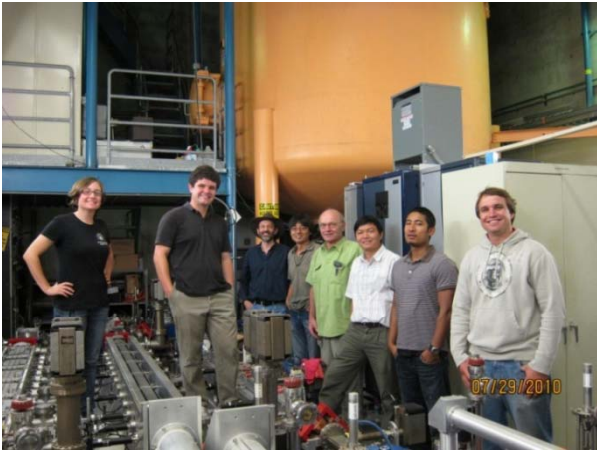


Developing a High Power Electron Paramagnetic Resonance (EPR) Spectrometer

- Justin Bricker, Oxnard College (EE Major)
- Mentor: Devin Edwards
- Faculty Advisor: Mark Sherwin, Physics Department
- Funding Source: NSF, Keck Foundation

Background



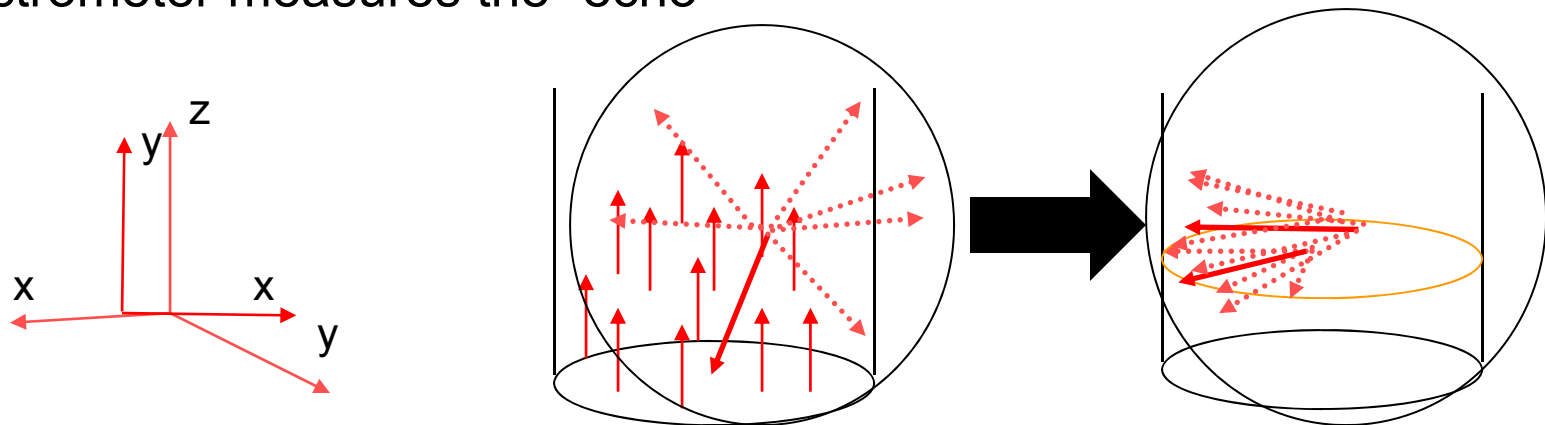
What is EPR?

- Radiation source and detector
- How spins react to radiation
- Free Electron Laser (FEL)

Two-Pulse EPR Experiment

240 GHz, kW power

- One pulse strikes the sample
- Second pulse strikes sample to re-phase
- Spectrometer measures the “echo”
- Fast spin dynamics → Ex. proteins



