Supplementary material:

Parameters Phantom and Simulation SRUS reconstruction:

Table 1:

	Phantom	Simulation
Number of expected MB	200 for fast MB, 400 or slow MB	30
Maximum linking distance in pixel	2px for fast moving MB, 1px for slow moving MB	4
Minimum track length in pixel	7	20
Filtering	For fast MB SVD filter with cutoff of first 10 singular values, for slow moving MB Butterworth bandpass filter Filtering of phantom acquisition differs from filtering of chicken embryo acquisitions, since only a little amount of stationary signal is present in the phantom.	None

Figures acquisitions:

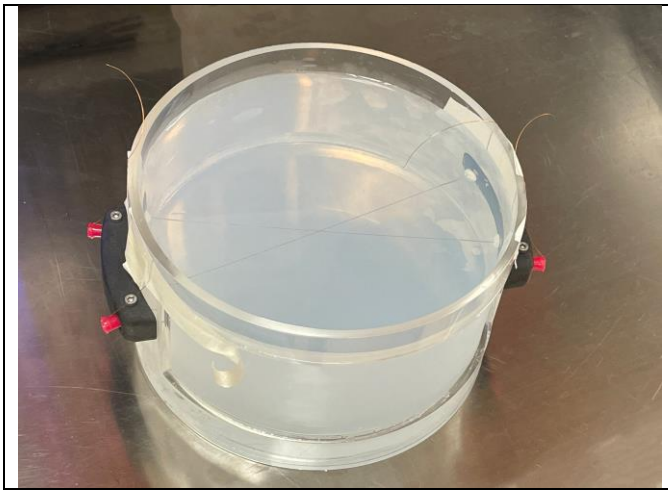


Fig 1: Photo of phantom during its creation. To create the wall-less tubes, copper wires were spanned across the phantom. After the PAA solidified the wires were pulled out and left tubes in the PAA.

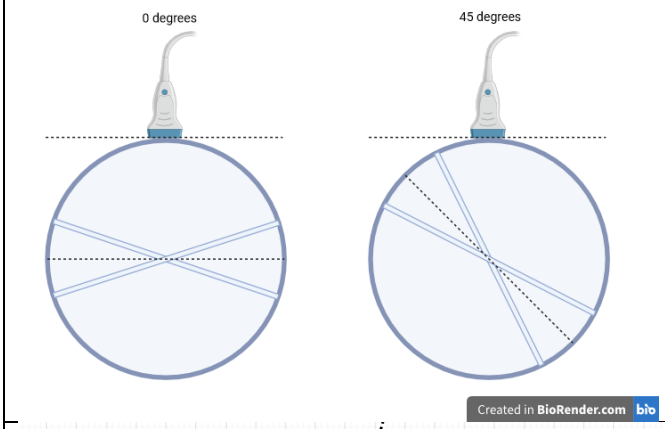


Fig 2: Description of angle of rotation ϑ:
Theta is the angle between the two dashed lines, one of which is in the transducer's lateral direction and the other is the bisector of the angle between the two tubes of the phantom. The left image shows schematically an acquisition at an angle ϑ of 0 degrees the right image shows schematically an acquisition at an angle ϑ of 45 degrees.

