A Kolsky Bar Technique for Impulsive Fluid Pressurization

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Work Supported by ARO and ARL

2010 SEM Annual Conference & Exposition
Indianapolis, IN, June 7-10, 2010

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- Low-impedance soft materials will also require a much better signal-to-noise ratio for sub-megapascal measurements.
- A long pulse, low stress compression technique is needed to study the overpressure effects on the function of brain cells. This is important to identify the cause of blast-induced traumatic brain injury.

OBJECTIVES

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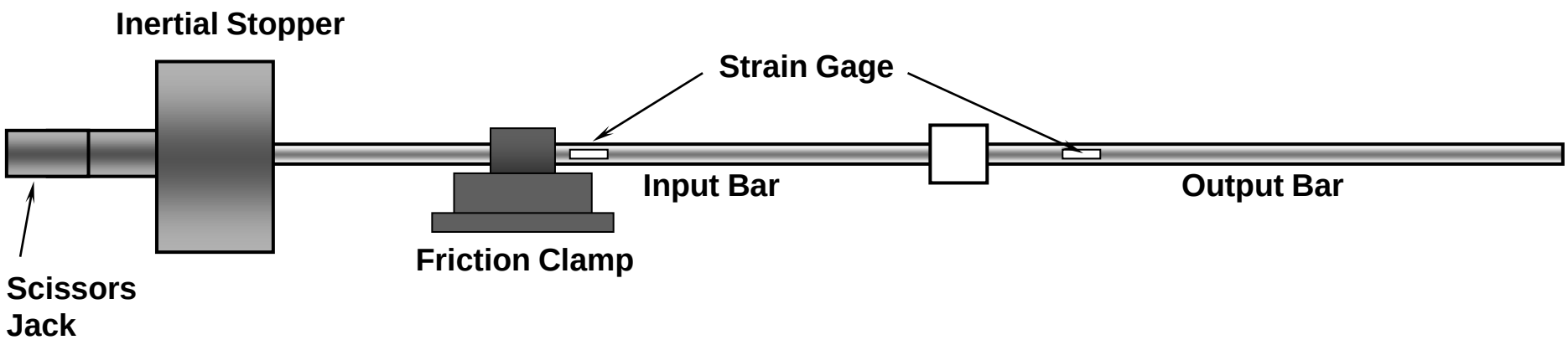
- To apply this method for single stroke impulsive pressurization of in-vitro brain cells.

A New Design of Kolsky Compression Bar



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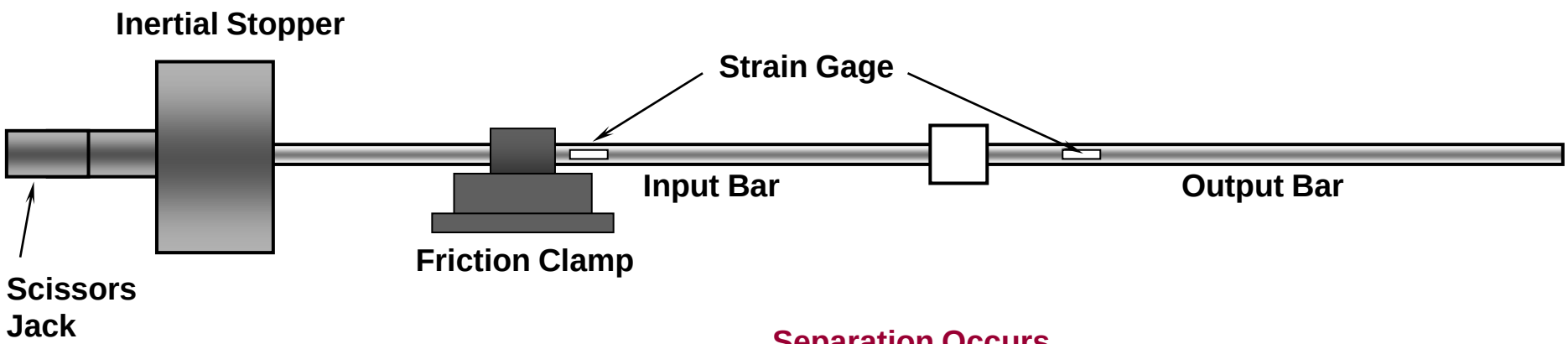
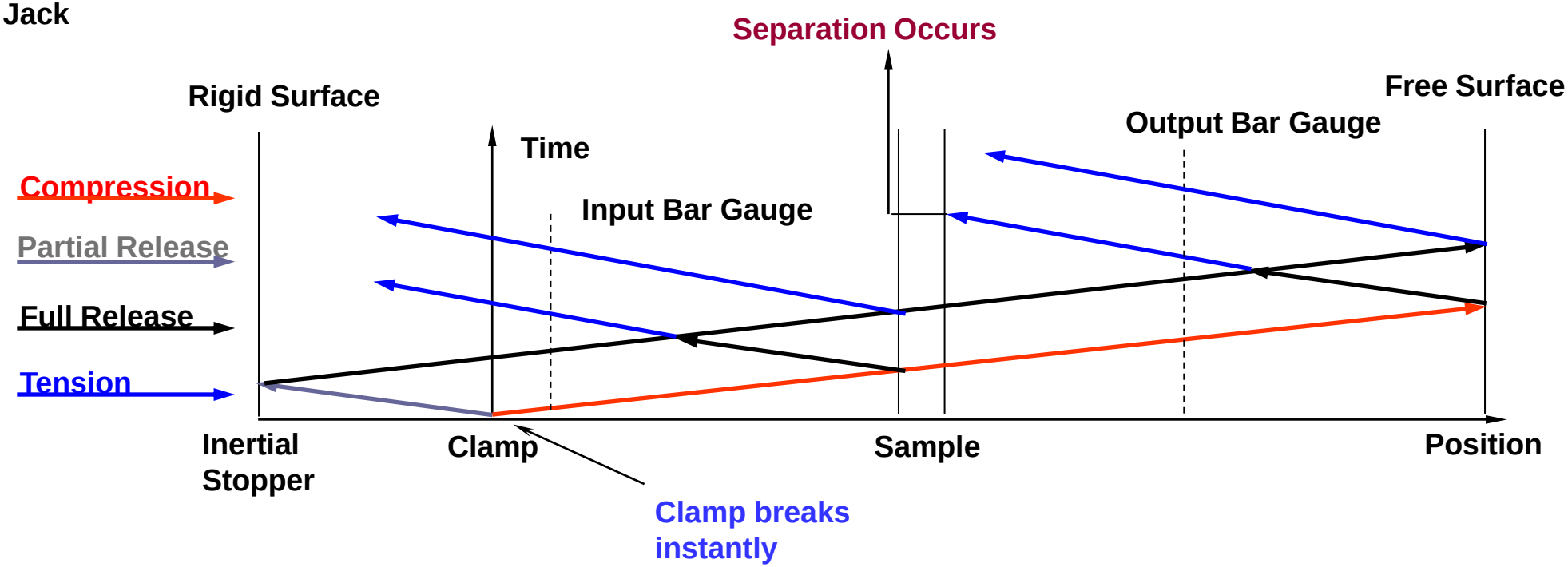
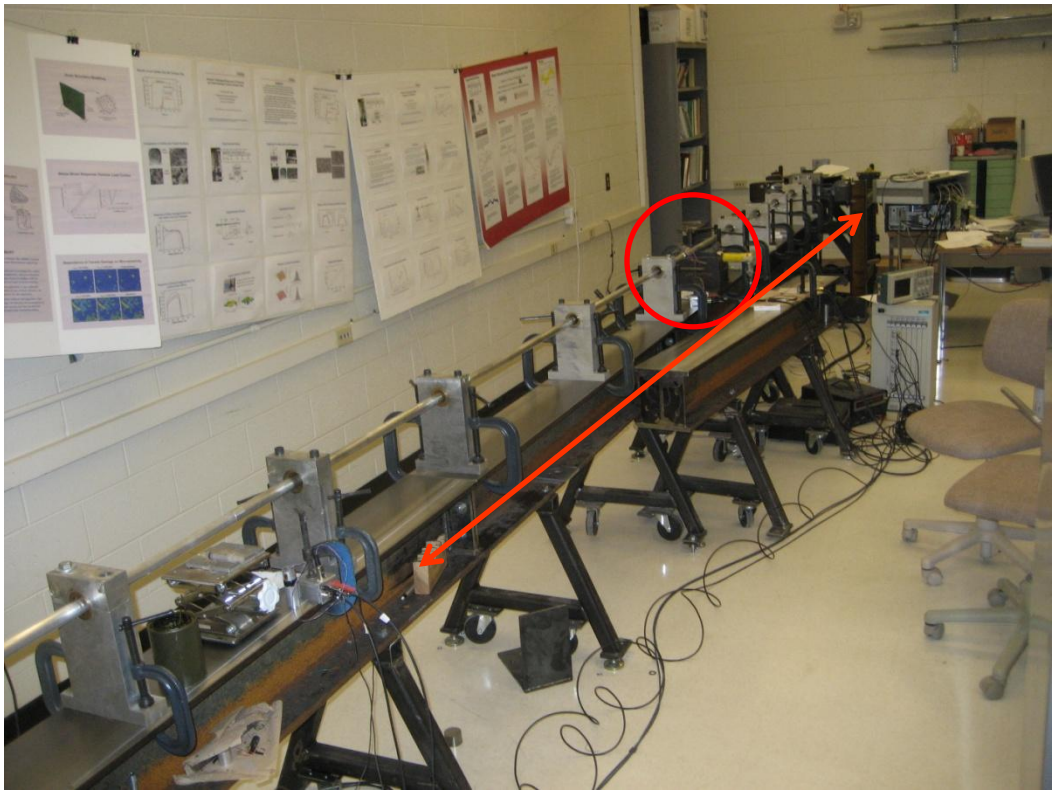
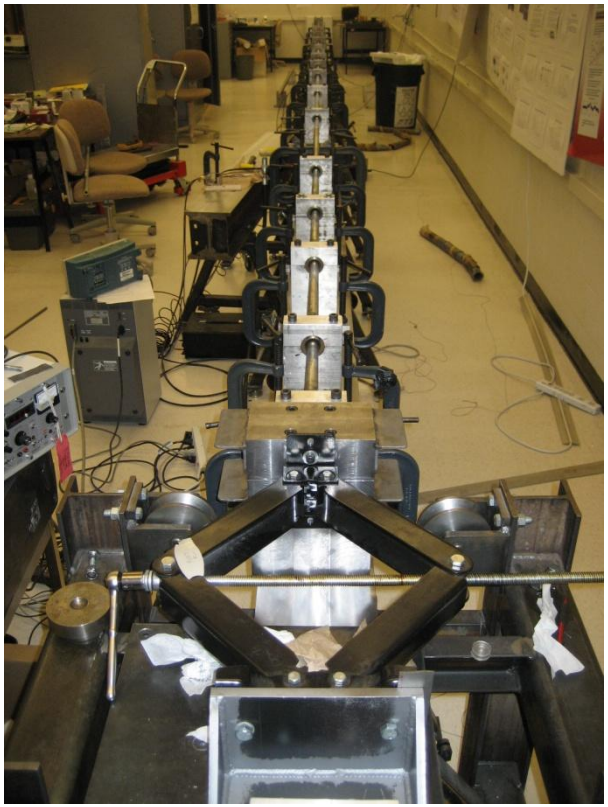


