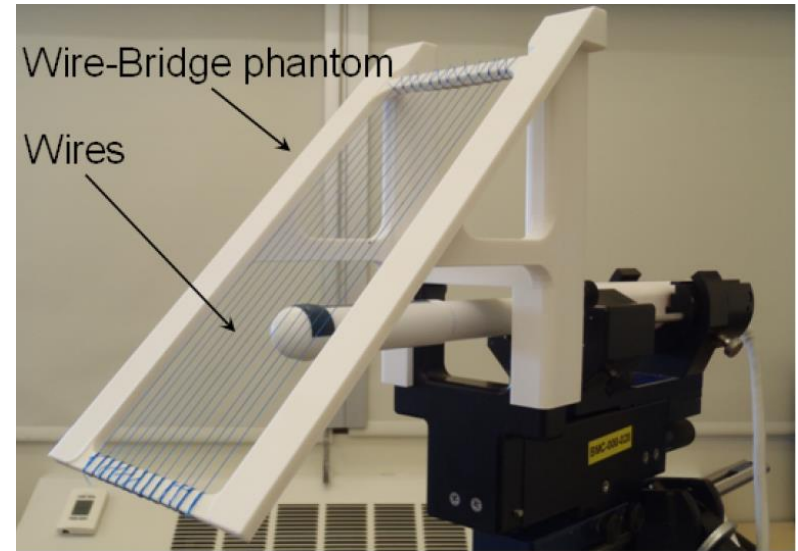
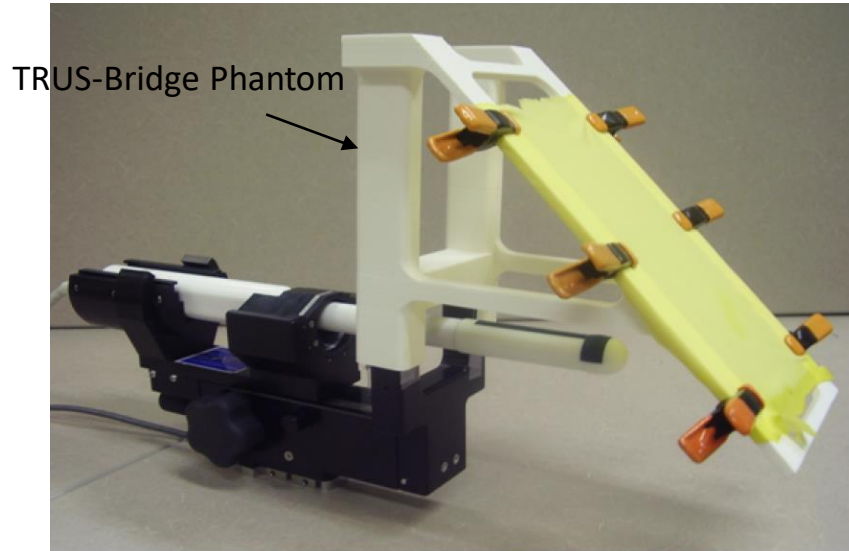