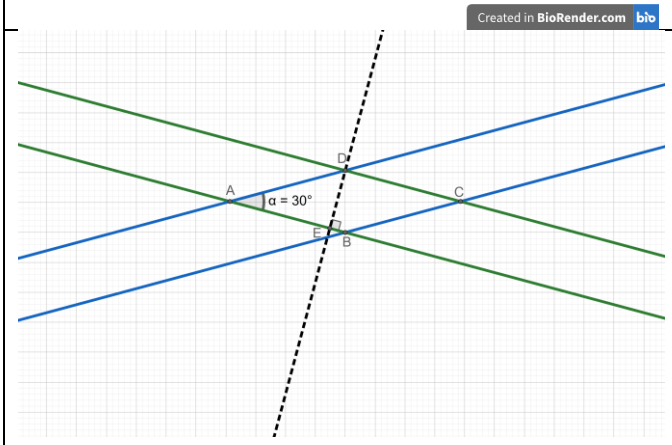


Fig 3: Description of overlap distance:
The two crossing tubes (green and blue), form a rhombus where they are overlapping. The measured overlap distance is the distance AC (longer diagonal of the rhombus).
Ground truth calculation:
Distance DE is known to be the diameter of the tube (200µm) and the angle α is known to be 30°.
The side length of the rhombus is thus:

(1) $AD=DE/\sin(\alpha)$

The longer diagonal of a rhombus is:

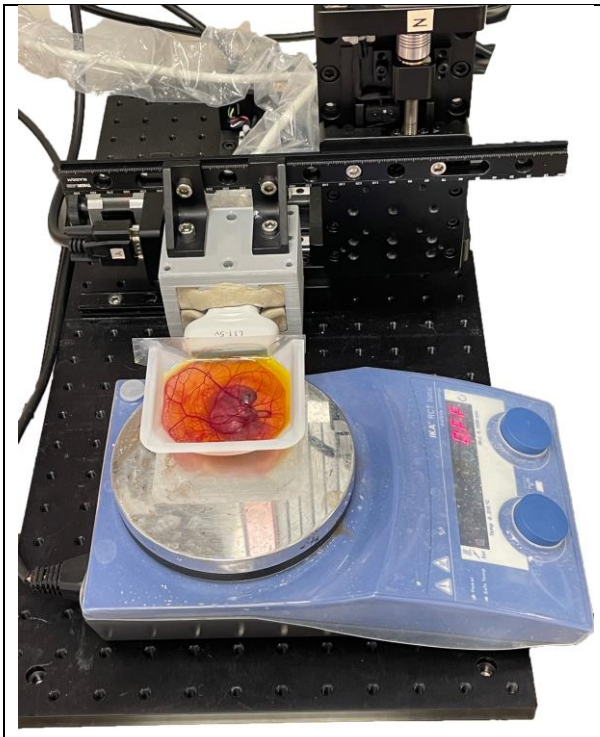
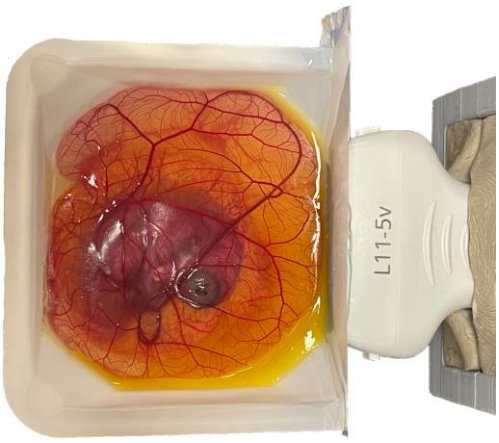
(2) $AC=AD*\sqrt{2+2\cos(\alpha)}$

Plugging (1) in (2) gives:

(3) $AC= DE/\sin(\alpha) *\sqrt{2+2\cos(\alpha)}$

With the values for α and DE we get ~772.7µm

Figures embryo acquisitions:

	Fig 4: Measurement setup of the chicken embryo. The embryo lies in a modified weighing boat which stands on a heating plate at 40 degrees. The ultrasound transducer is mounted to a motorized setup.
	Fig 5: Top view of the chicken embryo during US acquisiton. The vertical Mylar wall is well visible. The transducer can move along the wall without moving the embryo.

