Perfusion Imaging with ASL

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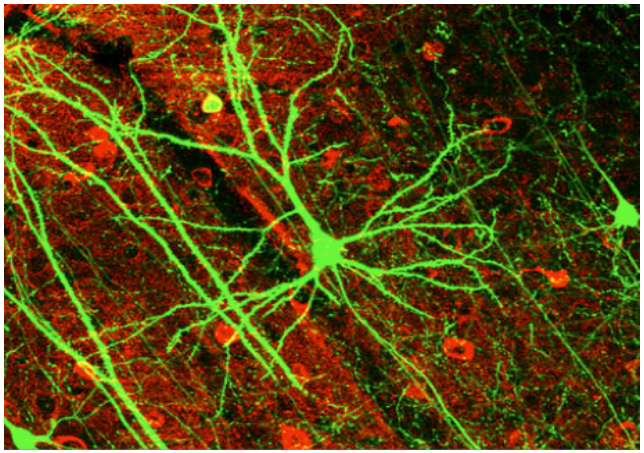
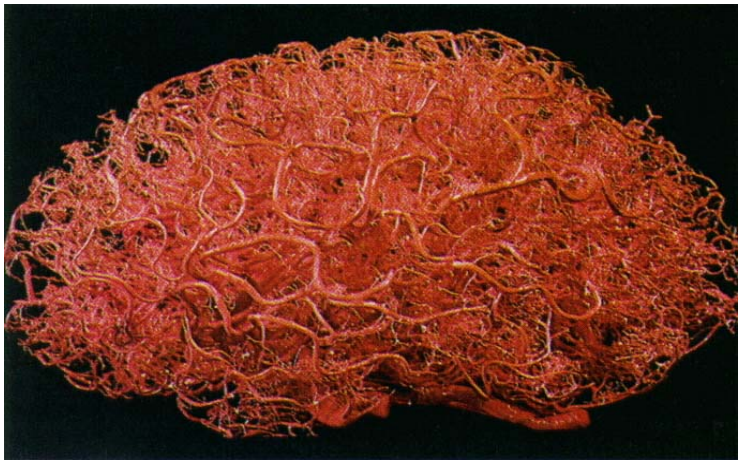
Vascular & Neuronal function

