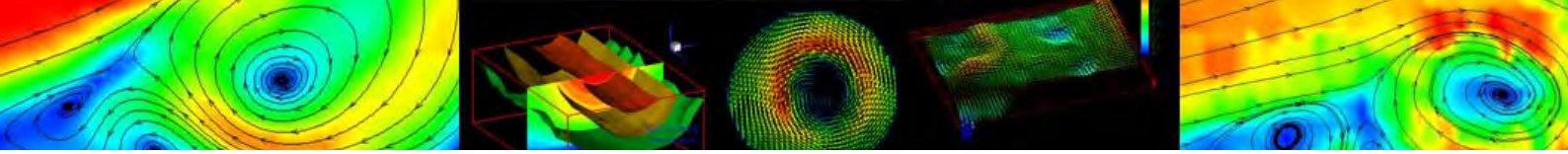


MicroVec Light Field PIV

3D3C velocities in a single camera

Microvec has developed a new light field volumetric PIV (LF-PIV) system. Microvec LF-PIV can resolve 3D velocity fields through MART based reconstruction and 3D cross correlation. This new system can provide an interesting alternative and affordable substitute to a Tomographic PIV. It is based on only one compact camera, and can be used to calculate 3D3C velocity in applications and environments with space constraint.

Figure 1. Jet flow experiment with Microvec LF-PIV camera

In-house light field camera was developed according to plenoptic imaging where a customised micro-lens array (MLA) is precisely positioned one focal length away from the CCD of a 29 megapixel camera (See Figure 1 and 2). The MLA consists of 458×301 hexagonal lens unit, which maximises the pixel usage when compared to square lens unit. Light field image of tracer particle article can be simulated via linear Gaussian optics.

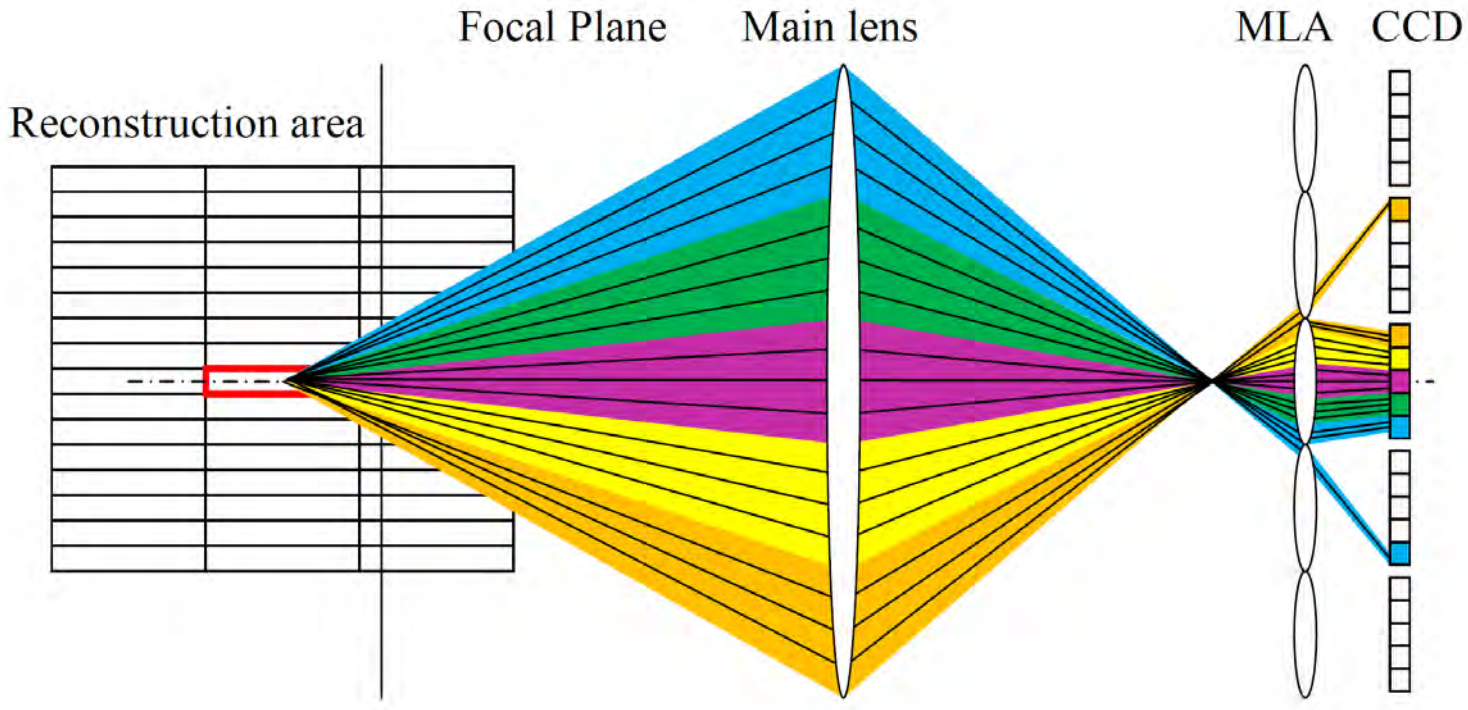
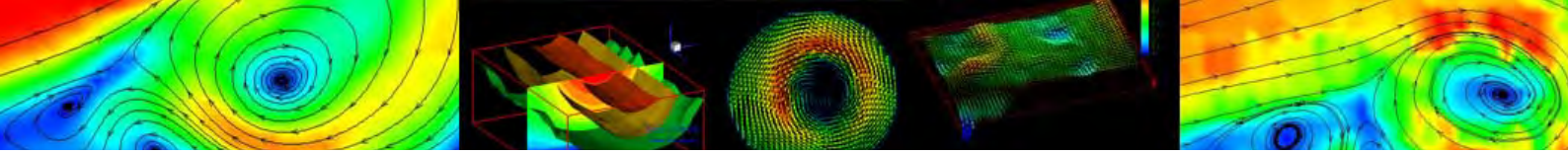


Figure 2. Principle of DRT MART reconstruction technique

LF-PIV system pre-determines the location of a particle through inverse dense ray tracing (DRT) and reconstructs the voxel value using multiplicative algebraic reconstruction technique (MART).

