Science & Technology Facilities Council

UK Research and Innovation

Measurement of Compressor Distortions on a TW Class Laser System

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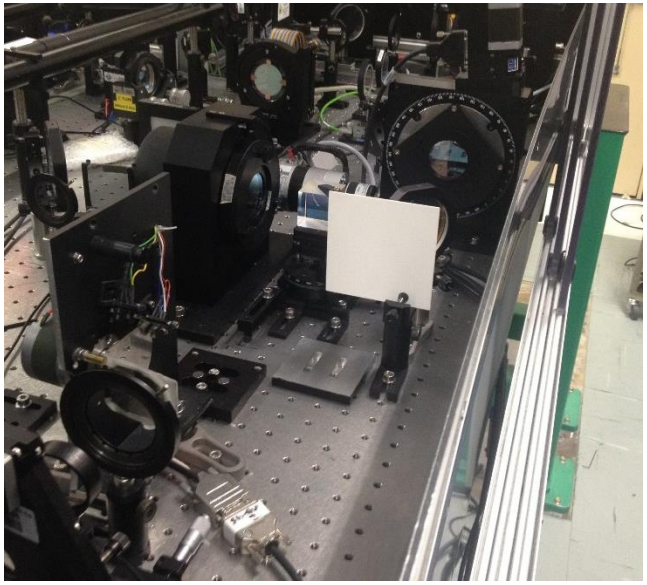
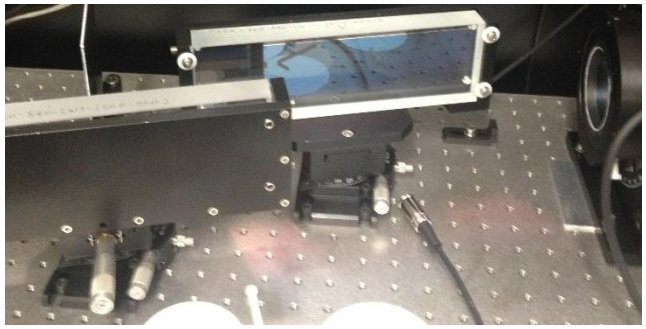
Outline

- The Astra laser
- Compressor set-up and diagnostics
- Grating heating problem
- Solutions
- Future plans

