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Title:	Some applications of Photonic Doppler Velocimetry (PDV) to gas-gun experiments
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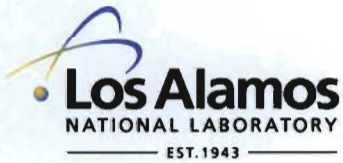

Form 836 (7/06)

SOME APPLICATIONS OF PHOTONIC DOPPLER VELOCIMETRY (PDV) TO GAS-GUN EXPERIMENTS

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To be presented at:
6th Annual PDV Workshop
Nov. 2 – 4, 2011
Lawrence Livermore National Laboratory
Livermore, CA

In this presentation we will discuss the use of Photonic Doppler Velocimetry (PDV) in the following gas-gun applications. (1) Projectile velocity and impact time measurement. (2) Projectile launch and acceleration in a 2-stage gas gun. (3) Projectile integrity after launch in a 2-stage gas gun. (4) PDV generated wave profiles from several different types of experiments. (5) A more extensive discussion of using multiple point PDV to measure the two dimensional initiation behavior of PBX 9501 explosive which was impacted by flat nosed rods.

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Some applications of Photonic Doppler Velocimetry (PDV) to Gas Gun Experiments

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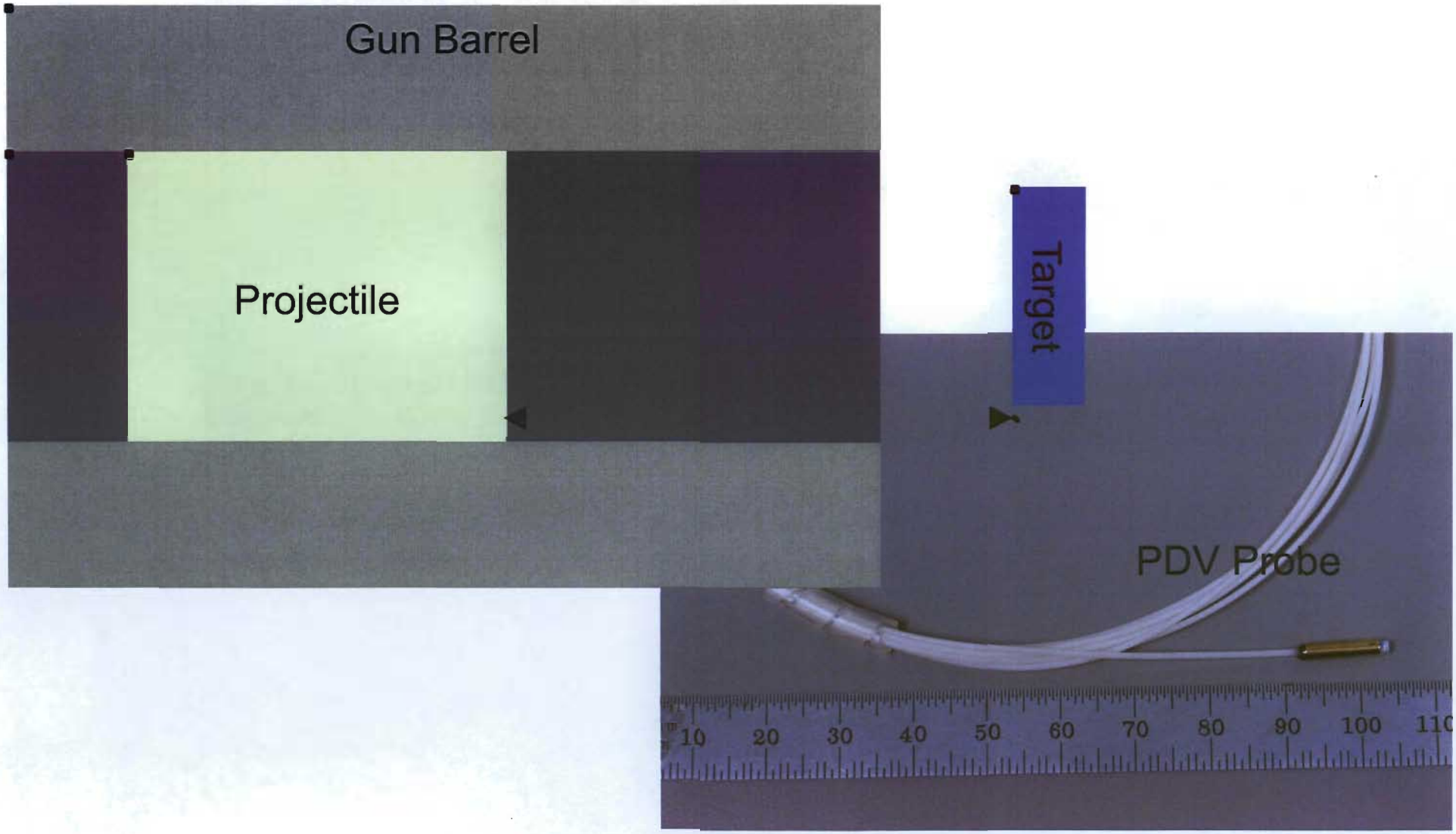
1 - Projectile velocity (1 probe)



