PHANTOM SPECIFICATIONS – 2016-10-20
Updates per discussion with O. Kripfgans, B. Fowlkes, C. Baiu, M. Trew.

• **Phantom housing:**
  o Increase width of phantom to additional 1.5 cm on each side (width is the dimension across the tubing, not parallel to it)
  o Make phantom CT compliant in order to obtain 3D lumen path and cross-section
  o 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
  o Add label to warn against using excessive force on transducer against phantom surface

• **Phantom stenosis:**
  o Position stenotic tubing section as shown in Figures 1 and 3
  o 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).
  o 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).
  o 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:**
  o 5 mm diameter tubing
  o The straight tubing section for stenosis at 20° angle with respect to surface
  o 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
  o The center arch should approach phantom surface to within 0.69 cm or less for the position of the anterior side of the lumen
  o 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.

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**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 $20^\circ$ 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.