Institut
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TPA-TCT beam position monitoring

F9 weekly meeting, 15. 04. 2022

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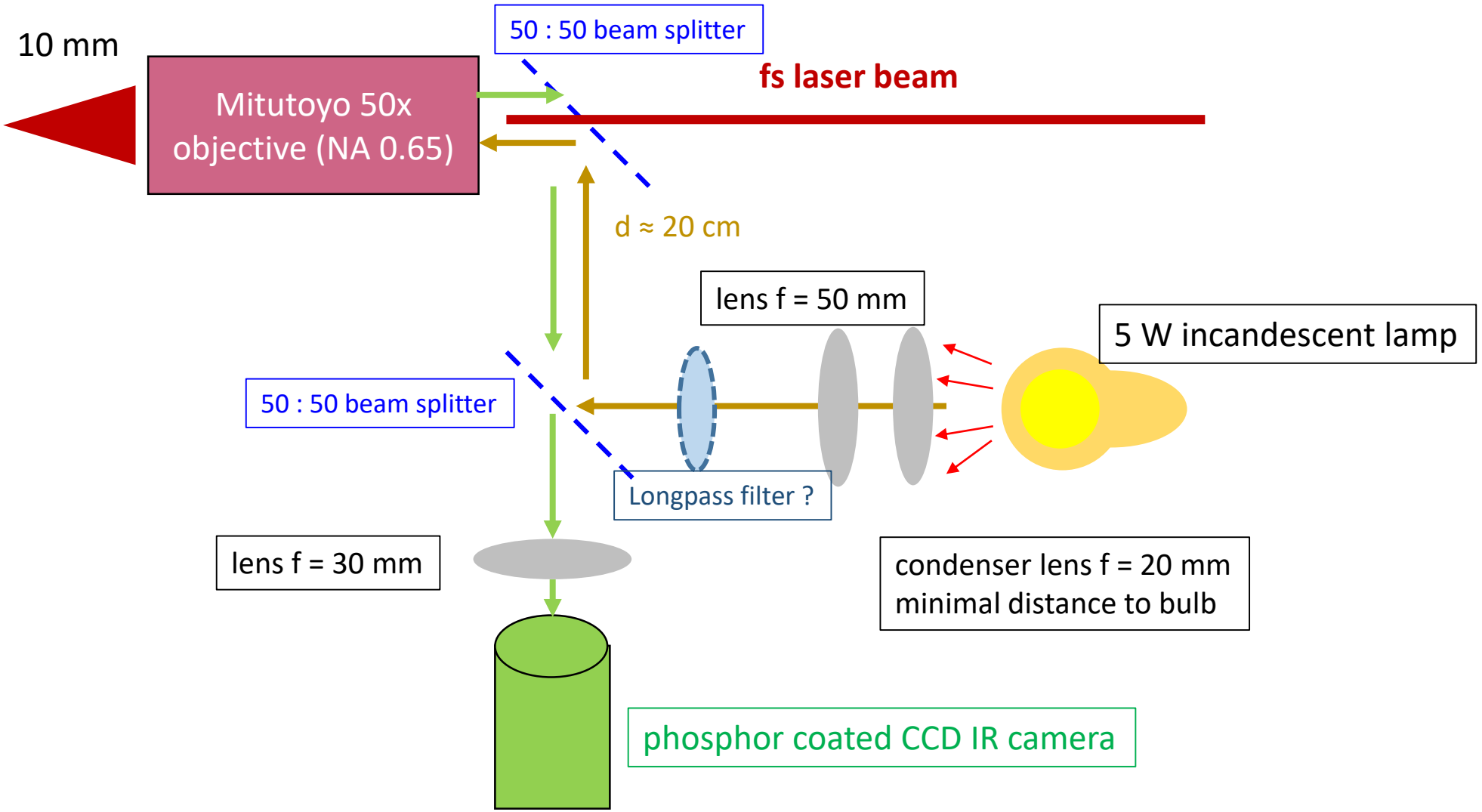
Background TPA-TCT setup

- 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)