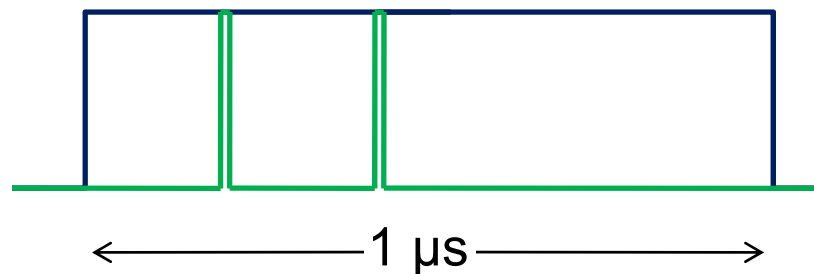
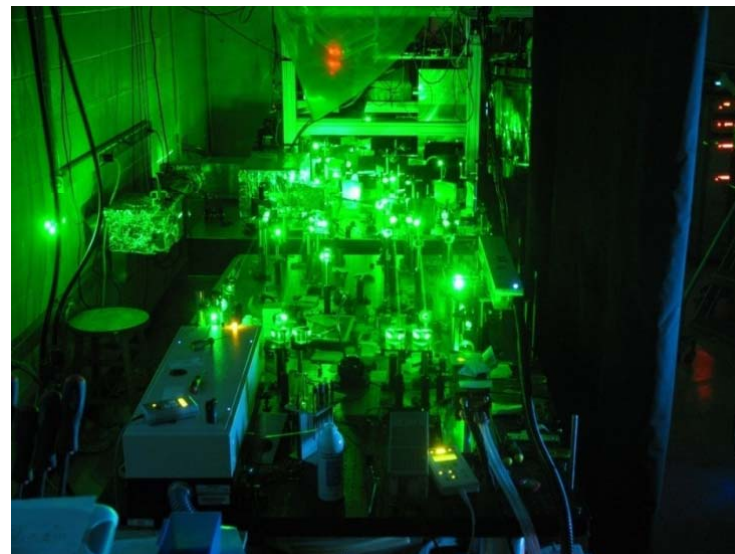
Our Focus

Sherwin Group's Focus:

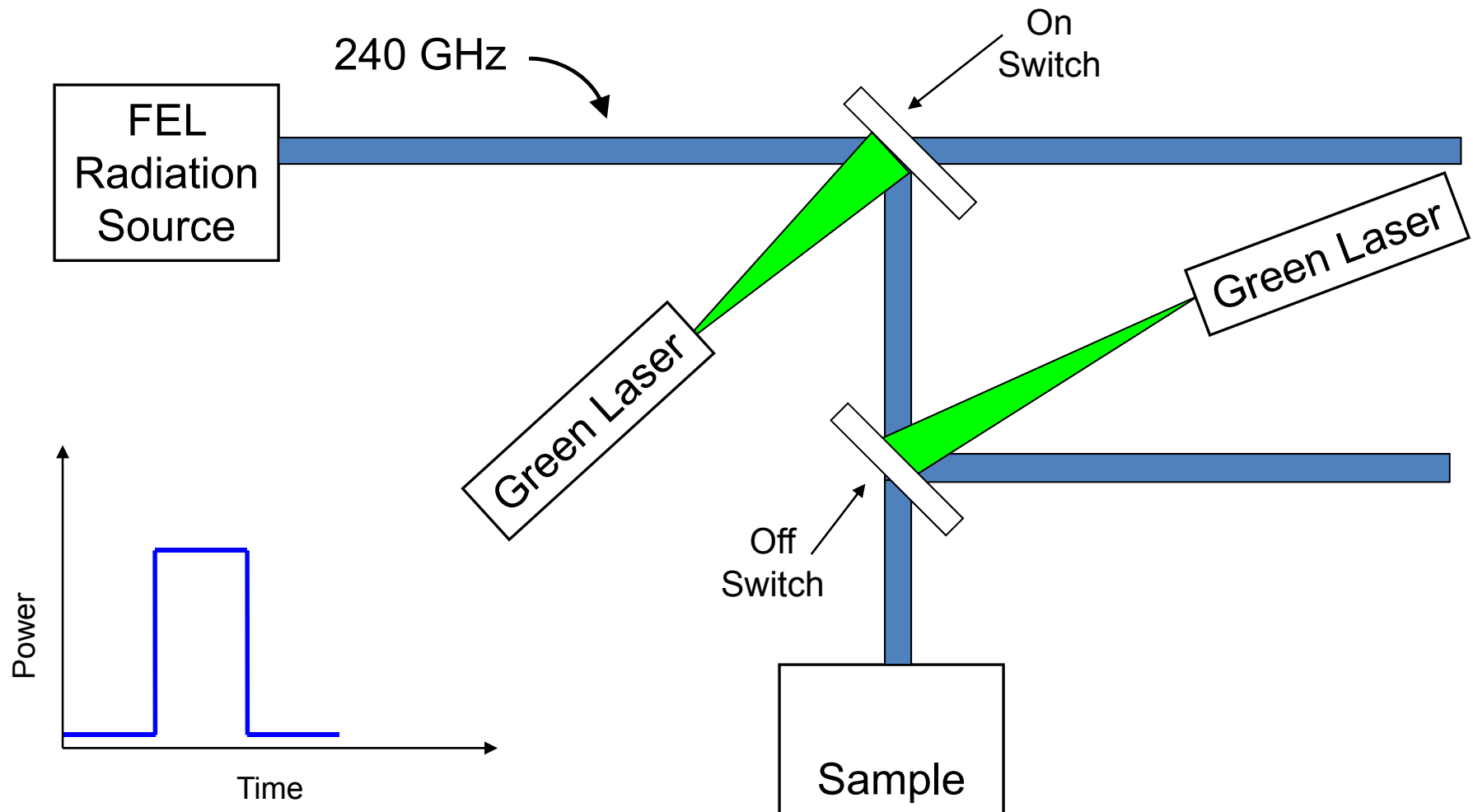
- Develop the two pulse system
 - Samples with fast reaction time
 - Create two very short pulses
 - Reduce radiation leakage

