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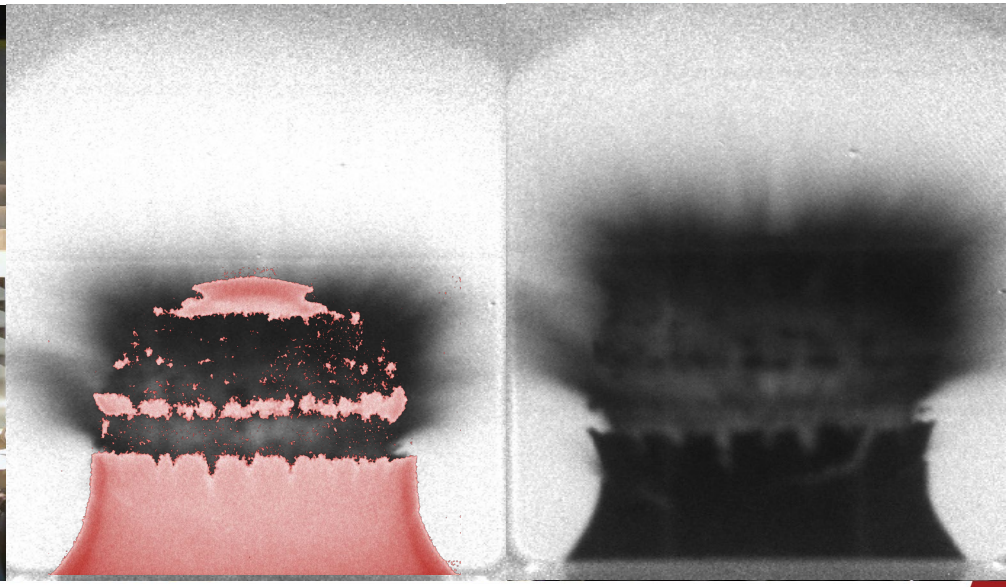
Surface motion trigger system using PDV-like optical frequency shifts



