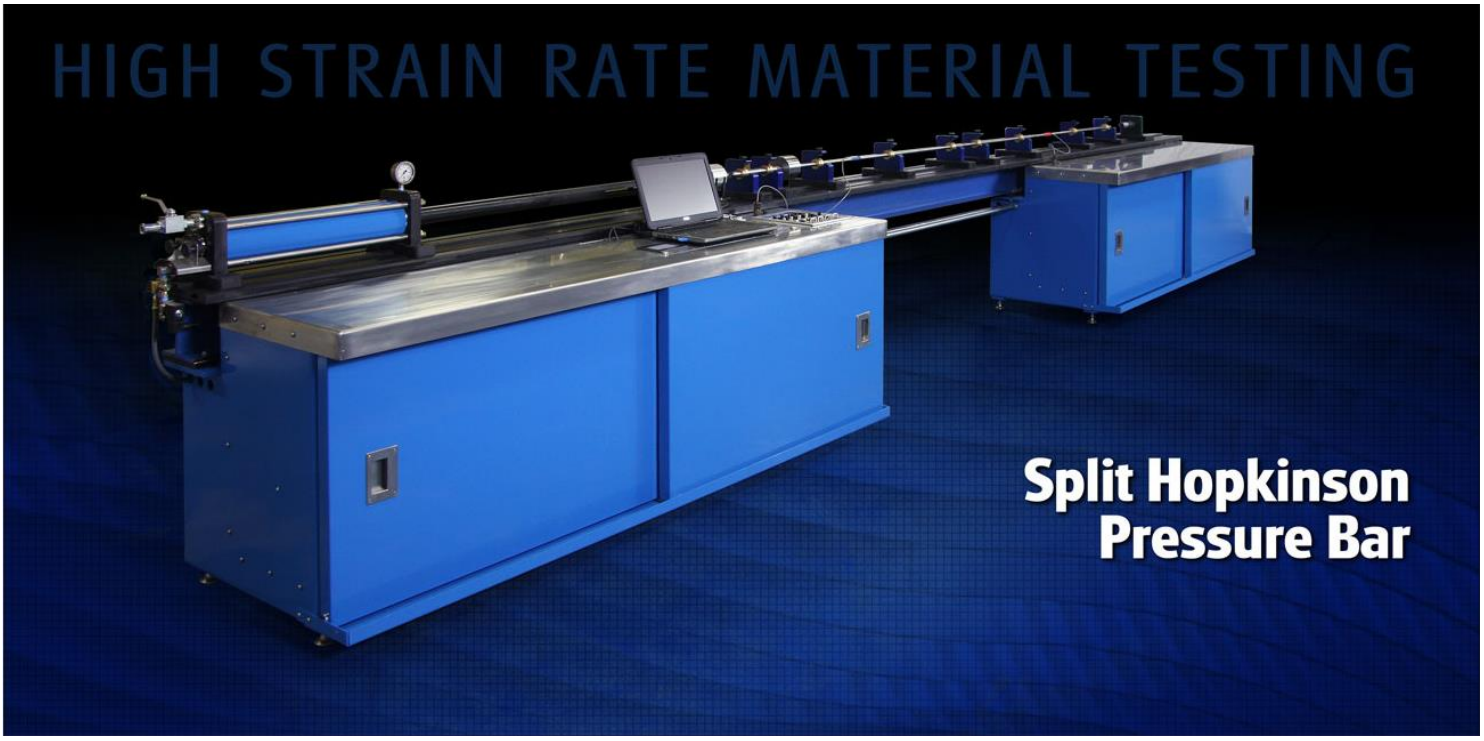
57640 North Eleventh Street | Calumet, MI 49913
906.337.3018 tel 906.337.2930 fax rel@relinc.net