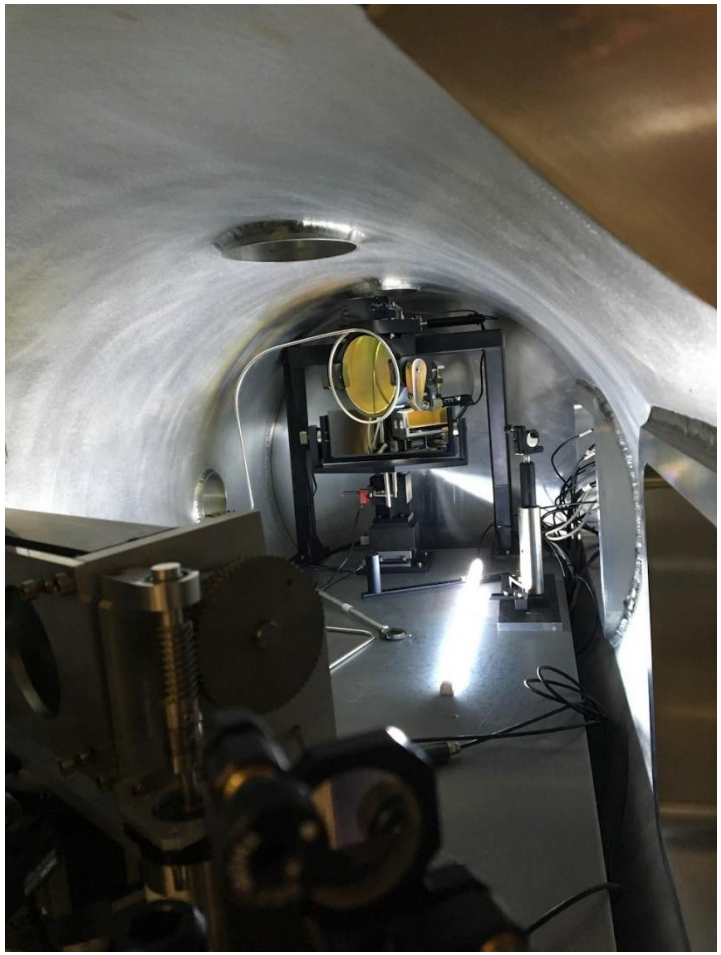
The Astra Laser





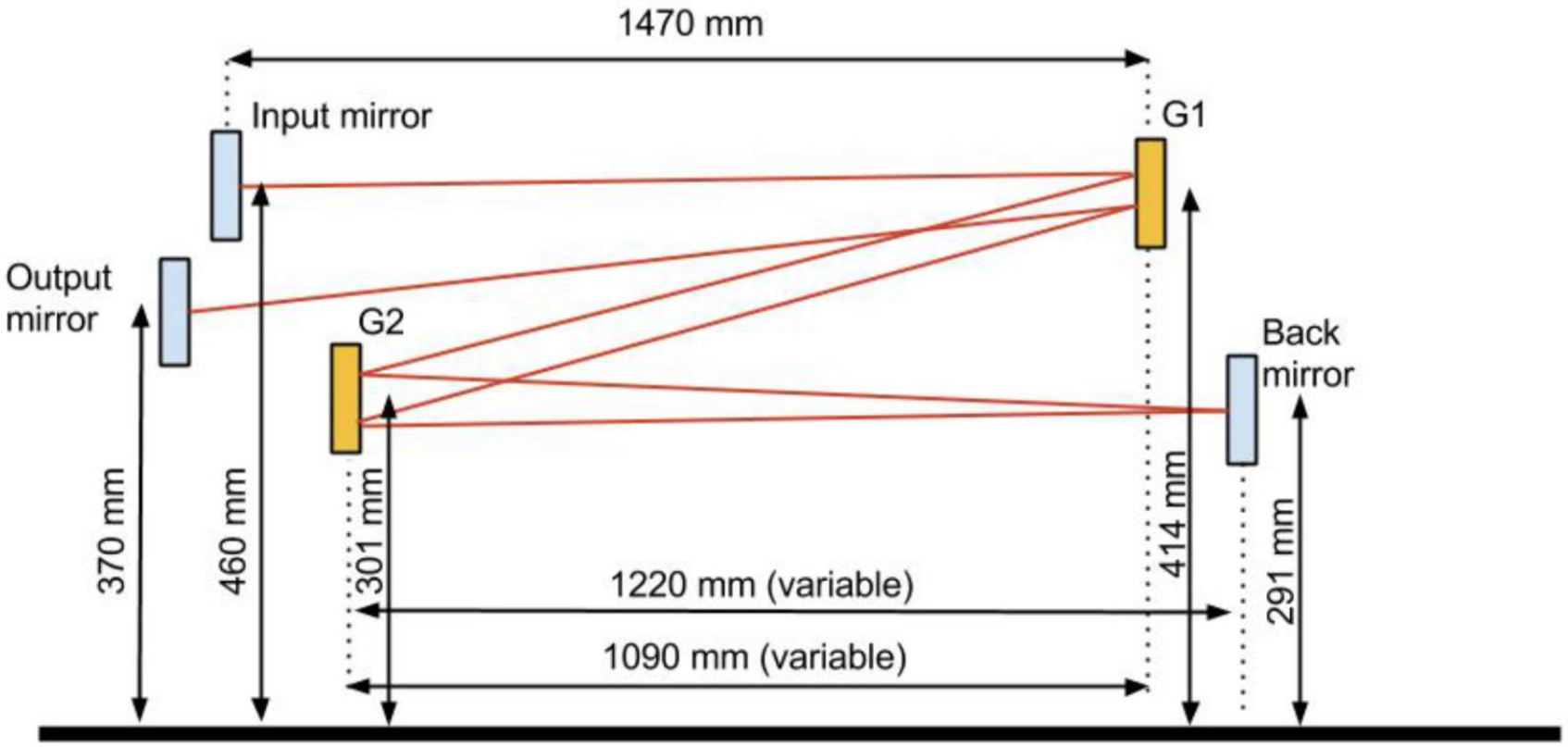
- The front end to the Gemini Laser system, began in the late 90's
- Produces 900 mJ at 100 ps with a beam diameter of 55 mm and rep rate of 5 Hz.
- Pulse selection achieved by fast shutter. Energy controlled by a series of wedges and a waveplate/polairser combination.
- No active temporal stabilization.

