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Nicer, Tinier Images at the 0.9-m:...(1Dec93)
Image Corrector Installed
(from KPNO, NOAO Newsletter No. 36, 1 December 1993)

The field accessible with Tektronix 2048 x 2048 CCD at the 0.9-m f/7.5 focus is an impressive 23 arcmin on a side. The Mini-Mosaic, currently under development, will have an even larger field with the added bonus of smaller pixels to sample better the observed point spread function (PSF). However, it has been known for some years that the images at this focus degrade far from the optical axis, becoming enlongated blobs in the corners of our Tek 2048 chip. As the f/7.5 is a Richey-Chretien design, we have been fighting two effects: (1) the focal plane is curved, but the chip is flat, leading to position-dependent "best" focus; and (2) the images are highly astigmatic.

In order to deal with both of these problems, a simple, two-element corrector was designed and has now been installed and fully tested. Although the corrector is easily removed from the beam, we expect that most, if not all, observers will benefit from the use of this corrector, and will want to use it.

[Figures not included]

We are pleased with the performance of the corrector. The PSF variability has been greatly reduced, particularly in the corners of the chip. This is illustrated in the attached figure which shows images in the center and corner of the chip with and without the corrector. As an extra bonus, the images used for guiding by the off-axis TV are greatly improved. Some residual PSF variability remains, but due to the non-symmetric nature of the variability, we do not believe the corrector is responsible. Our leading contender for the origin of this problem is the support of the f/7.5 secondary. We plan further investigation and hope to cure this problem this year. The PSF behavior with the corrector is straightforwardly modeled using DAOPHOT II, which was not true for images taken in good seeing without the corrector.

The scattered light performance of the corrector appears to be good. We have observed fields containing bright stars with and without the corrector, and no scattered light problems are apparent. Surface photometry of galaxies has also been performed with the corrector in and out of the beam, and identical results were found.

The one and only drawback we have found to the corrector is that the corrector U throughput is only 65% relative to the uncorrected throughput. The relative throughputs at other wavelengths are much better: 87% at B, 94% at V, 98% at R, and 94% at I. We nevertheless believe that most observers will still gain even at U from the use of the corrector if attempting stellar photometry in anything but the center of the chip, as more light will be concentrated in fewer pixels. Even for non-stellar sources, the photometric accuracy at U will be improved through finite-sized apertures.

The corrector is not designed to be used with the f/13.5 secondary and will be removed from the beam when that secondary is used. It may also prove desirable to remove the corrector for f/7.5 projects which make use of only the central part of the field (particularly at U), and where paranoia over scattered light outweighs PSF constancy considerations.

Subject: RE:focal Distances for 0.9-m [05/01/01]
From: Heidi Schweiker <heidis@noao.edu>
Date: Tue, 24 Feb 2004 13:39:05 -0700 (MST)
To: heidis@noao.edu

---------- Forwarded message ----------
Date: Tue, 01 May 2001 14:03:35 MST
From: Nigel Sharp <sharp@vms.noao.edu>
Reply-To: sharp@noao.edu
To: mack@astronomical.com
Cc: hschweiker@noao.edu, MATHIEU@ASTRO.WISC.EDU, ATA@ASTRO.UFL.EDU,
sharp@noao.edu
Subject: RE: Distances for 0.9-m

I've given up on drawings. We built an interface unit that fits between
the Mosaic corrector and the 4-inch FSA we have for our universal dewars.
I found this piece of metal (it's now with Heidi) and measured it,
and measured the thickness of the FSA from the dewar mounting surface.
On the principle that the metal doesn't lie and knowing that this
unit was actually used ... 4.075 inches, and that includes the filters
which are 9mm thick. The FSA is 1.500 and the interface is 2.575
and the filters are single and 9mm and that's that and that has to
be a definitive number since it's hardware.

If you'd like to measure or inspect any of the metal I'm sure that
can be arranged.