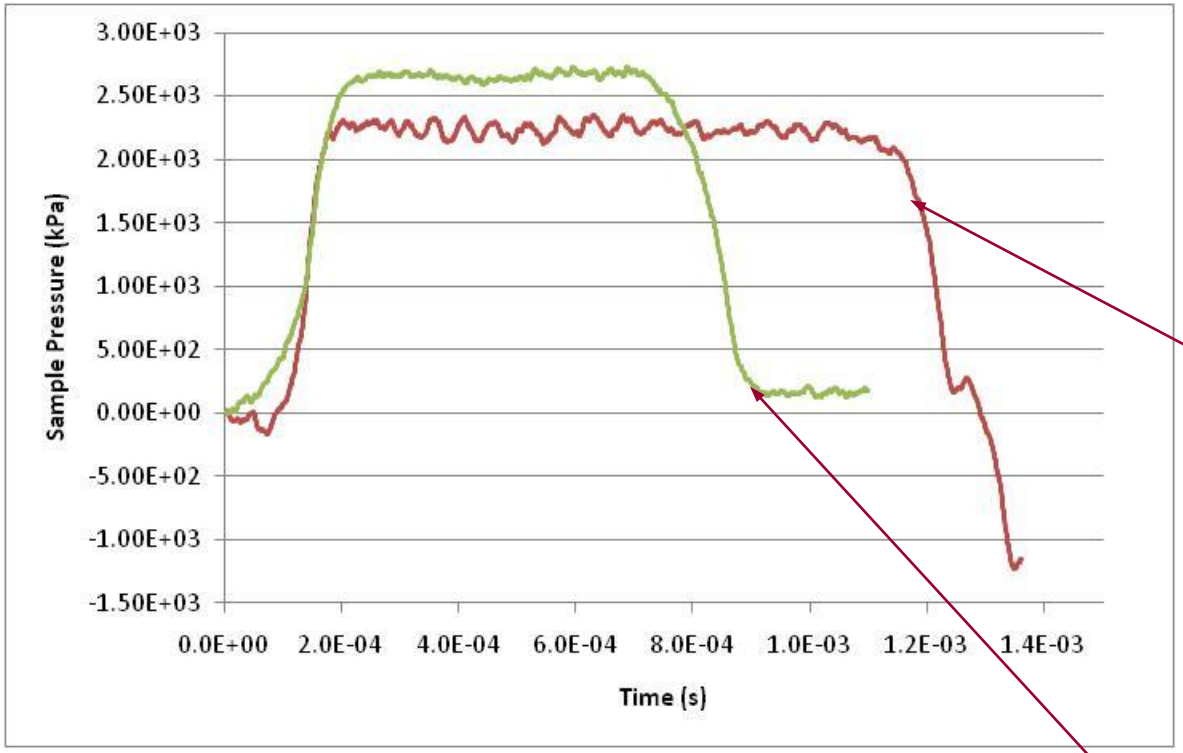


The Experimental Setup





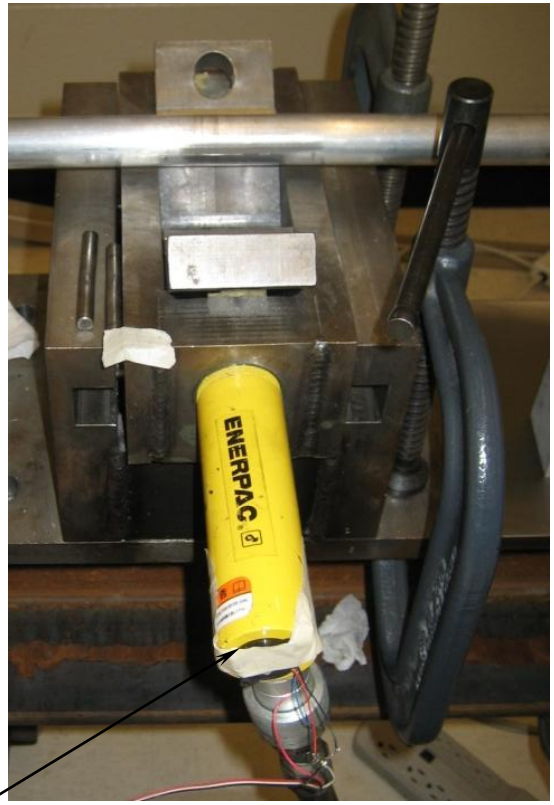
Variable Pulse Duration



1ms Pulse (115in)

.7ms Pulse (69in)

