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First LGAD SEB test with TPA

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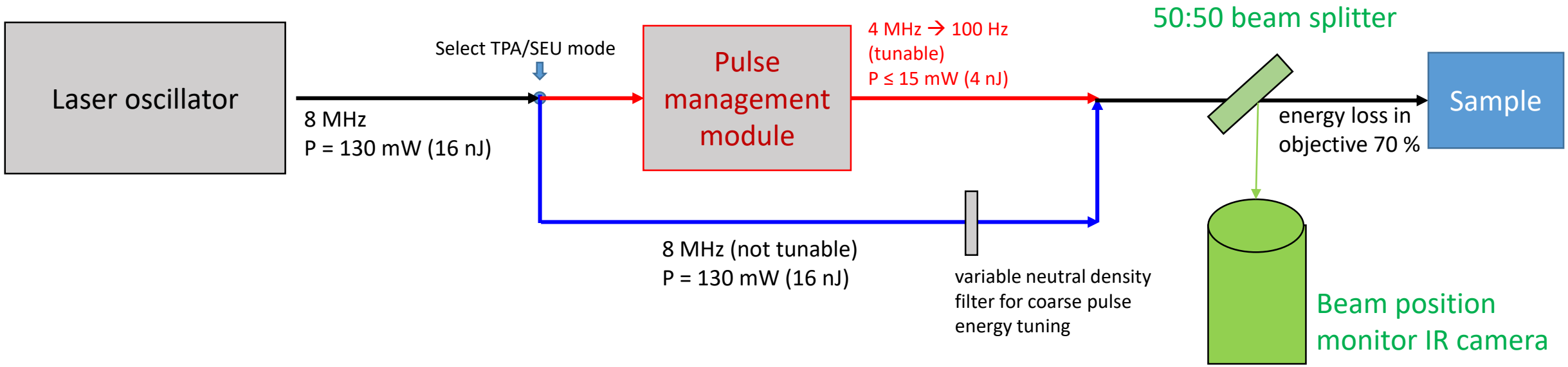
Background TPA-TCT setup

- 1550 nm infrared laser
- Pulse duration ≈ 500 ps
- Repetition rate 8 MHz down to Hz
- Max power at 8 MHz ≈ 150 mW before objective
- Beam waist size 1–2 µm (Rayleigh length 25 µm)

- **Imaging**
  - Online monitoring of beam position on display
  - Fluorescent IR CCD camera
  - Bright field microscopy with coaxial illumination
  - 5 W tungsten light bulb (W5W car lamp)

- ARRS project submitted this year

TPA-TCT vs. TPA-SEU setup



Selectable between TCT and SEU mode:

- TCT has tunable pulse energy and repetition rate, but larger power losses
- SEU has maximized power

LGAD Single event burnout (SEB)

- Tested HPK LGAD 3e15 n, 50 um (30330 W14, Type 3.2 Single Set P4 Se5 (5x))
- In test beam SEB started at 625 V, happens very fast at 675 V

- In our test:
  1. SEU-TPA at - 30°C
  2. Bias to 675 V: I_{leak} = 50 uA (laser ionization)
  3. E_{pulse} = 2.5 nJ (with beam splitter) – no effect
  4. E_{pulse} = 5 nJ (remove beam splitter) – sample now breaks down at 330 V, does not recover

Imaging setup