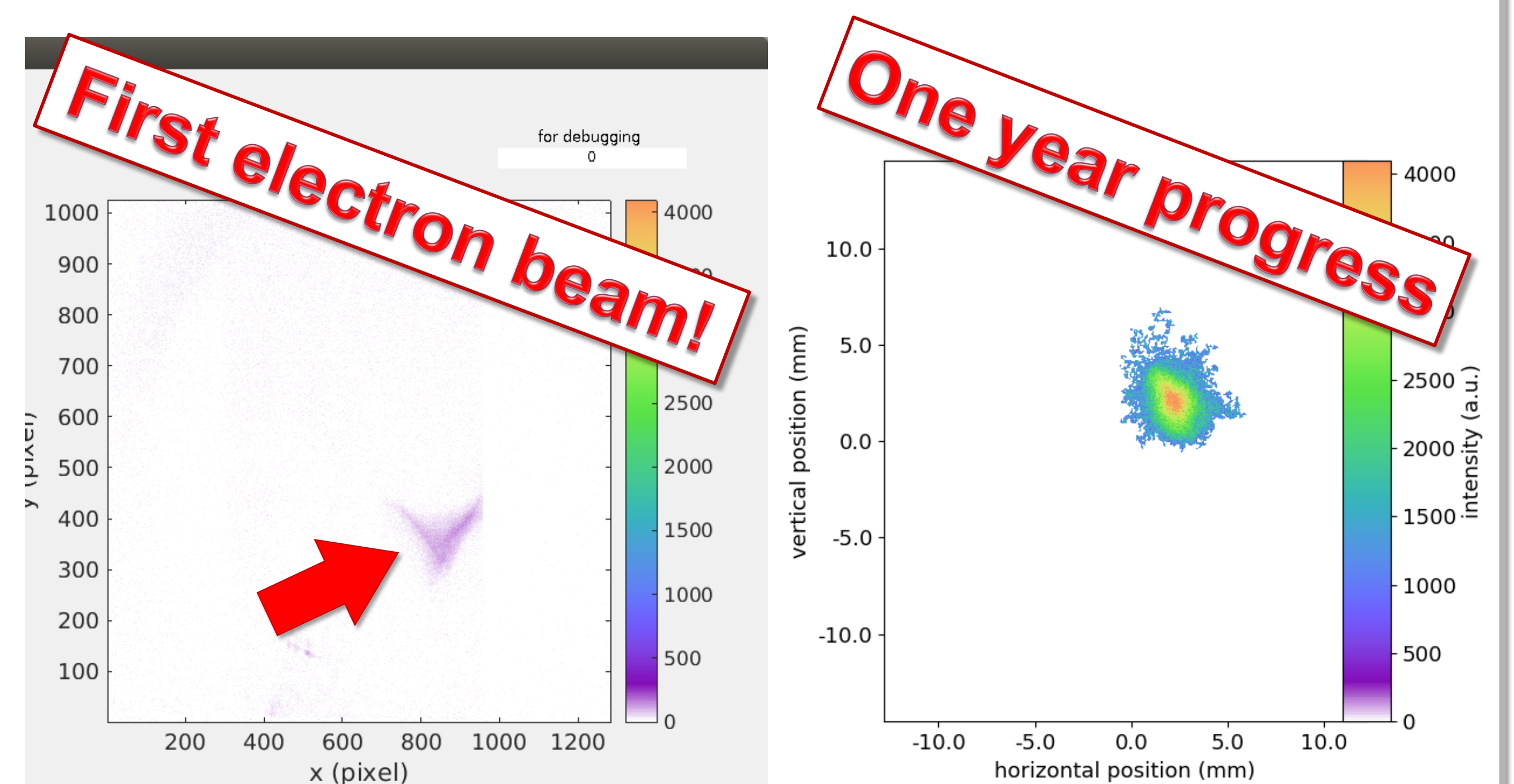
FLUTE is a dedicated test facility for accelerator physics and instrumentation and will also generate intense ultra-short electromagnetic pulses in the THz regime.

Commissioning Progress

First electron beam at FLUTE was recorded in May 2018.