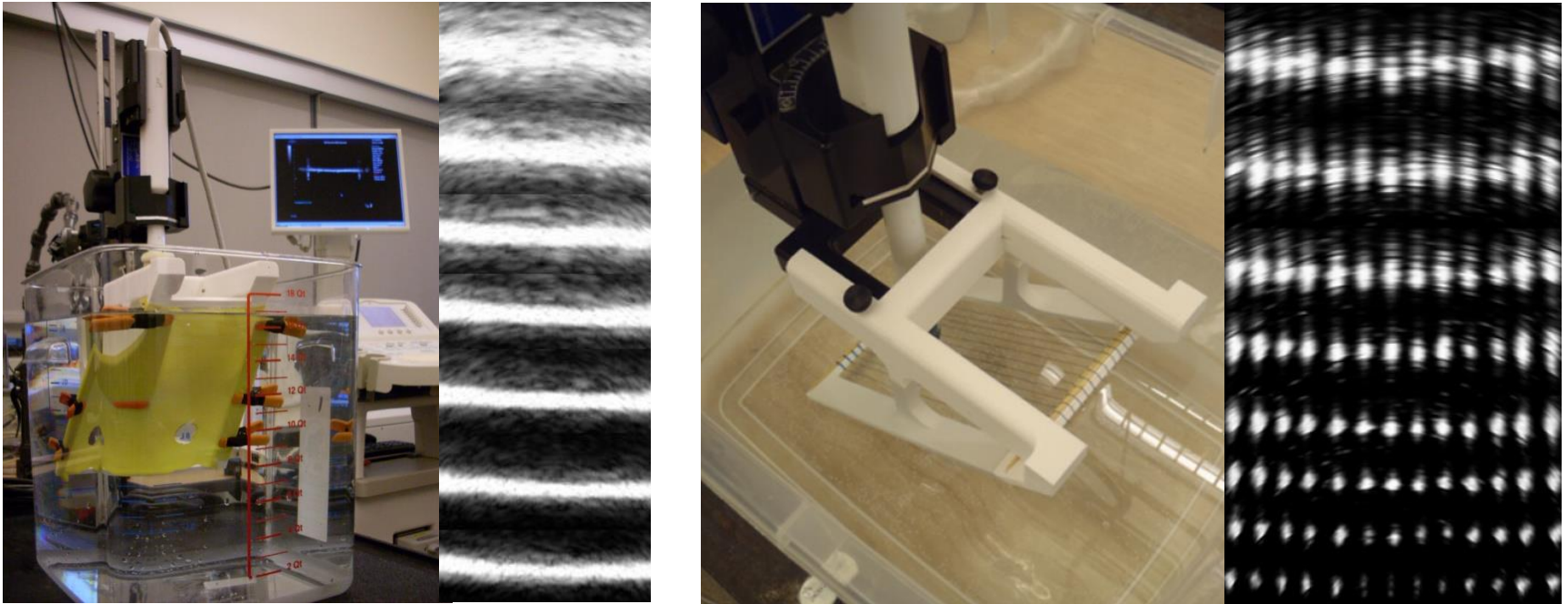


