Supplementary Data 1

diagnostics:

plots: # Plotting parameters.

combiner_calibration: # Plotting parameters. Note that enabling will enable serial execution mode which will slow down scanning.

enable: False # Flag to enable x/z and positive/negative image combination calibration plots.

phi_stitching_calibration: # Plotting parameters

enable: False # Save phi calibration partial field-of-view stitching plots to the image directory.

recon:

inverse_xz_image_combiner: # Inverse problem X and Z channel image combination.

enabled: False # Flag to enable the inverse problem image combination. If disabled, simple image averaging is used.

equalize_psf: True # The X and Z PSFs are used in the forward model of the image combination. If this parameter is true, the PSFs are divided by the tangential envelope in the Fourier domain to equalize the PSF for reconstruction.

num_edge_crop_pixels: # Number of pixels to crop from each edge of the image.

x: 3 # Along X axis. Value in [0, 10]

z: 3 # Along Z axis. Value in [0, 10]

num_iter: 30 # Number of FISTA iterations to run in the optimization. Value in [1, 2000]

smoothing_lambdas:

- 10.0

- 10.0

tikhonov_lambda: 100.0 # Tikhonov L2 regularization parameter. Value in [0.0, 1000000.0]

rcn_transverse: False # Flag to reconstruct MPI "transverse" (z/x, x/z) image.

relaxation_shift:

```
    x: 0.15 # Distance to shift in image combiner. Value in [-1.0, 1.0] mm
    z: -0.2 # Distance to shift in image combiner. Value in [-1.0, 1.0] mm
  system_phi: # Linear phase calibration constants due to system delays, specified for `x`, `z`, and `relaxometer` scan configurations.
    x: 2.04 # Linear phase (constant time delay) due to the MPI system. Value in [0.0, 6.28] radians
    z: 5.173 # Linear phase (constant time delay) due to the MPI system. Value in [0.0, 6.28] radians
  tracer_phi: # Linear phase calibration constants due to the tracer, specified for `x`, `z`, and `relaxometer` scan configurations.
    x: 0.0 # Linear phase (constant time delay) due to the tracer. Value in [-1.0, 1.0] radians
    z: 0.0 # Linear phase (constant time delay) due to the tracer. Value in [-1.0, 1.0] radians
  use_calculated_combiner_values: False # Flag to use auto-detected combiner shift and intensity scaling values.
scan:
  fovx: 6.0 # x Field-of-view. Value in [0.0, 6.0] cm
  scan_modes: # Generated from Standard
    Standard:
      baseline_params: # Baselining modes.
        baseline_type: # Type of imaging baseline for scan by transmit axis.
          x: time # Type of baseline. Value in ['image', 'none', 'panel', 'time']
          z: time # Type of baseline. Value in ['image', 'none', 'panel', 'time']
      gradient: 5.7 # Gradient strength {5.7, 5.067, 3.055}. Value in [0.0, 6.11] T/m
      rf_amp: # RF excitation field strength array.
        x:
          - 5.0
        z:
```

```
      - 5.0
sdk:
  sdk_data_output: # Enable expanded output data (Momentum SDK only).
    enable_gridded_pFOVs: True # Enable gridded partial field-of-view export.
    enable_received_signals: True # Enable received signals export.
    enable_sequence_waveforms: True # Enable sequence waveform export.
user:
  acquisition_window: 0.0 # Gating enabled when nonzero. Value in [0.0, 2000.0] ms
  enable_baseline: True # Enable baselining.
  enabled_transmit_axes:
    - x
    - z
  fovz: 12.0 # z Field-of-view. Value in [2.0, 12.0] cm
  lin_motor_fov_offset: 2.0 # Bed offset from center. Value in [-9.0, 9.0] cm
  num_angles: 21 # Number of angles (>1 implies 3D scan). Value in [1, 101]
  num_scan_averages:
    x: 1 # Number of scans to average together. Value in [1, 25]
    z: 1 # Number of scans to average together. Value in [1, 25]
  projection_reconstruction_method: fbp # 3D recon method. Value in ['fbp', 'tv_l1']
  scan_mode: "Standard"
  scan_type: pr # Type of acquisition. Value in ['pr', 'relaxometer', 'timecourse']
  single_projection_angle: 0.0 # Angle for 2D image. Value in [-90.1, 90.1] degrees
  timecourse_delay_between_frames: 1.0 # Time between frames. Value in [0.0, 120.0] s
  timecourse_num_frames: 10 # Number of frames in timecourse mode. Value in [2, 100]
```