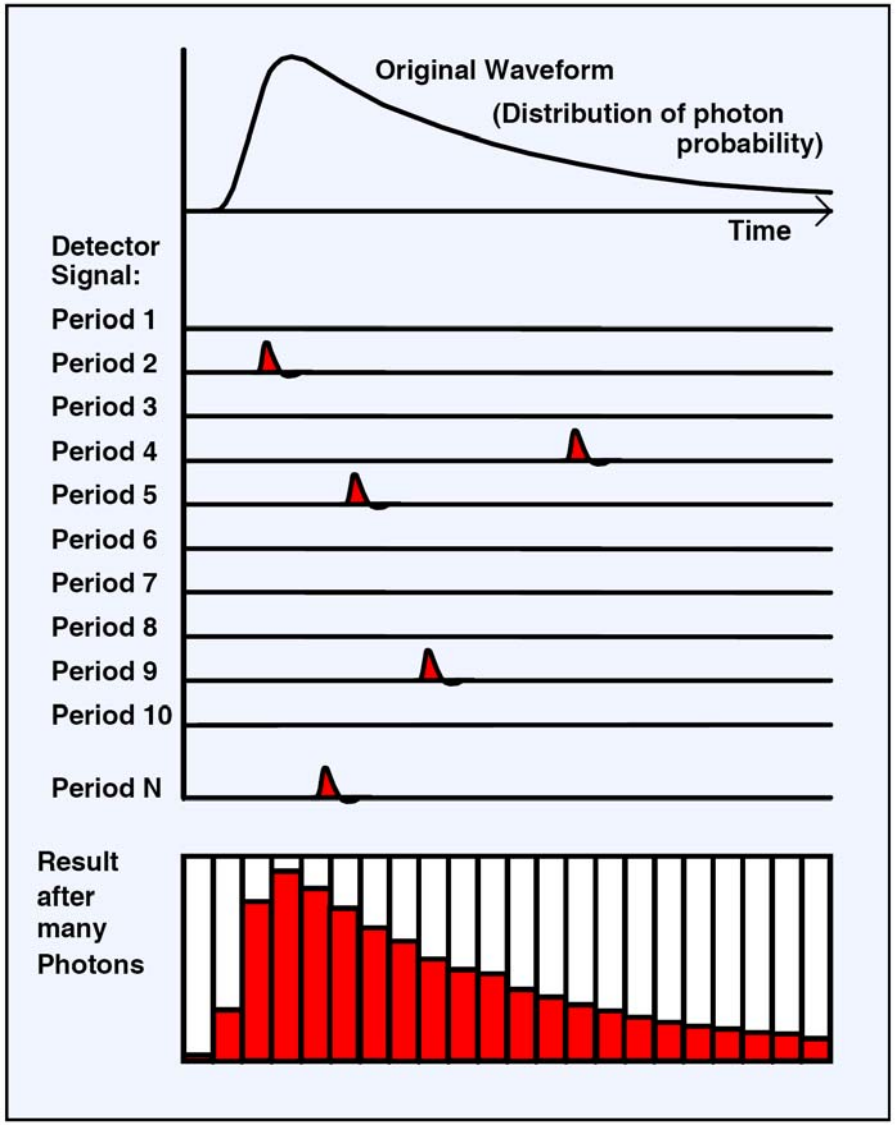
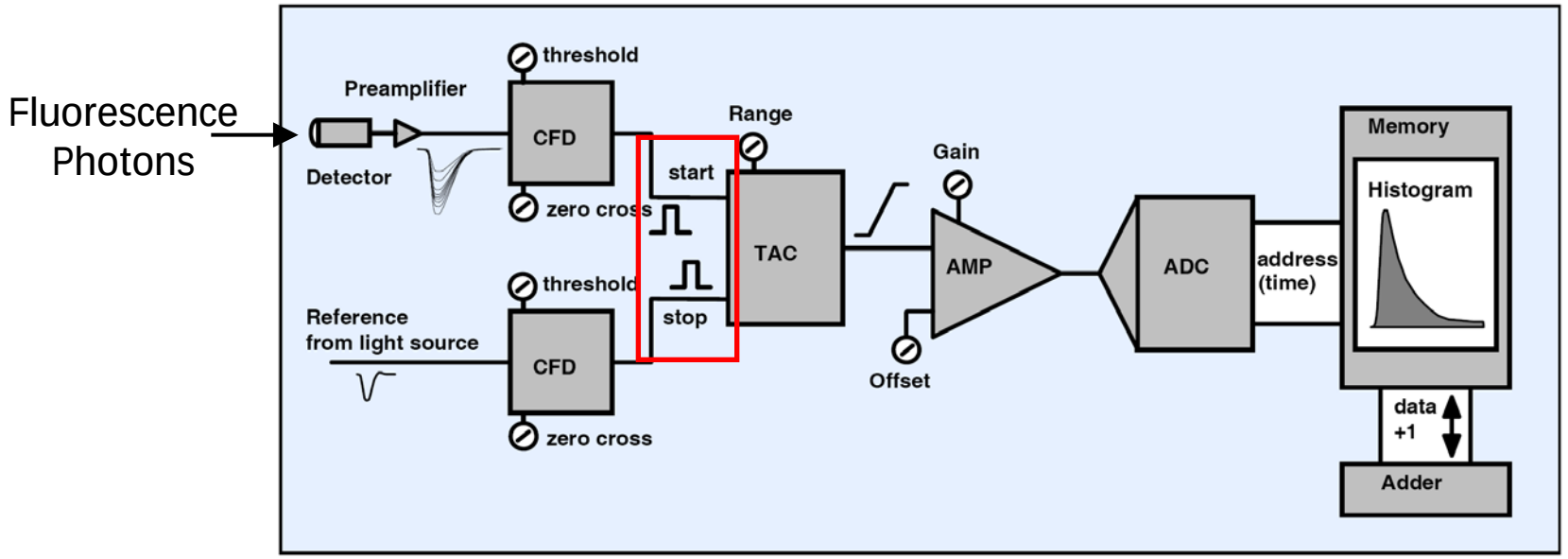
Measuring a Lifetime Decay



