Radial Sampling and KWIC Reconstruction Reduce Motion Artifacts for DCE-MRI of Mouse Pancreatic Cancer

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- Objectives :
  - To acquire both tumor DCE and cardiac left ventricular blood pool AIF in an orthotopic mouse model of pancreatic cancer with sufficient spatial and temporal resolution to fully characterize both traces.
  - To perform pixelwise fits the resulting data various pharmacokinetic models yielding maps of perfusion parameters over the tumors.

- Data acquisition :
  - Reference T1 map : ECG gated, radially sampled Look-Locker inversion recovery.
  - DCE data : ECG gated, Golden Angle radially sampled, global saturation recovery gradient echo acquisition of cardiac short axis and axial series spanning tumor before and during first pass of Gd based contrast agent.

- Data Processing
  - Image Reconstruction : Sliding window view sharing (KWIC), allows for tradeoffs between spatial and temporal resolution during processing
  - Modeling : Non-linear least squares fit of time dependent signal intensity to standard pharmacokinetic models.

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SAIF
Small Animal Imaging Facility
University of Pennsylvania

Golden Angle Sampling with KWIC Reconstruction Allows Trade-offs Between Spatial and Temporal Resolution

KWIC reconstruction : only the most recently sampled views contribute to signal at center of k-space (image contrast).

High Spatial Resolution

High Temporal Resolution

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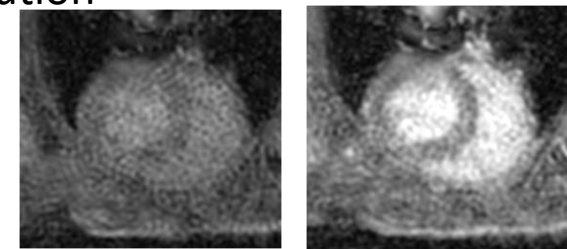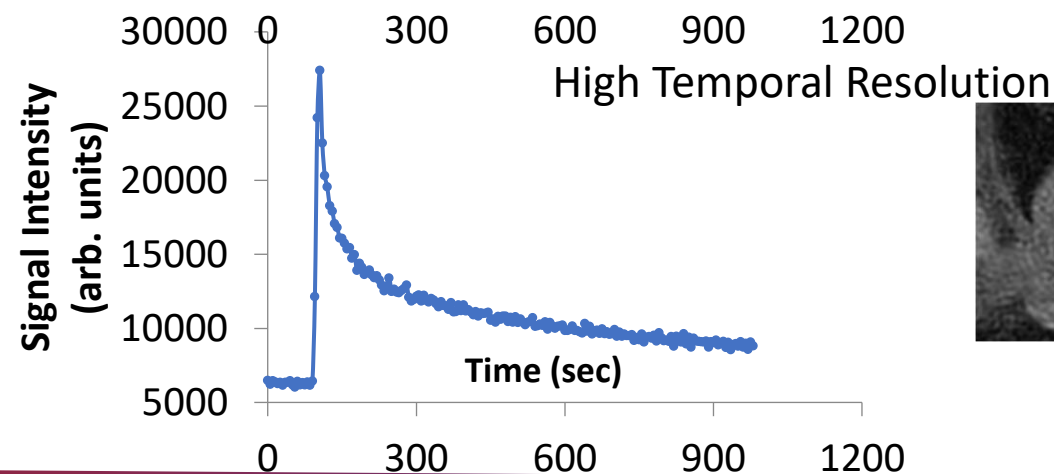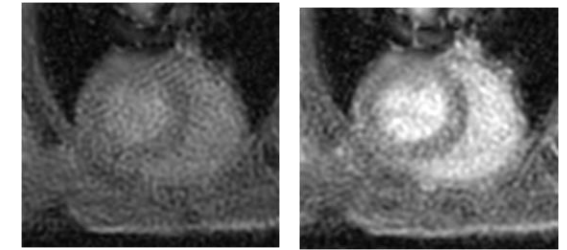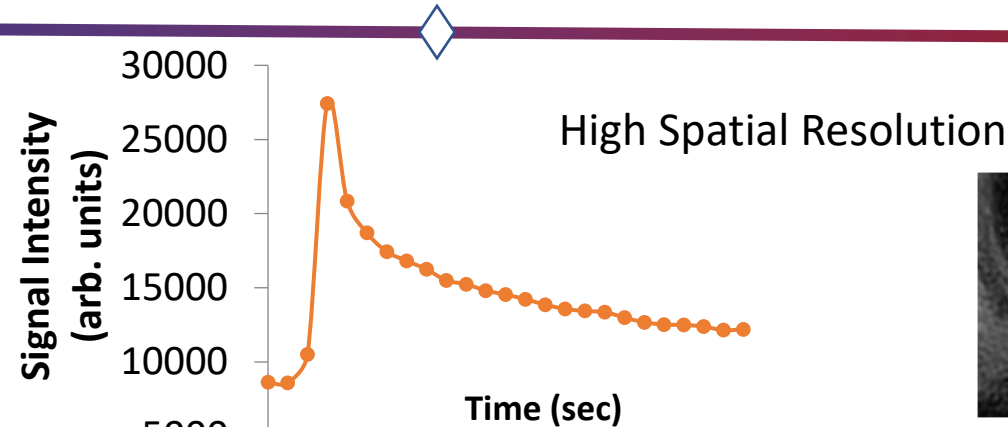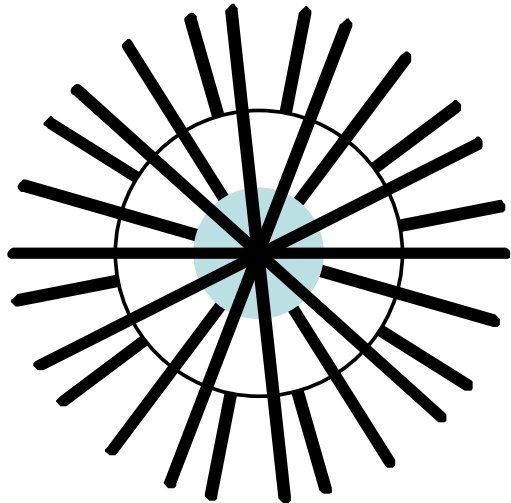
Cardiac and Tumor Images can be Processed with Different Spatial/Temporal Resolution

