

Characterization of the aerogels for the RICH of the AMS experiment

Mid-term Report, HELEN programme
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The Alpha Magnetic Spectrometer (AMS) is a particle detector for the International Space Station (ISS). It will be equipped with a Ring Imaging Cherenkov (RICH) detector for measuring the electric charge and velocity of the charged cosmic particles. In this report we describe the two tests that we are currently performing on the aerogel tiles that are going to be used as the radiator of the AMS RICH.

The AMS RICH detector

The AMS RICH counter design has to meet a set of specific constraints imposed by the launch and flight conditions, on the resistance to vibrations of the structure and of its elements, and on the volume and shape of the payload, as well as by the particular experimental environment of a long duration spatial experiment.

The geometry of the RICH also imposes constraints on the geometry of its components, so it is necessary to control the dimension of the aerogel tiles. This is also necessary to control the performance of the detector itself. The configuration of the tiles is shown in figure 1, where it is also clear that we need to use different geometries for the tiles, these are shown on figure 2.

We are doing two types of measurements to the tiles; the first one is a metrology test to study the shape of the aerogel surface, as well as side measurements to check the dimensions of each tile; the second type of measurement consists in an optical test to study the refractive index variation along the tile.

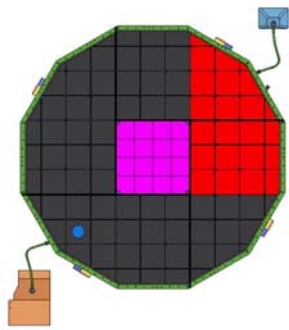


Fig. 1 Tiles configuration.

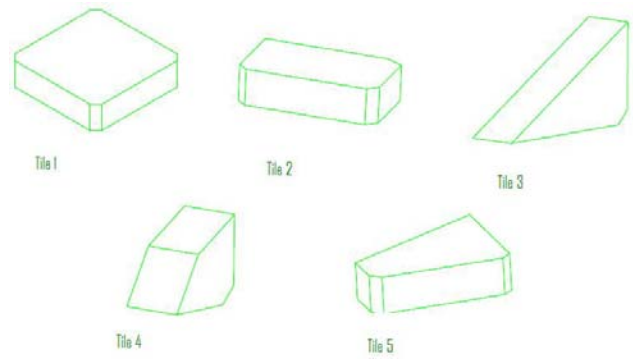


Fig. 2 Geometries of the tiles.

Metrology test

For this test, we are using a very precise comparator device connected to a PC to measure the deviation from a flat surface of the tiles. The measurements are made almost automatically and inserted on an Excel data matrix that will be used afterwards to determine if the tile has the requirements of the detector design. For each of the different geometries we have developed a different data acquisition file. Up to this point, we have made the metrology test for 54 tiles.

Optical test

The precise determination of the refractive index for each tile is done with a laser deviation method. The set-up, with an aerogel sample is shown in figure 3. The vertical and horizontal deviation of the laser beam entering normally to the surface of the tile provides a measurement of the refractive index gradient at a given position on the tile. So far we have done this measurement for 30 tiles.

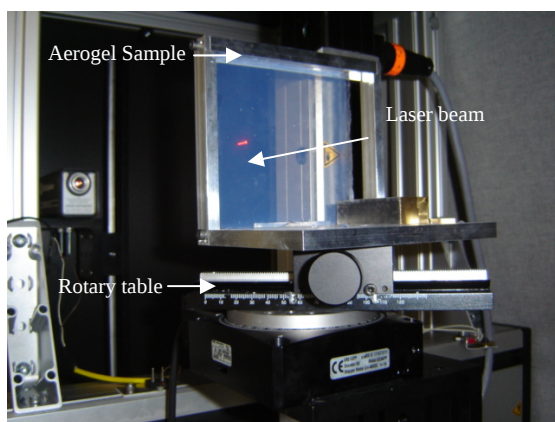


Fig. 3 Set-up for the optical test

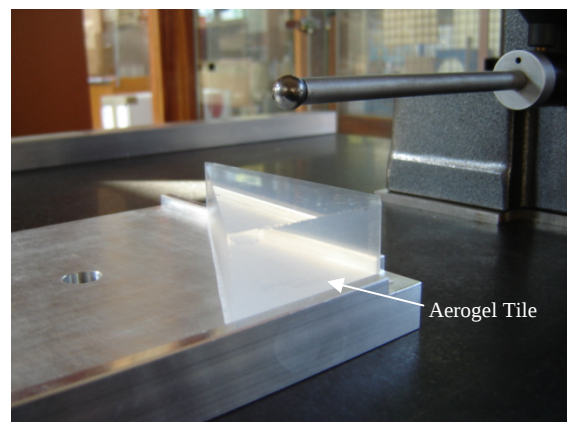


Fig. 4 Set-up for the metrology test

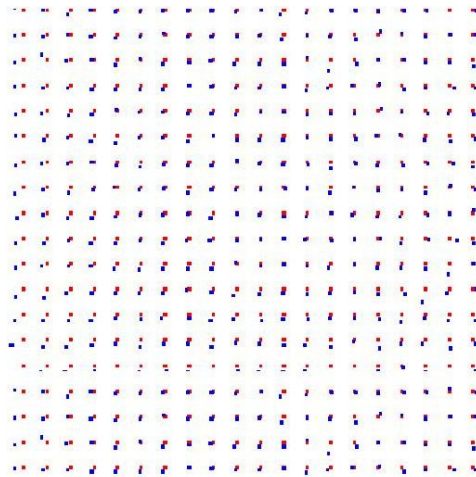


Fig. 5 Data from the optical test

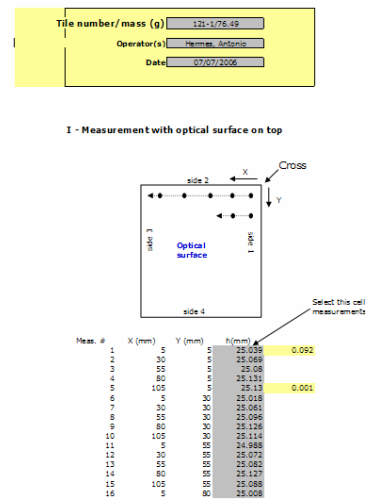


Fig. 6 Example of an Excel file for data acquisition

Figure 5 it is the output from the acquisition program for the optical test, the red points indicate the laser position in the absence of a refractive index gradient, the blue points indicate the real beam position detected with a camera. Figure 6 is an example of the data acquisition file for the tiles with square geometry.

Bibliography

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