Challenges of created two pulses

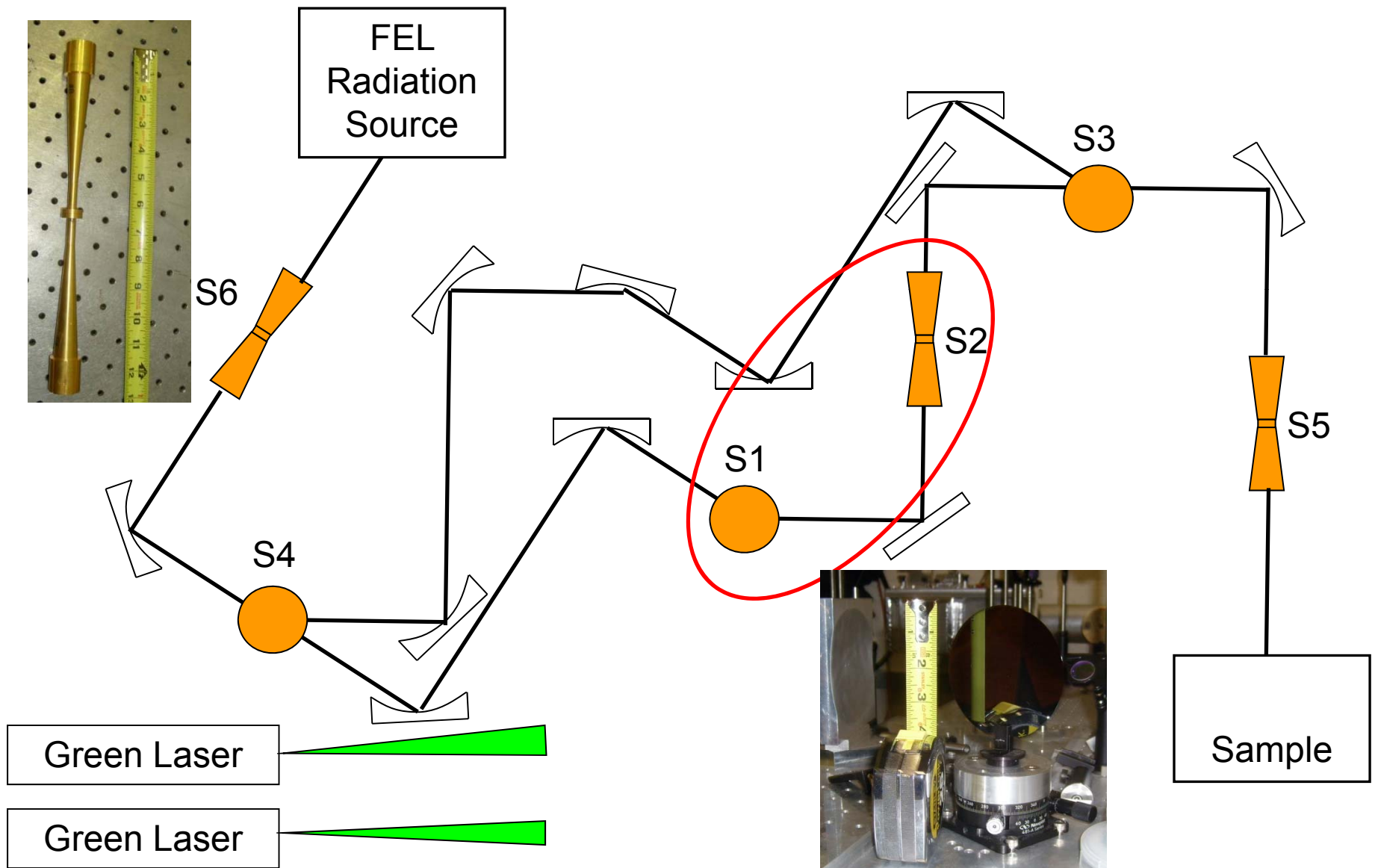
- FEL pulse is $\sim 1\mu\text{s}$, we need $< 5\text{ ns}$
- Use switches activated by green lasers
- Many sources of background noise



