#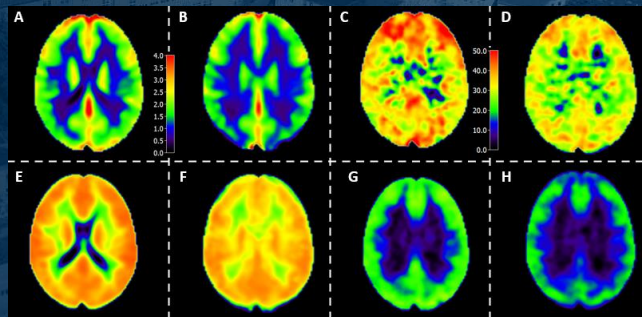 Investigating the applicability of dual echo ASL for simultaneous BOLD- and CBF-based mapping of cerebrovascular reactivity

Gabriel Hoffmann[1,2,*], Franziska Richter[1,2], Jan Kufer[1], Lena Schmitzer[1], Carina Gleißner[1], Jens Göttler[1], Stephan Kaczmarz[1,2,3] and Christine Preibisch[1,2]

Session: Advances in ASL & BBB Mapping
Abstract Nr.: 0378
Time: 08:15
Room: 701B

*gabriel.hoffmann@tum.de

[1] Technical University of Munich, School of Medicine, Department of Diagnostic and Interventional Neuroradiology, Munich, Germany   [2] Technical University of Munich, TUM-Neuroimaging Center, Munich, Germany
[3] Philips GmbH Market DACH, Hamburg, Germany

Declaration of
Financial Interests or Relationships

Speaker Name: Gabriel Hoffmann

I have no financial interests or relationships to disclose with regard to the subject matter of this presentation.
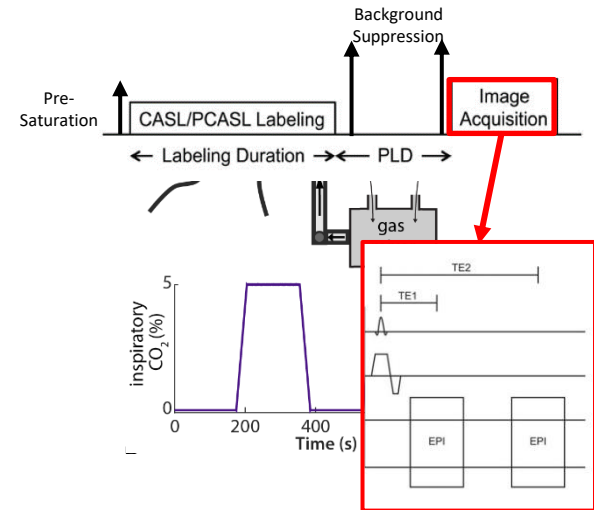
Cerebro-vascular reactivity (CVR) with dual echo Arterial Spin Labelling (deASL)

|	
Background	• Cerebro-vascular diseases major health risk[1,2] • CVR promising for vascular status • Vasoactive stimulus & simultaneous imaging (BOLD or ASL)

|	
Purpose	• Investigating the applicability of deASL for CVR

1: Donahue, JCBFM, 2018   2: Petty, Stroke, 1999 Jain

Images: Zimmermann,…Hoffmann et al (in Submission), Nature Neuroscience, 2023 (Hypercapnia Setup), Alsop, MRM 2015 (ASL sequence scheme), Faraco, MRM 2015 (de-readout)

