A novel amalgamation of computing models to follow the Propagation & Entropy of Atrial Fibrillation (AF) in the Left Atrium (LA). A simulation model

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Introduction: To better understand the propagation and entropy of AF in the LA, is essential for AF termination and treatment (catheter ablation). Components of 3 computing models were amalgamated, they were: Fenton & Karma, Courtmanche *et al.* and Simitev-Biktashev[1]. Formerly, frequency analysis highlighted dominant frequency (DF) patterns that showed evidence of re-entry circuits and phase patterns. It aims to follow the spread of AF in simulation form in the LA and be generalisable, using a larger set of parameters, achieved by combining the models. Potentially, enabling a degree of efficiency in trailing the propagation of AF in the LA in an individualised manner for each patient.

Methods: Retrospective data from 10 subjects who underwent persistent AF (PersAF) ablation for the first time was placed over stimulation protocol of the amalgamated model on MATLAB. Retrospective data used were derived from LA virtual electrograms (VEGMs). From generated data characterisation maps were retrieved showing phase singularities with Sample Entropy (SampEn) and Approximate Entropy (ApproxEn). 3D simulations on subject data were run creating virtual visualisation of the propagation and entropy of AF in the LA. Results were verified by determining singularly high DF (HDF) and phase analysis. Model verification was also obtained via entropy maps collected.

Results & Conclusions: Using code combining the 3 models[1] on MATLAB retrieved 3D simulations for all 10 patients, with a success rate of propagation trailing of 79±5%. Propagation route coincided with HDF regions in 66% of patient data. Phase analysis criterion over simulations showed 57% of expected re-entry wavelets. Results imply widening parameters of each individual computing model [1]and combining them can successfully create a criterion to follow propagation of AF in the LA. Future research should involve developing the code into a standard subset to follow propagation of AF in real time during ablation procedures.