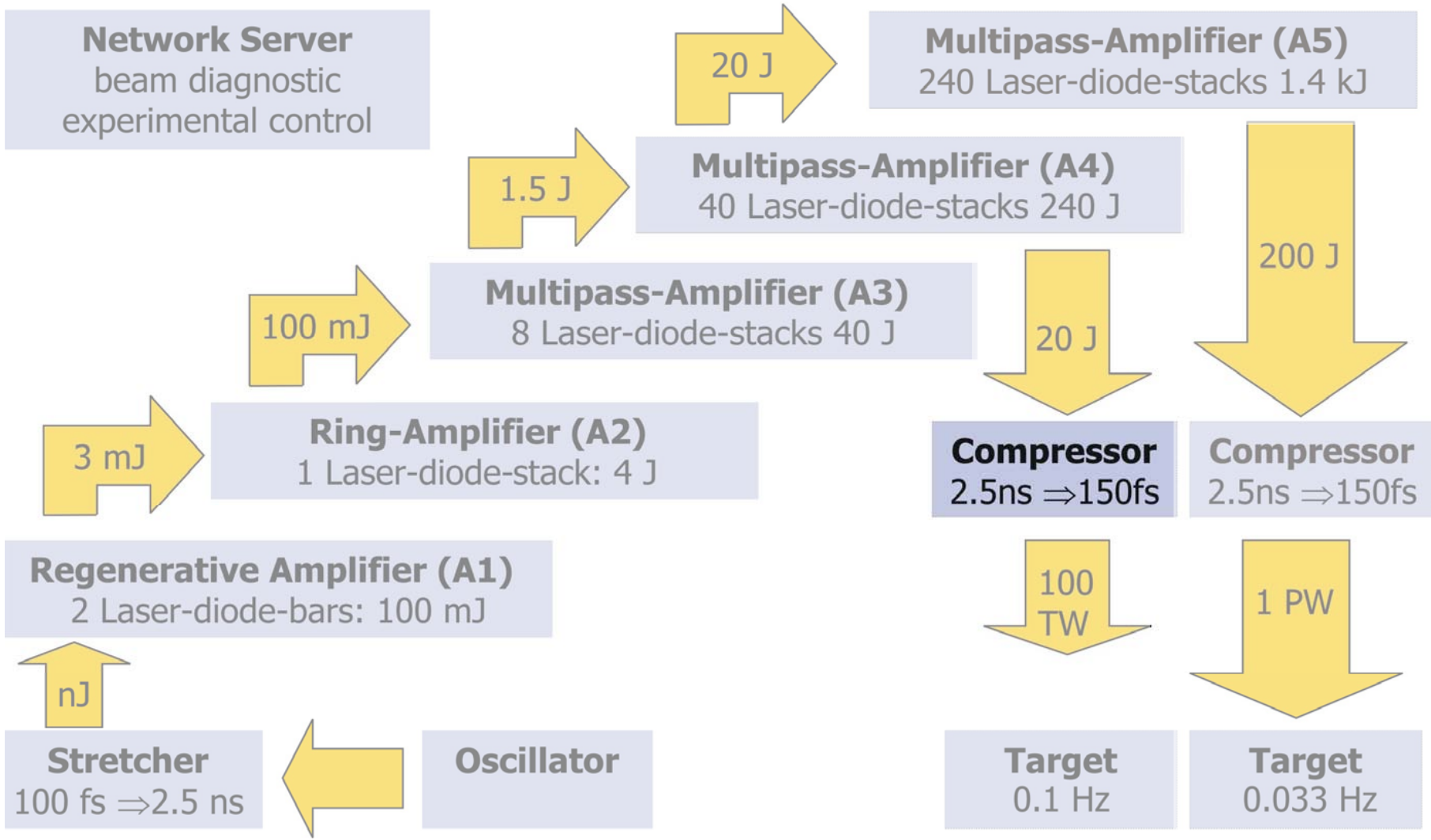
Pulse Compression From 2.2 ns To 150 fs

J. Hein, R. Bödefeld, M. Hornung, M. Brückner, M. Siebold, M. Hellwing, S. Podleska, M. Schnepp, M. Kaluza, R. Sauerbrey*

Institute for Optics and Quantum Electronics, Friedrich-Schiller-University Jena

***Forschungszentrum Rossendorf**

POLARIS A5


Network Server
beam diagnostic
experimental control
20 J
Multipass-Amplifier (A5)
240 Laser-diode-stacks 1.4 kJ
1.5 J
Multipass-Amplifier (A4)
40 Laser-diode-stacks 240 J
200 J
100 mJ
Multipass-Amplifier (A3)
8 Laser-diode-stacks 40 J
20 J
3 mJ
Ring-Amplifier (A2)
1 Laser-diode-stack: 4 J
Compressor
2.5ns ⇒150fs
Compressor
2.5ns ⇒150fs
Regenerative Amplifier (A1)
2 Laser-diode-bars: 100 mJ
100
TW
1 PW
nJ
Stretcher
100 fs ⇒2.5 ns
Oscillator
Target
0.1 Hz
Target
0.033 Hz

Front End

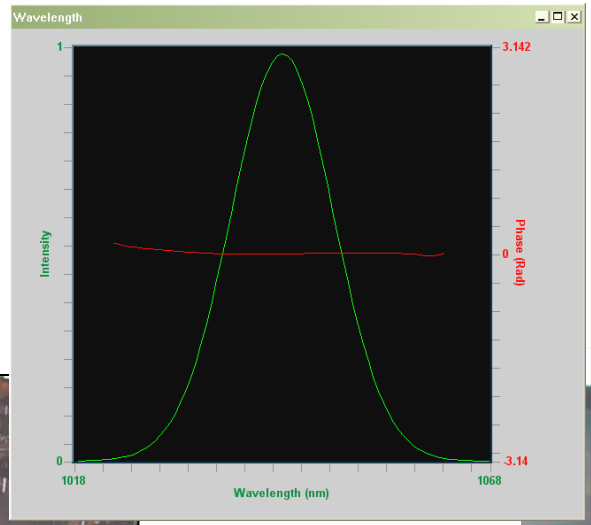
Mira 900 & 10 W Verdi:

grating stretcher: (LLNL grating)

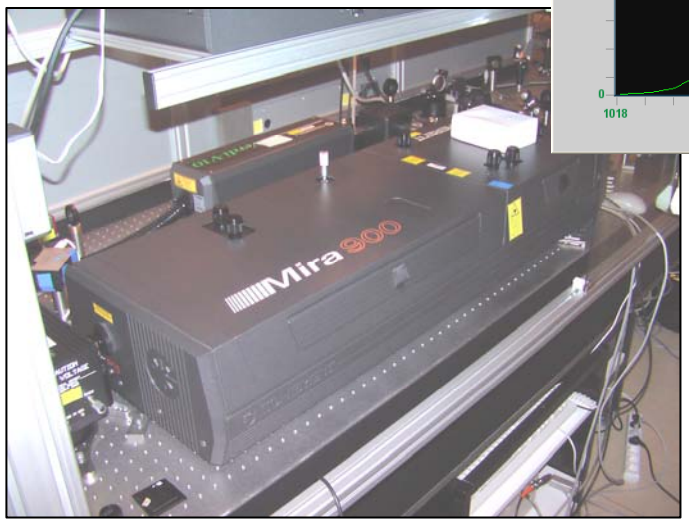
τ = 105 fs

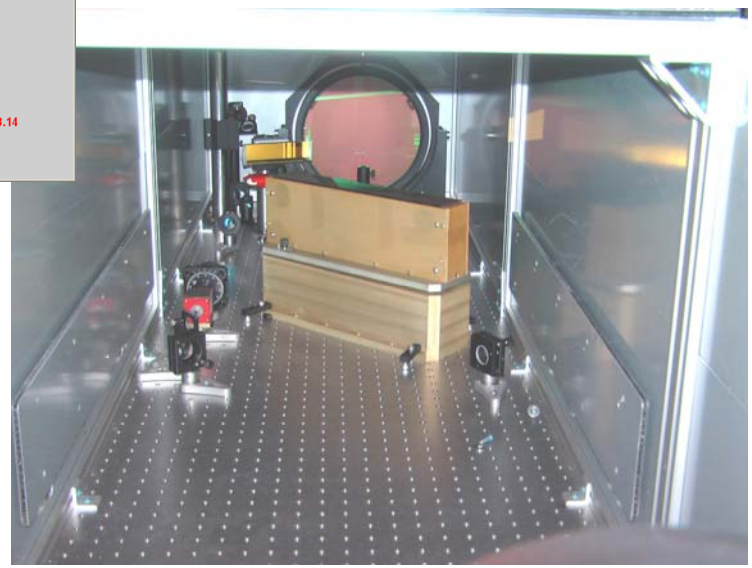
$\Delta\lambda$ = 14,5 nm

λ_{Center} = 1030 nm



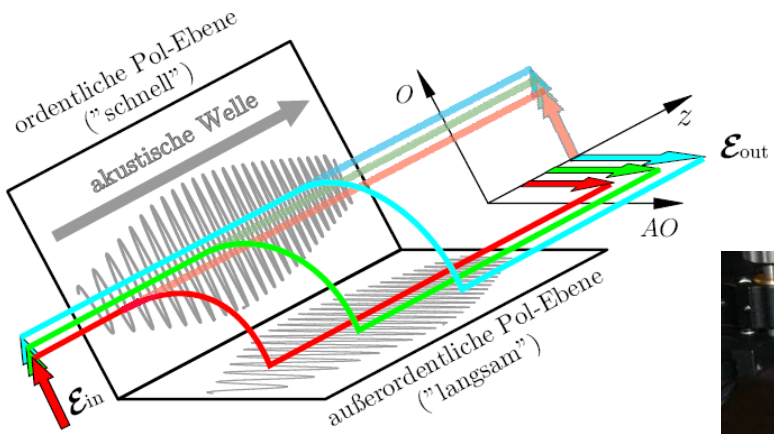
- 140 ps/nm
- $A_{Strectch}$ = 22000
- 2,2 ns FWHM

