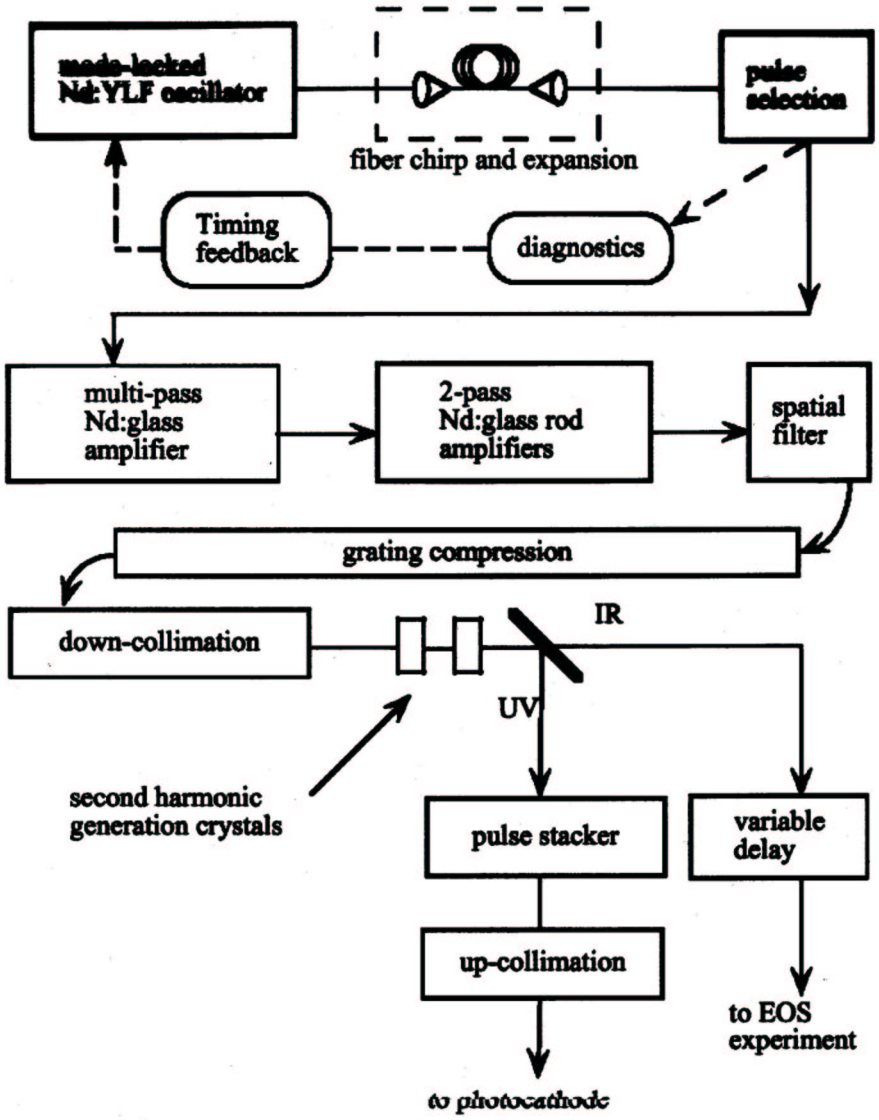
Overview

- Need improved laser intensity.
- Need improved laser stability.
- Need to run laser continuously.
- Need adequate spares for laser.
- Need scheduled routine maintenance of laser.
- Need continuous monitoring and data logging of laser.
- Need motorized laser tuning for Photoinjector users.