# Beamwidth Profiling Devices



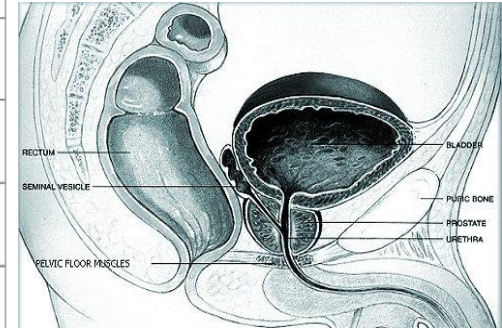
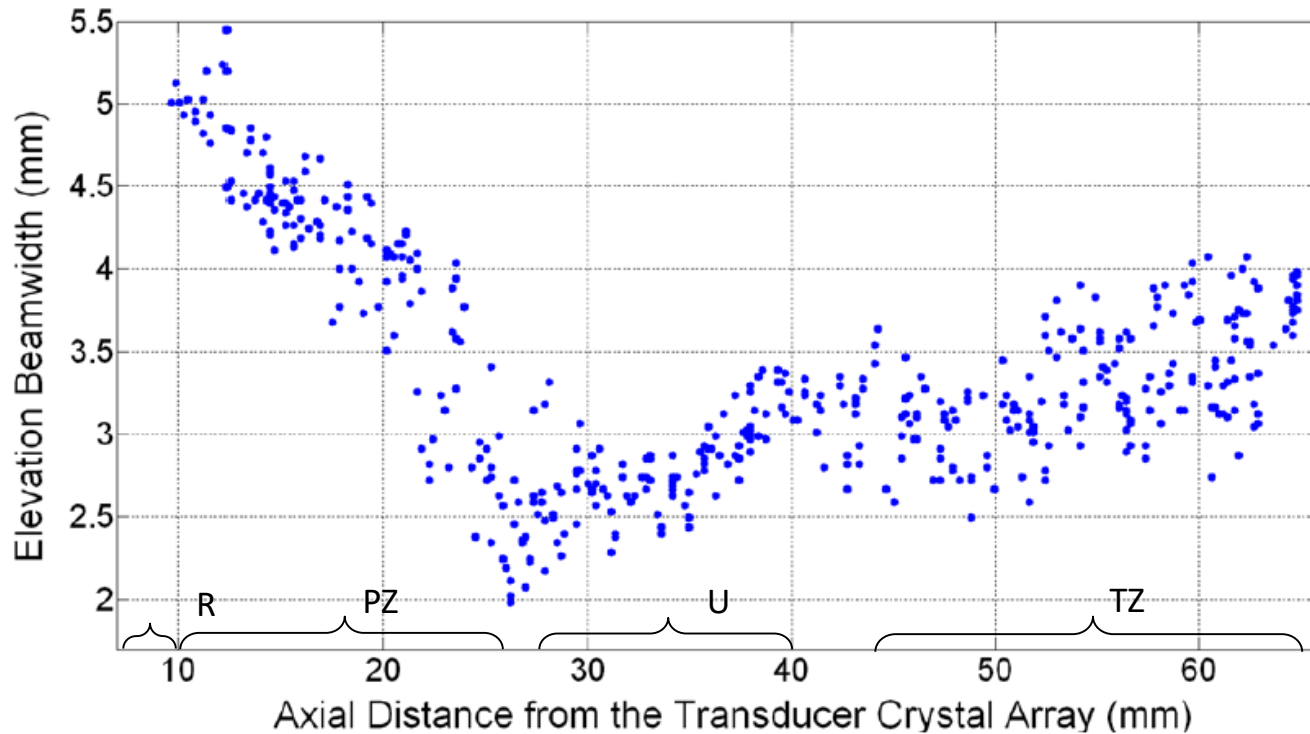
- |   |  |   |
|---|--|---|
| Beamwidth for one lateral position      | • Beamwidth for multiple lateral positions | • |
| Rubber membrane                         | •  |   |
| 45° inclined surface to the beam        | • 13 Nylon wires, with respect to grid     | • |
| Side walls and screw holes              | • Smaller thickness than rubber membrane   | • |
| Compatible with all commercial steppers | • Compatible with all commercial steppers  | • |

# Beam Profiling Experimental Setup



- TRUS images acquired for every depth and manually segmented
- Experimented with the SonixTouch US machine
- US beam profile is generated

