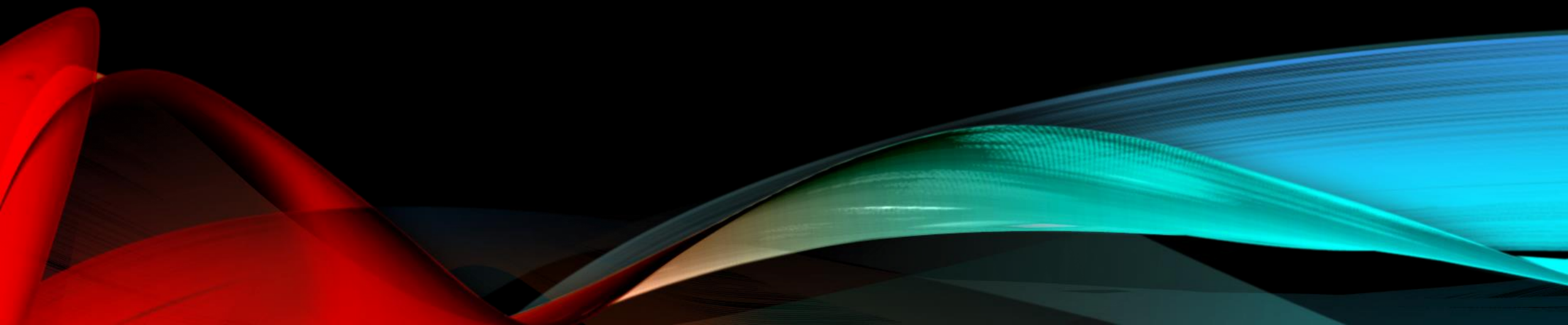
The patented DeSa monochromator was designed on first principles to be the perfect spectrophotometer for stopped-flow spectroscopy.

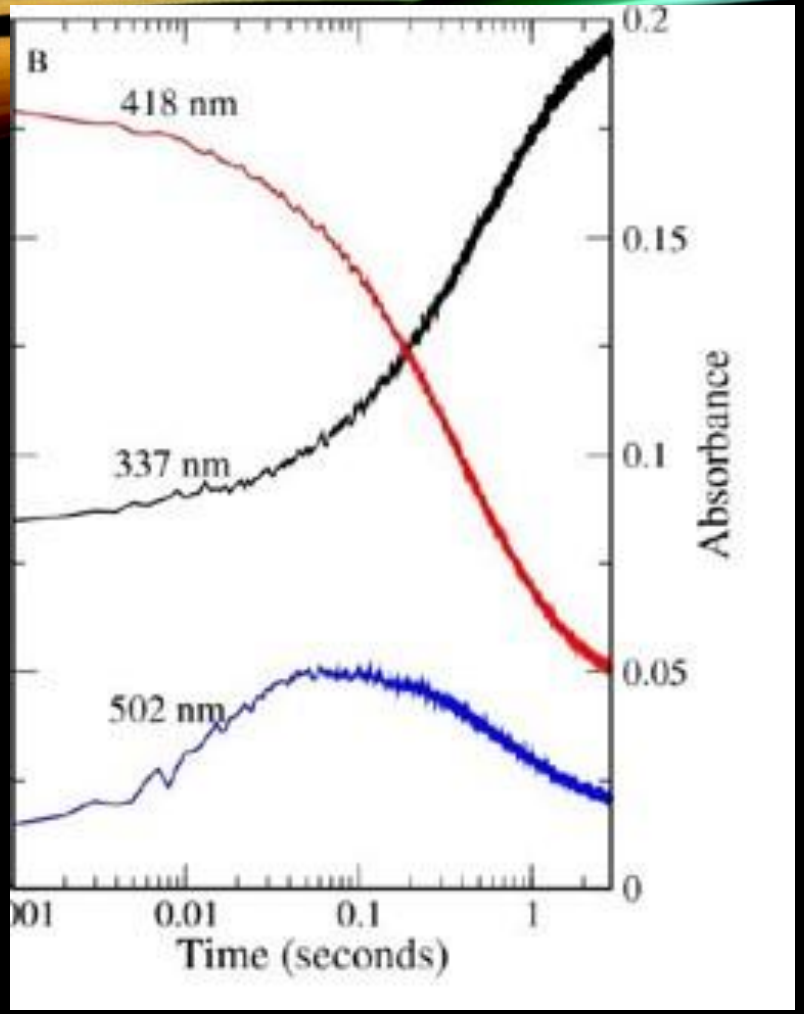
Only years later, did we realize it was also ideal for other highest performance UV/Vis spectrophotometers, too.