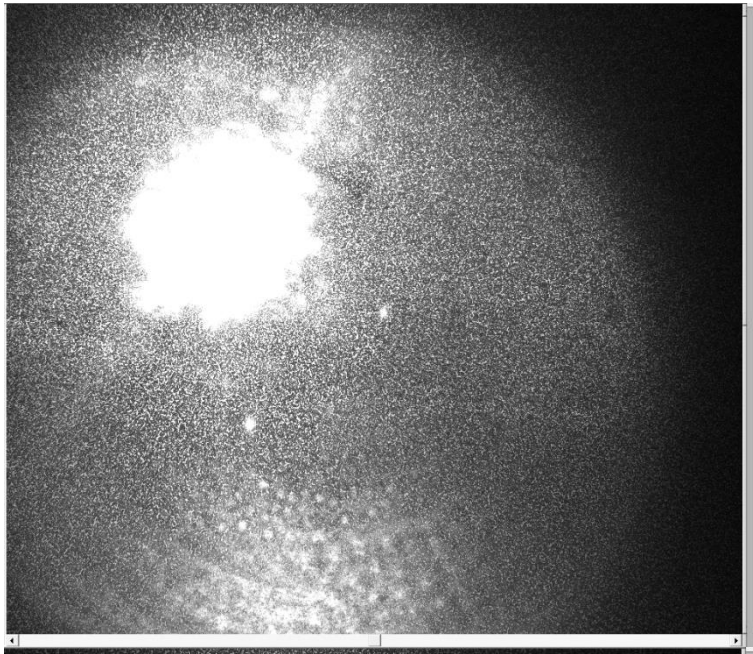
- **Imaging**
  - Online monitoring of beam position on display
  - Fluorescent IR CCD camera
  - Bright field microscopy with coaxial illumination
  - 5 W tungsten light bulb (W5W car lamp)

