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Title: The Parametric Array in Berea Sandstone, revisited

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James A. TenCate

Intended for: Acoustics 08
Paris, France
July 4th

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Pierre-Yves Le Bas

From: Skelt, Chris [cskelt@chevron.com]
Sent: Friday, June 13, 2008 4:02 PM
To: Pierre-Yves Le Bas
Cc: James A TenCate
Subject: RE: guidance for talks
Attachments: chevron_logo.jpg

Pierre-Yves,

Please acknowledge Chevron. A word on the CRADA scheme can't hurt, but don't let it cut into the tech time. Here's a logo.

As far as I'm concerned, the subsurface applications are now protected by the patent application, so discuss as you see fit. However, please be realistic! Until we have run the field tests, much of this is speculative. Good luck with the presentations, and enjoy your travels.

Regards, Chris.

Christopher Skelt
Tel +1 832 854 5660

From: Pierre-Yves Le Bas [mailto:pylb@lanl.gov]
Sent: Friday, June 13, 2008 12:26 PM
To: Skelt, Chris
Cc: 'James A TenCate'
Subject: guidance for talks

Hi,

With Jim, we are putting slides together for our presentations in Paris and Stockholm. Do you wish the Chevron logo to appear on them? How much could we talk about applications of the parametric array in rocks and boreholes?

Thanks

Pierre-Yves

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<http://www.lanl.gov/orgs/ees/ees11/geophysics/nonlinear/nonlinear.shtml>

access publications at:



The Parametric Array in Berea Sandstone, Revisited.

P.-Y. Le Bas, J. TenCate

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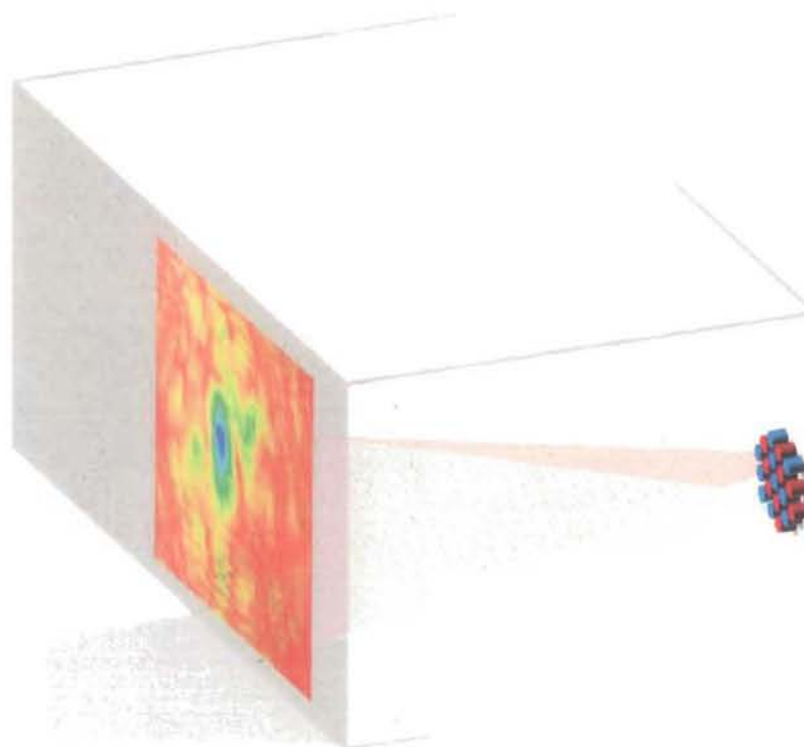
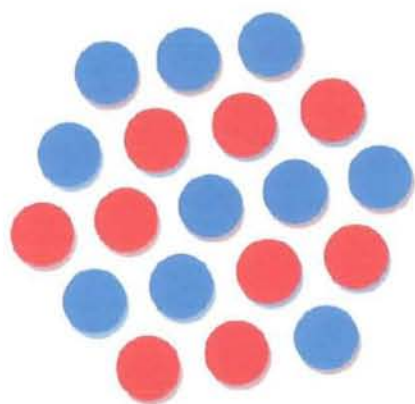


