

AbstractID: 8721 Title: Registration and fusion of MRI and interventional X-ray images based on external markers in a XMR suite.

### Abstract Submission

**Purpose:** To report a method for registration and fusion of 3D magnetic resonance (MR) volume and 2D X-ray images obtained from a C-arm mounted flat panel detector. This XMR (X-ray/MR) technique has been designed as a support for X-ray guided embolization of venous malformations using pre-interventional magnetic resonance imaging (MRI).

**Method and Materials:** Registration and fusion are performed through a custom-made graphical user interface and are based on multimodality external markers. A high resolution MR sequence has been optimized to obtain a precise pre-interventional localization of the markers. After the localization, a rigid body registration method is implemented, based on one or two X-ray acquisitions, which can be apply to subsequent images with different C-arm angulations. The precision of the registration, with respect to the number of markers used, has been evaluated on a phantom and tested off-line with patients.

**Results:** The computation of registration parameters from one MR volume, two X-ray images and four external markers on a phantom, is a good example of realistic clinical conditions. For this computation, an excellent registration accuracy is obtained for any subsequent image taken at different C-arm orientations ( $0.9\pm 0.6\text{mm}$ ). Furthermore, we find that only one X-ray view is sufficient to reach equivalent accuracy when the registration is performed on images taken at similar C-arm orientation ( $0.8\pm 0.6\text{mm}$ ).

**Conclusion:** As far as we know, this level of accuracy has never been reported in the literature using a similar registration method. Starting with only two X-ray acquisitions, this work shows that excellent registration accuracy with an MRI acquisition is possible for any subsequent image taken at different C-arm angulations. Moreover, we show that when the registration is performed on images taken at about the same C-arm orientation, one view is definitely enough for an accuracy of approximately 1 mm.