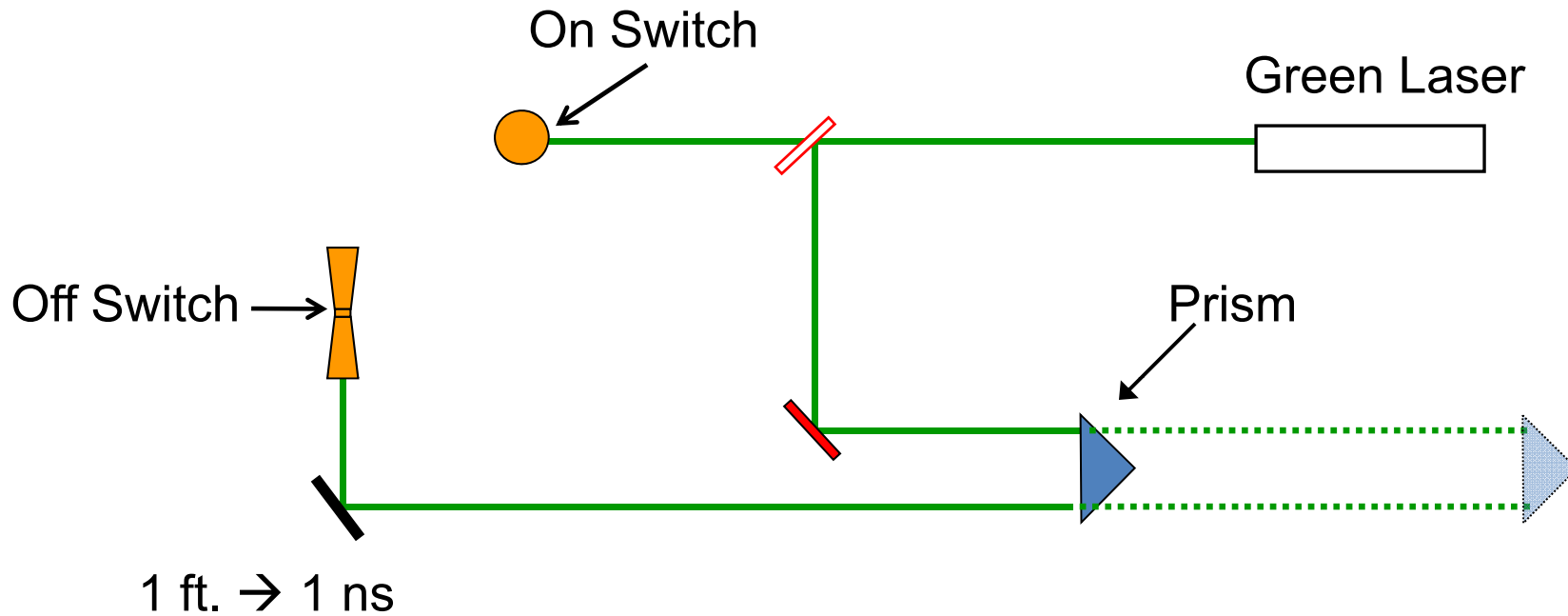
Pulse Slicing



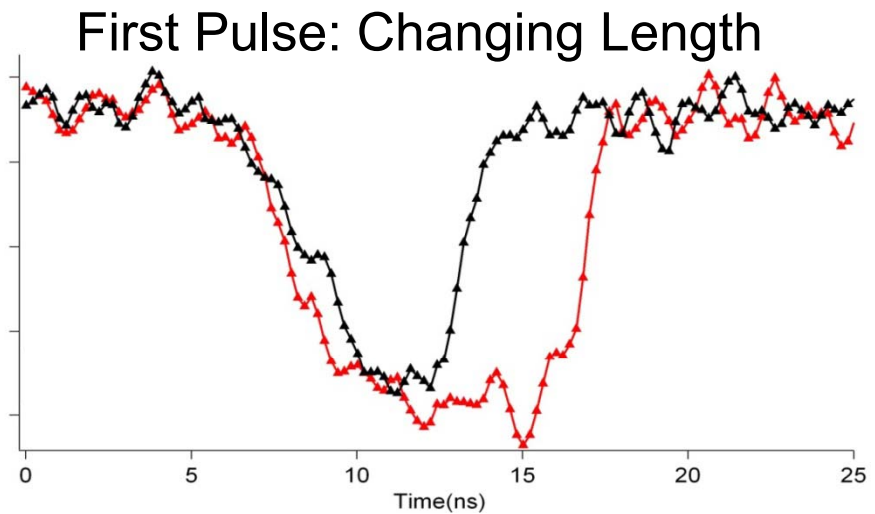
FEL Radiation Beam Path



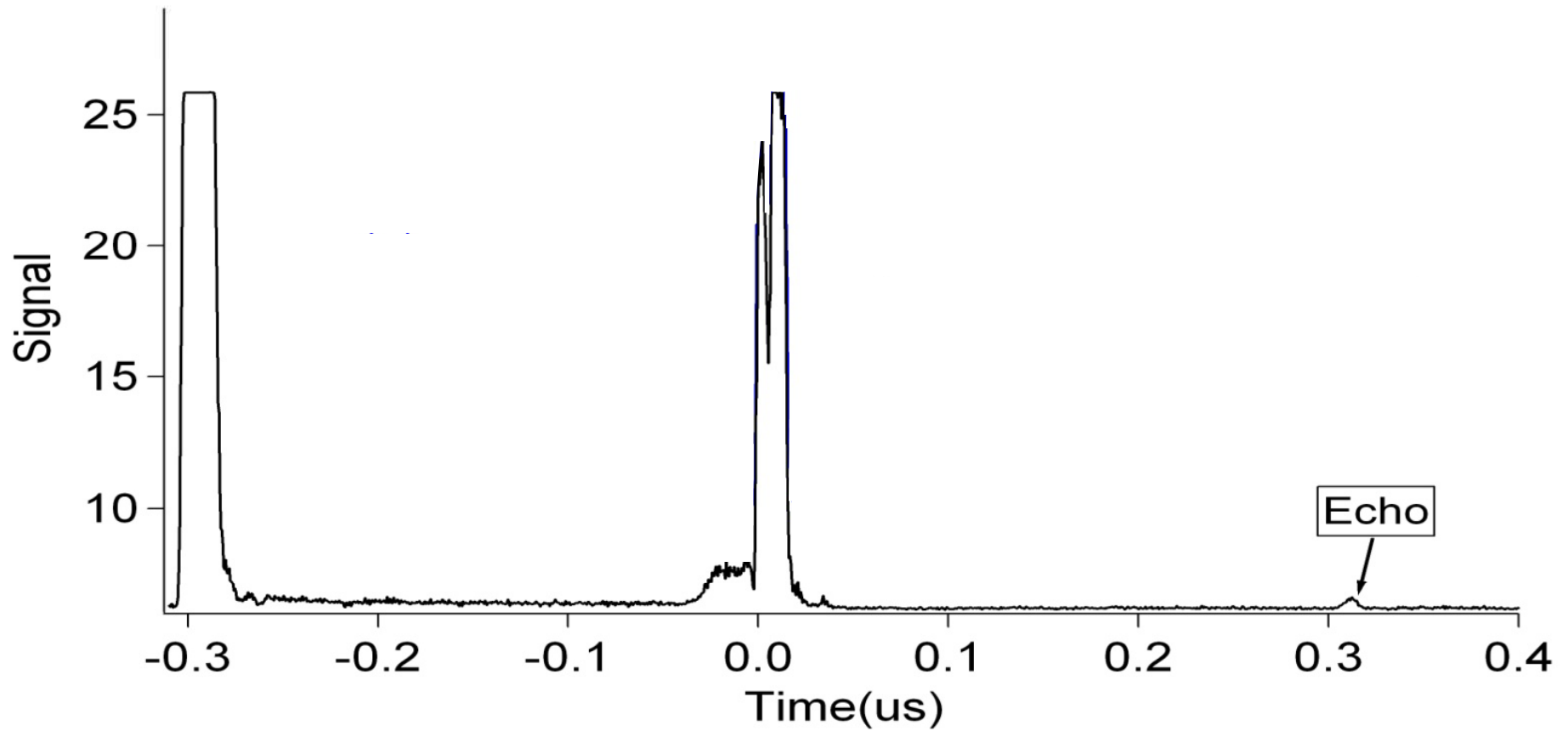
