



# Towards Mapping Amyloid-Beta Plaque Load in the Human Brain with MRI at 3T

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## Introduction

The evaluation of A $\beta$  plaque load depends on either PET scans or CSF analysis of A $\beta$  levels. It has been shown that A $\beta$ -plaques can be visualized with T2\*-weighted images (T2\*WI) of histological brain samples at high field. Recently, we demonstrated the feasibility of detecting A $\beta$ -plaques in vivo at 3T.

Goal: To determine the specificity of MRI T2\* contrast to quantify A $\beta$ -plaques in the human brain, since T2\* contrast is non-specific..

## Methods

50 subjects participated in the study (16 M, 68.5 $\pm$ 8.3 years, MoCA score 24.5 $\pm$ 3.5). T2\*WIs acquired on a Siemens Prisma-Fit 3T scanner with a 64-channel head coil and MEFIC in a resolution of 0.4x0.4x0.7 mm<sup>3</sup>. A $\beta$ -PET scans conducted on a Siemens Biograph mCT20 PET/CT scanner with Florbetapir. MEFIC and PET images co-registered in each subject's native space. The correlation between T2\*WI signal and A $\beta$ -plaque load in cerebral cortex was analyzed. ROI-based analysis was conducted using the Desikan-Killiany atlas.

## Results

To establish the specificity using co-registered MRI and PET images within the same subject, a significant negative correlation between A $\beta$ -PET SUVr and T2\*WI signal was established in the cerebral cortex ( $r = -0.85 \pm 0.11$ ,  $p = 6E-28$ , Fig. 1). Out of the ROIs that overlapped with the MEFIC images, a significant negative correlation between average A $\beta$ -PET SUVr and average T2\*-weighted signal was observed in the left precuneus (Fig. 2). Figure 3 shows the MEFIC T2\*WI and corresponding A $\beta$ -PET SUVr map of one A $\beta$ - cognitive normal and two A $\beta$ + MCI subjects. The high A $\beta$ -plaque load areas in the cortex showed low T2\*-weighted signals.

