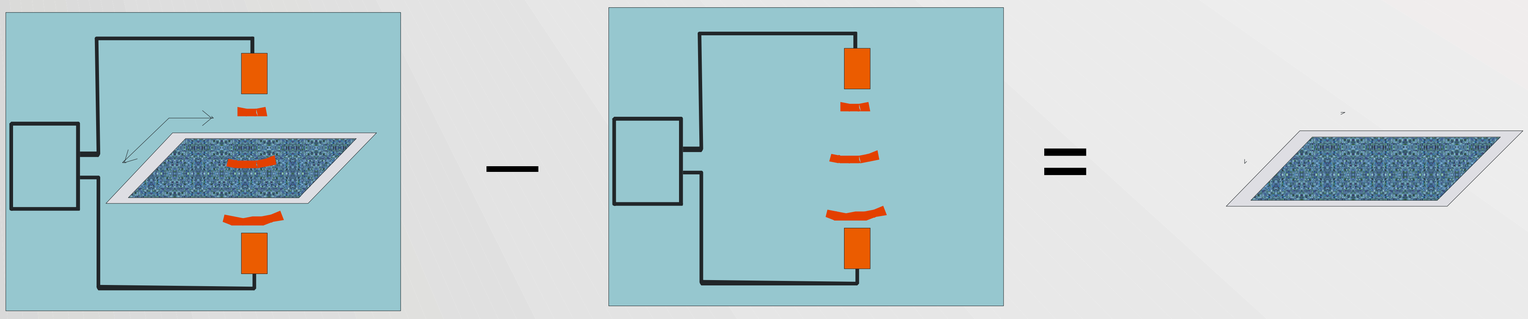
Airborne Ultrasound Investigations of Cellular Polypropylene Ferroelectret Film

J. Döring, M. Gaal, J. Bartusch, M. Kreutzbruck,
Federal Institute for Materials Research and Testing, Berlin, Germany

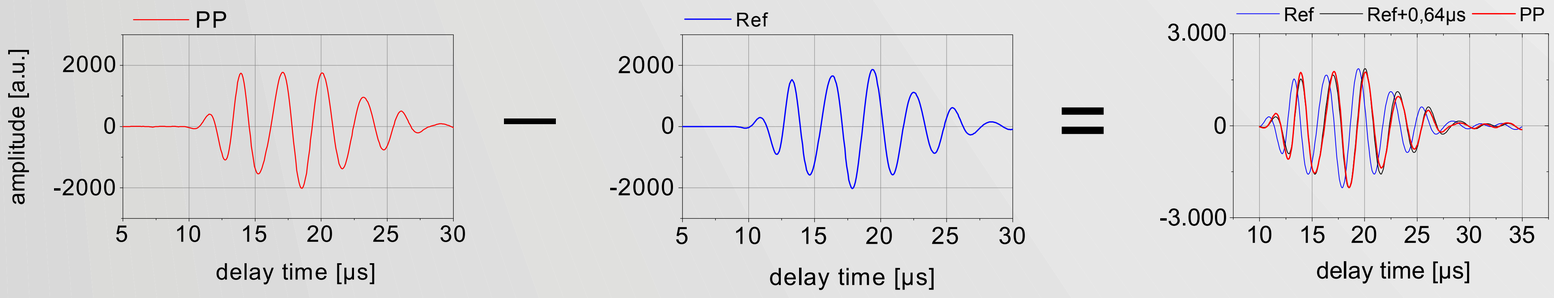
Cellular polypropylene ferroelectret films are considered as a promising material for airborne ultrasound transducers. This polypropylene porous film has remarkable piezoelectric properties and a very low acoustic impedance. Therefore this film is interesting for the development of airborne ultrasound transducers, especially for their use in NDT. For the shown measurements ultrasound pulses transmitted the polypropylene film. On this occasion they are damped and delayed in dependence upon the frequency. The exact material parameters like sound velocity and damping are needed for the construction of airborne transducers.