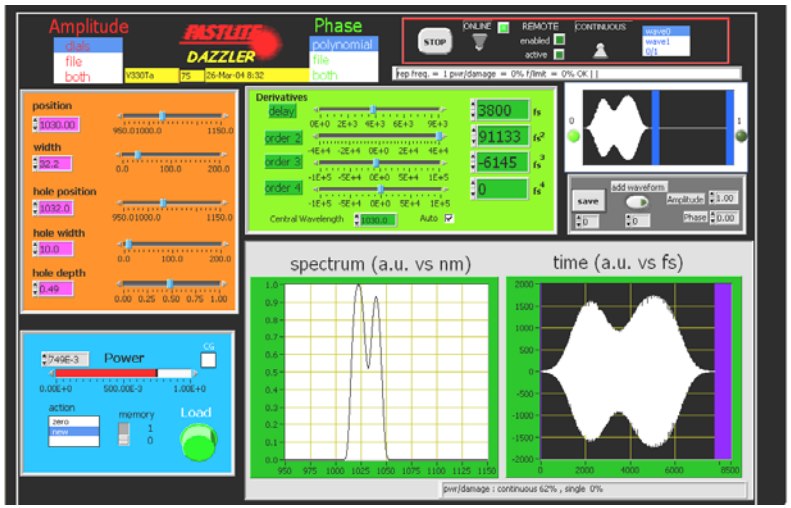


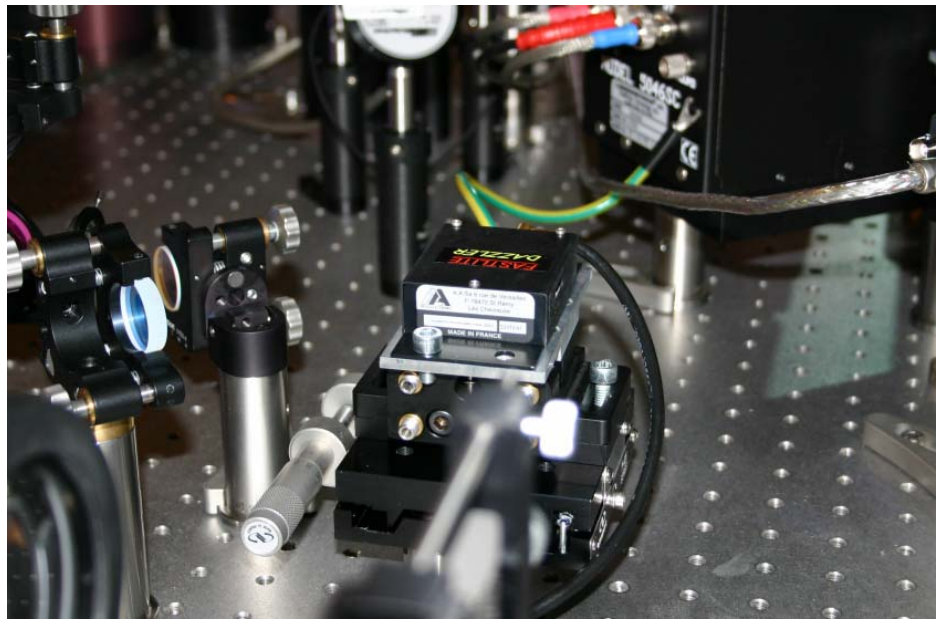


Dazzler

AOPDF = acusto-optic programable dispersive Filter

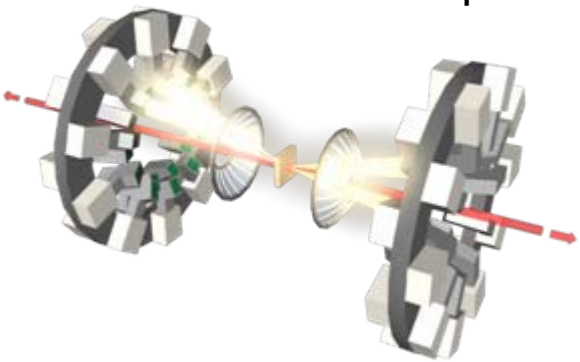






Compressor

These pulses should be compressed

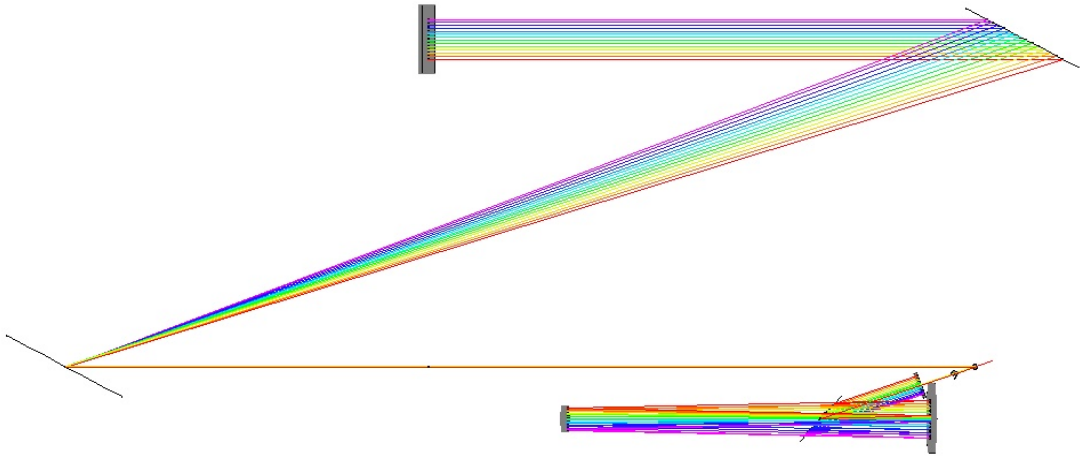


E_{Pulse} = 10 J

τ_{Pulse} = 2.2 ns