High Spatial Resolution

High Temporal Resolution

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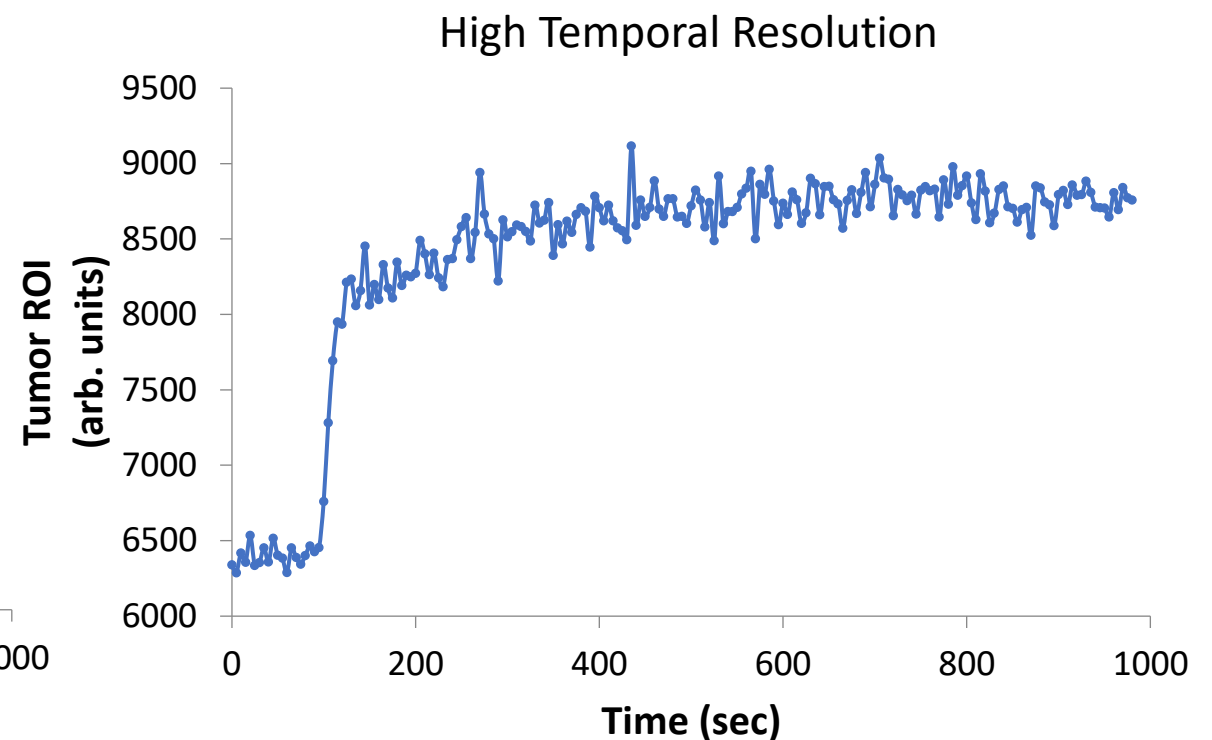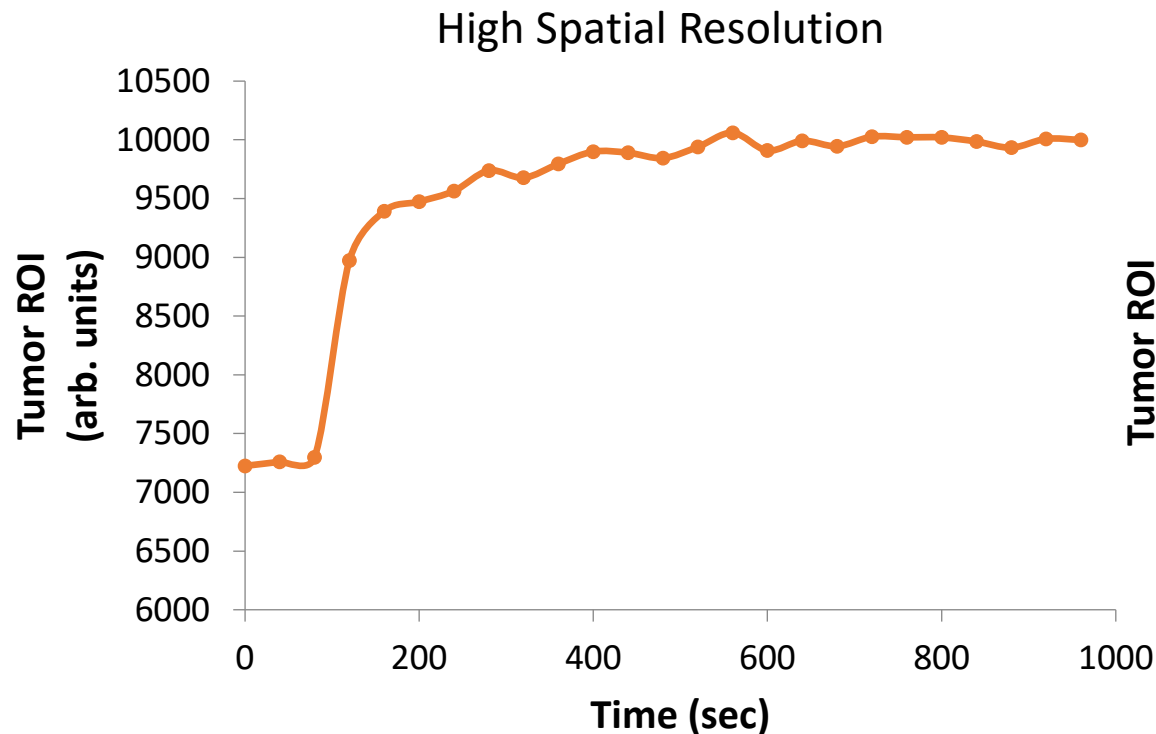
Dynamic Image Quality

- The combination of the proposed acquisition and image reconstruction method provides high spatial resolution (230 microns in plane) and high temporal resolution (50 cardiac cycles ~ 6 sec/image) for both tumor and cardiac short axis imaging.
- Some streaking artifacts are presnt in the cardiac images.

