



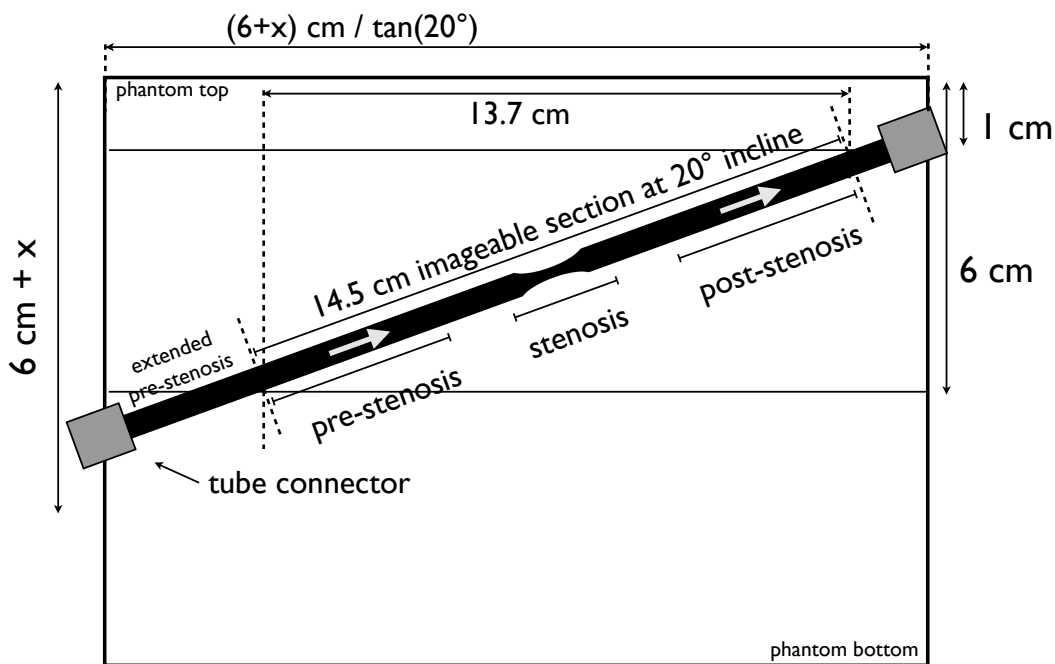
AIUM/QIBA  
Ultrasound Volume Blood Flow  
Biomarker

## PHANTOM SPECIFICATIONS – 2016-10-20

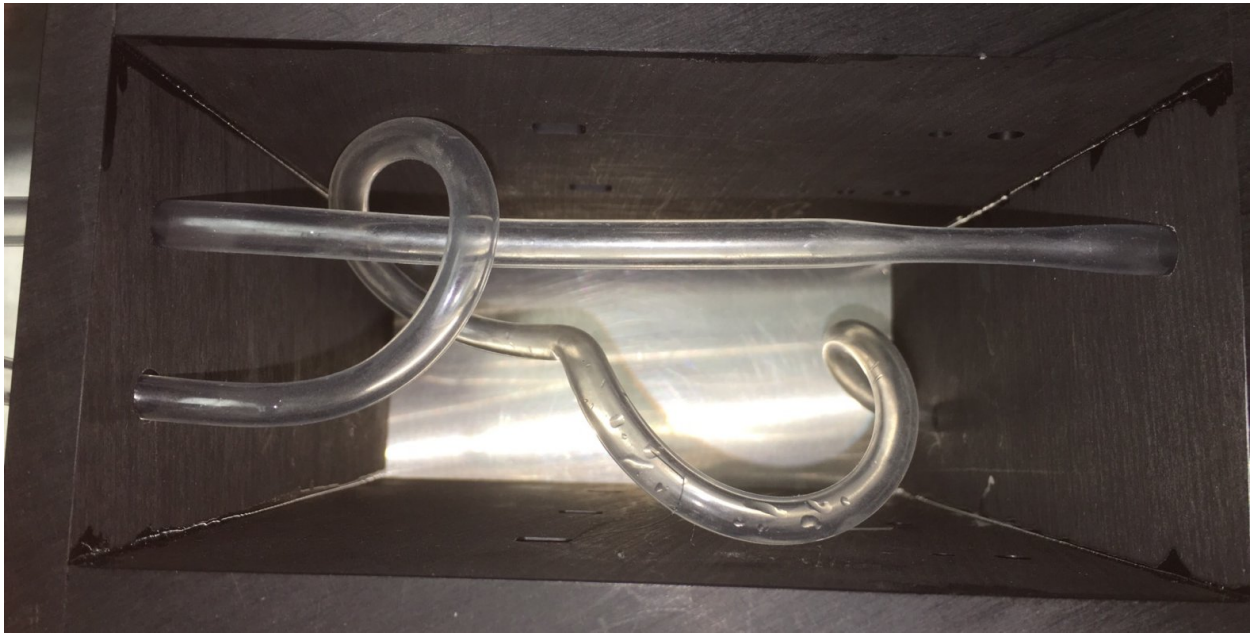
Updates per discussion with O. Kripfgans, B. Fowlkes, C. Baiu, M. Trew.