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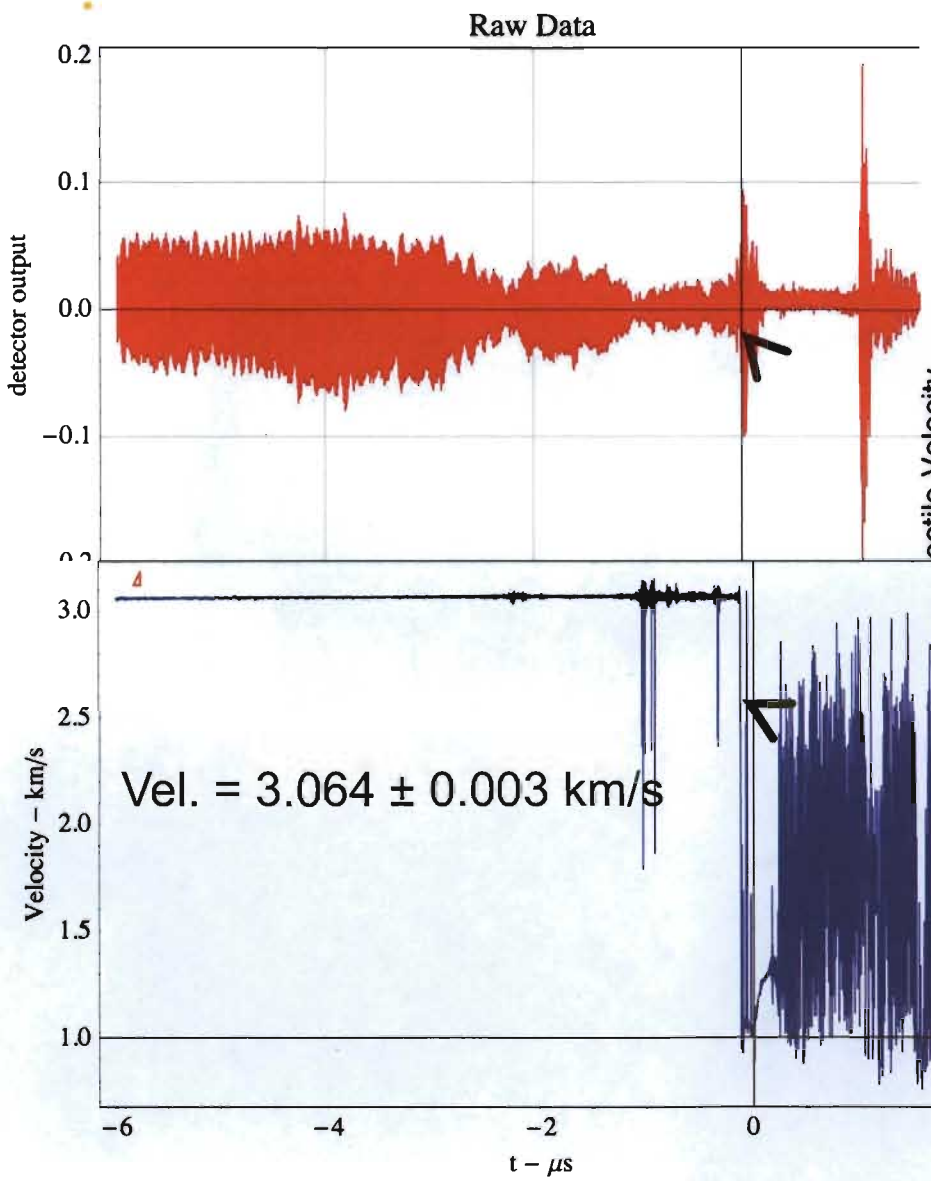
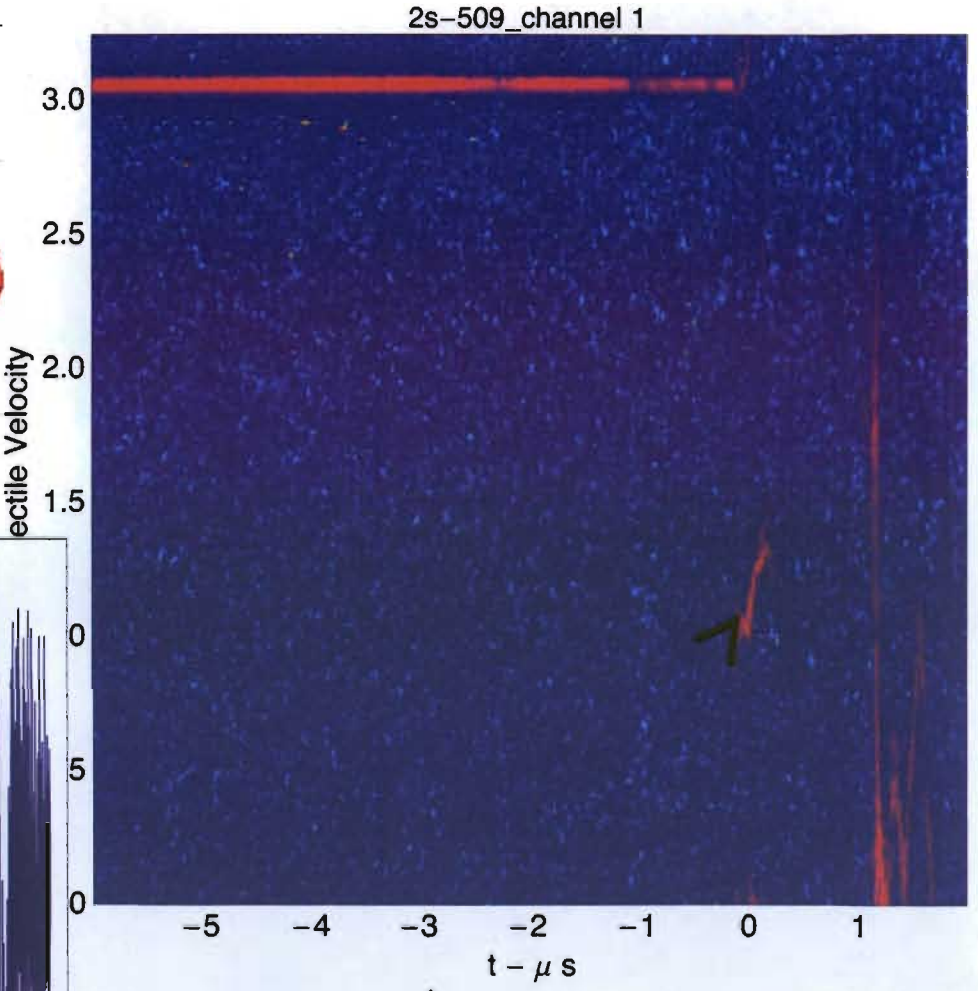
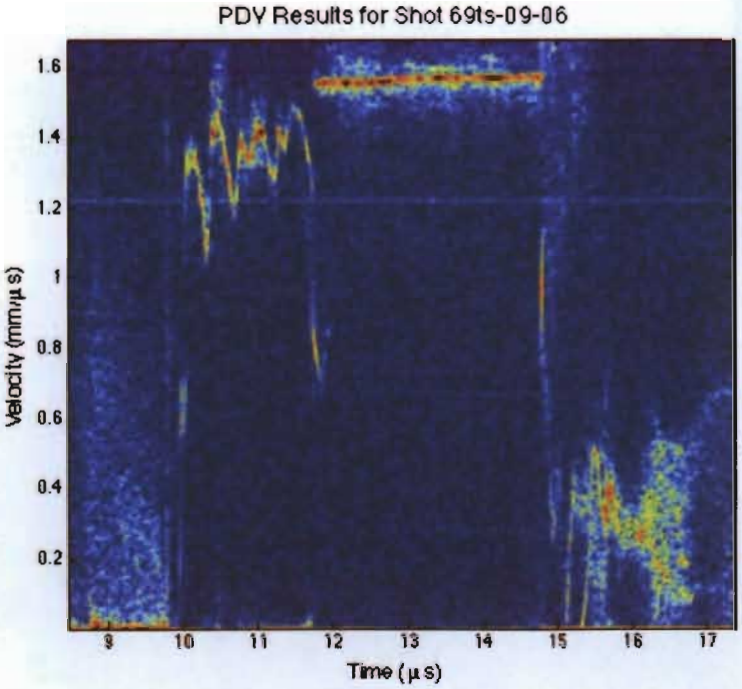
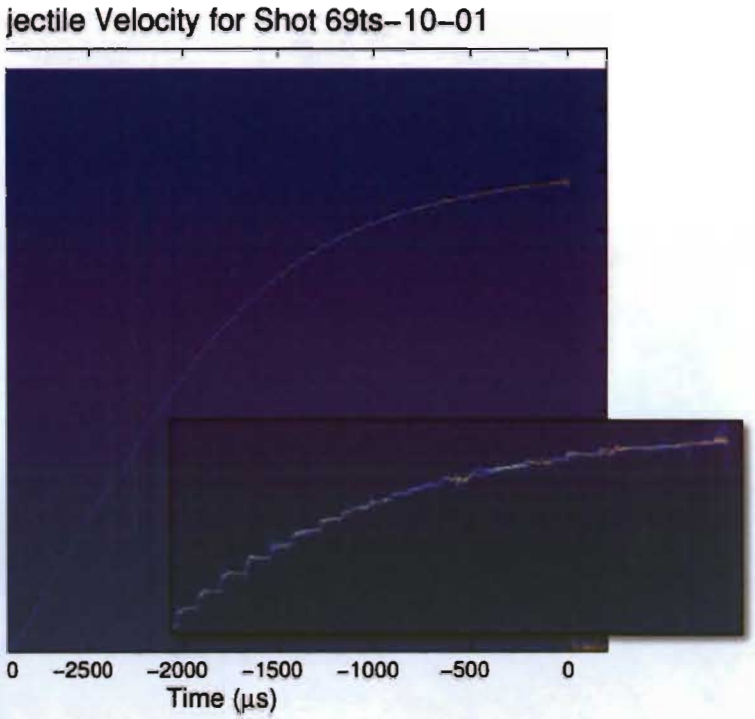
Data from a shot