Conclusions

K_{trans} kep
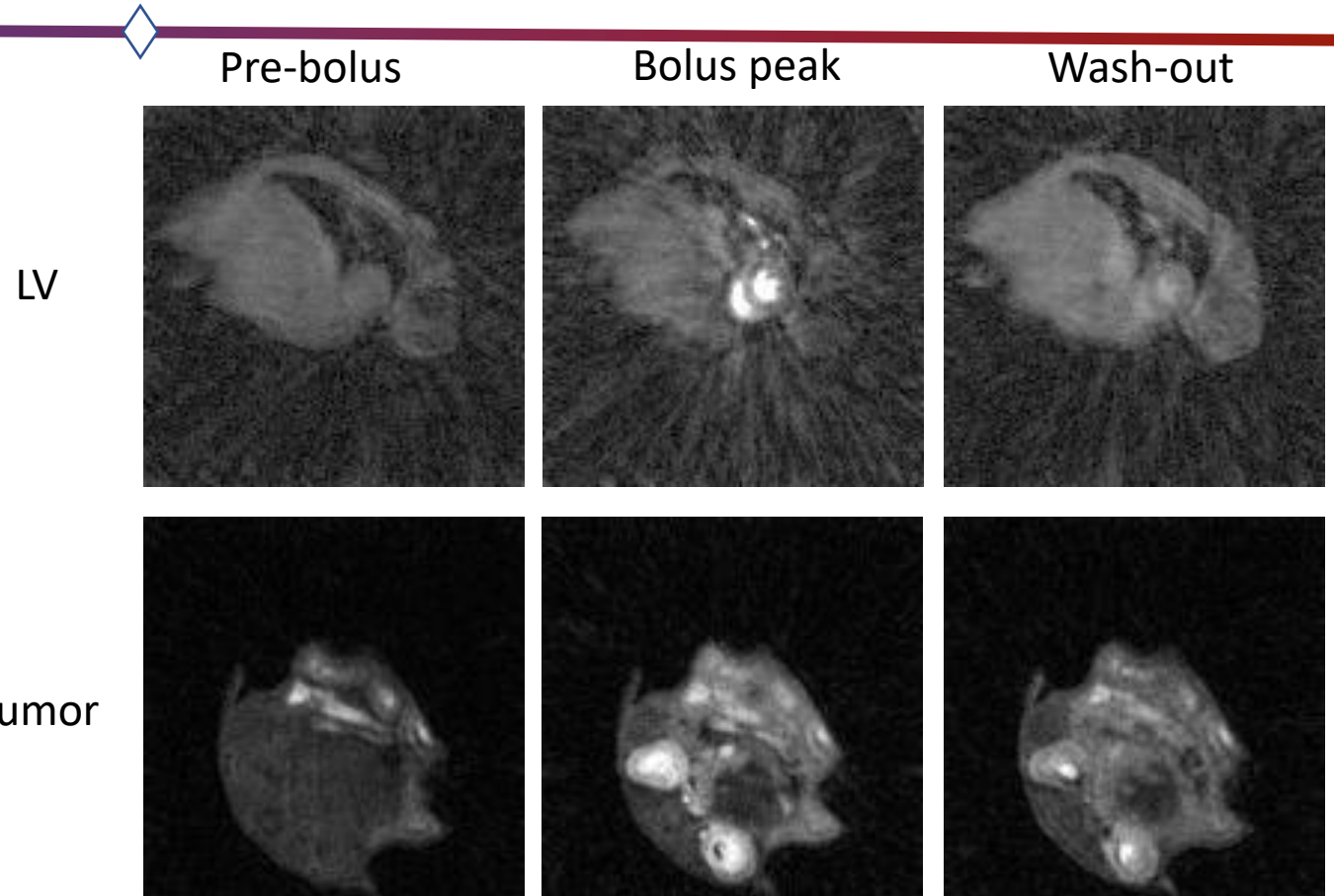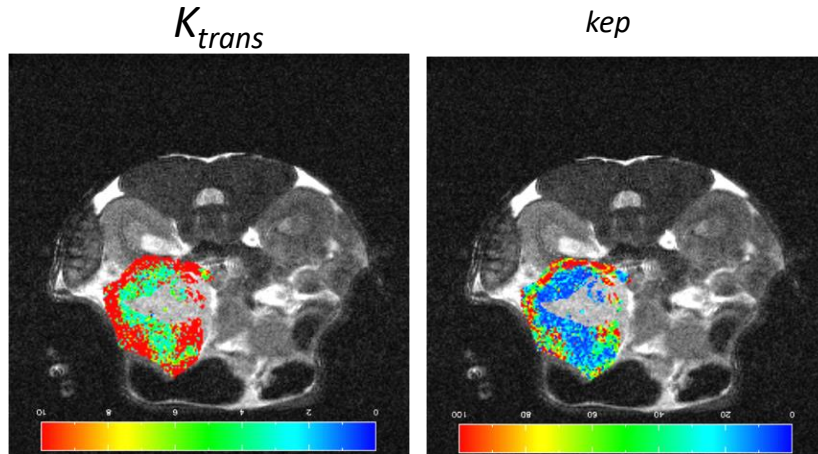
Color maps of perfusion parameters overlaid on T2 weighed images.

- ECG gated, Golden Angle, radially sampled, saturation recovery gradient echo acquisition acquisition combined with KWIC image reconstruction allows trade-offs between spatial and temporal resolution.

- The protocol provides dynamic images of sufficient temporal and spatial resolution to allow pixelwise pharmacokinetic modeling

- The resulting perfusion parameter maps reveal a highly perfused outer region surrounding a poorly perfused core.

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