

### T1 mapping of the carotid artery vessel wall with correction of B1+ and respiratory motion

Isabel Montón Quesada,<sup>1</sup> Augustin C. Ogier,<sup>1</sup> Pauline Calarnou,<sup>1</sup> Jean-Baptiste Ledoux,<sup>1</sup> Christopher W. Roy,<sup>1</sup> Jérôme Yerly,<sup>1,2</sup> Matthias Stuber,<sup>1,2</sup> Ruud B. van Heeswijk<sup>1</sup>

<sup>1</sup> Department of Radiology, Lausanne University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland

<sup>2</sup> CIBM Center for BioMedical Imaging, Lausanne, Switzerland

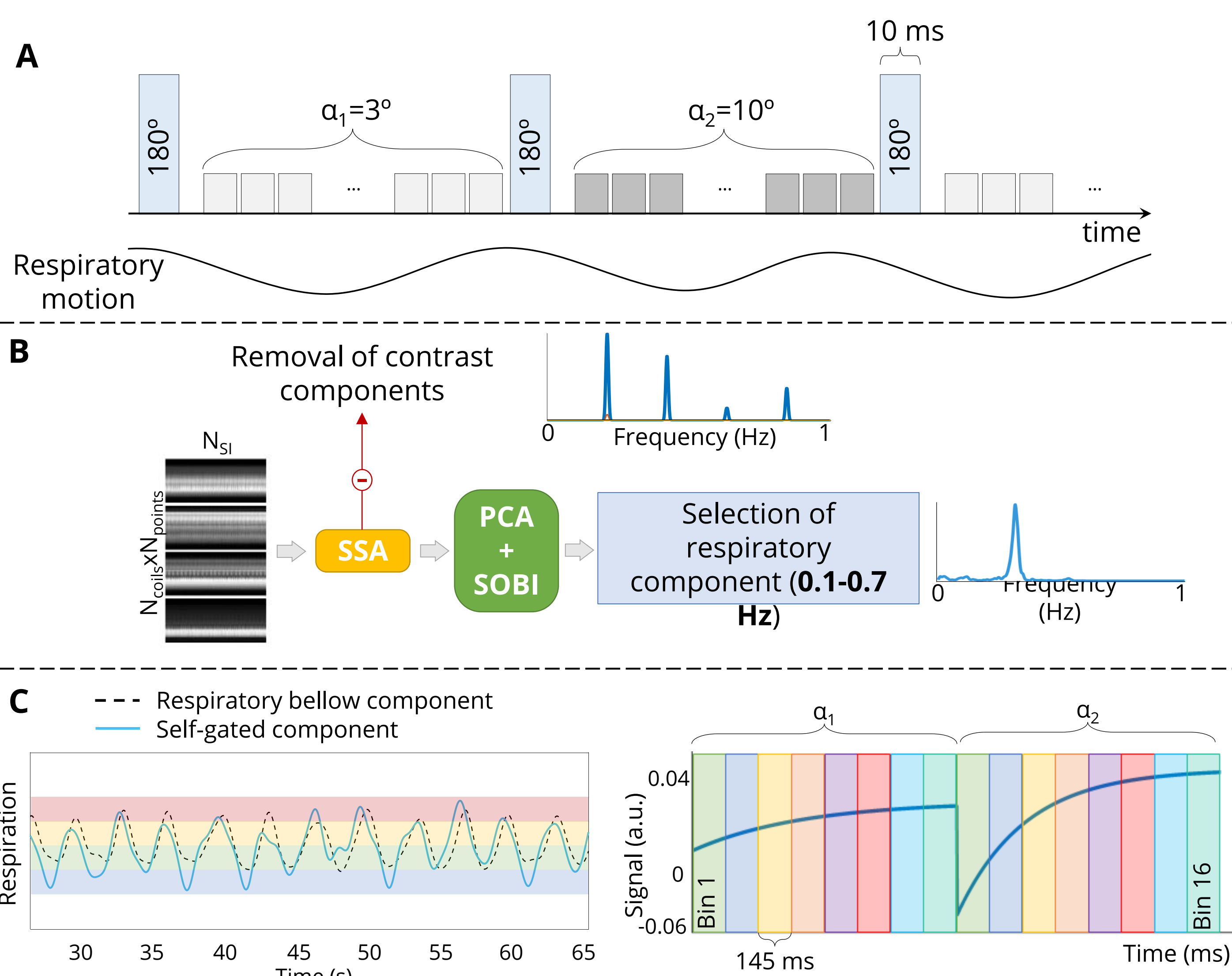
#### INTRODUCTION

- **T1 mapping** of the carotid has been used to quantitatively assess the **vessel wall** and **plaque components**.<sup>1</sup>
- T1 estimations can easily be biased by **B1+ inhomogeneities**, especially at higher magnetic field strengths.
- In carotid MRI, respiration is one of the main sources of **motion artifacts**,<sup>2</sup> and may also alter the T1 estimation due to misaligned voxels in the source images.