d_{Beam} = 18 mm

All measurements were done at 10 mJ only and in air



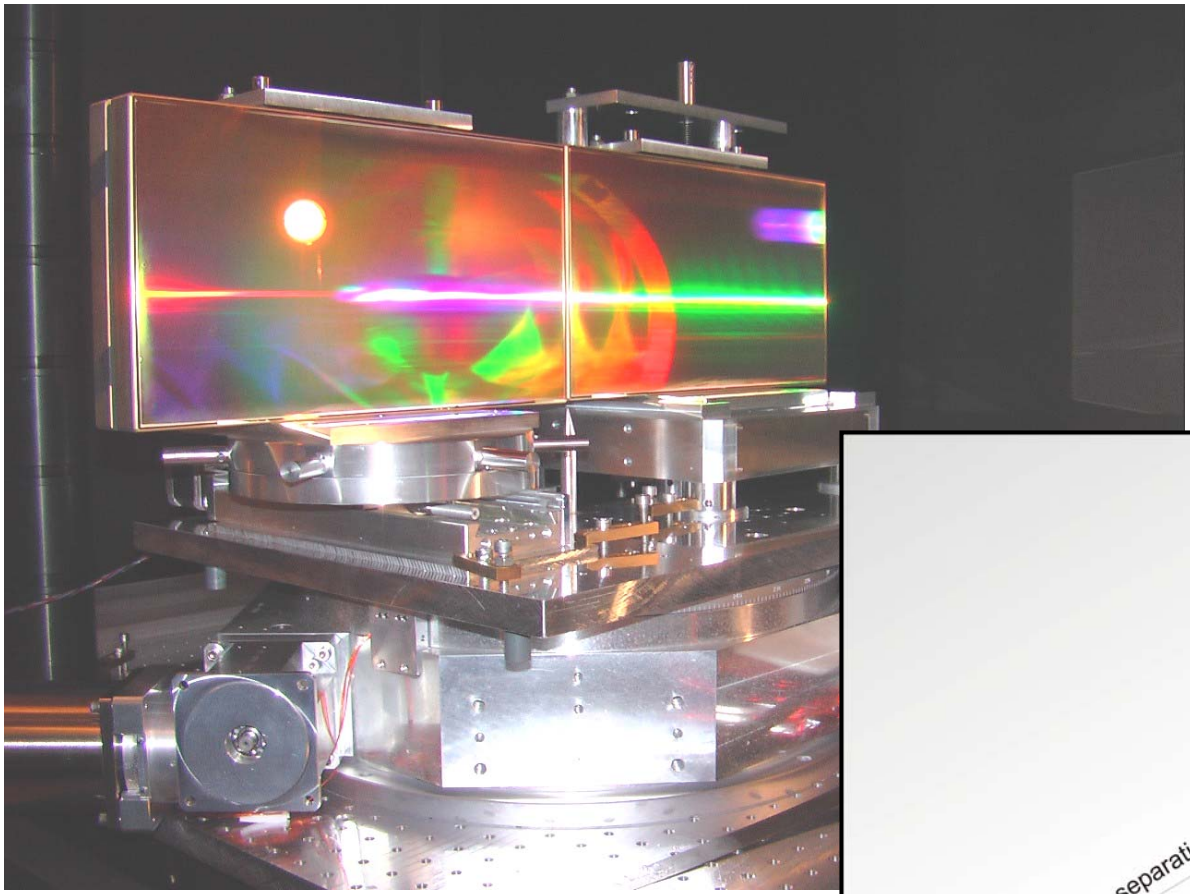
Lines: 1480/mm

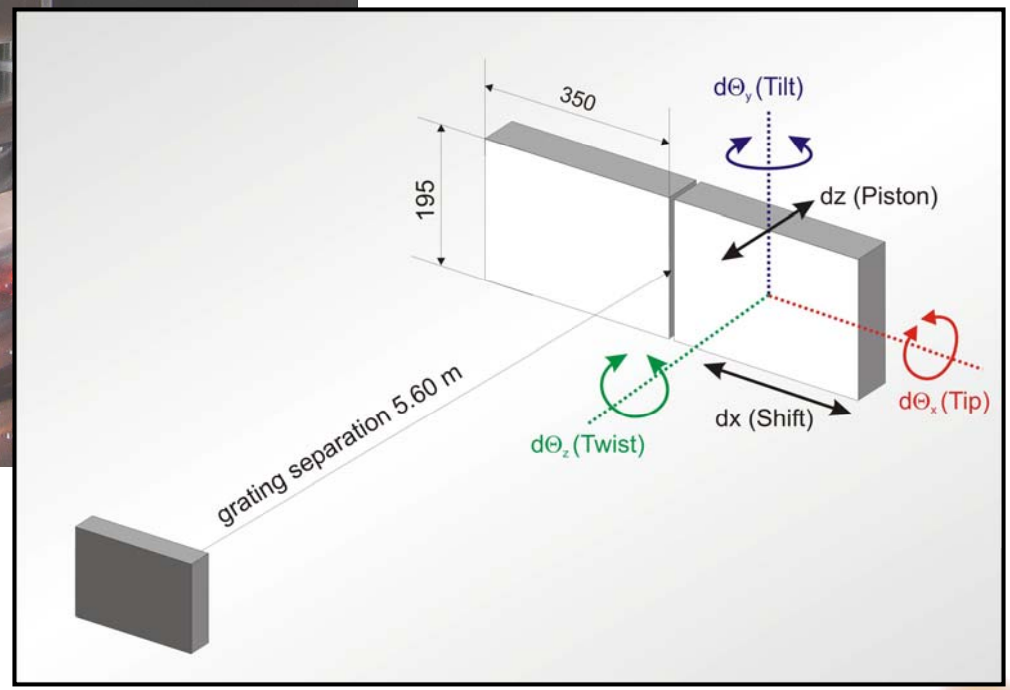
α_{inc} = 60,68°

α_{out} = 40,73°

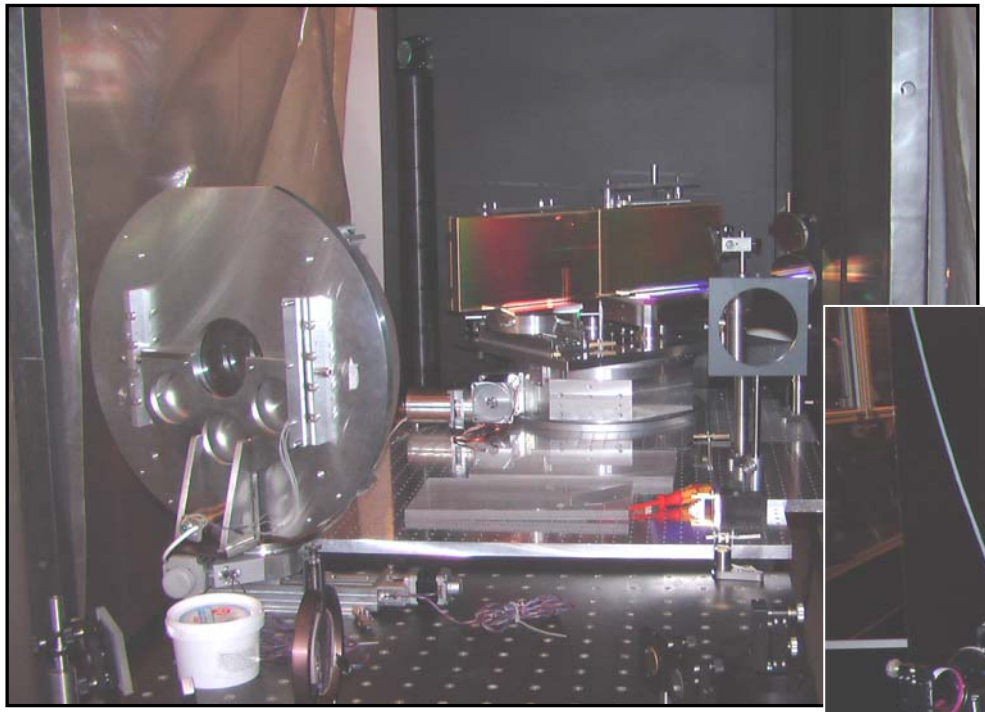
l_{sep} = 5,607 m

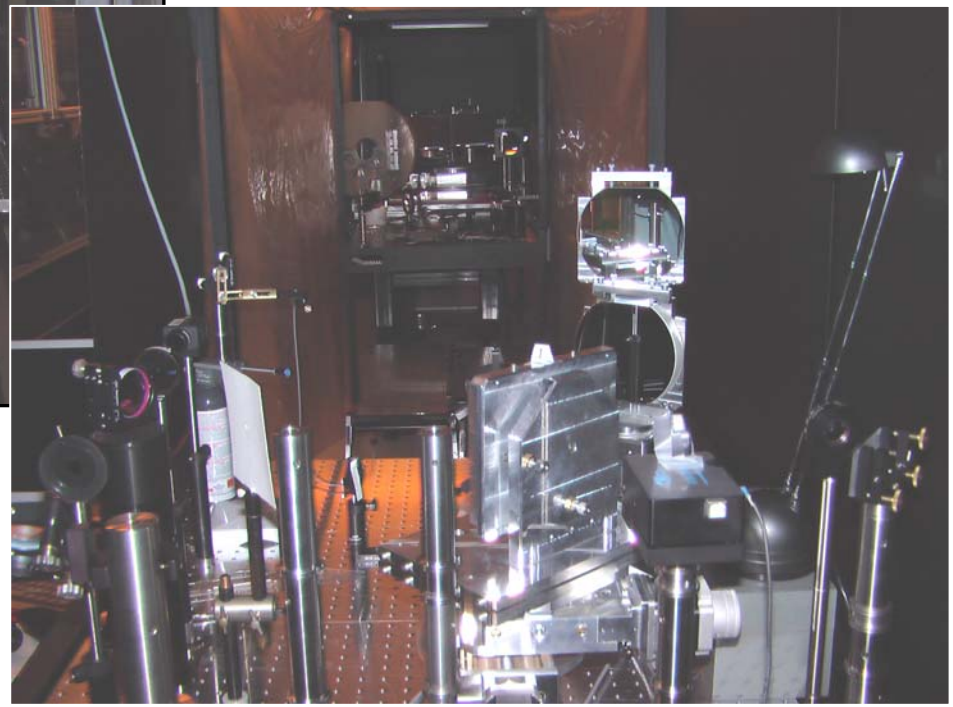
