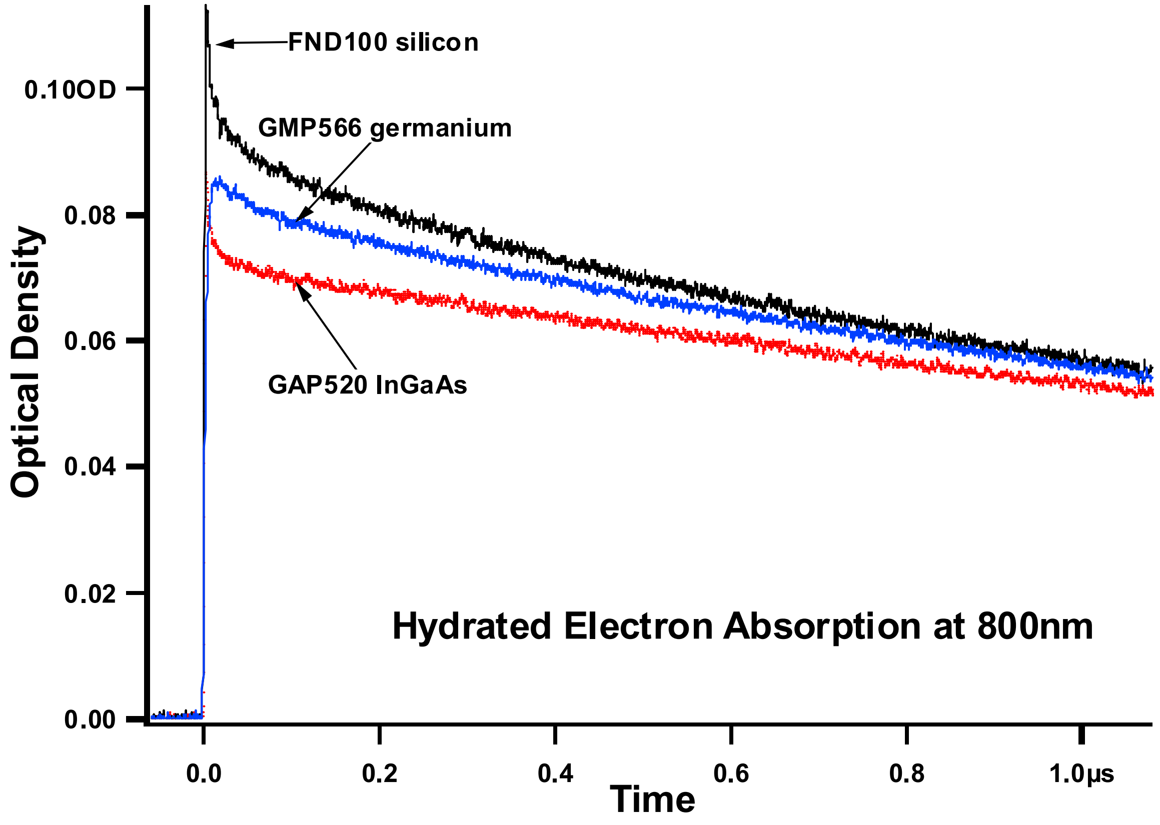
Spur Kinetics in Water Using the Argonne Linac

Spur Decay of the Solvated Electron in Picosecond Radiolysis Measured with Time-Correlated Absorption Spectroscopy†
David M. Bartels*, Andrew R. Cook, Mohan Mudaliar and Charles D. Jonah,
Journal of Physical Chemistry A, 2000. **104**(8): p. 1686-1691.