Outline

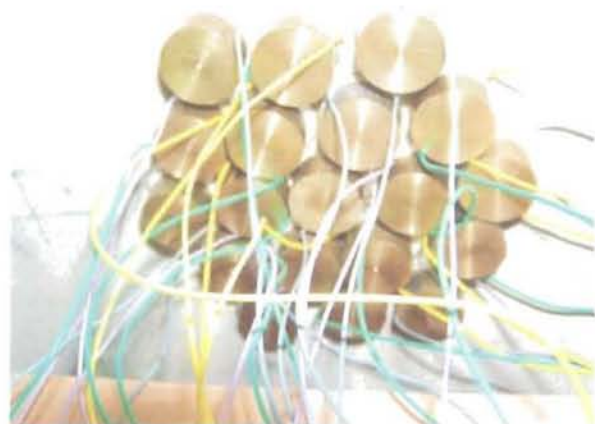


- The parametric array principle
- Beam patterns
- Extraction of the nonlinear parameter
- Steering the beam
- Conclusion and applications

The Parametric Array Principle



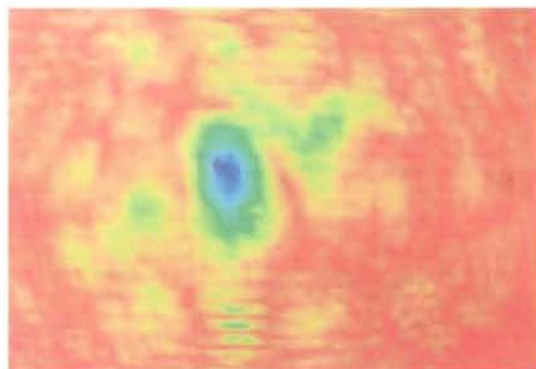
Actual setup



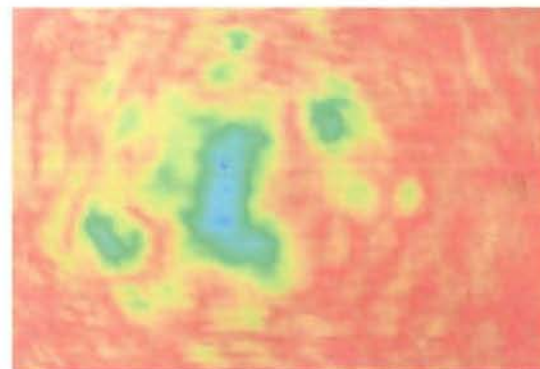


Beam patterns for primary frequencies 170 & 190 kHz

