First Blush Acoustic Analysis
“Tall Ace of Spades”,
a.k.a. “Carlos”
1st “shot” only
at request of 5x5 news
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Introduction

There are six known “shots” fired at the lead in to the Route 91 massacre. Several videos record these shots. This paper reviews the audio from the “Tall Ace of Spades” video with a focus on the very first round.

Gunshot “sounds” are primarily percussive in nature and appear as narrow vertical line(s) on a spectrogram. Many percussive sounds are contained in the audio, my job is to separate out the gunshot sounds from the drums, symbols, rocks, and other miscreants.

The region(s) of interest begin about three minutes twelve seconds and ends eight seconds later. With four seconds attached to the beginning and end for reference, a total of twelve seconds is presented for examination. Within the full video, the first round is contained entirely within a one second region beginning at 3:12.394. If using the extracted .wav, this translates to 1.8773 seconds from the beginning of the snippet.

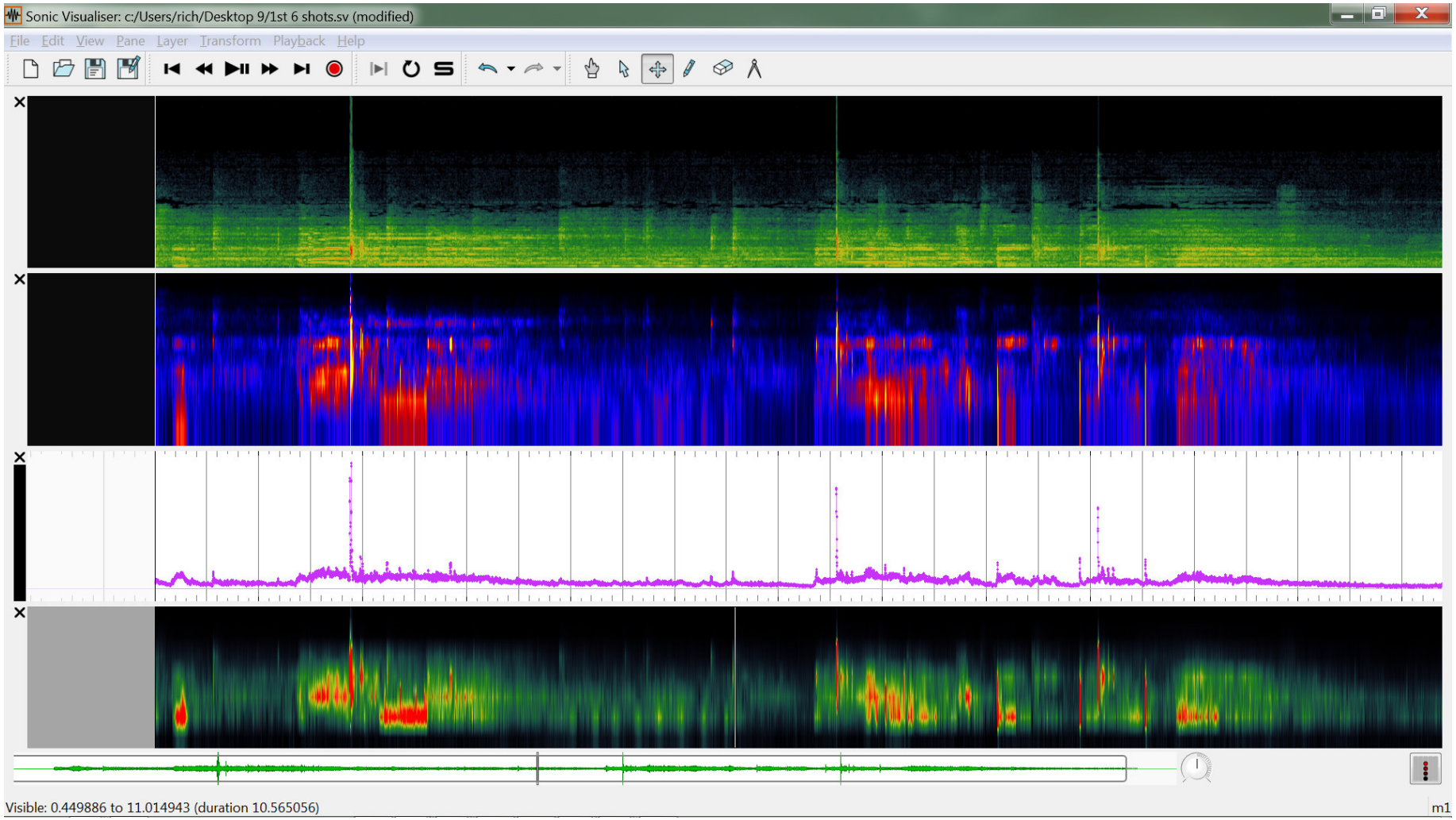
Tall Ace of Spades records all six shots to varying degree and presents three strong sonic “kracks” (shots 1,2,6), three strong muzzle blasts (shots 4,5,6), along with two weak muzzle (shots 1,2). The remaining sonic and muzzle waves are present, but are mixed within the background sounds and often have poor signal to noise ratios.

