Laser System for Charged Particle Optical Detection (CPOD)

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Coulomb field of the electron bunch:

\[ E = \gamma N_e \frac{q}{4\pi \epsilon_0 r^2} \]

acts on the nonlinear crystal inducing birefringence that can be detected with the help of a short laser pulse.
Laser setup for CPOD

- **Yb - oscillator**
- **Pockels cell**
- **50 m single mode fiber**
- **Yb-doped fiber amplifier**
- **Diode pump laser**
  - 976 nm
  - 0..50 W

- **Compressor**
  - ~1-5 μJ
  - 250 fs

- **81.6 MHz**
- **250 fs**
- **1 nJ**

- **1.2 kHz**
- **250 fs**
- **1 nJ**

- **3 – 6 ps**
- **0.1 nJ**
Temporal shape of laser pulse
FROG measurements

- Duration of the oscillator pulse is about 250 fs
- GVD in the fiber causes pulse broadening.
- The original pulse duration can be restored with help of the grating compressor.
Laser pulse energy

- S/N ratio scales linearly with laser pulse energy
- The optical damage threshold is around $10 \, \mu J \ (3ps)$ for $20 \, \mu m$–core fiber
- This pulse energy is expected at pump power of $5.5 \, W$
Summary

• We designed and build a laser system for Charge Particle Optical Detection Experiment

• The laser system is capable to produce 250fs pulse

• The maximum output energy is limited by 1-5 μJ