Green Laser Beam Path



- ~4-8 ns pulses
- Want to increase variability



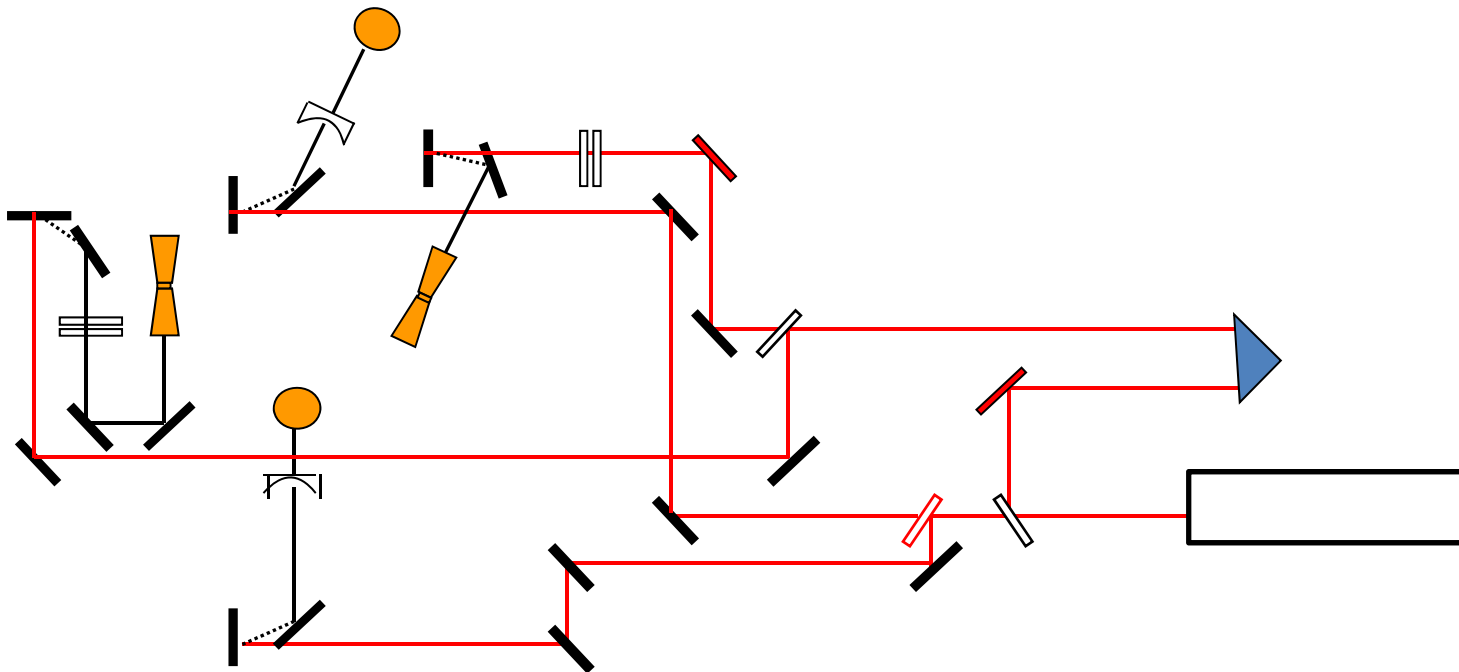
Two-Pulse Experiment