Probe Impacted
Impact time to 1 – 2 ns


PDV Results for Shot 69ts-09-06
Velocity (mm/μs)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
9
10
11
12
13
14
15
16
17
Time (μs)


jectile Velocity for Shot 69ts–10–01
0
–2500
–2000
–1500
–1000
–500
0
Time (μs)

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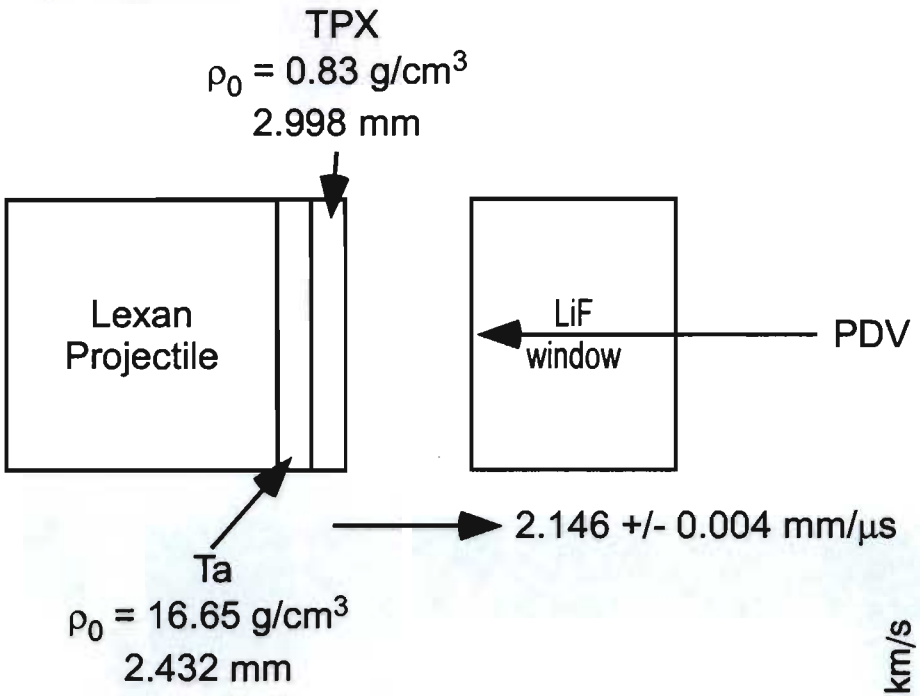
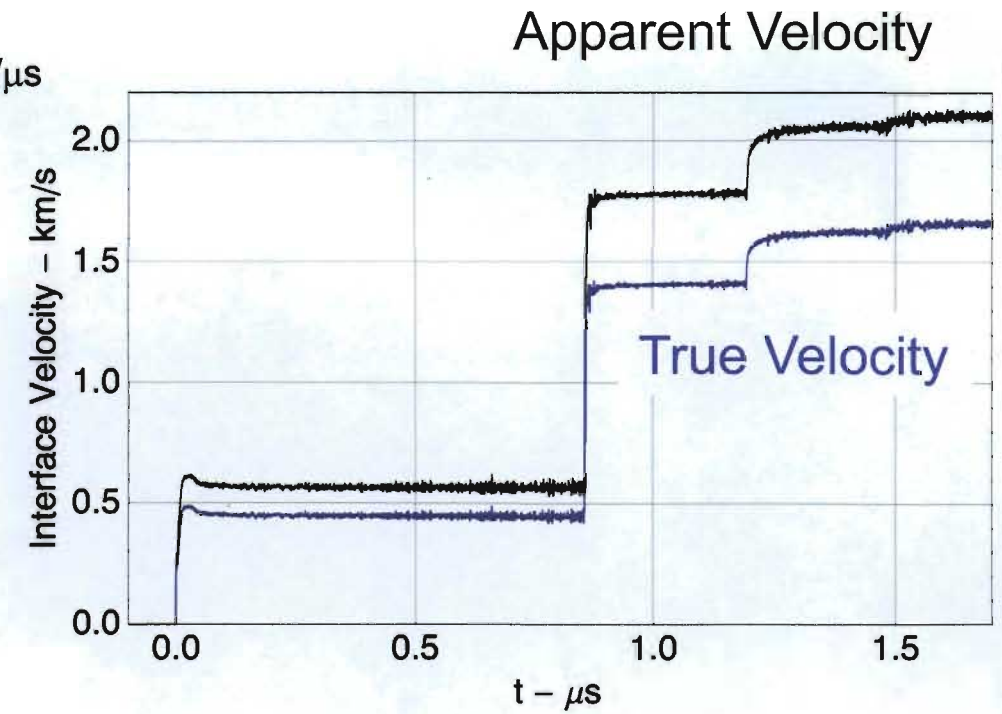
Double Shock - front surface impact





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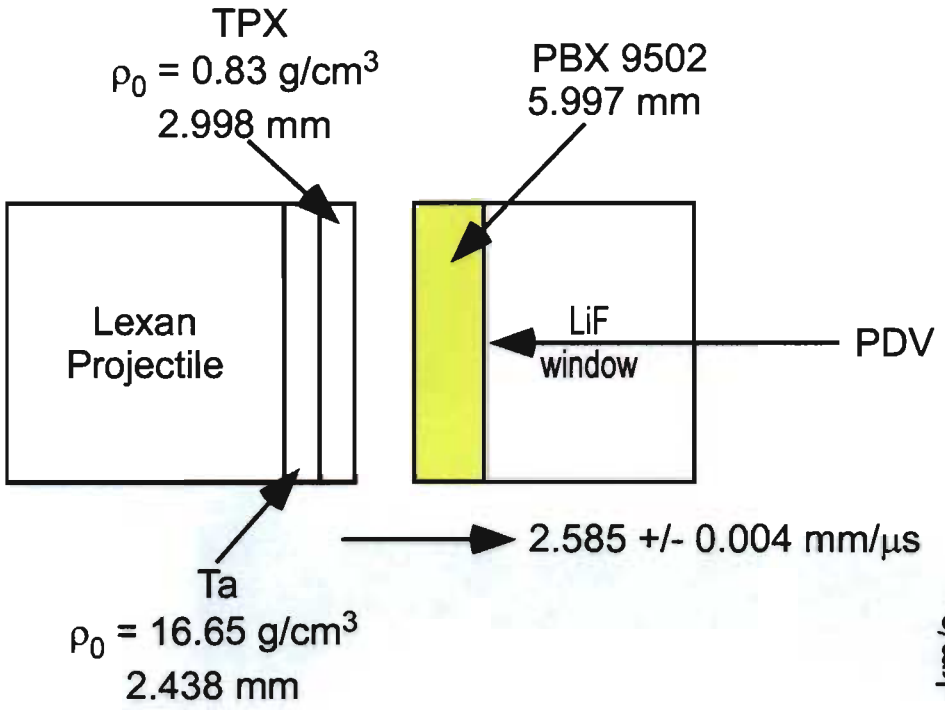
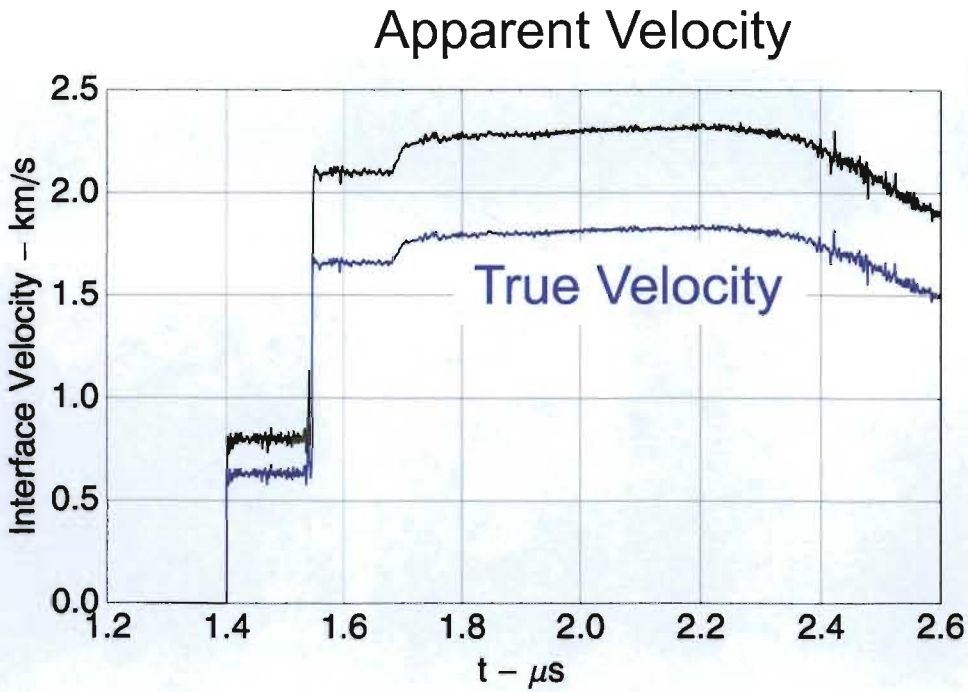
Double shock - transmitted





