

# Procedure phantom QC for preclinical MRI TRISTAN

V0.9

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1. Identify your set of TRISTAN agarose phantoms with five different nickel concentrations. Verify that the phantoms are intact with no air bubbles or other obvious signs of damage.
2. On each of two separate days bury each phantom in a piece of cucumber. The use of cucumber is intended to reduce susceptibility artefacts, Gibbs ringing, mechanical vibration and thermal gradients. Allow the five cucumbered phantoms to come to thermal equilibrium in the magnet bore.
3. For each of the cucumbered phantoms
  - a. Use a volume transmit coil – preferably a rat body coil (~70mm id) if available in your centre
  - b. Measure the temperature of the cucumber flesh in several places and verify thermal equilibrium has been reached. Report the temperature with 0.1°C precision as the T1 of nickel agarose phantoms is slightly temperature dependent.
  - c. In ParaVision 5 or 6, start a new study. All images are coronal with 1.16mm slice thickness and 58mmx58mm FoV
4. ParaVision 5 and 6 users should invoke ParaVision standard installed RARE T1 saturation-recovery measurement method using a soft slice-selective  $\pi/2$  followed by a hard  $\pi$  train.
  - a. In PV6 load T1map\_RARE protocol from Rat/Head/Relaxometry. Specify slice thickness (1.16mm), FOV (x=58mm; z=58mm), acquisition matrix (x=128; z=128) and RARE factor (8). The following TR values should be employed: 5500; 2000; 1200; 750; 500; 300; 200; 100 ms. In the routine editor of the method, set
    - Effective Echo Time: 30.00 ms
    - Averages: 1
    - Repetitions: 1
    - Scan time (greyed out)
    - Echo spacing: 7.500 ms
    - Rare factor: 8
    - T1 experiments: 8
    - Repetition Time Mode: Enter
    - Repetition Time: 5500; 2000; 1200; 750; 500; 300; 200; 100 ms.
    - Slice Package: 1 of 1
    - Slices: 1
    - Slice orientation: Coronal
    - Read Orientation: Ro-Cd
    - Slice Thickness: 1.160 mm

- Image Size: 128 x 128
  - Field of View: 58 x 58 mm
  - Scan time = 3 m 12 sec
- b. Store adapted protocol
    - Right click on the protocol to be stored
    - Select *Store Scan Protocol*
    - In the *Store Protocol* window that appears, enter Name/Object/Region/Application, e.g. T1map\_RARE/Rat/Abdomen/Tristan\_T1
    - For all phantom experiments use the created T1map\_RARE protocol from Rat/Abdomen/Tristan\_T1
  - c. Acquire the T1 data
  - d. Run a dynamic stability (“DNE”) series for 5 minutes with repeated acquisition using the parameters in 4(a) above but with Repetition Time TR fixed at 500ms
5. When the measurements are finished, measure the temperature of the cucumber flesh in several places and report with 0.1°C precision.
  6. You will now have (2 days x 5 phantoms):
    - a. 10 T1 image sets: follow the steps below using the Bruker-generated T1 map and the “stability” ISA.
    - b. 10 DNE sets
  7. For each T1 image set, place ROIs on each T1 map or vTI image using the general ISA package “stability” or T1InvRephFisp, respectively, and then report out the fitted T1
    - a. Draw 25mm<sup>2</sup> roi at {X,Y,Z} = {0,0,0} and from ParaVision get R1±SE
    - b. Draw 25mm<sup>2</sup> roi at {X,Y,Z} = {10,0,0} and from ParaVision get R1±SE
    - c. Draw 25mm<sup>2</sup> roi at {X,Y,Z} = {0,0,12} and from ParaVision get R1±SE
    - d. Report results using the table below
  8. For each DNE image set
    - e. Draw 25mm<sup>2</sup> roi at {X,Y,Z} = {0,0,0} and from ParaVision get signal mean±SD
    - f. Report results using the table below

Centre (institution)	
Centre (city)	
email(s) of investigator(s) at this centre	
Make and model of scanner	
Field strength	
Transmitter-receiver coils	
Software version	

repeatability day	phantom	date	time of pre-scan temperature measurement	pre-scan temperature /°C	time of post-scan temperature measurement	post-scan temperature /°C	filename(s)	comment
first	0.5							
first	1							
first	2							
first	4							
first	8							
second	0.5							
second	1							
second	2							
second	4							
second	8							

repeatability day	phantom	RARE R1±SE for roi at {X,Y,Z} = {0,0,0}	RARE R1±SE for roi at {X,Y,Z} = {10,0,0}	RARE R1±SE for roi at {X,Y,Z} = {0,0,12}	5 minute RARE DNE signal ±SD
first	0.5				
first	1				
first	2				
first	4				
first	8				
second	0.5				
second	1				
second	2				
second	4				
second	8				