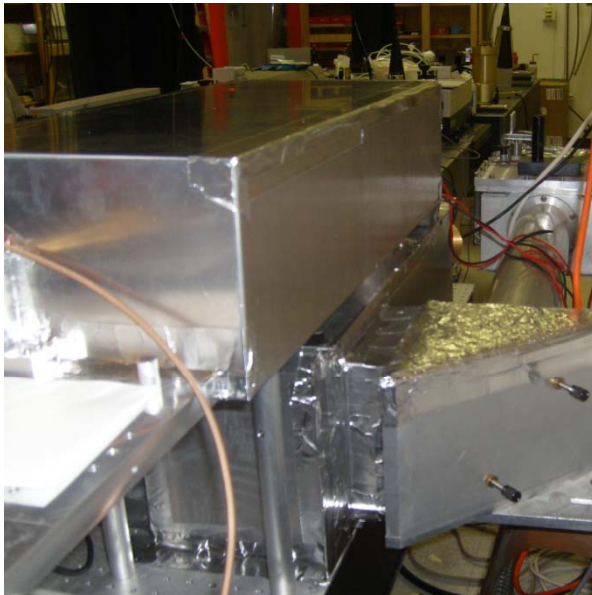
Progress

- Altered and aligned green laser beam
- Created diagrams of beam path for analysis



