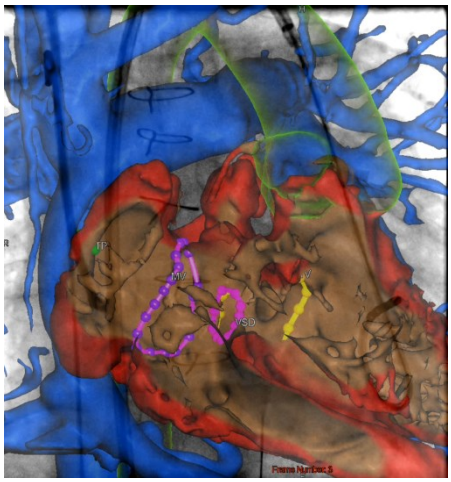
# New Biplane 3D Data Fusion Prototype with Multiple Visualization Techniques for 3D Enhanced Guidance in Congenital Heart Disease Catheterizations

Tanja Kurzendorfer[1], Erin Girard[3], Kevin Gralewski[2], Atilla Kiraly[3], Norbert Strobel[1], Yoav Dori[2]

[1]Siemens AG, Healthcare Sector, Forchheim, Germany
[2]Cardiology, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA
[3]Imaging and Computer Vision, Siemens Corporate Technology, Princeton, New Jersey, USA

**Background:** Fluoroscopically guided catheterization procedures can benefit from integration of 3D data. Current fusion systems have limited visualization and data input options and allow fluoro overlay only for a single plane. Here we present a new biplane 3D fusion prototype capable of handling multiple 3D data inputs and more elaborate visualization features (Siemens, Forchheim, Germany).

**Methods:** We retrospectively reviewed data from 20 consecutive prospectively enrolled patients undergoing x-ray magnetic resonance fusion (XMRF) in our institute. Registration was performed using manual visual matching of 3D data to biplane X-ray projections using internal markers. The prototype can accept DICOM or multiple *.stl files and overlays volume rendered or multiple surface rendered models. Multiple visualization techniques and tools were incorporated, such as contour and solid rendering and surface carving, to facilitate a clear presentation of complex 3D anatomy. Surface models were generated by segmentation of high-resolution MRA sequences.




**Results:** The max segmentation time was 10 min (range 2 - 10 min) and max registration time was 30 sec (range 10 - 30 sec). Registration was performed without the need for contrast or additional radiation exposure. In phantom experiments the registration accuracy was measured at 0.6 ± 0.3 mm in the AP projection and 0.3 ± 0.2 mm in the lateral projection. In contrast to volume rendering, solid rendered surfaces provided a clear view of internal structures, such as vessel ostia, when using a carving feature (figure). Contour rendering alone was not suitable for complex overlapping structures due to imperceptible 3D depth information, but when used in combination with solid rendered structures it provided a see-through 3D relation between adjacent structures.

**Conclusions:** This new prototype demonstrated a high level of accuracy for fluoroscopic biplane overlay using a fast internal marker based registration procedure without the need for additional radiation or contrast. This new biplane XMRF prototype provides enhanced guidance under fluoroscopy by integrating 3D information and has the potential to reduce radiation during complicated catheterization procedures