Becker, W. Bh TCSPC Handbook 2nd ed. 2006

Reverse Mode



Delayed Reverse Mode

Excitation pulse delayed so that it is used as the stop pulse

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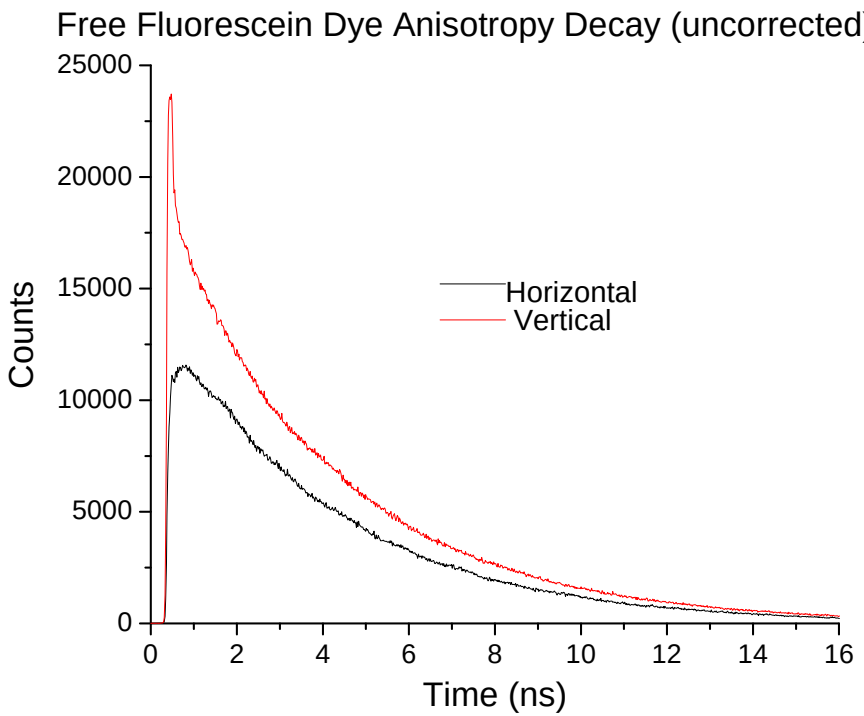
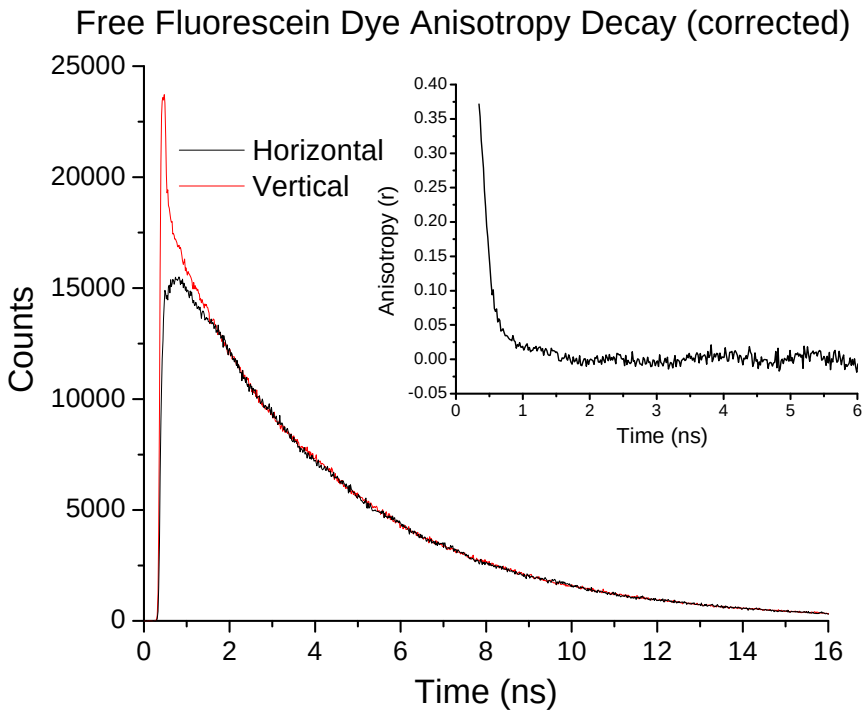
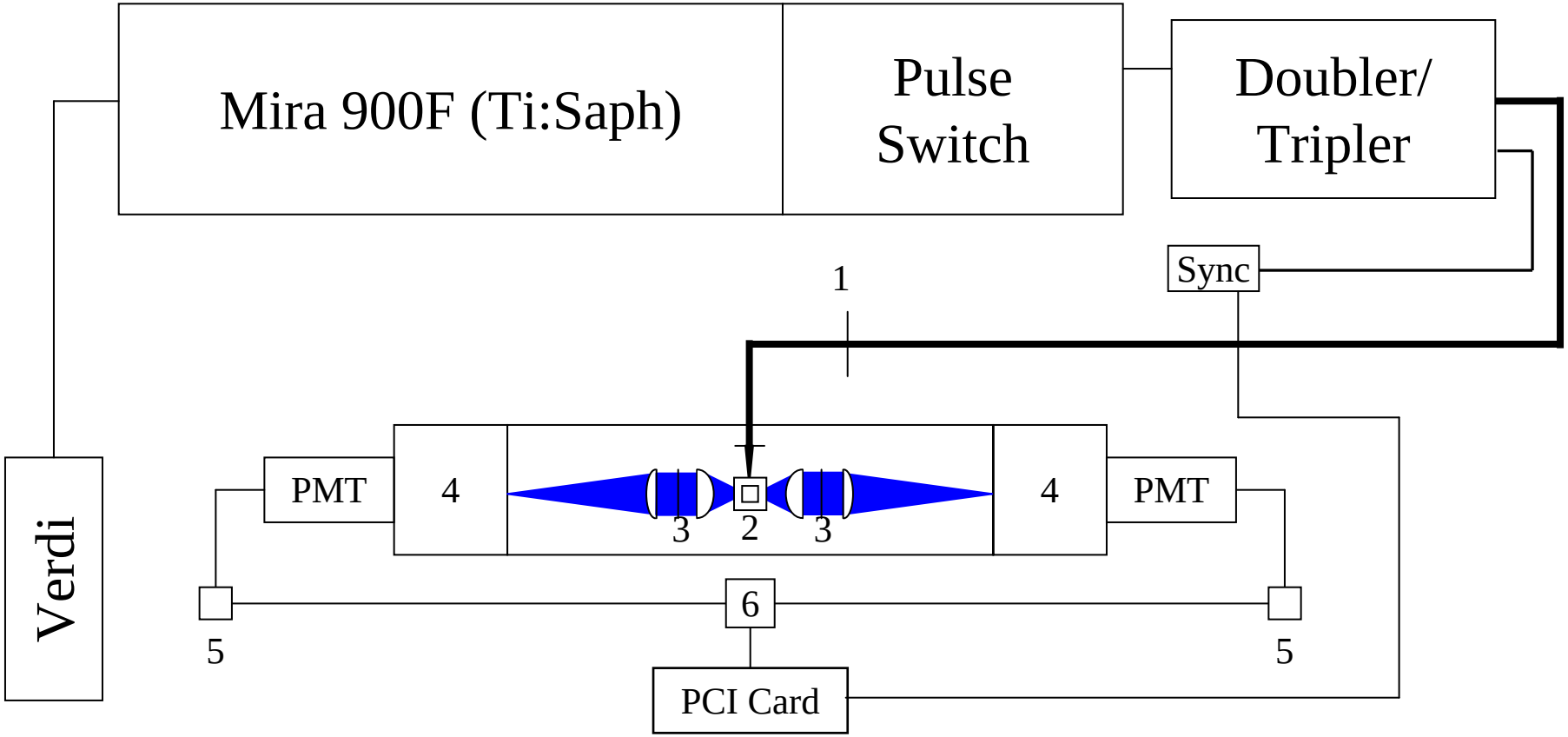
Measuring Anisotropy

- Use vertically polarized light for excitation
- Collect emission at both vertical and horizontal polarizations (0° and 90° relative to the excitation beam)
- Correct the two channels (g-factor) $r(t) = \frac{g \cdot I_V(t) - I_H(t)}{g \cdot I_V(t) + 2I_H(t)}$





