



LIGO Laboratory / LIGO Scientific Collaboration

LIGO-T070300-00-D

LIGO

12/10/2007

Characterization of the mode cleaner spare mirrors

Liyuan Zhang (on behalf of the Caltech COC group)

Distribution of this document:
LIGO Science Collaboration

This is an internal working note
of the LIGO Project.

California Institute of Technology
LIGO Project – MS 18-34
1200 E. California Blvd.
Pasadena, CA 91125
Phone (626) 395-2129
Fax (626) 304-9834
E-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Project – NW17-161
175 Albany St
Cambridge, MA 02139
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

LIGO Hanford Observatory
P.O. Box 1970
Mail Stop S9-02
Richland WA 99352
Phone 509-372-8106
Fax 509-372-8137

LIGO Livingston Observatory
P.O. Box 940
Livingston, LA 70754
Phone 225-686-3100
Fax 225-686-7189

<http://www.ligo.caltech.edu/>

1 Mirrors and measurements

For the e-LIGO, six mode cleaner spare mirrors have been characterized at Caltech OTF lab for the transmission and scatter, as summarized in the following table. The specifications of these mirrors can be found at the initial LIGO Wiki (http://lhocds.ligo-wa.caltech.edu:8000/iLIGO/Optics_Inventory).

Sample ID	Transmission at 0°	Transmission at 45°	AR reflection at 45°	Scatter $1.5^\circ < \theta < 78^\circ$
MMT14K04	X			X
MCCM4K01	X			X
MCCM4K04	X			X
MCCM4K05	X			X
MCCM2K03	X			X
MCFM06		X	X	

2 Results

Fig. 1 and 2 show the measured transmission results of the curved mirrors MCCM4K01, MCCM4K04, MCCM4K05, MCCM3K03 and MMT14K04 with the incident angle at zero degree, as well as the transmission and AR coating reflection results of the flat mirror MCFM06 with the incident angle at 45 degrees and S polarization. While all the measured transmissions at zero degree are well within the specification of <20 ppm (E980139-00, E980140-00 and E980141-00), the results at 45 degrees of the flat mirror MCFM06 are a bit out of specification, this may be due to the incident angle of 45 degrees was not well controlled in the measurement set-up.

Fig. 3 and 4 show the integrated scatter maps and histograms respectively of the curved mirrors MMT14K04, MCCM4K01, MCCM4K04, MCCM4K05, MCCM2K03 and an one 1" REO mirror for comparison. The measurement was done by using a focused beam and an integrating sphere. The beam waist is about 150 microns and adjusted to be at the surface of the optic. The integrated polar angle range is from 1.5° to 78° , corresponding to a spatial bandwidth of $250 - 9200 \text{ cm}^{-1}$. According to the E980139-00, E980140-00 and E980141-00, only the MMT14K04 and MCCM4K01 meet the scatter specification of <15 ppm.