Measurement equipment: Commercial transmitter and receiver, driven in transmission

Transmission — T. without sample = PP-film: 70 µm thick

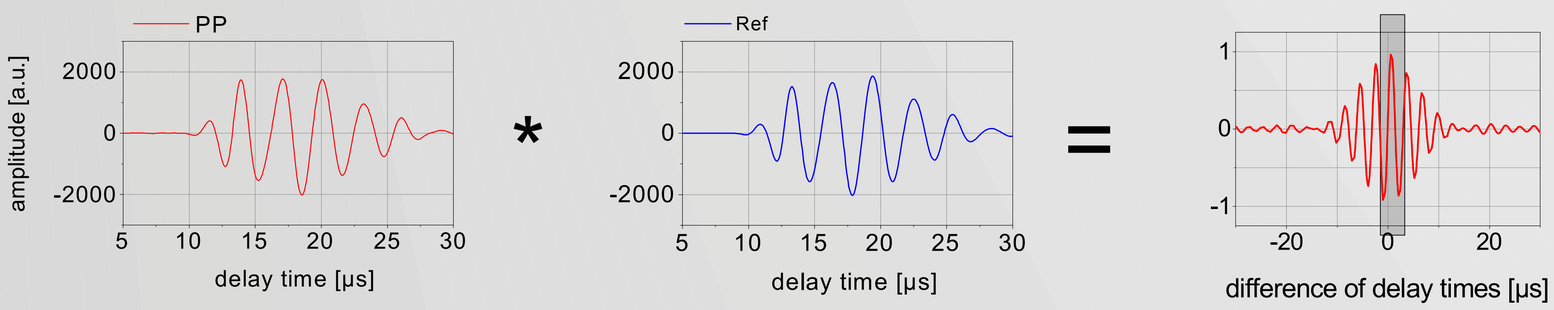


Determination of the sound velocity - by peak-peak-method



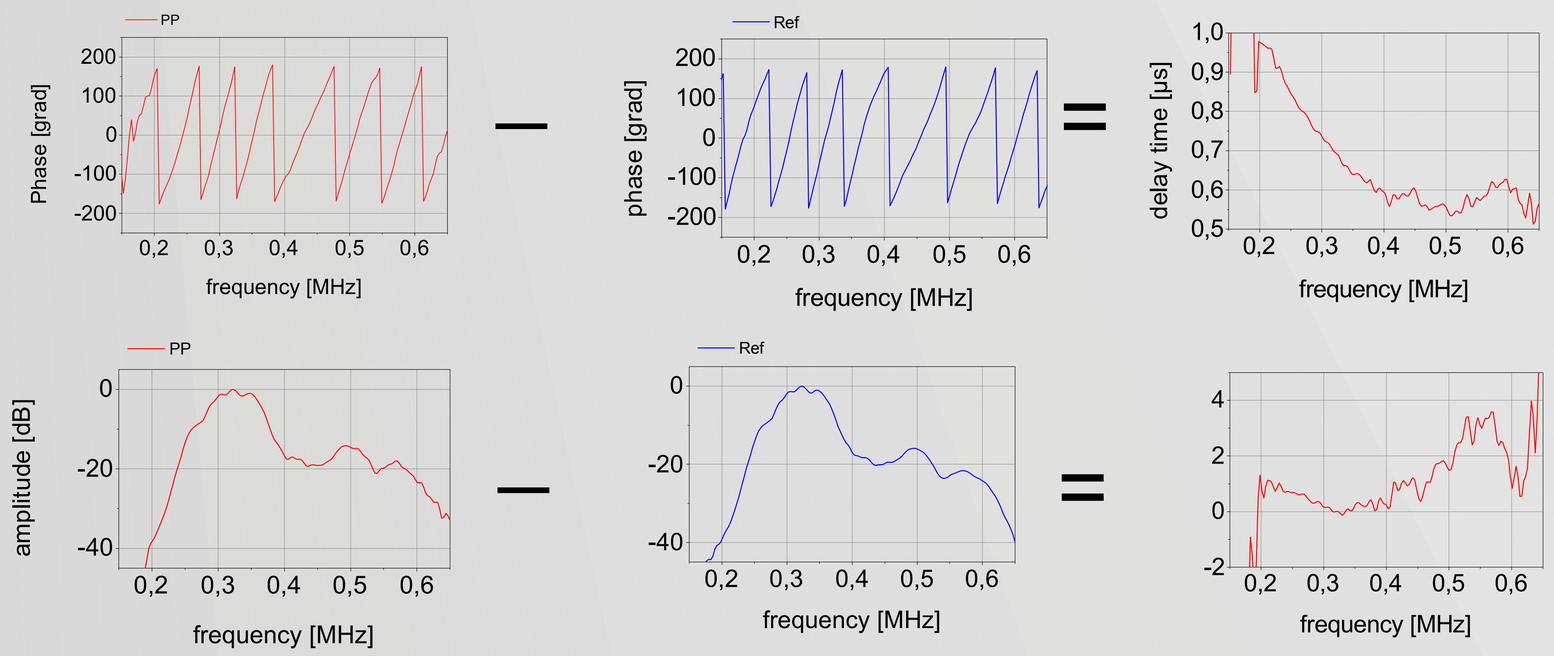
R+0,64 µs » 82 m/s; 0,73 µs » 75 m/s

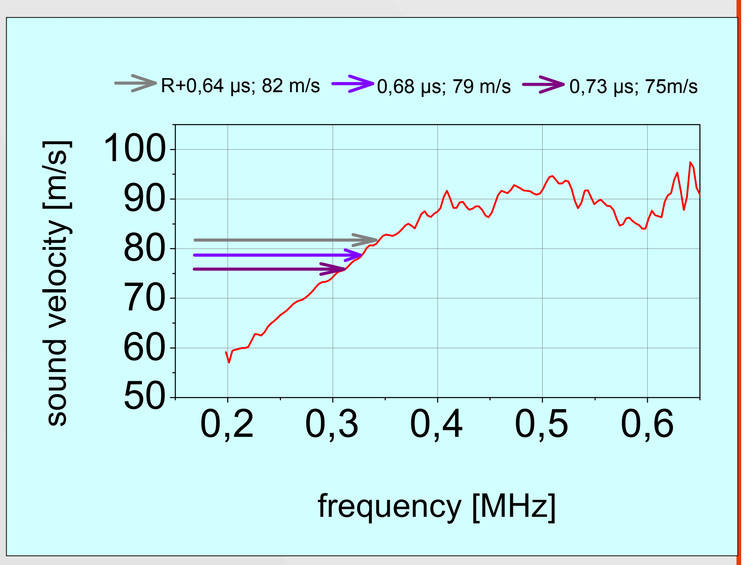
- by cross-correlation



0,68 µs » 79 m/s

- by Fourier transform





Summary

The sound velocity is determined with sample thickness and delay time measurement:
- the peak-peak-method is a simple kind of delay time determination
- the cross-correlation gives a conservative result for the delay time at the center frequency
- the Fourier transform shows the frequency dependence of the delay time

BAM

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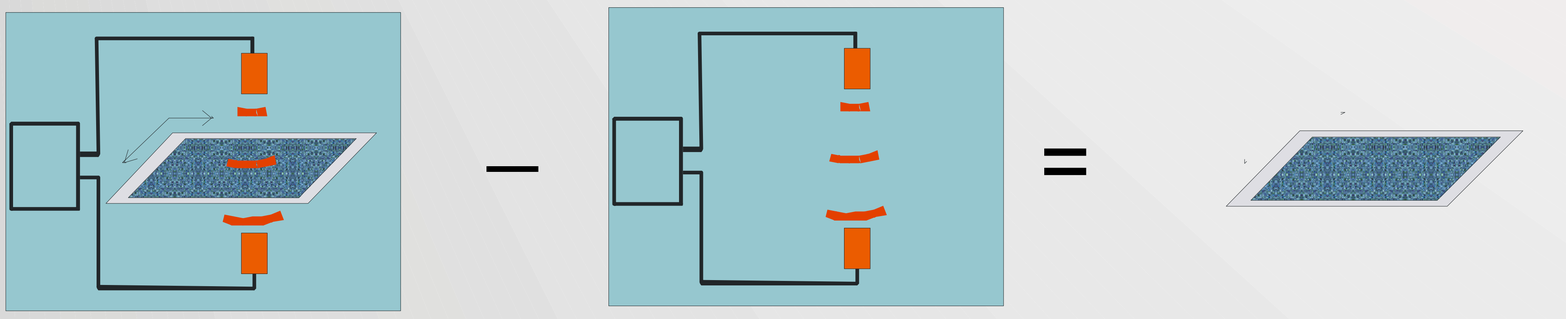