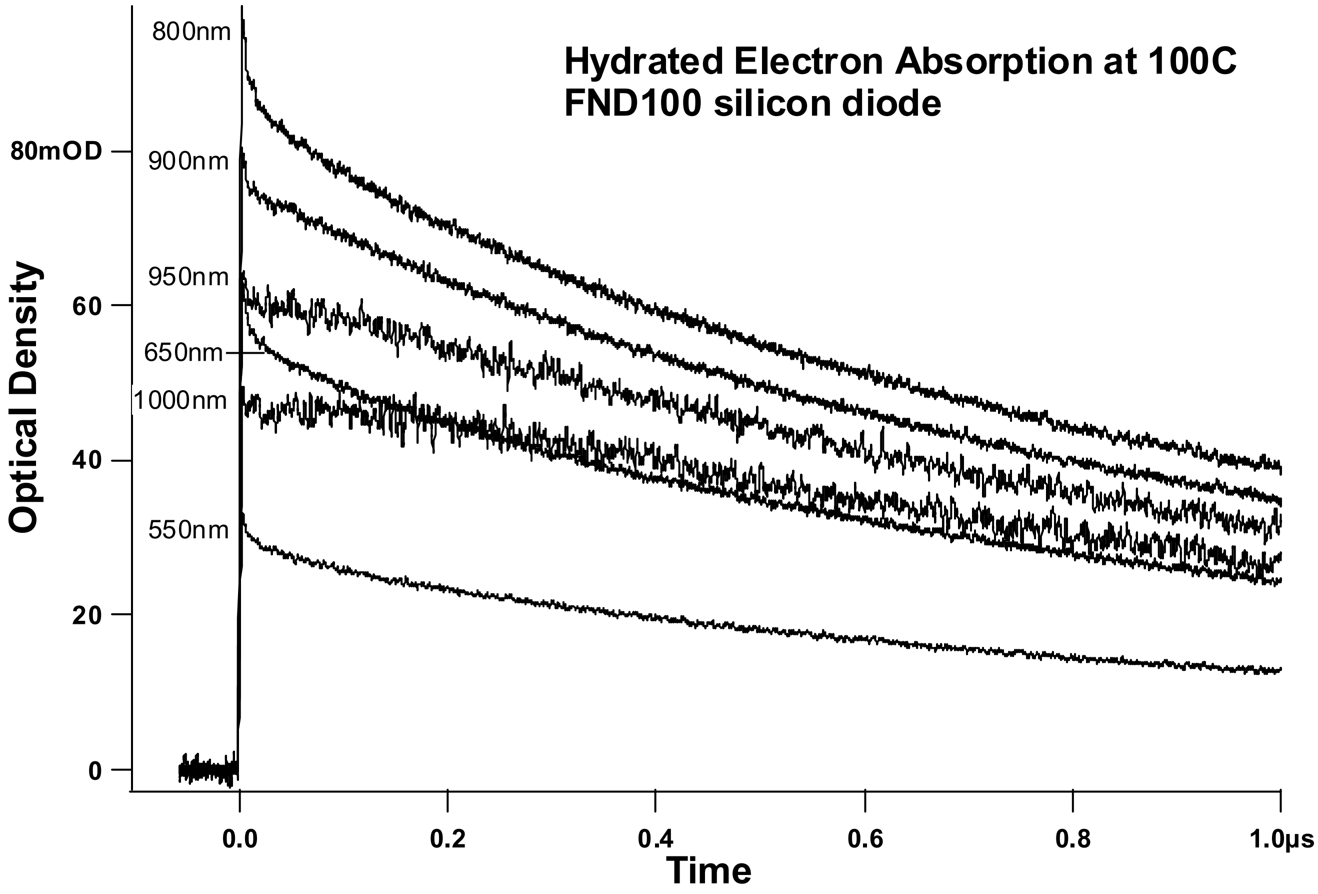
Spur Decay Kinetics of the Solvated Electron in Heavy Water Radiolysis†
David M. Bartels*, David Gosztola, and Charles D. Jonah,
Journal of Physical Chemistry A, 2001. **105**(34): p. 8069-8072.

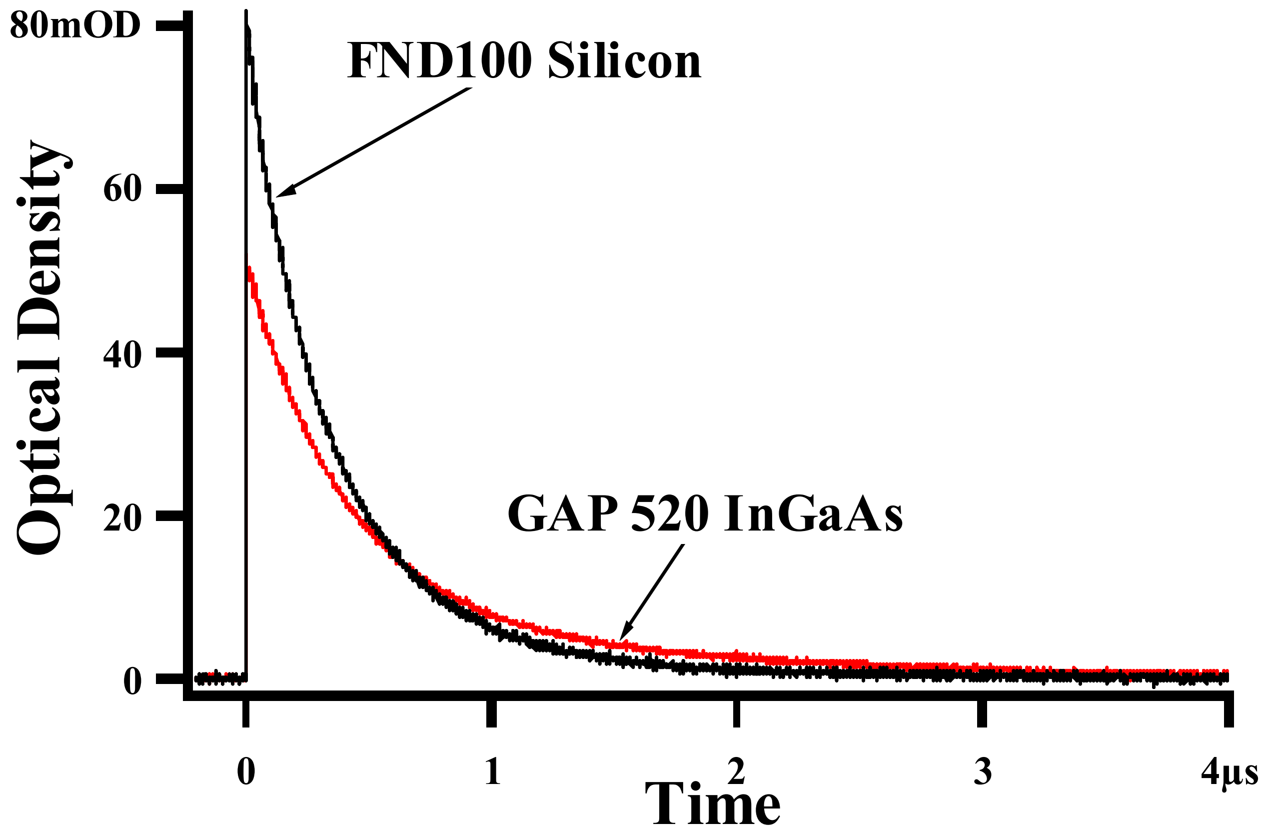
Also Jason Cline, Tim Marin, Sergey Chemerisov