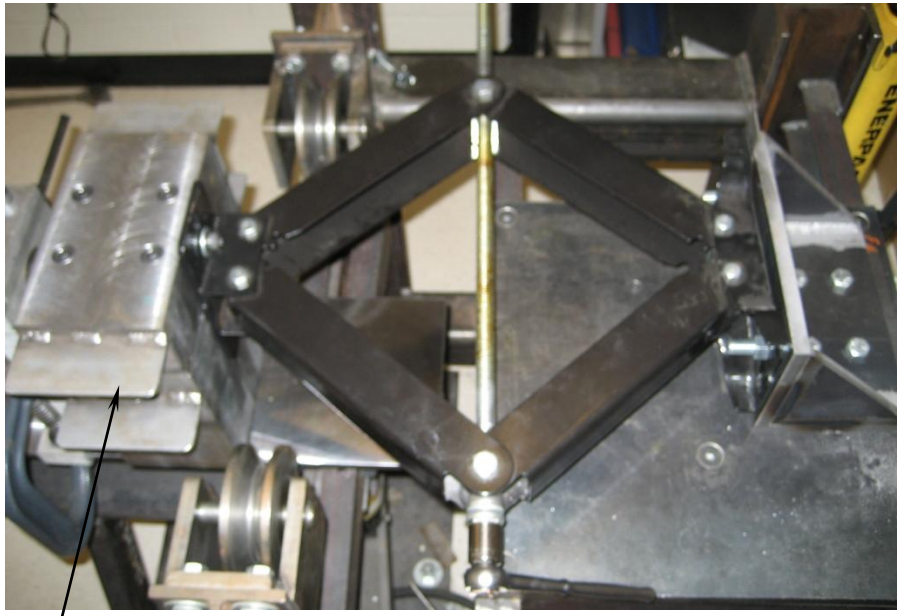
Operation of New Kolsky Compression Bar



Piezo-Buzzer Trigger

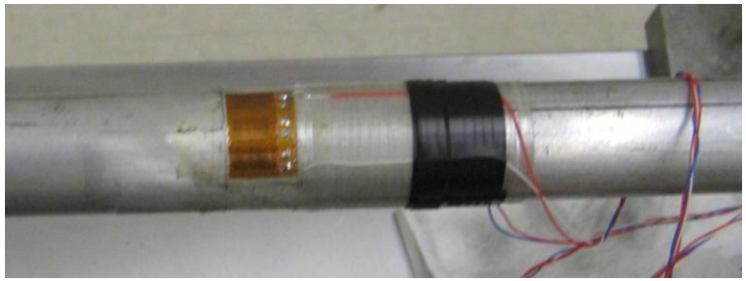
Friction Clamp

Operation of New Kolsky Compression Bar



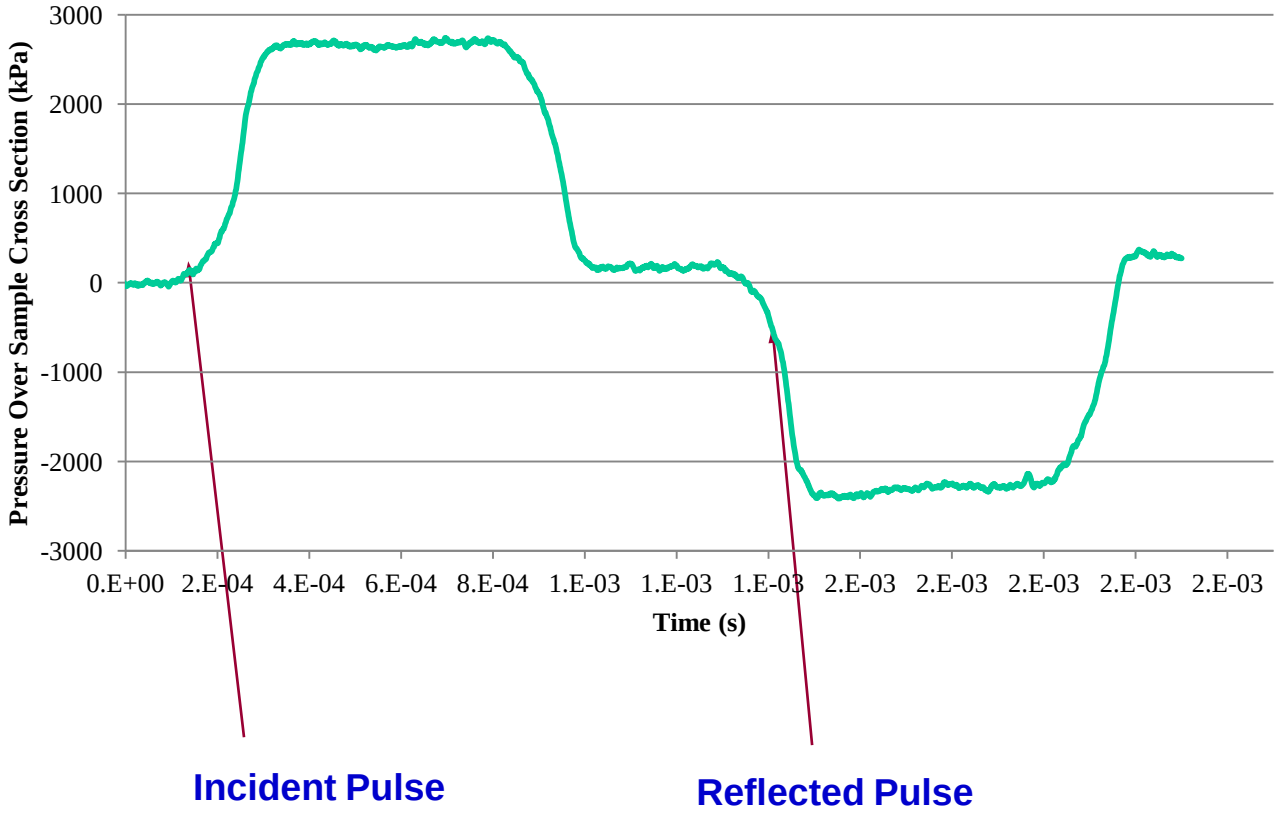
Heavy Mass

Heavy Mass and Jack

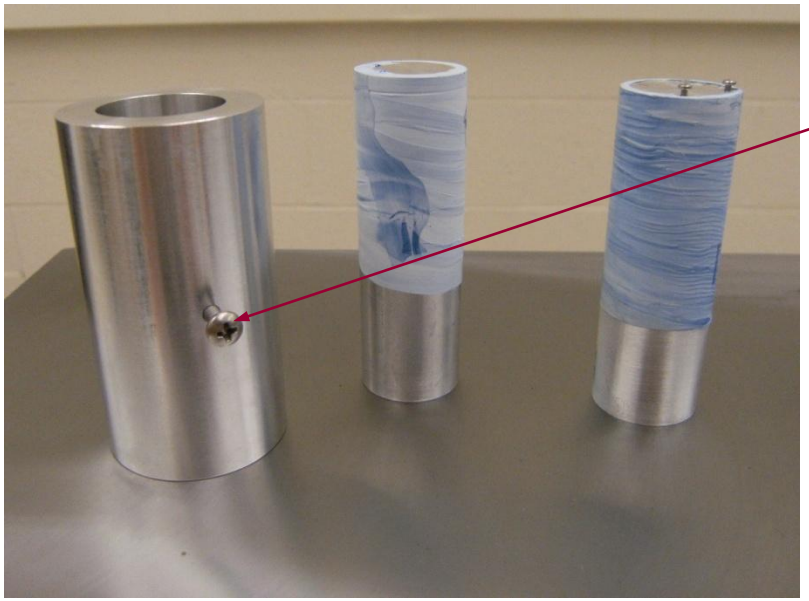