Grating Parameters

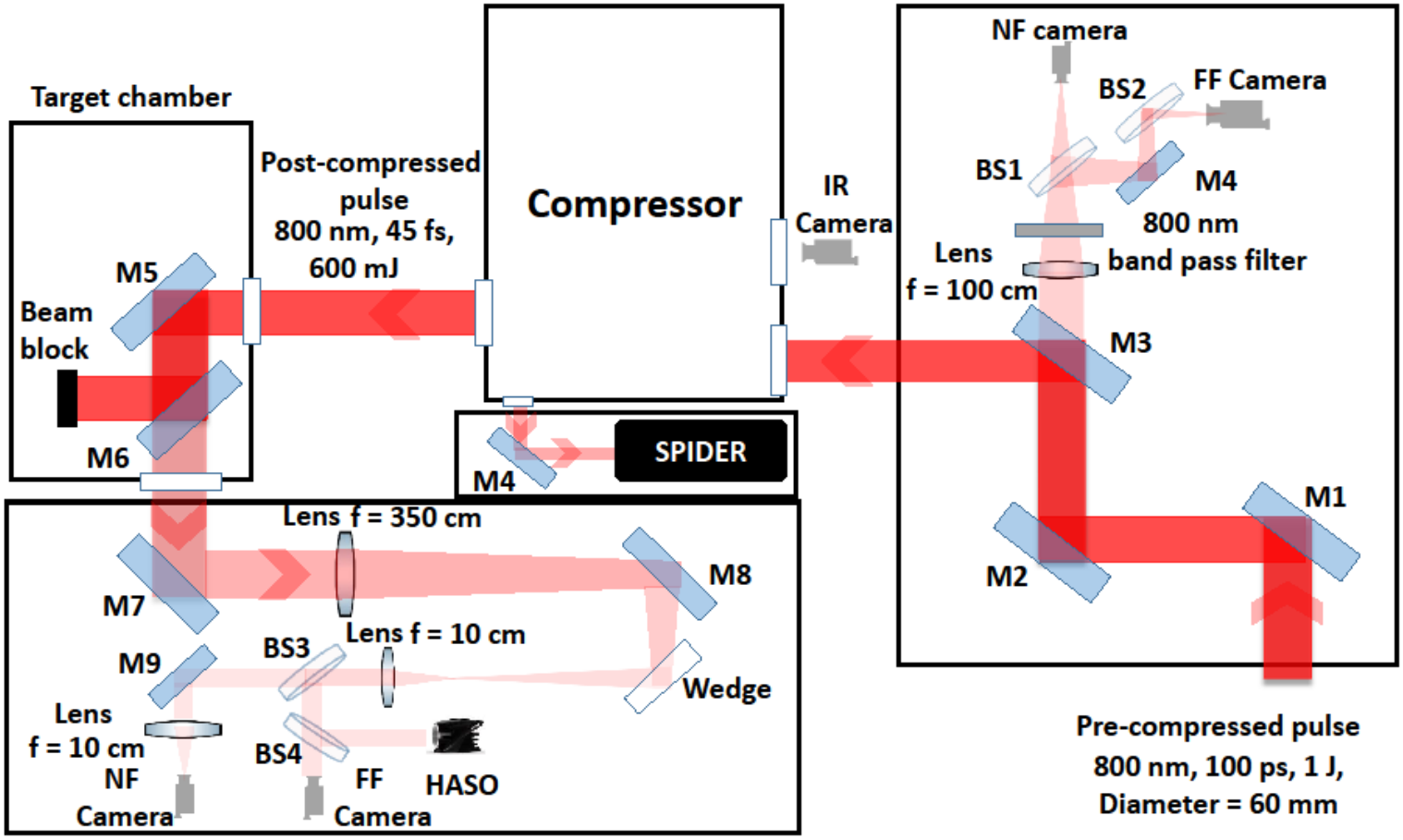


- Energy density: 30 mJ cm^{-2}
- Pulses delivered in bursts: 50 pulses at 5 Hz then 1 s pause
- Original LLNL gratings that are ~ 15 years old, with a fused silica substrates and gold coating .

