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Magnetic Resonance Velocimetry in High-Speed Turbulent Flows - Sources of Measurement Errors and a New Approach for Higher Accuracy MARTIN BRUSCHEWSKI, KRISTINE JOHN, SVEN GRUNDMANN, University of Rostock — Magnetic Resonance Velocimetry (MRV) has great potential to become a versatile velocity measurement technique for applied fluid mechanics. One of the most dominant errors in MRV is the effect of displacement which describes the spatial misregistration of the acquired signal in a moving fluid. The overall aim of this study is to highlight the significance of displacement errors in conventional MRV and to provide an improved method. A new MRV sequence, named SYNC SPI (single point imaging with synchronized encoding) has been developed to significantly reduce this error. Measurements were performed in several test cases including a U-bend as part of the 2019 MRV Challenge. In comparison to conventional MRV, this sequence provides reliable velocity data for a wide range of flow velocities. It is shown that flow velocities up to 15 m/s can be accurately measured with this technique. The main disadvantage of the SYNC SPI sequence is the relatively long acquisition time. This disadvantage is partly resolved using a modern undersampling technique called Compressed Sensing to reduce the number of samples required to provide fully-resolved velocity data. It is shown that the acquisition time can be reduced by more than 70% while still maintaining high measurement accuracy.

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