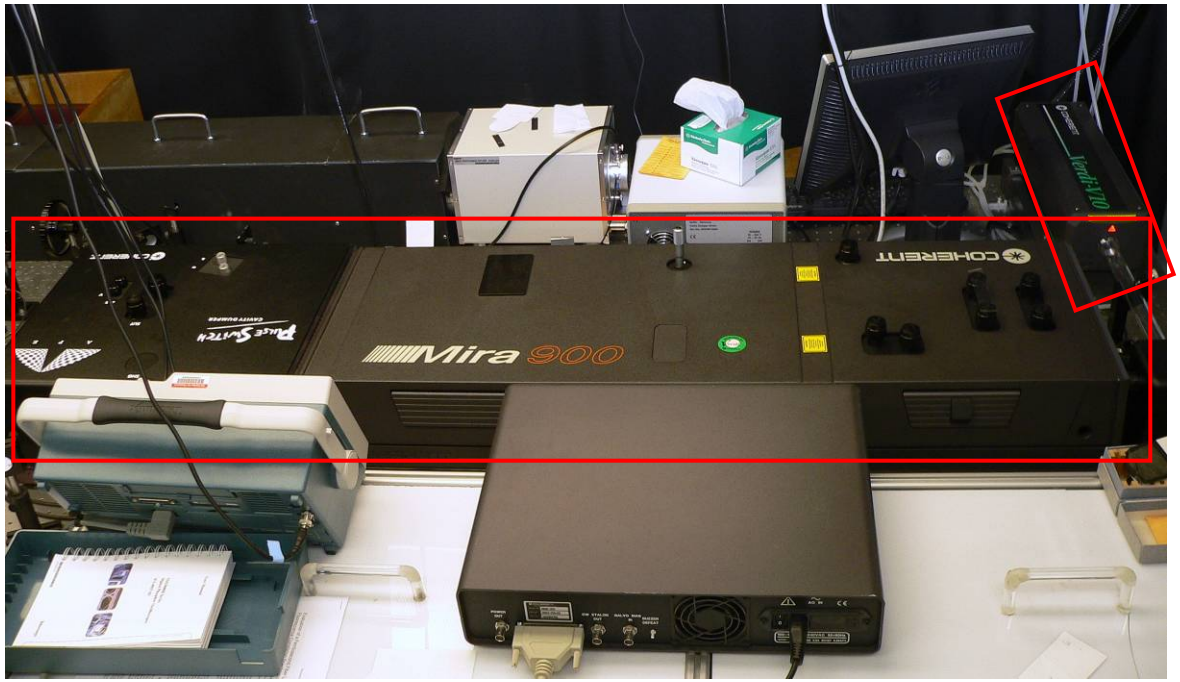
T-format Block Diagram



1 – Variable Neutral Density Filter
2 – Sample Holder
3 – Emission Linear Polarizers
4 – Monochrometers
5 – Pre-amps with Overload Protection
6 – Router