PDV workshop

NNSS: Brandon La Lone, Eric Larson

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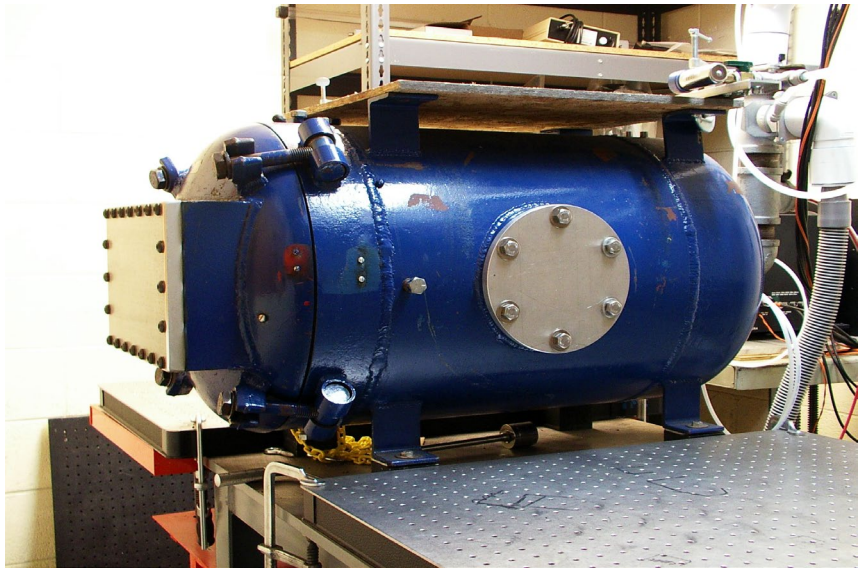
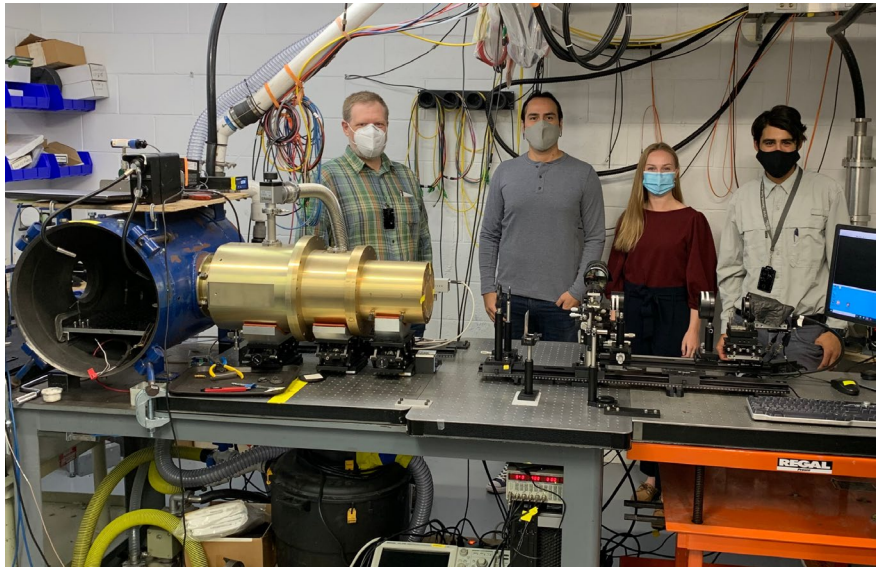
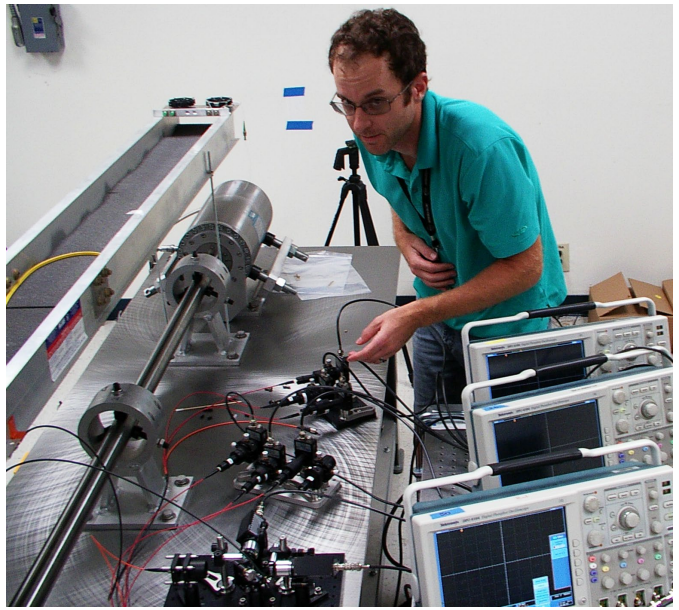
NNSS is one of the DOE defense program sites

Special Technologies Laboratory (STL) in Santa Barbara is one of the NNSS satellite sites