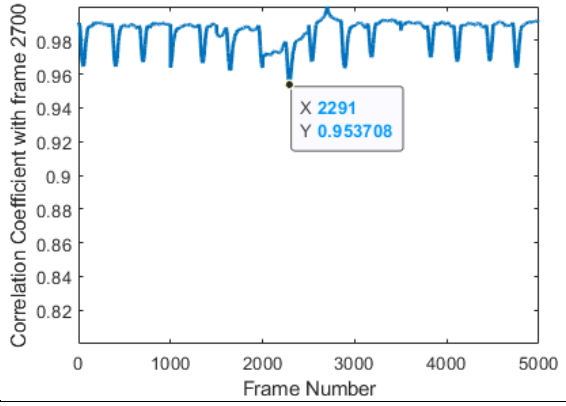
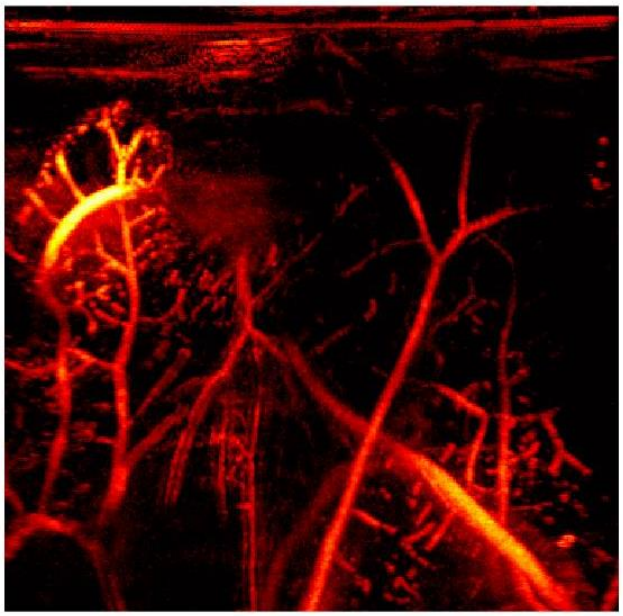


Fig 6: Correlation coefficient of all B-Mode frames with frame 2700 for the chicken Embryo acquisition. The selected frame (2700) is in the middle of the acquisition and between two heartbeats. A high correlation between all frames is clearly visible, as well as a periodic drop of the correlation coefficient due to heartbeats.