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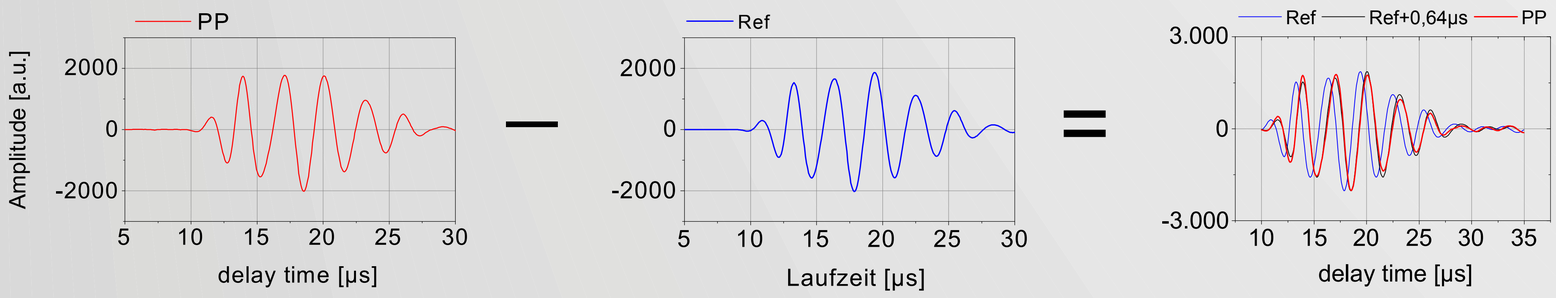