REL SURE-PULSE

SHPB Momentum Trapping Techniques

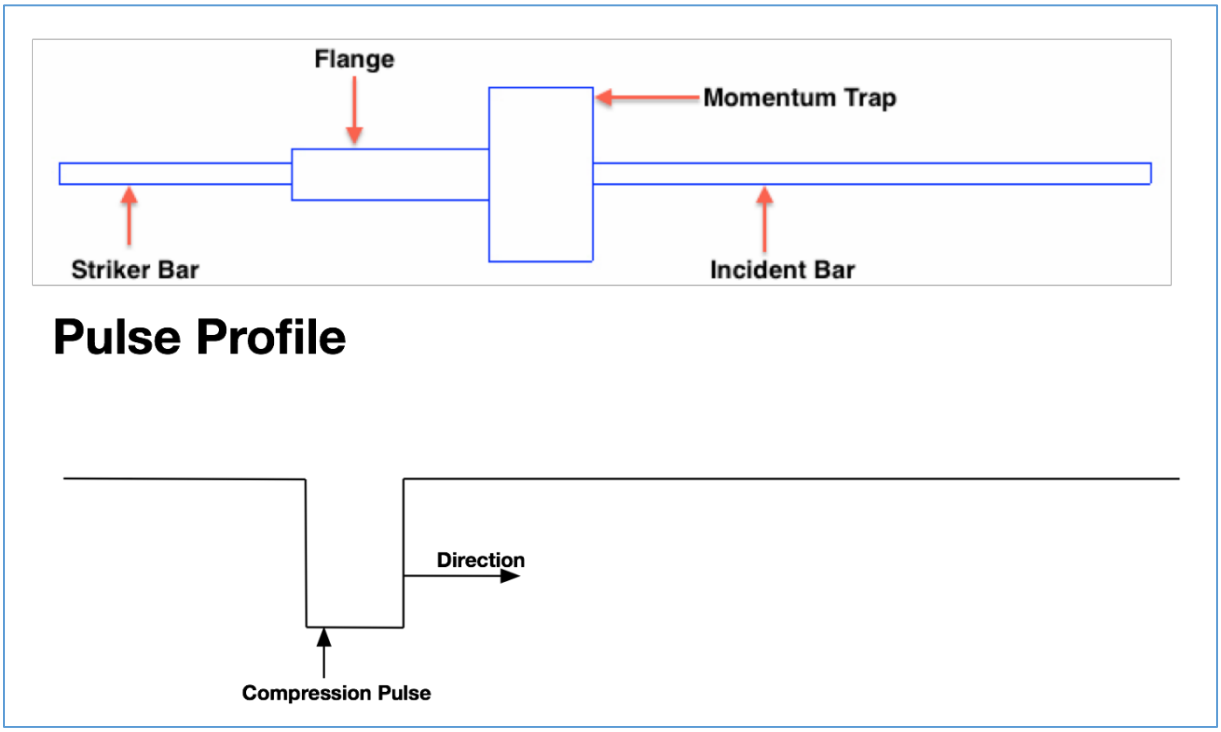
G Momentum Trapping

Momentum Trapping

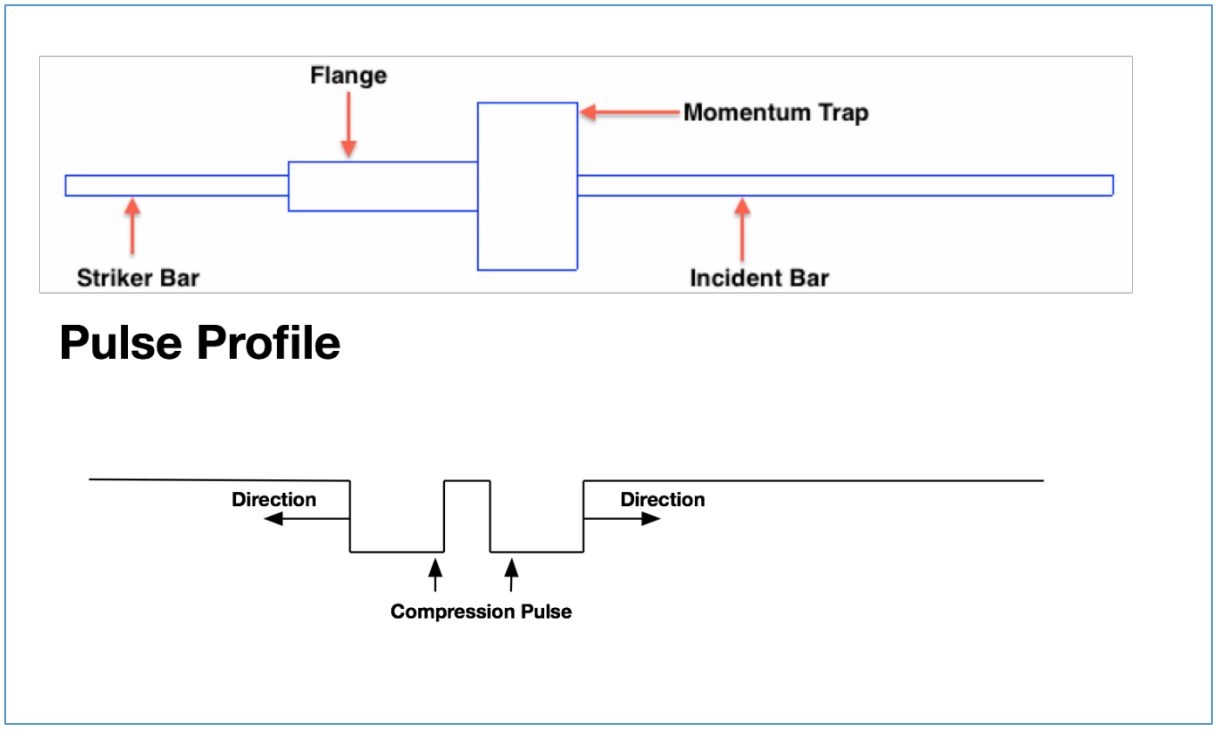
Typically in an untrapped Split Hopkinson Pressure Bar shot, a sample is struck many times by the incident bar, as the energy is transferred from the incident bar into the transmission bar. This crushes the sample beyond the initial deformation. If it is desired to measure the real