

Appendix XVI: Quick Start – the Spectra Physics model 470 confocal, spherical-mirror, scanning Fabry-Perot interferometer

This instrument is a spherical mirror Fabry Perot interferometer designed with one of the mirrors mounted on a piezo-electric tube that can be driven a ~100 V sawtooth voltage, such as can be derived from older oscilloscopes. The optical and electrical layouts and mirror reflectivities are shown in Figs. 16-1-4 below.

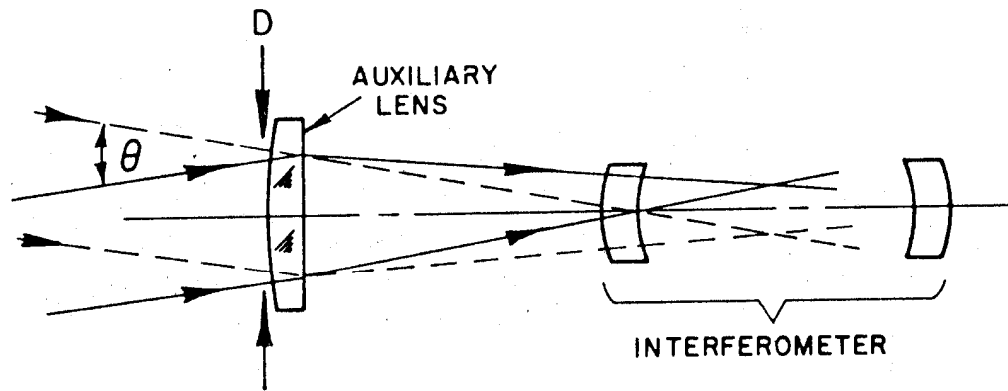


Fig. 16-1. Incident beam path showing how angular control is needed to adjust incident beam to focus at the confocal spot.

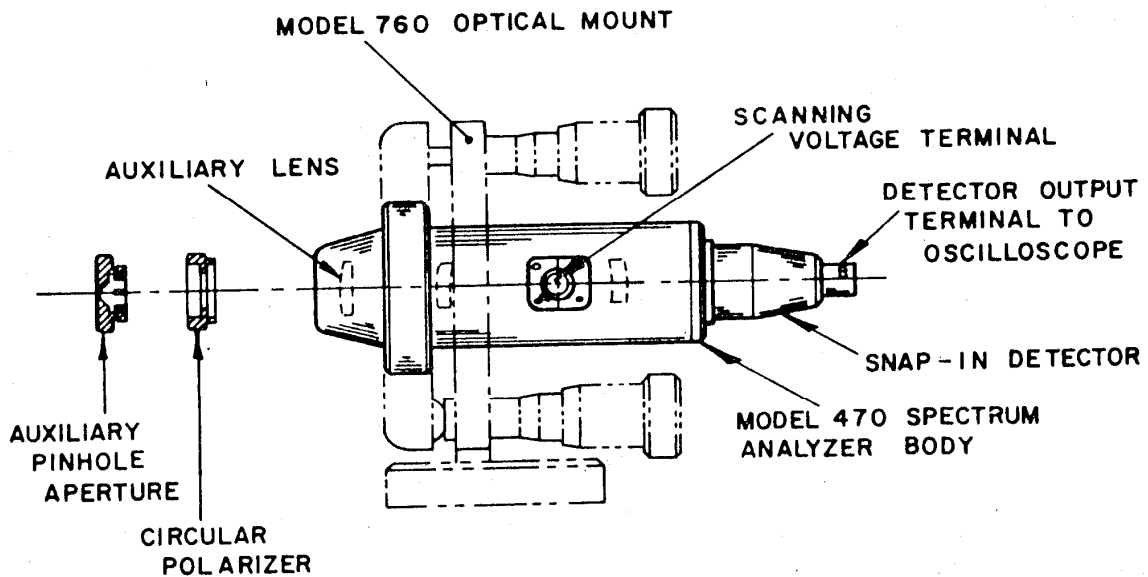


Fig. 16-2. Mounting structure of the Fabry-Perot showing photodiode detector, pinhole aperture, circular polarizer/optical isolator, and connection for scanning voltage.

