mode using a 12-bit A/D and no automatic background subtraction. The third mode is threshold densitometric, and yields one level of background subtracted isodensitometric data plus densitometric data within all images above that level. The fourth mode is most useful for objective prism plates and uses a previously generated map of images to digitize only areas around those images.

Software is available on the PDP-11/60 to fully reduce the isodensitometric data and display it on a 1024x1024 color image display system. Some densitometric data may be reduced using IRAF which is available on a Sun 3 with a dedicated interprocessor link to the PDP-11/60. The Sun is on the campus Ethernet and has access to the University of Minnesota Supercomputer Institute Gray 2 running UNIX.

Current projects by users include population studies in the Galaxy and nearby galaxies, proper motion studies and W-R candidate detection. Prospective users may contact us.

27.05
Further Developments of a 2-stage X-ray Detector for use in Astronomy

M. C. Weisskopf and B. Ramsey (NASA/MSFC)

The technique of multistaging has been shown to successfully eliminate the usual trade-offs in X-ray proportional counter design by providing two separate regions within the detector, one optimised for energy resolution and the other optimised for position measurement.

We present here new results detailing the excellent performance available from such a two stage detector over a wide range of operating conditions.

27.06
AXAF FLIGHT CALIBRATION

M. S. Davis (Lockheed)

The Advanced X-ray Astrophysics Facility (AXAF) is planned to be a long-term space-based X-ray observatory using a grazing-incidence telescope of 3.2 meter aperture. Scheduled for launch by NASA in the 1990's, AXAF will have 10 times the angular resolution, 100 times the imaging sensitivity, and 1000 times the high resolution spectral sensitivity of the predecessor EINSTEIN X-ray Observatory. In achieving these goals, AXAF will feature a diverse and complex set of science instruments. These instruments will require a significant amount of flight calibration efforts, complementary to calibrations accomplished prior to launch, to characterize unique instrument signatures and assist observers to make full scientific evaluations of their data.

This paper identifies those flight calibrations that have already been determined to require celestial sources, discusses their implementation, lists required source characteristics, and presents a preliminary sampling of candidate objects that appear to satisfy these calibration objectives. Early analysis in this area will allow timely incorporation of any science requirements generated by these studies into the maturing AXAF Observatory design, so as to maximize the science return of this major astronomical project.

27.07
Current Status of the High Resolution Spectrograph (HRS) for the Hubble Space Telescope

J. C. Brandt (NASA/GSFC), K. G. Carpenter (CASA/U. of Colorado & NASA/GSFC), D. Ebbets, H. Garner (BASD), S. Heap (NASA/GSFC), D. Lindler (ACC)

The Hubble Space Telescope underwent Thermal Vacuum and Thermal Balance testing and Optical Throughput Tests at the Lockheed Missiles and Space Co., Sunnyvale, CA during May and June 1986. Here, we summarize the major results of the tests and the current status of the HRS. Items covered include:

1. the lack of contamination in the HRS
2. improved estimates of HRS sensitivity, dark count, dynamic range, and spectral resolution
3. estimates of the instrumental stability
4. the discovery of a tight leak and its correction.

27.08
Thermal Vacuum Test Results for the Hubble Space Telescope High Resolution Spectrograph: I. UV Optical Throughput

K. G. Carpenter (CASA/U. of Colorado & NASA/GSFC), D. Ebbets, H. Garner (BASD), S. Heap (NASA/GSFC), D. Lindler (ACC), J. C. Brandt (NASA/GSFC)

During May and June of 1986, the Hubble Space Telescope (HST) and its five science instruments were subjected to a series of Thermal Vacuum and optical throughput tests at Lockheed Missiles and Space Company in Sunnyvale, California. One of the major goals of this test program was to check the throughput of the Optical Telescope Assembly (OTA) and each of the science instruments, using for the first time light that had traversed the entire optical system of the HST. We report in this paper the results of the Optical Throughput Tests involving the High Resolution Spectrograph (HRS). The HRS tests were designed to measure the UV transmission of the OTA, check for and evaluate any hydrocarbon-related contamination of the optics, verify that the two HRS science apertures were clear, and, if possible, improve the calibration of the HRS, especially below 1400A. The OTA ultraviolet throughput measured by HRS was within the measurement error (±28 percent) of its expected value at all wavelengths above 1400A, except in the 1500-1600A region, where the HRS measured a slightly smaller than expected value. Below 1400A, the tests provided strong evidence that the HRS sensitivity is substantially greater than previous laboratory measurements had indicated (up to a factor of 7 at 1200A). No evidence of contamination of any optical component was discovered, and both of the HRS apertures were demonstrably clear. A small light leak 45 arcsec from the actual HRS apertures, that could have caused great confusion in orbit, was discovered during these tests and will be filled with a baffle system before launch. Quantitative estimates of the OTA and HRS efficiencies in the UV, based on these tests, are presented.

27.09
Thermal Vacuum Test Results for the Hubble Space Telescope High Resolution Spectrograph: II. Scientific Performance


During the recently completed thermal vacuum test of the Hubble Space Telescope, an extensive suite of tests was performed which allowed many important performance characteristics of the High Resolution Spectrograph to be assessed. Although the TV test was not intended to produce a comprehensive calibration, the results did demonstrate that the HRS meets or exceeds all of the specifications required to carry out its scientific mission. This paper will highlight results which demonstrate the quality of the science data and which have a direct bearing on the planning and interpretation of observations. The dark count rate in both detectors is less than 3x10^4 cts/diode sec, which corresponds to about 1 count per resolution element per orbit. The dead-time in the pulse-counting electronics is approximately 10.4 μsec, allowing count rates up to 150000 cts/diode sec to be photometrically corrected. The useful dynamic range of the digicons is thus greater than 10^4. The optical image quality is superb in all spectroscopic modes. The instrumental line spread