Since then commissioning has continued reducing the dark current significantly. Several points have improved the quality and reproducibility of the beam:

- Faulty circulator replaced: insertion loss: -1.7 → -0.14 dB
- Laser-to-RF synchronization was successfully implemented:
⇒ laser phase-locked to RF pulse, reproducible electron bunch acceleration (laser-to-RF timing jitter now ~110 fs)
- Improved synchronization with 50 Hz line voltage and re-cabling of the klystron heater supplies and grounds
⇒ RF power noise considerably reduced: 2.2 → 0.3%
- Laser stabilization system implemented, enabling also remote controlled movement of laser spot on cathode



Left: YAG screen monitor showing one of the first electron bunches (2018-05-03).

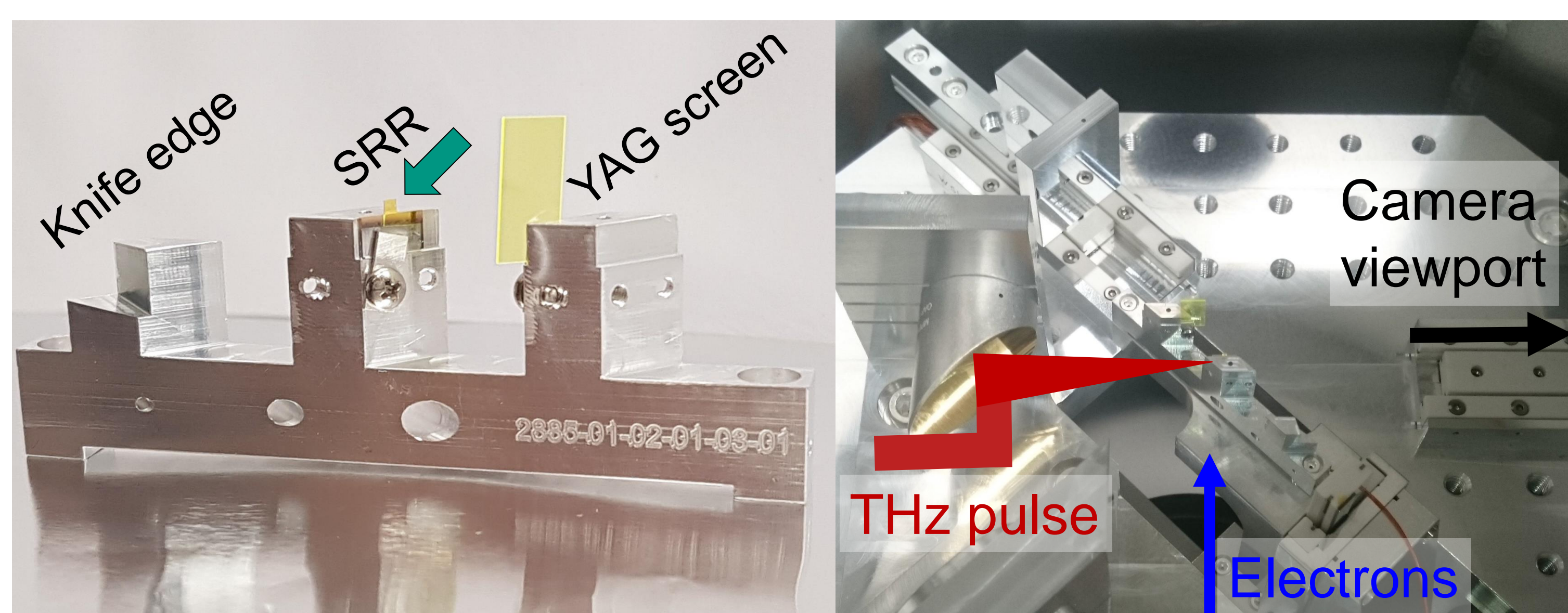
Right: Beam profile measurement using YAG screen monitor (2019-05-08).

The background with the dark current (laser off) was subtracted.