F N P L L a s e r P e r f o r m a n c e



Recent Major Laser Failures

- January 2001 to April 2001
  - **Oscillator** rod face damaged -LCW leak at rod
  - Pulse Picker has low extinction ratio -**Pockels Cell** bad
  - **Multi-Pass** will not lase or amplify -Cavity needs rebuilding
- May 2001
  - **Multi-Pass** cavity damaged -Burned rod and Q-Switch
- June 2001
  - Q-Switch failed slow fall time -**Pockels Cell** bad
- August 2001
  - **Oscillator** rod face damaged -Condensation from LCW
- December 2001
  - **Multi-Pass** not lighting -**Simmer** supply failed

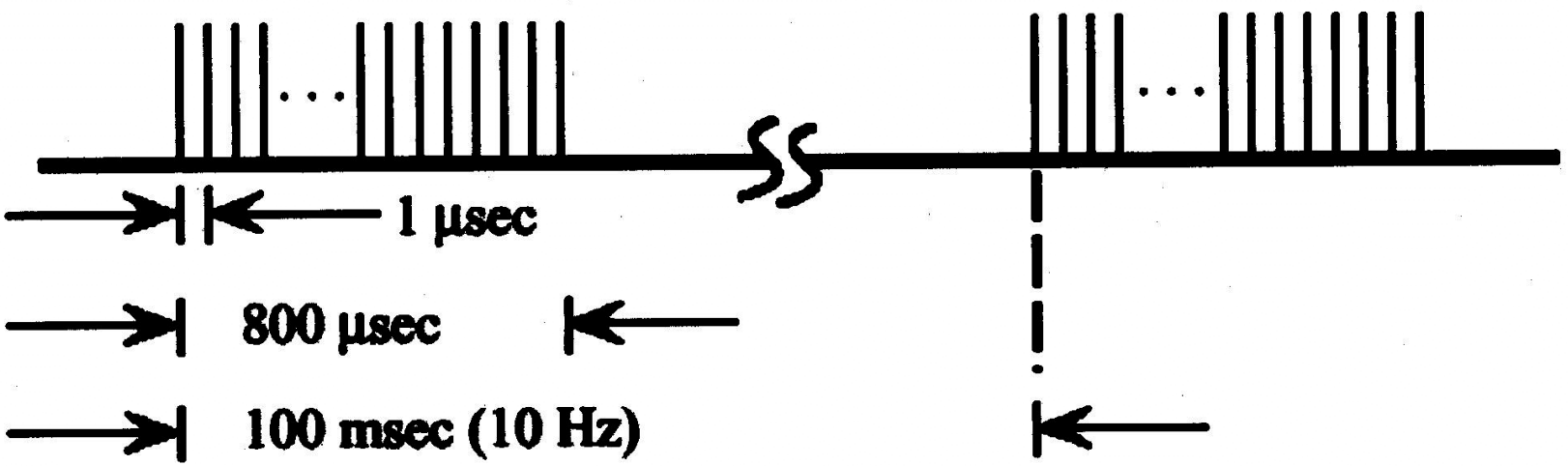
FNPL Laser Performance

- March 2002
  - Cross 1 optics damaged -Roof leak
- April 2002
  - 2-Pass 6mm head not lighting -Simmer wire broke
- May 2002
  - **Multi-Pass** not lighting -**Simmer** supply failed
- June 2002
  - Oscillator Lamp not lighting -Load cable & Broken lamp
- July 2002
  - **Multi-Pass** not lighting -**Simmer** supply failed
- August 2002
  - **Multi-Pass** PS failed -Burned rod and Q-Switch
    -HV power supply regulation

Short Term Laser Stability Issues

-BEAM TIMING-

- **Micro**: Pulse to pulse instability (10^{-6} sec).
  - Chop off first pulses in train (~ EASY)
  - Balance amplifier outputs (EASY)
  - Implement feed back systems
  - Acquire a long memory scope ($$$)
- **Macro**: Shot to shot instability (10^{-0} sec).
  - Implement feed forward systems
  - Reduce air currents (EASY)
- **Drift**: Room temperature fluctuations (10^{+4} sec).
  - Lock AC compressor on (~ EASY)
  - Phase controller on electric reheat (~ EASY)
  - Omega temperature controller (~ EASY)



Laser timing.