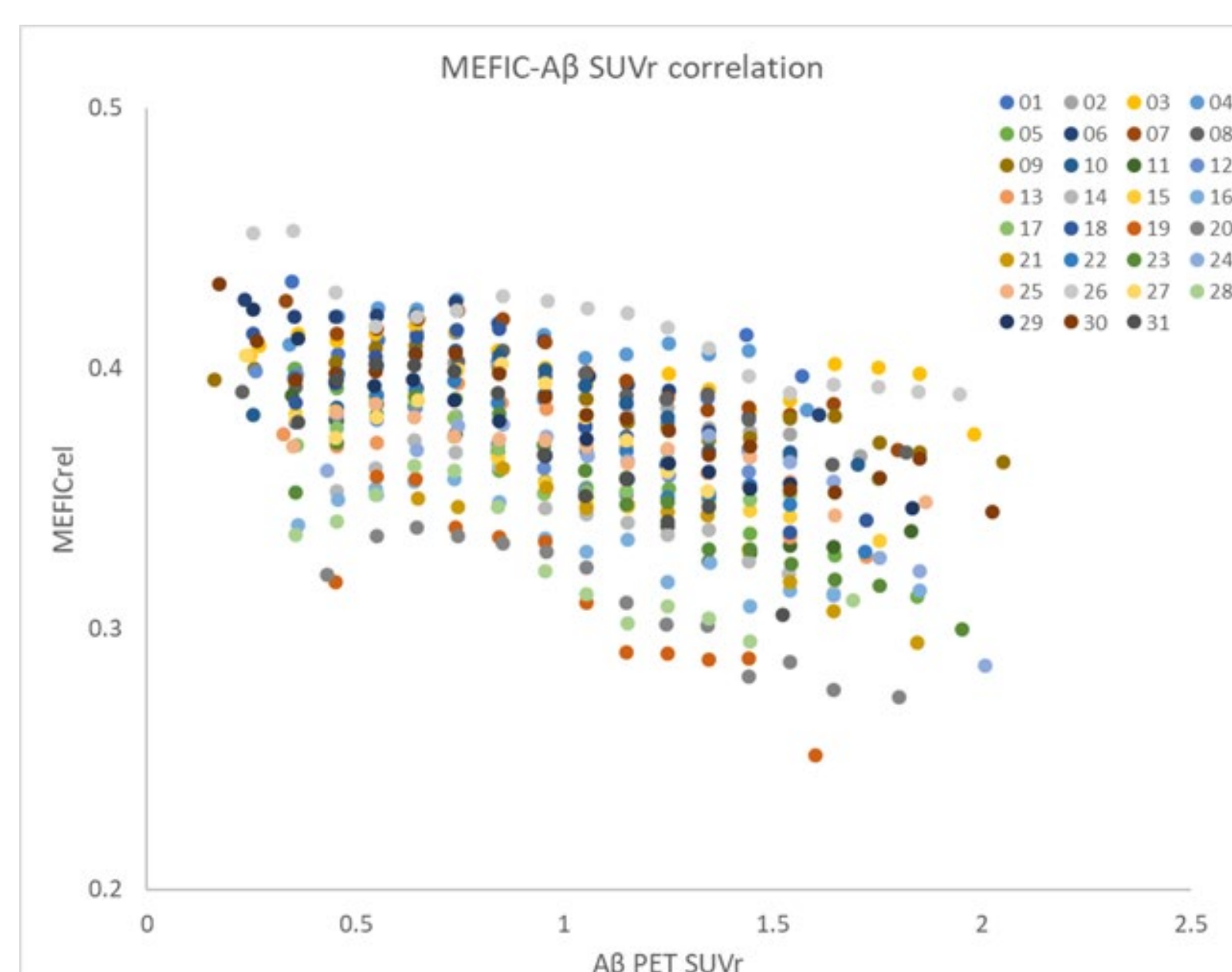


Fig. 1. Scattered plots of relative MEFIC signal (MEFICrel, MEFIC signal divided by average signal of gray and white matter) and A $\beta$ -PET SUVr from 31 subjects (8 M, age 65.7 $\pm$ 7.2).

## Results (cont)

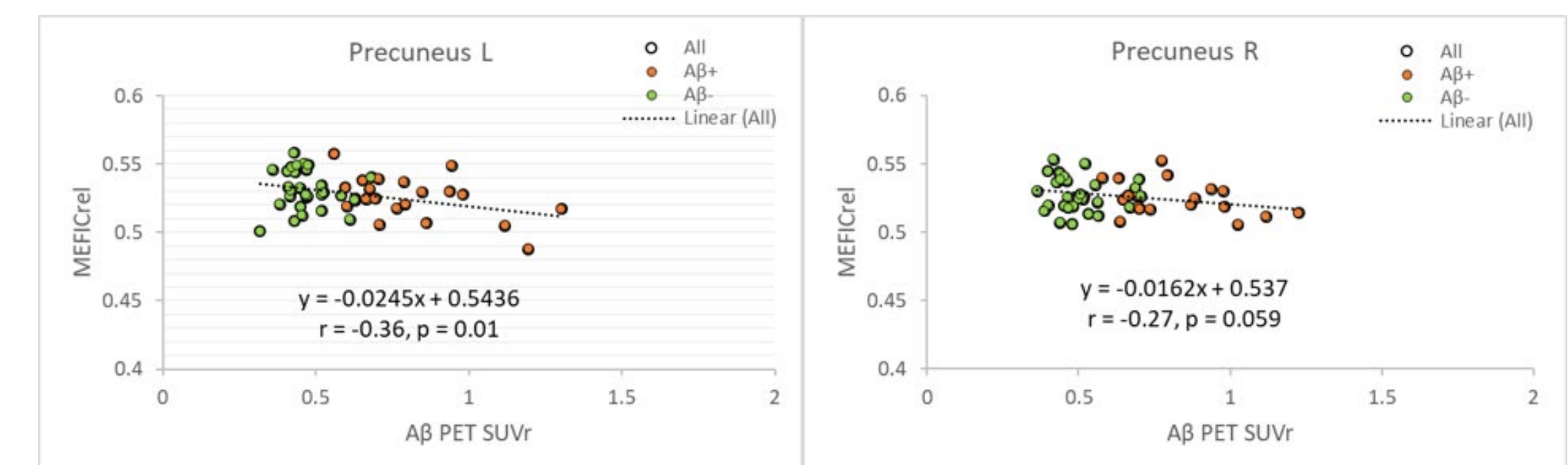


Fig. 2. ROI-wise correlation between average relative MEFIC signal (MEFICrel) and average A $\beta$ -PET SUVr in the left and right precuneus of 50 subjects.