Compound Strain Gauge

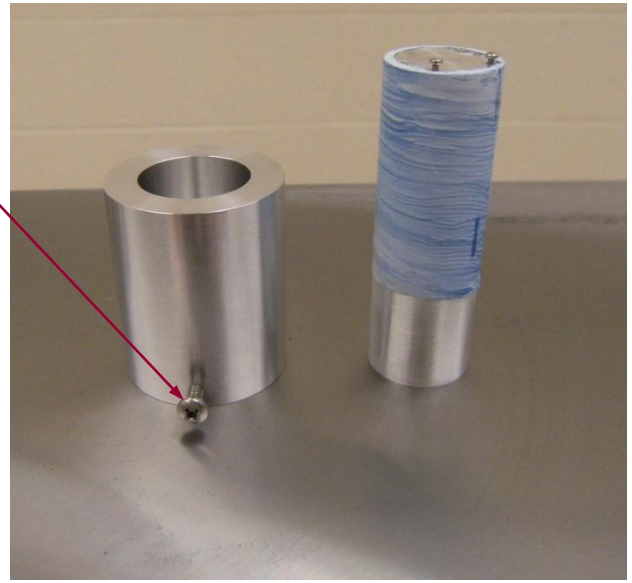
Typical Pulse Profile

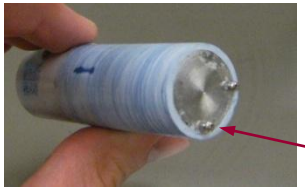


In-Vitro Cell Containment Vessel

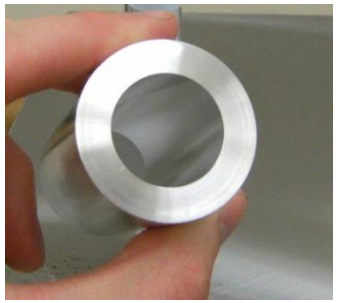


Water Vent



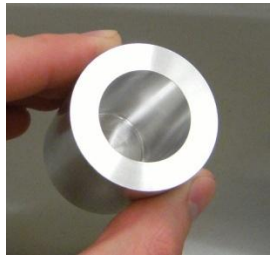


Sample securing screws



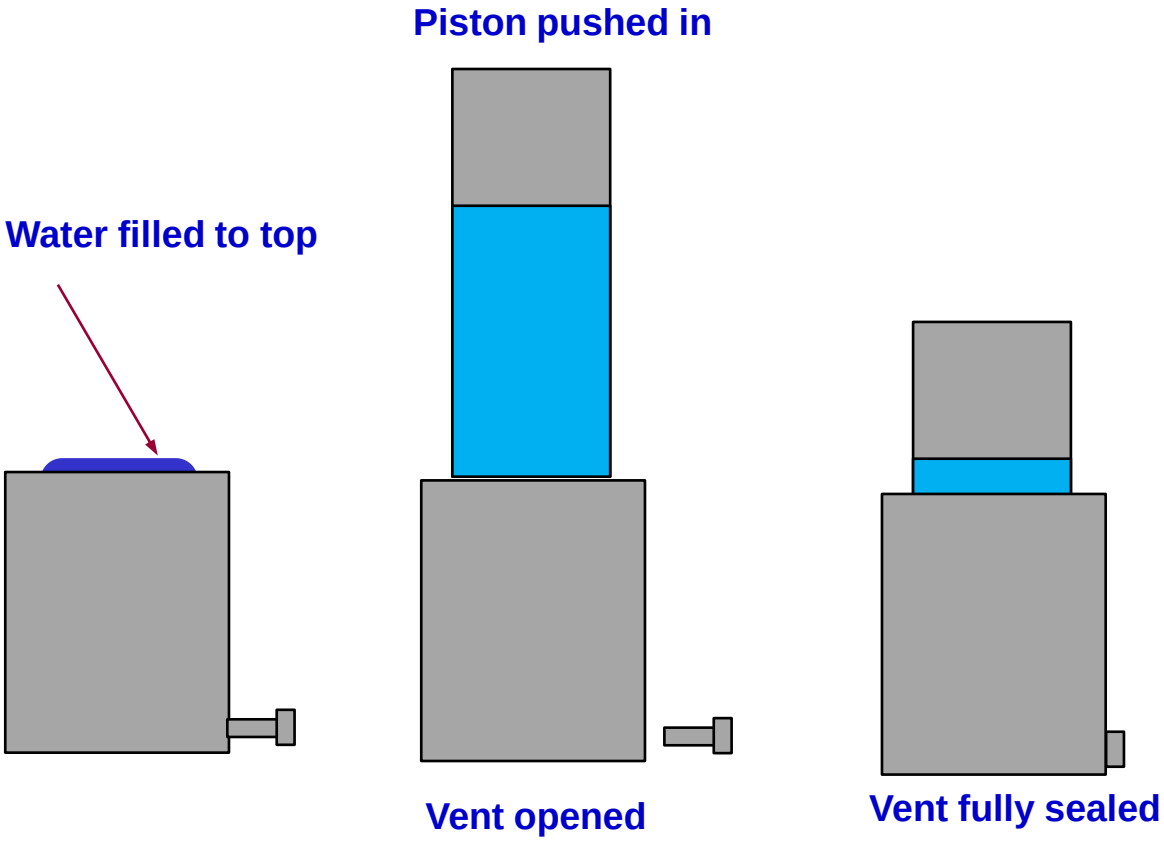