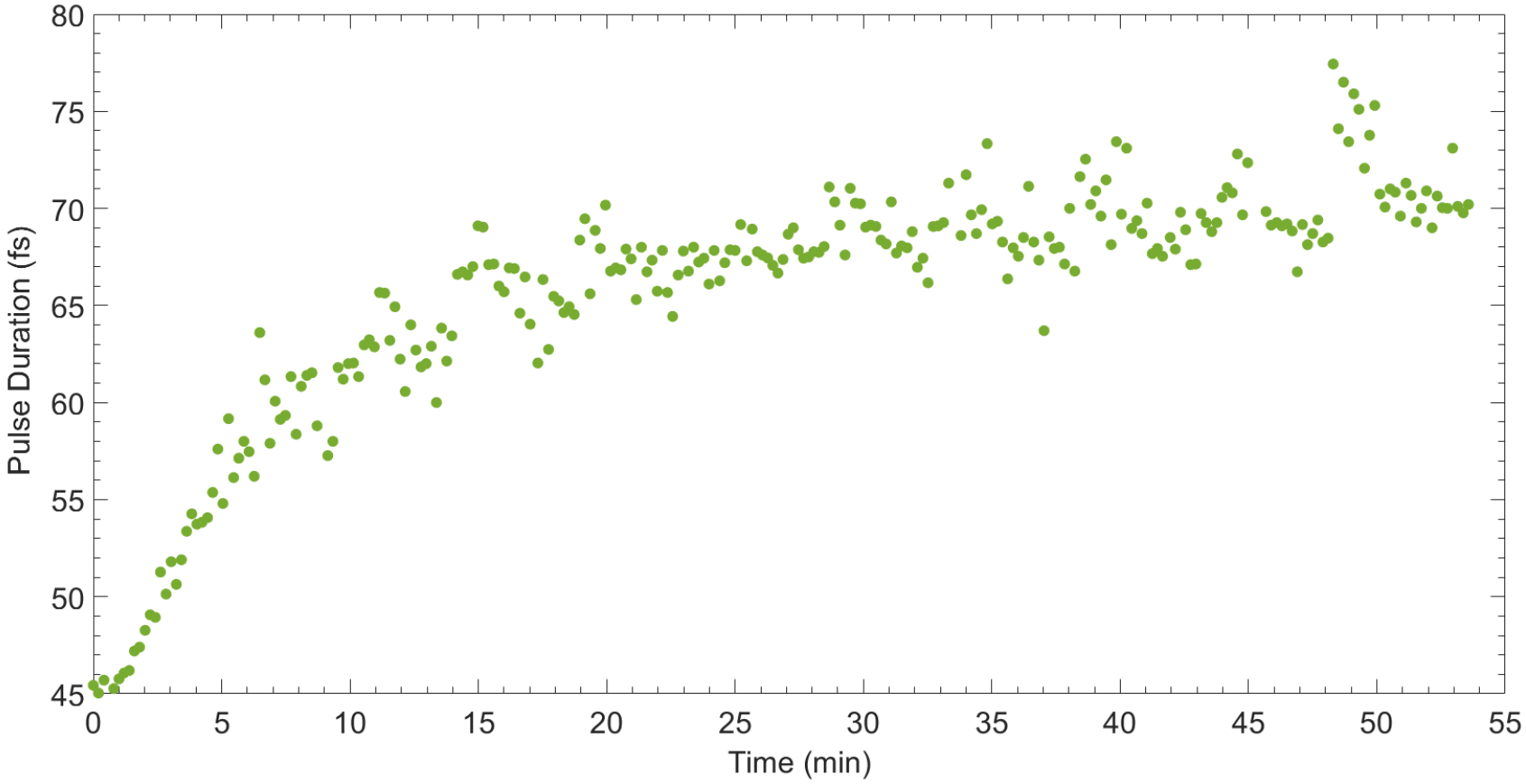
Compressor Littrow Configuration



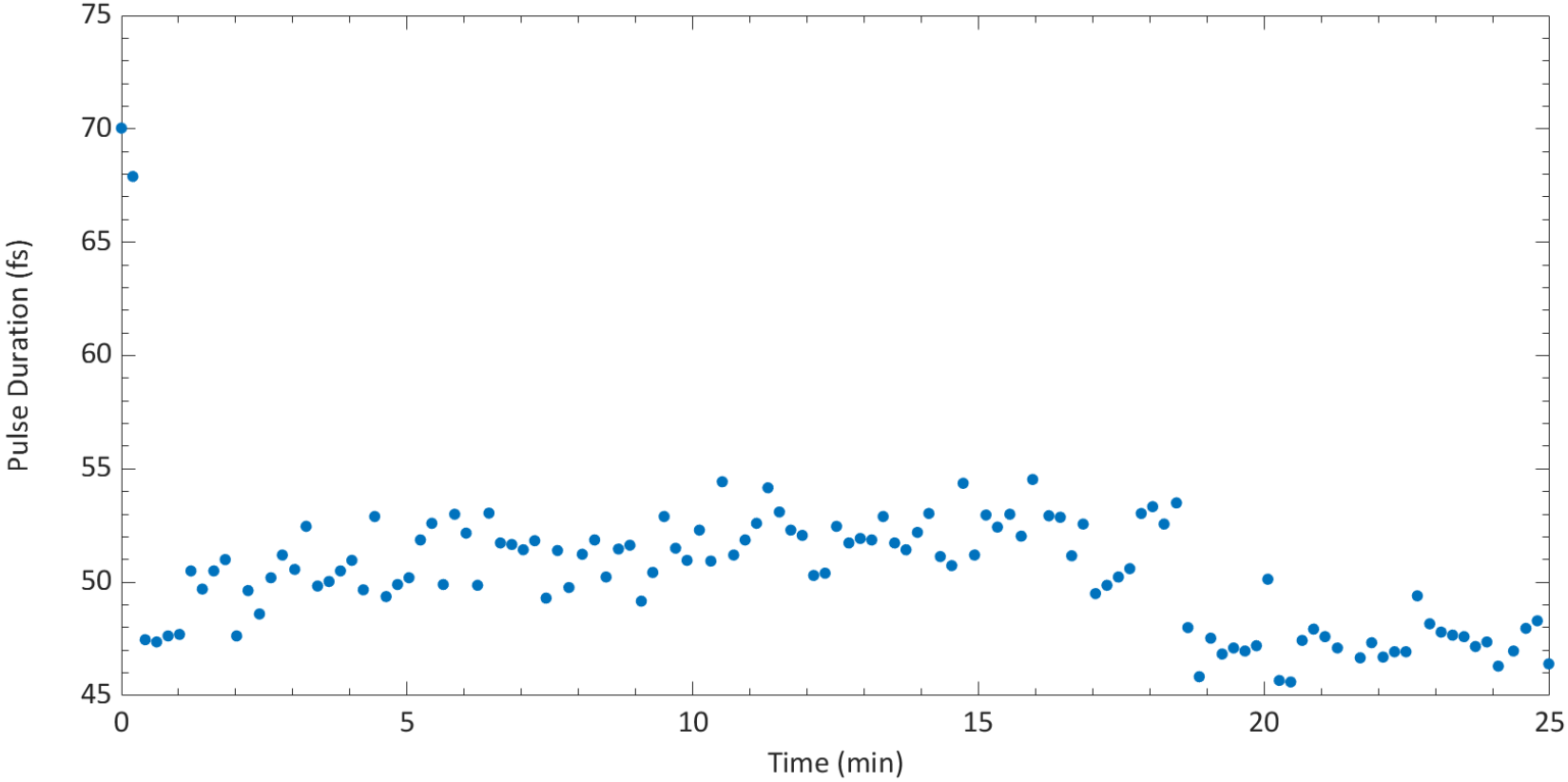
Diagnostics



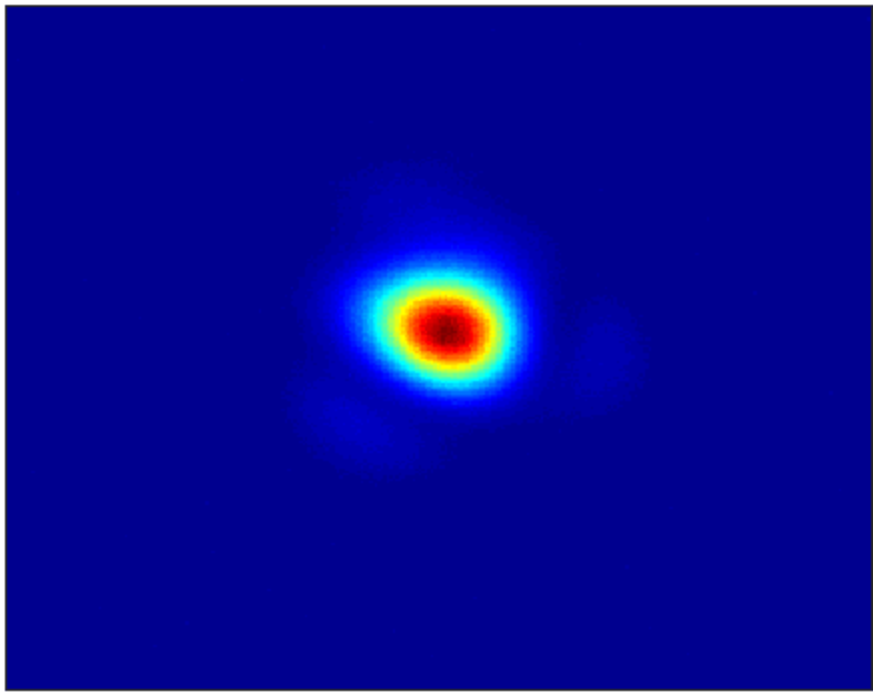
