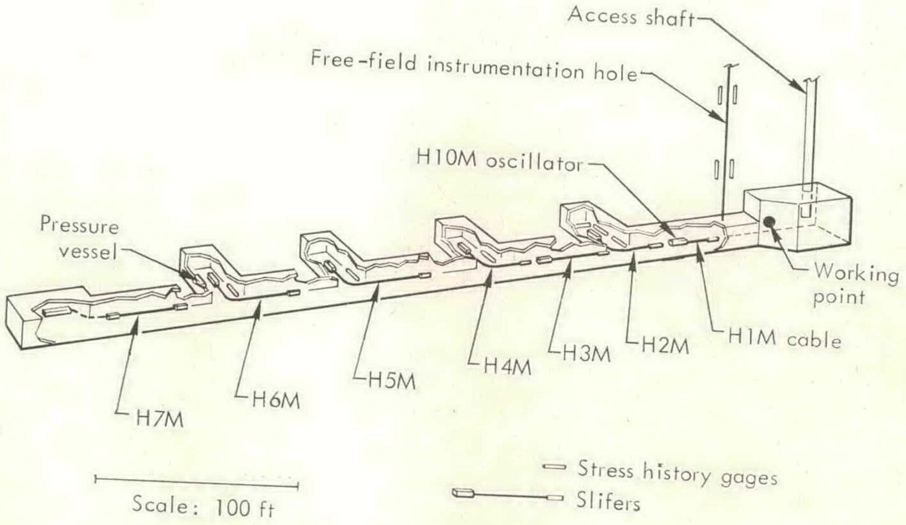


Fig. 3. Location of the slifers and stress-history gages.

the first and third alcoves to provide independent TOA checks. Figure 4 presents the results for these measurements; details have been reported by *Glenn and Crowley* [1970].

*Slifers*. Seven slifers were used to measure shock arrival in the tunnel and alcoves, and all produced useful data. Each slifer sensing cable was 12.2 meters long. The cables along the sides of the tunnel were buried 5 to 12 cm from the inside surface of the tunnel. The cables were wrapped with lead foil to inhibit radiation-induced ionization of the cable ahead of the shock wave.

*Cavity gas-pressure instrumentation*. In alcove no. 4 (100 meters from the device) a pressure-measuring system was installed (in a surplus 16-inch naval gun barrel). There was a silicone oil coupling between the tunnel and the pressure gages. The purpose of this system was to measure the late-time pressure in the cavity and tunnel (up to a few minutes after the shock had passed). The fluid coupling protects the pressure gages from the hot, radioactive gases. Two 100-kpsi-range gages and one 15-kpsi-range gage were used in the system. The 15-kpsi gage was located behind an orifice system designed to cut off the peak of the initial shock pulse and prevent overranging of the gage. This gage was to record the low pressure in the cavity after the initial shock wave. It was hoped that the very heavy hardware would protect the electronics and signal cables through the shock wave, but the system failed at about 17 msec, presumably from ground motion that resulted in severed signal cables. The 100-kpsi variable-reluctance pressure gage went into 'resonant saturation' with the onset of pressure. The 100-kpsi, bridge-type pressure gage performed well and recorded the signal shown in Figure 5. The 15-kpsi bridge gage gave little information because it was behind an orifice whose mechanical time constant was 3 msec. These pressure data are also given in Table 2, section 3, where a comparison with the calculations is made.

*Free-field measurements*. Two slifers were placed in the instrument hole that intersected the tunnel at 9.8 meters from the device. Both of these slifers gave good results. In addition, four piezoelectric stress gages were placed in two locations in this instrument hole (see Figure 3). These free-field data are also presented in section 3, where a comparison with the calculations is made.

To determine the position of the shock wave in the tunnel from the slifer closure, two corrections were made, one for the travel time of the shock from the tunnel to the cable, and another for the time it takes the cable to collapse after impact of the shock wave. Four of the slifers were placed with part of the cable along the tunnel and part of the cable turning the corner into the alcoves, where the cable was perpendicular to the tunnel. Agreement of the TOA data for the slifers, piezoelectric gages, and light-pipe photodetector system is illustrated in Figure 4.