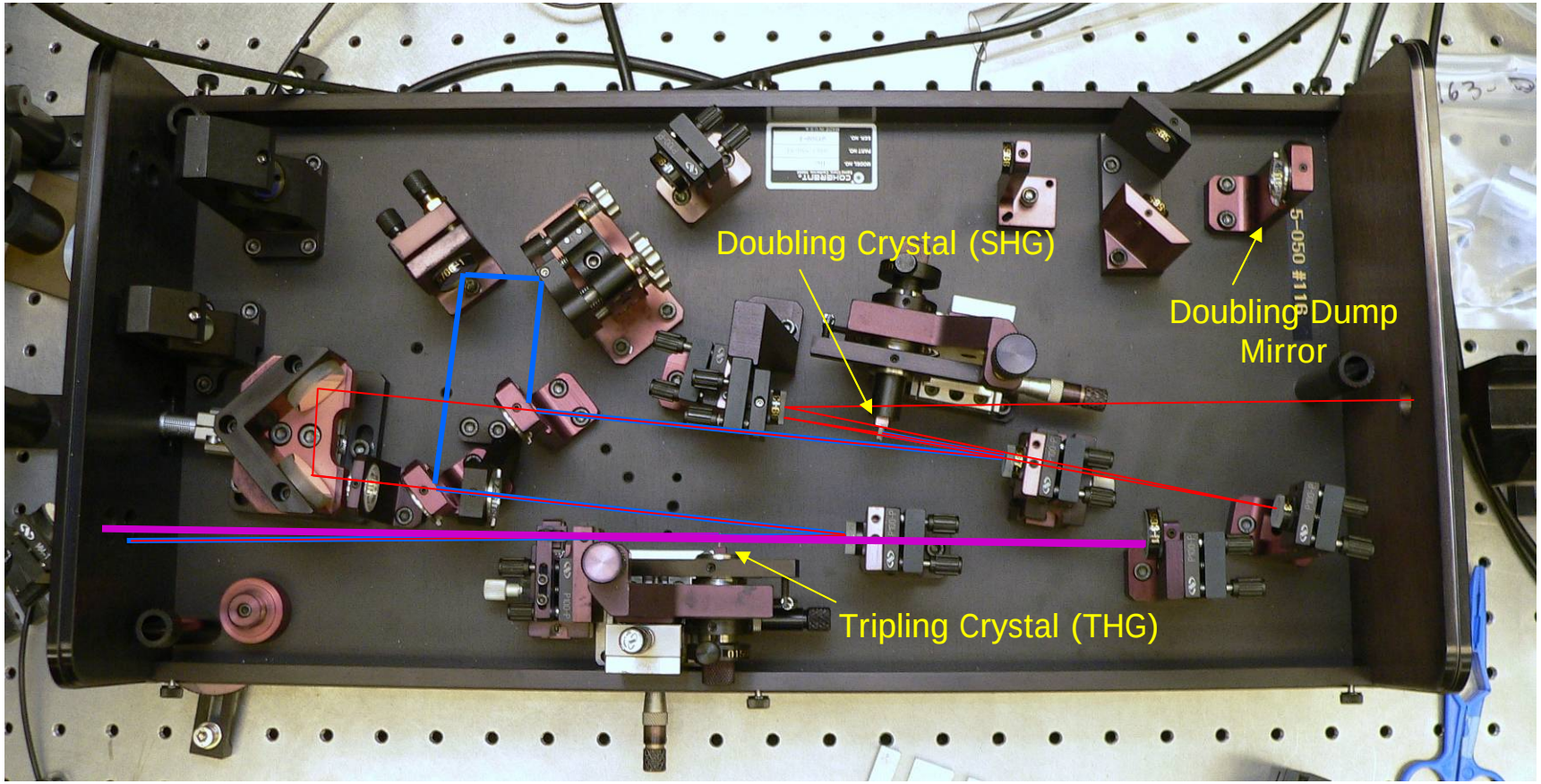
Excitation Source

- Coherent MIRA with Pulse Switch option
  - Pumped by a Verdi 10W diode pumped, frequency doubled Nd:Vanadate (Nd:YVO_4)
  - Wavelength range (nm) 740-980; 370-490 (SHG); 247-327 (THG)
    - May be possible to excite at 500-600nm using photonic crystal fiber
  - Repetition Rate 10MHz-1MHz and slower