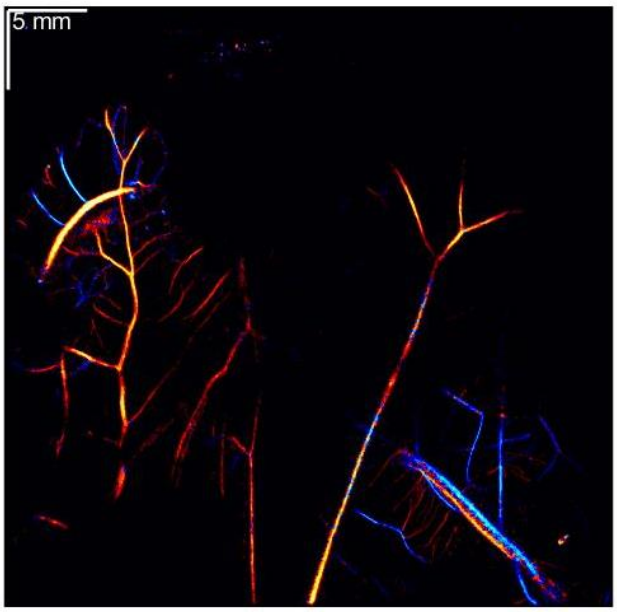
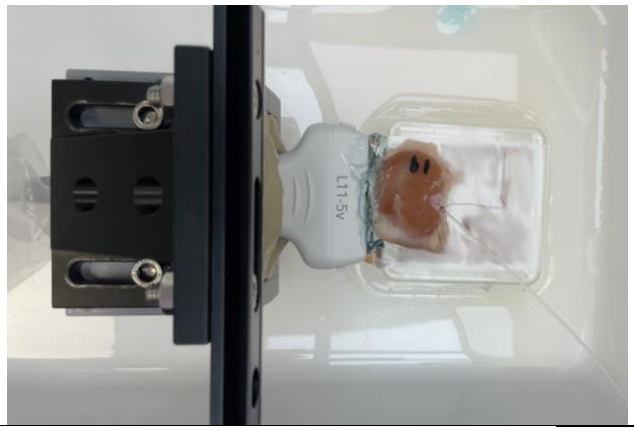
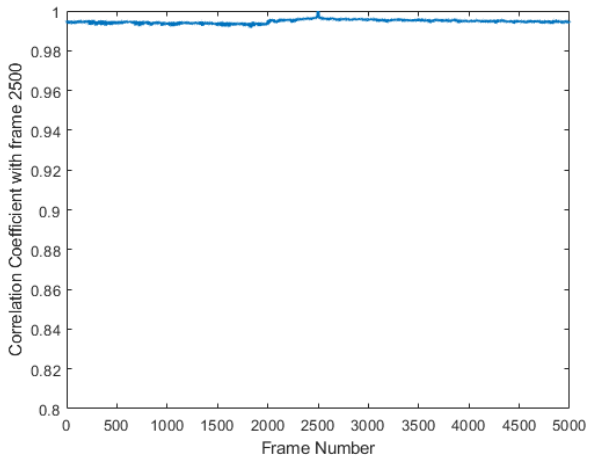
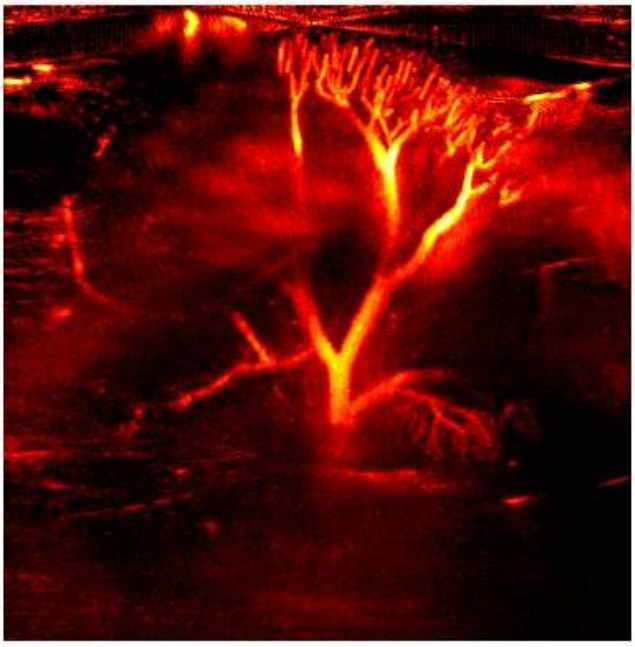
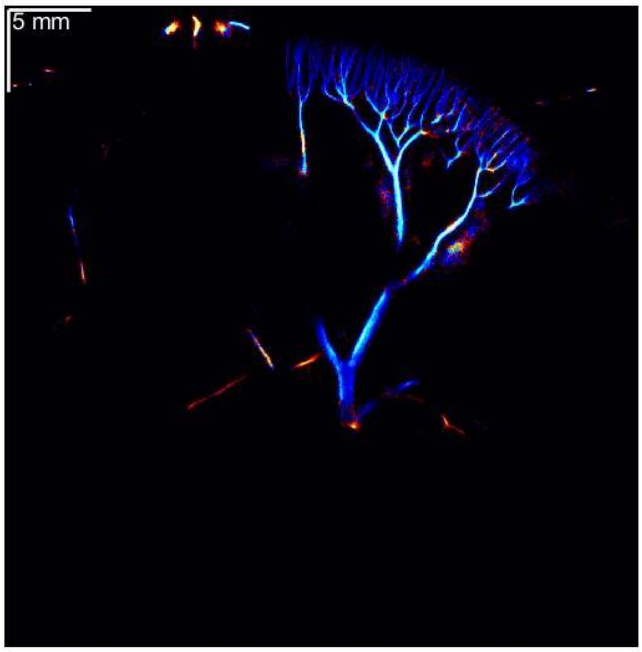