Detector Secondary Response in Transient Absorption



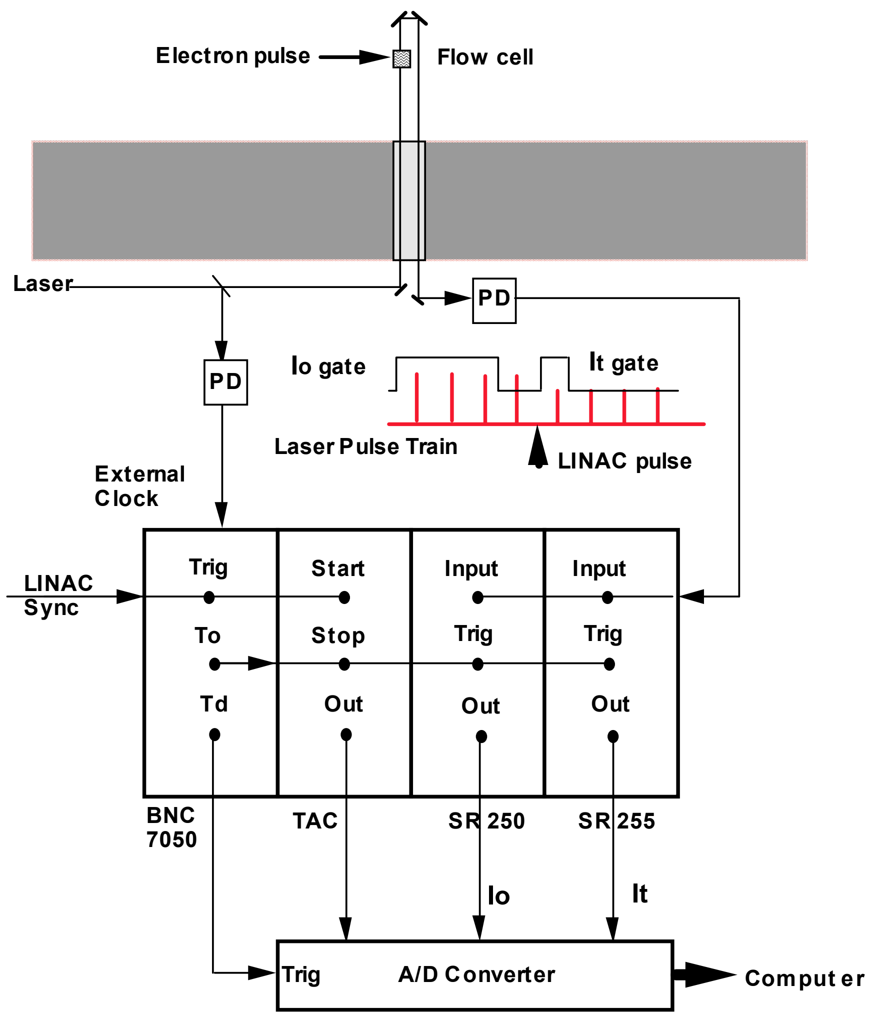
Secondary Response is Wavelength Dependent



