

Summary of Data Management Principles Holometer

Experiment description:

The Holometer is small-scale interferometry experiment designed to probe the microphysics of space-time at the Planck scale. It comprises two 40-meter, power-recycled Michelson interferometers installed at Fermilab. The 2 kW power of each interferometer provides repeated measurements of the beamsplitter position to a Poisson shot-noise-limited resolution of 10^{-18} m/rtHz. By cross-correlating the output signals of the two interferometers, the shot noise can be further averaged down to achieve resolutions of a few 10^{-21} m/rtHz at which point the instrument becomes sensitive to Planck-suppressed quantum fluctuations of space-time. The Holometer began its operations phase in 2014 and is expected to run through mid-2016.

DOE's roles in the experiment:

Fermilab is the host lab for the Holometer. The DOE has funded the construction and operations

Partnerships:

None.

Organization – Agency/Lab level

The DOE is responsible for construction and operations through the end of the project.

Organization – Experiment level

Aaron Chou (FNAL) and Stephan Meyer (U.Chicago) are the co-spokespersons, and also share project management responsibilities for a small collaboration of 8 scientists and 4 students. Being a small project, each collaboration member has primary responsibility for a specific aspect of the experiment (optics, digital control system, data acquisition system, etc), though in practice the project is operated as an extensively collaborative effort.

Collaboration:

The collaborating institutions are Fermilab, the University of Chicago, the University of Michigan, and MIT.

Data policy management:

The data policy has been agreed to by the collaboration, and Fermilab is responsible for its implementation, including providing public website access and tape archive.

Data Description & Processing: [SC Req. 3]

Description:

The raw, time-series outputs of the interferometers are Fourier transformed in real-time to produce power spectra of the interferometer measurements. The 16 MB file sizes of these individual spectra is easily manageable.

Types of data:

The data products are power spectra of the interferometer measurements in units of distance/rtHz.

Processing:

The data are processed with quality control measures to reject periods of poor operating conditions. Calibrations derived from supplementary monitoring systems are applied to the data products.

Data Products and Releases: [SC Req. 4]

The full resolution, calibrated power spectra, integrated over the accumulated period of high quality operating conditions will be released upon publication of results papers providing detailed descriptions of how these spectra were produced.

Plan for Serving Data to the Collaboration and Community: [SC Req. 1]

The data will be made available for re-analysis by the public via the Fermilab Holometer website. The format will be the processed spectra and cross-spectra at full resolution, obtainable as files of approximate size 16 MB in a standard HDF5 format, along with instructions on how to read the file, and the averaging procedure used to produce the published high precision science results. The published frequency-averaged spectra will also be made available as a smaller HDF5 file.

Plan for Archiving Data: [SC Req. 1]

The data will be indefinitely archived in the Fermilab tape farm.

Plan for Making Data Used in Publications Available: [SC Req. 2]

The publications will use the same high-resolution spectra as published on the website, with data points rebinned to provide higher precision via frequency averaging. These higher precision, lower frequency resolution spectra will also be made available on the website.

Data point values from supplementary plots in the papers will also be made available in machine readable format on the website at time of publication. These plots include for example calibration data and dark spectra.

Responsiveness to SC Statement on Digital Data Management

This data management plan fully follows SC Statement on Digital Data Management.