170 kHz



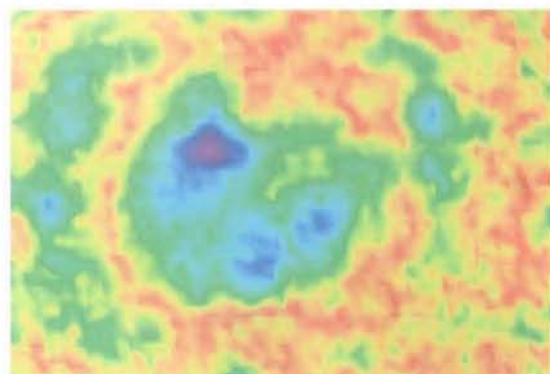
190 kHz



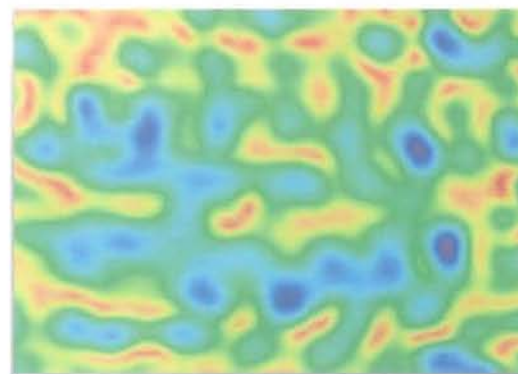
High velocity



Low velocity



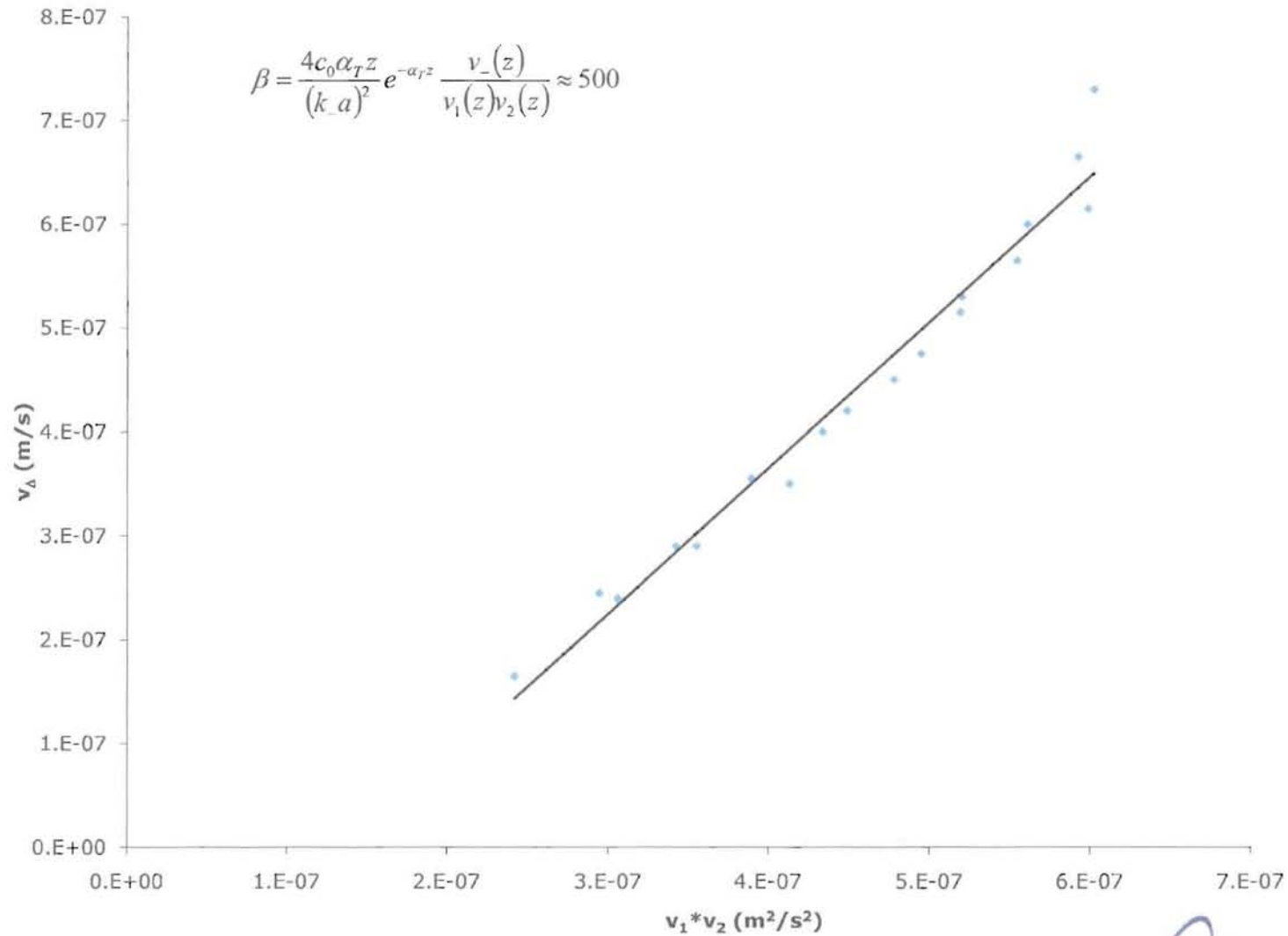
Difference frequency 20 kHz



20 kHz broadcasted

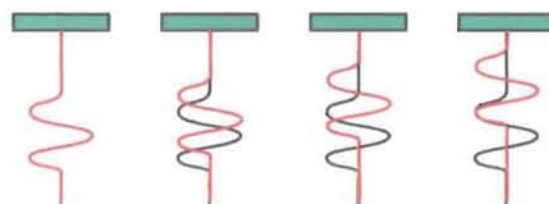


Nonlinear parameter for primary frequencies 80kHz-95kHz