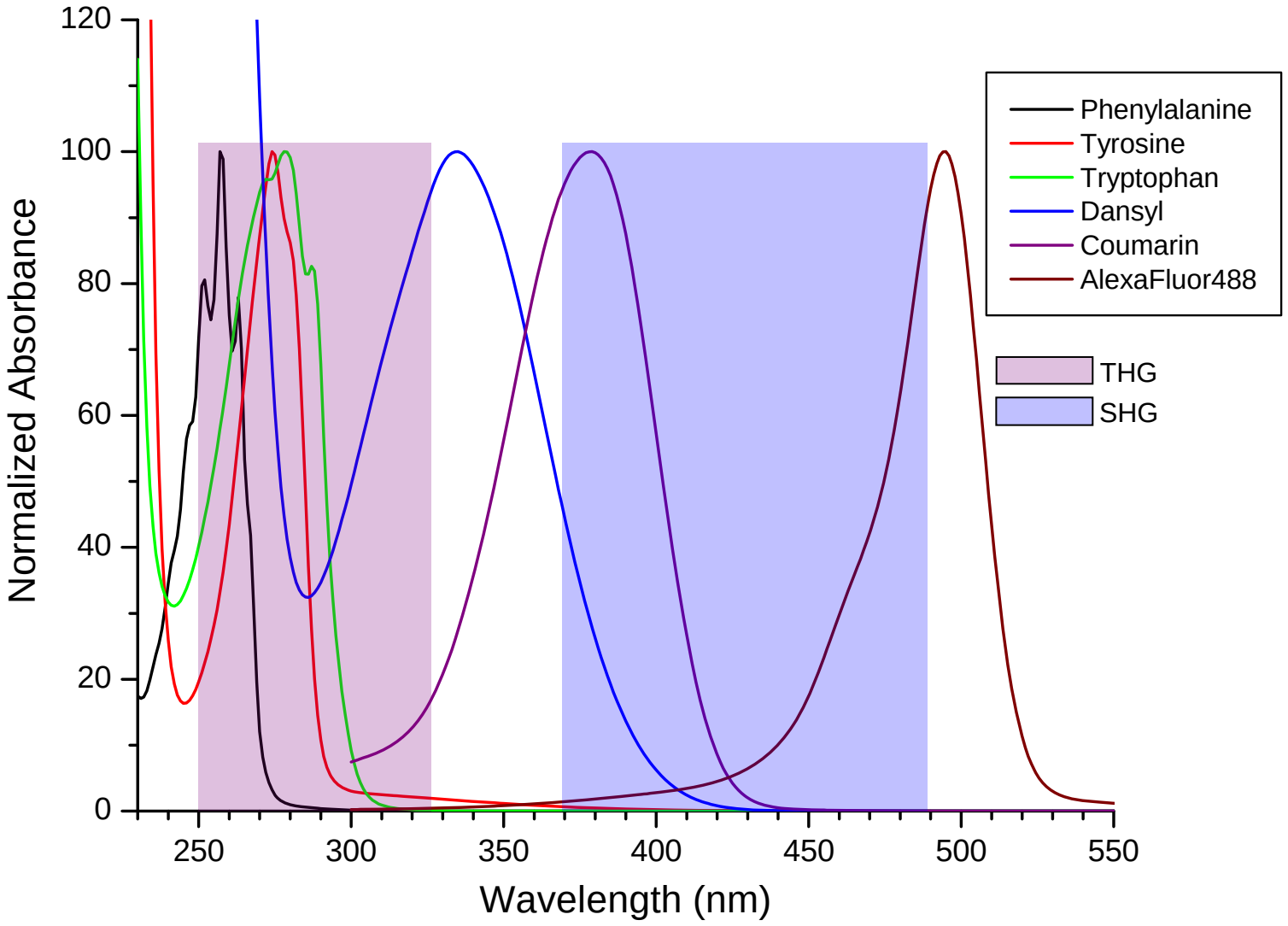


Excitation Source

- Frequency doubler/tripler Model 5-050 (Inrad Inc.)
  - Tripling arrangement shown in picture

