During the temperature measurement, the spectral line is scanned using an oscillating Fabry–Perot.[3] Figure 1 shows a block diagram of the apparatus. The interferometer plates are epoxied to a barium titanate crystal 6 in. long which has a resonant frequency of about 10 kc/sec corresponding to a half-period of oscillation of approximately 50 μsec. The interference pattern is focused on the entrance slit of a monochromator which acts as a narrow band filter and the dispersed light is monitored by a photomultiplier whose output is displayed on an oscilloscope screen. Since the interferometer displacement is sinusoidal with time, part of the voltage applied to the barium titanate tube is picked off and phase shifted, and then used to drive the horizontal sweep of the oscilloscope. Slight modifications to the oscilloscope electronics enabled it to be used in a single sweep mode.

Adjustments in the phase could be made to insure that the sweep of the oscilloscope was linear with wavelength to better than 4%. Then the display recorded photographically could be used directly for the profile reduction. Since only three profiles are scanned in 50 μsec, this technique gave many photons per resolution time, a prime requisite in this experiment which studies optically thin lines emitted from a 6000°K plasma. Even then, for narrow lines, intensity was often a problem so that signal to noise ratios were of the order of five at profile maximum.

A typical set of data acquired during a single shot is shown in Fig. 2. The waveforms of the intensity of the optically thick line Si I λ3905 is exhibited along with the pressure pulse and the Fabry–Perot scan. From such a scan the half-width of the profile could be measured in units of the free spectral range, the distance between fringes. The calibration of this type of sweep is made simply by measuring the separation of the plates with a telemicroscope. A detailed description of the data reduction process can be found in Ref. 4.

III. RESULTS

Figure 3 shows the studies of two spectral lines measured in this manner. λ5949 is a $4s^1P^\circ - 5p^1D$ transition and λ5708 is a $4s^3P^\circ - 5p^3P$ transition. Since they come from rather high-lying levels, both of these lines have a considerable Stark broadening contribution, and this fact is reflected in the rather

[3] J. Cooper and J. R. Grieg, J. Sci. Instr. **40**, 443 (1963).
[4] R. A. Day, Shock Tube Spectroscopy Laboratory, Harvard College Observatory, Report No. 18 (1967).

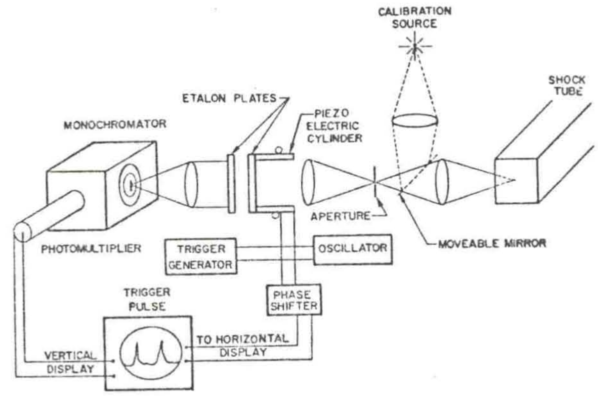

FIG. 1. Schematic diagram of oscillating Fabry–Perot interferometer.

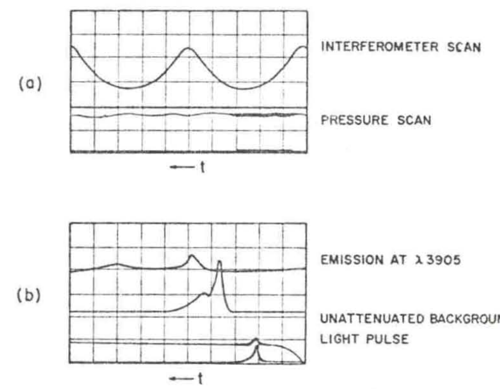

FIG. 2. (a) Upper trace: interferometer scan of spectral lines; total time of trace 50 μsec. Intensity 0.2 V/cm. Lower trace: pressure transducer output (1 V/cm, 20 μsec/cm). (b) Upper trace Si λ3905 emission with attenuated flash lamp signal. Unattenuated flash is also shown 0.1 V/cm, 5 μsec/cm. Lower trace: same display at slower sweep speed (0.2 V/cm, 50 μsec/cm).

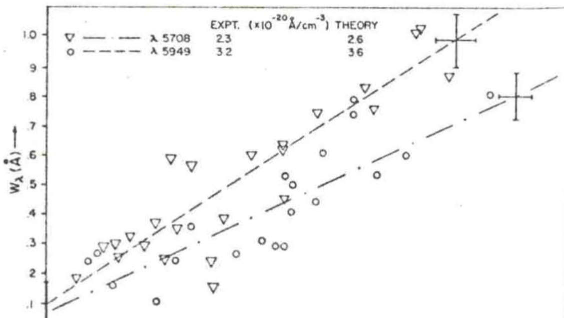

FIG. 3. Widths of silicon lines plotted as a function of total density of perturbing argon atoms. The theoretical and experimental widths are in units of 10^{-20} Å/cm^{-3} λ5708: 2.6, 2.3 ± 0.4 λ5949: 3.6, 3.2 ± 0.5.