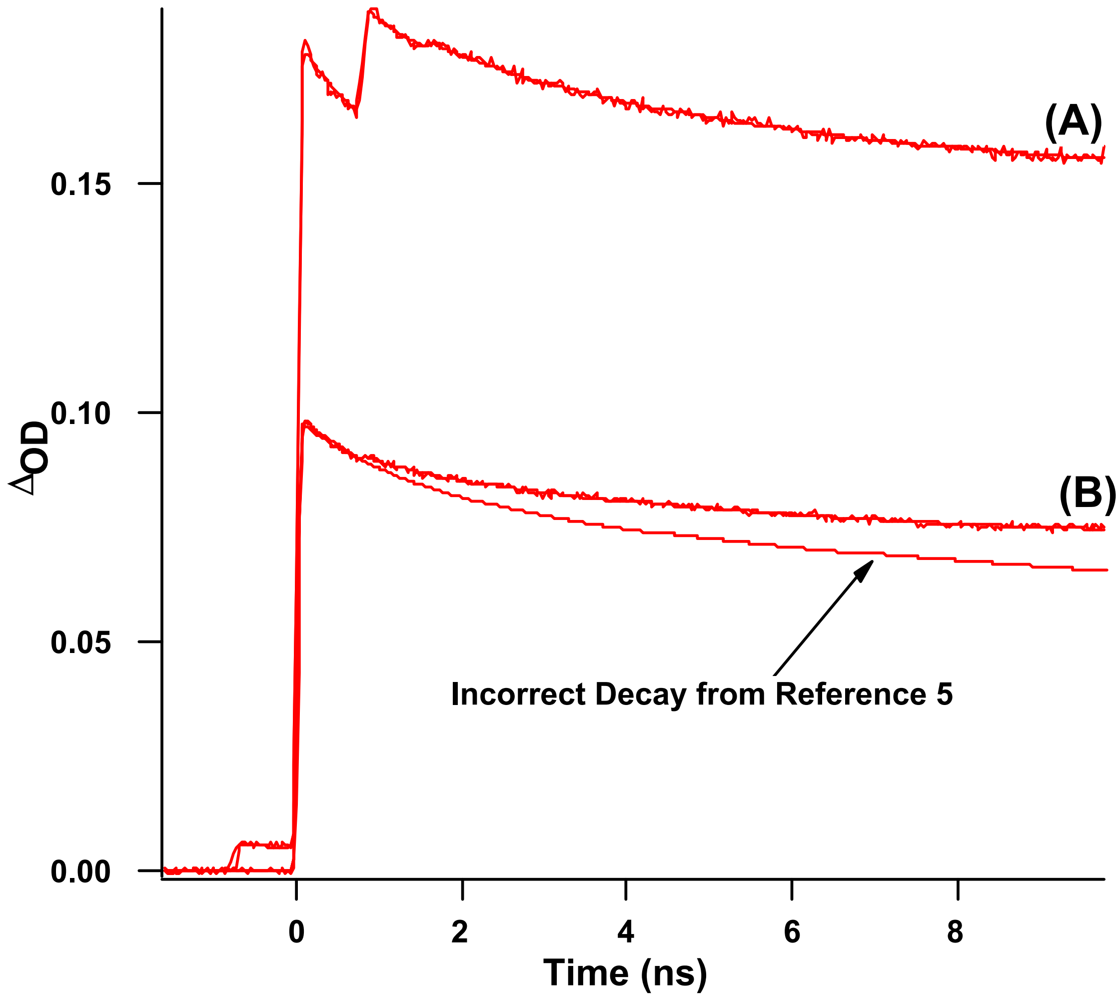


Secondary Response is not Saturation–
Transmittance is Conserved!