**AIM:** To implement a free-running<sup>3</sup> GRE dual flip angle (**2FA**) technique for **B1+ correction** combined with a **respiratory-resolved** reconstruction.

#### METHODS

- The NIST **phantom**<sup>4</sup> and **6 healthy volunteers** were scanned on a **3T Siemens scanner**.
- Adiabatic **inversion** pulses and **2FA**<sup>5</sup> (Fig. 1A).
- **Respiratory** component (Fig.1B) extracted with PCA and **SOBI**<sup>6</sup> after removing **contrast components** with singular spectrum analysis<sup>7</sup> (**SSA**).
- The acquisition was divided in 16 **contrast** (Fig. 1C) and 4 **respiratory bins**, and images were reconstructed using **compressed sensing**.<sup>8</sup>
- **Validation** with single flip angle (**1FA**) and **MOLLI**.
- **T1** measured in **vessel wall** and **muscle**.



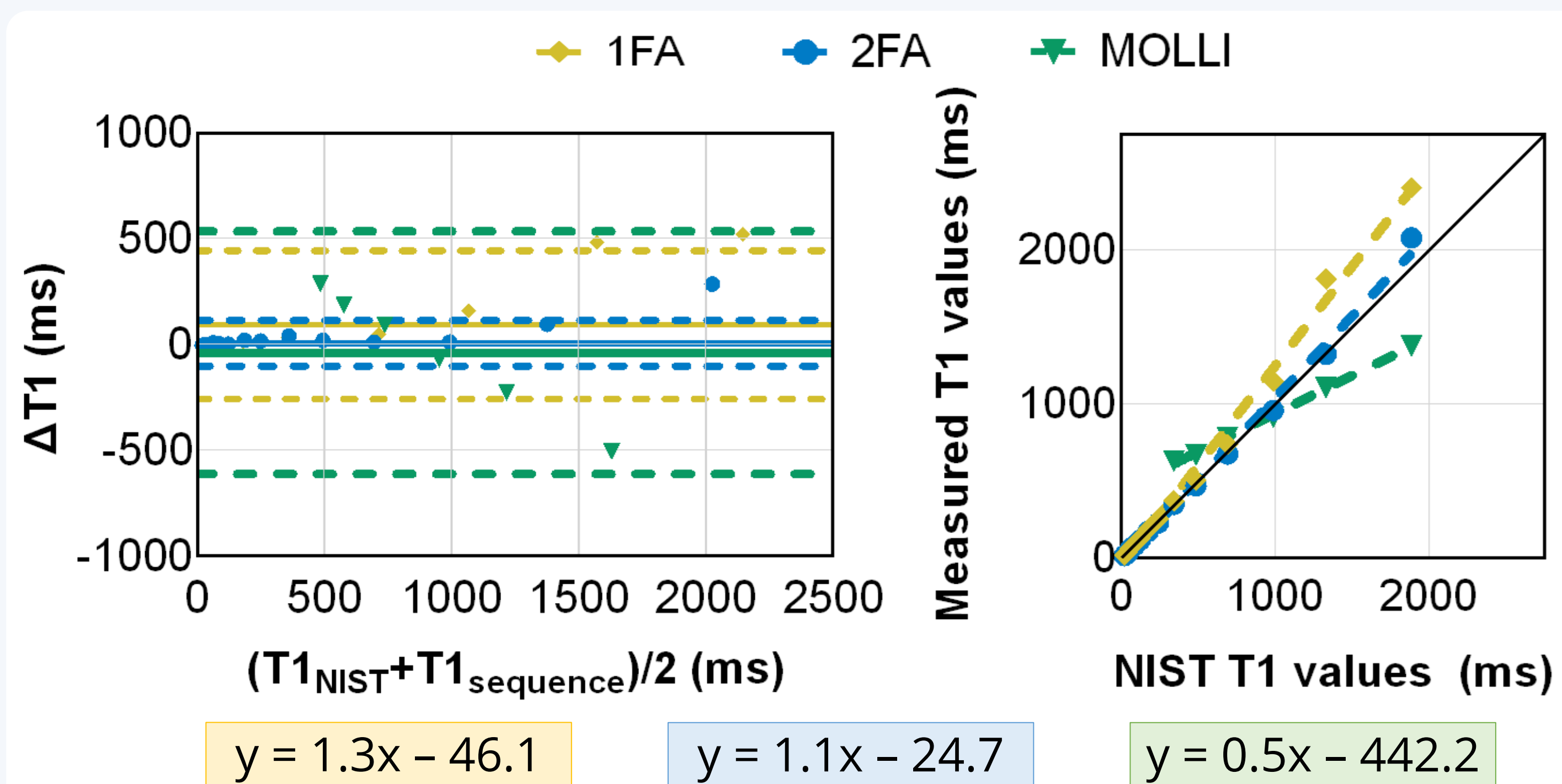
**Figure 1.** A. The free-running 2FA pulse sequence. B. Removal of contrast components with SSA and extraction of the respiratory component using SOBI. C. Binning in the respiratory and T1 dimension for the 2FA acquisition.