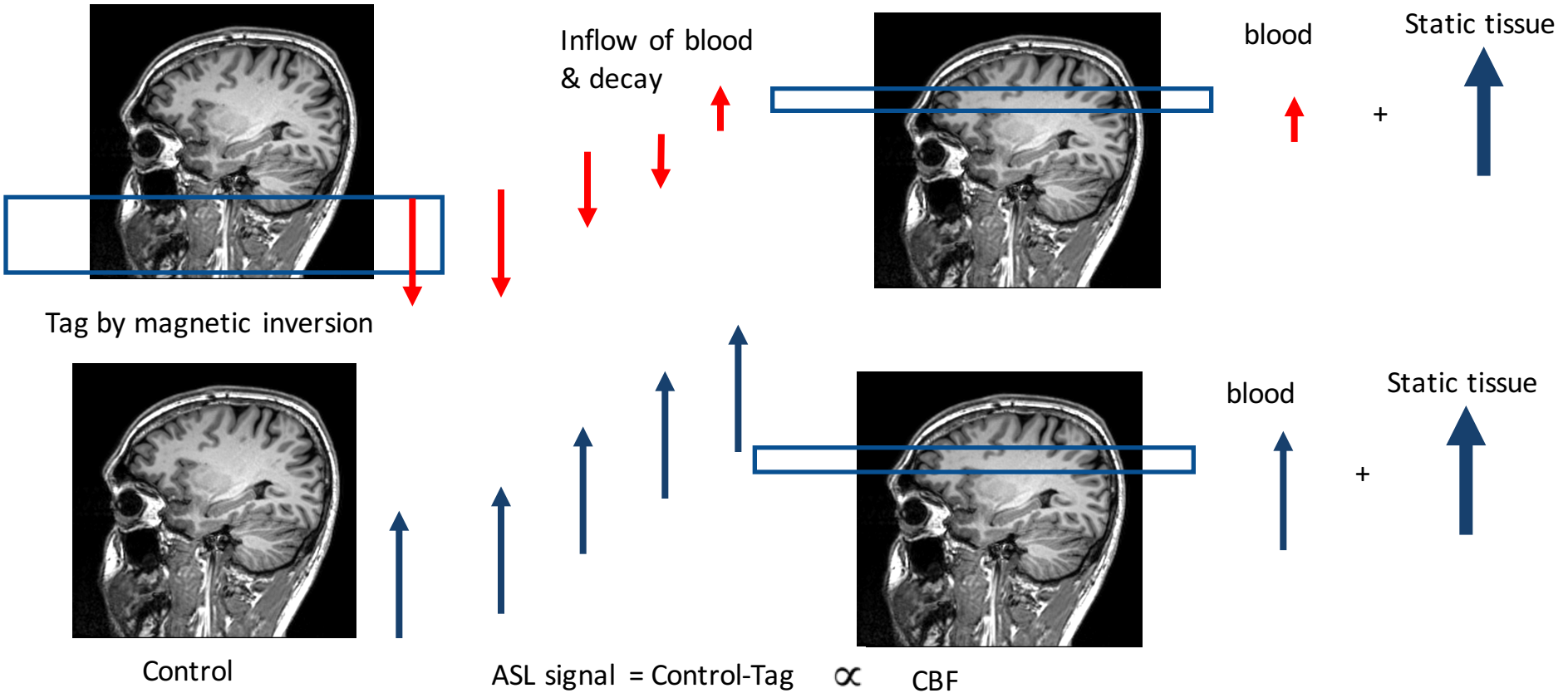




Methods for measuring perfusion/flow

- Arterial spin labeling
  - Use tagged water as endogenous contrast
- Exogenous Contrast Agent based method
  - Dynamic Susceptibility Contrast
  - Dynamic Contrast Enhancement (MR & CT)
- PET
  - O15 water
- Flow
  - U.S.
  - MR phase contrast