My preferred tool is Sonic Visualiser, here shown with four panels. From top to bottom:

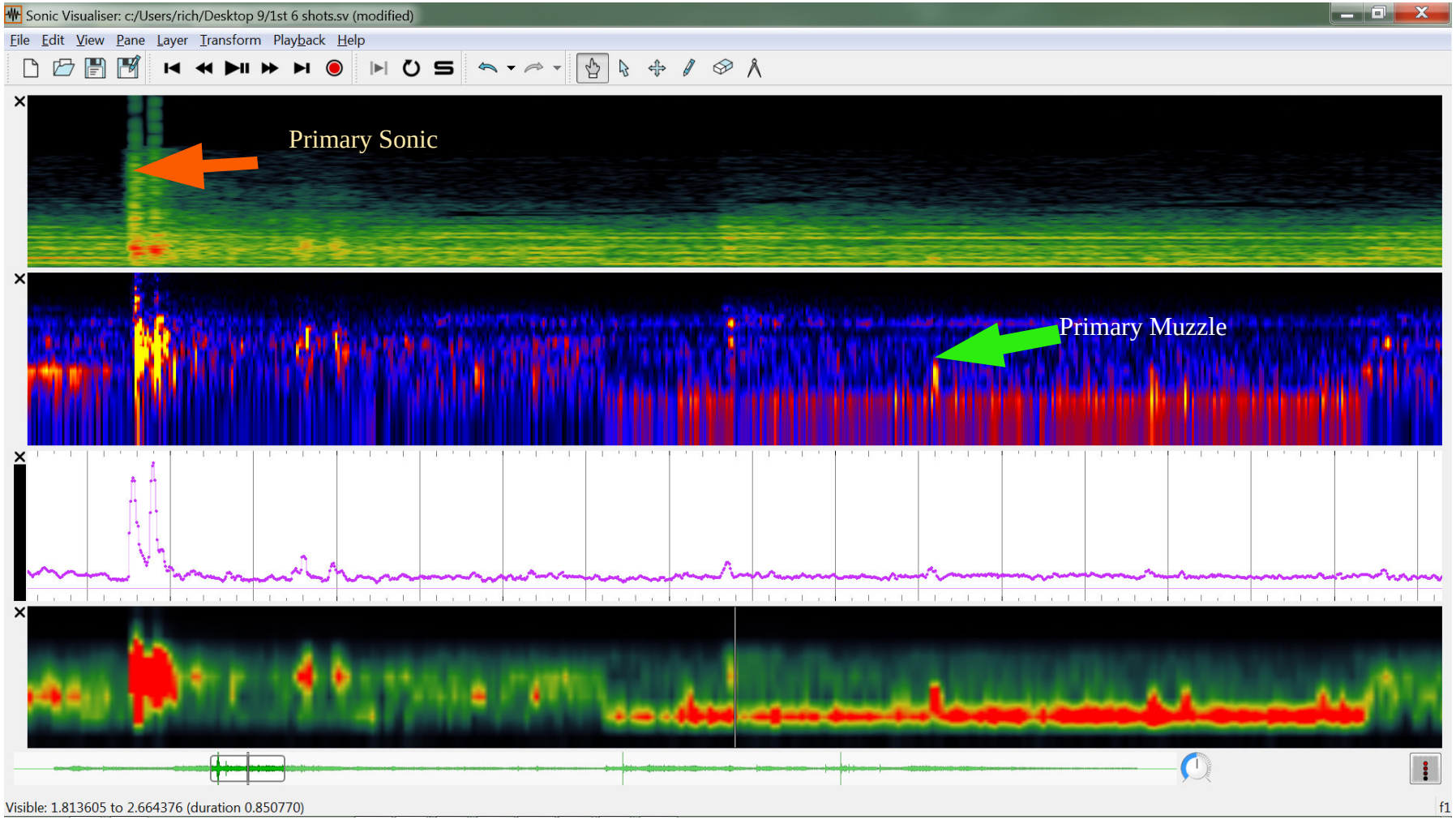
1. db^2 – linear scale, which is a good approximation to the “power” of the signal
2. log frequency bins – a scale/coloring which highlights the lower frequencies and compresses the upper. One of the most usefull for separating out sonics waves from muzzle waves.
3. RMS Energy – root mean square energy plot on a fairly fine scale. Good for confirmation of where the signals of interest may be
4. spectral contrast – assists in separating out muzzle from sonic frequencies

Also used (but not shown) is a normal waveform plot for exactly locating the start of an area of interest.

All Shots in One Set of Panels



First Shot Panels



Noted Events:

Name	Full Video Time	Snip Time	Power	Type	Centroid
Primary Sonic	**3:12.394**	**1.8773**	**0.297**	**sonic**	**Bin 3,4,5,6**
reflection	3:12.406	1.8893	0.217	sonic	Bin 3,4,5
reflection	3:12.497	1.9803	0.077	sonic	Bin 3,4
reflection	3:12.514	1.9973	0.064	sonic	Bin 3,4
reflection	3:12.749	2.2323	0.0658	unknown/sonic	Bin 4,5,6
Primary Muzzle	**3:12.873**	**2.3563**	**0.0607**	**muzzle**	**Bin 3**
reflection	3:13.004	2.4873	0.0604	muzzle	Bin 2,3
reflection	3:13.024	2.5073	0.0538	muzzle	Bin 2,3

Summary

A primary path sonic shock wave occurs first, followed closely by a very strong reflection. 0.480 seconds later a very weak primary muzzle wave arrives. All sonic related waves are quite strong. All muzzle related waves are quite weak. Muzzle sounds may not be audible and are “hidden” within some electronically generated signal, probably associated with the music that is ever present. Given the large lag, the weak muzzle, and the shape of the frequency response, the shooter is not nearby. Given the very strong sonic sound following the primary and the time between them, it’s possible the bullet was as close as six feet and likely within a 20 foot radius from the recorder. There are multiple sources of reflections, some from a flat surface, some from an uneven surface. If pushed to give an answer I would suggest the bullet traveled overhead about 8 feet. Meaning it would soon hit the dirt somewhere nearby. Having not worked all the numbers, the multiple reflections may indicate an elevated shooting position. That is the sonic cone arrived at an angle not parallel to the ground.