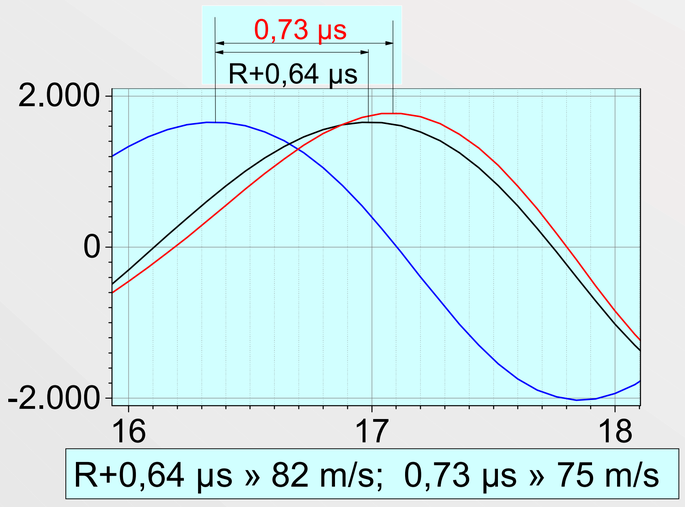

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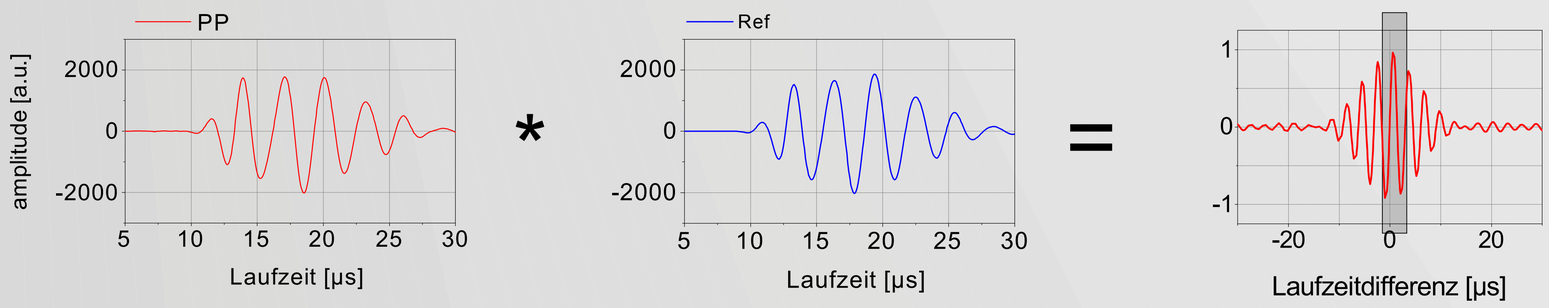