Nigel

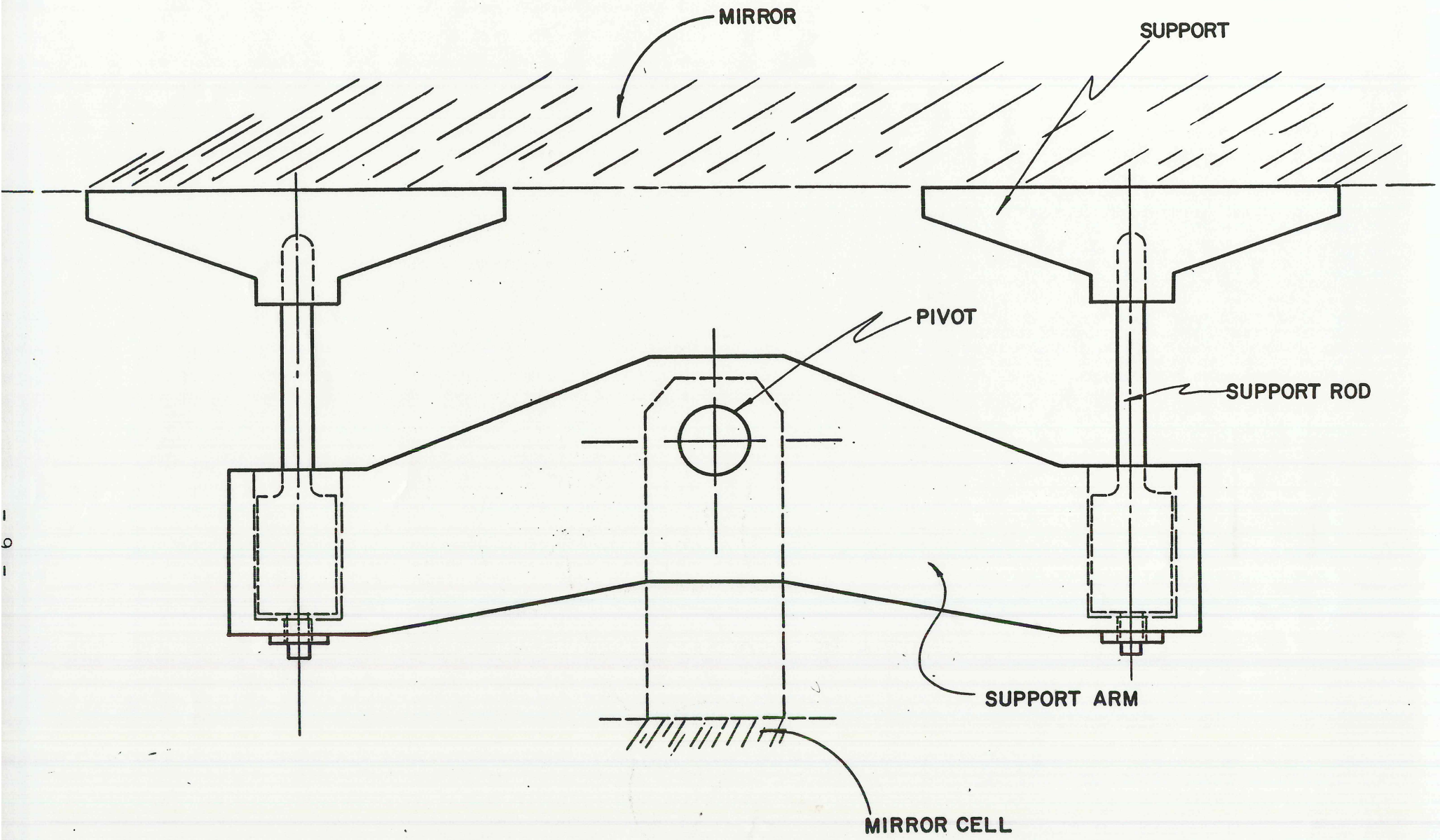
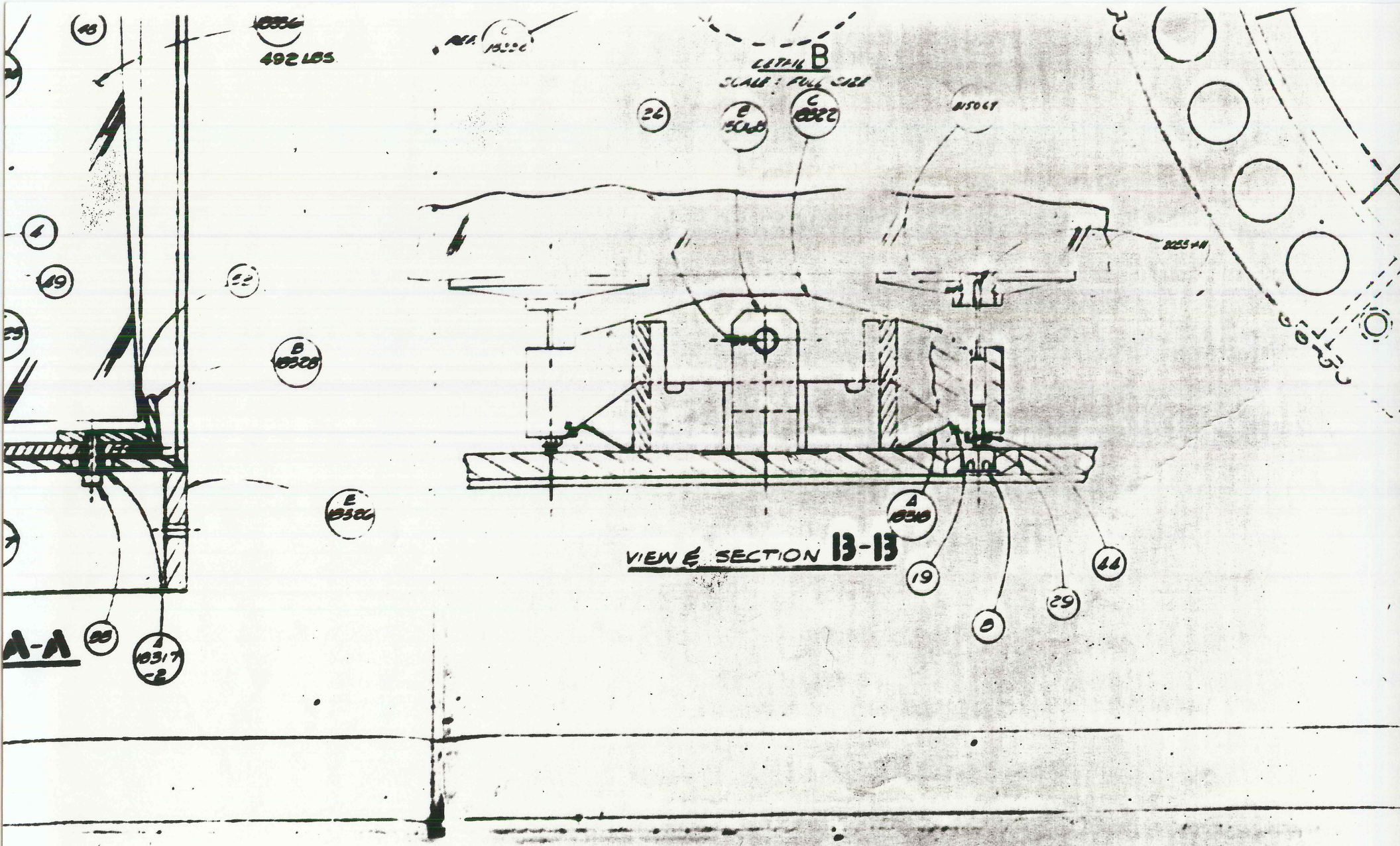