SPECTRA ARE **ALWAYS** PREFERABLE TO SINGLE WAVELENGTH MEASUREMENTS FOR KINETIC STUDIES.

Kinetics can only tell you rates.

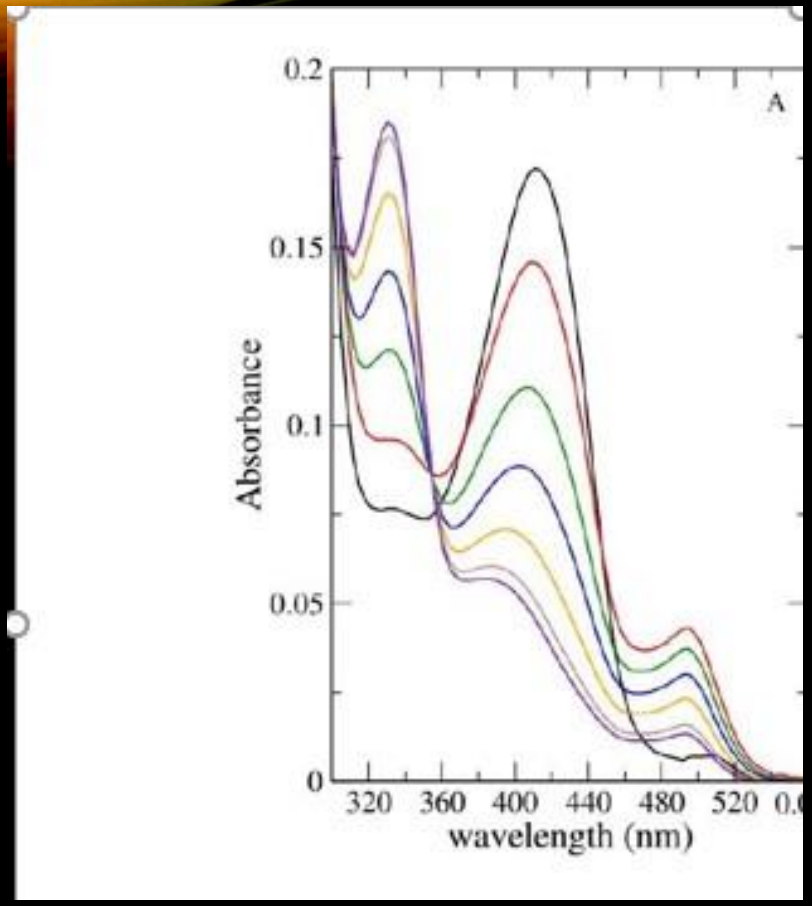
Spectra let you know what is changing.



One stopped-flow shot

Gorgeous kinetics!

BUT WHAT IS CHANGING?



Same experiment.

A few selected spectra inform us of the species involved.

