Introduction: A novel non-invasive three-dimensional (3D) mapping software shows the unique feature of combining 3D DICOM data with 12-lead electrocardiographic (ECG) data to precisely localise ventricular arrhythmias. This allows to “move” the localisation diagnosis to the ward prior to the invasive cath lab procedure and is especially helpful in patients with polymorphic premature ventricular complexes (PVCs). Its accuracy to localize PVCs and guide catheter ablation has been already demonstrated in previous studies. However, all previously recruited patients had structurally normal hearts (<10% of scar burden). We aimed to challenge the non-invasive 3D mapping software accuracy in a different and more challenging patient population with structural heart disease and > 10% of scar burden.

Methods: Seventeen consecutive patients (10F, mean age 48±17yrs) were studied. Underlying cardiac conditions were: 7 (41.2%) patients with congenital heart disease of moderate severity (Bethesda 2), 2 patients (11.8%) with dilated cardiomyopathy, 1 patient (5.9%) with Brugada syndrome, 6 patients (35.3%) with structurally normal heart and <10% of scar burden, and lastly one (5.9%) with structurally normal heart but severe ischaemic disease. For all, a 3D personalised model of the heart and torso were generated from either cardiac magnetic resonance imaging or computed tomography scans. This was merged with a 3D picture of the ECG-leads position. Subsequently, digital ECG files of the PVCs or paced beats derived from either 12-lead Holter or electrophysiological recording system were imported into the 3D non-invasive mapping software for analysis. Finally, the location was compared to the site of ablation on electro-anatomical mapping system.

Result: The non-invasive 3D mapping software showed an accuracy of 89.6%, when compared to the electroanatomic system localisation during the procedure, in the 29 ECG locations collected: 11 right ventricular outflow tract (RVOT, 37.9%), 6 endocardial right ventricle (RV, 20.7%), 9 endocardial left ventricle (LV, 31%) (Figure), 3 epicardial LV (10.3%). Overall, 3 paced beats (10.3%), 2 VTs (6.9%) and 24 PVCs (82.7%).

Conclusion: Accurate non-invasive 3D localization of VT/PVCs’ origin was achieved in 89.6% of the analysed samples in a diverse and challenging cohort of patients, including patients with structural heart disease, cardiomyopathy and a scar burden beyond 10%. These promising results suggest a broader indication for such technology, and should be further validated by prospective trials.