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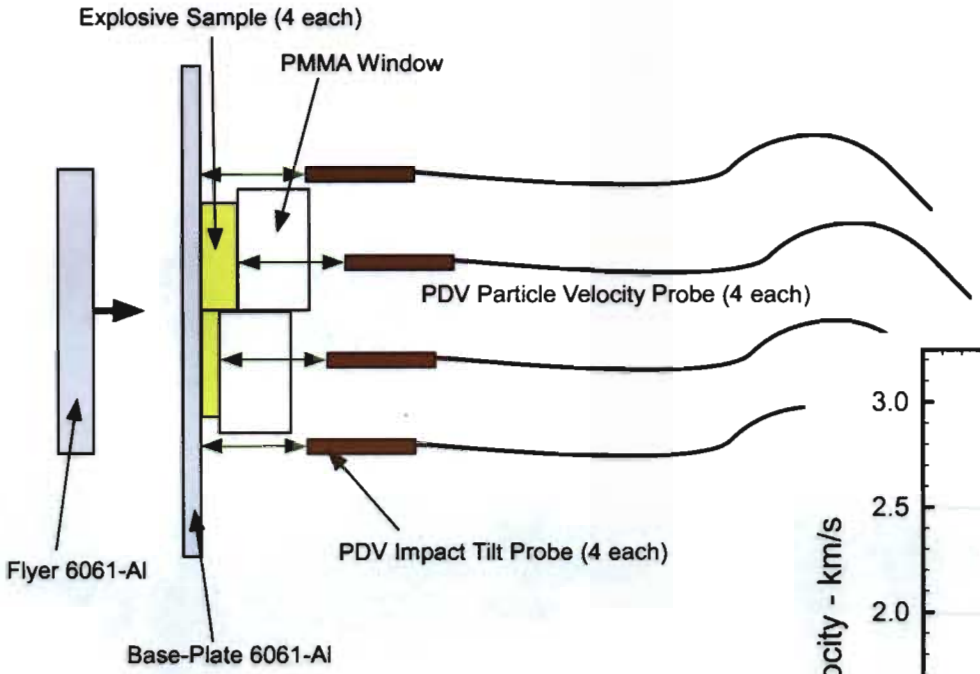
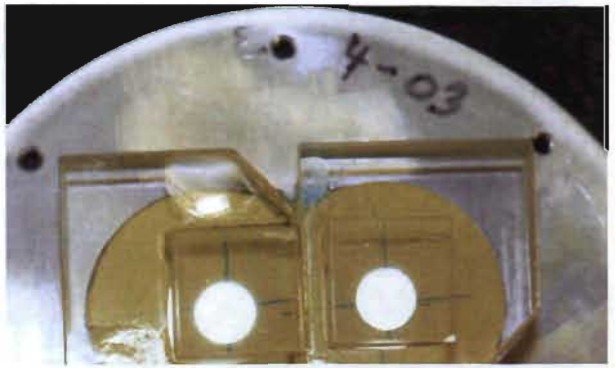
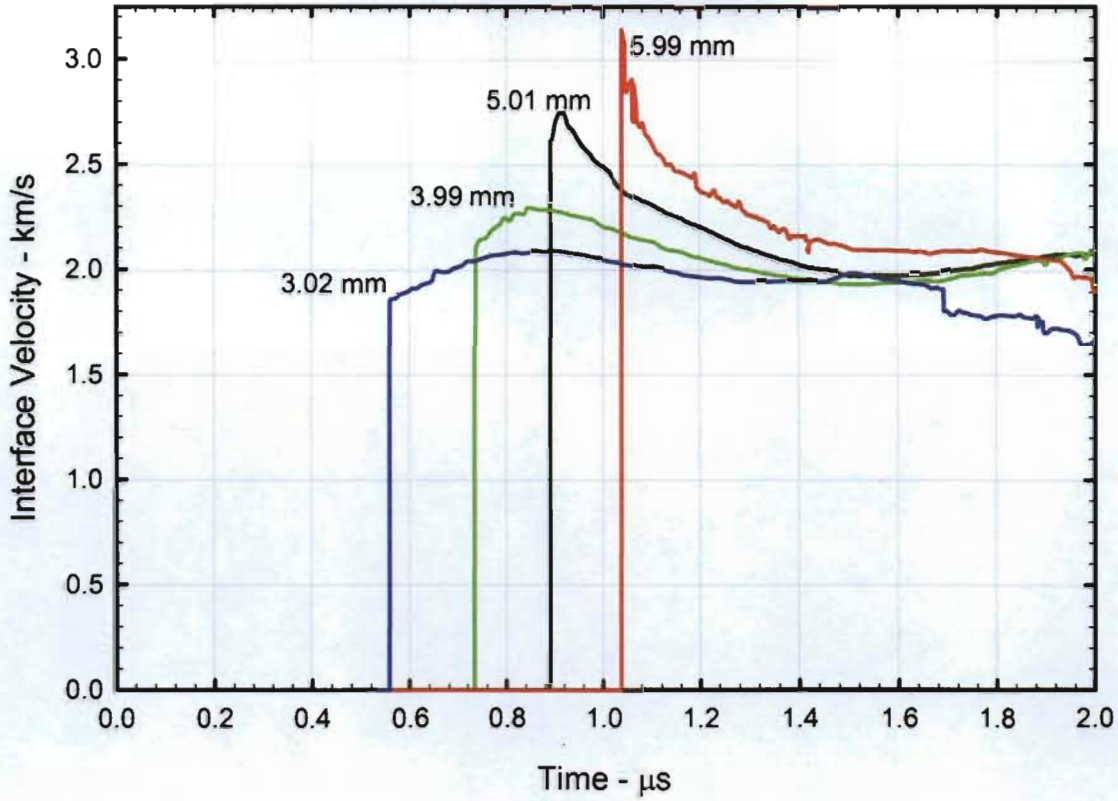
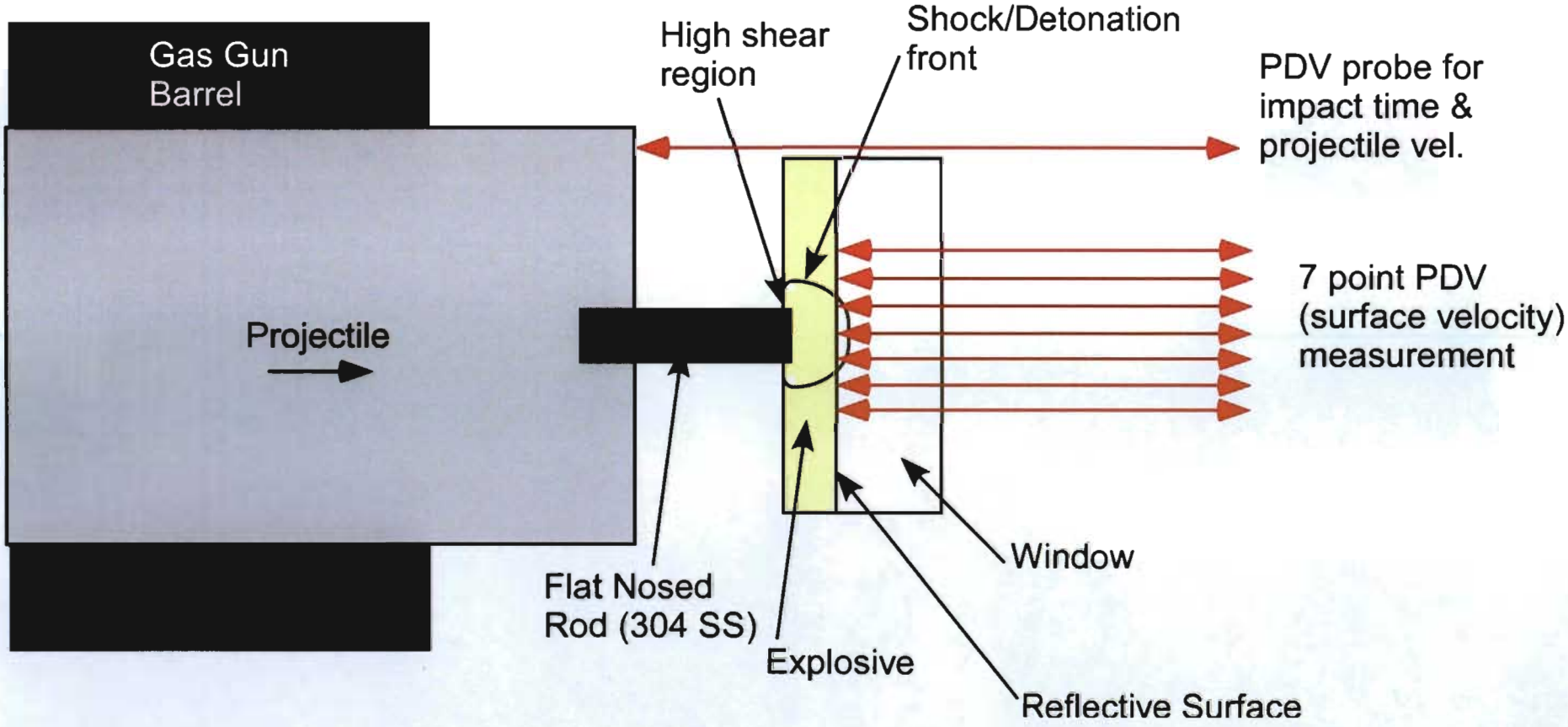
Multi-slug plate impact experiment