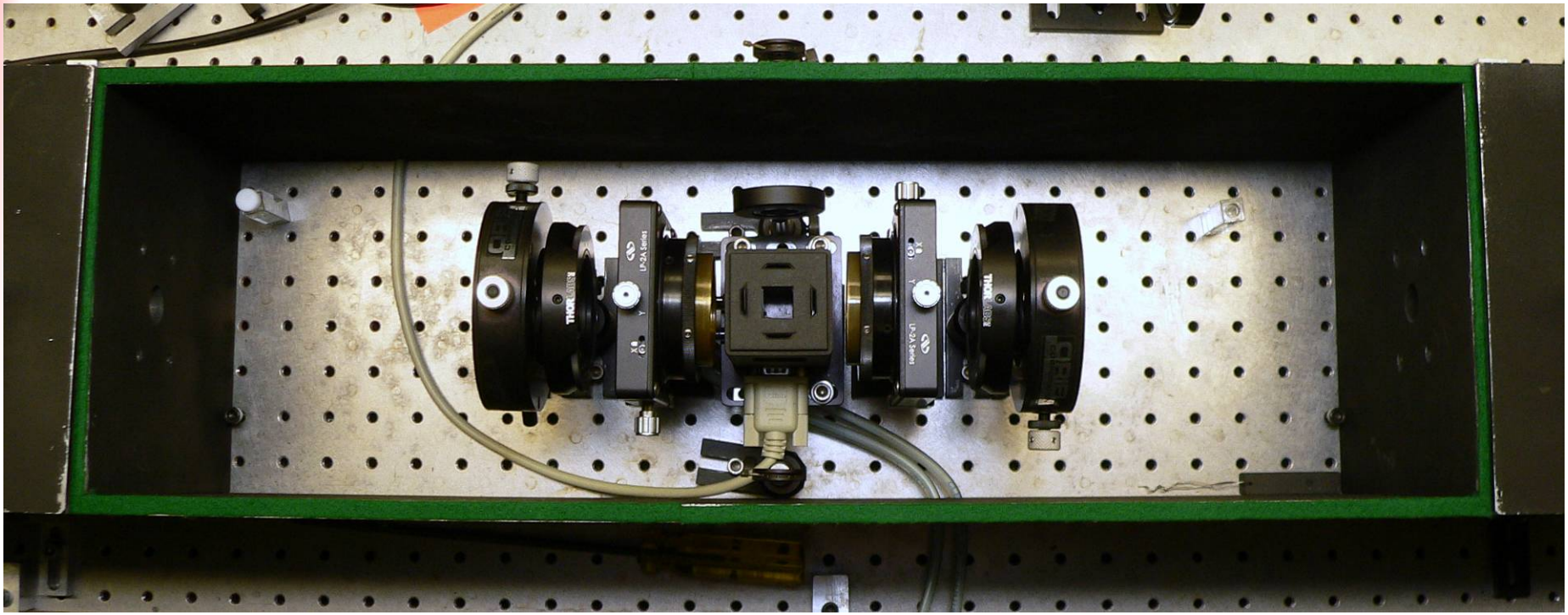


Wavelength Range



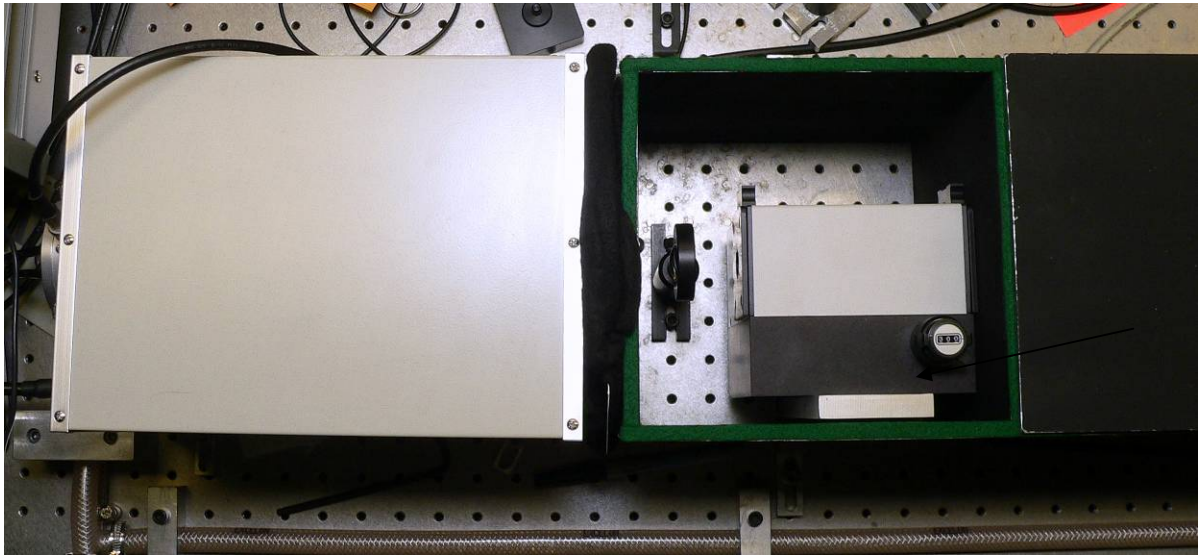
Detection System

- Sample Cell Holder
  - Peltier thermoelectric temperature controller and stirrer (Quantum Northwest TLC 50)
    - Temperature range -10°C - 105°C
    - Magnetic stirrer capable