Double Piston Chamber

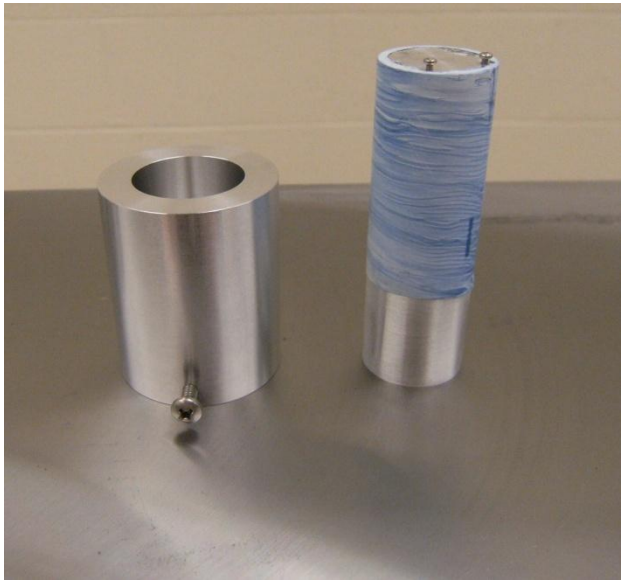
Piston



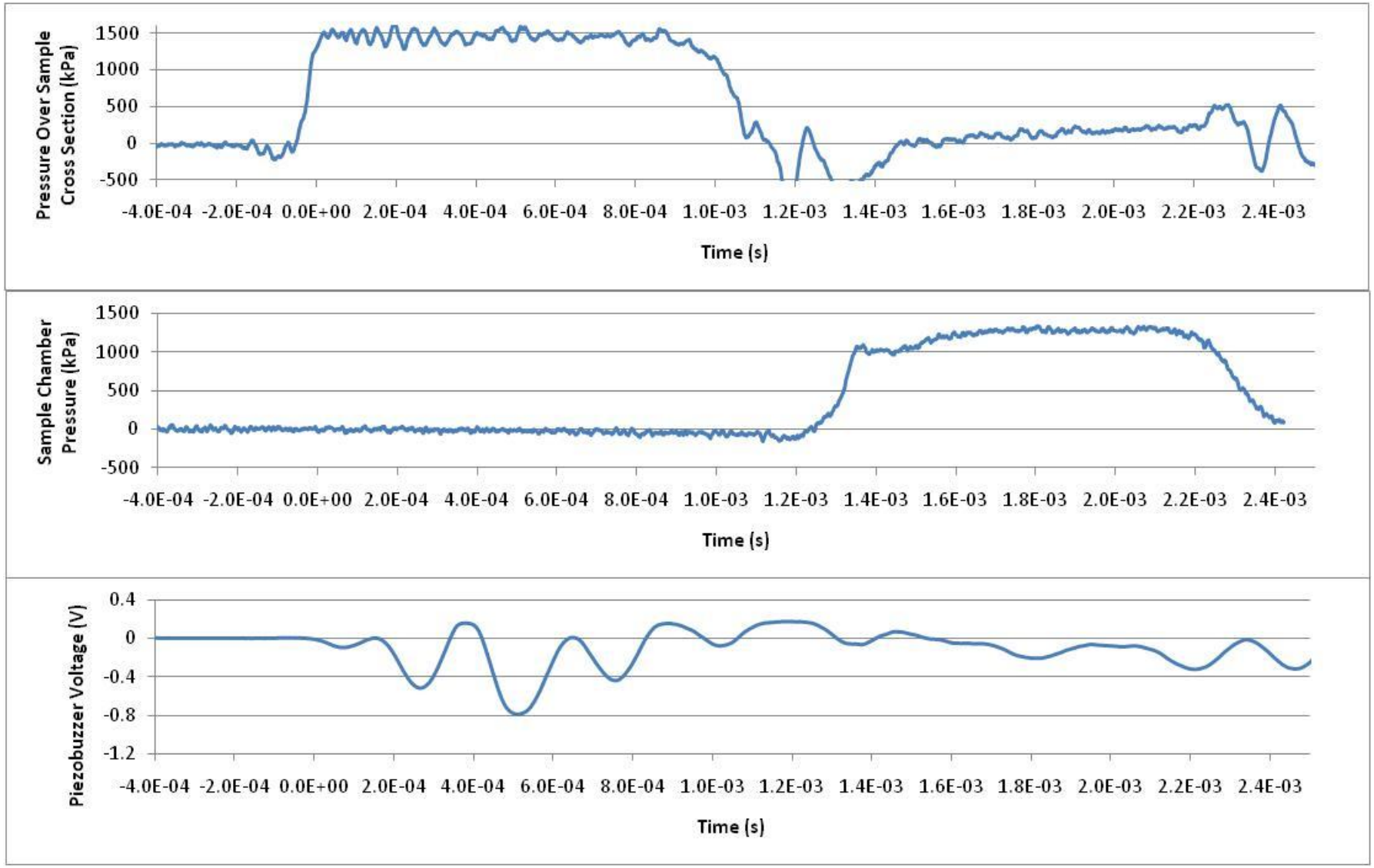
Single Piston Chamber

In-Vitro Cell Containment Vessel Installation

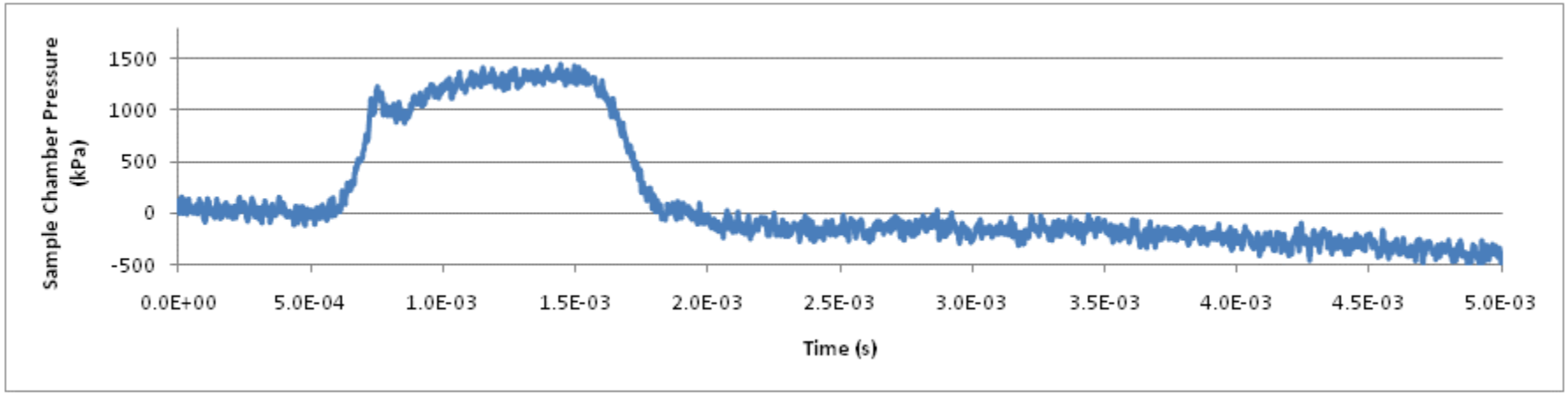




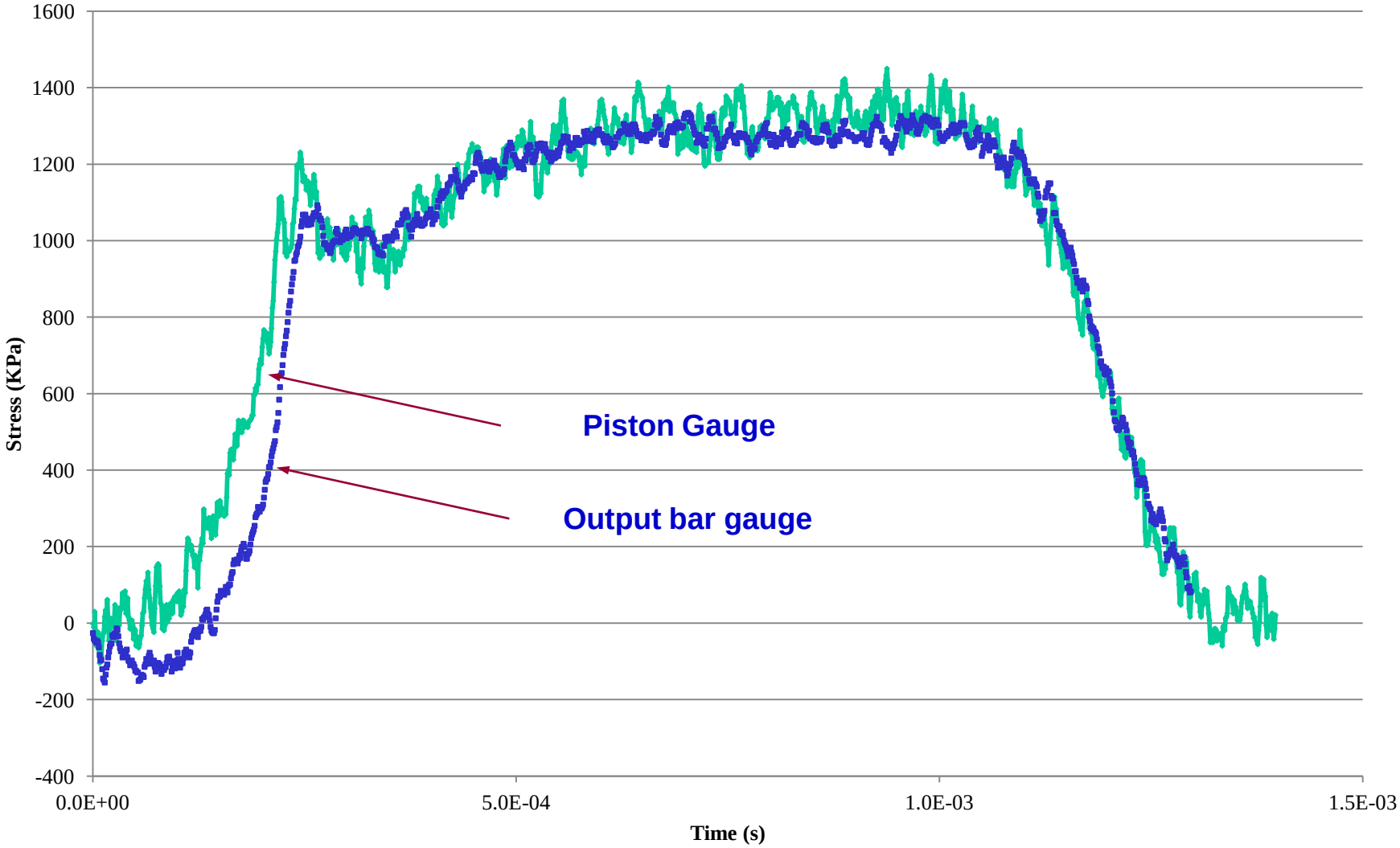
Typical Measurements for Single Piston Vessel