Progress

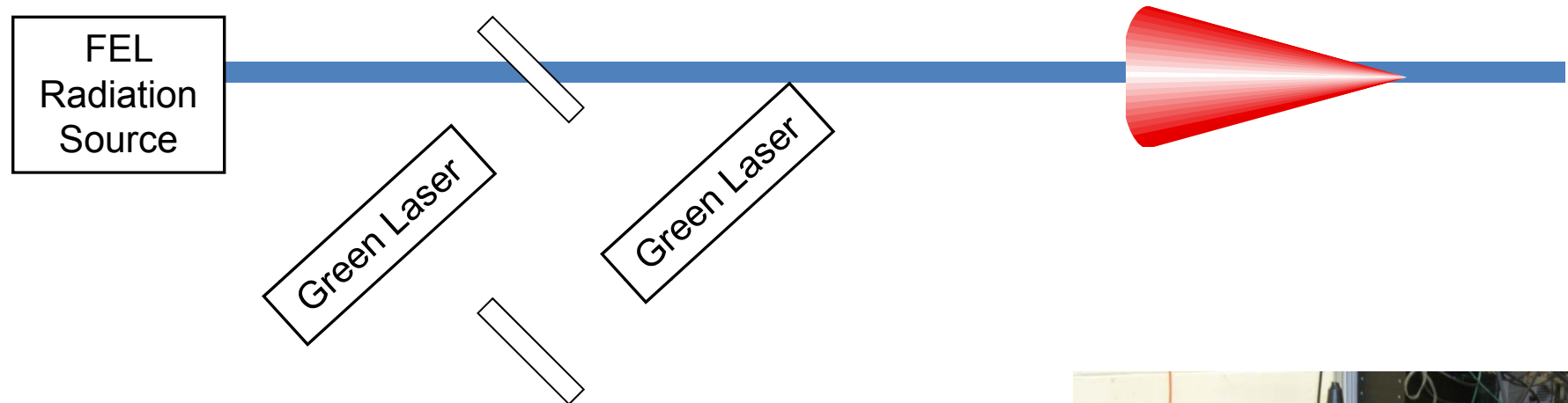
- Designed and constructed isolation boxes



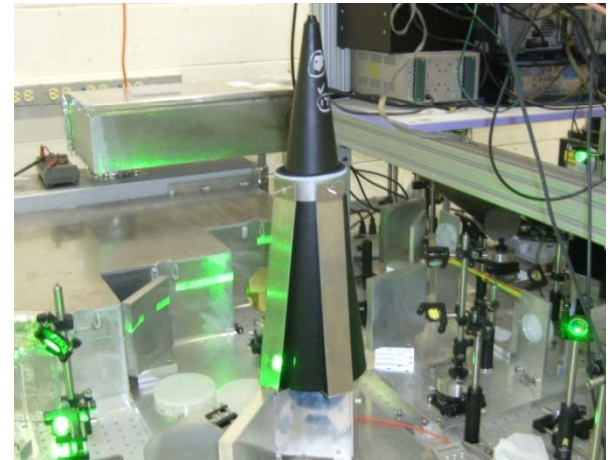
- Designed and constructed radiation-dumping apparatus (witch's hat)