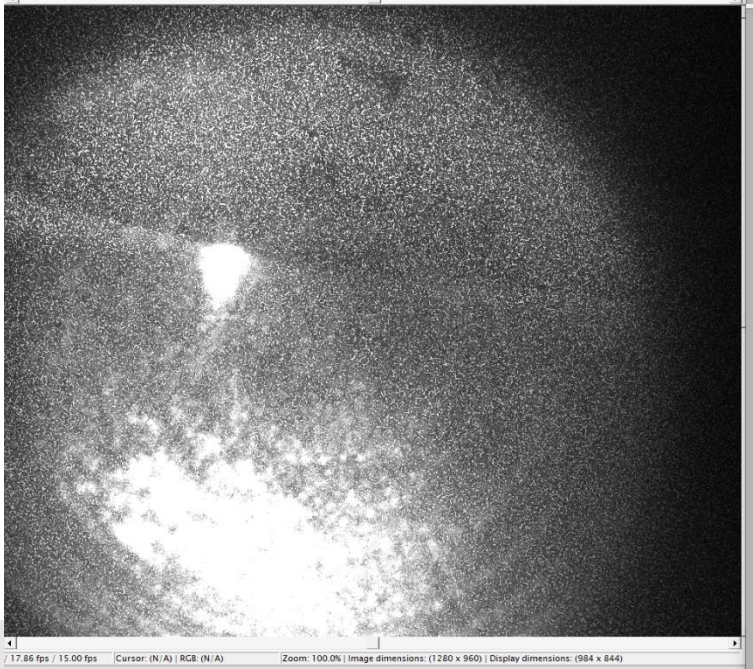
- ARRS project submitted this year

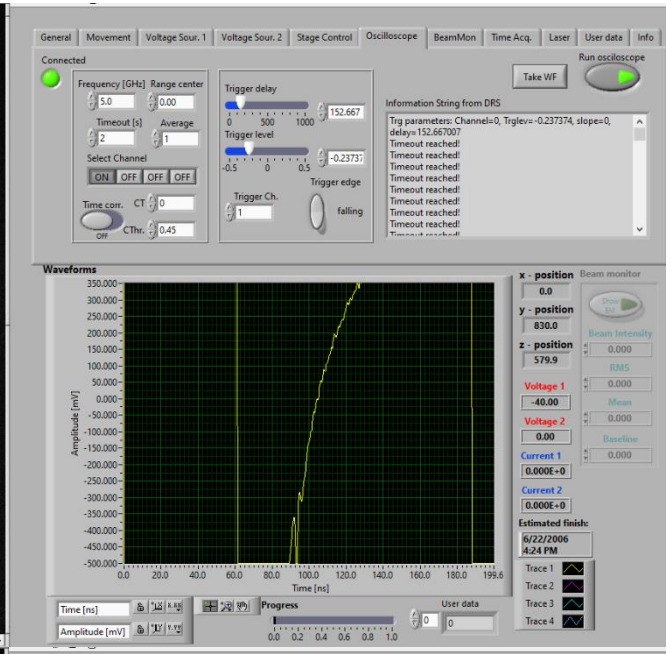
Imaging setup

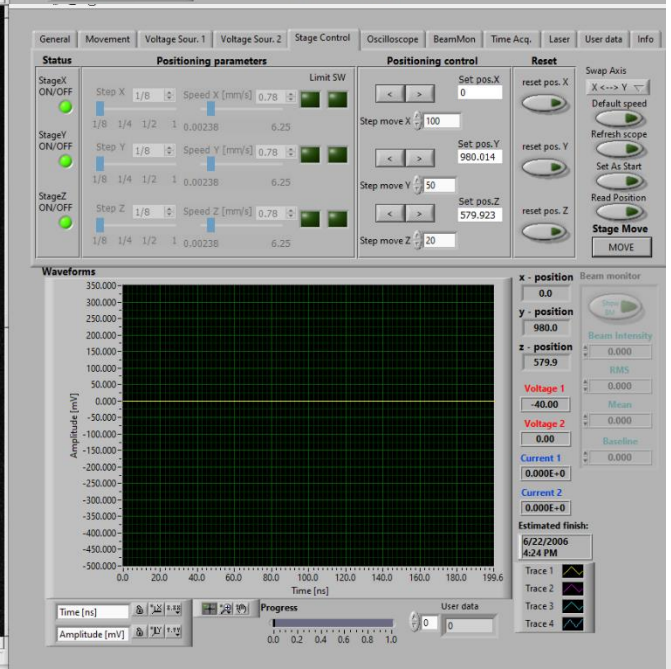


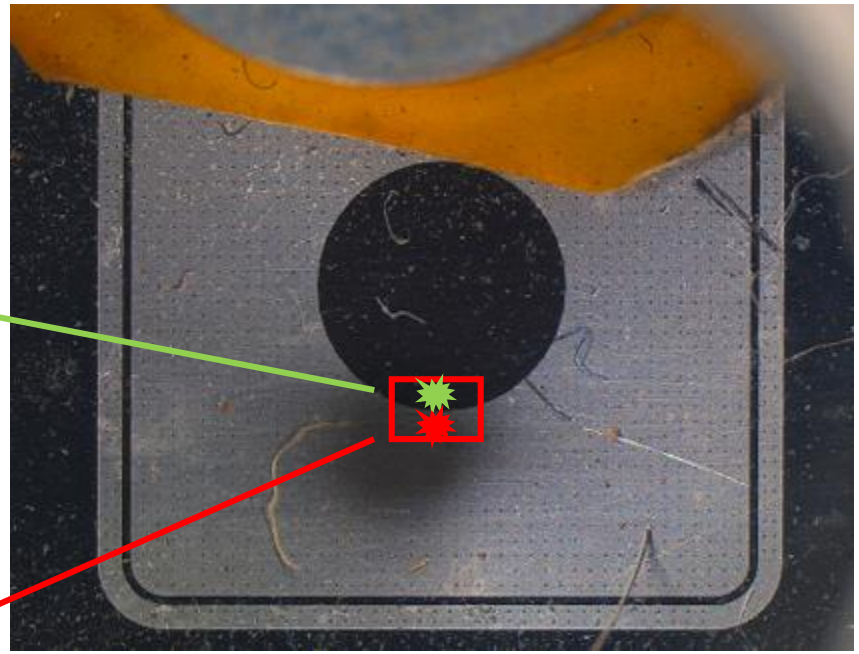
Hello world





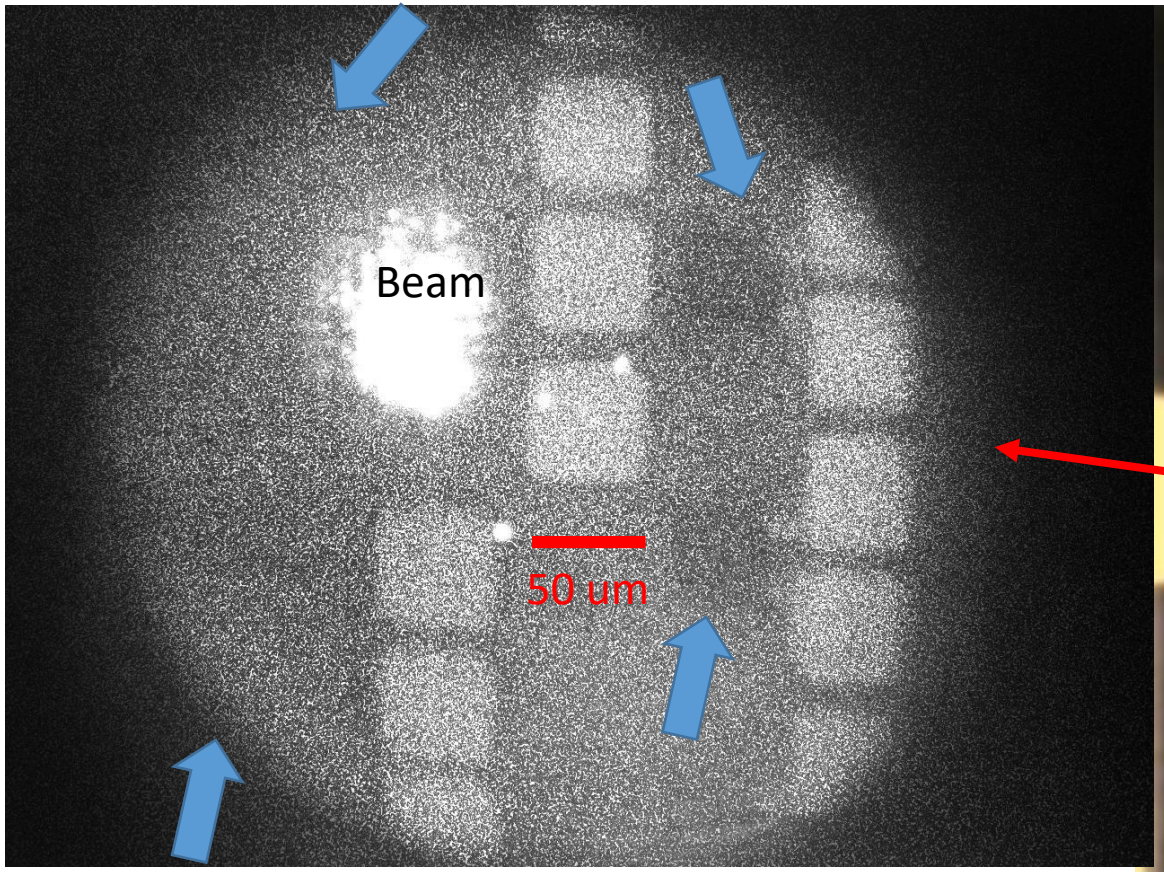

General
Movement
Voltage Sour. 1
Voltage Sour. 2
Stage Control
Oscilloscope
BeamMon
Time Acq.
Laser
User data
Info
Connected
Run oscilloscope
Take WF
Frequency [GHz]
Range center
Timeout [s]
Average
Select Channel
Trigger delay
Trigger level
Trigger edge
Trigger Ch.
falling
Time corr.
CT
CThr.
Information String from DRS
Waveforms
x - position
y - position
z - position
Voltage 1
Voltage 2
Current 1
Current 2
Estimated finish:
Beam monitor
Beam Intensity
RMS
Mean
Baseline
Amplitude [mV]
Time [ns]
Progress
User data
Trace 1
Trace 2
Trace 3
Trace 4

