Working with the FROG

By Alex Branciale
Frequency-Resolved Optical-Gating (FROG)

GOALS

* Align the FROG
* Produce Second Harmonic Generation (SHG)
  * Blue light
* Record Pulse Characteristics
* Optimize LabView Program
* Trigger the Camera Shutter
* Understand Shutter Controls
* Expand the FROG to other Wavelengths
FROG Set-Up

- ND Filters
- Delay Stage
- Curved Mirror
- BBO Crystal
- Focusing Lens
- Camera
- 2D Spectrometer
FROG Set-Up
What happens in the FROG

\[ E_{\text{sig}}(t, \tau) \propto E(t)E(t - \tau) \]

The gate pulse is complex!

Field amplitude

Time \((t)\)

From Rick Trebino Ultra-Fast Optics Course
Blue Light

- Overlap in BBO crystal
- Space
- Time
How to get Pulse Characteristics

- Run a scan with LabView program
- Put scan data into FROG Reconstruction program
What we found with the FROG

* We have a functioning Single-Shot and Scanning FROG and FROG Software
What we found with the FROG

- Smearing has been diminished in Single Shot mode
- Shutter Issue
FROG Program Front Panel
Automation of the High Intensity Tunable Source (HITS) Lab

* Monitor Pressure gauge
* All vacuum chambers in Lab
Automation of the High Intensity Tunable Source (HITS) Lab

* Data Acquisition Box
* Digital Analog Converter and Analog Digital Converter
* Works with all High Voltage Power Supplies
Automation of the High Intensity Tunable Source (HITS) Lab

- Genetic algorithm
  - Electron Time of Flight Experiment
    - Optimizing Electron yield on the MCP
    - Control Voltages on Einzel lenses
  - Fitness - Optimize electron yield for certain energy ranges
Automation of the High Intensity Tunable Source (HIT(S) Lab

* Implemented Genetic Algorithm LabView Front Panel
What’s Next?

* Understand Shutter Controls better
  * Test without laser
* Implement background reading process
  * Take pre-laser image to be subtracted from all raw data
* Take more traces with the FROG
* Apply my Genetic Algorithm VI to the Experiment
  * Power Supplies and Pico-oscope
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