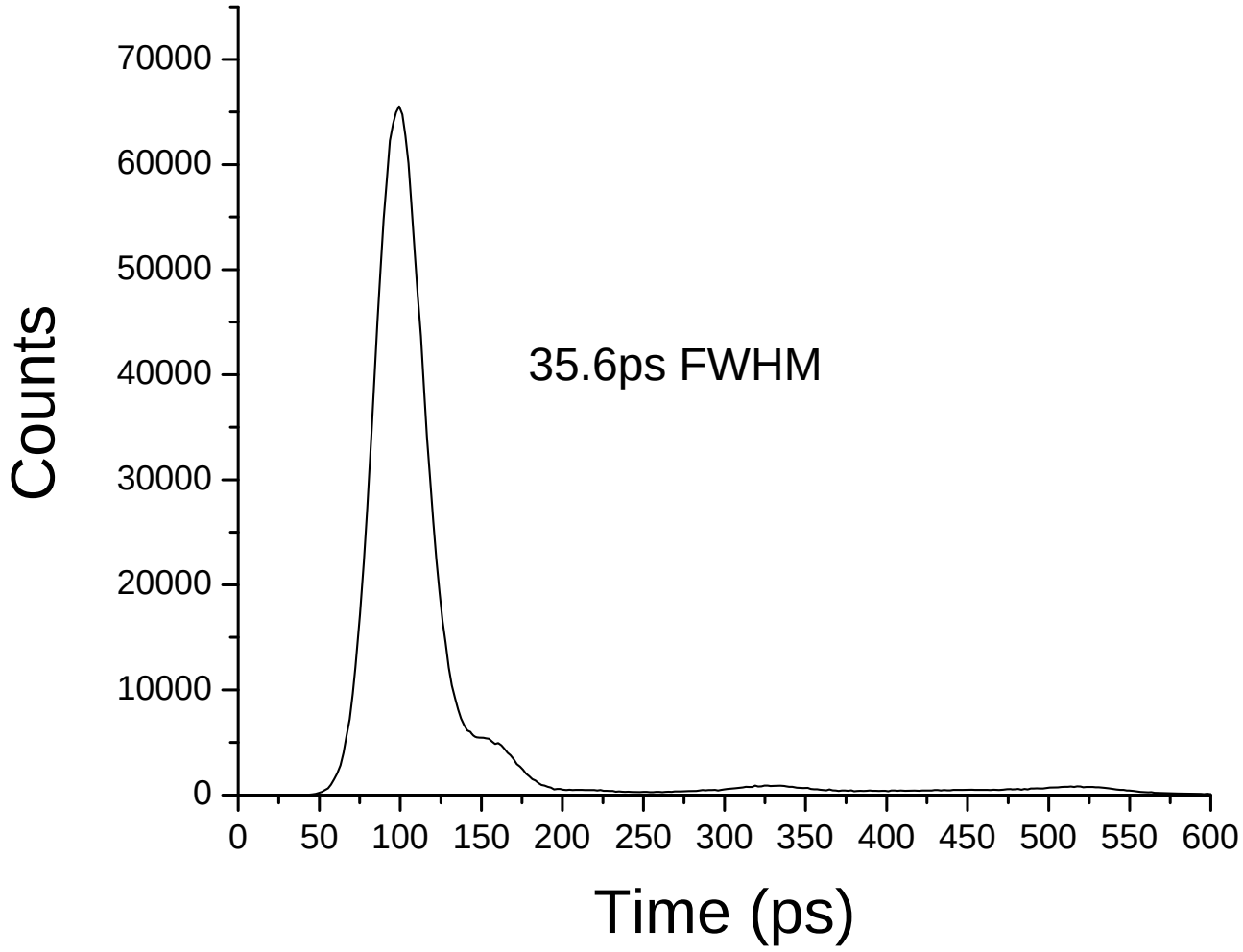


Detection System

- Single-pass concave holographic monochromators
  - Better throughput at the expense of slight dispersion
- Hamamatsu R3809U-50 microchannel plate PMTs with cooler housing
  - Wide spectral response
  - 25ps Transit Time Spread
  - Dark counts <1/sec



