CARMA Software Development and Data Archiving

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CARMA (Combined Array for Research in Millimeter-Wave Astronomy) will combine the existing BIMA and OVRO mm interferometers into a single array at a new high altitude site (~ 8000 ft). A third array, the Sunyaev-Zeldovich Array (SZA), will be built in the next 2 years and co-located with the CARMA interferometer. The SZA antennas will be available at times for cross-correlation with the CARMA antennas. This combination of hetereogeneous antennas and their subsytems bring up new challenges not only in hardware, but also in software and in remote collaborations.

The two existing arrays have their own mature operations software, developed over the last decade, and the SZA software will be partially based on the DASI system currently at the South Pole. For CARMA, the situation is not as simple as choosing one over the other. It is further complicated by the fact that the software developers are dispersed among 5 institutions (UC Berkeley, Caltech/OVRO, U. Maryland., U. Illinois, U. Chicago) and 3 time zones. Such multi-institution development requires frequent communication, local oversight, and reliable code management tools.

Timeline has forced us to carefully balance reusing existing software, with perhaps wrappers to a new more object oriented approach, and rewriting from scratch. New hardware, such as the correlator, has already resulted in new software, but we anticipate re-using a fair fraction of the existing telescope software.

Each existing array also has its own visibility data format, storage facility, and tradition of data analysis software. The choice for CARMA was to use one of a number of an existing formats or devise a format that combined the best of each. We describe our solution in which the pipelined data passes through two forms: a low-level database-based format oriented toward engineers and a high-level dataset-based form oriented toward scientists.

We will adopt the BIMA Data Archive at NCSA which has been operating in production mode for a decade and will be reused for CARMA with enhanced search capabilities. The integrated BIMA Image Pipeline developed at NCSA will be used to produced calibrated visibility data and images for end-users. We describe how the data move from the CARMA telescope correlator to delivery to astronomers over the web and show current examples of pipeline-processed images of BIMA observations.