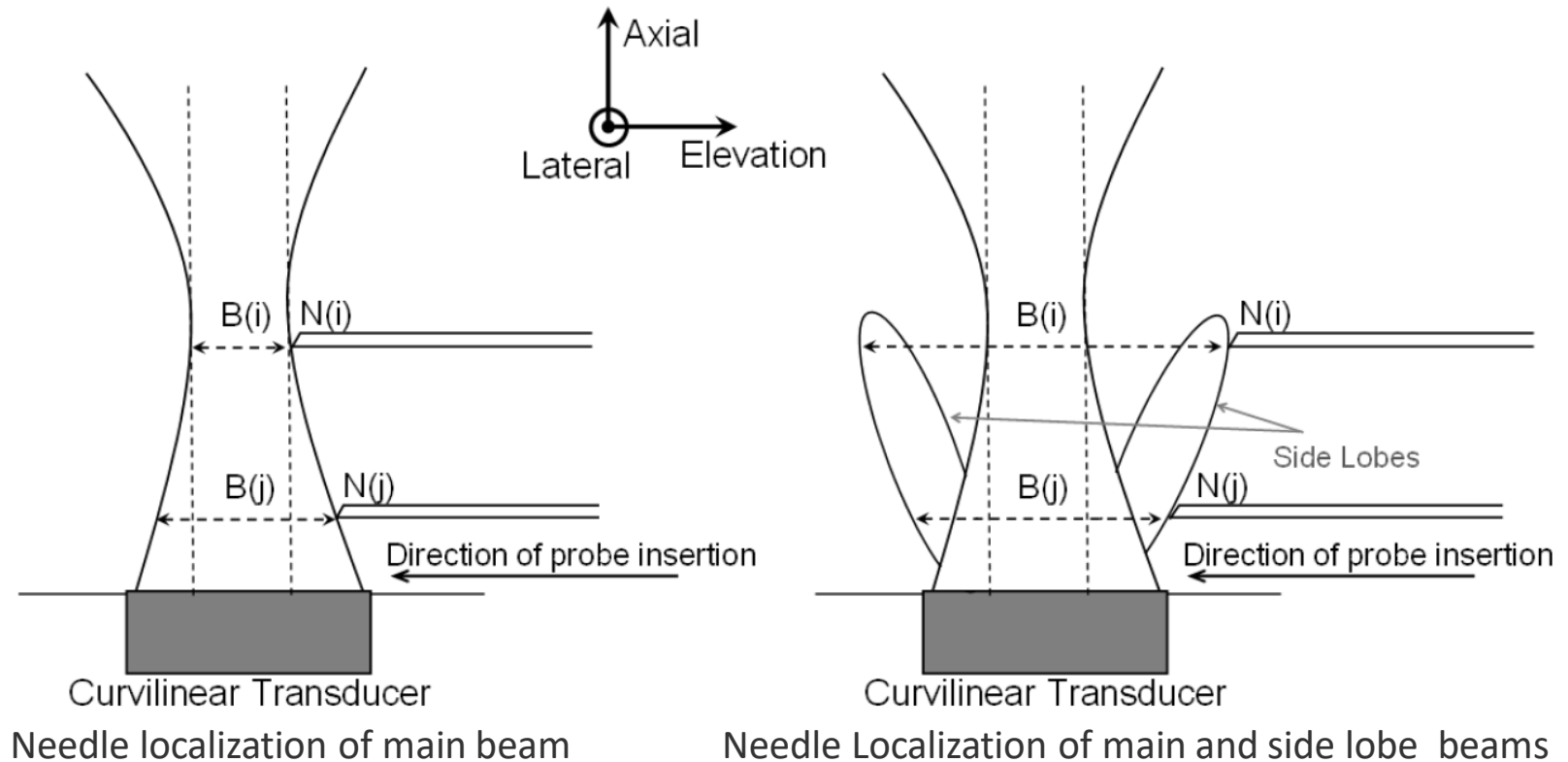
# TRUS Beam Profile



R=Rectum  
PZ= Peripheral Zone  
U=Urethra  
TZ=Transitional Zone

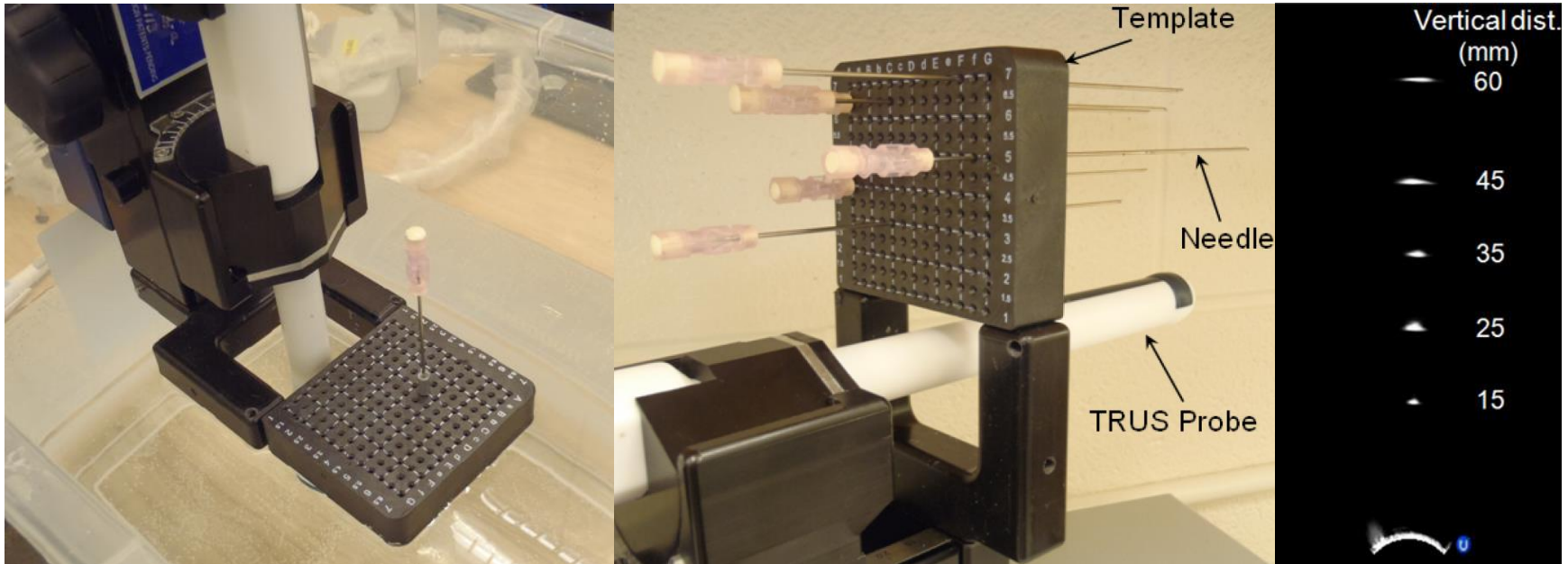
- Section-thickness starts diverging after the focal zone
- Focal zone is closely located to the US transducer

# Needle Localization Measurement



- Compare the observed reflections to a reference point