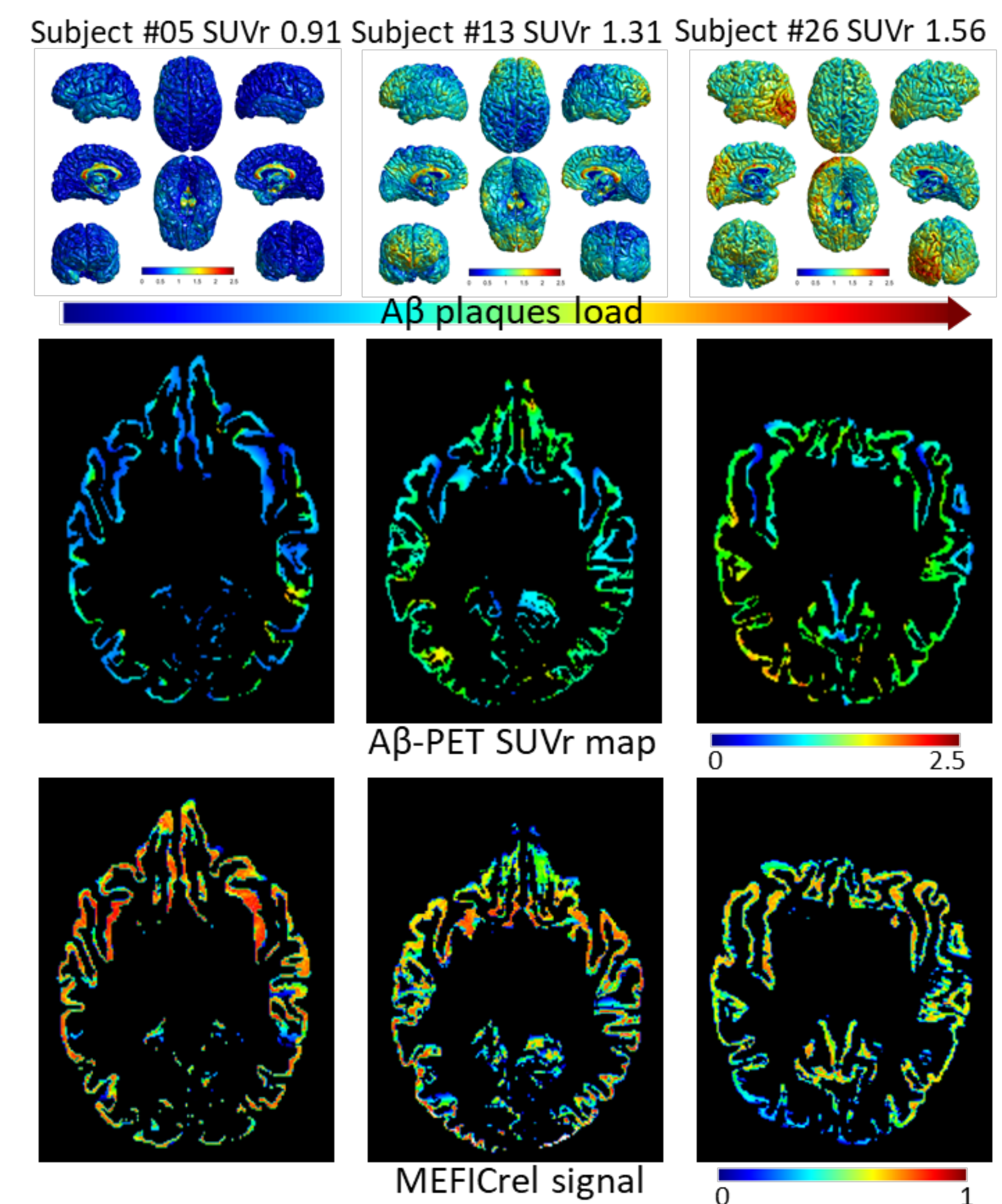


Fig. 3. Relative MEFIC signal (MEFICrel) and A $\beta$ -PET SUVr map of one A $\beta$ - cognitive-normal subject (left, MoCA score 28) and two A $\beta$ + MCI subject (MoCA score 24 & 22). Note: the color contrast in the MEFIC images is opposite to that in the PET SUVr maps.

## Conclusion

We have established voxel-wised and ROI-wised negative correlation between T2\*-weighted signal and A $\beta$ -PET SUVr in the human brain, demonstrating that MRI with T2\* contrasts can be a proxy for imaging A $\beta$ -plaque load in the human brain in vivo. Our approach can impact Alzheimer's disease research significantly because it would make the evaluation of A $\beta$ , brain atrophy, and amyloid related imaging abnormalities (ARIA) with MRI, a single image modality that is broadly available.