ASL Principle



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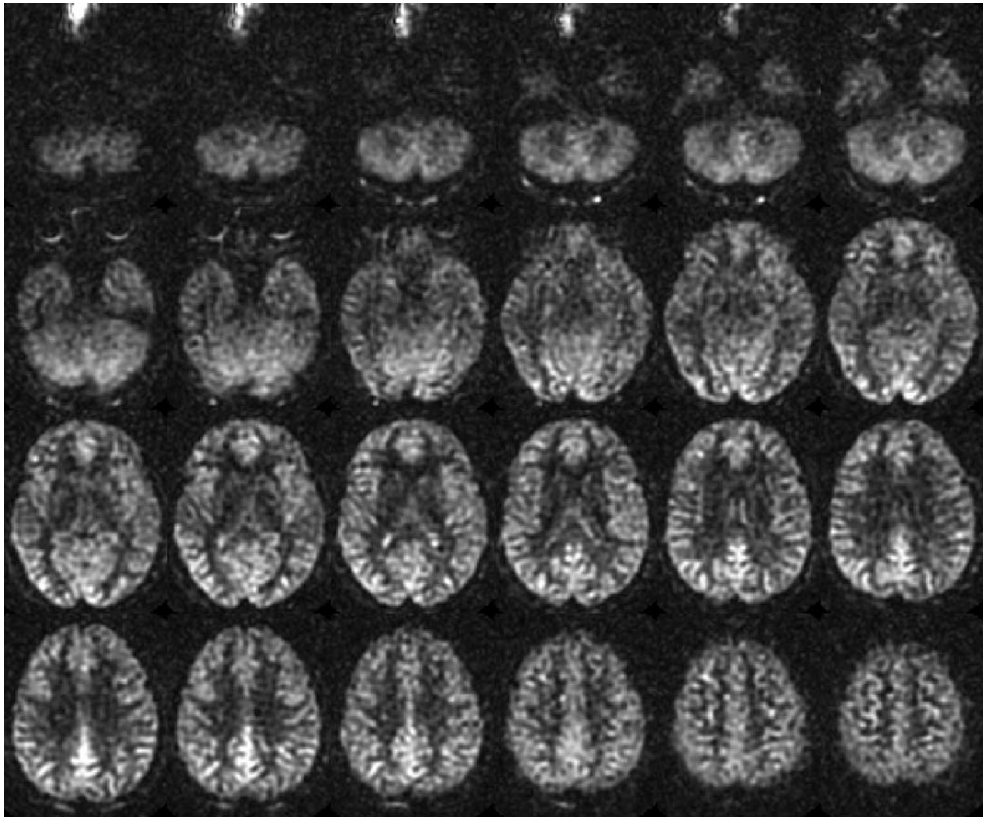
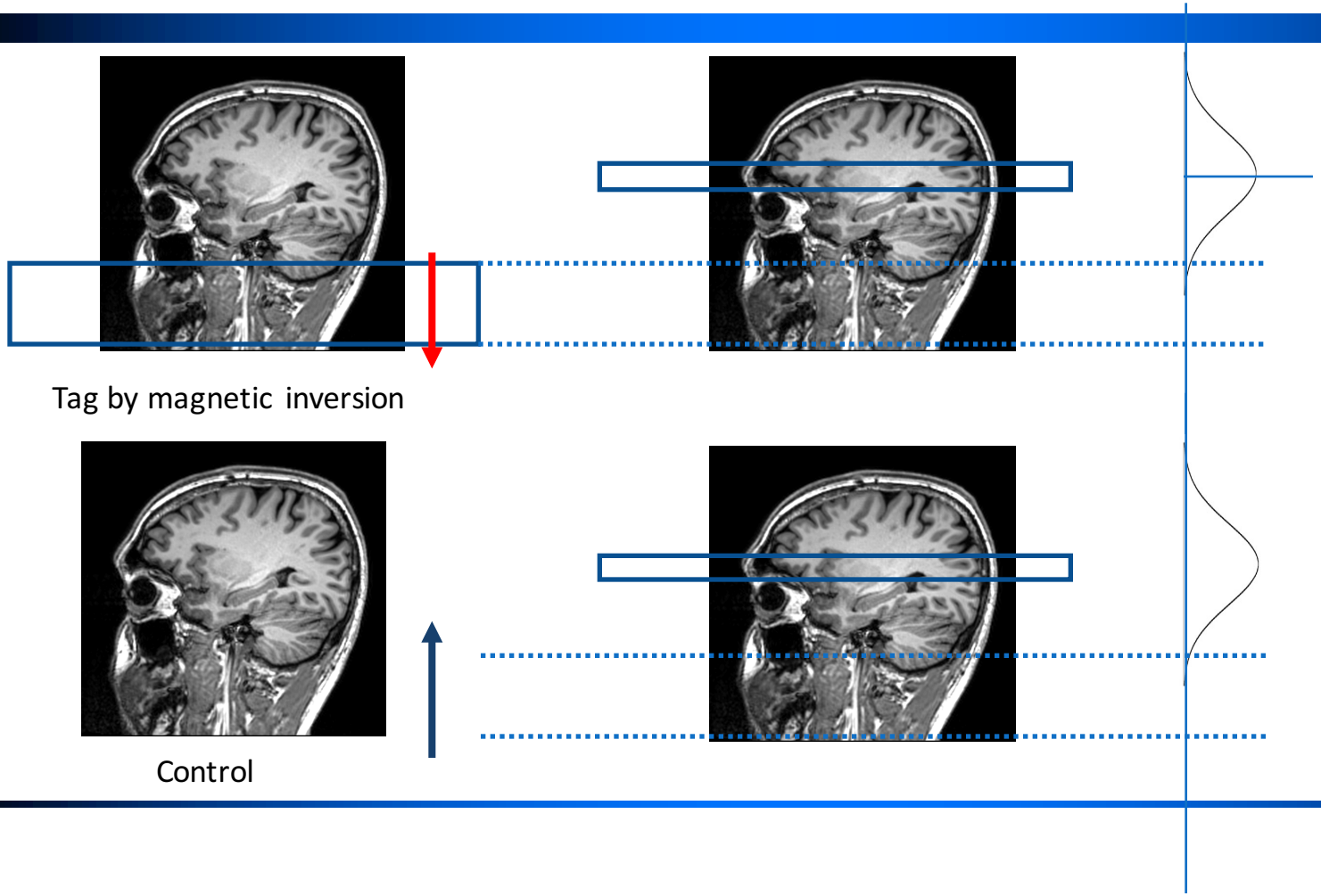
ASL CBF images