#### CONCLUSION

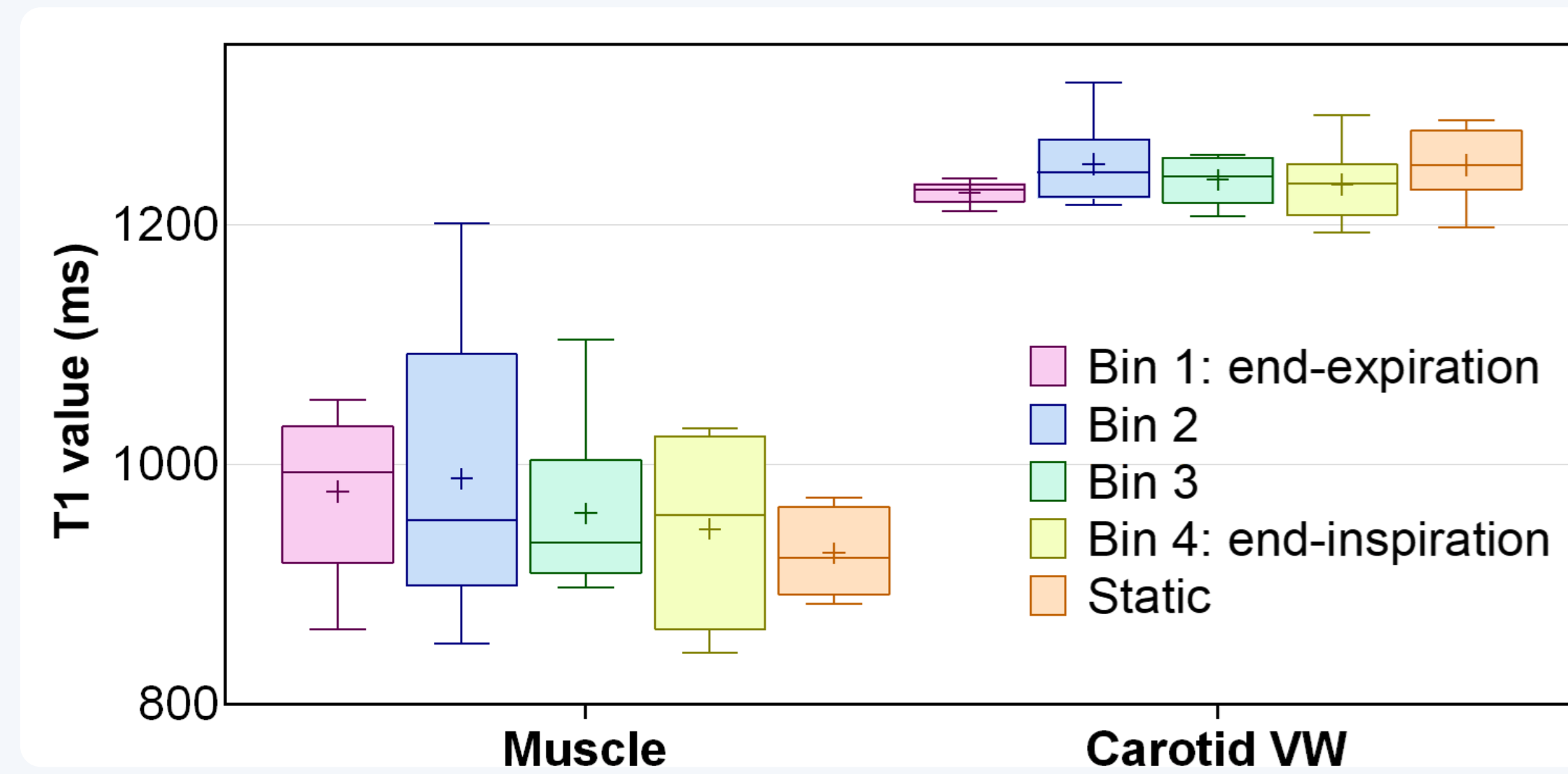
T1 value **overestimation** in the carotid artery wall was **avoided** by applying the **2FA technique**. Measured **values** at **end-expiration** agreed with those reported in literature and showed **better repeatability** compared to static 2FA, 1FA and MOLLI maps.

