# The $B_1$ sleeve

**$B_1$ reduction annular cylinder (rigid sleeve) creates realistic body quantitative MR phantom – a proposal**

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This is on www.paul-tofts-phd.org.uk/recent-pubs along with summary slides.

Summary:

Realistic QA phantoms are needed to progress qMR, particularly in the body. These must represent the imperfections which happen *in-vivo*. The most important one is unknown $B_1$ variation, and hence Flip Angle.

Placing a rigid sleeve containing NaCl solution around a head phantom creates a body phantom which mimics the unknown variation of $B_1$ within the body.

# Establishing the validity of an in-vivo qMR technique using phantoms

## Why a traceable phantom is not enough

| Phantom type | Testing for in-vivo validity in presence of imperfections | Role of good performance[c] in establishing in-vivo validity |
|---|---|---|
| #1 traceable[a] | some imperfections | necessary |
| #2 realistic[b] and traceable | all imperfections | necessary and sufficient |

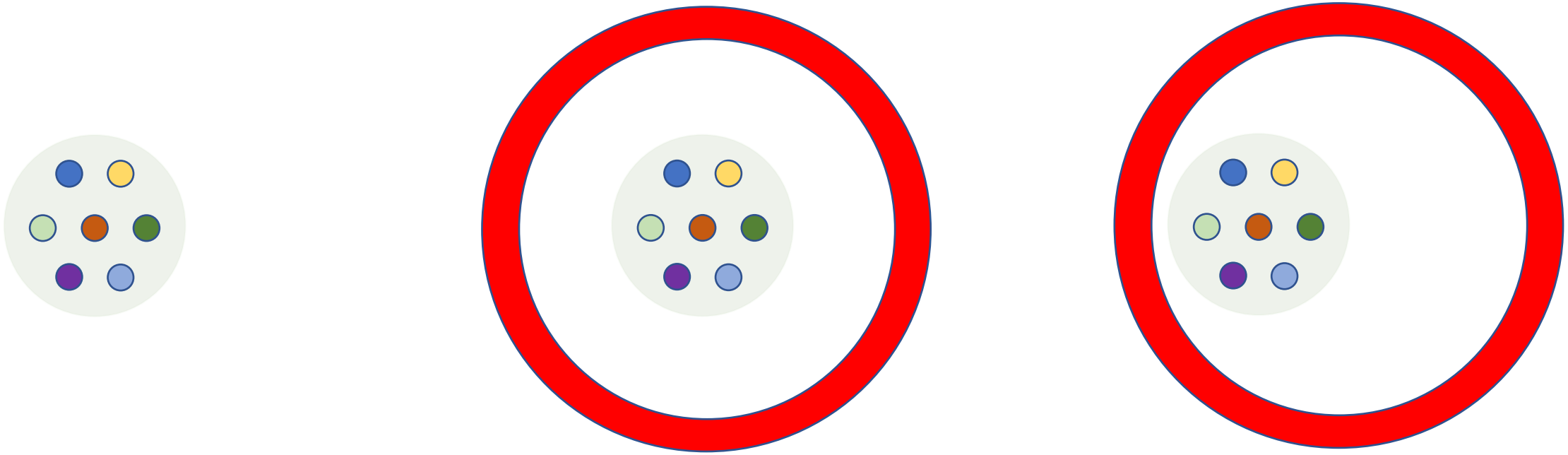
[a] traceable: related to true value of parameter, as measured at a metrology lab.

[b] realistic: identify processes of imperfection in in-vivo measurement process, then replicate these in phantom

[c] good performance: i.e. accurate (close to true value), reproducible (at different centres) and repeatable (at one centre) and sensitive (accurate over a range of true values).

*From Tofts PS submitted April 2023*

# $B_1$ reduction concentric cylinder creates realistic body MR phantom



a) head phantom

b) body phantom

c) offset body phantom

An existing head phantom (a) can be converted to a realistic body phantom (b) by the addition of a concentric cylinder containing NaCl solution (**red**). Measurements offset from the isocentre are possible (c).

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An example of $B_1^+$ distribution in the body at 3T (from Sacolick et al MRM 2010). The colour images (lower row) show $B_1$ values with an approximate range from 0.04 to 0.09 gauss.