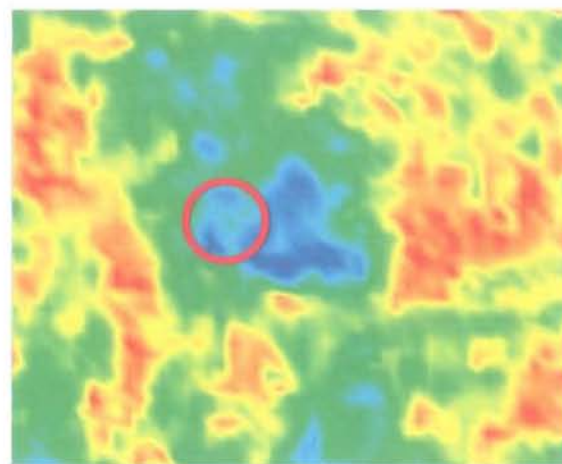
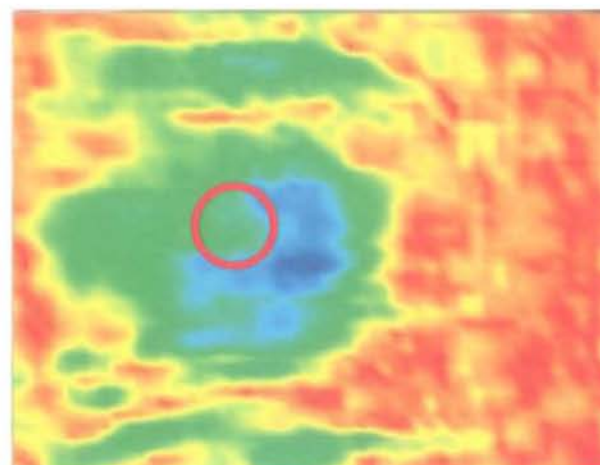
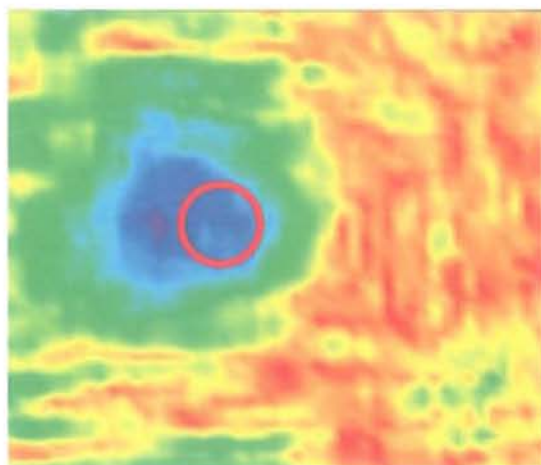


Steering principle





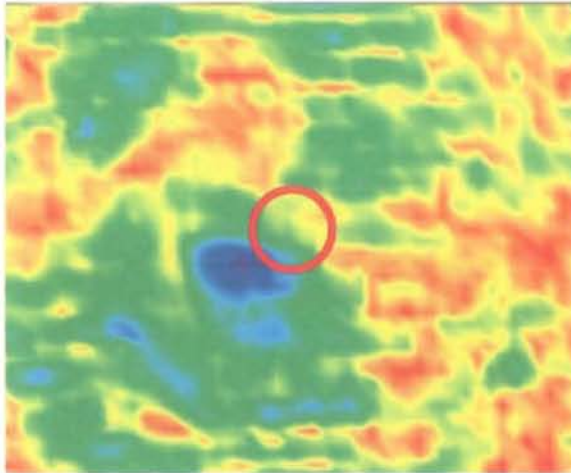
No steering (0°) for primary frequency 60 & 65 kHz



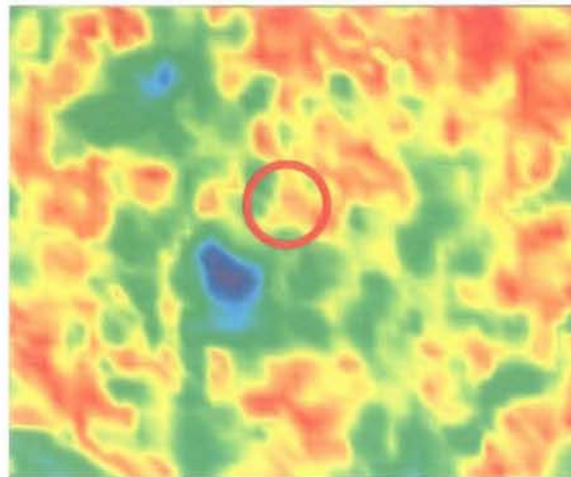
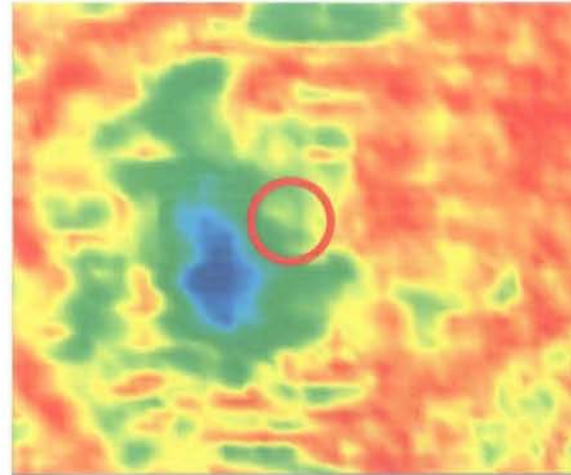
15° steering for primary frequency 60 & 65 kHz



