Shape Reconstruction of Irregular Bodies with Multiple Complementary Data Sources. Mikko Kaasalainen¹, Matti Viikinkoski¹, Benoit Carry² and Josef Đurech³ 
¹Department of Mathematics, Tampere University of Technology, PO BOX 553 33101 Tampere ²ESA, Madrid, Spain ³Charles University, Prague, Czech Rebublic

We discuss inversion methods for shape reconstruction with complementary data sources. The current main sources are photometry, adaptive optics or other images, occultation timings, and interferometry, and the procedure is readily extended to include range-Doppler radar and thermal infrared data as well. We present the octantoid, a generally applicable shape support that can be automatically used for surface types encountered in planetary research, including strongly nonconvex or non-starlike shapes. New models of Kleopatra (from photometry, adaptive optics, and interferometry) and Hermione (photometry and adaptive optics) are examples of this approach. In addition, we explore some implementation details for computing profile contours and interferometric curves, and we consider how these algorithms can be implemented on CUDA-enabled graphics card for parallel computation. An important concept in the inversion is the optimal weighting of the various data modes. We have developed a multimodal generalization of the maximum likelihood estimate, called the maximum compatibility estimate, for this purpose. We also present a specific version of the procedure for asteroid flyby missions, with which one can reconstruct the complete shape of the target by using the flyby-based map of a part of the surface together with other available data. Finally, we show that the relative volume error of a shape solution is usually approximately equal to the relative shape error rather than its multiple.