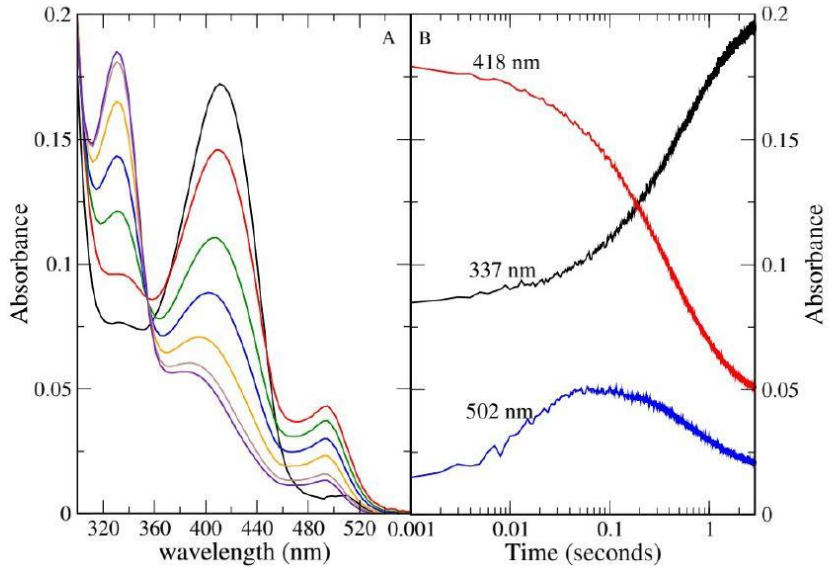
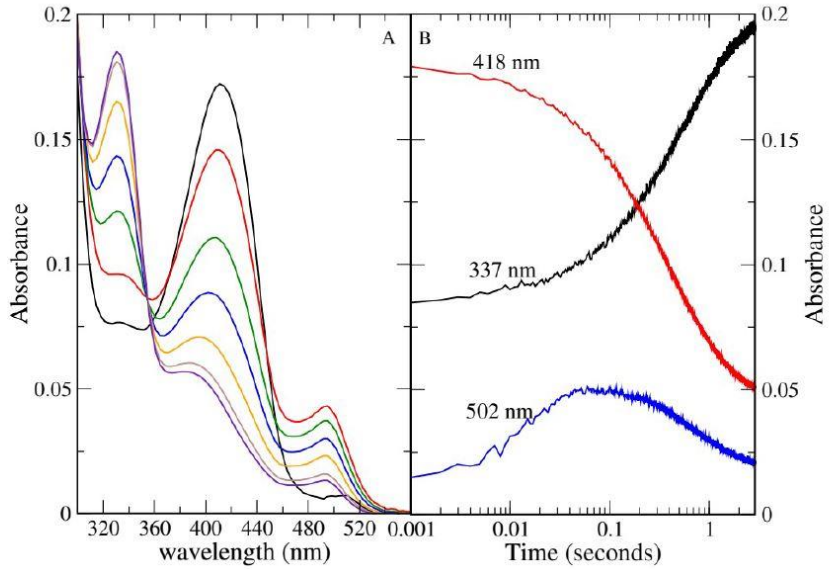


Figure 3. Rapid-scanning stopped-flow measurements of the reaction of wild-type TPL with L-tyrosine and 4-PD. The reactions contained 20 μM TPL, 2 mM L-tyrosine, and 10 mM 4-PD in 0.05 M potassium phosphate, pH 8.0 at 295 K. A. Representative scans collected during the reaction. The scans were collected at 0.002 sec (black), 0.095 sec (red), 0.292 sec (green), 0.582 sec (blue), 0.872 sec (orange), 1.452 sec (brown) and 2.612 sec (violet). B. Time courses at 337 nm (black), 418 nm (red) and 502 nm (blue).

All data you need in a single shot.

Prof Rob Phillips chose to present kinetics at three wavelengths from among the 300-530 nm range, and seven spectra of the 1000 collected.



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One stopped-flow shot

All the data one needs for outstandingly good results.

Choices for spectral acquisition:

Single wavelength **kinetic traces taken at many wavelengths**

Sample and time intensive

Full **spectral acquisition with a diode array or CCD**

Seemingly attractive

Full spectral acquisition with a **scanning monochromator and PMTs**

Without Downside

Full spectral acquisition with a diode array or CCD
SEEMINGLY ATTRACTIVE

- Diode array and CCD detectors are insensitive;
- Thus, Necessitates use of bright white light which photolyzes the sample,
- Thus, Limiting utility to samples unaffected by broad spectrum light.
- No means to reduce measurement light seen by sample other than filtration (i.e., removal of needed intensity)
- Can only detect ‘spectra’; no means to isolate to single wavelength work
- Fixed spectra range; fixed acquisition rate.
- Useless in fluorescence, luminescence, phosphorescence, circular dichroism
- Limited top speed
- Detector is separated from sample by a dispersing spectrometer, increasing loss of information from the sample
- Low cost and available from numerous sources
- Solid-state