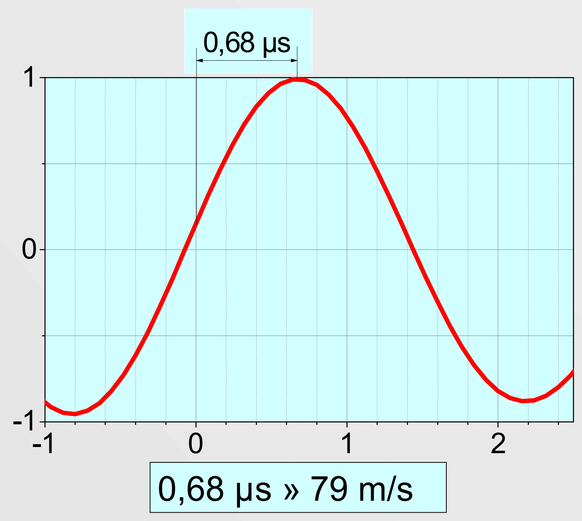
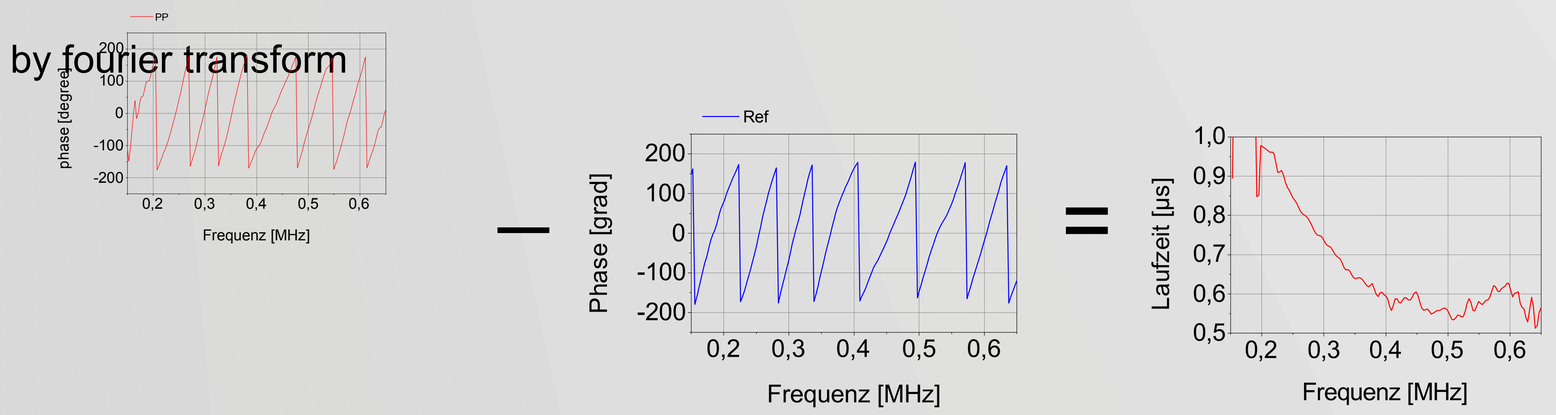
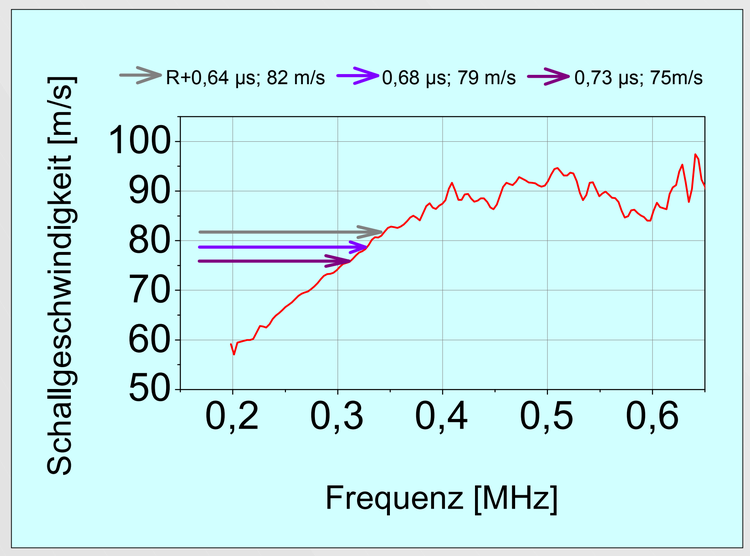
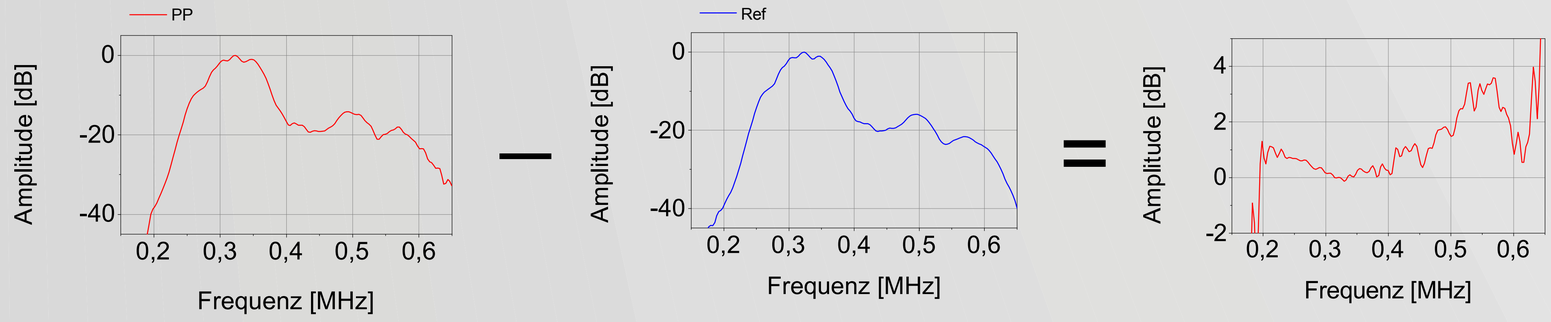