Dynamic compression platforms at STL



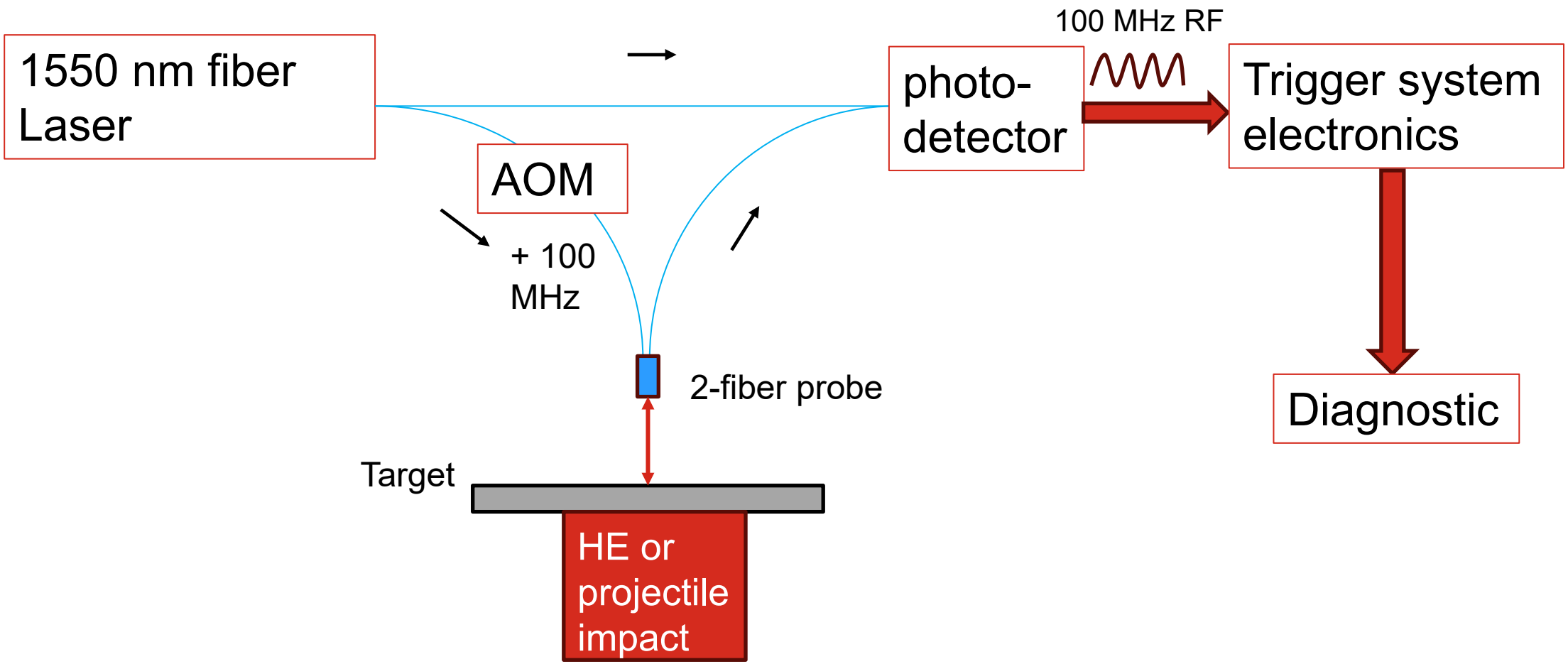




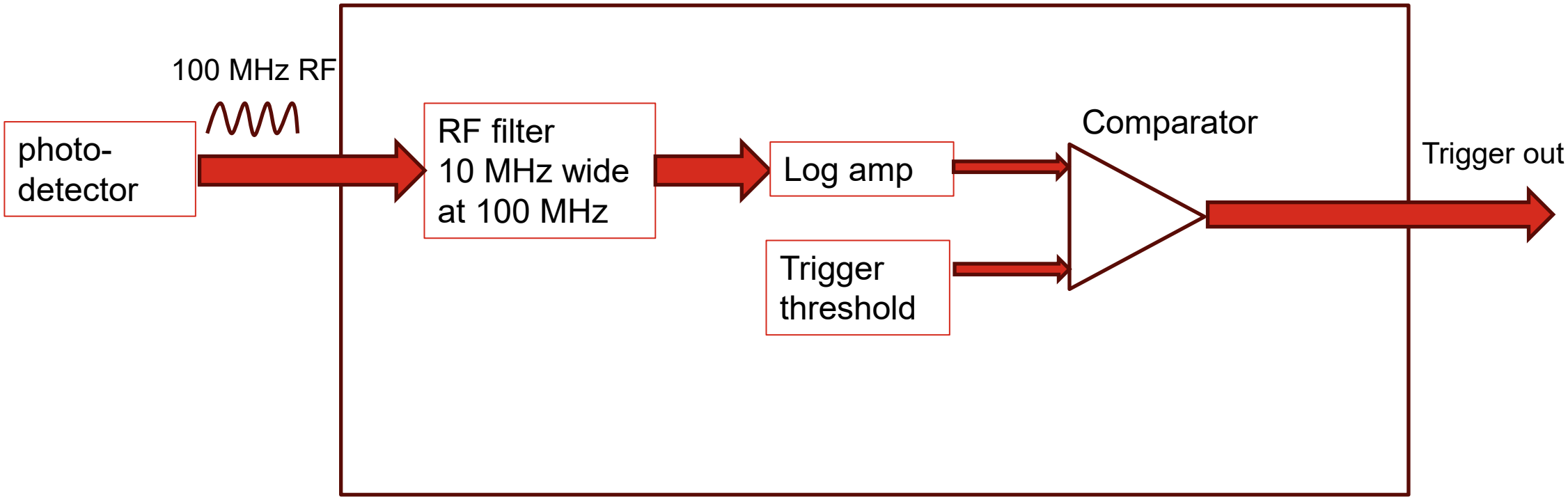
All optical triggers can be useful

- For shock wave experiments using explosives or projectile impacts when you do not know exactly when shock breakout is going to occur.
- When a precise trigger time is needed but there isn’t space for contact pins (or they’re detrimental to the experiment).
- For triggering of streak cameras, framing cameras, or flash x-ray systems at a specific time.