Alsop D et al. MRM. 2015

Magnetization Transfer Effect



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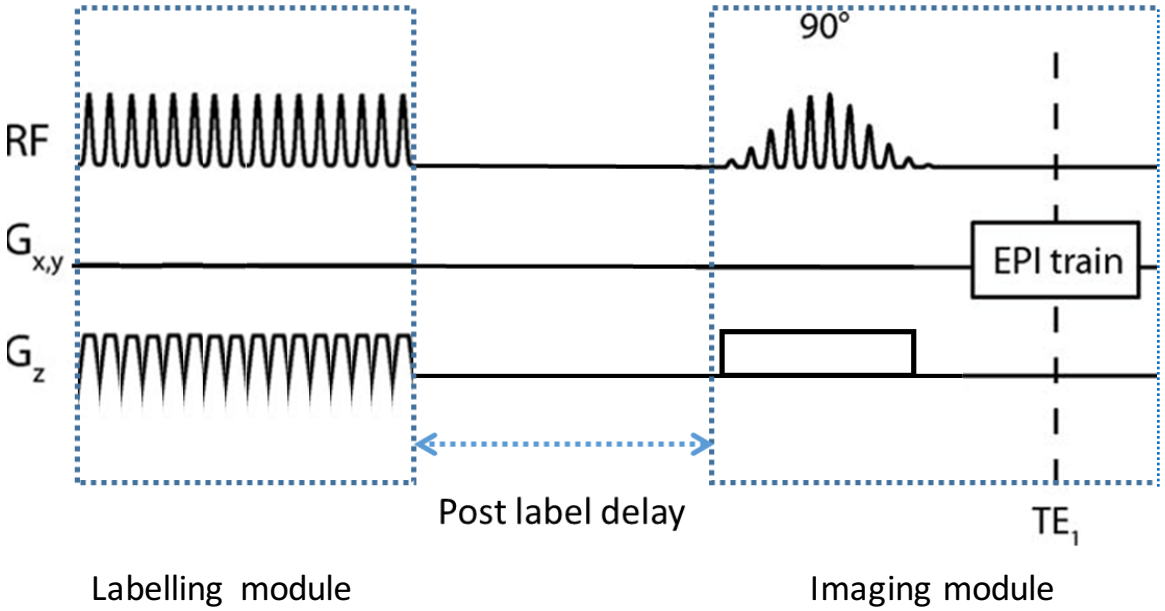
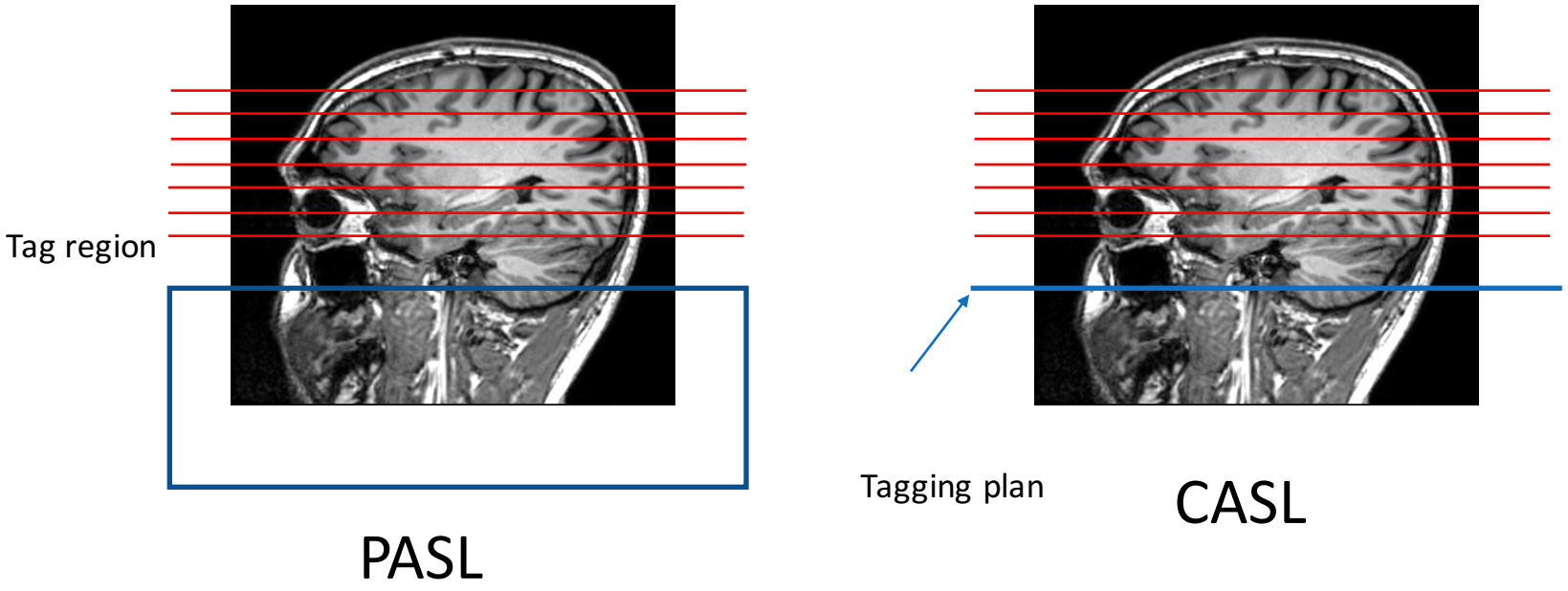
General Structure of an ASL sequence