by fourier transform







Ergebnisse für die Schallgeschwindigkeit der PP-Folie

- die Peak-Peak-Methode ist das einfachste Verfahren zur Laufzeitbestimmung
- die Kreuzkorrelation liefert ein sicheres Ergebnis bei der Mittenfrequenz
- die spektroskopische Darstellung zeigt die Frequenzabhängigkeit der Schallgeschwindigkeit und der Dämpfung

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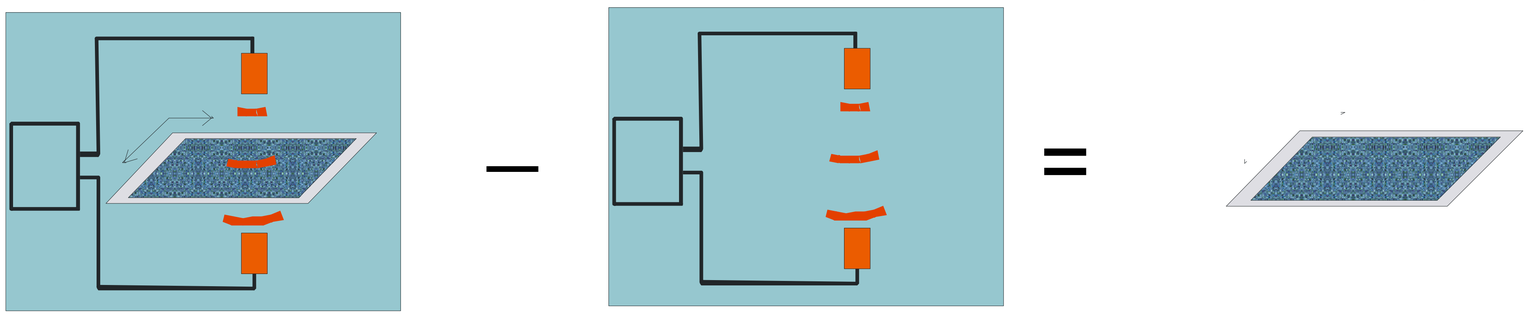