Fig 7:
On the top power doppler and below the SRUS image of the chicken embryo's CAM

Figures kidney acquisitions:

	Fig 8: Rabbit kidney during ultrasound acquisition: The main artery is connected to a hose through which the microbubble suspension was pumped. The Transducer is mounted to the same platform as in Supplementary figure 4.
	Fig 9: Correlation coefficient of the first 5000 frames of the kidney acquisition.
	Fig 10: On the top power doppler and below the SRUS image of the Rabbit kidney


5 mm

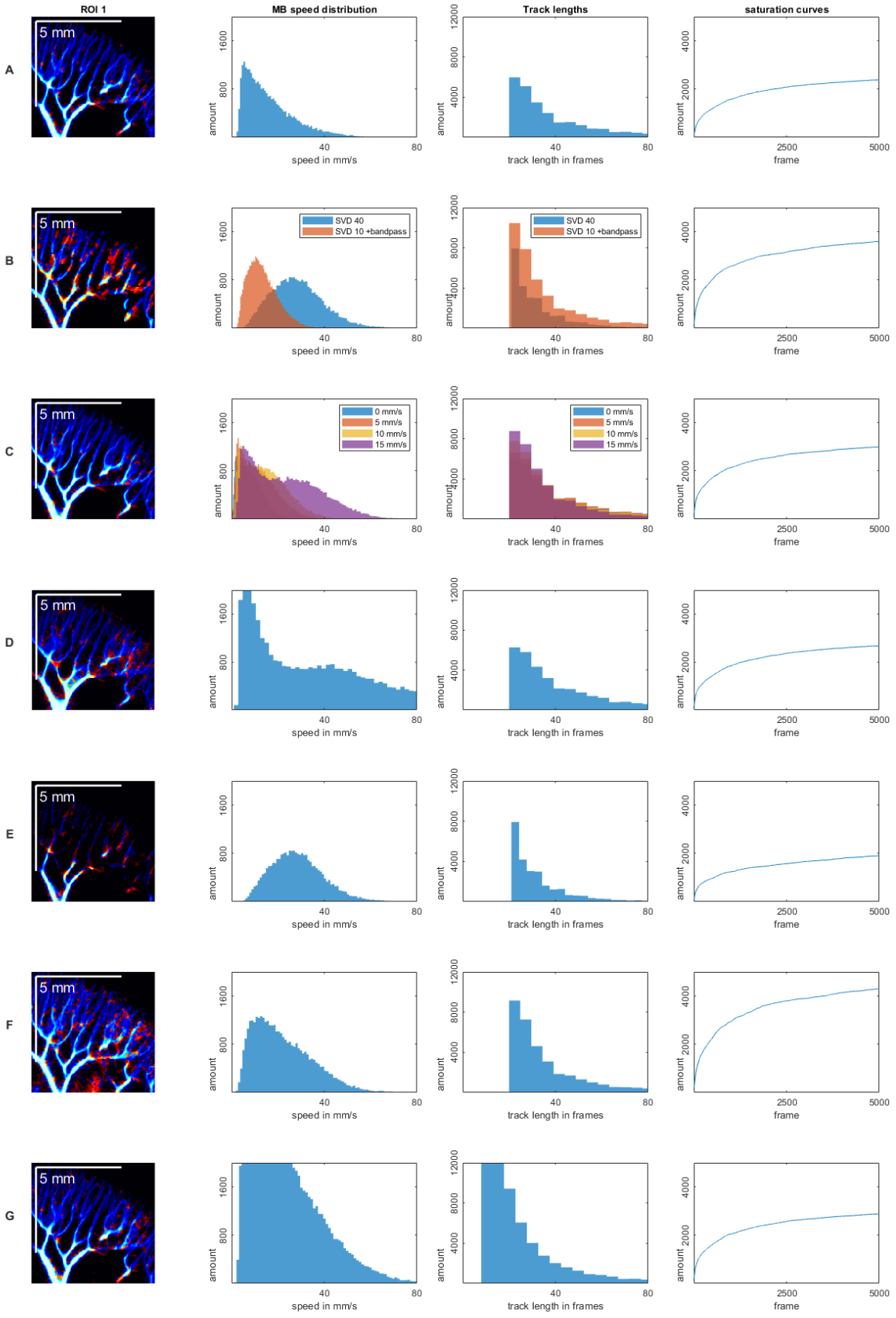

ROI 1
MB speed distribution
Track lengths
saturation curves
A
B
C
D
E
F
G
5 mm
amount
speed in mm/s
track length in frames
frame
SVD 40
SVD 10 +bandpass
0 mm/s
5 mm/s
10 mm/s
15 mm/s

Fig 11:

One region of interest, histograms of MB speed, track length and image pixel saturation of SRUS images of the rabbit kidney. For each