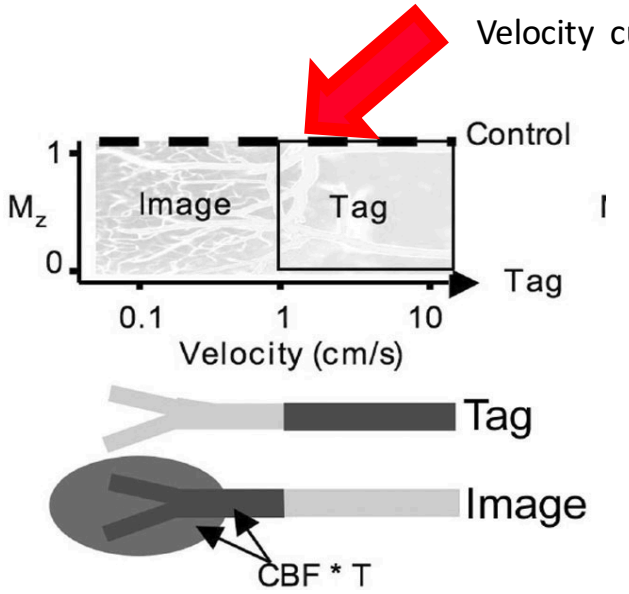
Different Labelling Method

- Pulsed ASL (PASL)
- Continuously Labeled ASL (CASL)
  - Pseudo-Continuous ASL
- Velocity Selective ASL