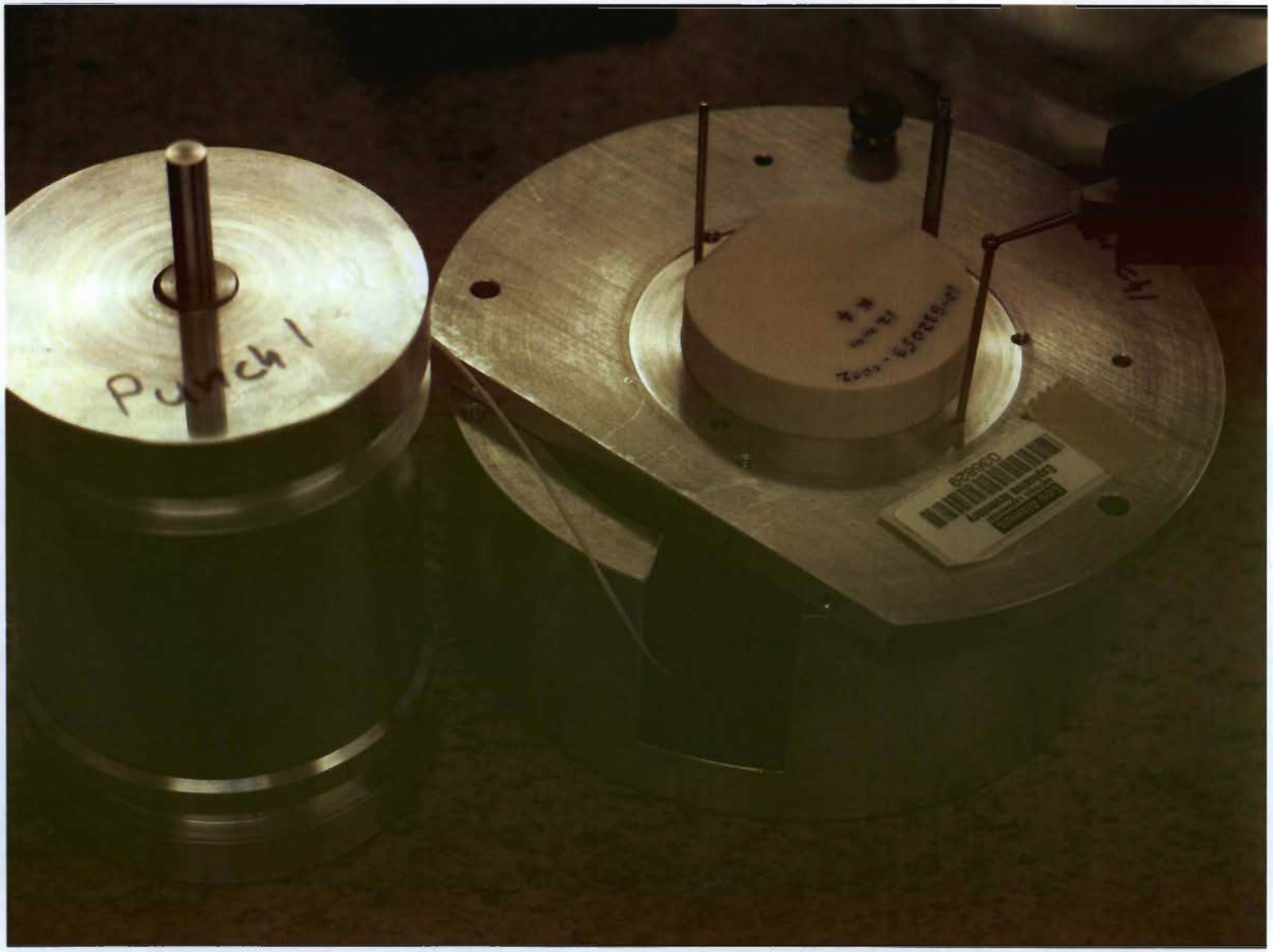




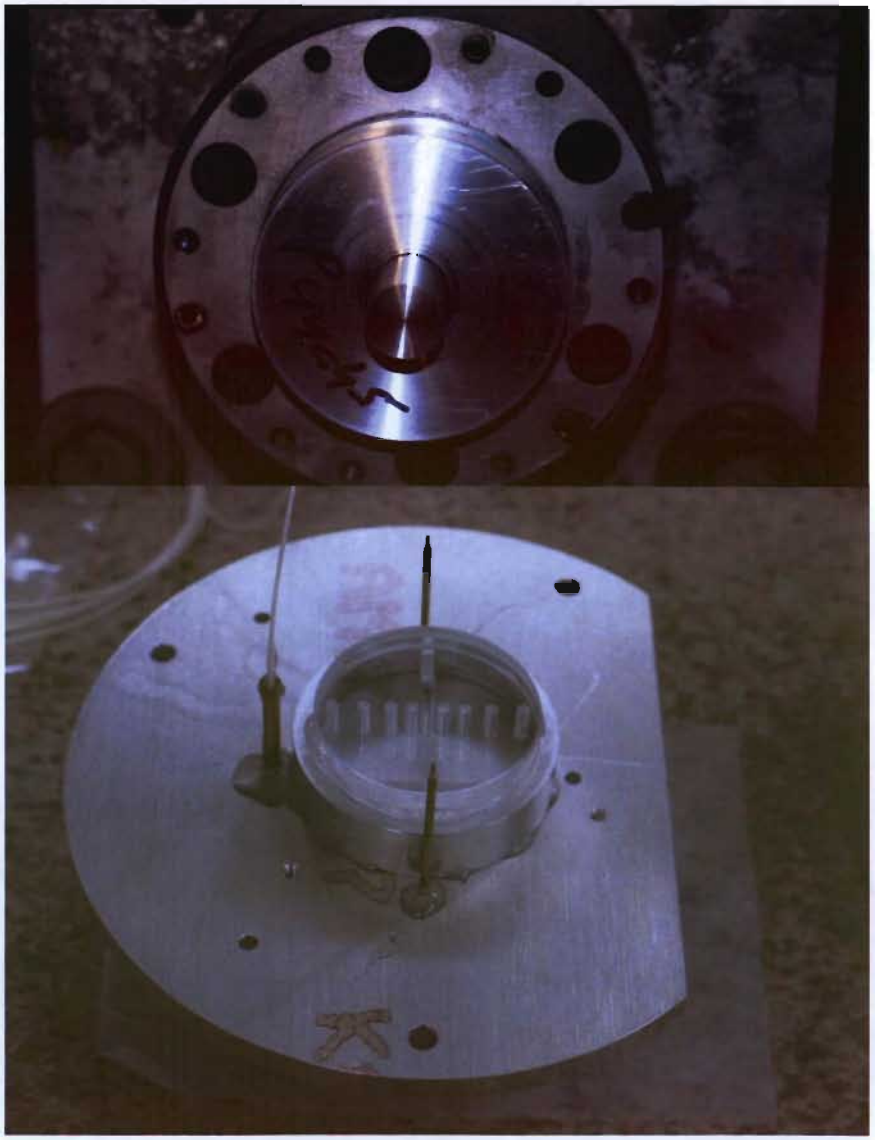
Flat nosed rods: a 2-D shock initiation experiment