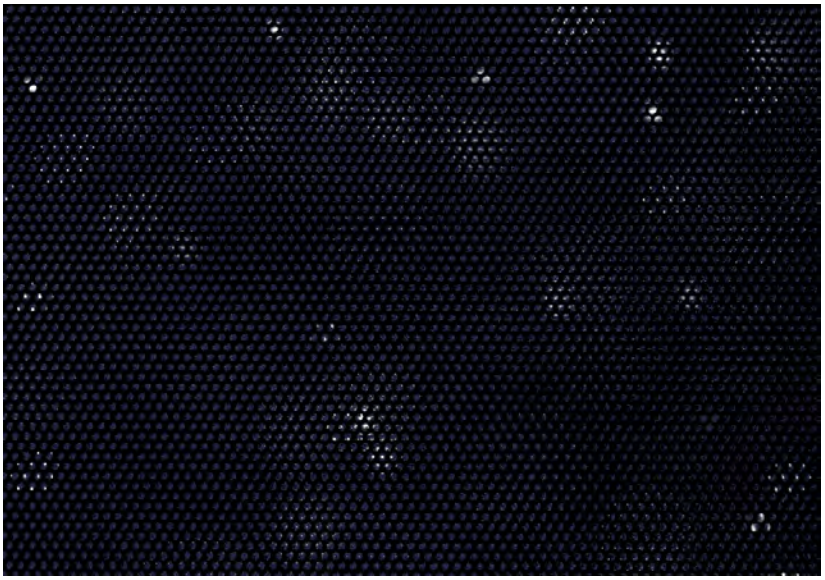
DRT-MART technique implemented in Microvec LF-PIV achieves higher reconstruction resolution at much better computational efficiency than the MART method. To speed up the calculations even more, the system supports GPU and its parallel processing.

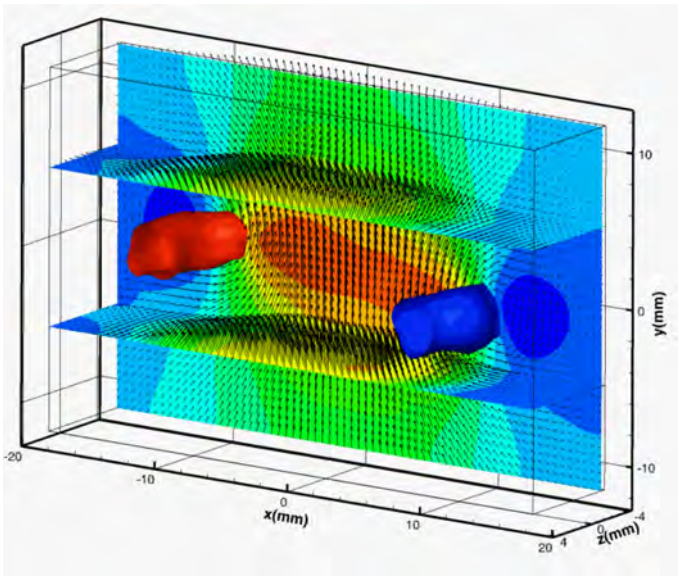
MicroVec



Case 1: Low Speed Jet

The experiment was conducted in air with a slow jet. Measurement Volume: 39.4×26.2×10.7 mm and 2200×1466×130 voxels.

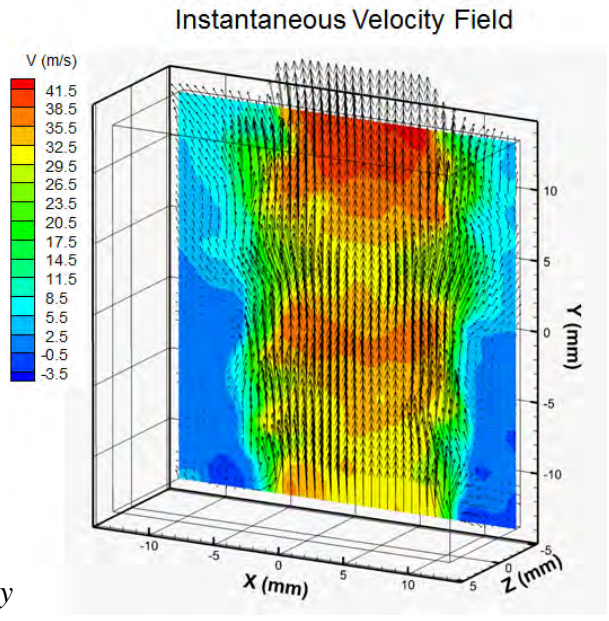




Case 2: Air Jet

Tracer particle: 1μm olive oil, ReD: 45000, Measurement Volume: 27.3×34.2×12 mm DRT-MART Iteration: 40, Multi-grid Cross Correlation: Initial Volume: 120×120×64, Final Volume: 60×60×32, Overlap: 75%

Pictures courtesy of Dr. Shengxian Shi, Shanghai Jiaotong University



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