

Investigating power variation in first breaks, reflections, and ground roll with different charge sizes

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Introduction

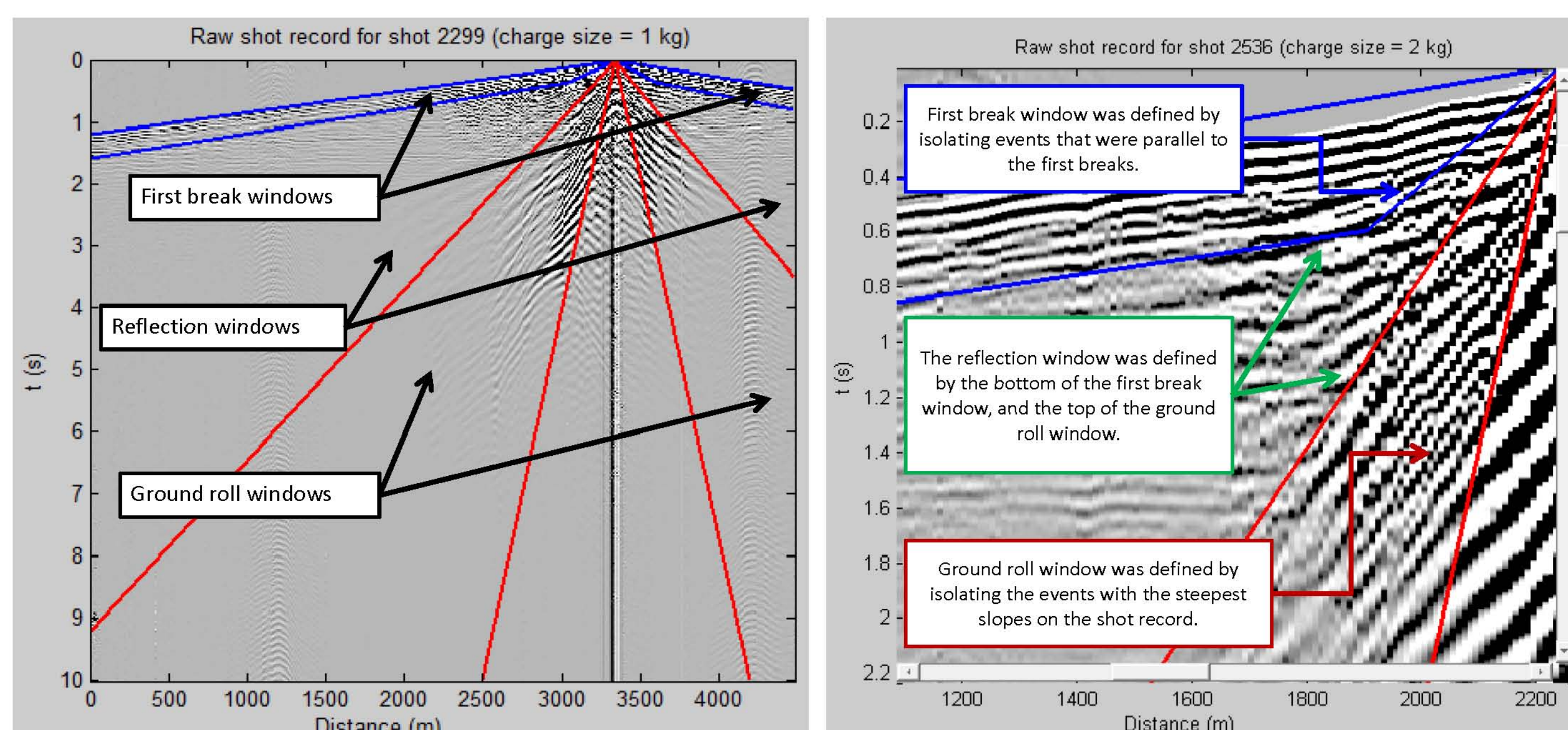
- ❖ Dynamite is a common tool used in exploration seismology to image the subsurface.
- ❖ The power of a dynamite shot is proportional to the charge size.
- ❖ Reflections are of particular interest in exploration geophysics as they contain most of the valuable information regarding the subsurface.
- ❖ In this study, we investigate the link between charge size and reflection power in order to improve survey design and interpretation.