3

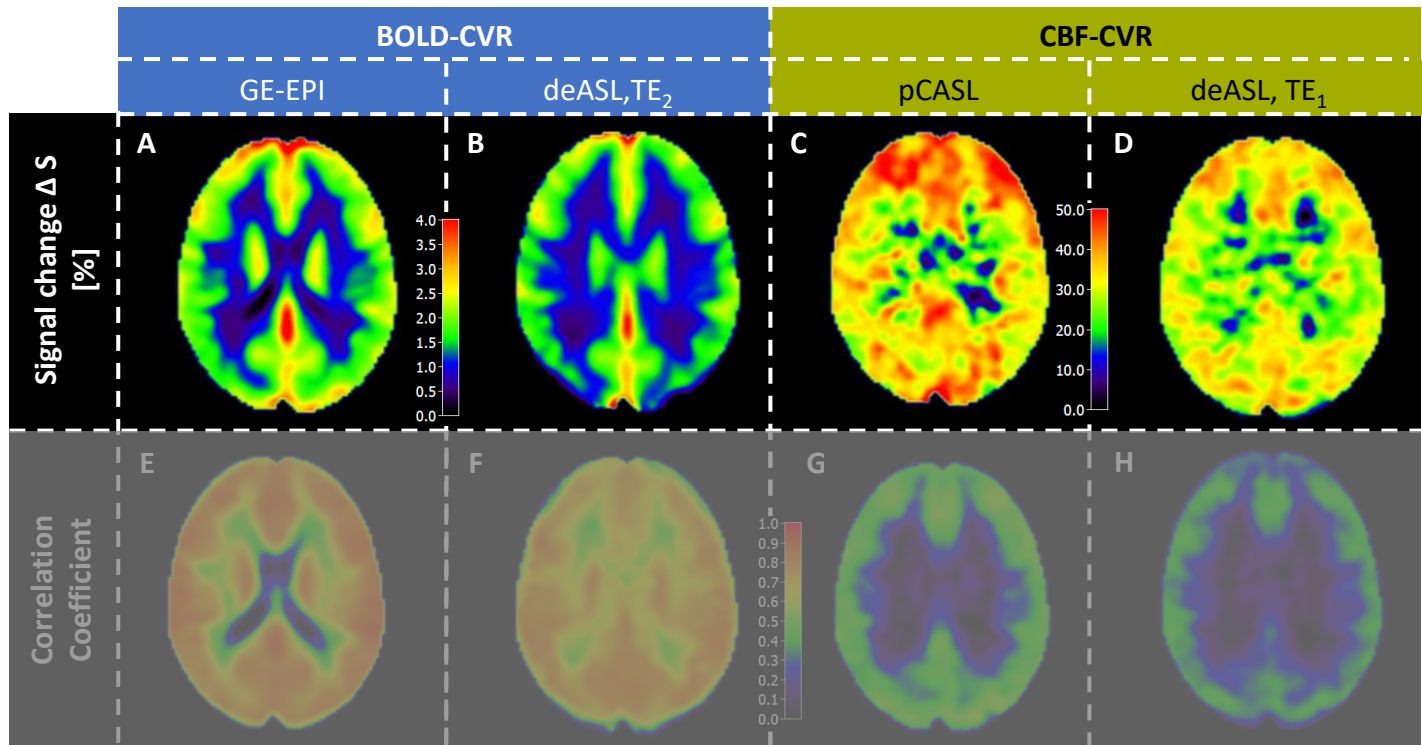# Comparing dual echo ASL with dedicated BOLD and pCASL MRI
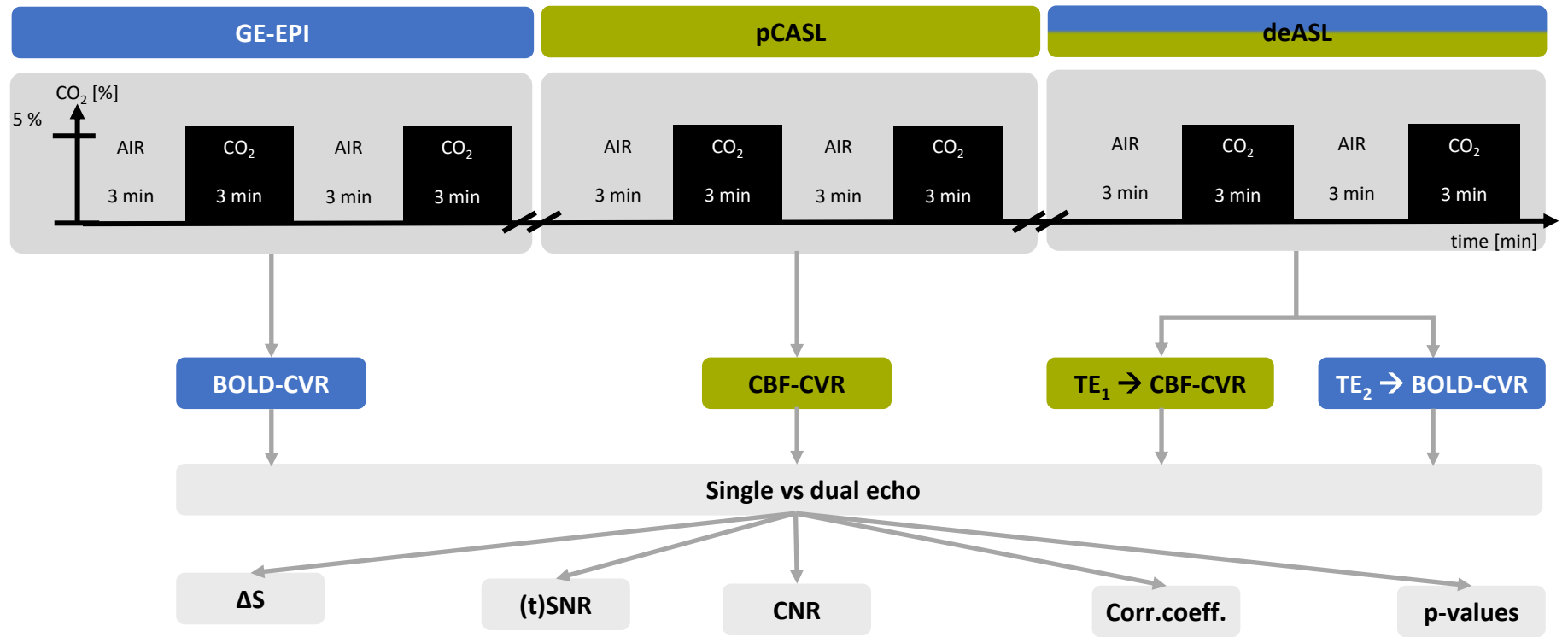
Study population included young and healthy subjects
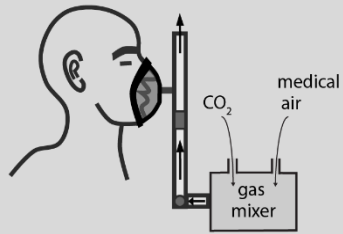
- 21 healthy participants (29.1±8.6y)
- 10 female / 11 male