Instrument Response Function

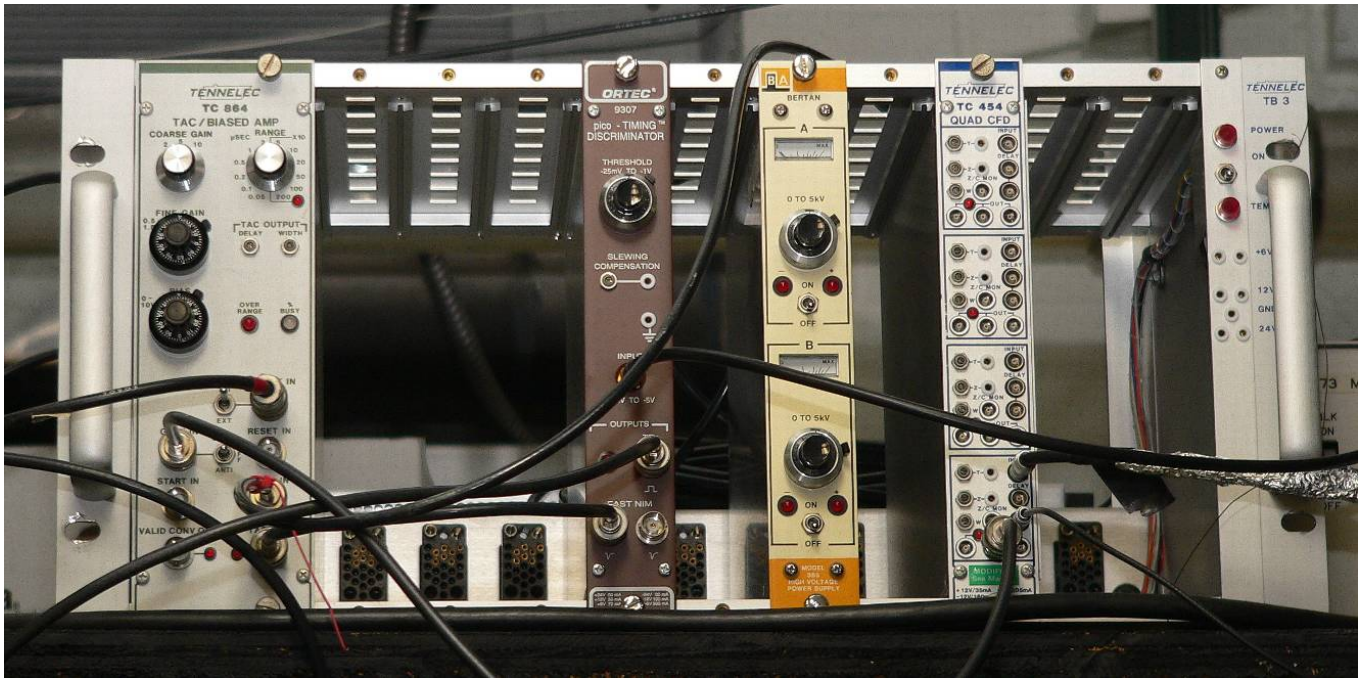


Data Collection

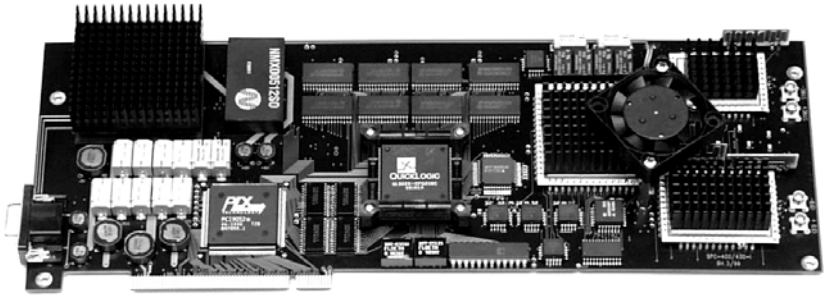
- Becker and Hickl GmbH SPC-630 PCI card interfaced with 4-channel router
  - Simultaneous collection of both PMT signals
  - Complete signal processing done on one board
  - Completely software driven
  - Time resolution range (1024 channels)
    - 3.26ps/ch ideal for very short lifetimes or very fast rotation (3.33ns collection window)
    - 1,950ps/ch good for long lifetimes and slow rotation(2000ns collection window)

Old vs. New Electronics

NIM Bin Electronics



SPC-630 PCI card



SPC-630 Software