Time-Correlated Transient Absorption Spectroscopy

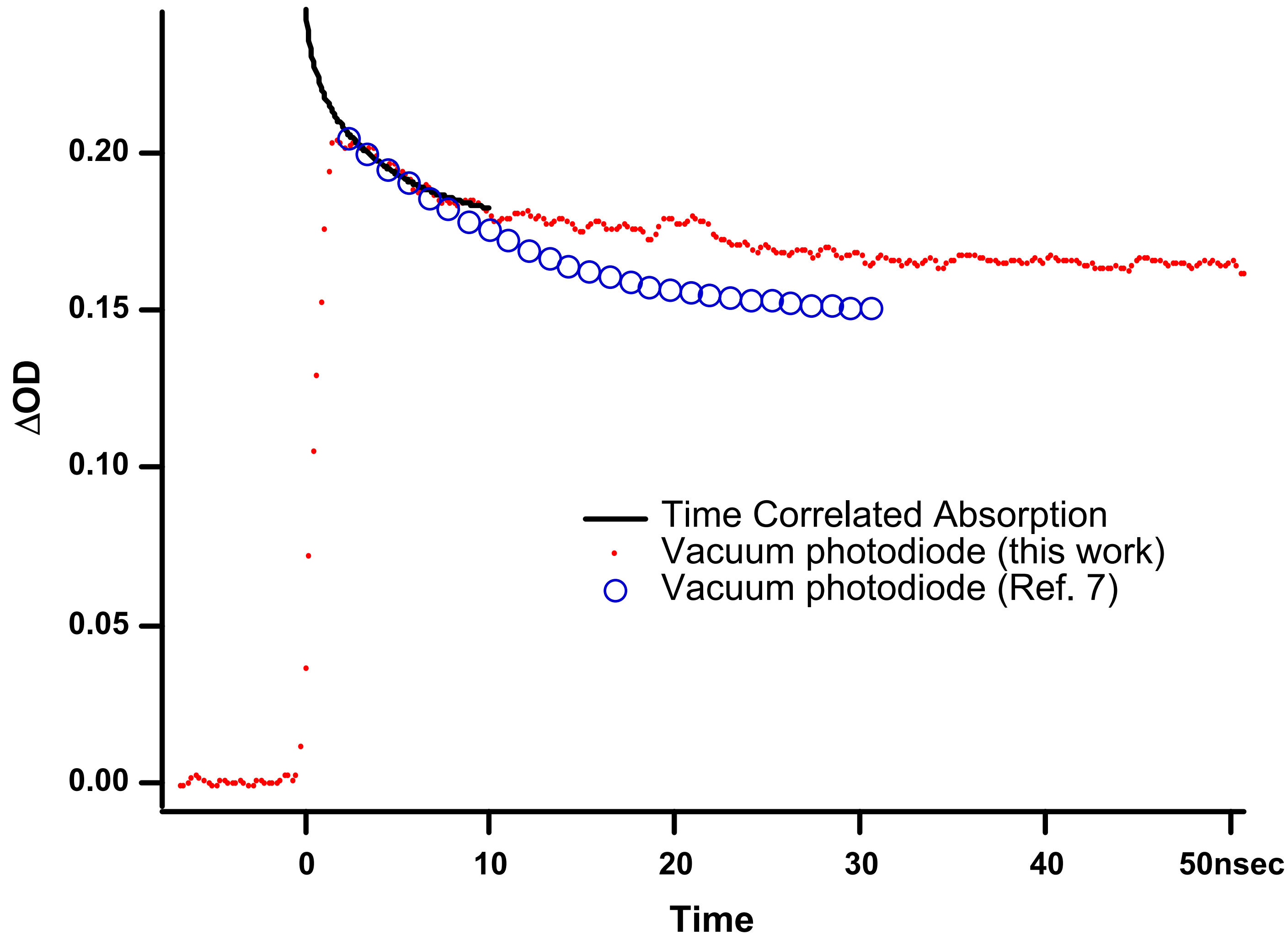


Typical Data

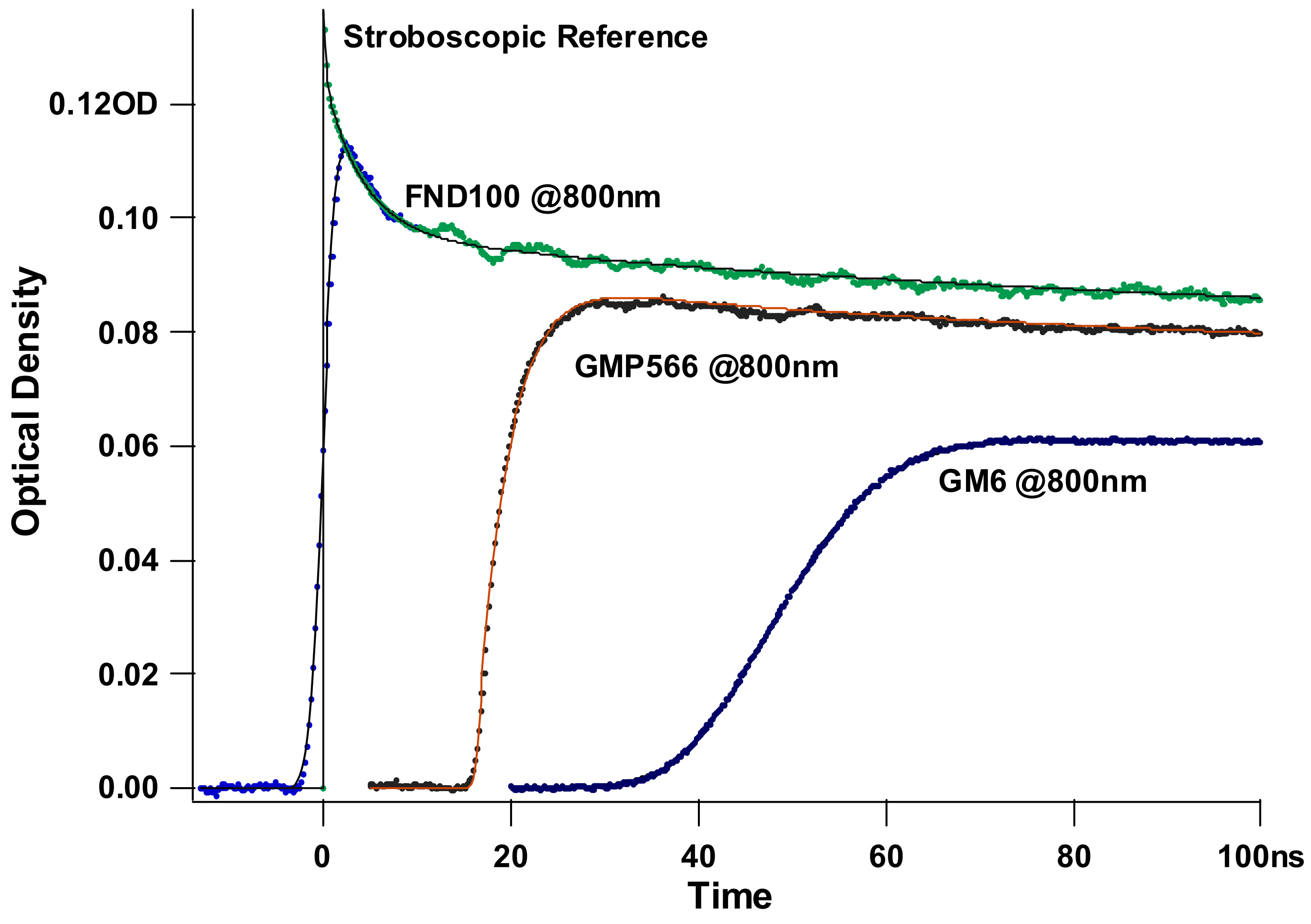


440 channels at 24.56ps