Data Acquisition

- ❖ The data for this study was obtained during the Hussar low frequency experiment conducted by CREWES in the Fall of 2011.
- ❖ Test charges ranging in size between 1 and 4 kg were buried 15 m deep at three separate locations along the seismic line.
- ❖ Data was recorded by a 3-component geophone array, consisting of 5 different receivers at each recording location.
- ❖ We used the vertical component of a 10 Hz receiver to carry out this investigation.
- ❖ The sample and geophone intervals were
 - ❖ $\Delta t = 2$ ms and $\Delta x = 10$ m
- ❖ Data was collected for a total of 17 different charges

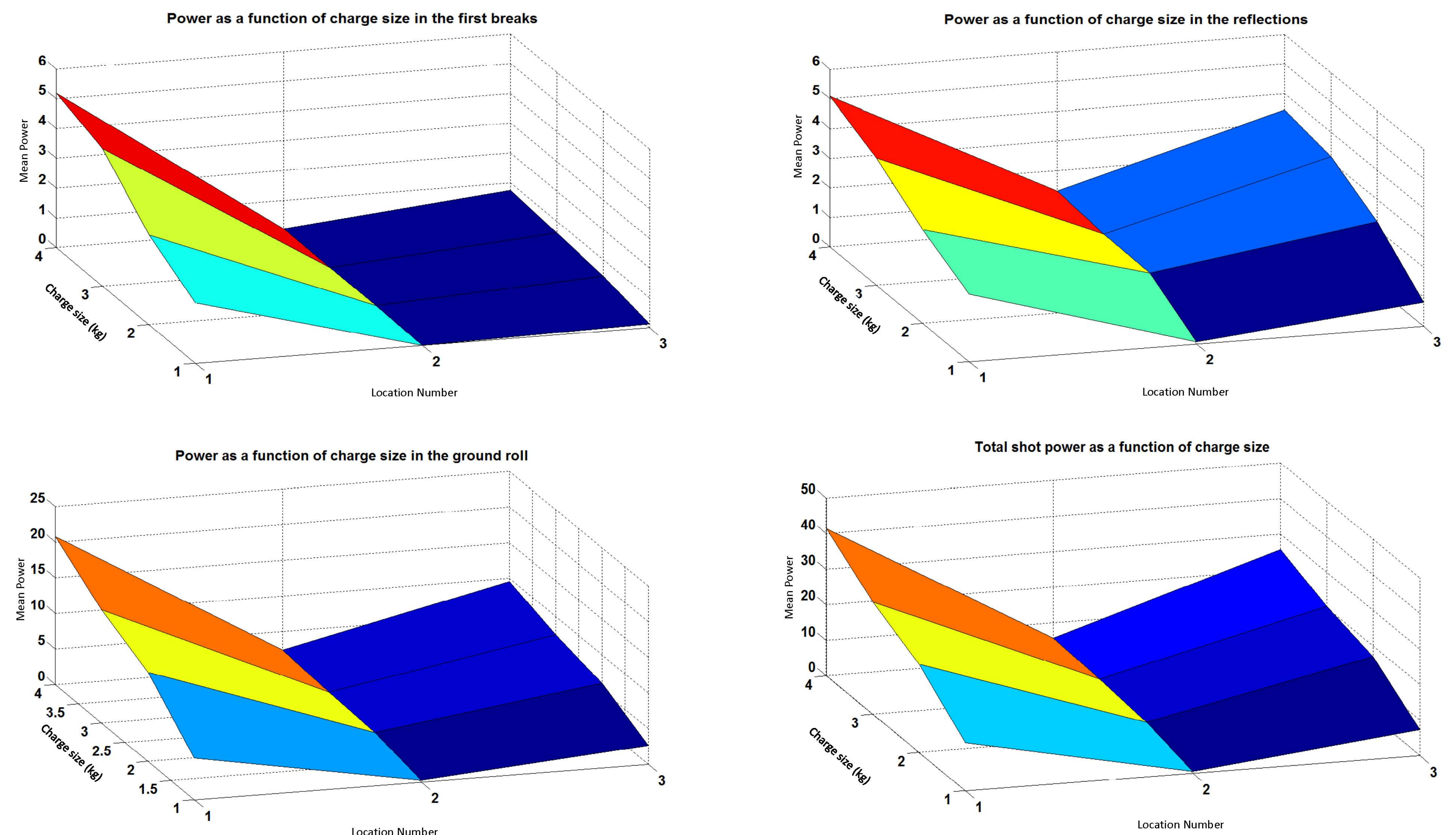
Isolation of the Components

- ❖ First breaks, reflections, and ground rolls were isolated into time windows using straight lines in x-t space.
- ❖ A specific set of criterion was used to isolate each component, as shown in the figures below.
- ❖ MATLAB was used to compute the power in each component of the seismogram by using the lines for indexing.