- Ref. point=first inserted needle reflection on a column

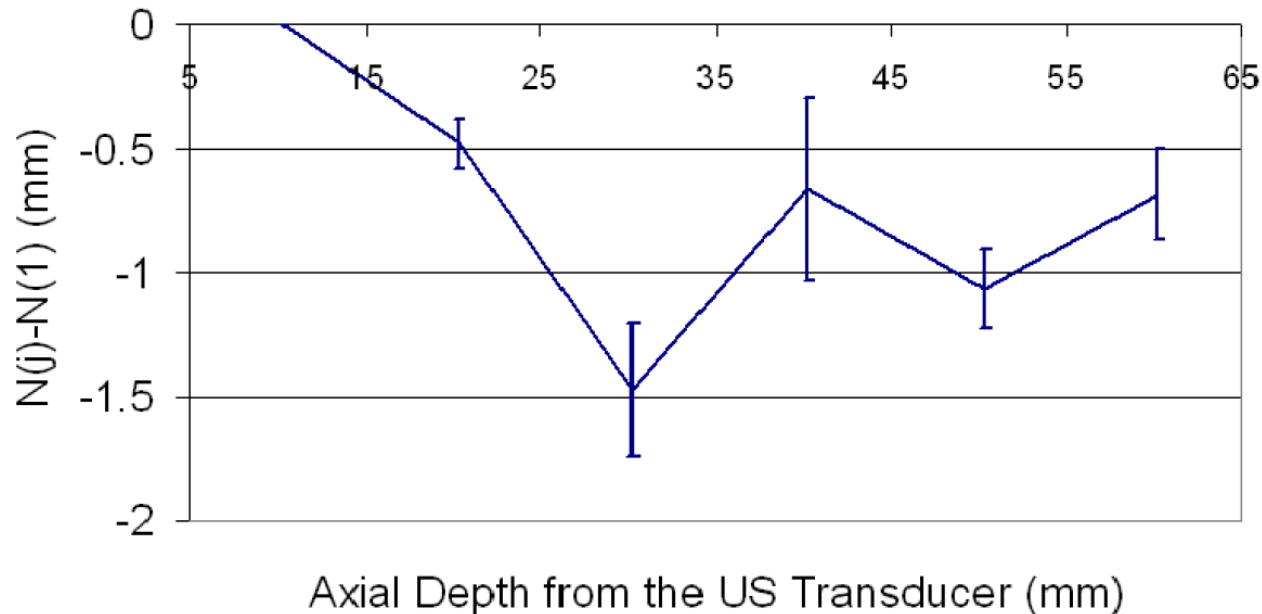
# Needle Insertion Experimental Setup



- Brachytherapy stepper and grid template are in submerged distilled water-glycerol bath
- Experimented with the SonixTouch US machine
- For each needle, the stepper position where the first reflection appears is recorded