…*Seemingly attractive, but not much on the PLUS column*

- Diode array and CCD detectors are insensitive;
- Thus, Necessitates use of bright white light which photolyzes the sample,
- Thus, Limiting utility to samples unaffected by broad spectrum light.
- No means to reduce measurement light seen by sample other than filtration (i.e., removal of needed intensity)
- Can only detect 'spectra'; no means to produce rapidly varying colored light
- Fixed spectra range; fixed acquisition rate.
- Useless in fluorescence, luminescence, phosphorescence, circular dichroism
- Limited top speed
- Detector is separated from sample by a dispersing spectrometer, increasing loss of information from the sample
- Low cost and available from numerous sources
- Solid-state

Full spectral acquisition with scanning monochromator and best detectors *No Downside*

Highest photometric accuracy achievable

- the RSM utilizes a double monochromator,
- the optical system is true sample and reference (dual beam)
- the detectors are the fastest and highest sensitivity available: photomultiplier tubes
- data are collected by twin channel 14 bit 2 MHz A/D cards to Win 10 computer
- all data handling and processing is supported by sophisticated data analysis software.

In more detail …

Full spectral acquisition with scanning monochromator and best detectors *No Downside*

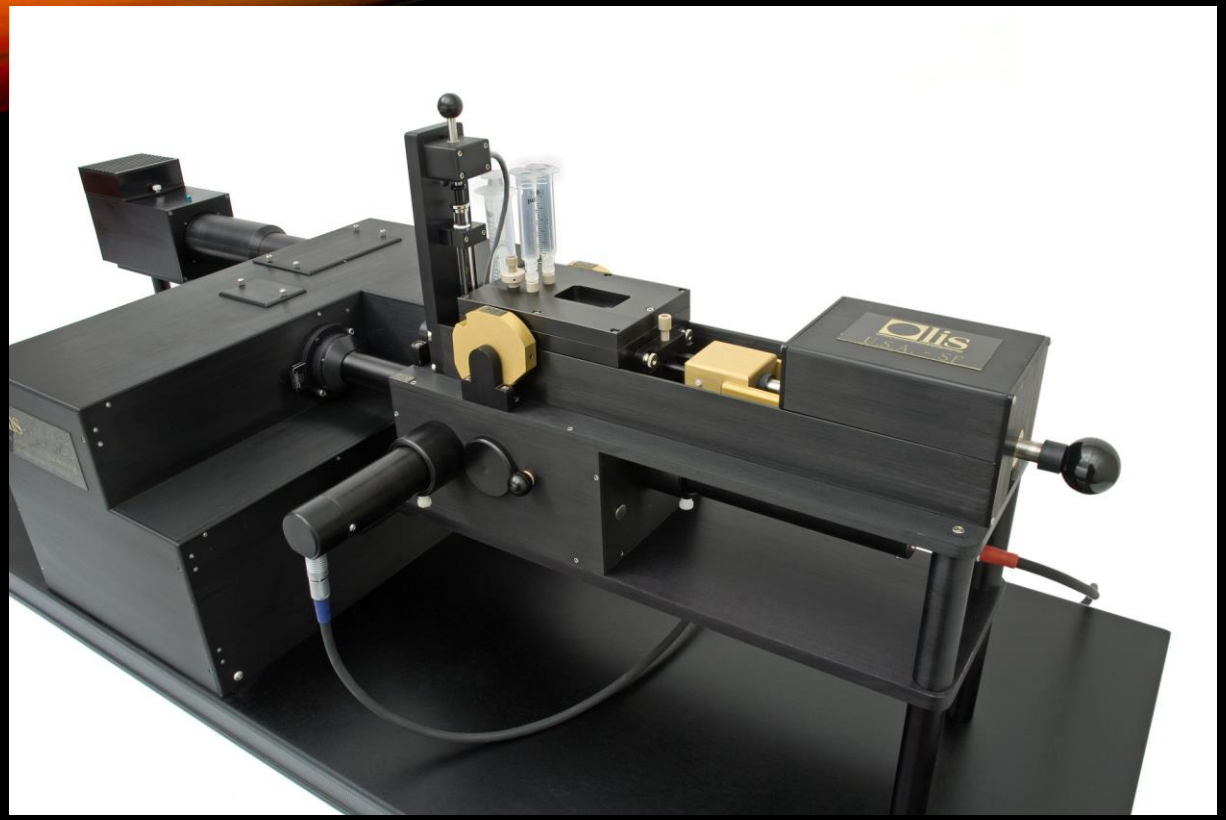
- Top spectral speed captures a full spectrum every millisecond
- The photomultiplier tube is the most sensitive detector extent
- Thus, gentle monochromatic light can be used
- Thus, utility covers every sample type, including highly photolabile biological systems
- Quick adjustment of light intensity by varying slit width(s)
- Easy movement between millisecond spectral scanning and microsecond fixed wavelength measurements