- ❖ (Left) Fig. 1. Time windows used to compute the power in the first breaks, ground roll, and the reflections. (Right) Fig. 2. Criterion used to isolate each of the components in x-t space.

Power Analysis in MATLAB



Results and Conclusions

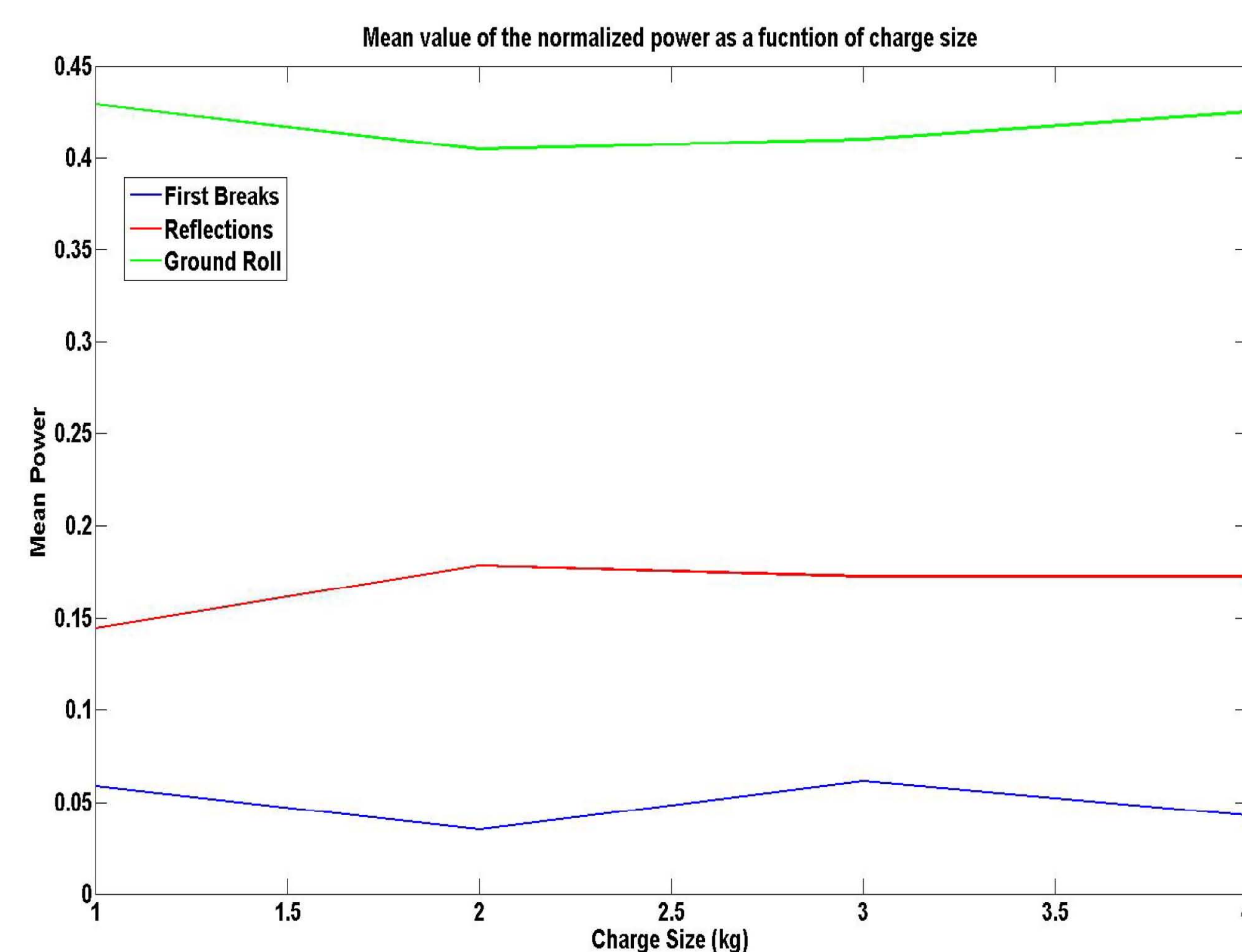


Fig. 3. Mean power calculated with respect to the total shot power for each shot. This mean power can be thought of as a percentage of the total shot power.

- ❖ Quazi-linear relationship between power and charge size
- ❖ Power increases with charge size
- ❖ Most of the power is dissipated in the ground roll
- ❖ Reflection power is independent of the other two components
- ❖ Increased charge size will result in more reflection power
- ❖ Fractional power remains constant with varying charge size

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