- Phantom housing:
  - Increase width of phantom to additional 1.5 cm on each side (width is the dimension across the tubing, not parallel to it)
  - Make phantom CT compliant in order to obtain 3D lumen path and cross-section
  - Add reference ruler or tick marks to top of housing housing (adjacent to scanning area, not as depicted in Figure 3) to aid user to position transducer
  - Add label to warn against using excessive force on transducer against phantom surface
  
- Phantom stenosis:
  - Position stenotic tubing section as shown in Figures 1 and 3
  - Create stenosis similar to that shown in Figure 2, i.e. reduce diameter from 5 mm to 3 mm, thus creating a 40% stenosis. Length of stenosis should be 2-3 cm (length is defined from where diameter begins to decrease to where it returns to pre-stenosis diameter).
  - A section that can be imaged (scanned) (14.5 cm) is assumed to exist from a depth of 1 to 6 cm (see Figure 1).
  - Pre- and post-stenotic sections are therefore ~5.7 cm long (each, since stenosis is 3 cm long). An extended pre-stenotic section may exist between the inflow connector and the start of the section that can be imaged (scanned) (see Figure 1).
  
- Phantom tubing:
  - 5 mm diameter tubing
  - The straight tubing section for stenosis at 20° angle with respect to surface
  - The looped tubing section with two loops diving towards phantom bottom; at least one loop should exceed 10 cm of depth with respect to surface and the other loop, if possible, should not exceed 7 cm; note: depth refers to center of tube
  - The center arch should approach phantom surface to within 0.69 cm or less for the position of the anterior side of the lumen
  - Tubing connectors for the stenotic section should enter phantom parallel to tubing in phantom. The tubing connector on the pre-stenosis side should also minimize cross section changes to promote laminar flow.

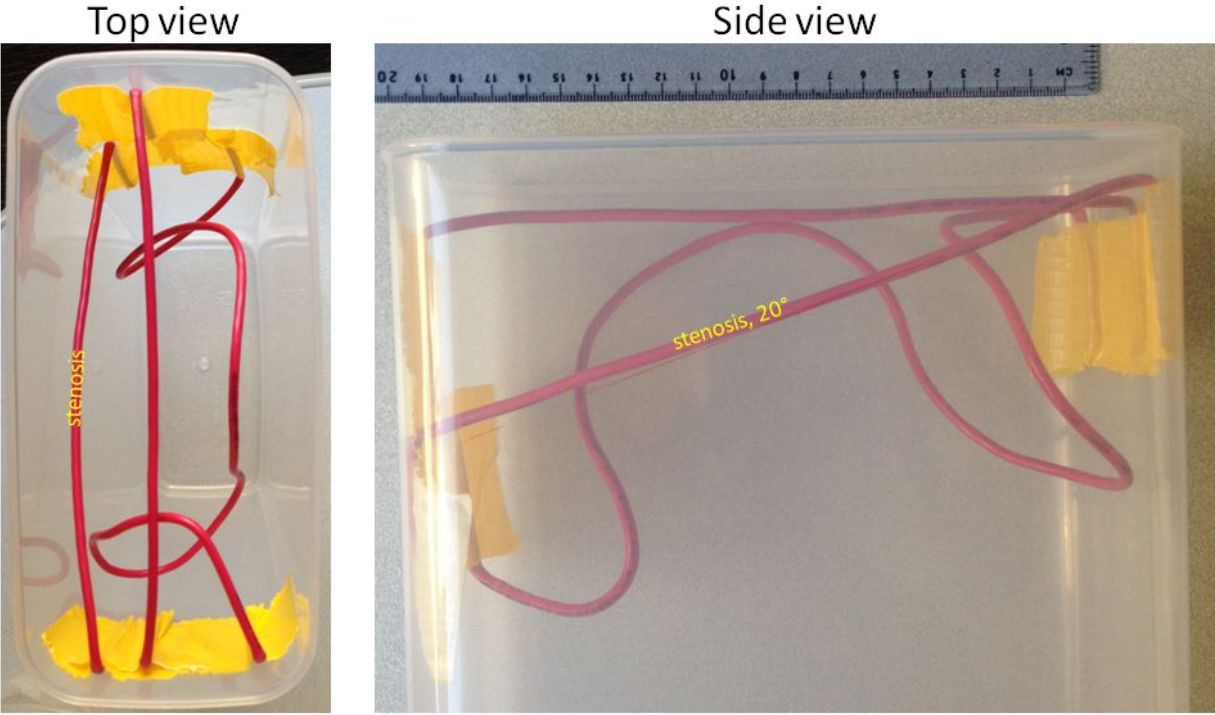
- The extended pre-stenotic section should have a length at least 10x the diameter change of the incoming tubing inner diameter relative to the connector inner diameter.
  - Minimum strings/wire targets should be used to secure tubing.
- Phantom flow meter
    - Flow meter used in the current prototype phantom shall be used.
    - In case displayed flow does not equal actual flow, please provide a conversion table.
  - Phantom pump
    - Current pump (12 mL/s) and flow meter configuration, same as in the current prototype phantom
    - May produce 10 white streaks per scan at 12 mL/s.
- Note: decision is not to use the 1.5 L/minute pump as it requires a redesign of the flow meter, power supply and a larger container, and it will cause cavitation around the stenotic region.



**Figure 1:** Schematic showing the position of stenotic tubing section. Stenotic section and transition zone are not to scale.



**Figure 2:** Photograph of prototype 1. Note: Looping tube section in second generation will not loop around stenotic section. Also, stenotic section will be at a 20° angle.



**Figure 3:** Photograph of wireframe model of prototype 2. Vertical placement of looping sections directed towards phantom bottom should be seen as a non-binding guideline. New phantom shall have 2 tubes.