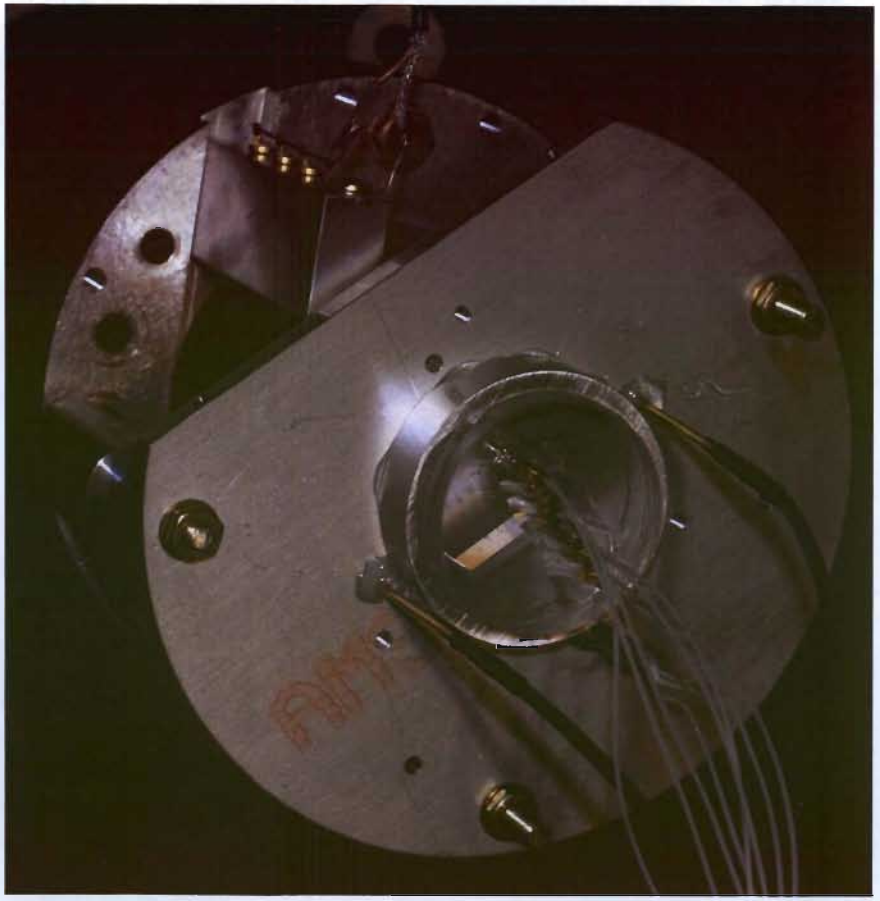


impactor and front of target

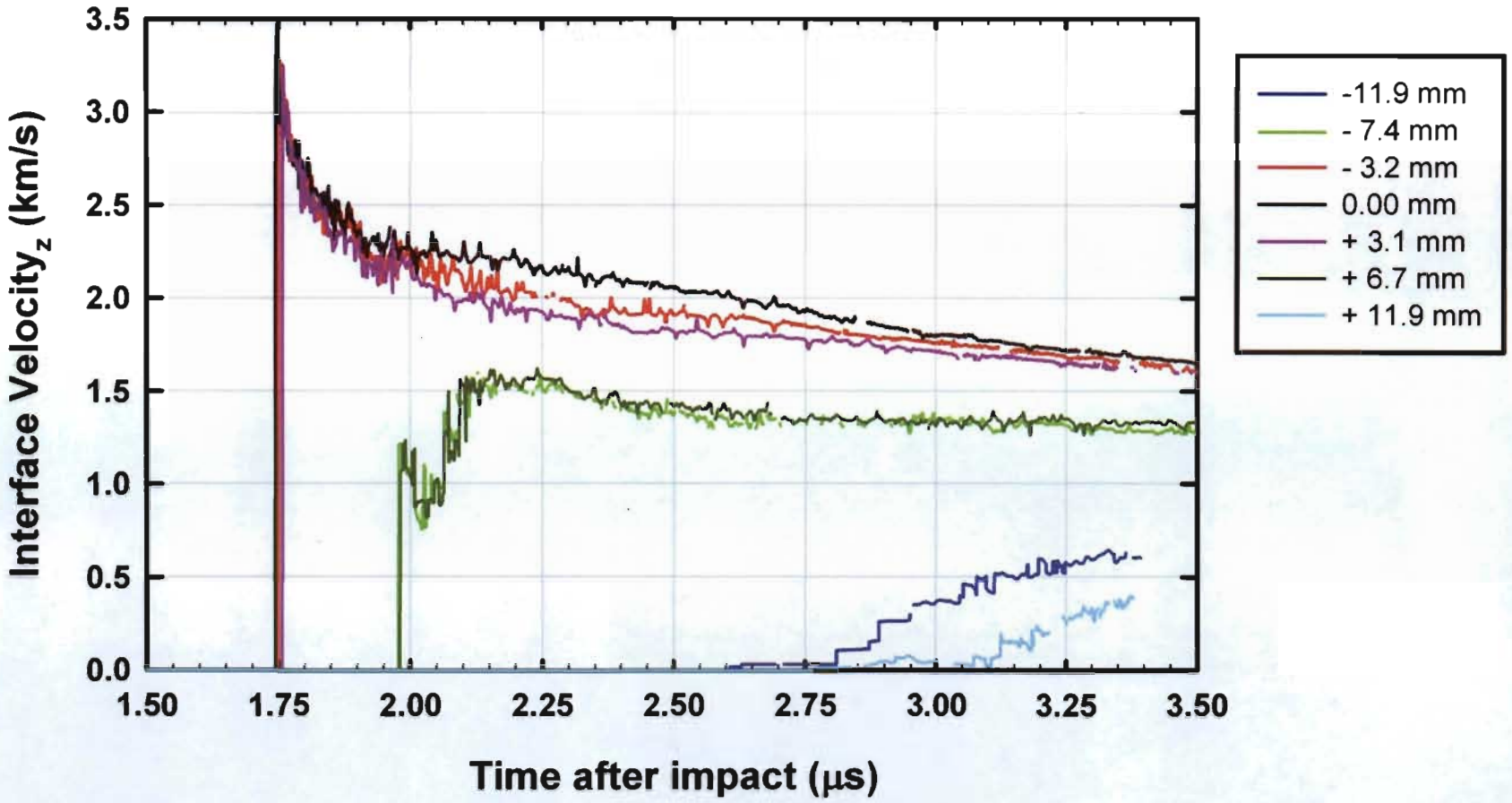


Flat nosed rod experiment

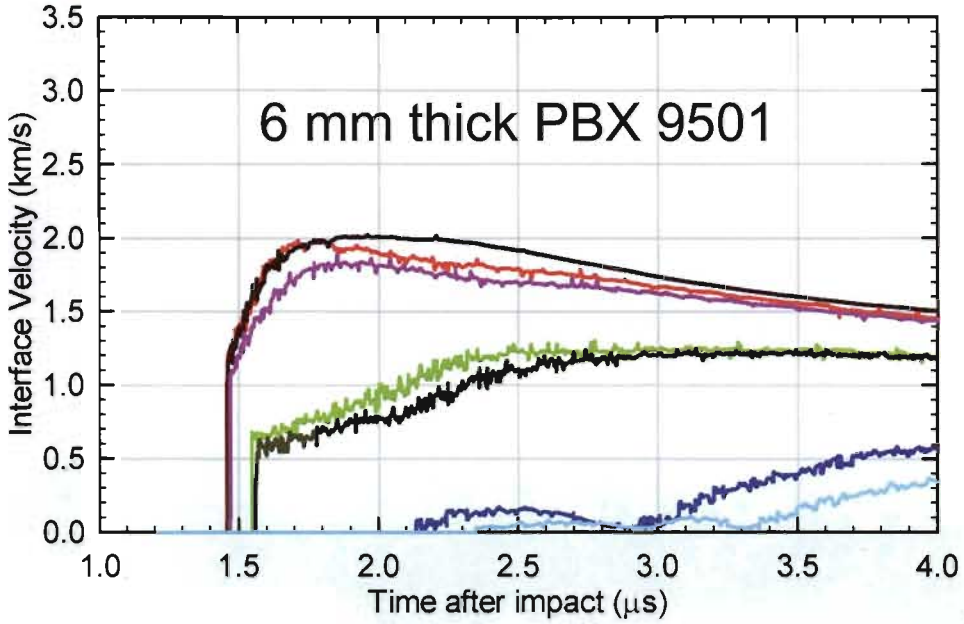




Result from a single experiment: 17 mm φ rod impacting 8 mm PBX 9501 at 0.74 km/s