Full spectral acquisition with scanning monochromator and best detectors
No Downside

- Spectral ranges from tens to hundreds of nanometers
- Spectral scan rates from 1000 scans per second to arbitrarily slow, along with microsec single wavelength rates
- Produces measurement light as rapidly varying monochromator light or high intensity single wavelength
- Detects emitted light as rapid-scanning varying monochromatic light (when enhanced)
- Detector is millimeters from the sample so as to capture every possible photon

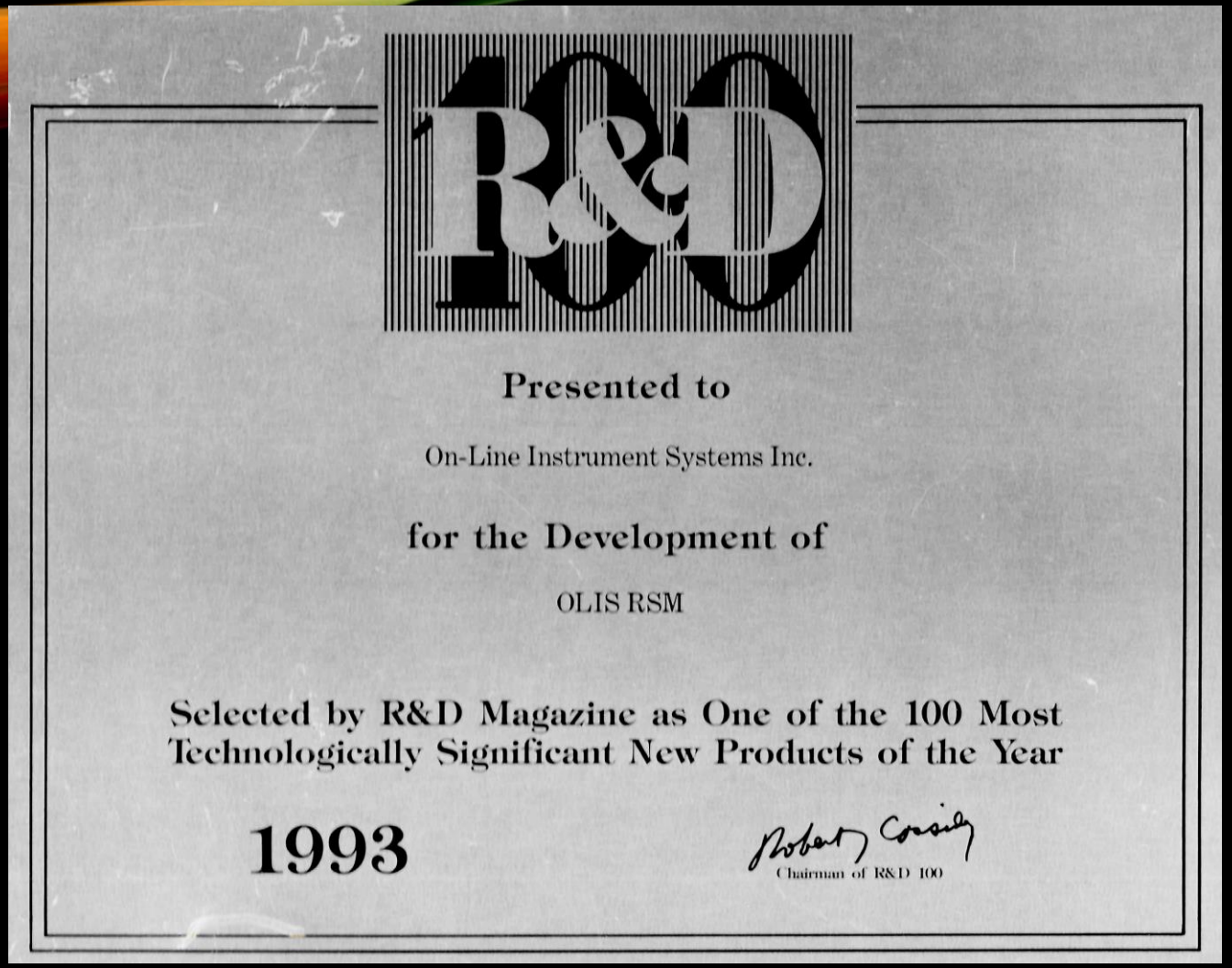
Full spectral acquisition with scanning monochromator and best detectors *No Downside*