Primary 1



Primary 2

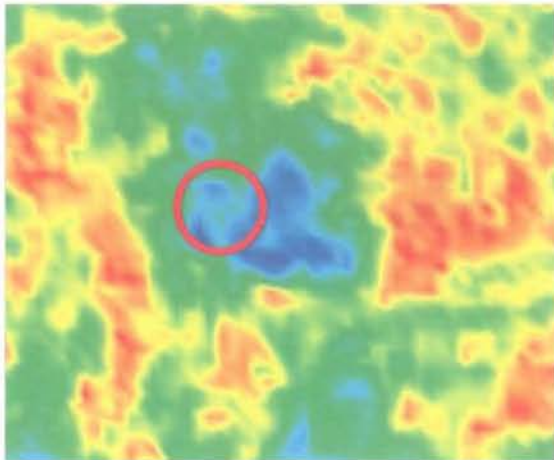


Difference

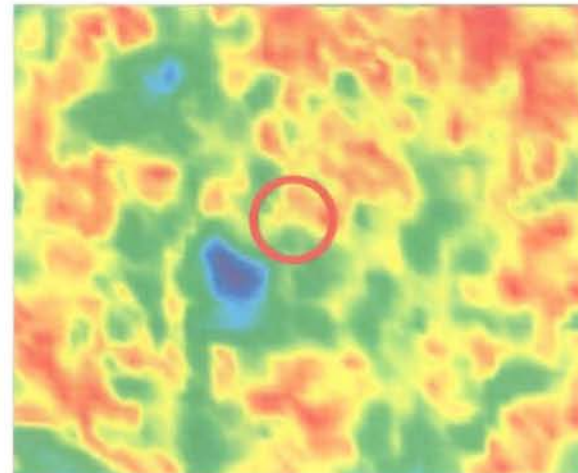


Steering: difference frequency primaries: 60 & 65 kHz

0°



15°

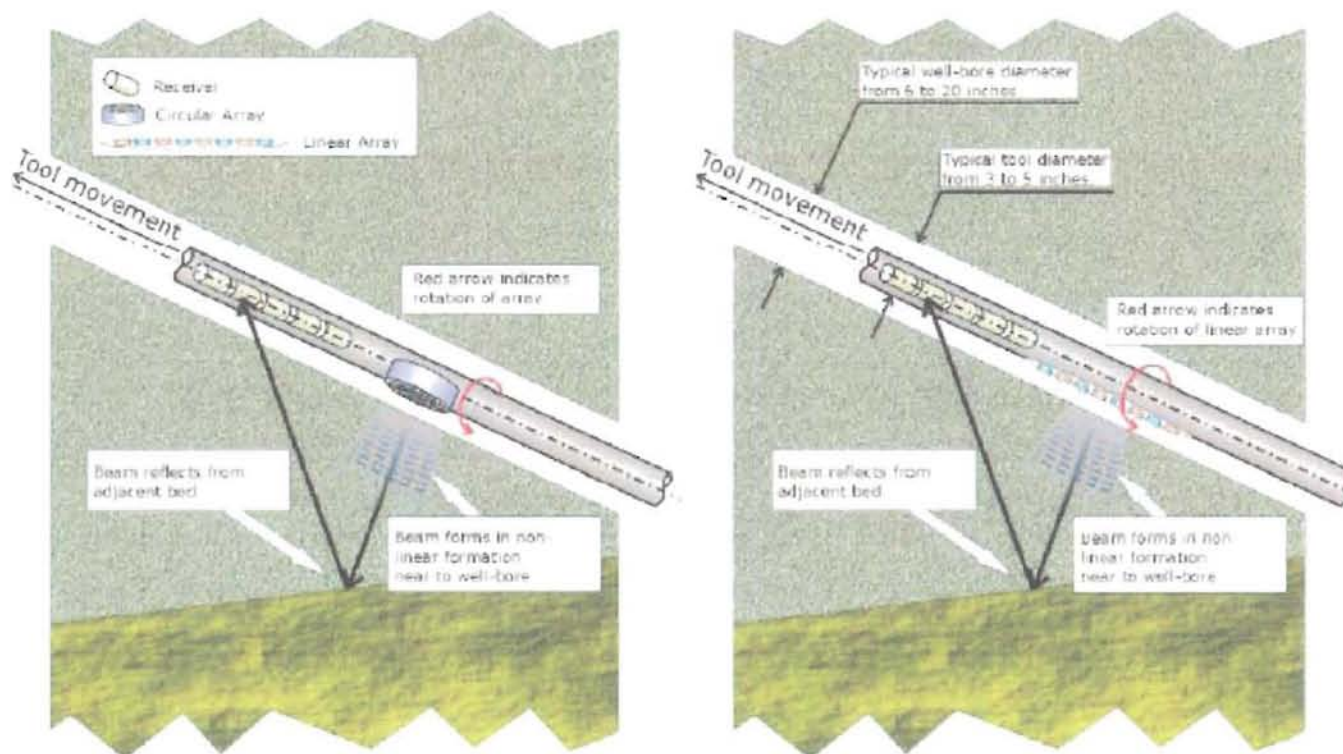