Pulsed ASL vs CASL



Velocity Selective ASL



VSASL, tagging based on Velocity

Wong E.et al, 2006. MRM

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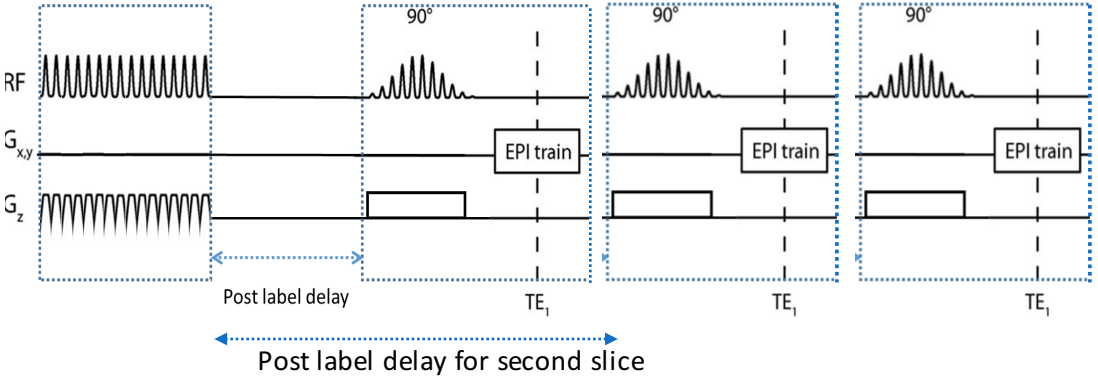
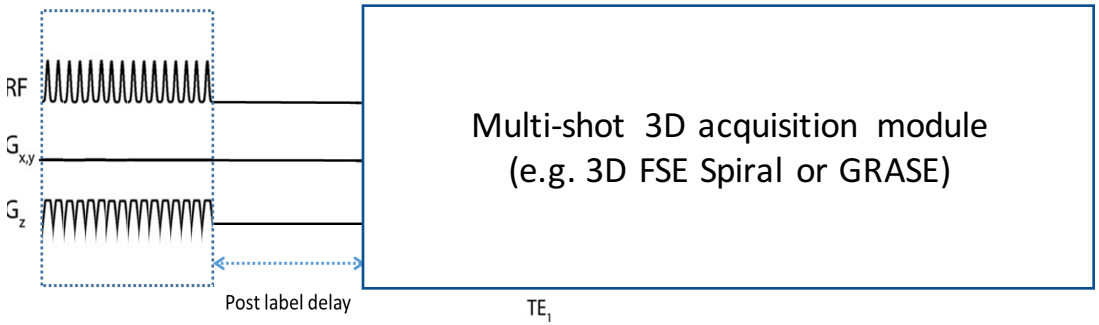
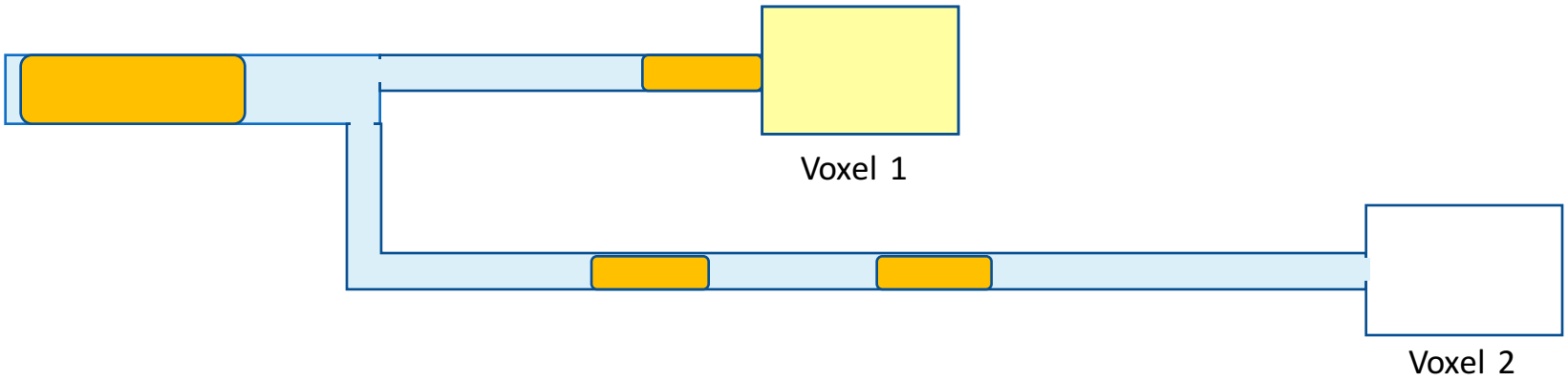
2D vs 3D image acquisition



