

*LEAF*



*International Symposium on Ultrafast  
Accelerators for Pulse Radiolysis  
Technical Roundtable*

June 27, 2004

Chemistry Department

Brookhaven National Laboratory

Office of Basic Energy Sciences  
U.S. Department of Energy

Advanced Energy Systems



# *Technical Roundtable Topics*



- 10:40 Photocathodes (types, efficiency, lifetime, behavior, saturation, special considerations)
- 11:10 Pulse width measurement and control (real-time, non-destructive)
- 11:40 Temperature control for systems that are frequently cycling on and off, power dissipation
  
- 1:00 Real-time automated control of laser and accelerator performance
- 1:30 Detection schemes for T3 radiolysis
- 2:00 Other topics suggested by participants

# *Photocathodes*



## Types and efficiency

Mg is most widely used in this community - efficiency marginal

Cs<sub>2</sub>Te proving to be reliable and sufficiently robust - good efficiency

Potential new development - diamond coating

## Lifetime

Cathodes are lasting a long time (> year)

## Behavior

Mg: dynamic effect of UV on quantum yield

## Saturation

Importance of uniform illumination for highest charge

## Other considerations

# *Pulse width measurement and control*

## Non-real-time measurement

Rise time of prompt optical signal

Visible: water      NIR: acetonitrile

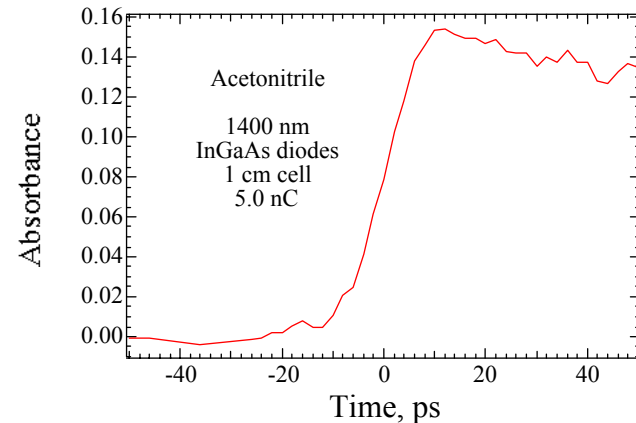
## Real-time measurement

Relative RF power radiated by beam  
at two frequencies (Waseda, others)

Optical Transition Radiation (OTR) from “back” of first pulse-probe  
mirror

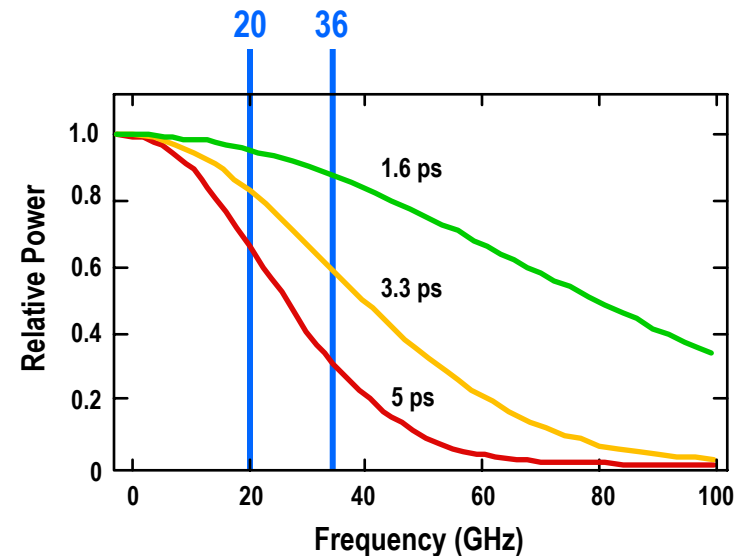
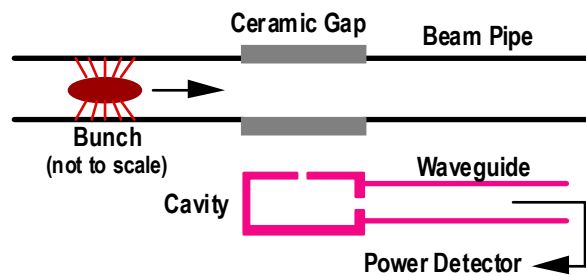
Requires fs streak camera, bandpass filter, reflective transport optics

Effect of electron beam field on crystal birefringence



# Pulse Width Measurement

## Measurement of Beam-Induced Microwave Power at Two Frequencies

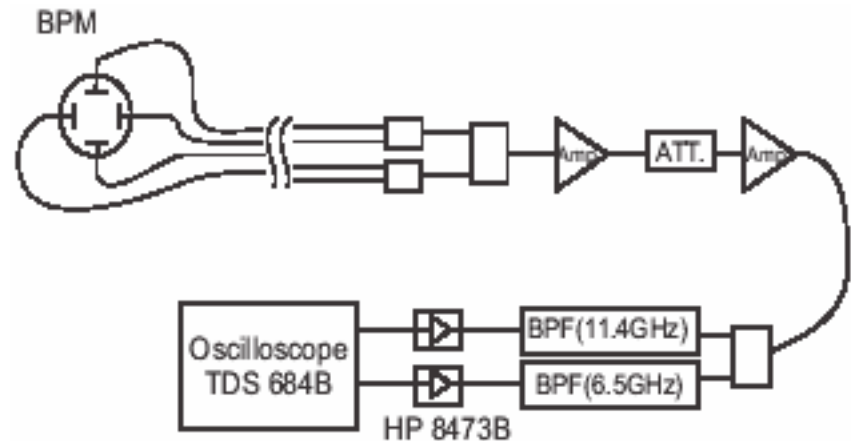


E. Babenko, R. K. Jobe, D. McCormick, and J. T. Seeman SLAC-PUB-6203 (PAC 93)

Proceedings of EPAC 2002, Paris, France

### CHARACTERIZATION OF ELECTRON BEAM FROM A Mg PHOTO-CATHODE RF GUN SYSTEM \*

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EPAC 2002 TUPRI074

# *Temperature control for systems that are frequently cycling on and off, power dissipation*



Experience of various facilities

- Operational modes

- Sophistication of temperature control

  - Gun, klystron, waveguide, loads for reflected RF power

Work-arounds

- Remote sample handling

# *Real-time automated control of laser and accelerator performance*



- Beam Charge/pulse
- Electron pulse width
- Probe laser - electron bunch synchronization
- Laser (UV) - Accelerator RF phase
- Laser Pulse Energy - UV
- Regenerative amplifier pulse train buildup
- YAG pump laser power (mode)
- RF power
- RF breakdown

# *T<sup>3</sup> Radiolysis: Detection Schemes, Other Issues*



AAC: Much progress in T<sup>3</sup> systems as electron beam sources.  
Valuable as ultrafast X-ray sources.

## Detection Schemes for T<sup>3</sup> Pulse Radiolysis

### Transient Absorption

Detection geometry

Velocity distribution

Transverse beam profile/dose distribution