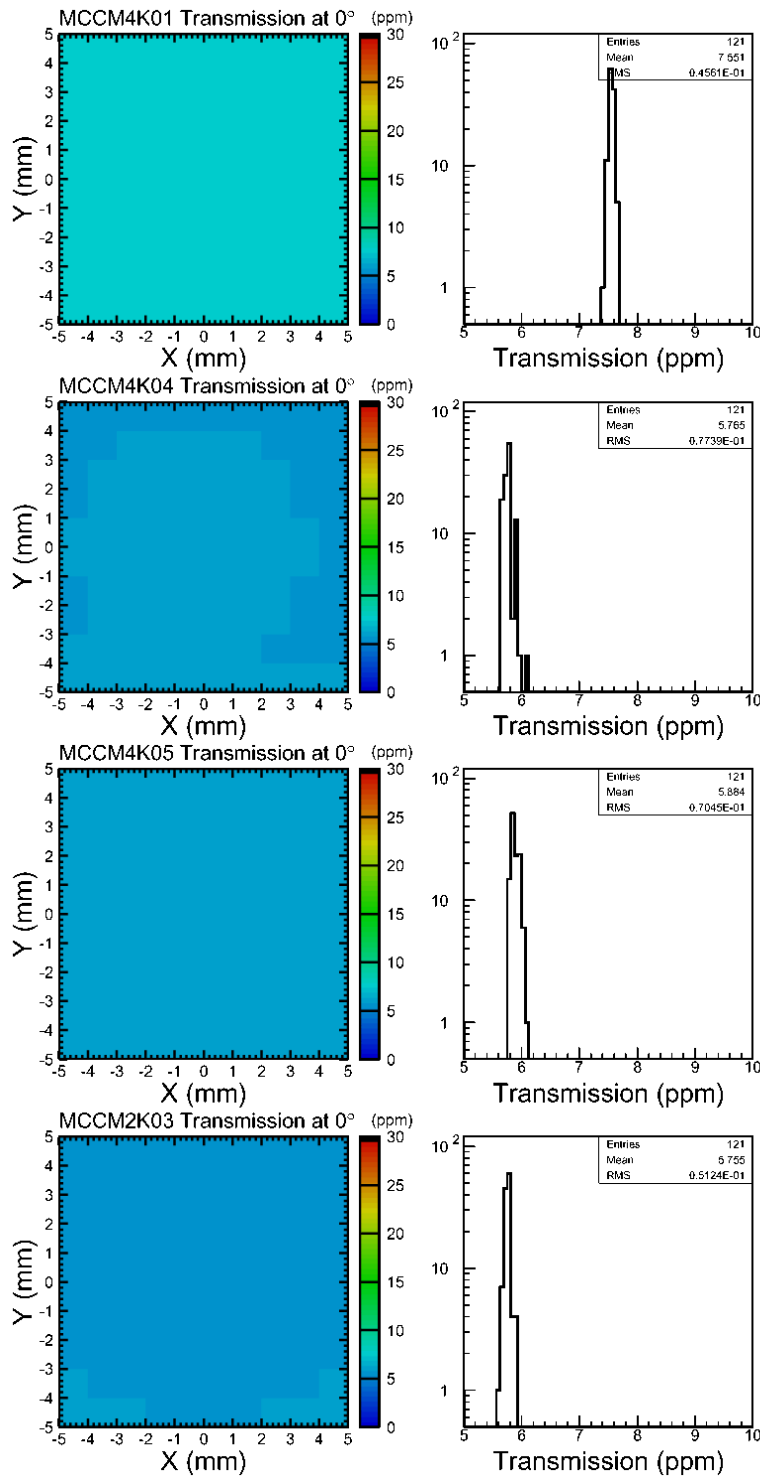


Fig.1 The measured transmission maps and the histograms of the mirrors MCCM4K01, MCCM4k04, MCCM4k05 and MCCM2K03.