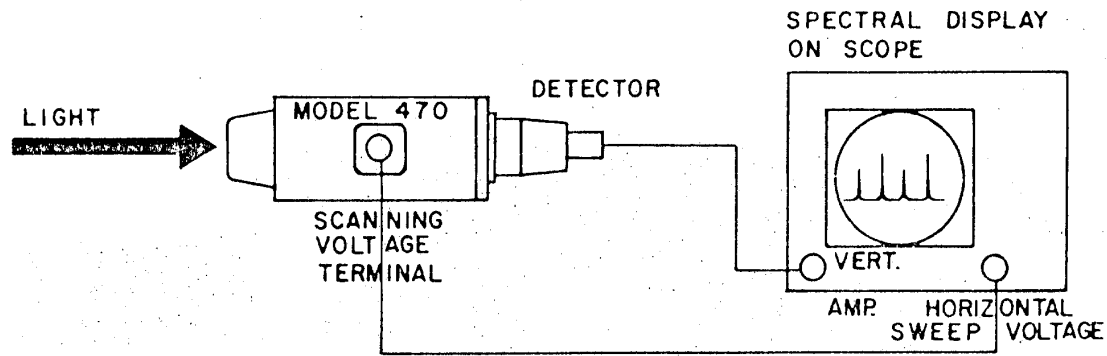


Fig. 16-3. Electrical connections for the piezo-scanned Fabry-Perot.

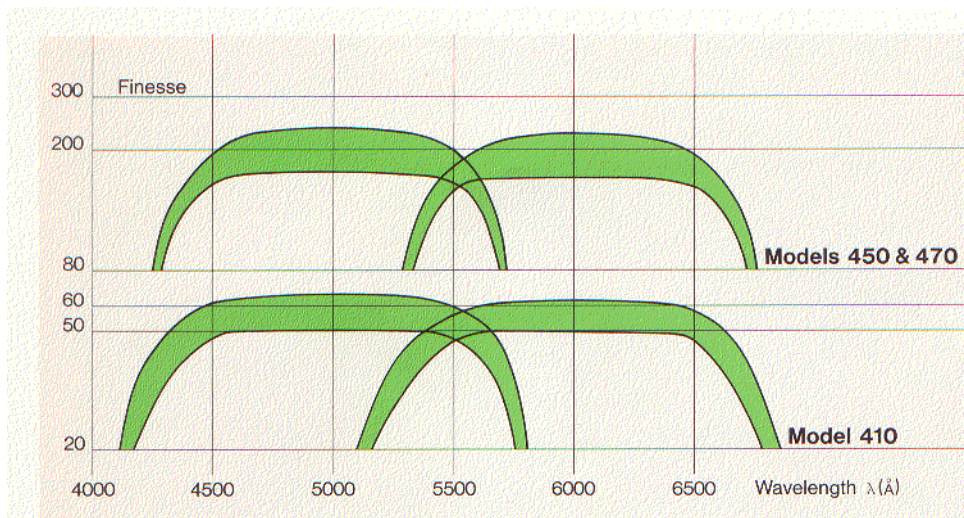


Fig. 16-4. Reflectivity curves for the two sets of mirrors available for the model 470-4 Fabry Perot.