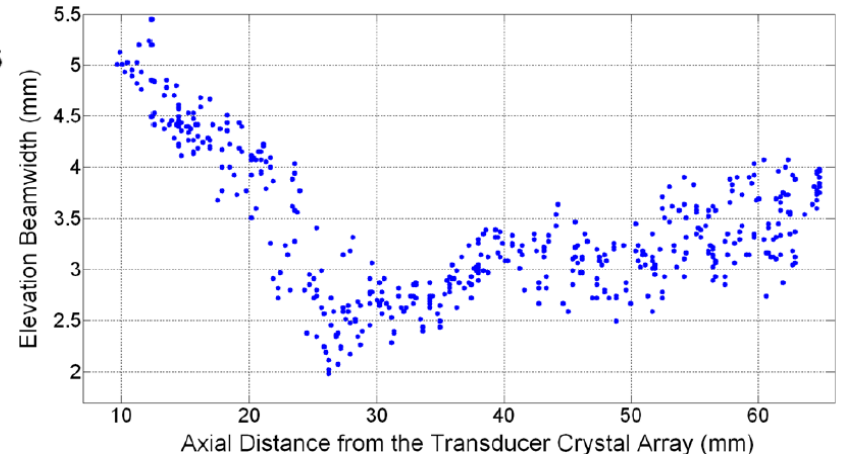
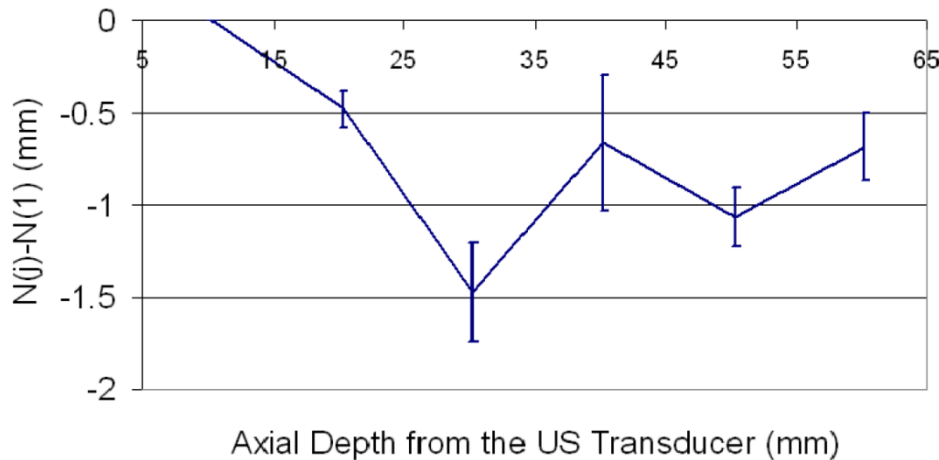


