by a receiver after the acoustic beam has altered as a result of a characteristic of the formation.

[0019] The method can further include exciting the transducer by a fixed, high frequency signal and a chirped frequency signal; producing one or more high frequency acoustic beams; receiving the one or more high frequency acoustic beams; generating a fixed frequency tone burst and a chirp having a same duration as the fixed frequency tone burst, wherein the fixed frequency tone burst is equal to the difference in frequency between the high frequency signal and the chirped frequency signal by the non-linear mixing process in the non-linear material. The fixed, high frequency signal can be between 250 kHz and 1.5 MHz and the chirped frequency signal can be chirped such that the difference between the fixed and chirped frequency is between 3% to 20%.

[0020] The method ~~can further~~ includes producing a first pulse having a first central frequency and a first bandwidth spread and a second pulse having a second central frequency and a second bandwidth spread by the transducer; transmitting the first pulse and the second pulse in the non-linear material; and generating an acoustic beam pulse with a central frequency equal to the difference in frequency between the first central frequency and the second central frequency and a bandwidth spread equal to the sum of the first bandwidth spread and the second bandwidth spread by the non-linear material by the non-linear mixing process.

[0021] In accordance with an aspect of the invention, a system for imaging properties of the formation and other materials surrounding a borehole is disclosed. The system includes a compact low frequency acoustic source assembly and beam conditioning device within a logging tool conveyed in a borehole that directs a collimated acoustic beam out of the logging tool into the surrounding well bore and thence to the formation or casing and cement, such that some of the radiated energy returns to the well bore by a combination of reflection, refraction and scattering, an array of receivers, and the software and hardware necessary to control the beam direction and optimize its properties, record the received signals, and transform the recorded data to create images of the formation and other materials surrounding a borehole that may be interpreted to yield information about the volume surrounding the borehole.

[0022] The system further includes the generation of transmitted signals optimized in duration and frequency content for the imaging requirements of the application in question and the selection the dimensions and configuration of the beam generation and conditioning

also enables the indirect measurement of the dip and azimuth of reflecting bodies ahead of the bit. Another application is the detection of fault geometry ahead of the bit.

[00101] The term "lens," as used herein, should be understood to include both refractive and reflective structures and materials as will be appreciated by those skilled in the art.

[00102] Although the invention has been described in detail for the purpose of illustration based on what is currently considered to be a variety of useful embodiments, it is to be understood that such detail is solely for that purpose and that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the ~~spirit and~~ scope of the appended claims. For example, though reference is made herein to a computer, this may include a general purpose computer, a purpose-built computer, an ASIC including machine executable instructions and programmed to execute the methods, a computer array or network, or other appropriate computing device. As shown in Figure 10 and 14, the data collected by the receivers would undergo some processing and are either stored in memory in the tool, or transmitted up hole for further processing and storage. As a further example, it is to be understood that the present invention contemplates that, to the extent possible, one or more features of any embodiment can be combined with one or more features of any other embodiment.