# A SYMBIOTIC BEAMFORMING APPROACH FOR IMPROVED ASTRONOMICAL SURVEYS

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The instantaneous Field-of-View of a dish radio telescope constitutes a tradeoff between the maximum survey speed and sensitivity of the instrument. Phased Array Feeds (PAFs) allow the sampling of an area of a dish antenna focal plane, as opposed to the sampling of its center-only with single feed receivers. Linear combinations of the PAF elements - or beamforming - enables then the customization of the response of the instrument. Multi-beamformers, i.e. the instantaneous formation of multiple digital beams, can emulate numerous independent look directions while mechanically steering the dish at a single direction in the sky, increasing therefore the size of the observed field.

Forming independent beams is a suboptimal solution for astronomical observations where the observed field is not a priori known. The sub-optimality originates from the non-zero inter-beams correlation coupled to the discrete aspect of the global designed response. The correlation between beams induce information redundancy in the total collected astronomical information.

Based on this observation, we suggest here the concept of a *symbiotic* multi-beamformer based on the minimization of pairwise mutual information between beams. Additionally, the statistically optimum multi-beamformer is constrained to provide a desired global response as required by the experiment. For an increased survey speed, the designed global response may preferably present a uniform sensitivity over a continuous extended Field-of-View. Alternatively, the global response may match the shape of an extended astronomical source.

We present in this talk the early concepts and simulated results of the symbiotic beamformer, introduce quality metrics and address the expected limitations of this solution.