



# Digital Reference Object for DCE-MRI Analysis Software Verification Software report for T1-mapping Update 9/3/2013



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## Coming to consensus

- Clear that the evaluation of a large area of parameter space has limitations
  - If data is so noisy that one software has estimate of  $R1$  that gives an overestimate by 300%, how is this “superior” to software that gives an overestimate by 1000%?
- Can we come to consensus about which areas of parameter space are relevant to our use cases?



## Use cases


- We identified two use cases:
  - 1. Use of software to evaluate the phantom
  - 2. Use of software to calculate R1 as an intermediate value for Ktrans, IAUGC
- Importance:
  - Give manufacturers / software groups goals, insight on how to “tune” software
  - Acceptance criteria and certification



## Results were mixed


- Disagreement on signal and noise metrics
- Disagreement on philosophy
  - Shouldn't the areas of parameter space be the same for both applications?
  - Should we look only in clinically realistic areas?  
Why look in areas where data is “better” than we can really get?

## Sample submissions – areas of parameter interest in blue



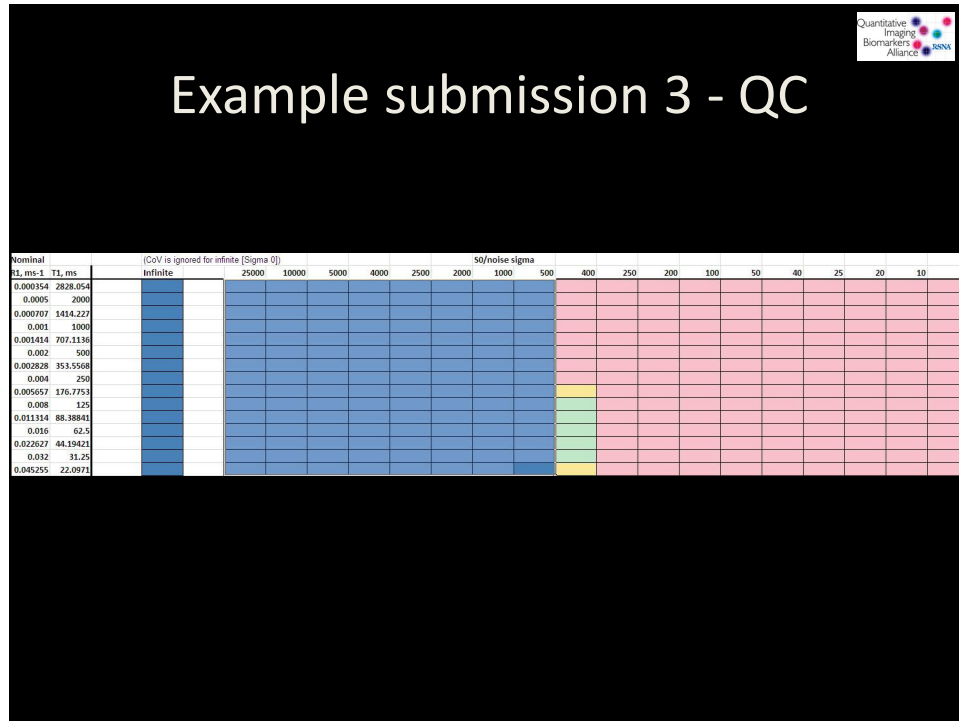
- Interm – use case as intermediate calculation
- QC – use case as QC from phantom


## Example submission 1 - interm



Nominal	(CoV is ignored for infinite (Sigma 0))	S0/noise sigma																		
R1, ms-1	T1, ms	Infinite	25000	10000	5000	4000	2500	2000	1000	500	400	250	200	100	50	40	25	20	10	
0.000354	2828.054	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.0005	2000	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.000707	1414.227	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.001	1000	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.001414	707.1136	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.002	500	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.002828	353.5568	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.004	250	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.005657	176.7753	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.008	125	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.011314	88.38841	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.016	62.5	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.022627	44.19421	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.032	31.25	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
0.045255	22.0972	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green





Quantitative Imaging Biomarkers Alliance 

## Directions forward

- What are clinically relevant areas of R<sub>1</sub>?
- $R_1 = R_{1,0} + r_1$  [Gd]
- Peak [Gd] is likely 6mM
- Are we interested in  $R_1 < 0.0005 \text{ ms}^{-1}$  ( $T_1 > 2000 \text{ ms}$ )?
- Would we anticipate peak  $R_1 > 0.0035 \text{ ms}^{-1}$  ( $T_1 < 285 \text{ ms}$ )? (This is the  $R_1$  we would expect to see if vertebral marrow or pancreas had superimposed peak [Gd] at 1.5T)



## Directions forward

- What are clinically relevant areas of noise and signal max?
- Would we anticipate noise sigma > 10?
- Would we anticipate equilibrium magnetization < 1000?



## Directions forward

- Do we anticipate phantom  $S_0$  < 5000?
- Do we want to test noise levels on phantom > 10 ?

Thank you!