Ca. 30 shots/channel @ 60Hz
Ca. 4 minutes to acquire

Comparison with Digitizer Data



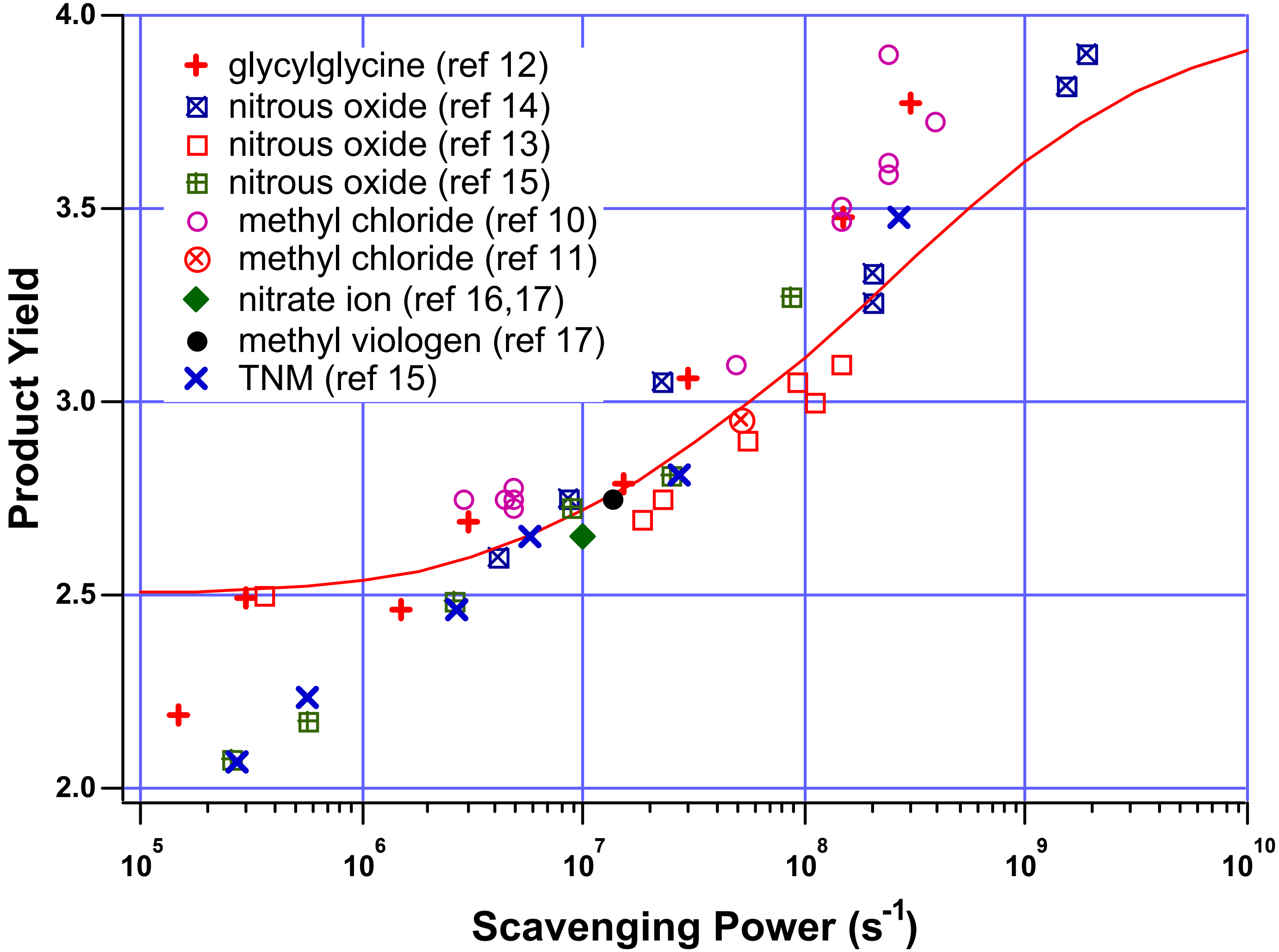
Calibration of Detector Response