→1 failure in GE-EPI; 2 failures in pCASL; 5 failures in deASL

Image: Zimmermann,…Hoffmann et al (in Submission), Nature Neuroscience, 2023

5

Group average maps – signal change

→ Better correlation for BOLD CVR
→ Similar signal change (ΔS) for single echo sequences (GE-EPI&pCASL) vs deASL
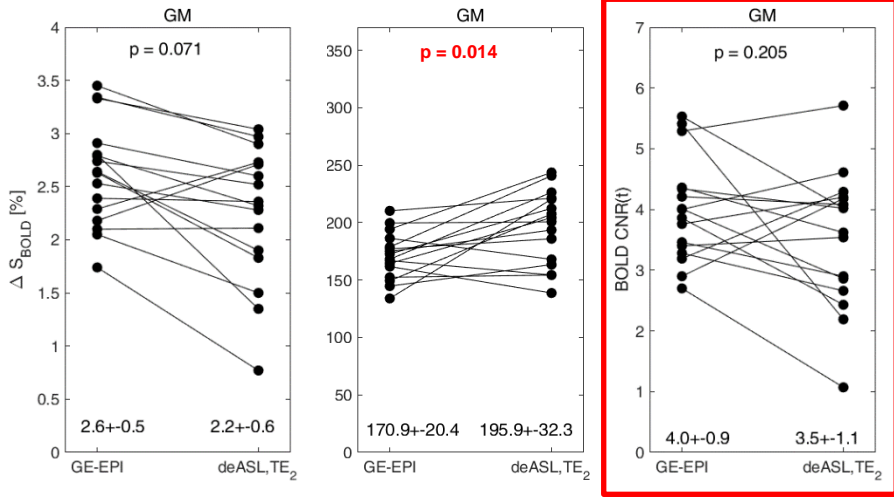→ Better correlation for single echo sequences