Two Gratings – Five Degrees of Freedom





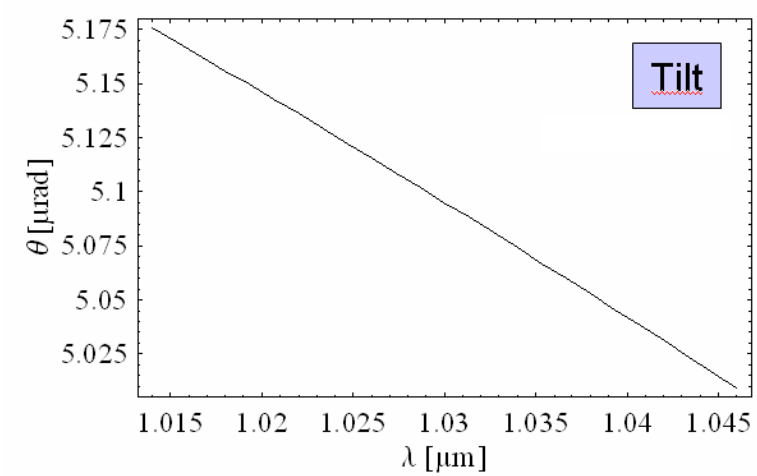
Mechanical Setup

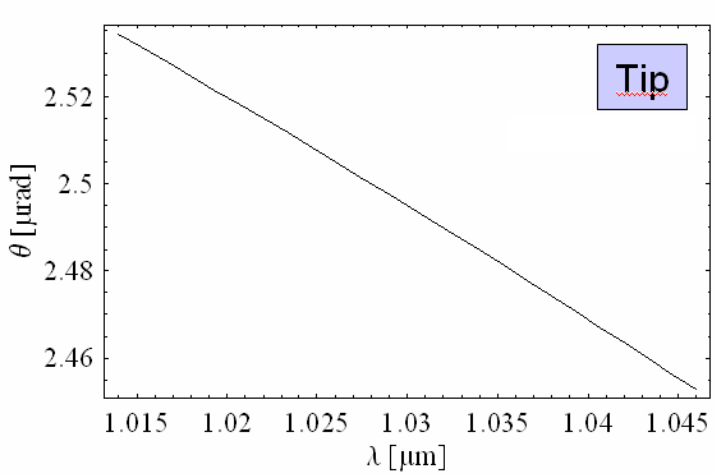


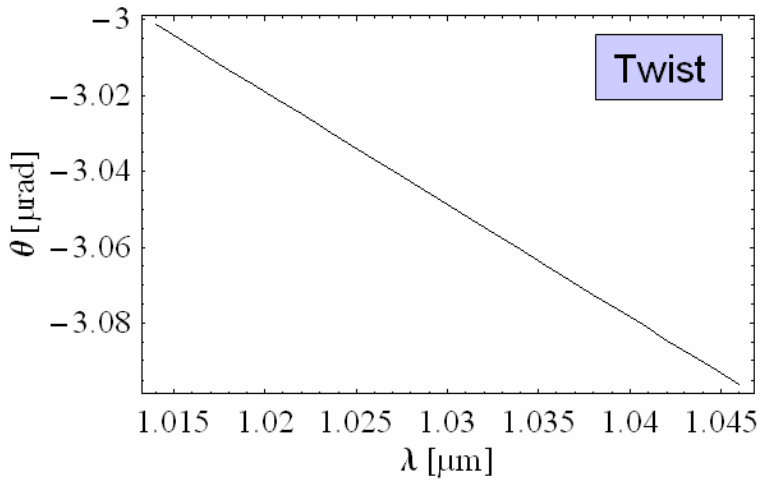


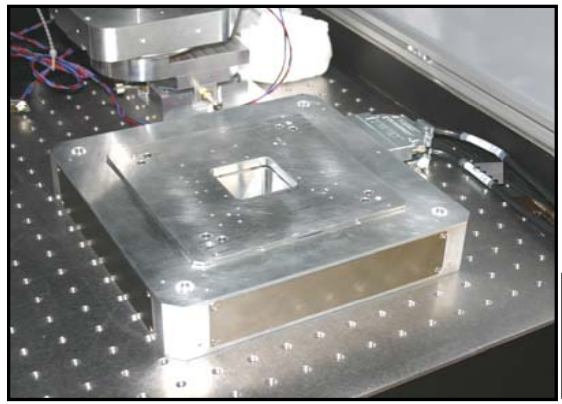
Requirements for Adjustment

Phase shift induced by 1 µrad rotational misalignment