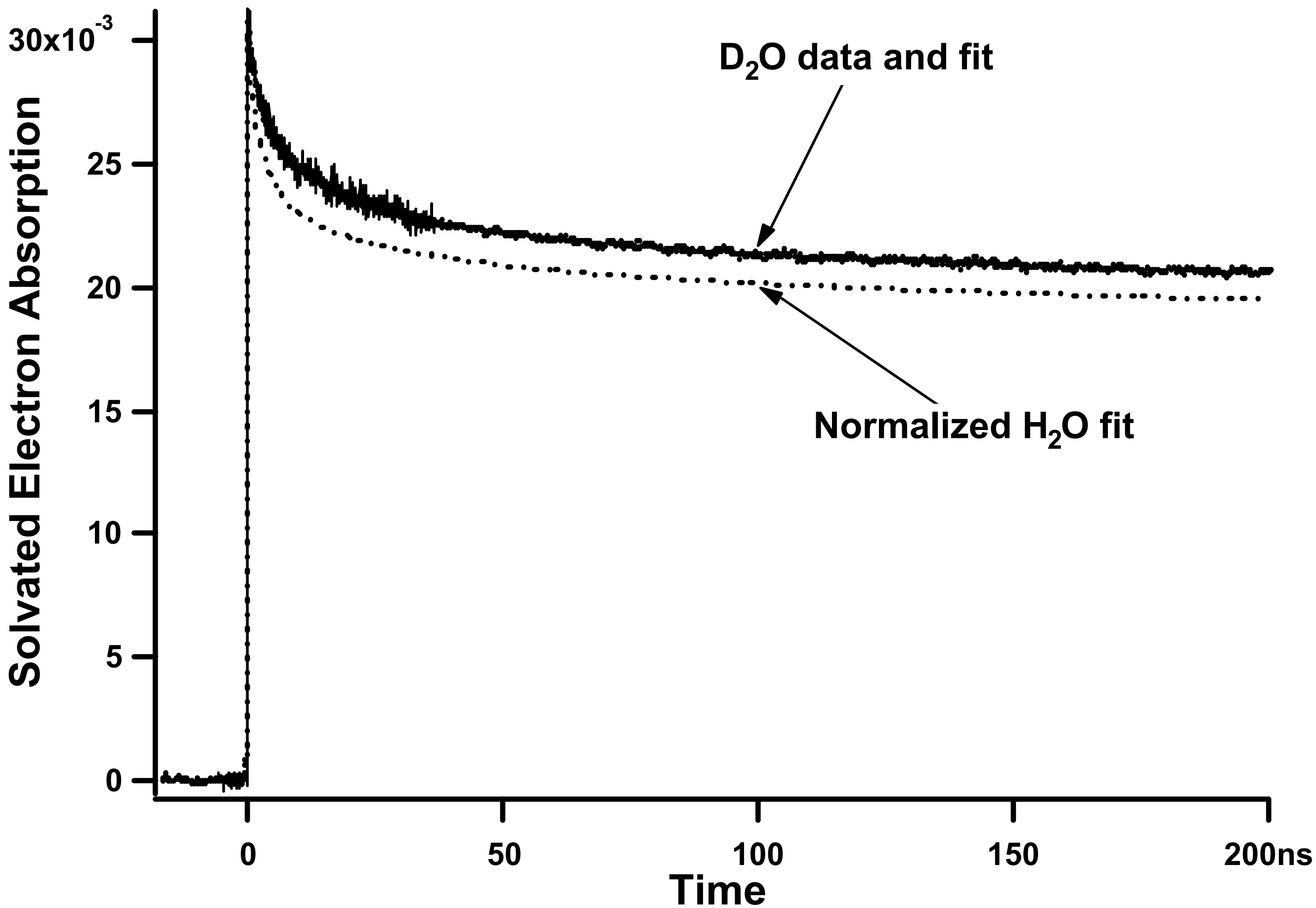
Fit to the overall shape at 25C

- $G_o(t)/G_{inf}$ = 1 + .090 exp(-t/139ns) +
  .128 exp(-t/24.4ns) +
  .255 exp(-t/3.51ns) +
  .118 exp(-t/0.480ns)