Figure 5. SCHEMATIC OF SUPPORT ASSEMBLY


492 LBS
DETAIL B
SCALE : FULL SIZE
VIEW E SECTION 13-13
A-A

Subject: 0.9m drawings [04/21/01]
From: Heidi Schweiker <heidis@noao.edu>
Date: Tue, 24 Feb 2004 13:37:15 -0700 (MST)
To: heidis@noao.edu

---------- Forwarded message ----------
Date: Sat, 21 Apr 2001 01:33:24 MST
From: Nigel Sharp <sharp@vms.noao.edu>
Reply-To: sharp@noao.edu
To: MACK@ASTRONOMICAL.COM
Cc: hschweiker@noao.edu, MATHIEU@ASTRO.WISC.EDU, ATA@ASTRO.UFL.EDU,
sharp@noao.edu
Subject: 0.9m details

I have added some drawings to the web site showing more of the mounting detail, in particular, drawing 2258.001E1, which shows the underside of one of our FSA units to which the dewar bolts. I had made a mistake earlier about the isolation: we will be providing the isolation spacer and mounting ring on the top of the dewar. There's a "conceptual" (i.e. don't design from it) AutoCAD drawing there now, but I fear most of the stuff is still PDF files scanned from the original non-AutoCAD drawings (yes, oldies but goodies). Two drawings also show the head electronics box which mounts to the side of the dewar at the end which bolts to the telescope, and is your biggest obstacle. The bolt pattern is asymmetric, but we have built interfaces with symmetric versions of the asymmetry, allowing dewars to be rotated by 180 degrees and very very occasionally 90 degrees (hard to get the bolt holes not to overlap).

As to the optical distance, I failed to pin down the designer this week and will try again next week. I am reading 4.791", which includes the effect of the Mosaic filters (12mm, various substances) and Mosaic dewar window (15mm, quartz is the best bet), but so far this is a handwritten comment on an unnumbered drawing (I'm sure we have the right stuff, I just haven't found it). I have 0.661" for this chip to the universal dewar window (including the effect of the window), and 0.189" above that to the flat mounting plate surface. Your numbers look right to me, modulo that extra 0.189 (sorry), but I will try to get the proper answer early in the week. Note that our nominal distance is 0.700" and we mount different chips which range from a little above 0.65 to nearly 0.72 from the dewar window, so we are ourselves "sloppy" in the few hundredths (don't pass this around our designers since I'm sure I'd be told off).

Unfortunately, the dewars parked at the fill station at the 2.1m don't include the mounting ring, but I should be able to find one somewhere to look at, which I suspect would help. I'm afraid I'm still trying to do this by being winsome, as I can't make official requests for answers that might take (accountable!) staff time. (It's not money Bob, there's just no people-time being allowed out: if it becomes an obstacle, Peter, then I will renegotiate with Richard about getting official support time and back-charging WIYN: we'd get a faster answer that way).

I wish I could find the interface we built (from the Mosaic corrector to one of our FSA units on a universal dewar).

Sorry. Keep bugging me ...

Nigel

0.9-m Telescope and Corrector Optical Layout

	Radius of curvature	Separation	Medium	Conic constant
Primary	-6254.496			-1.2176
Secondary	4093.9212	-1973.1061	air	-9.735
Corrector	plane	2297.6861	air	
Corrector	-310.3244	22	Silica	
Corrector	-277.1351	18.0465	air	
Corrector	plane	12	Silica	
Filter	plane	269.5265	air	
Filter	plane	4	BK7	
Window	plane	6	air	
Window	plane	6.477	Silica	
Focal Plane	plane	20	vacuum	