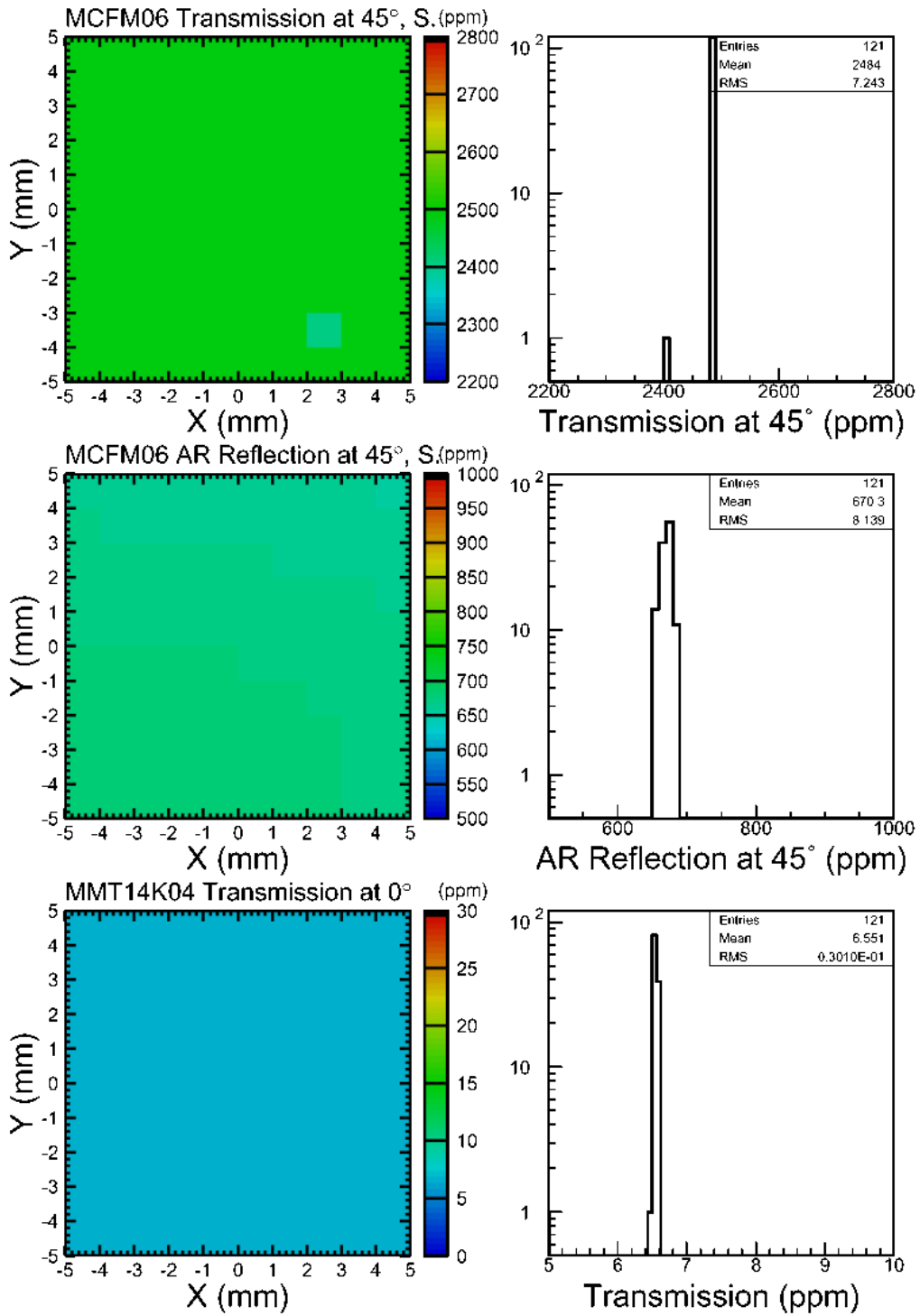


Fig. 2 The measured transmission maps and the histograms of the mirrors MCFM06 and MMT14K04, as well as the measured AR reflection map and histogram of the mirror MCFM06.

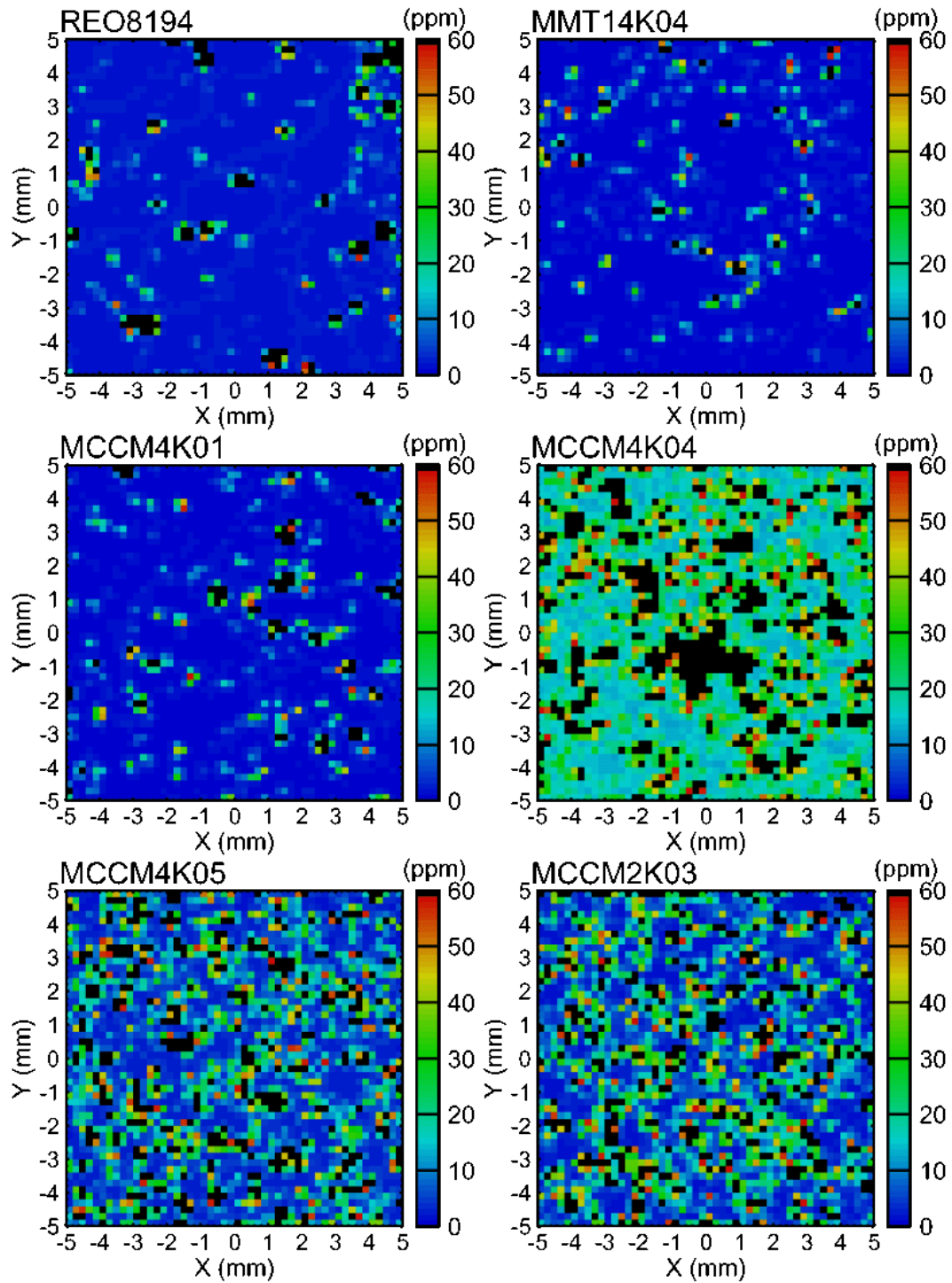


Fig. 3 The measured scatter maps of the mirrors MMT14K04, MCCM4K01, MCCM4K04, MCCM4K05, MCCM2K03 and a REO 1" in diameter mirror for comparison.