Progress on Split Ring Resonator (SRR) Experiment

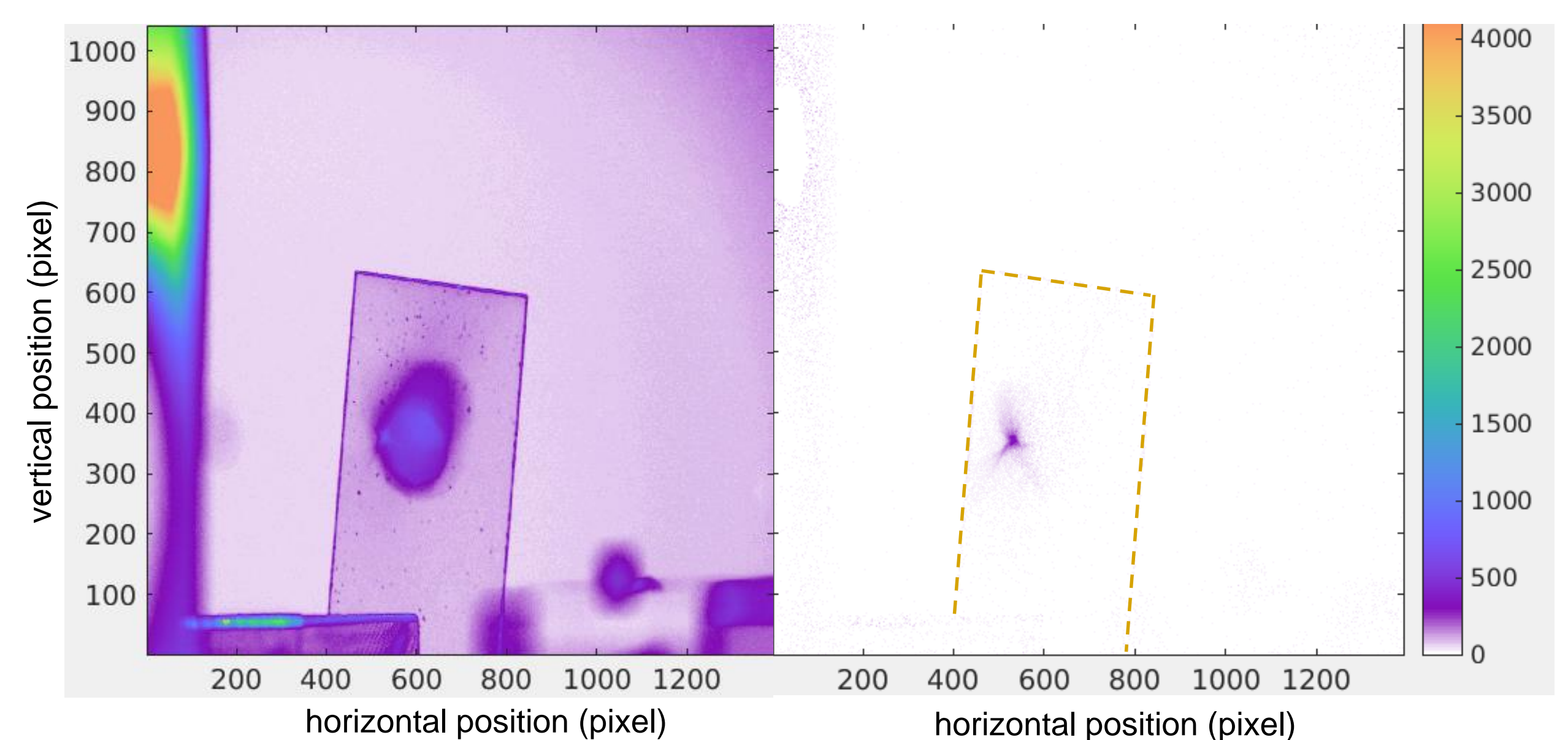
- Holder for SRR and YAG screen designed and manufactured, including knife edge.
- One screen and ring structure is mounted and inside experiment chamber.
- First tests with electron beam, focusing on YAG screen and guiding through hole in mirror for imaging onto YAG screen.
- Next steps: Moving THz setup onto optical table, measuring and optimizing beam parameters at resonator position.

Partner:  



Holder with mounted SRR structure and YAG screen.

View inside the vacuum chamber, with mounted holder, electrons coming from the bottom, THz laser pulses from the left, screen viewport is on the right.



Camera view, YAG screen with background lighting.

Focused electron beam on YAG screen, background subtracted.

Summary & Outlook

- Low energy section of FLUTE completed, commissioning/conditioning ongoing.
- Conditioning progress: RF power: 13 MW, pulse length: 4.5 μ s, repetition rate: 1 Hz. Electron energy: 5.8 MeV, charge: up to 70 pC.
- The split ring resonator (SRR) is mounted in vacuum chamber, THz setup for generating laser pulses is currently being set up.
- Next steps: Commissioning of the linac and the linac RF distribution system. Finishing design, assembly and commissioning of the bunch compressor.

Acknowledgement

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