Temporal Distortion

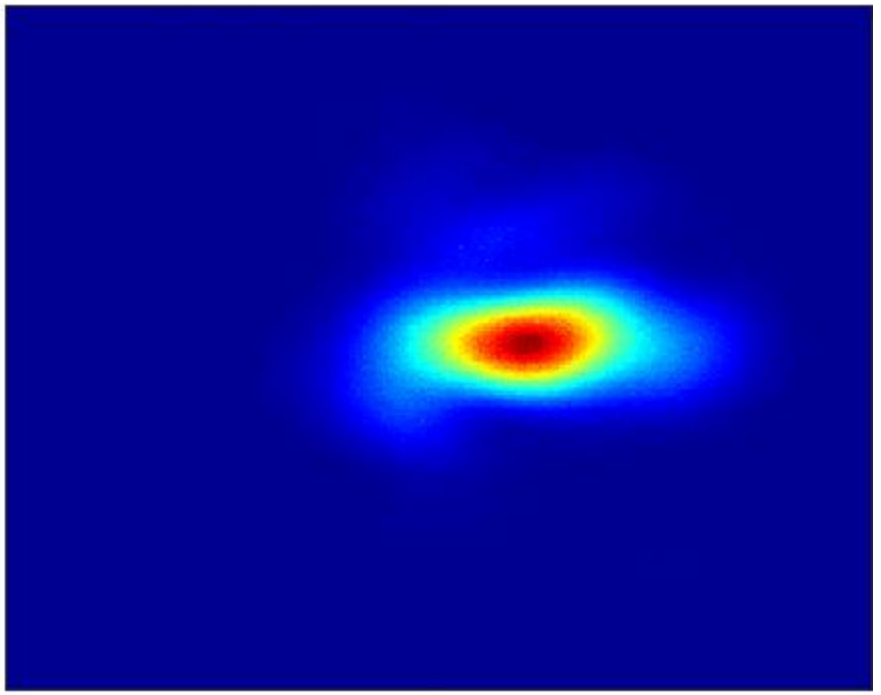


Temporal Correction

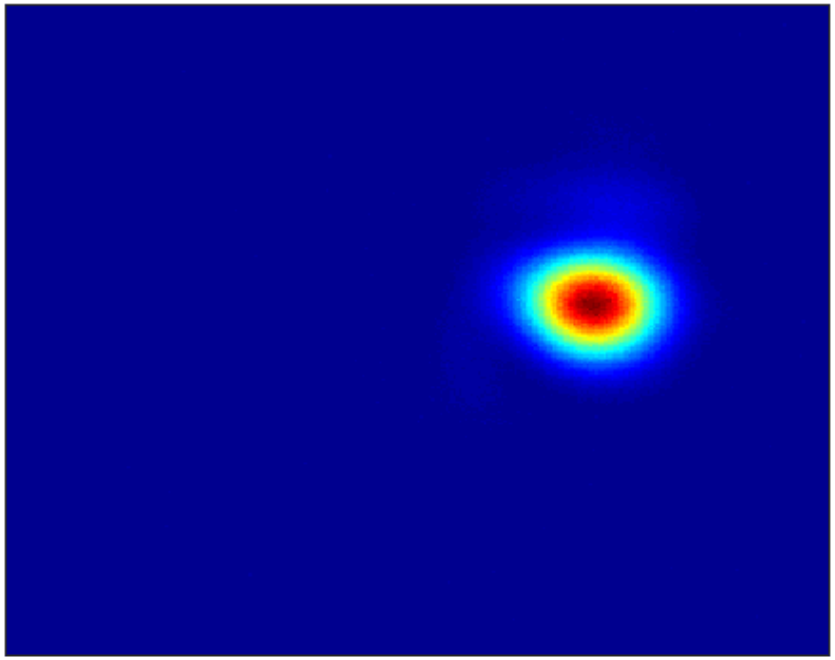


Spatial Distortion