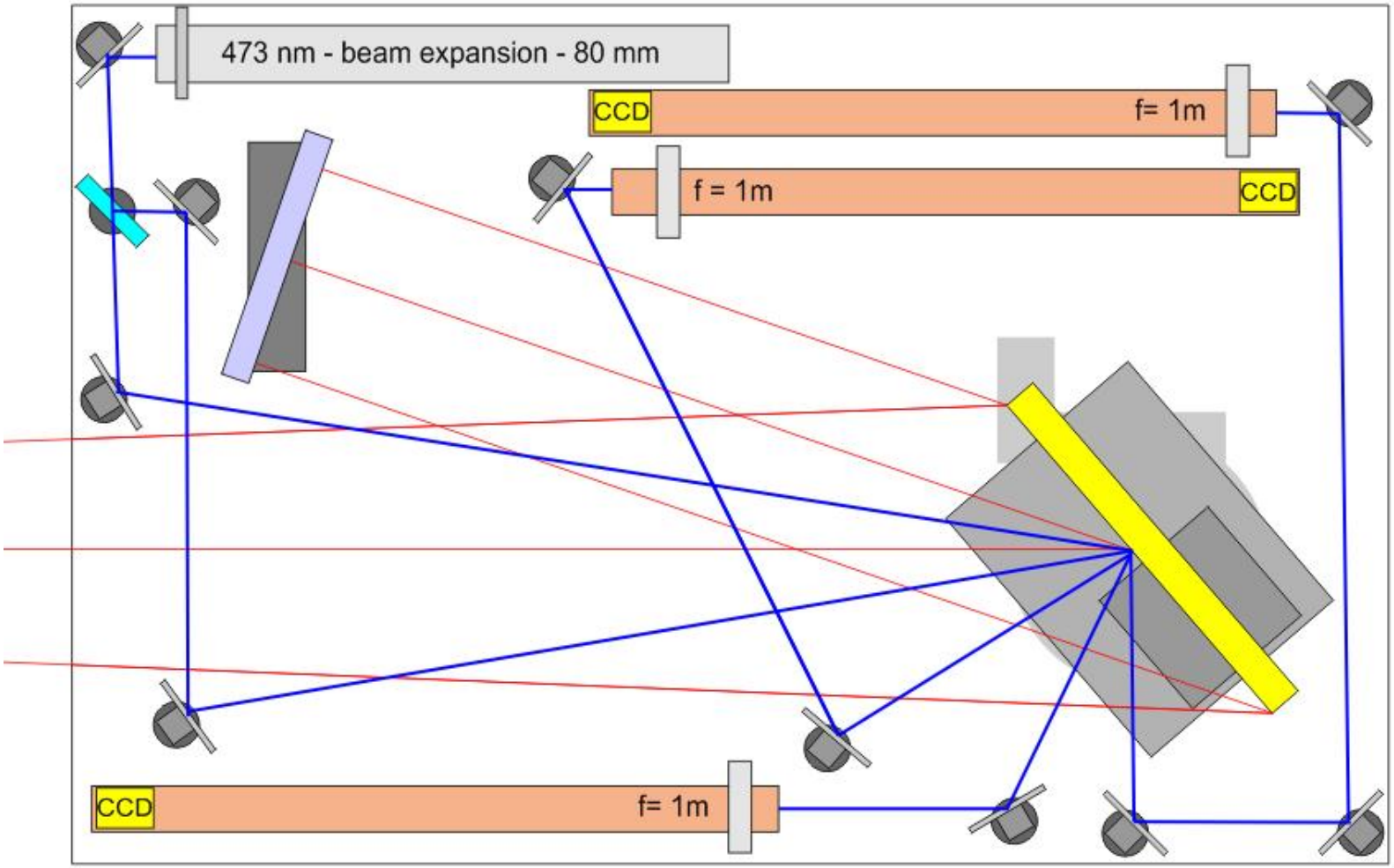




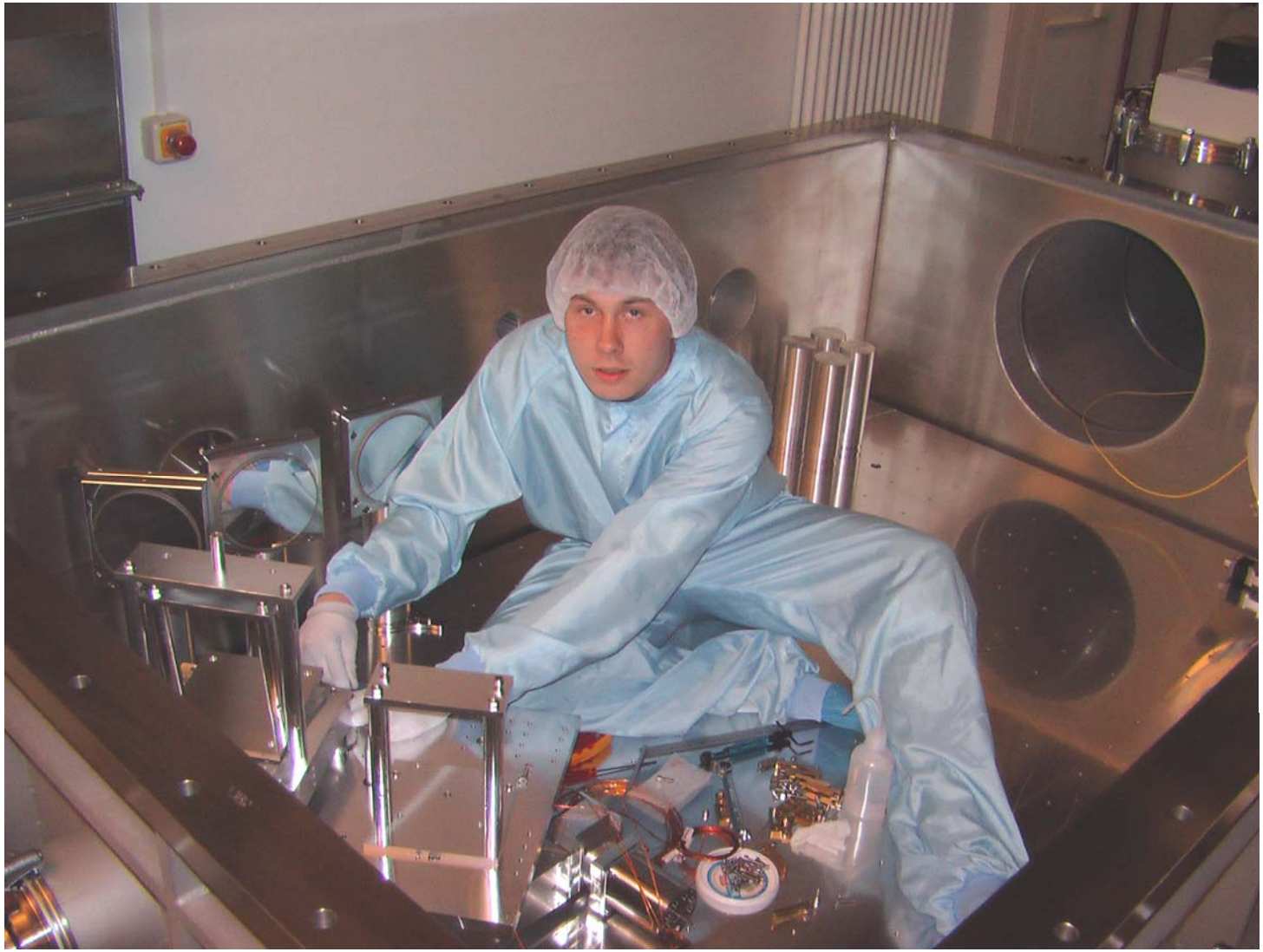
Δx = 15 nm
$\Delta\alpha$ = 0.4 µrad

6-axis piezo stage

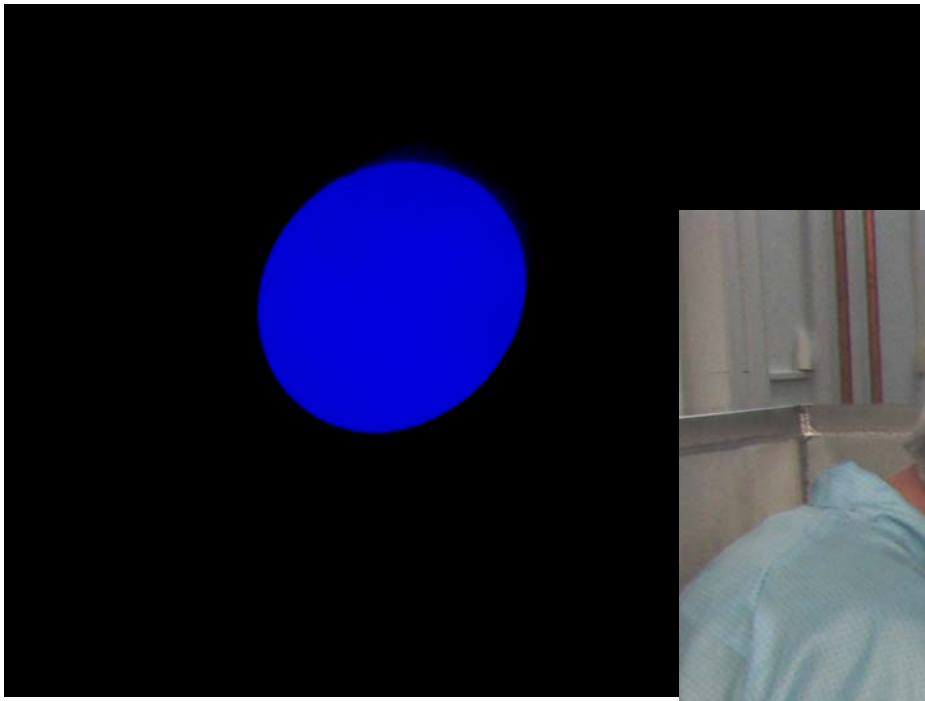
Far Field Diagnostics

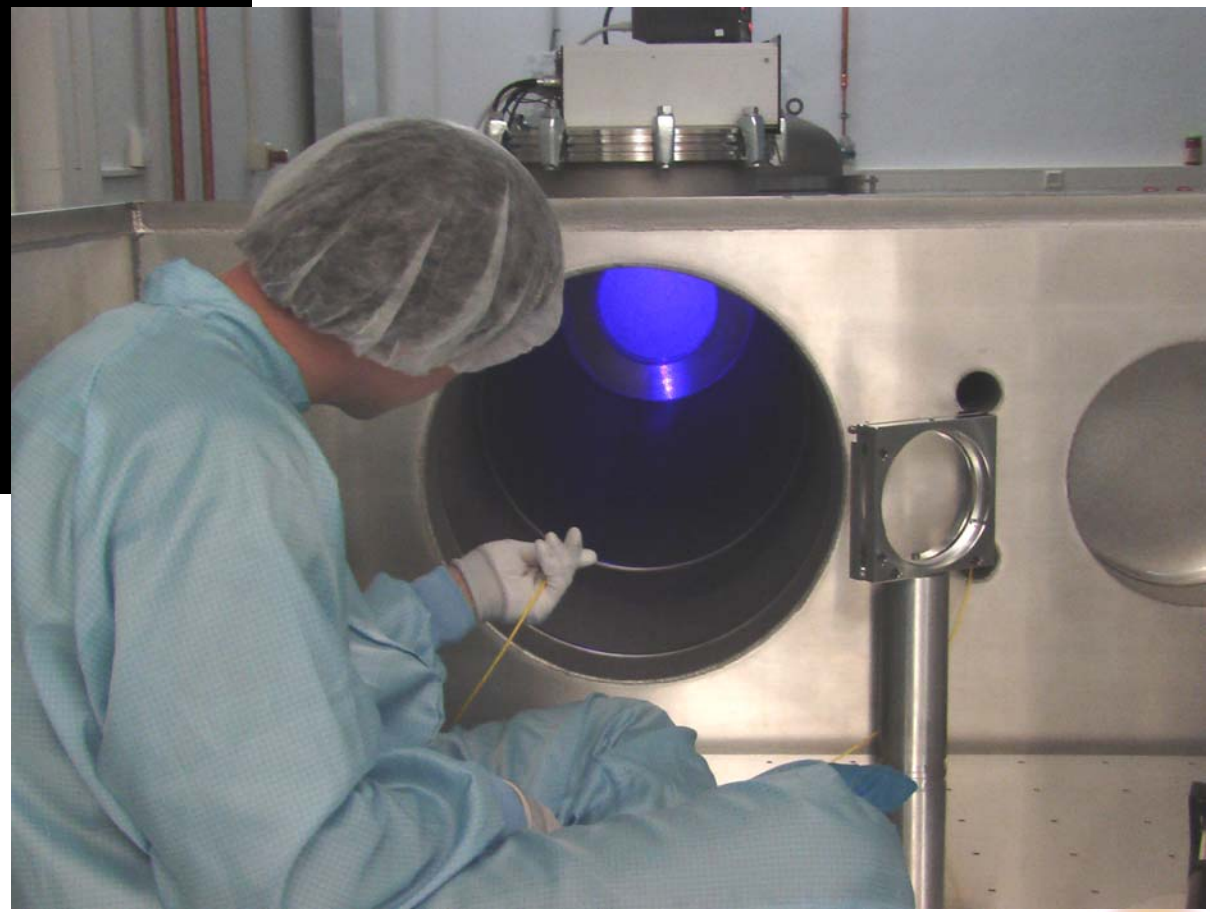


Set Up of Far Field Diagnostics



The Blue Laser Beam