deformation of the sample after a shot, it is necessary to trap the pulse.

Pulse trapping causes a tension wave to follow the main compression pulse down the bar. This causes the bar to pull away from the sample allowing the sample to only be struck once.

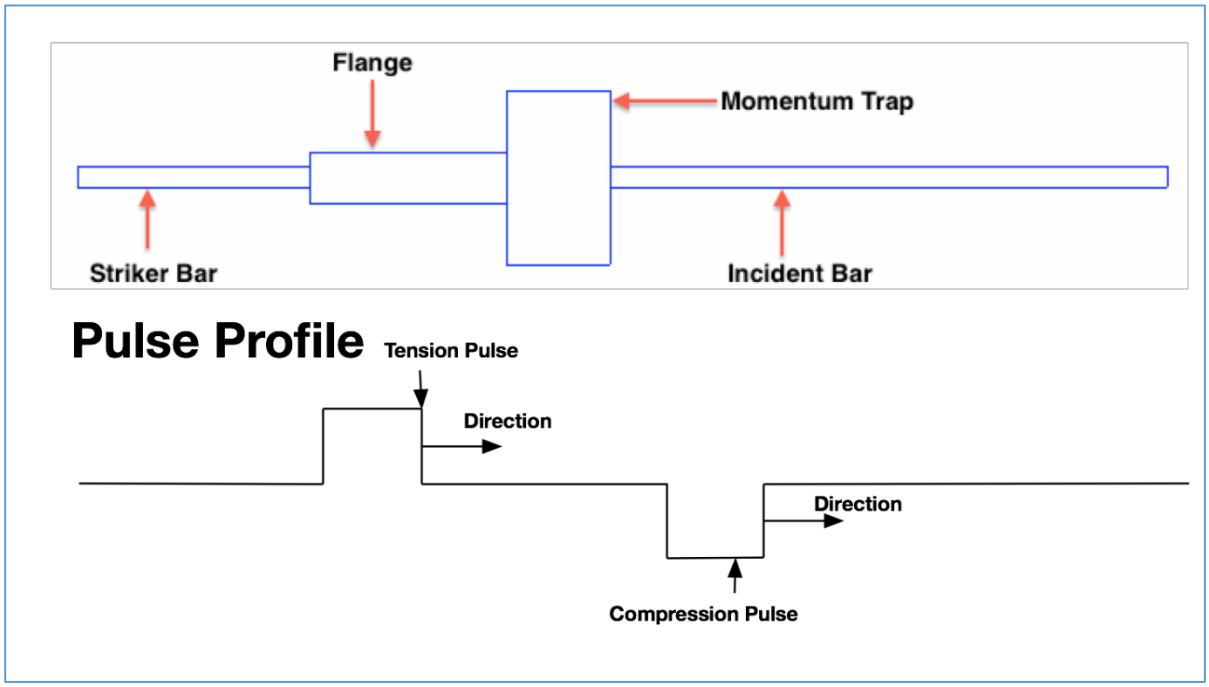
The pulse is split by the following mechanism. First, as seen below, the striker bar hits the flange, causing a compression pulse to travel through the flange