Typical Measurements for Single Piston Strain Gauge



Comparison of Piston and Bar Gauges



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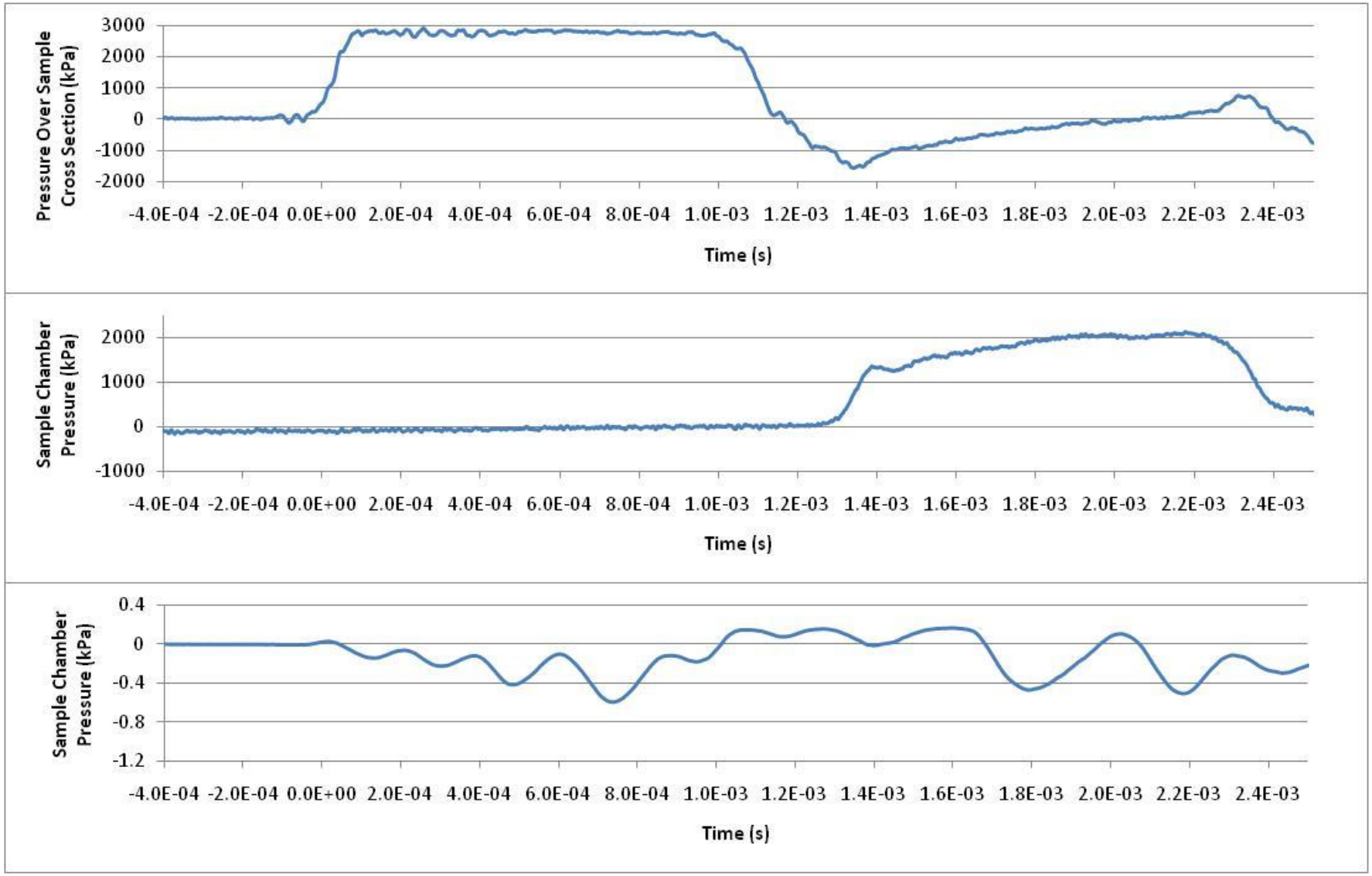
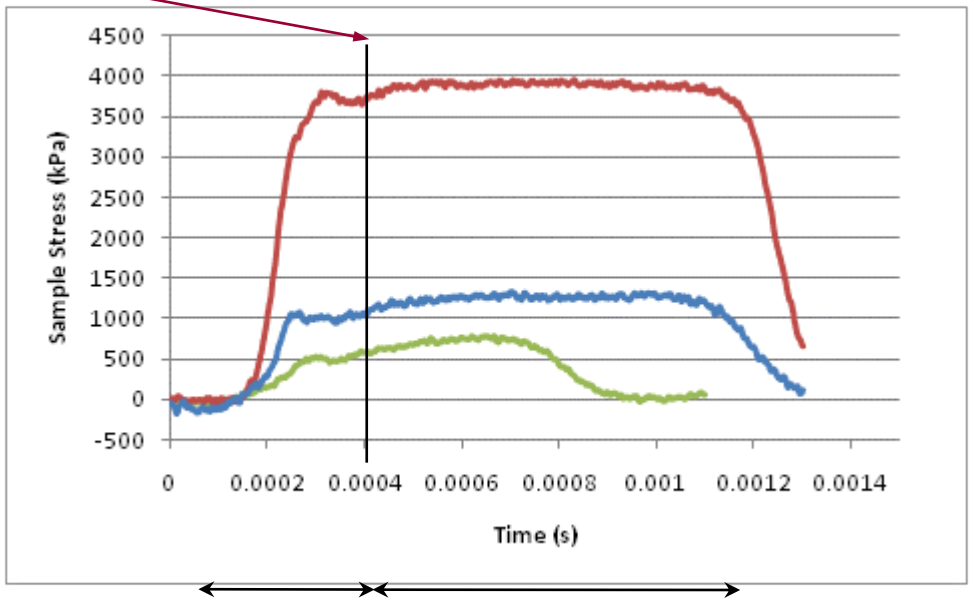


Results for Various Vessel Pressures

2nd Reverberation

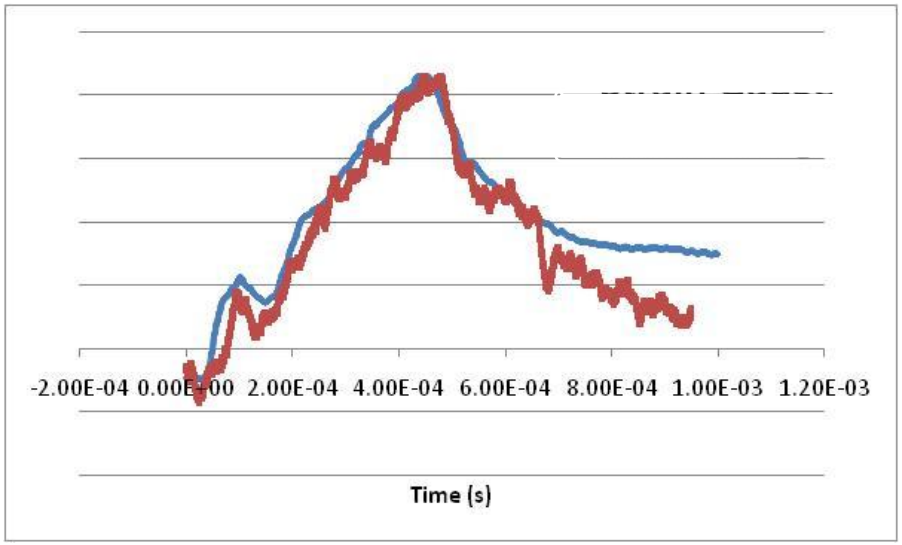
Output Bar Results



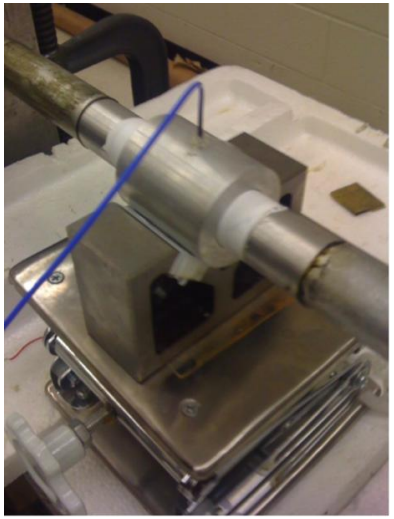
Water is compressible

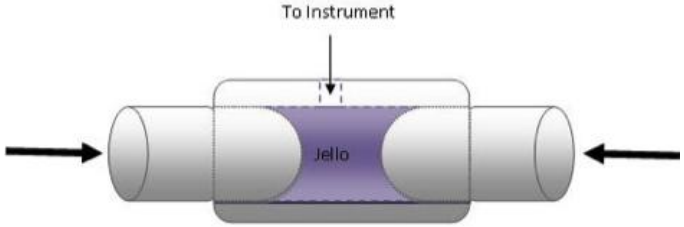
Water is incompressible

Measurements on Silicone Gel



- A test was conducted on a small pressure sensor imbedded in gelatin in a small casing.