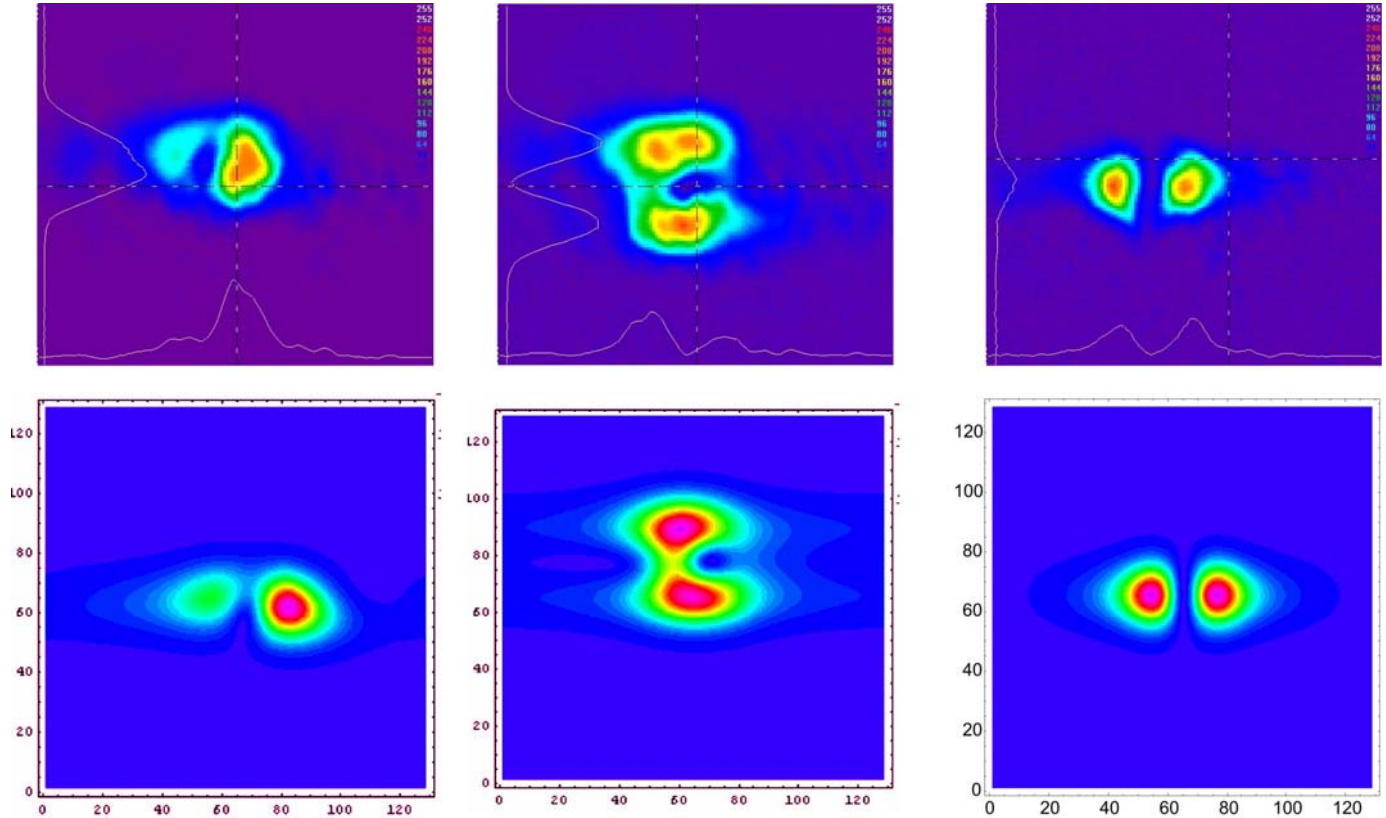




Comparison of Theory and Experiment

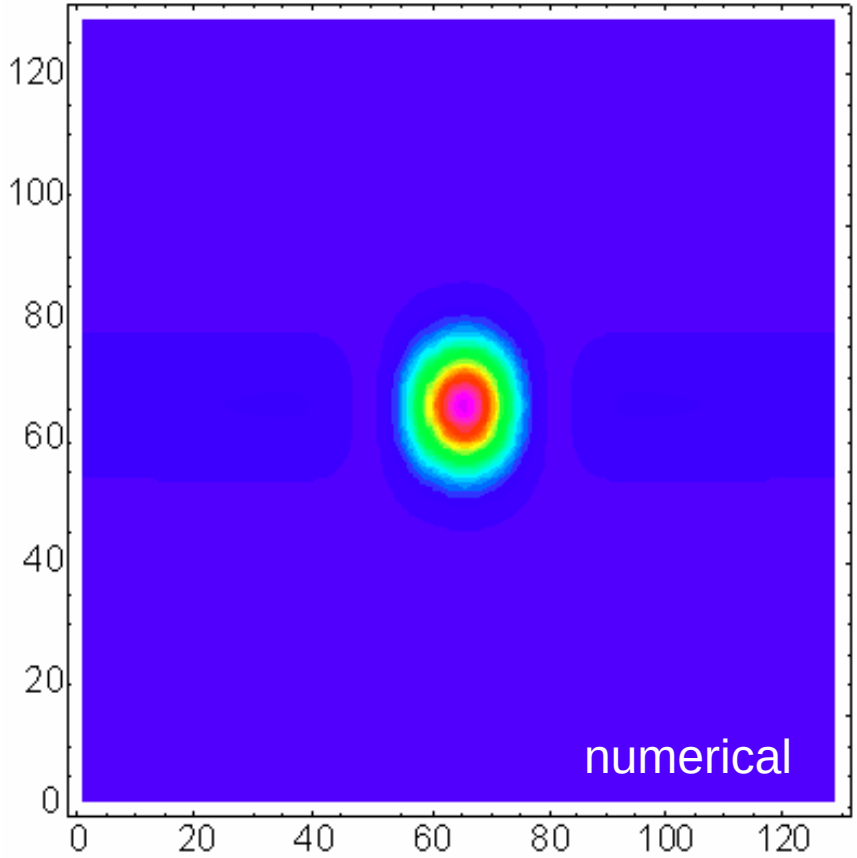
Measurement

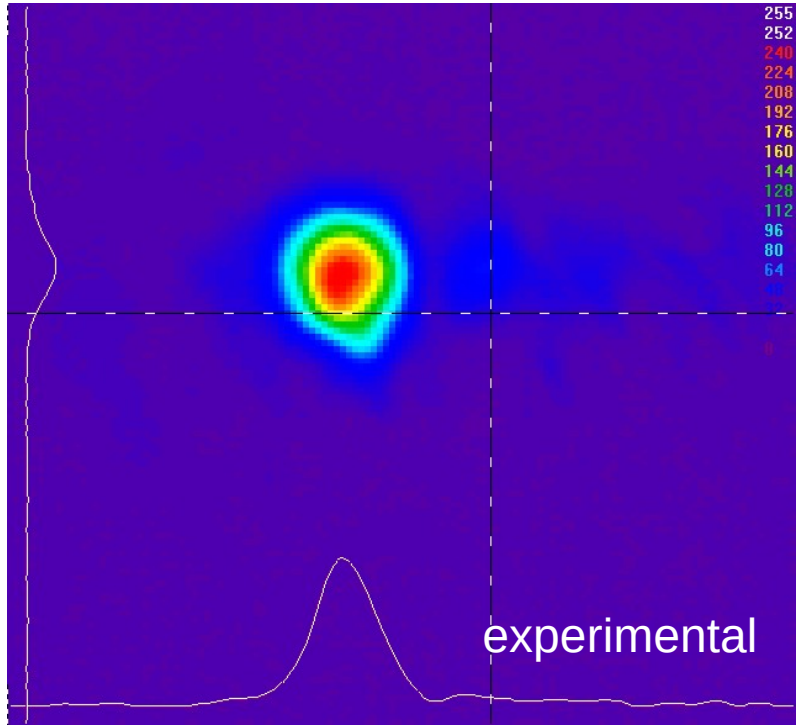
Calculation



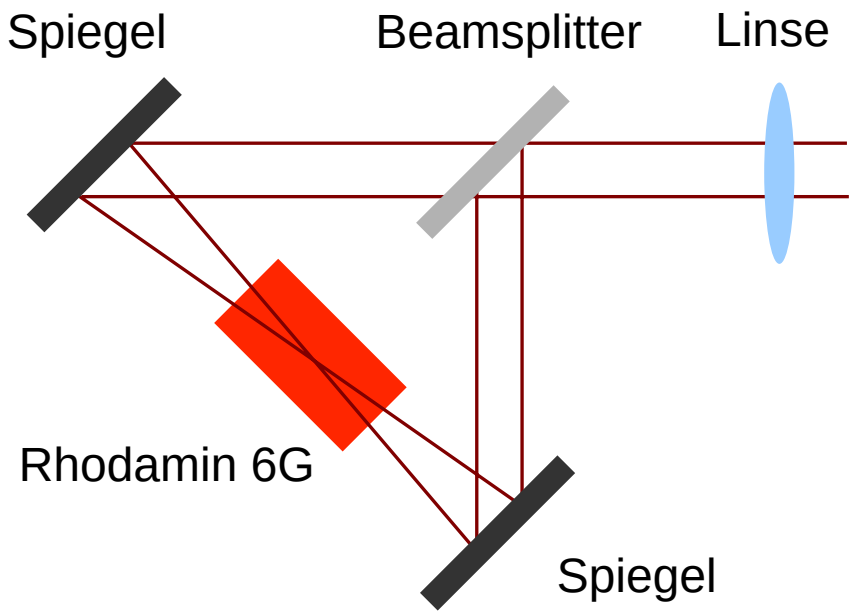
Tip = 2µrad & Tilt = 10µrad **Tip = 10 µrad & Tilt = 1µrad** **Piston = π**

