Poor Man's Beam Splitter

We are making high speed photometric observations with my Meade/SiTech 10-inch equatorial fork telescope. Speckle interferometry observations require an x4 Barlow, and I am using a Tele Vue Powermate which is long and heavy. An Andor Luca-S EMCCD camera is mounted on the far end of the Barlow. The x4 image magnification is required to match the sizes of the speckles and camera pixels (or, more formally, to match the theoretical resolution of the telescope, as speckle interferometry is not seeing limited).

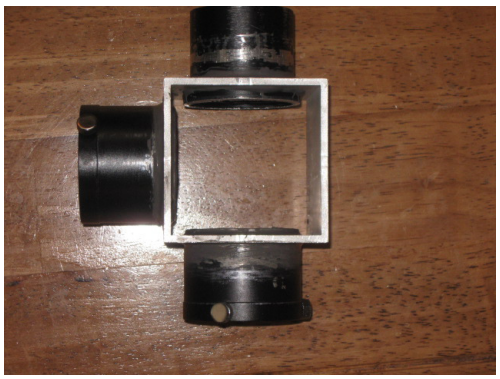
The optical path needed to be folded at 90 degrees to accommodate the long Powermate optics. A 2-inch diagonal was tried initially. While it was sturdy enough, and the telescope (which is mounted in a very substantial pier) was steady enough to keep a star within a fairly small Region-of-Interest (RoI) on the camera, it was difficult at this high magnification to get the star on the camera to begin with. Also, for long runs with a high-speed aperture PMT photometer on planned intensity interferometry experiments, autoguiding would be desirable. Thus some sort of beam splitter seemed appropriate.

Although a Meade 2-inch flip mirror could have been modified to serve as a beam splitter (we did this in the past using a dichroic mirror), we were inspired by a posting from Greg Jones that showed how he was building his own device using 3x3 inch square aluminum tubing with 1/8th inch thick wall as the basic structural component.

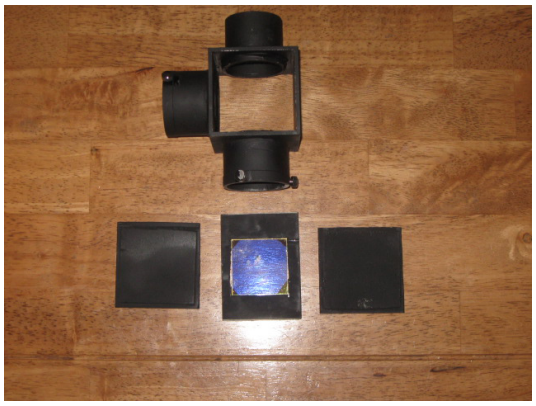
Greg had some extra tubing laying around, and he kindly cut us off a couple of3x3x3 inch cubes and squared up (at Dan's shop). My plan, for each beam splitter, was to use a two low cost Orion Telescope 2" extensions tubes, cutting them in two to provide one 2-inch OD female "snout" to insert into a visual back or microfocuser in the back of the telescope, and two 2-inch ID receptacles, one for the x4 Powermate and the other for the acquisition/guide camera. Greg kindly milled out the three holes for the extension tubes.

The 2-inch Orion Telescope extension tubes are less than $20, and one can purchase pre-cut 3x3x3 aluminum tubing for less than $20 each including shipping (I ordered three of them to try some more possibilities including a flip mirror). Thus the total cost, not including optical elements, is well under $100.

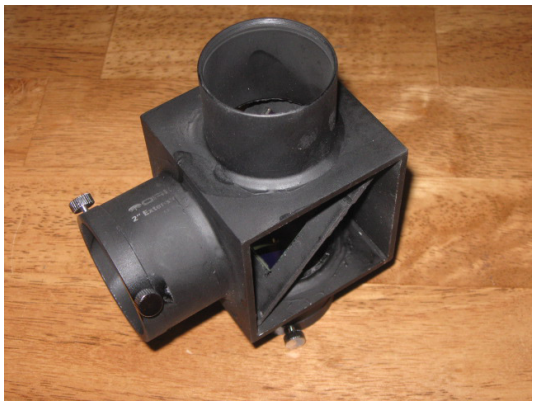
I placed a tube cuter in a vise (Home Depot has tube cutters that handle up to 2 1/8th inch OD tubing), and cut the tubing about 1/4th inch above where the 2-inch extension tube enlarges. A vice grip was used to turn the tubing in the cutter which was held in the vice.



The ends of the Orion extension tubing were ground down slightly to provide a tapered press fit into the square tubing holes. The three extension tubing pieces were placed in a freezer while the square tubing was placed in the sun. A press fit was then made in a vice and JB Weld applied to the seams both inside and out. This was probably total overkill but it is certainly Hell for stout ☺.



Hobby plywood was then used to make a fairly tight fitting holder for the optical 50x50 optical element which could be a dichroic splitter, a partially silvered mirror, etc. The holder was sized to have a fairly tight fit along the 45 degree slant, but still removable by simply pulling it out. Each end cap was made from two squares of hobby plywood, one slightly smaller than the other to fit inside the aluminum tubing. This provides something of a light seal, although I'll probably still put some tape on the seam.



One can have more than one optical insert, and can change it as desired to suit different projects or different telescopes (such as a straight through GEM versus a 90 degree fork).

After inserting the end caps, the beam splitter is ready for operation.

Russ Genet russmgenet@aol.com