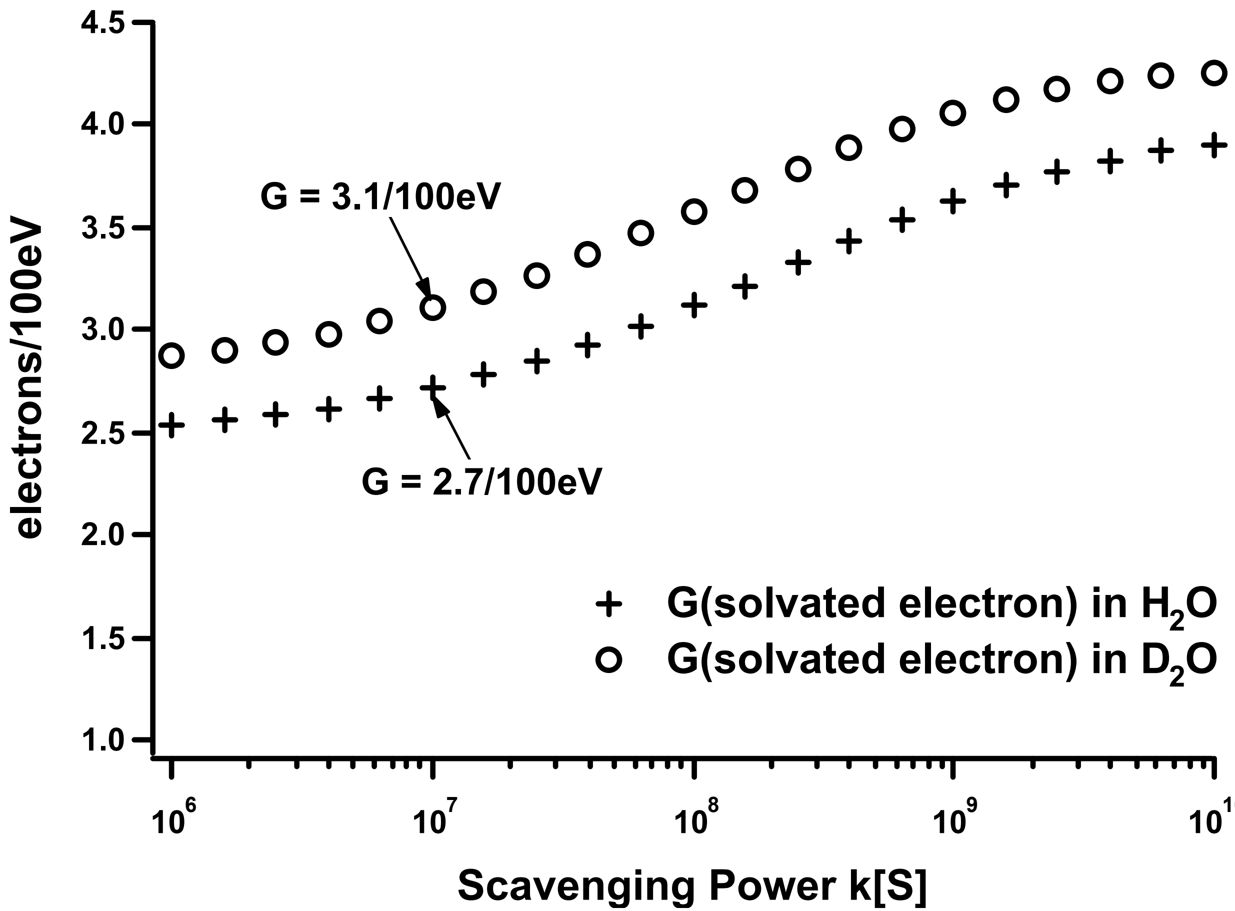
Normalization to Scavenging Data



Isotope Effect



Isotope Effect on Yields



Summary

In general we cannot assume single exponential response of optical detectors

Hydrated Electron Absorption is a Standard in Electron Radiolysis—the shape of the absorption should be known absolutely from the earliest times possible

Stability of the Argonne picosecond linac facilitates this determination via the time-correlated absorption technique