The Focal Spot



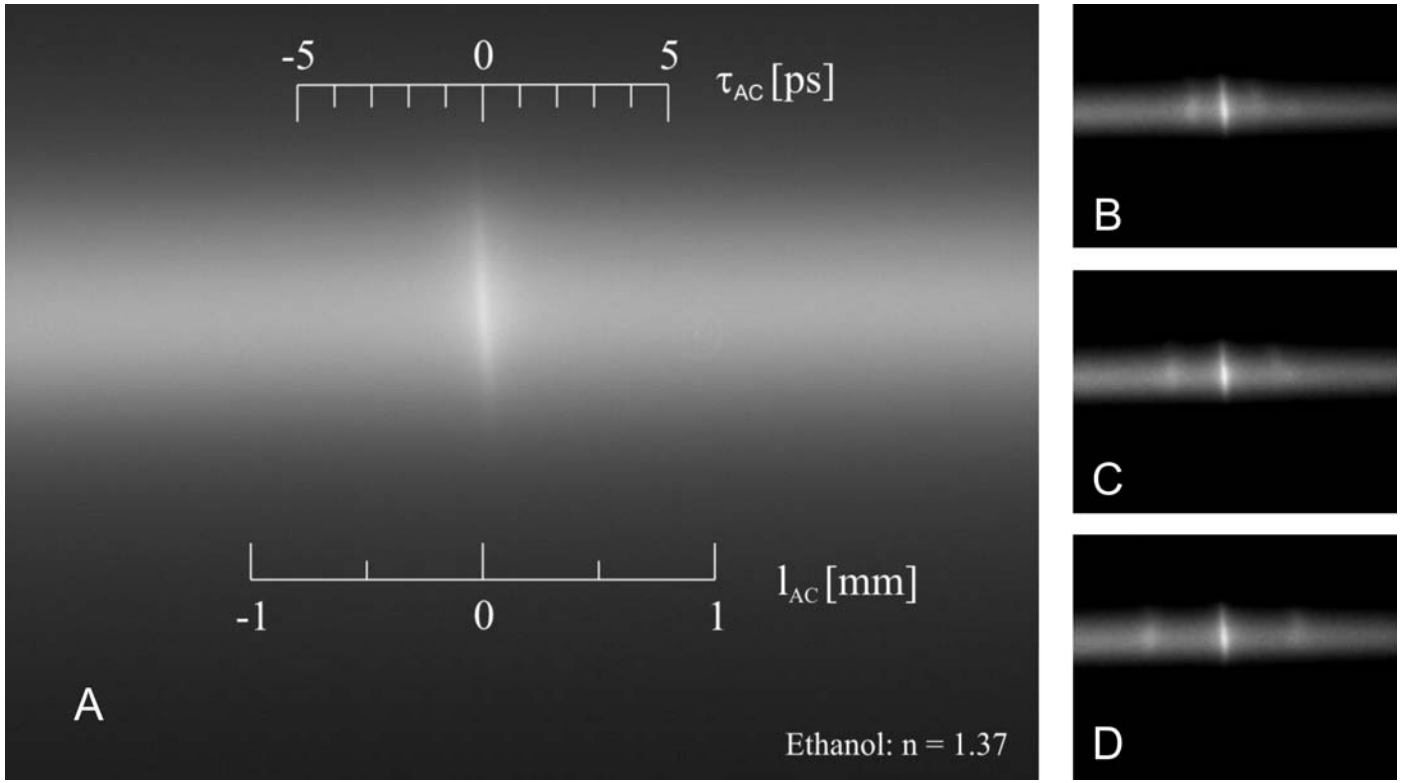


A Simple One Shot Autocorrelator

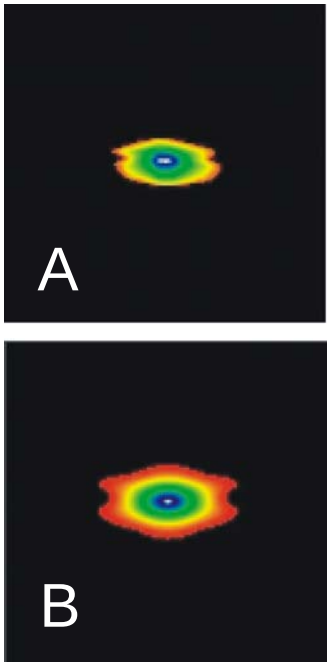


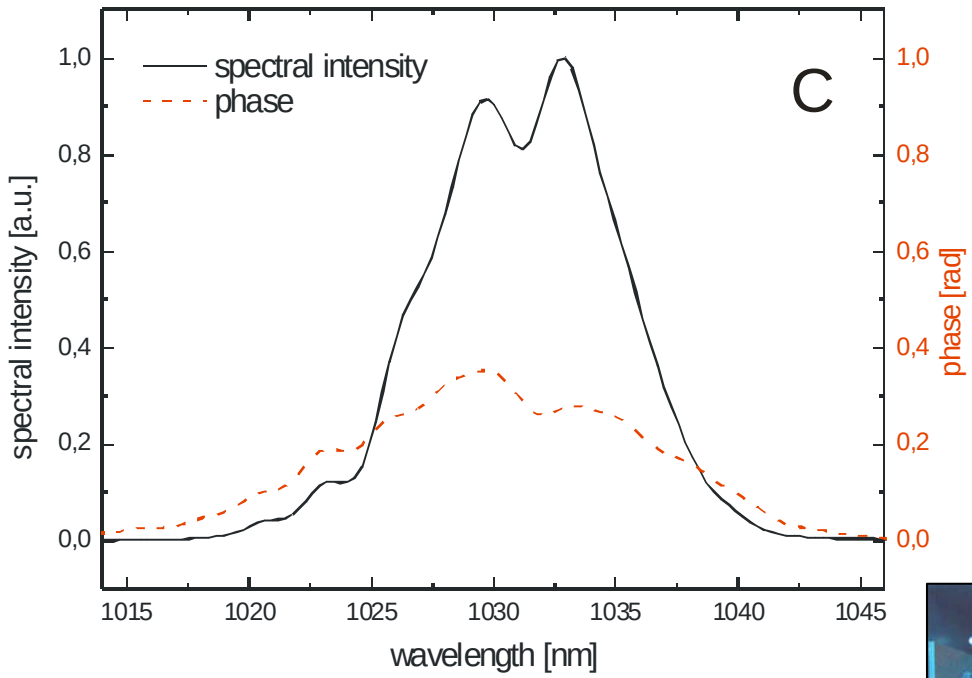
Autocorrelation Measurement

τ = 150 fs
$\Delta\lambda$ = 10 nm

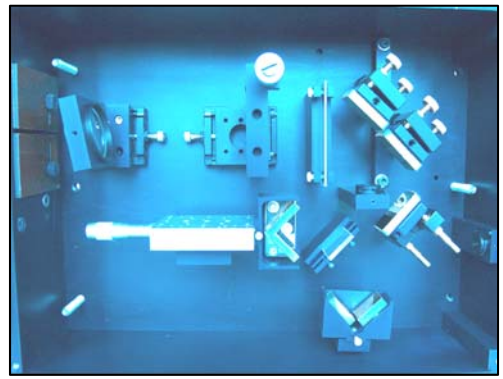


SHG - FROG



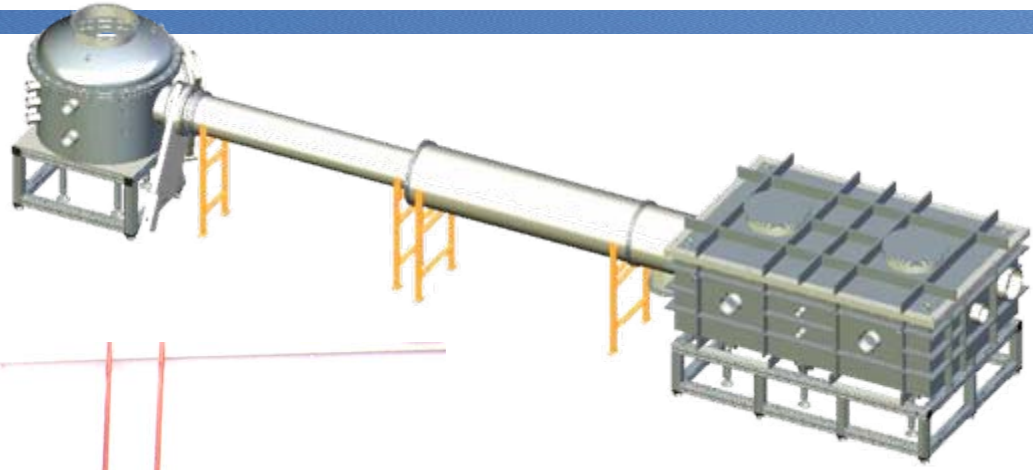


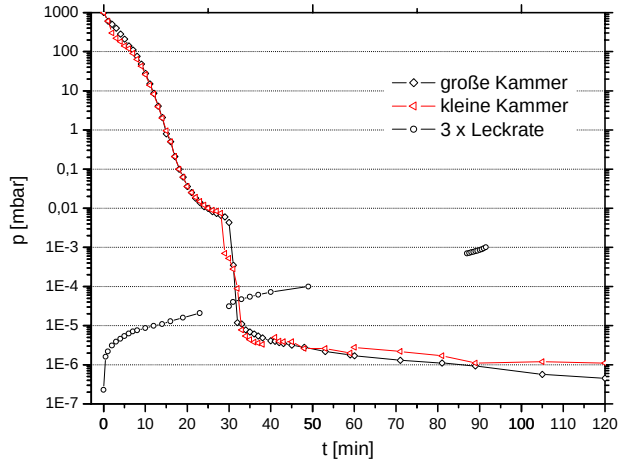
Femtos-Frog:



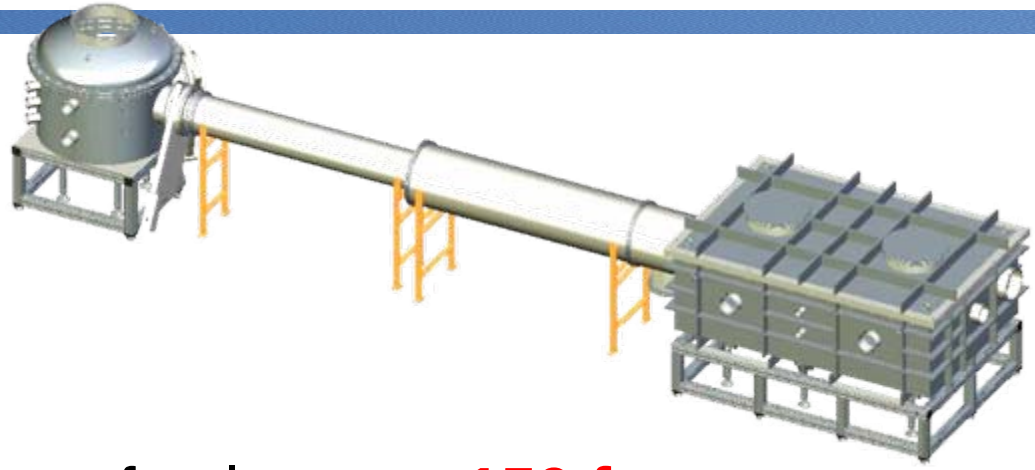
t_{Pulse} = 150 fs
$\Delta\lambda$ = 10,4 nm