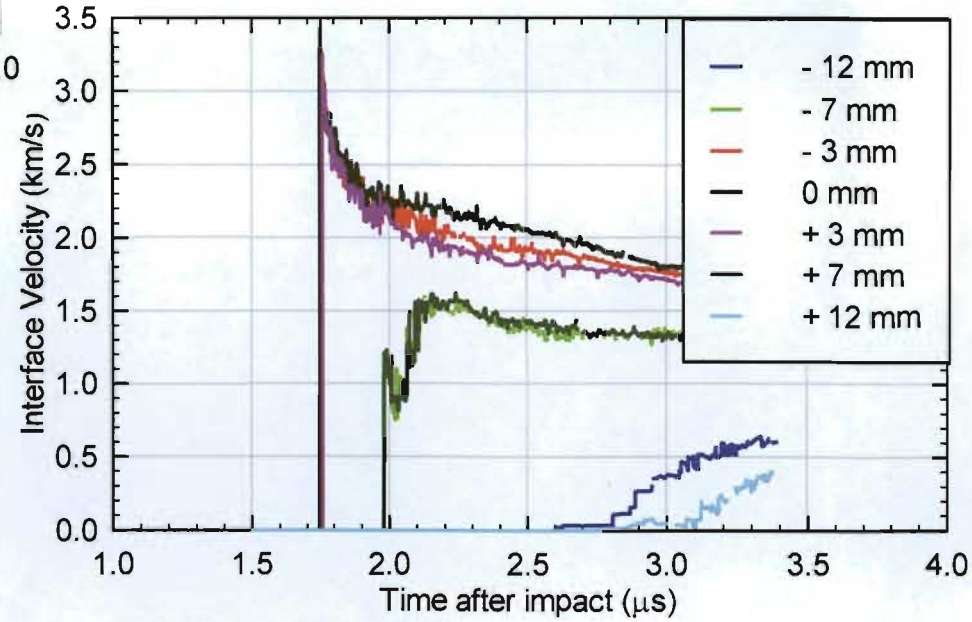


17 mm φ rod impacting PBX 9501 at 0.74 km/s

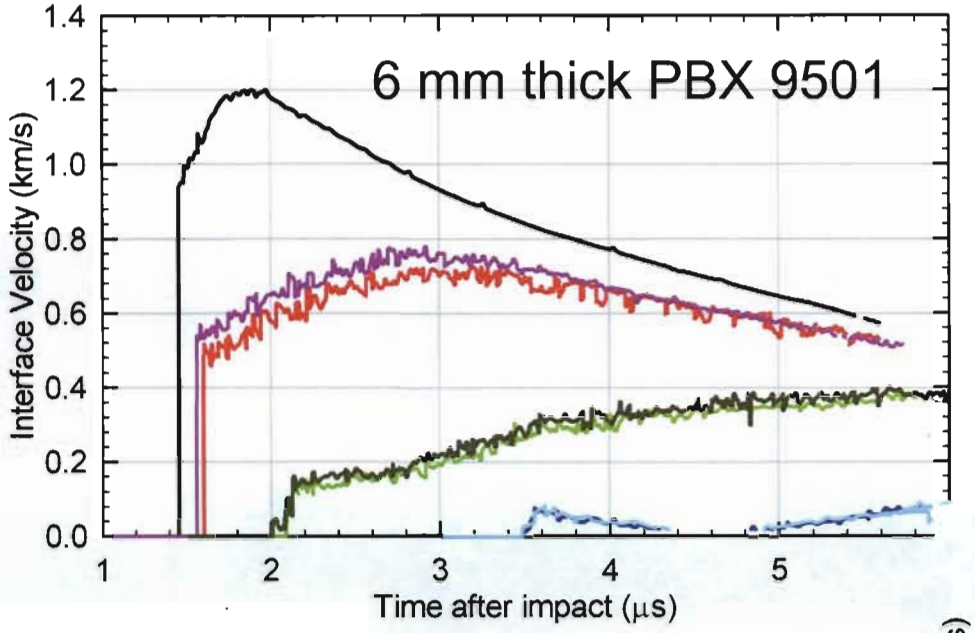


(Detonation)
P = 4.4 Gpa
u_p = 0.62 mm/μs
tau = 0.50 μs
E = 1.37

8 mm thick PBX 9501

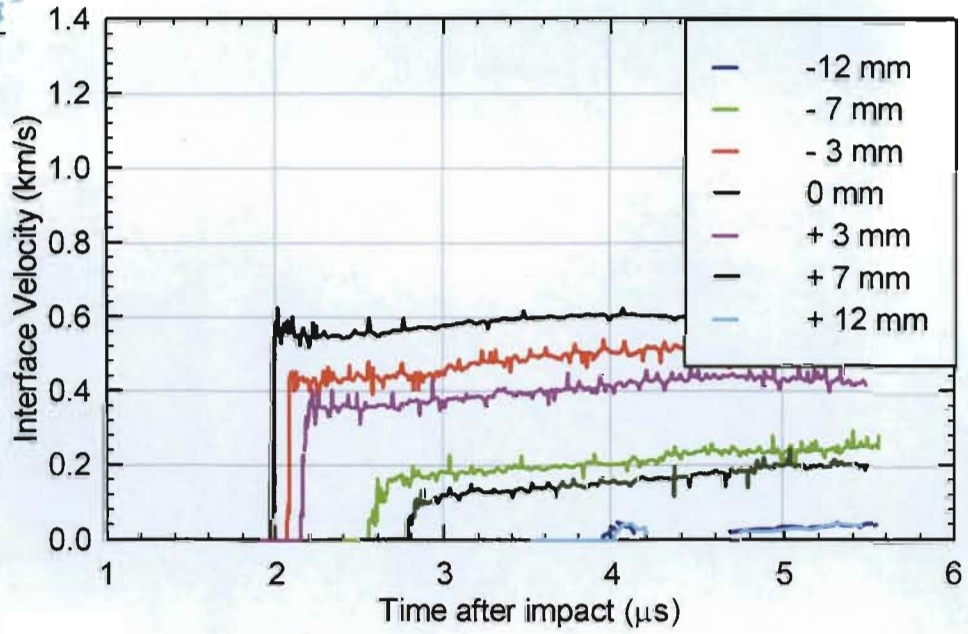


8.5 mm φ rod impacting PBX 9501 at 0.74 km/s

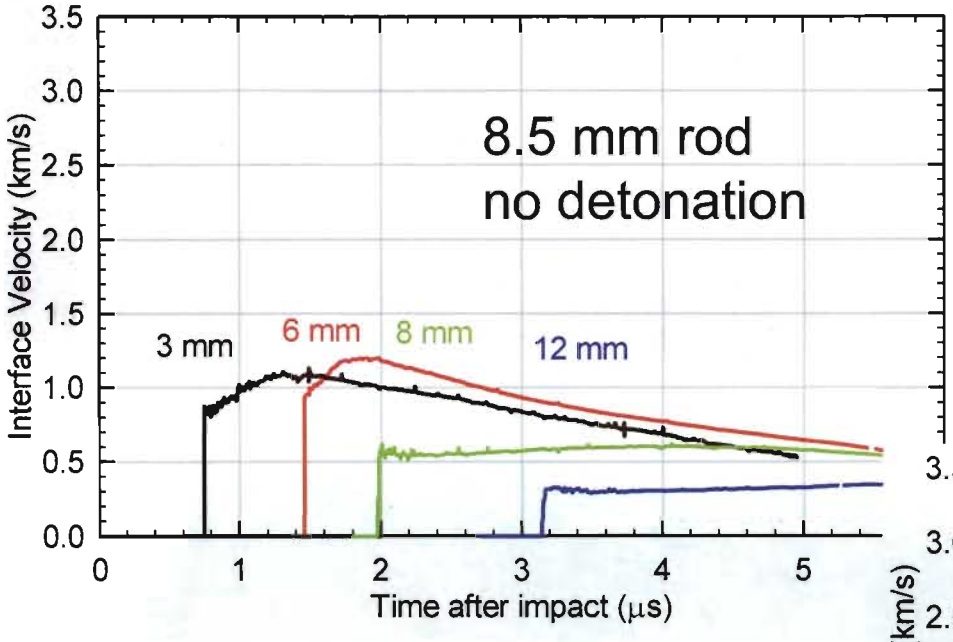


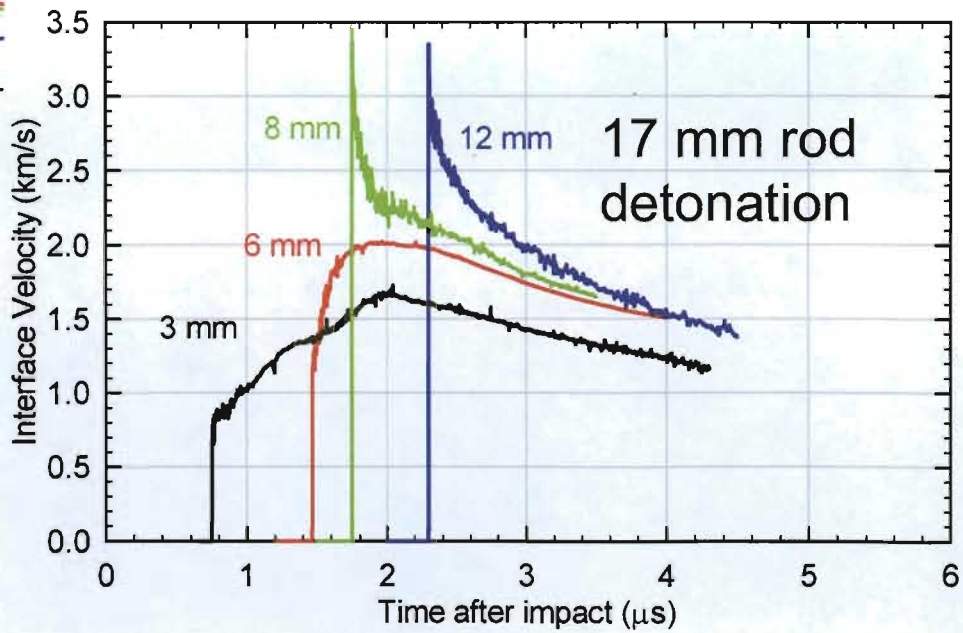
(No Detonation)
P = 4.4 Gpa
u_p = 0.62 mm/μs
tau = 0.25 μs
E = 0.69

8 mm thick PBX 9501



centerline results for flat-nosed rods on PBX 9501 at 0.74 km/s





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Summary

- Gas gun experiments can use PDV in many different ways
  - projectile velocity
  - projectile integrity
  - impact time
  - transit times
  - wave profiles

- Advantages include
  - easy to set-up
  - easy to field
  - easy to time correlate many channels
  - moderate per-channel cost
  - large number of users to ask for advice