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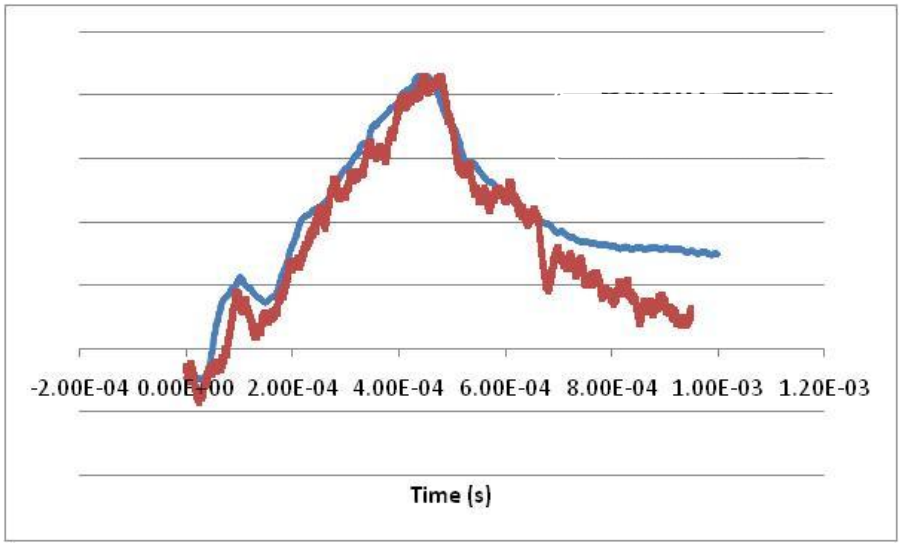
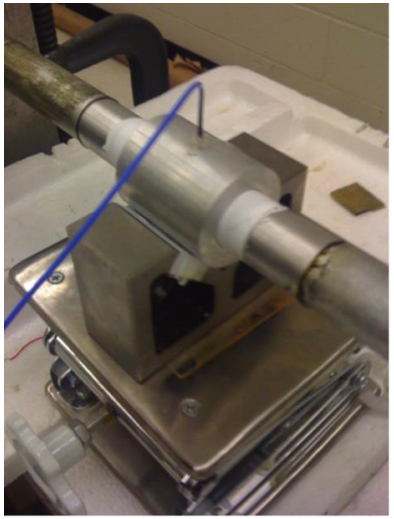
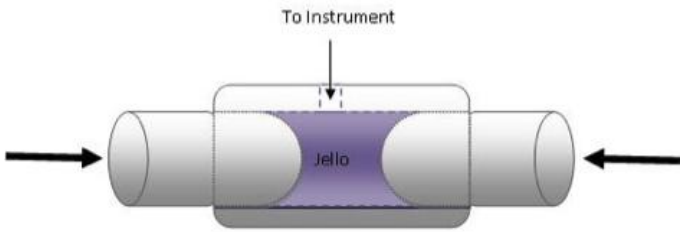


- A test was conducted on a small pressure sensor imbedded in gelatin in a small casing.
- It shows that the pressure inside the cell, and the response of the output bar are nearly identical.





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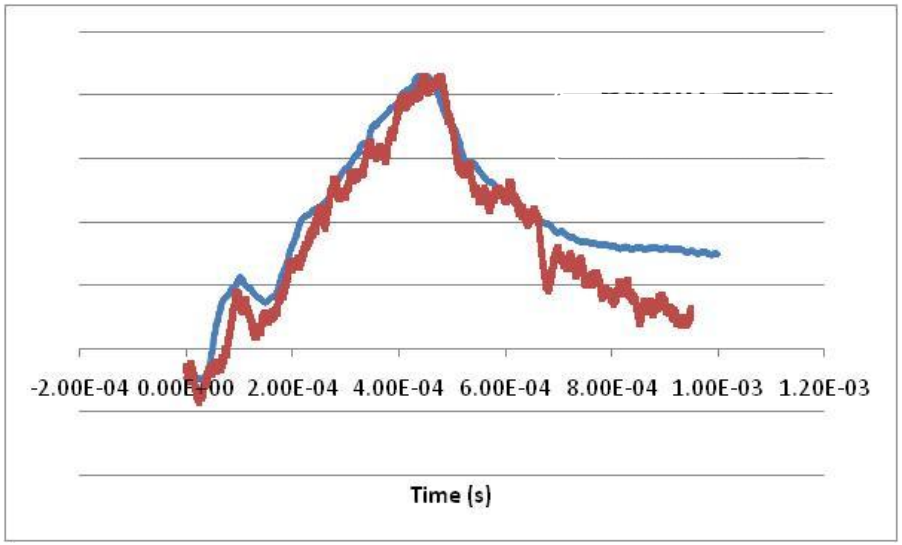

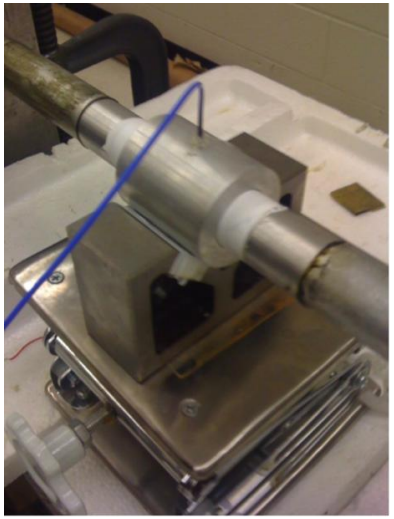

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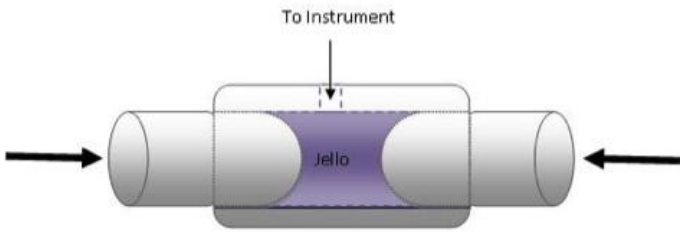
- It shows that the pressure inside the cell, and the response of the output bar are nearly identical.
- Thus the transmitted pulse obtained from the output bar should be proportional to the sample stress



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- With this new device, a compression pulse with pulse duration over 1ms has been achieved.
- Sample stresses as low as 0.5 MPa can be accurately measured and repeated.

Future Work

- Use the apparatus to test low impedance materials such as biological tissues and tissue stimulants.

Thank You

Questions?