New Vacuum Chamber





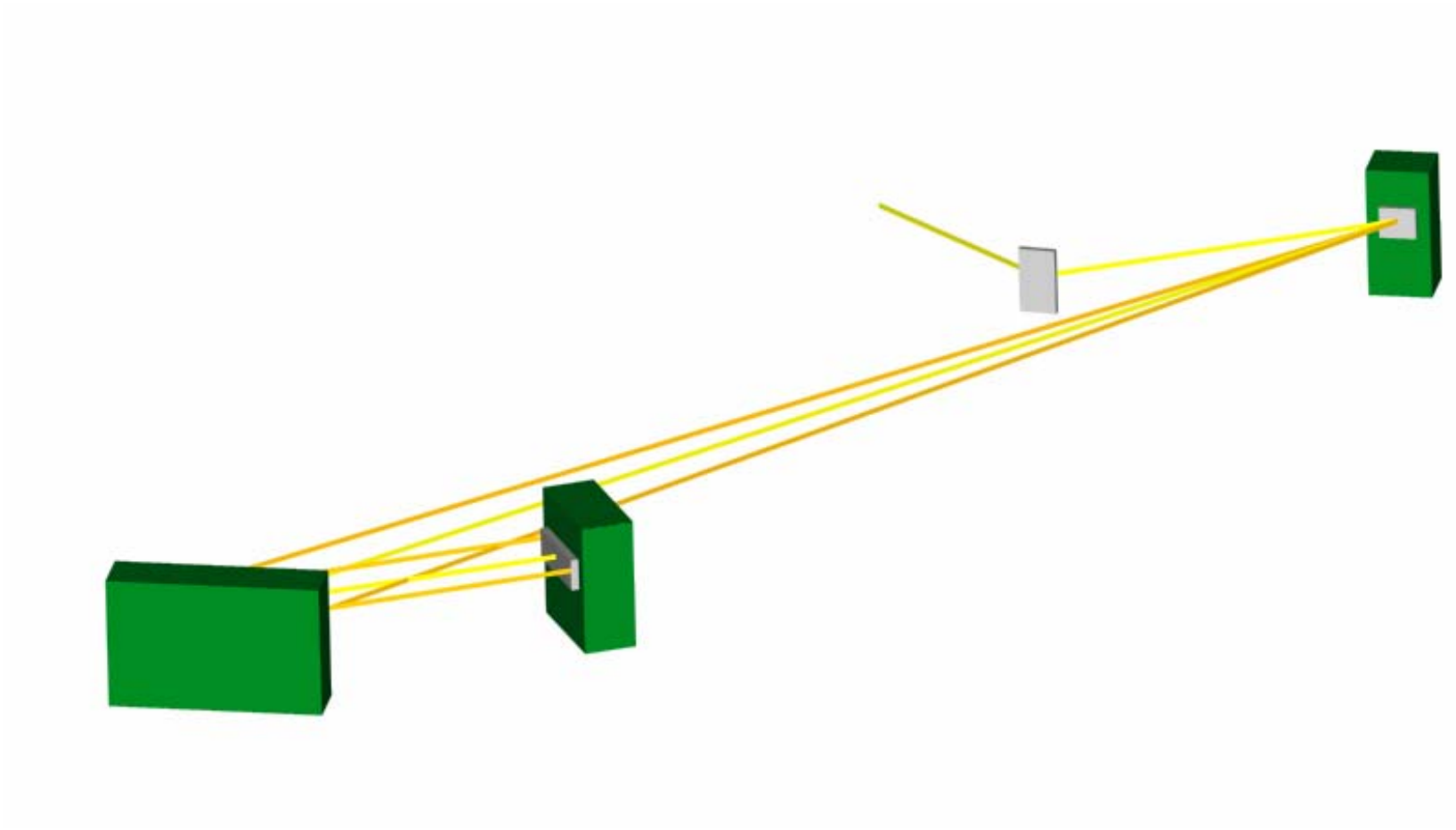
Conclusion and Next Steps



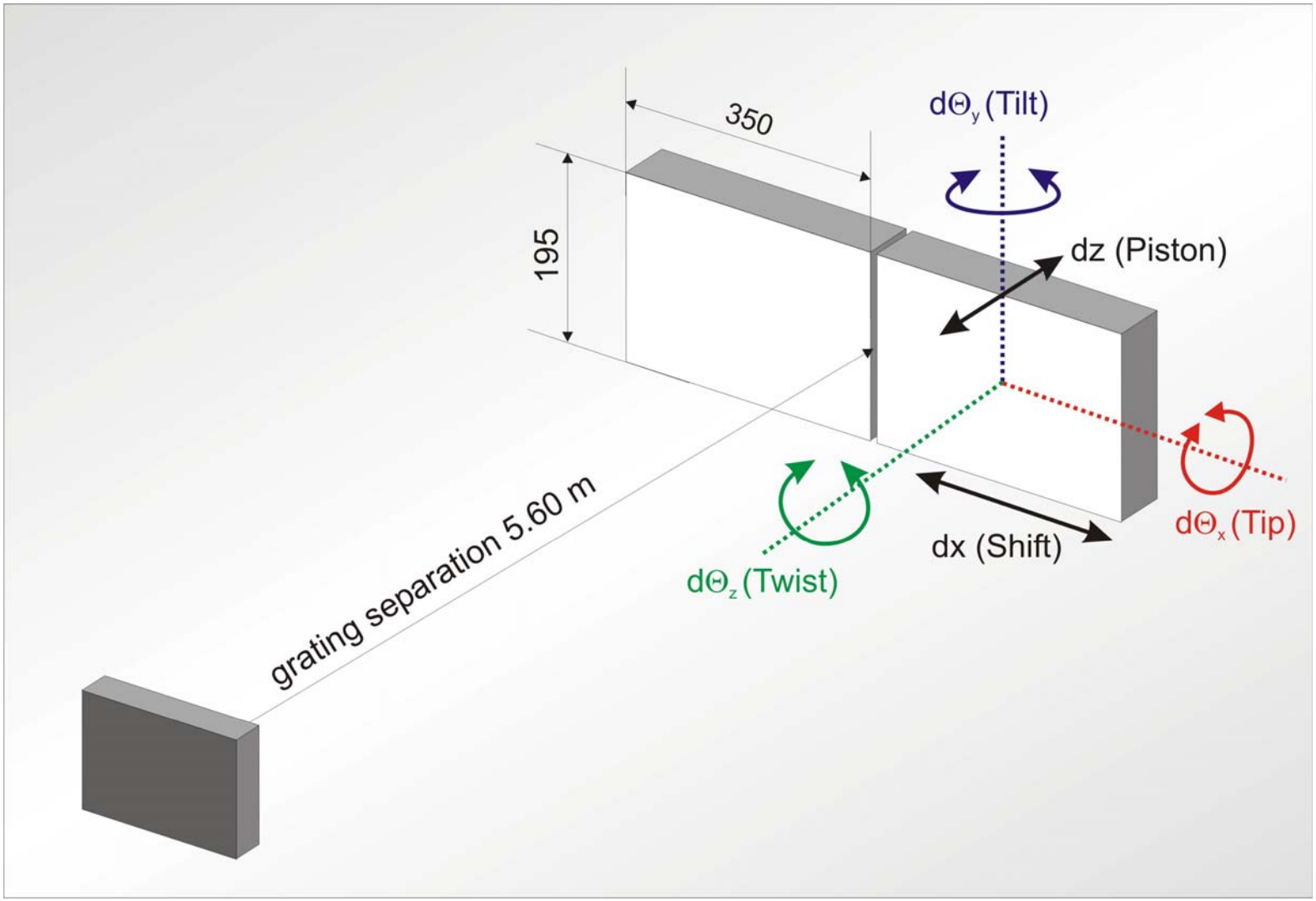
- succsesful compression of pulses to <**150 fs**
- stretcher and compressor fit together
- compressor in vacuum and with full power shots of A4

Thank you for your attention.

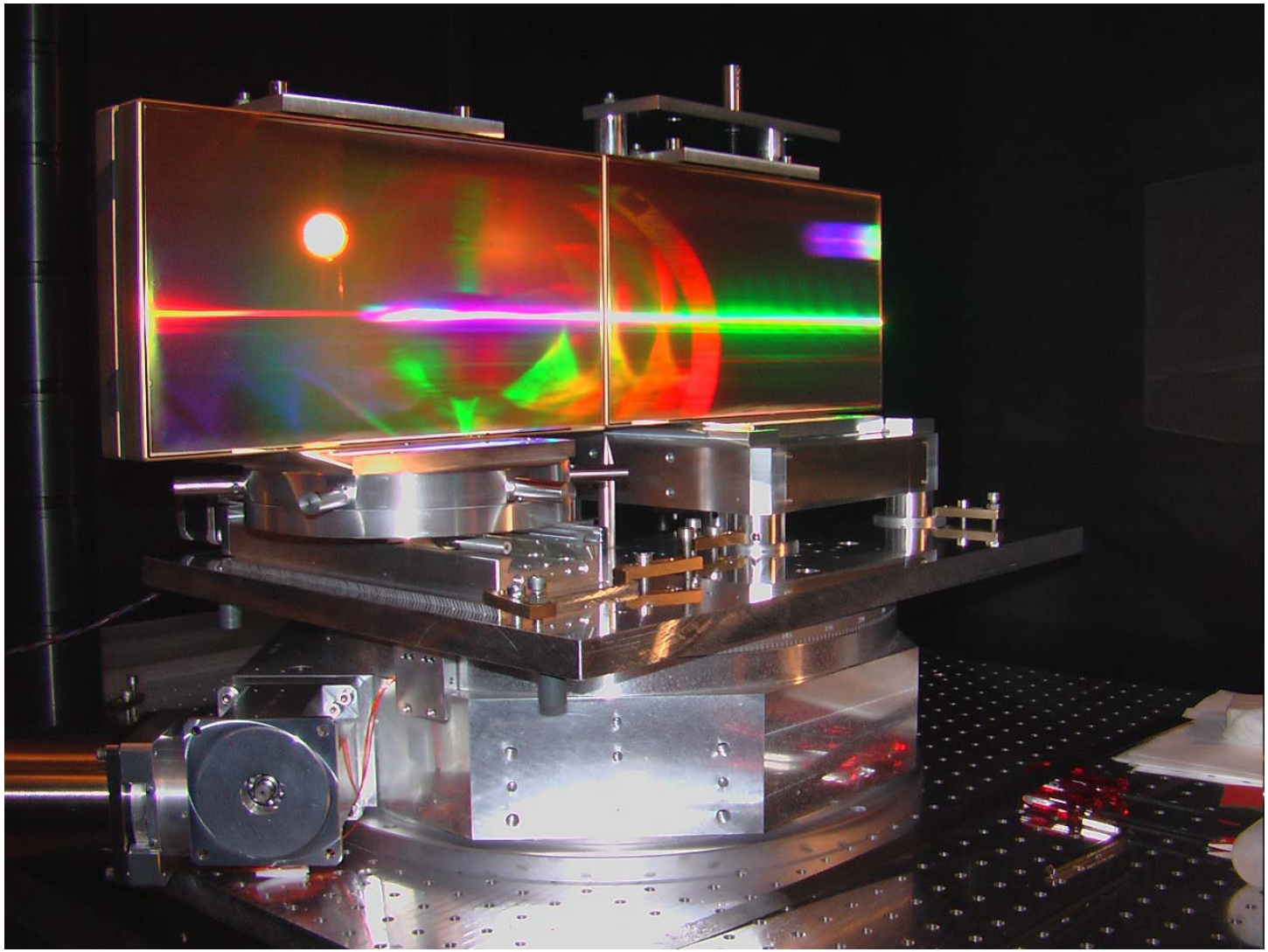
Pulse Compression



Tiled Grating Compressor



The Tiled Grating



Mittwoch 01.02.06 - Bei Schnee und Eis

Donnerstag 02.06.06 – Die Kammer steht

Compressor - The Vacuum Chamber