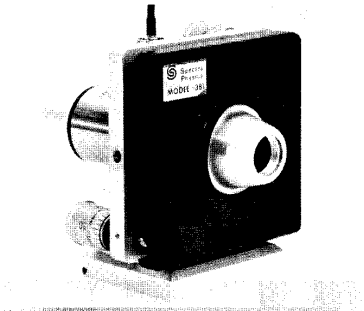
For operation, **the sawtooth output of the oscilloscope should be connected to the side bnc connector.** (DO NOT ATTACH THE SAWTOOTH VOLTAGE TO THE DETECTOR CONNECTOR AT THE BACK!!) As shown in Fig. 16-1, the input laser beam will have to be adjusted so that the focal spot coincides with the confocal spot of the F-P mirrors. This can be done with a little care on how the laser beam is directed into the F-P and then using the angular controls on the F-P mount to get the final adjustment. Use the oscilloscope display to optimize for the sharpest and highest amplitude peaks. Note that the output from the photodiode is negative.

Our model 470 has a free spectral range of 8 GHz (0.267 cm^{-1}). The sawtooth output of the Tektronix 585 oscilloscope is about $150 \text{ V}_{\text{p-p}}$ which is large enough to drive the mirror separation through four to five $\lambda/2$ or 4-5 free spectral ranges. Therefore you will see a repetitive pattern. It is convenient to use the times five "X5" setting on the horizontal display to magnify the center two centimeters of the display (without changing the sawtooth output).

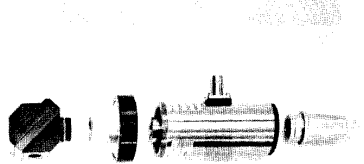
Caution! Do not exceed a sweep speed of 5 ms/cm! (Use only time scales of 5 ms/cm and slower!) Higher sweep speeds can damage the mirror mounting since the high acceleration (which occurs on the flyback portion of the sawtooth) can cause separation of the mirror from the piezo cylinder.

Note from Fig. 16-4 that there are two mirror sets for the model 470. As of February, 2004, the "red" mirrors are in so that the useable range is from about 550 to 650 nm. We do have the second set of mirrors that can be used for the argon laser range from 450 to 550 nm.

470 All-Purpose Confocal Interferometer



Model 470 in optional Model 381 optical mount.



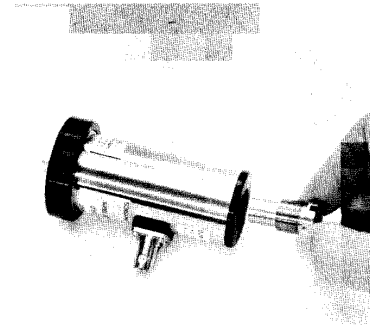
Designed for use as a spectrum analyzer, as a bandpass filter or Fabry-Perot ring interferometer, or as a frequency monitor, the Model 470 offers unusual versatility. It has a finesse of 200 and free spectral ranges of 2 GHz and 8 GHz for use in a variety of applications.

Detachable components:

Individual use of Model 470 components is permitted by easy removal of the detector head, input lens, and pinhole aperture. The head snaps in and out of the analyzer housing with ease, and the analyzer may be used as a filter by unscrewing the input lens and pinhole aperture.

The analyzer fits directly into the Model 381 precision optical mount for easy, accurate orientation.

The optional Model 470A right-angle monitor head fits directly into the analyzer for beam sampling. It rotates through 360° and uses as little as 2% of the incoming beam, permitting the remaining light to be transmitted with less than 1/20th wave distortion.



Easy mirror interchangeability:

This design solves the interchangeable mirror problem. The Model 470 is pre-aligned with your choice of mirrors for control of the free spectral range — 2 GHz or 8 GHz — and the wavelength range. When you need different ranges, you can easily install and align a different mirror set with a single tool. The mirrors are secured within protective cells; no spacers, O rings, or retaining rings are used.

Specifications

Model	Operating Wavelength	Free Spectral Range	Bandwidth	Finesse	Aperture
470-01	4500-6500 Å	2 GHz	20 MHz	200	Entrance
470-02	4500-6500 Å	8 GHz	40 MHz	200	Aperture 19 mm
470-03	5500-6500 Å	2 GHz	20 MHz	200	With isolator 13 mm
470-04	5500-6500 Å	8 GHz	40 MHz	200	With pinhole 2 mm