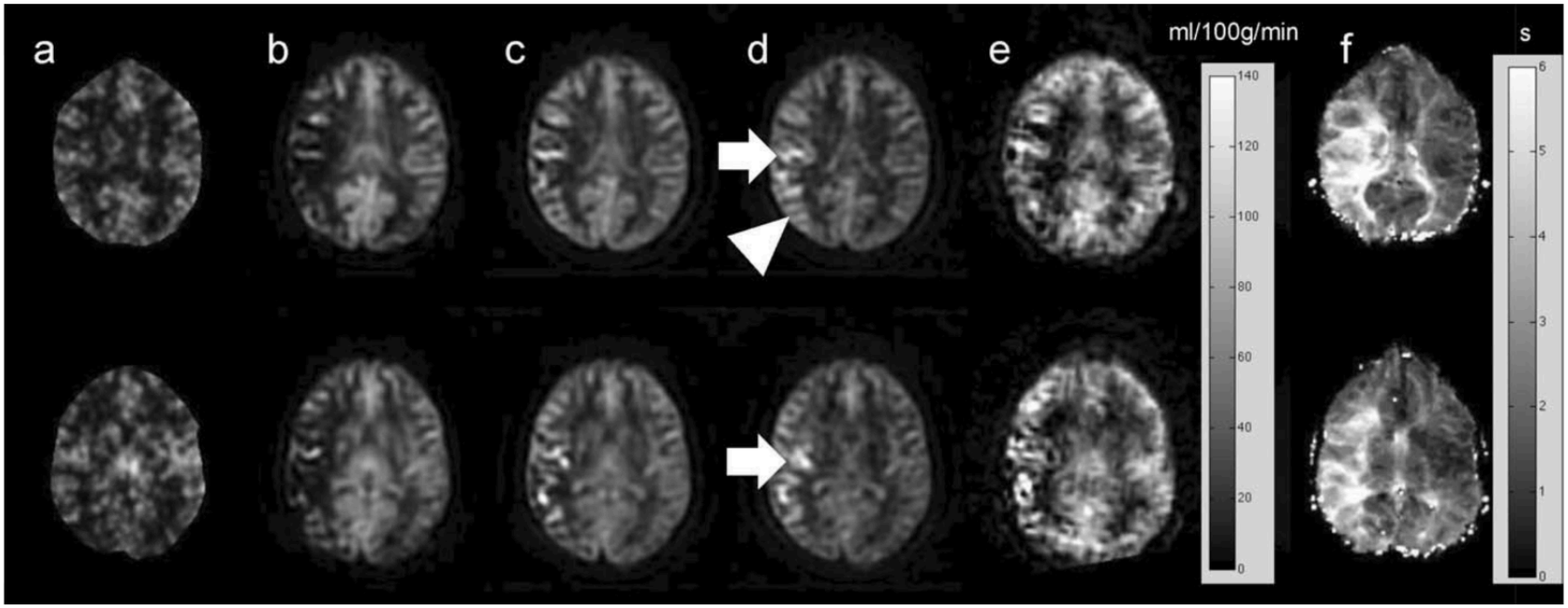


Consideration of post label delay

- Key assumption for ASL quantification is that all tagged spins reach the destination brain regions after PLD



Long arterial transit delay in patients with cerebrovascular disease



xeCT PLD=1s PLD=2s PLD=3s VSASL Tmax from DSC

Qiu D et al. JMRI. 2012

Recommended PLD

Table 1
Recommended Labeling Parameters

Parameter	Value
PCASL labeling duration	1800 ms
PCASL PLD: neonates	2000 ms
PCASL PLD: children	1500 ms
PCASL PLD: healthy subjects <70 y	1800 ms
PCASL PLD: healthy subjects >70 y	2000 ms
PCASL PLD: adult clinical patients	2000 ms
PCASL: average labeling gradient	1 mT/m
PCASL: slice-selective labeling gradient	10 mT/m
PCASL: average B_1	1.5 μT
PASL TI_1	800 ms
PASL TI	Use PCASL PLD (from above)
PASL labeling slab thickness	15–20 cm

Alsop D et al. MRM. 2015

ASL quantification

$$CBF = \frac{\lambda(1 - \exp(-2.0s/1.5s))\exp(PLD/T_{1blood})}{2\alpha T_{1blood}(1 - \exp(-TL/T_{1blood}))}\frac{\Delta S}{S_0}$$

Qiu D et al. JMRI. 2012


Q & A