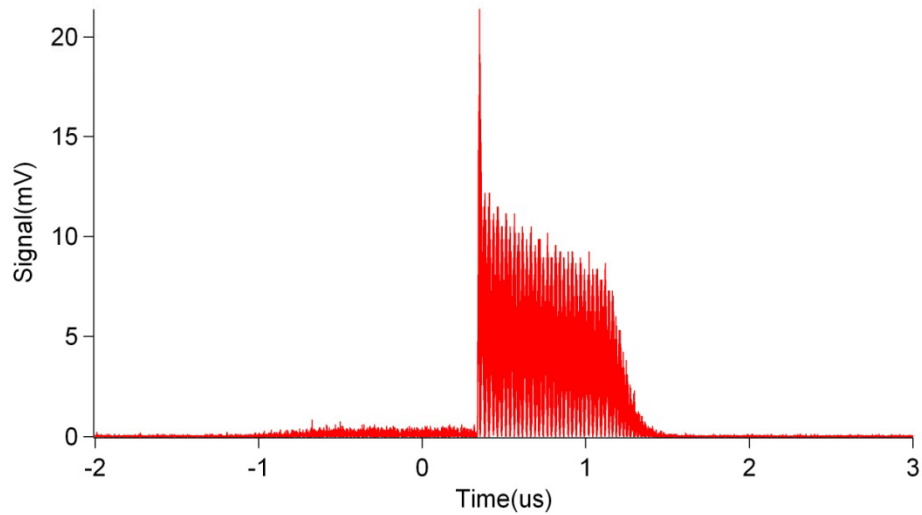
Radiation Dumping



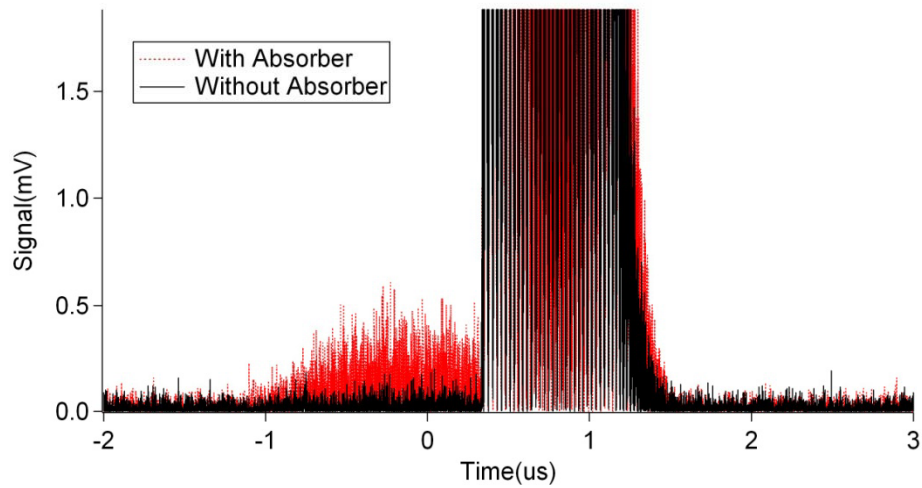
- Without hat → radiation leaks into room, detector
- Hat installed → radiation is absorbed, reduces background noise



Effect of Radiation Dumping: First On Switch



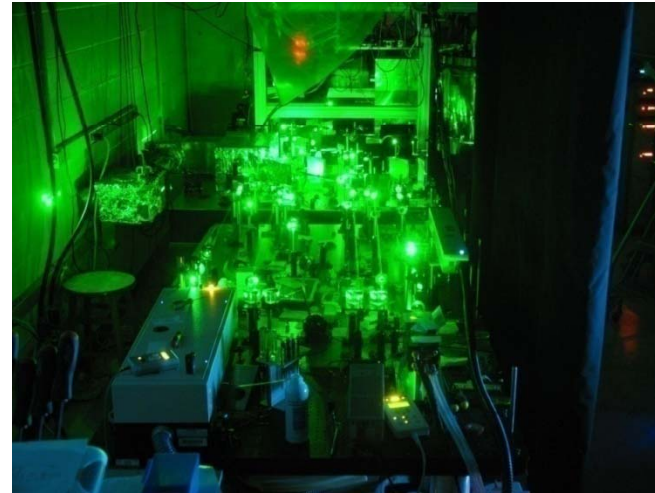
- Sufficiently minimizes background noise



Conclusions and Outlook

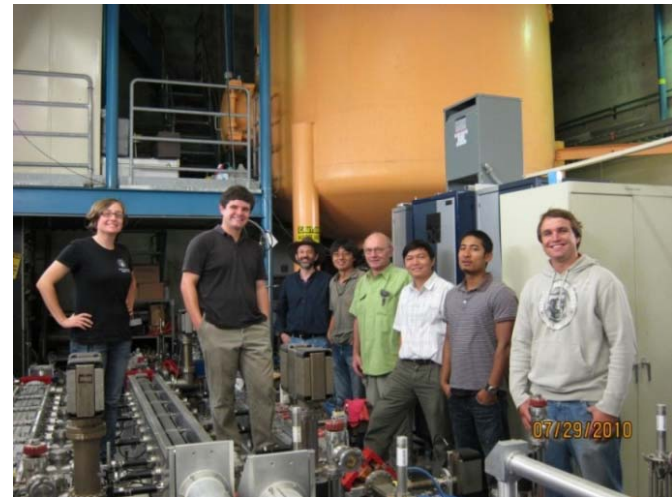
Improvements This Summer:

- Reduced background noise
- Improved green laser accuracy
- Created diagrams for analysis



What's Next

- Implement switch
- Increase pulse length variability
- Run two-pulse EPR experiment to show improvements



Thank you!

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