- Measurement light is homogeneous, regardless of the bandwidth so that every portion of the sample sees the identical light in color and intensity
- High cost and uniquely available from OLIS
- Single moving component: the moving intermediate slit
- Incredibly robust and indestructible
- Many of the 1990s era models have already been upcycled to 2010-2020
- All can be restored to 100% identical condition and performance as those produced in 2020.



Designed in 1991 to be **the perfect optical system** for stopped-flow kinetic studies.

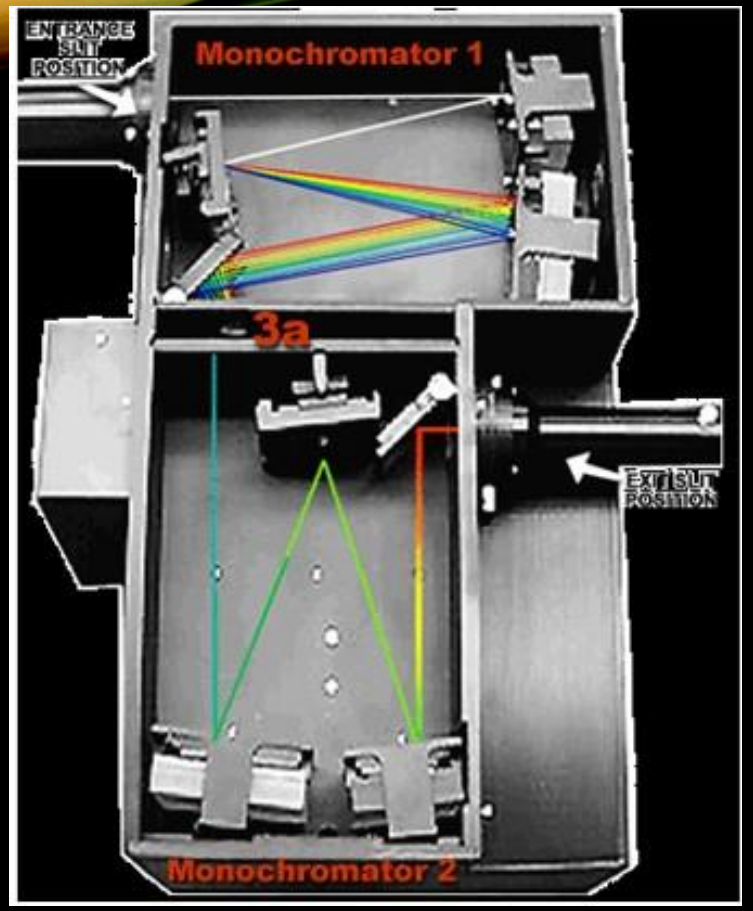
Anything remotely competitive is just a commercial, third party diode array or CCD.