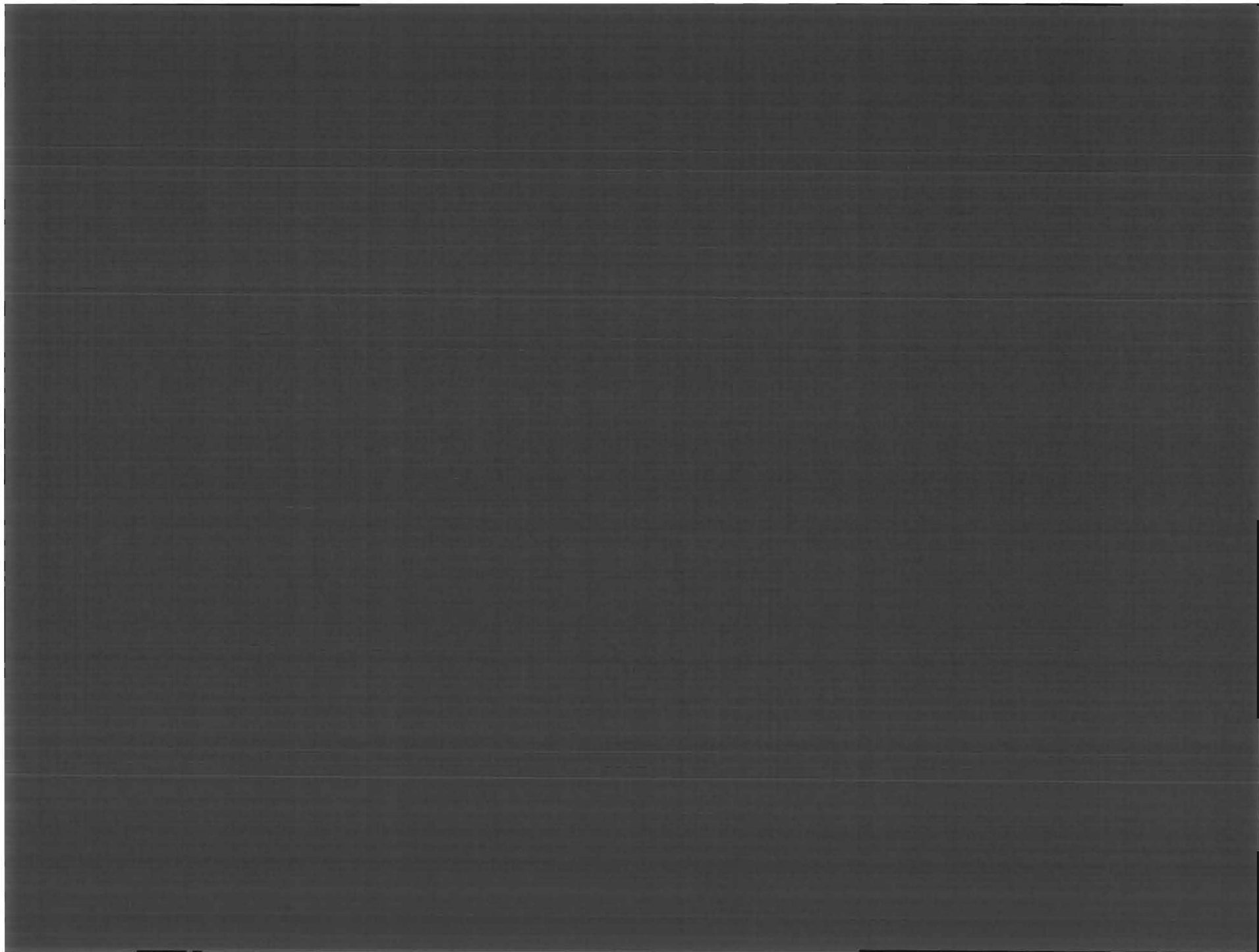


Conclusions

- The use of a parametric array in Berea sandstone allows a measure of the nonlinearity of the rock
- We can create a low frequency beam with the directivity of a high frequency beam