Optical Frequency Shift Trigger Concept



Optical Frequency Shift Trigger Concept (simplified electronic layout)



System photograph

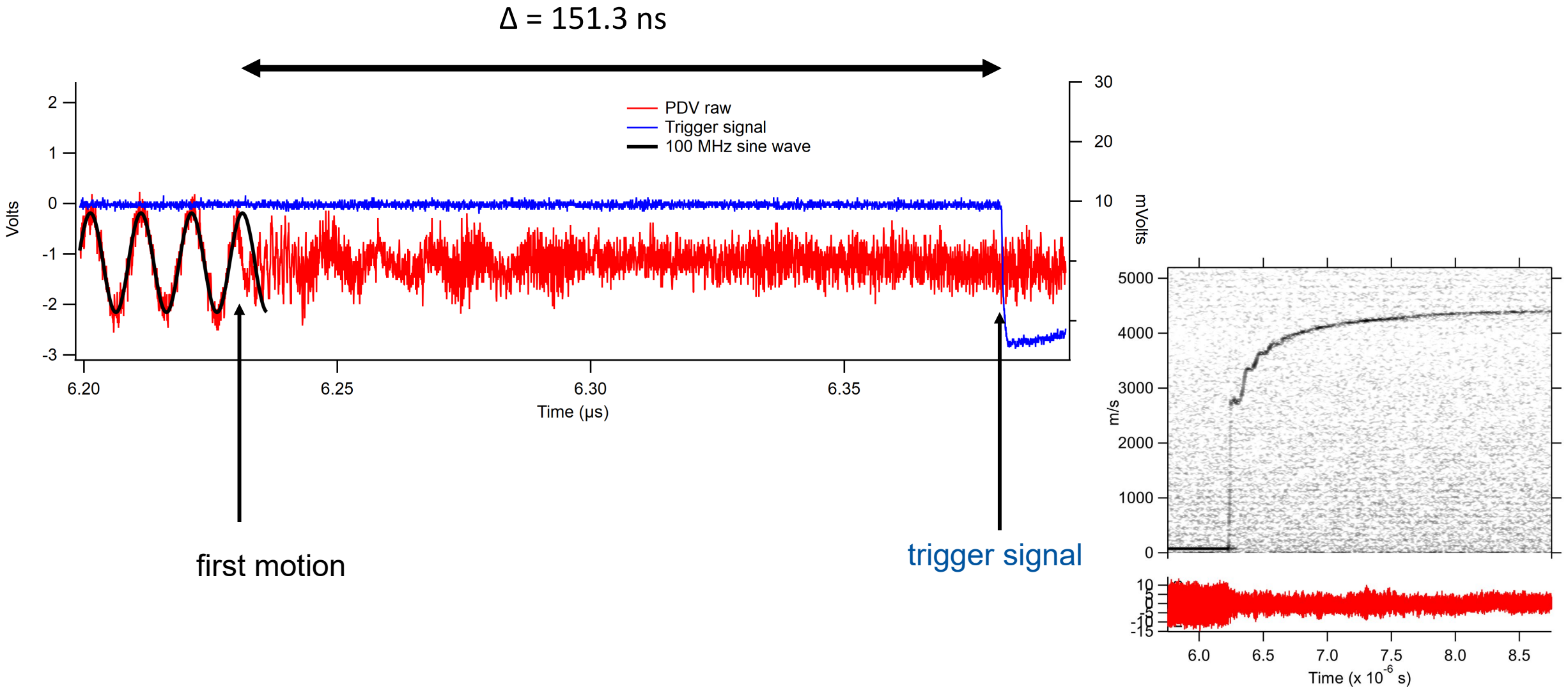
Input (optical or electrical)

Trigger out

Trigger threshold

Measured RF power

Data (explosively driven aluminum plate)



Average delay SBO to trig delay was 145 ns with standard deviation of 9 ns, greatest deviation from average was 15 ns

Shot Number	Breakout (PDV) (ns)	System Trigger (ns)	Δt (ns)
1 (HE)	6230.0	6381.3	151.3
2 (HE)	4602.6	4753.5	150.9
3 (Plate impact)	37959	38114	155.7
4 (Plate impact)	38986	39124	137.8
5 (Plate impact)	38488	38634	146.0
6 (Plate impact)	38248	38394	145.6
7 (Plate impact)	39565	39696	130.6
Average (stdev)			145.4 (8.6)

To sync with a spectral streak system (for example) it may be necessary to add 150 ns of fiber delay (30 meters) to match the trigger system delay