-BEAM QUALITY-

- Intensity low.
  - Reduce optical path length
  - Reduce optical elements
  - Increase Amplifiers power
  - Improve alignment (EASY)
- Spatial profile poor.
  - Tune higher modes out of Amplifiers
  - Need Spatial Filter after each amp stage
  - Install cameras for monitoring (EASY)
- Air currents
  - Install table tents with curtains (EASY)
  - Install air tubes (EASY)
  - Install enclosures (EASY)
- Optics movements
  - Procure better optic mounts (EASY)
  - Stabilize room temperature (EASY)

Short Term Equipment Stability Issues

- Oscillator
  - Room temperature fluctuations
- Multi-Pass
  - Thermal lensing
  - Internal cavity temperature fluctuations and micro air currents
- Two-Pass
  - Thermal lensing
  - Unbalanced rod sizes
  - Air currents
- Spatial Filter
  - Up stream beam movement
- Gratings
  - Transmission efficiency
  - Air currents

FNPL Laser Performance

- Crystals
  - Doubling efficiency low
  - Crystal temperature fluctuations
  - Poorly collimated beams
    - Third lens between crystals
- Pulse Stacker
  - Up stream beam movement
- Transport vacuum pipe
  - Transmission efficiency
  - Relay imaging of UV to Cathode
- Cathode UV spot
  - Size
  - Position
  - Intensity

Summary

- Need improved laser stability.
- Need improved laser stability.
- Need to run laser continuously.
- Need adequate spares for laser.
- Need scheduled routine maintenance of laser.
- Need continuous monitoring and data logging of laser.
- Need to motorize laser tuning for users.

In order to accomplish this:

- Need 3 people for a month for initial stability improvements.
- Need 75% larger laser operating budget than FY2002. ($65K).

Feedback scheme from paper by Ingo Will:

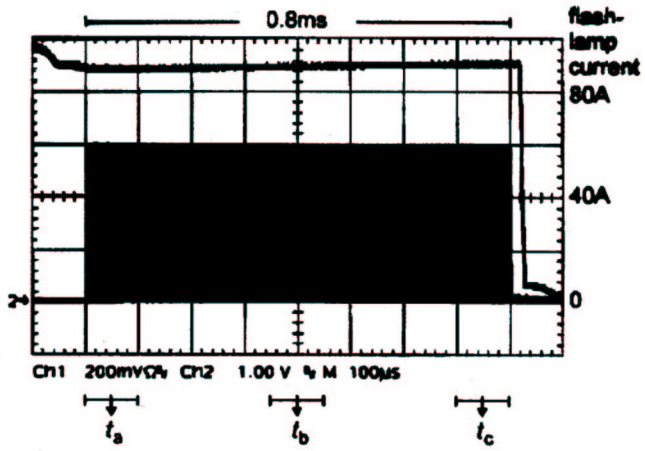


Fig. 8. Pulse train measured at the output of the laser system, when both the shot-to-shot stabilizer and the slope compensation system were active. The upper trace shows the instantaneous flashlamp current.

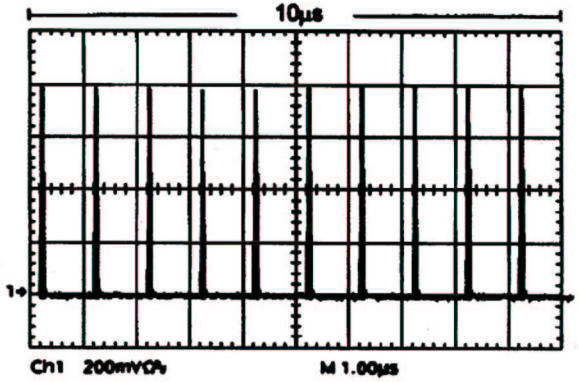


Fig. 9. Record showing the individual micropulses with a 1.0-MHz repetition rate (zoomed into Fig. 8 with increased temporal resolution).