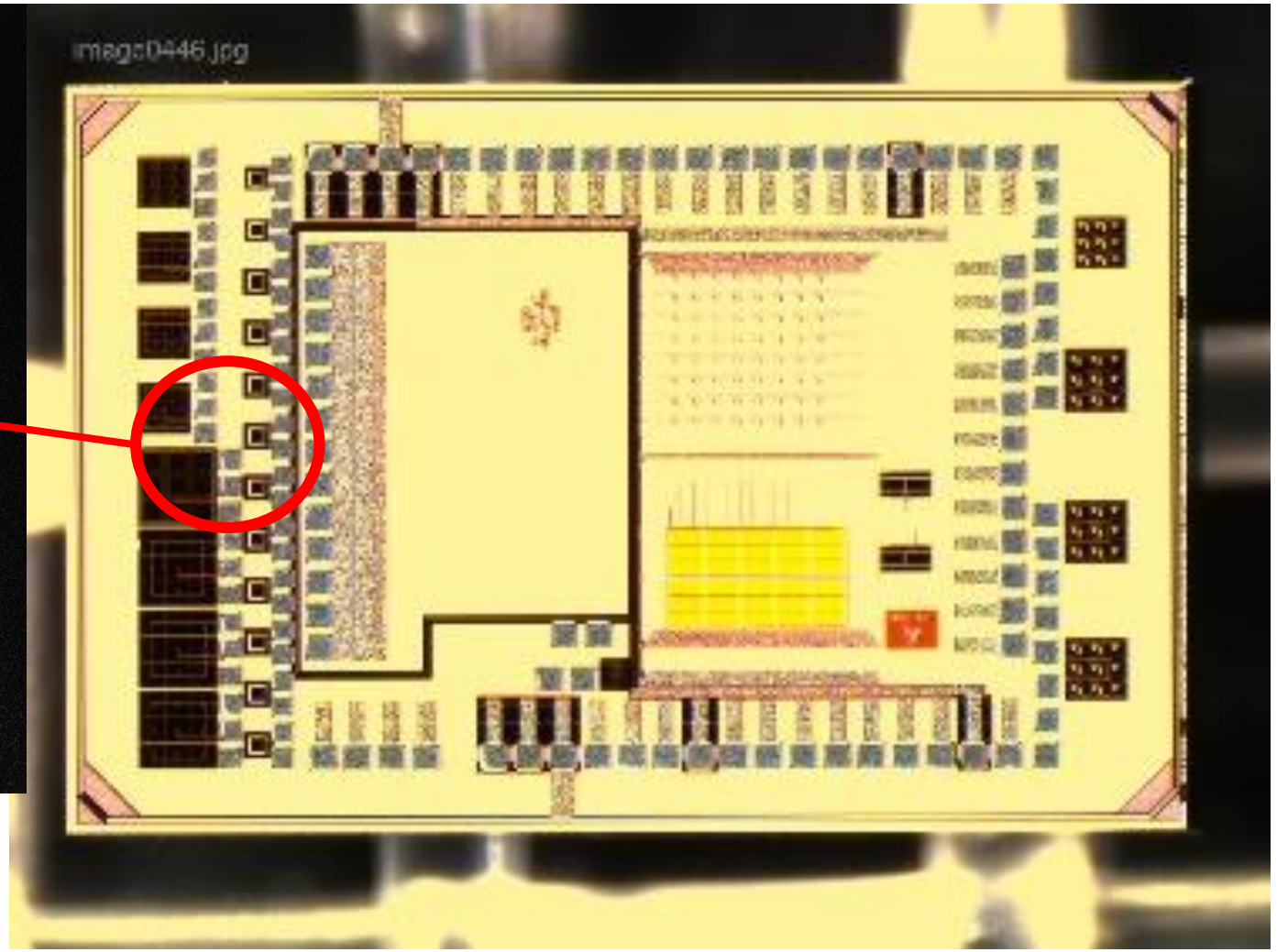

General
Movement
Voltage Sour. 1
Voltage Sour. 2
Stage Control
Oscilloscope
BeamMon
Time Acq.
Laser
User data
Info
Status
Positioning parameters
Positioning control
Reset
StageX ON/OFF
StageY ON/OFF
StageZ ON/OFF
Limit SW
Swap Axis
Default speed
Refresh scope
Set As Start
Read Position
Stage Move
MOVE
Waveforms
x - position
y - position
z - position
Voltage 1
Voltage 2
Current 1
Current 2
Estimated finish:
Beam monitor
Amplitude [mV]
Time [ns]
Progress
User data
Trace 1
Trace 2
Trace 3
Trace 4



Chip detail

Non-metallized silicon





Imaging from the front

Beam power is maximal (E_{pulse} 10 – 100x more than during CCE scans)

Outlook

- Illumination ≥ 20 % max power causes electrical breakdown in test sample
  - Long pass filter (cut-on 1300 nm ?) to remove non-used part of the spectrum ?
- Surface not visible from the back side
  - Silicon should be transparent to 1500 nm
  - Not sure how to fix
- Known large pulse-to-pulse deposited energy variations (20 %)
  - Considering using frequency doubler crystal + Si photodiode (a la Cantabria, I. Vila 39th RD50 workshop) for monitoring & compensation
- Retry single event burnout tests with irradiated LGAD