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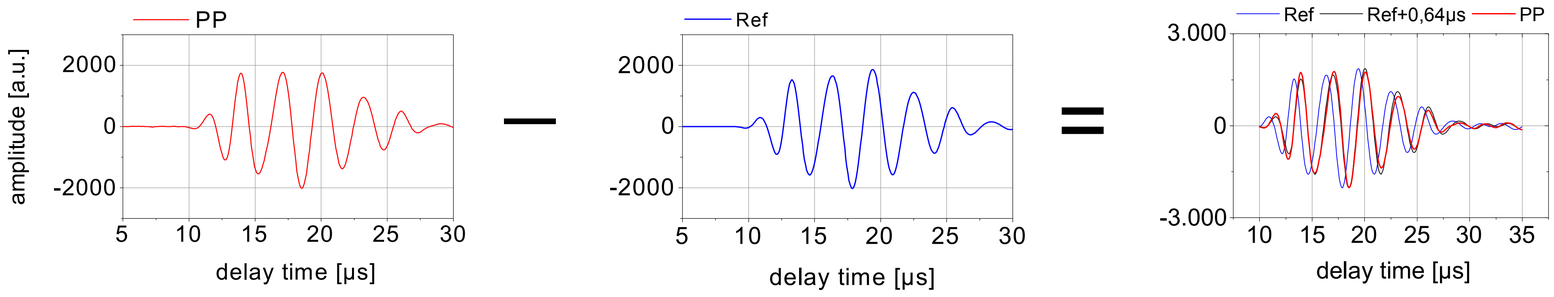

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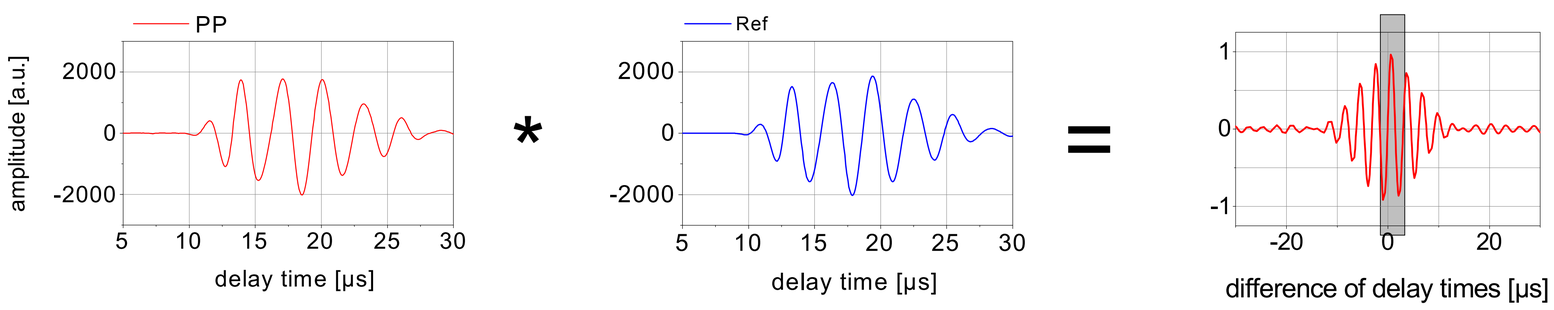

