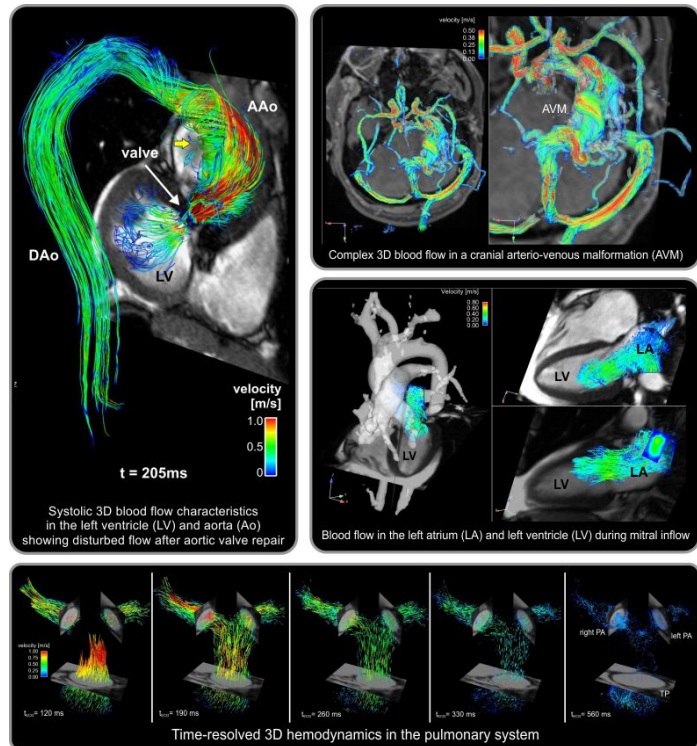


Michael Markl, Ph.D.  
 Associate Professor of Radiology and Biomedical Engineering  
 Director Cardiovascular Imaging Research  
 Dept. of Radiology, Feinberg School of Medicine  
 Northwestern University

## Assessment of Cardio- and Neurovascular Hemodynamics in the Human Circulatory System using 4D flow MRI

**Abstract:** The intrinsic motion sensitivity of magnetic resonance imaging (MRI) can be used to acquire and quantify blood flow. 4D flow MRI can be employed to encode blood flow velocities along all dimensions and offers the possibility to acquire spatially registered information on three-directional blood flow simultaneously with the 3D anatomic data within a single examination. As a result, 4D flow MRI permits the assessment of three-directional blood flow with full volumetric coverage of cardiac chambers or cardio- or neurovascular regions of interest such as the thoracic aorta or the large cerebral arterial and venous system.

A benefit compared to traditional imaging techniques is related to the possibility to visualize cardiac and vascular hemodynamics and retrospectively quantify blood flow at any location of interest. In addition to the 3D visualization of complex cardiac and vascular flow patterns, quantitative flow analysis can provide quantitative information on the impact of cardio- or neurovascular pathologies on altered hemodynamics associated with the presence of cardio- and neurovascular disease.



The presentation will

- 1) Introduce methodological aspects related to the measurement of 3D blood in the human body based on 4D flow MRI;
- 2) Illustrate the potential of EnSight for the 3D visualization and quantification of cardiovascular hemodynamics;
- 3) Provide examples of clinically relevant questions and how 4D flow and EnSight can be used to improve cardiovascular diagnostics.