row processing parameters were changed: A: the reference image, B: the pixel size for B-Mode reconstruction was set to 1.4805 λ in lateral direction, C: the pixel size for B-Mode reconstruction was set to 1.4805 λ in lateral direction and then the B-Mode image was interpolated to 0.5 λ pixels, D: SVD cuff was set to 40, E: filter design as described by Denis et al., F: filter design as described by Huang et al. , G: expected number of MBs was increased to 500, H: the minimal allowed track length was decreased to 7, I: the maximal allowed linking distance for the tracking algorithm was increased to 4 pixels.

System characterization

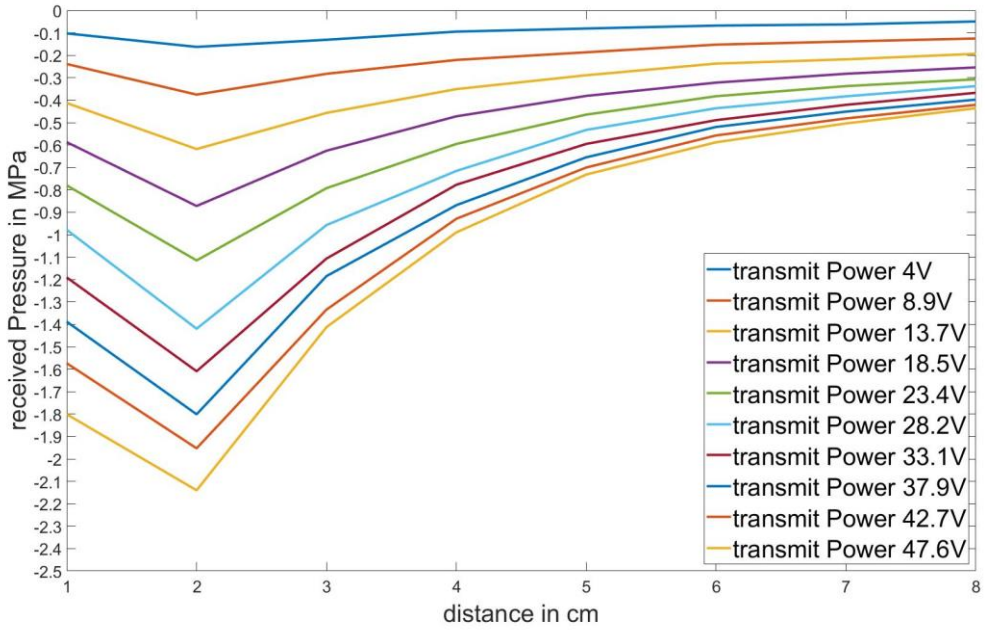


Fig 12:
The dependency of Peak negative pressure on transmit power and distance from the transducer at a transmit pulse of 7.6MHz. Measurements were taken using a needle hydrophone in a water bath.