# Needle Localization Offset



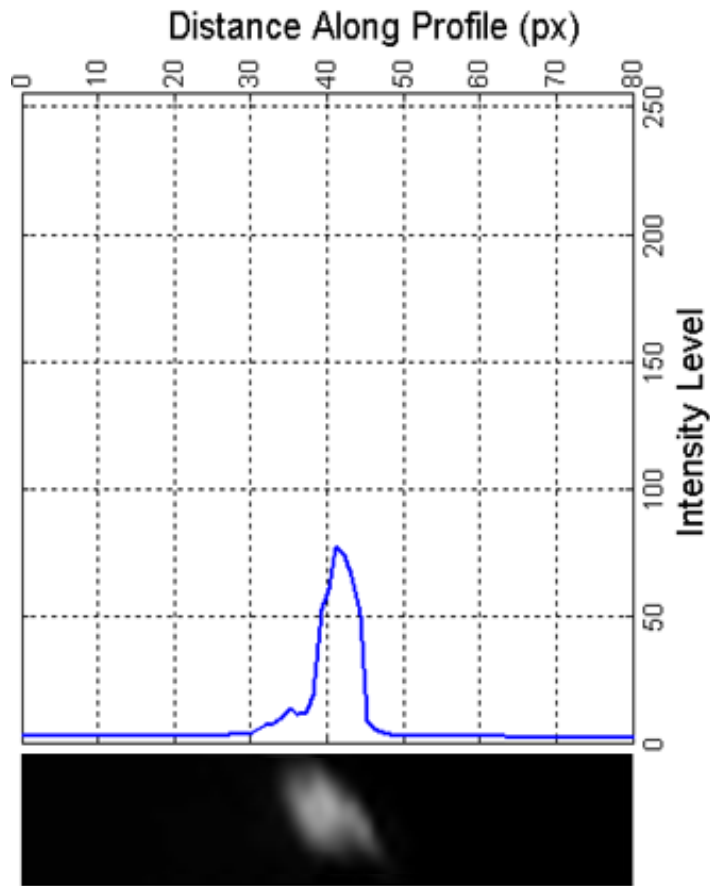
- Average and std. of  $N(j)-N(1)$  for gain=0%, dynamic range= 15, 50 and 100 dB, and power=0,-4, and -7
- Beam converges to a point and diverges right after
- Beam has a focal zone

# Needle Localization Offset

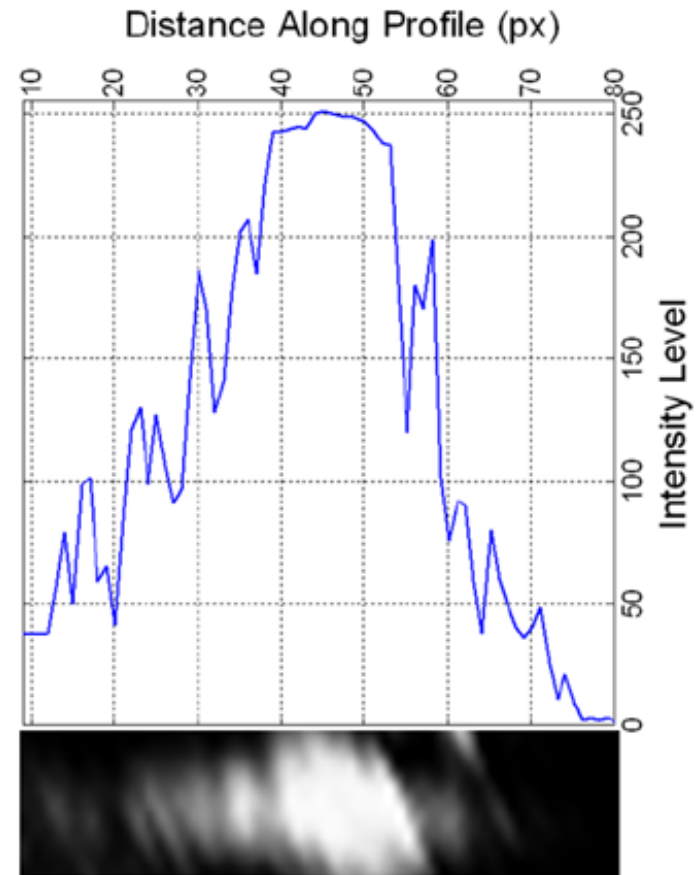


- Average and std. of  $N(j)-N(1)$  for gain=0%, dynamic range= 15, 50 and 100 dB, and power=0,-4, and -7
- Beam converges to a point and diverges right after
- Beam has a focal zone

# Side Lobe Effects



Intensity profile of main beam



Intensity profile of main and side lobe beams

Group of thin, parallel, low intensity bands on both sides •  
corresponding to side lobes