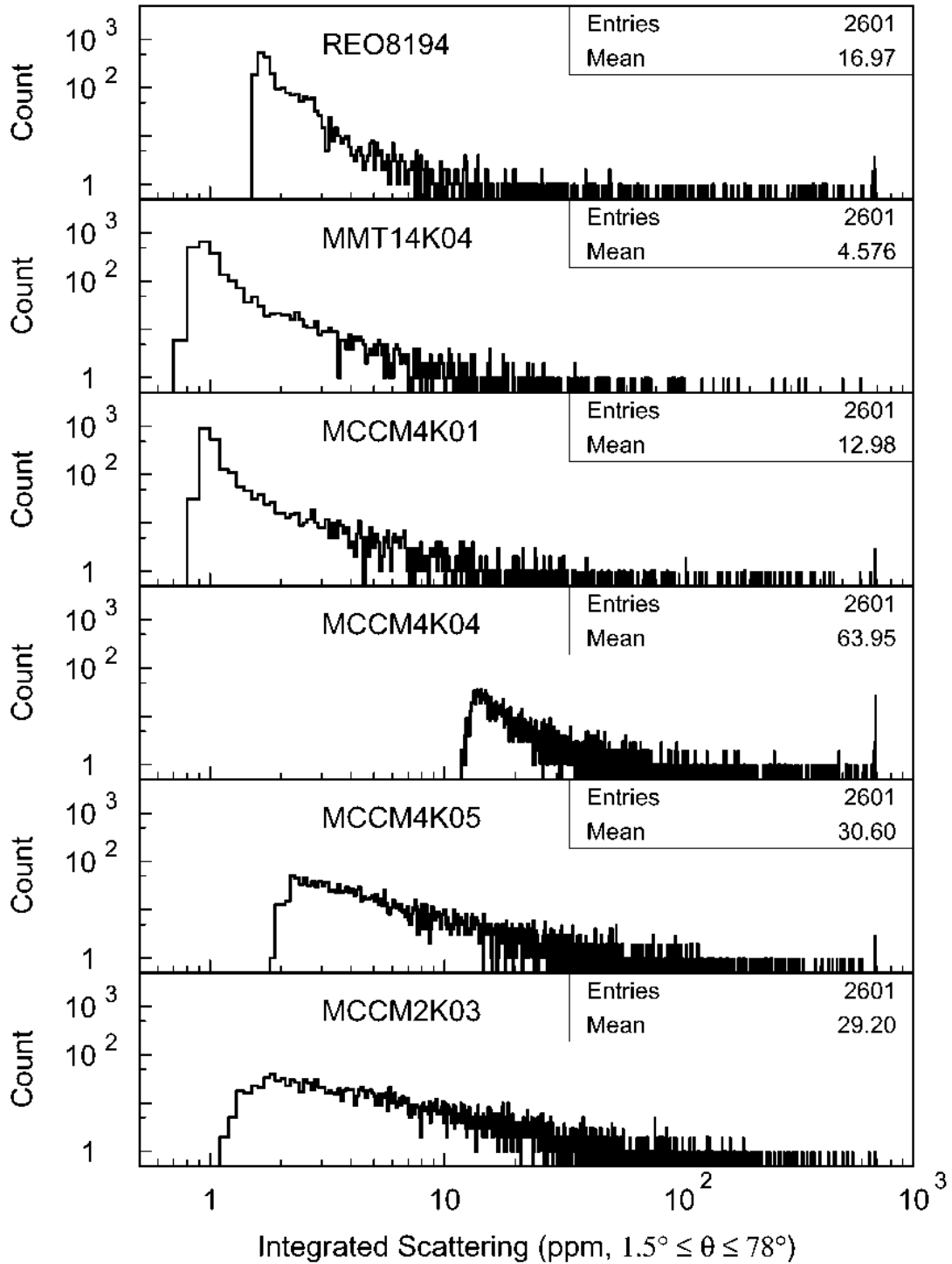


Fig. 4 The measured scatter histograms of the mirrors MMT14K04, MCCM4K01, MCCM4K04, MCCM4K05, MCCM2K03 and a REO 1" in diameter mirror for comparison.