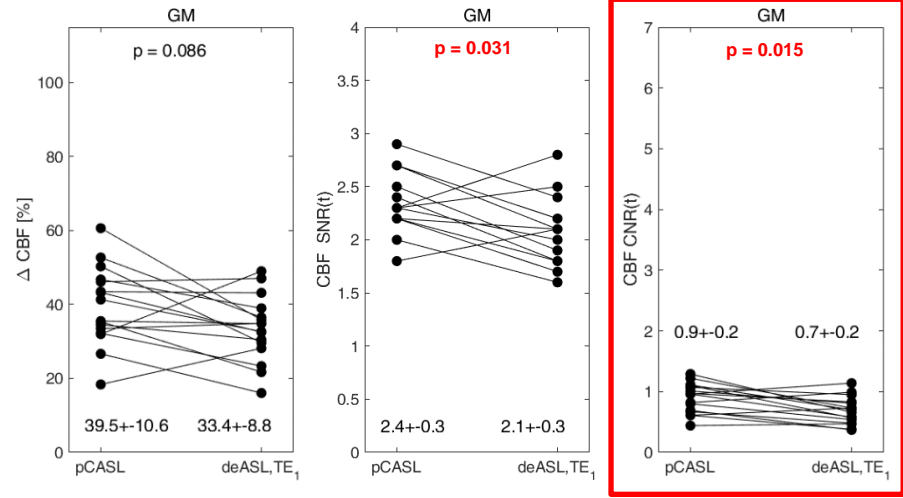# Comparing ΔS, (temporal) SNR and contrast to noise ration (CNR)

→ BOLD CVR similar for both methods
→ CBF (t)SNR and CNR reduced

→ $CNR_{BOLD} > CNR_{CBF}$

How do both method correlate with the GM-mean signal?
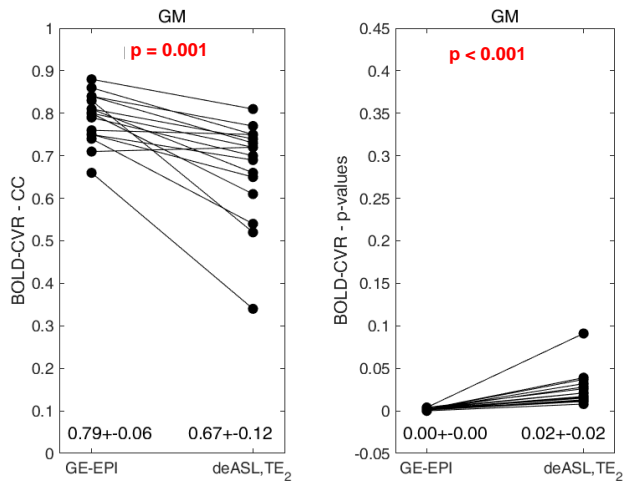
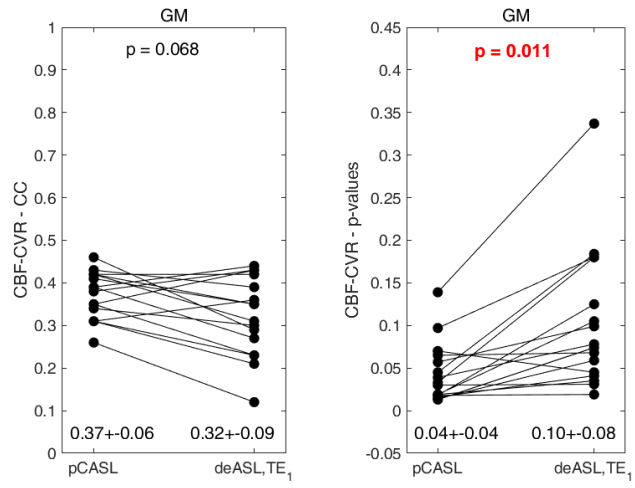→ Reduced correlation coefficients & significance (p-values) for deASL and CBF-CVR

Is the deASL suitable for CVR?

Discussion

Higher sensitivity & CNR for BOLD CVR in agreement with literature[1]

Similar signal differences for single echo vs deASL, TE_1 & TE_2

Reduced correlation for deASL, TE_1 and TE_2

Higher total drop out for deASL (23.8%) vs 9.5% for pCASL and 4.8% for BOLD

Summary

Similar performance under ideal circumstances

Lower sensitivity for deASL (corr. coeff.)

Elevated failure rate expected in patients

1: Ghariq, Neurimage, 2014

Thank you for your attention!

We want to highly appreciate the support by:

German Research Foundation (DFG)
Ev. Studienwerk Villigst