While waiting for our patent, we submitted data to the R&D 100 competition and were among the winners for 1993.

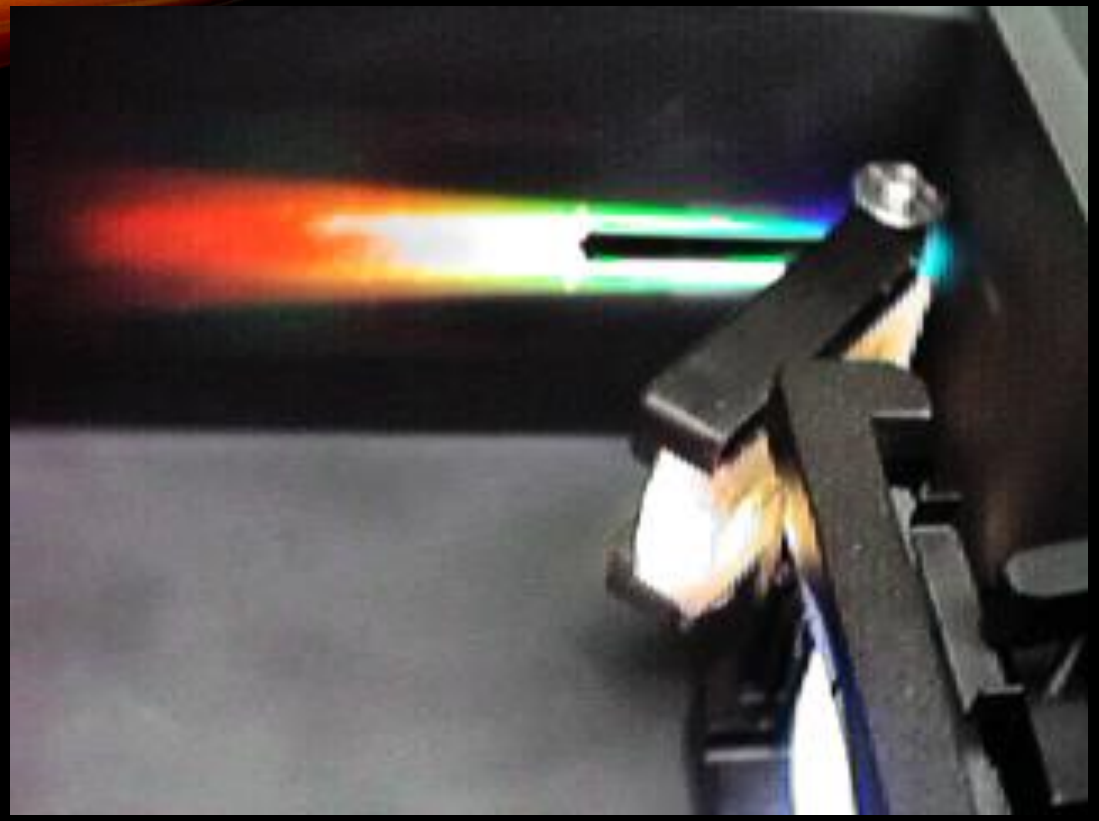
A working title was “Subtractive Double Grating Monochromator with Moving Intermediate Slit.”

A "subtractive“ monochromator produces a spectrally homogeneous output beam regardless of the resolution.



THIS DOUBLE GRATING MONOCHROMATOR HAS THE BEST OF EVERY ATTRIBUTE.

Light in from steady-state xenon arc lamp exits as *rapidly varying* monochromatic & homogeneous light.



What causes millisecond spectral scan rate?

A 25 mm wide aperture receives the spectrum produced by the first monochromator. All of the light used in the measurement passing through this ‘midplane’ window.