Applications

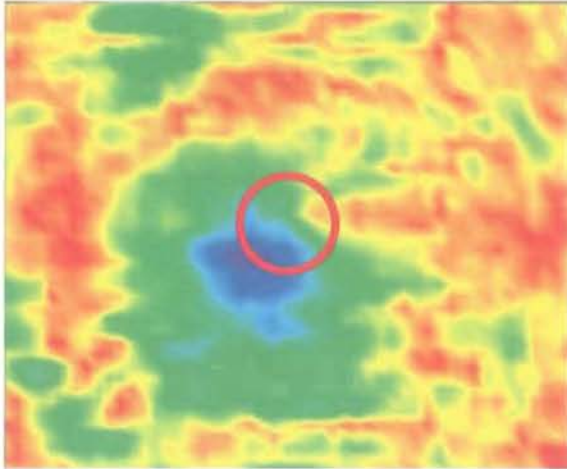




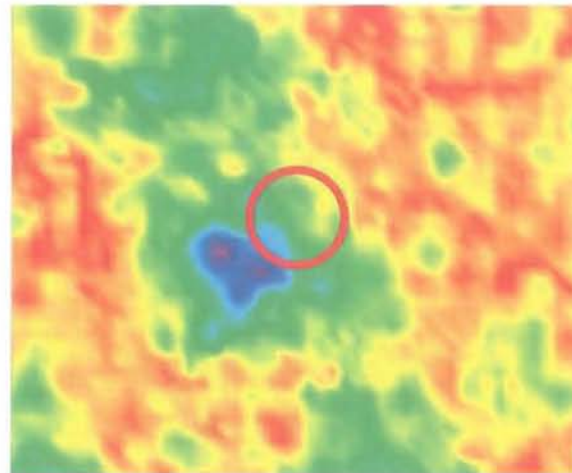
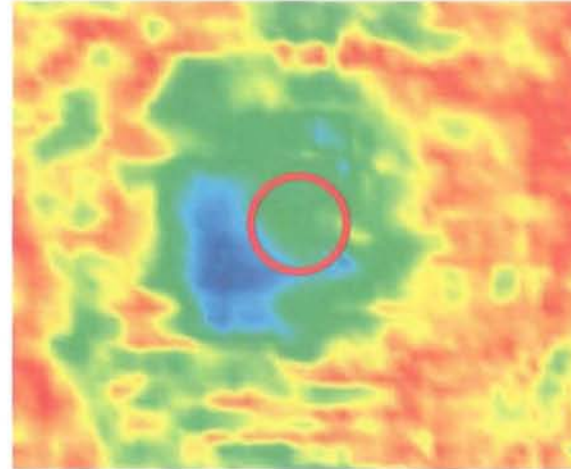
10° steering for primary frequency 60 & 65 kHz



Primary 1



Primary 2



Difference