Half of the compression pulse strikes the rigid body of the momentum trap and reflects back as compression. The other half of the pulse travels unimpeded down the bar.

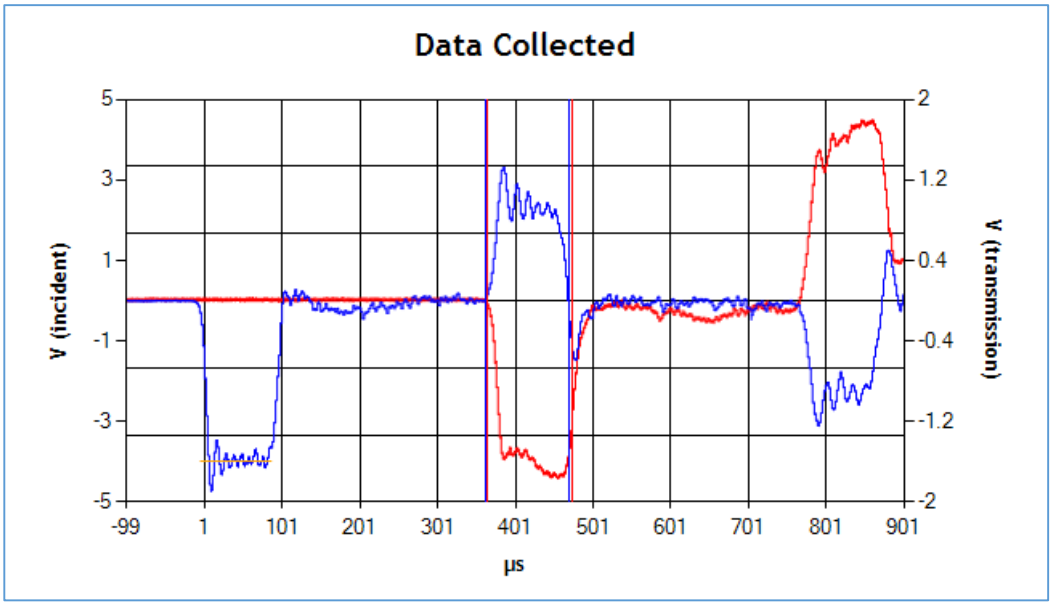


The compression pulse that was reflected by the momentum trap the hits the free face of the striker end of the transmission bar, reflecting back as tension.



This tension pulse follows the compression pulse down the bar. The leading compression pulse strikes the sample deforming the sample and reflecting a tension pulse back toward the strain gauge. This pulse represents the sample strain rate. The tension pulse then hits the end of the bar, pulling the bar back from sample.

Below is an example of an untrapped pulse displayed in the SURE-pulse interface. Notice that the expected pulse (orange line) closely matches the actual pulse, and there is no pulse between the incident pulse and the reflected pulse.



Below is an example of a trapped pulse displayed in the SURE-pulse interface. Notice that the expected pulse (orange line) is about 1.4 $(\sqrt{2})$ times the height of the incident pulse. This indicates that the pulse was split in half by the momentum trap. Also, notice the second tension pulse before the reflected tension pulse. This is the pulse that pulls the bar off of the sample.