The segments of the slifers located in the alcoves provided TOA data of the radial shock front in the grouted alcoves. These data are presented in Figure 6.

*Stress history measurements.* Six piezoelectric stress gages were placed in the four alcoves. There were three gages in the first alcove; two of these were oriented radially to the tunnel, and the third (in the back of the alcove) was radial to the device. The other three alcoves each contained a gage oriented radially to the tunnel and at a distance of 1 meter from the center line of the tunnel. All alcoves were filled in with alluvium-matching grout. Figure 3 also indicates the locations of the stress gages. The TOA data from the gages are given in Figure 6. Many of the gages recorded multiple shock pulses, but

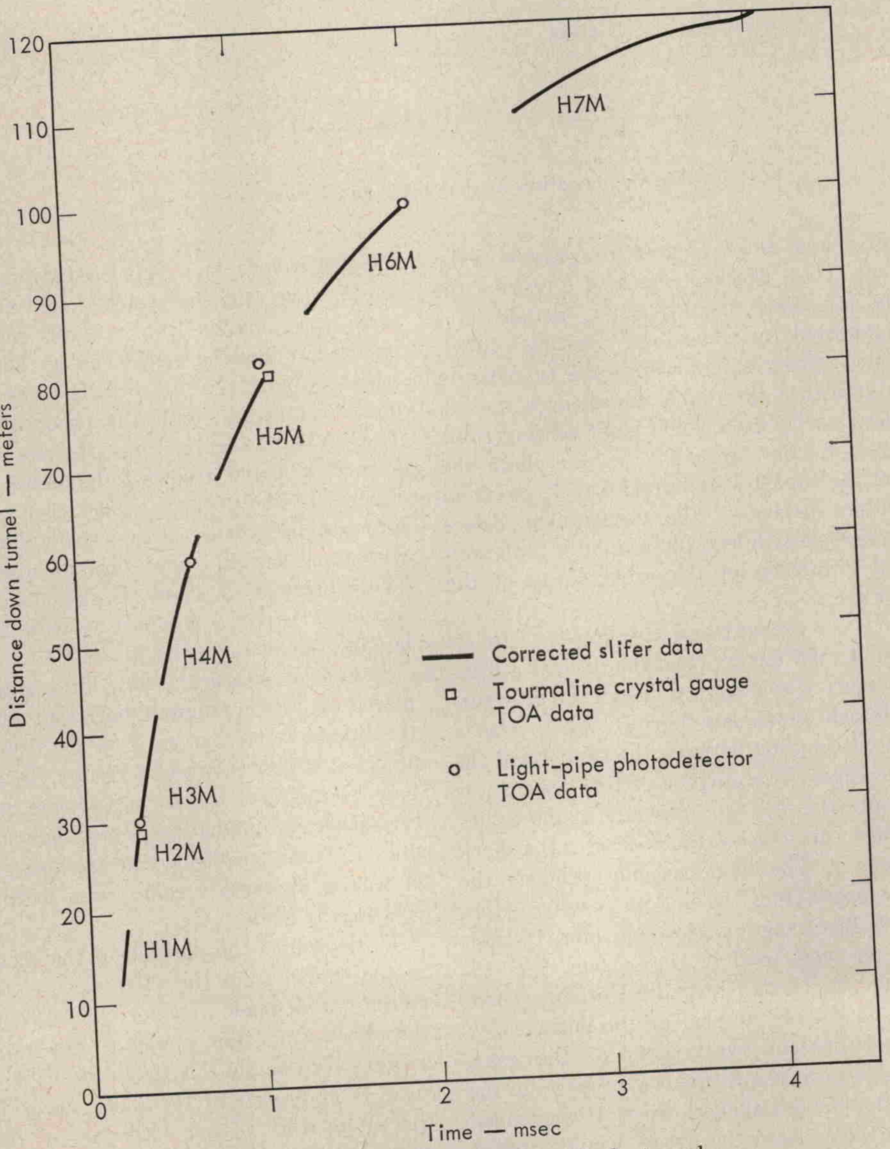


Fig. 4. TOA data of the shock front in the tunnel.