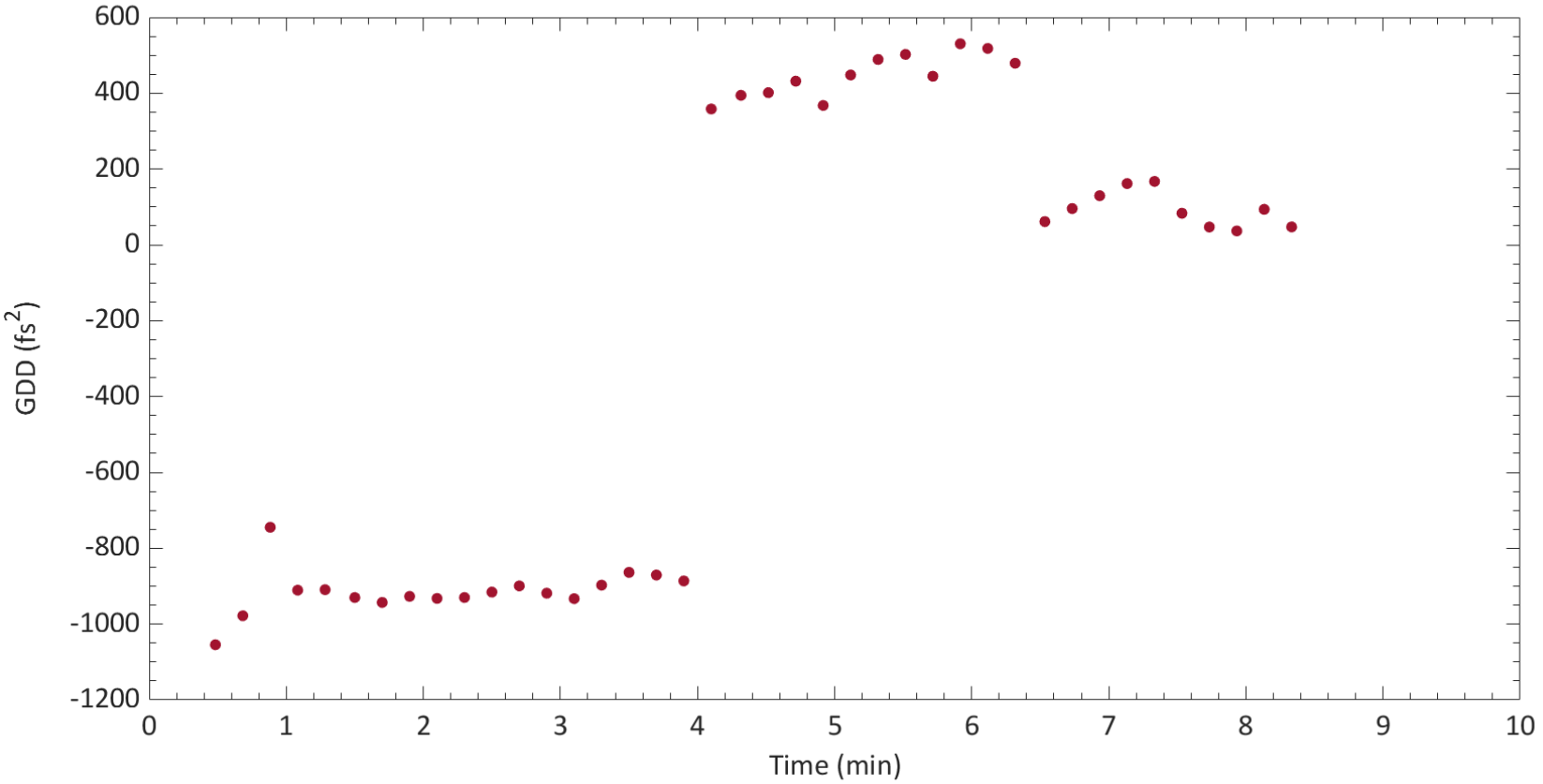




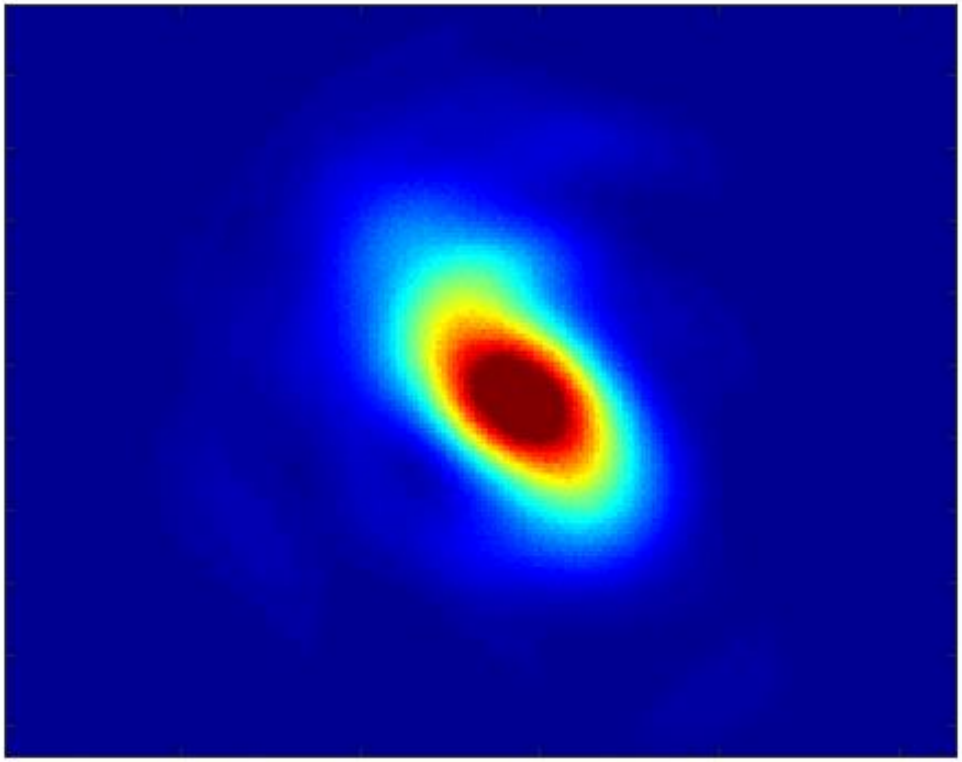
Spatial Correction



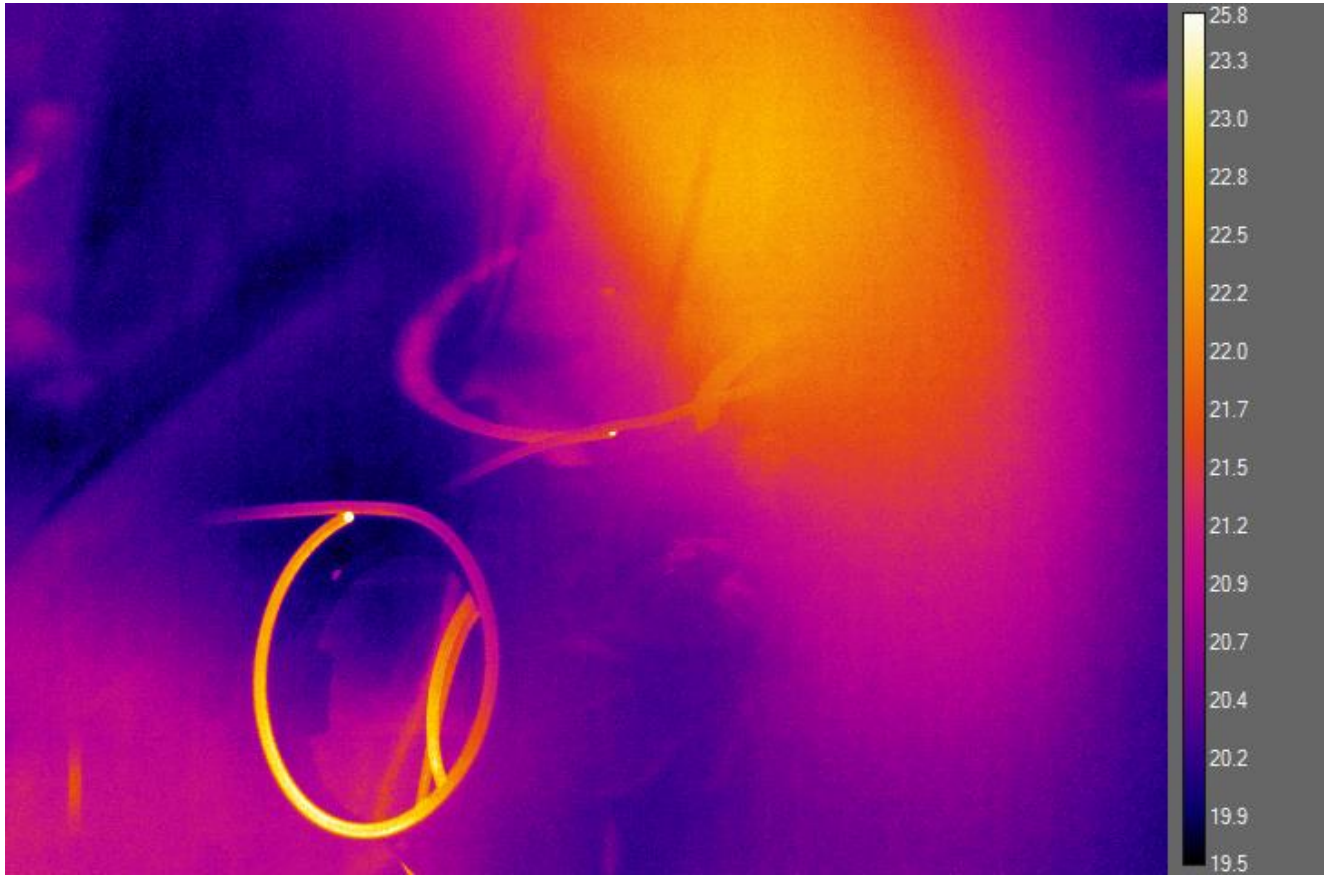
Effect on Temporal Domain



Heating Relaxation



Thermal Cam



Conclusion

- Shown that a thermal heating of the grating causes a spatial distortion.
- Found an effective solution but does not remove the problem.
- Future plans:
  - Thermal camera
  - Measurement of pulse front tilt using a folded wave front interferometer
  - Replacing of the gratings