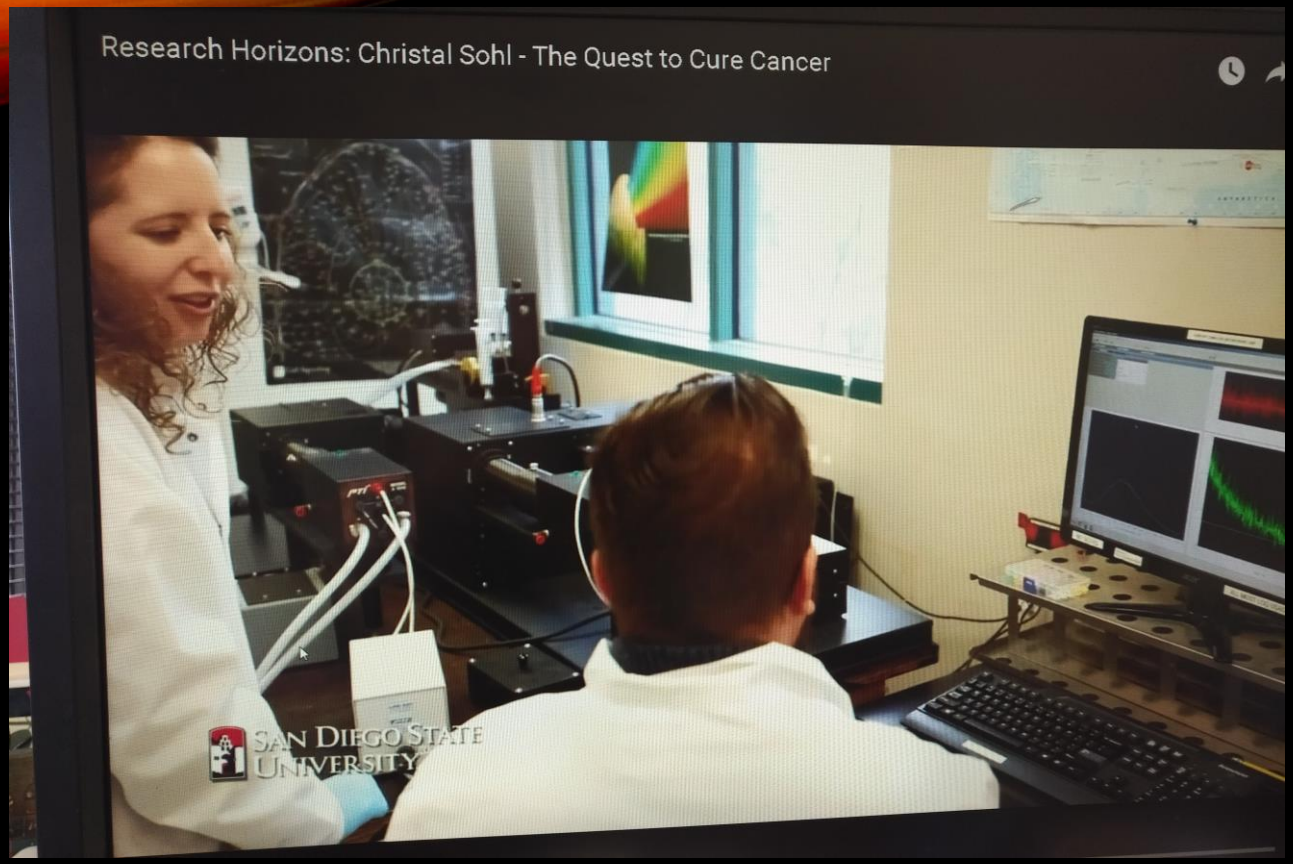
Our innovation is to house the intermediate slit in a motorized "ScanDisk." The 0.2 or 1 mm slit version is on the left; the spoke version is shown at right. A SpokeDisk is available to realize the Fellgett effect.

On the other side of the midplane divider is the moving intermediate slit wheel, which blocks 100% of this light's passage **except that which is in front of the current slit's position**.

16 slits on the wheel, spinning at 62.5 Hz = 1000 scans per second.

Precision of this speed is measured to the 1.0 microsecond.

The speed stabilizes quickly and once reached, does not vary.



Best kinetics with least sample, highest photometric performance, and maximum experimental design opportunities