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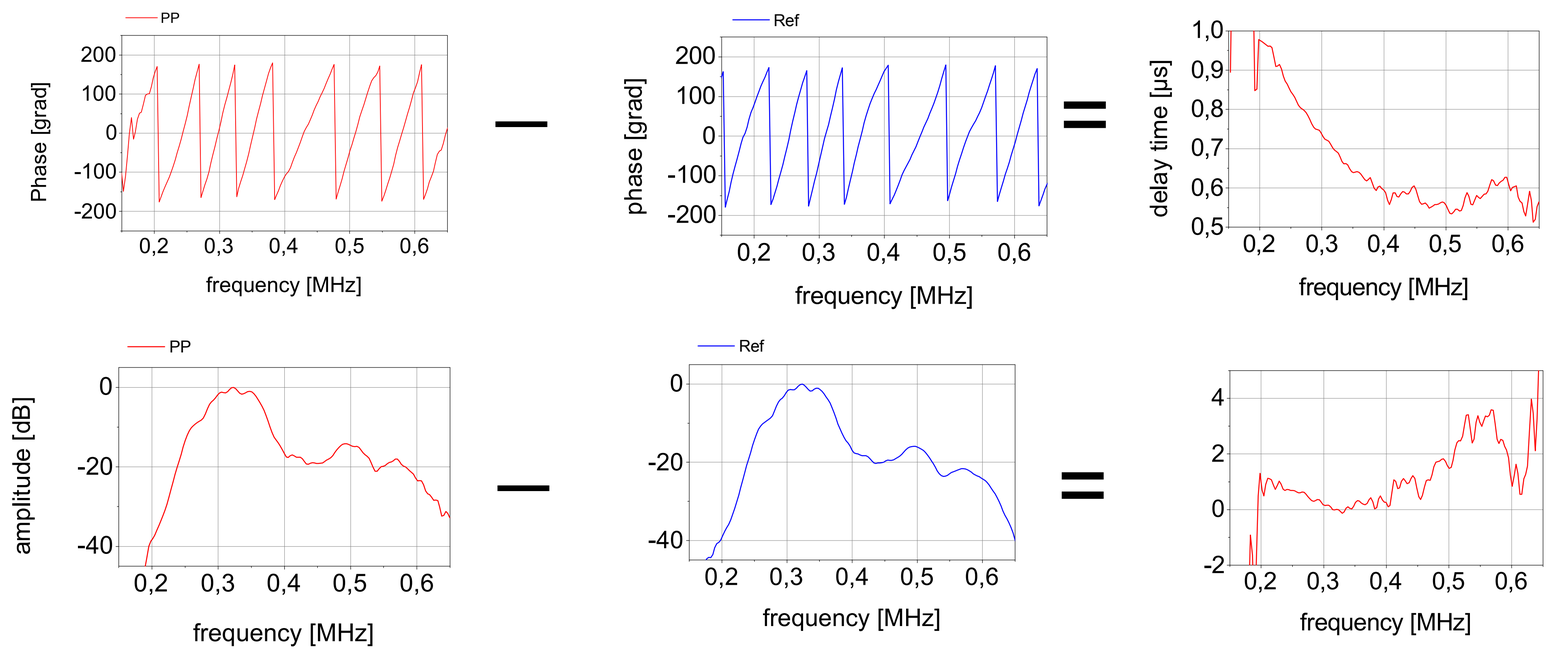

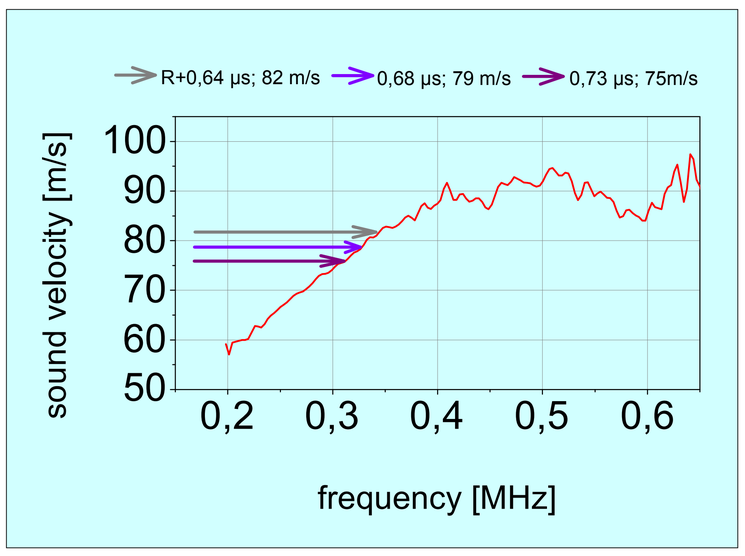

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