**References:** [1] Qi, Rad 2018, 287(1) [2] Bousset, JMRI 2006, 23 [3] Di Sopra L, MRM 2019, 82(6) [4] Stupic, MRM 2021, 86(3) [5] Serry FM, MRM 2021, 86(6) [6] Montón Quesada I, ISMRM 2023 [7] Rosenzweig, IEEE TMI 2020, 39 [8] Lustig, MRM 2007, 58(6)

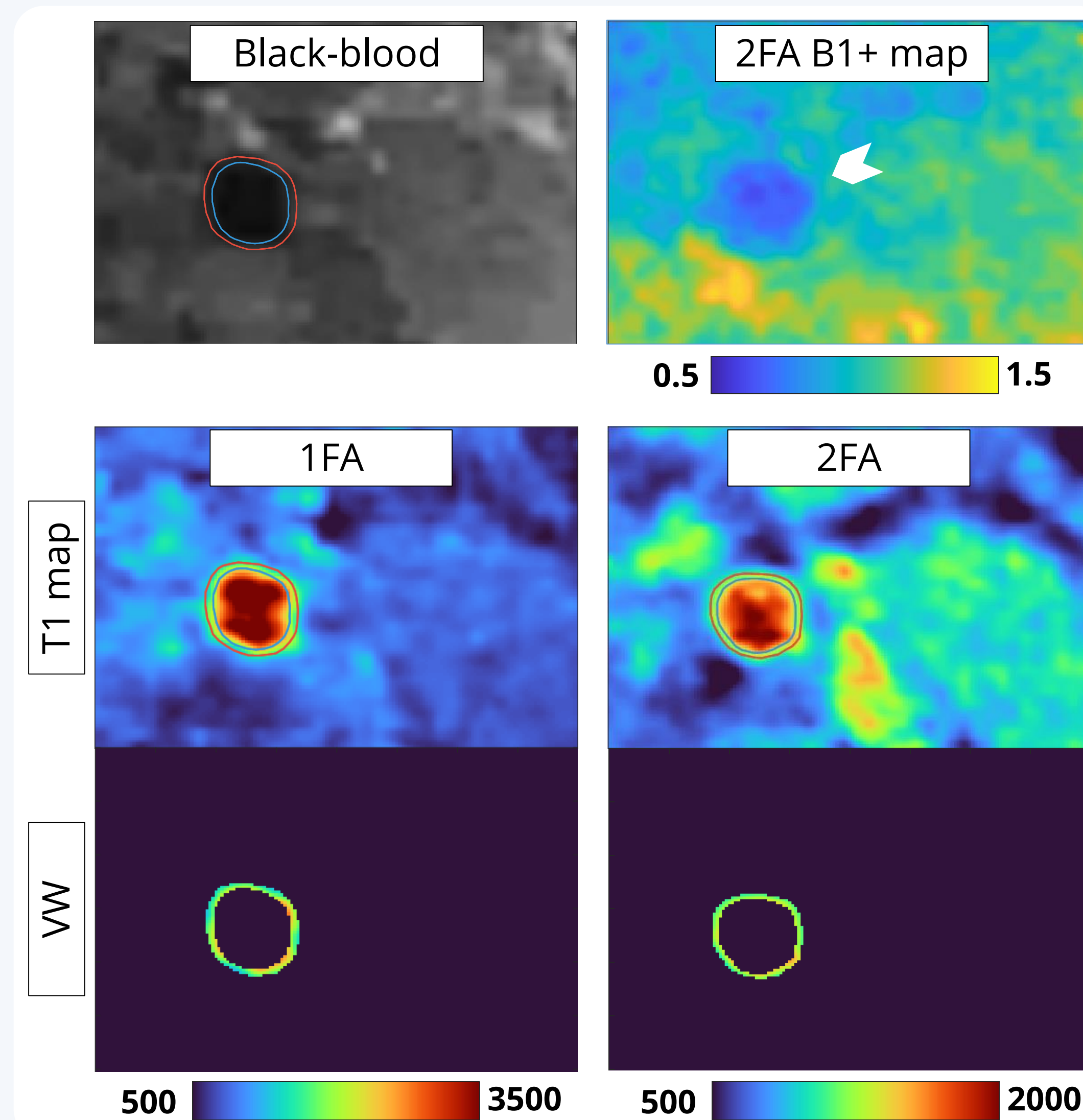
#### RESULTS



**Figure 2.** Phantom T1 Bland-Altman and correlation in **1FA**, **2FA** and **MOLLI** acquisitions.



**Figure 3.** 2FA T1 values measured in the different respiratory bins and in the **static reconstruction**. Note the low T1 variability in **end-expiration** for the carotid vessel wall.



**Figure 4.** Black-blood image, B1+ map, T1 maps and masked carotid vessel walls (VW) for 1FA and 2FA. The white arrow indicates the carotid artery.