

IUE TELESCOPE OPERATIONS NEWS

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DR. GYRO RETURNS

We received many positive comments about Dr. Gyro's column in the last newsletter. The eminent professor of IUEology has told us that he would be willing to answer any questions about IUE that our Guest Observers would like to send in, concerning anything from the satellite to image processing to IUE trivia. Please send your questions to Dr. Gyro in care of Cathy Imhoff, and we will see that he receives them.

NEW "HOT OBC" BETA ZONE DEFINED

A recent analysis by the IUE Operations Control Center (OCC) has refined the estimates of the "hot OBC" beta zone. The new zones for each month are, in general, smaller than previously thought. This should permit greater flexibility in scheduling and obtaining IUE observations. (See the report by Imhoff in this issue, also the revised discussion in the IUE Project Policies and Procedures guidebook, which is reprinted in this newsletter.)

NEW FES REFERENCE POINT

The new FES reference point was implemented at Goddard on January 22, 1990. The new reference point, which is located at $x = -144$, $y = -176$, will avoid the "fatigue spot" at the old reference point $(-16, -208)$. This should help in acquiring faint sources and should improve the photometric quality of the FES measurements. Observers who use offset reference points and FES magnitudes should be aware of this change.

The FES counts for stars observed in overlap mode appear to be roughly 20 percent higher than recent measurements taken at the old reference point ($x = -16$, $y = -208$). A more precise measurement of the photometric differences between the two reference points will be made and published in the newsletter.

VILSPA has not yet implemented the new reference point. This is awaiting delivery of a corrected version of our command procedure software set.

NEW DISPLAY PAGES

Recent observers may have noticed that the displays used by the Telescope Operators during observing shifts have been substantially modified. These changes were made to permit more information to be quickly available to the staff and to display information on both FESs, needed for the one-gyro control system. GOs may wish to check where useful information, such as the current radiation background, camera image number, and exposure time, is now located on the new display pages.

SOLAR PROTON STORMS

Last fall IUE was subjected to several very intense solar proton storms, apparently as a result of the very high solar maximum in progress. Several shifts were affected when the proton radiation background affected the cameras, even during the normally low radiation shifts. Extremely high proton fluxes were found to "fog" the cameras much the way that the electrons trapped in the Van Allen belts affect the cameras during the US2 shifts. In addition, the images were speckled with proton "hits".

We have performed some analysis of the radiation effects on the cameras and found that only very high proton fluxes cause measurable effects. For some reason, the LWP is 3 times as sensitive to the proton flux as the SWP. Fortunately extreme proton events have been rare, even during this solar maximum.

Reports on the proton storms and on the current solar maximum, contained in this newsletter, describe the storms and their effects on IUE's detectors in more detail.

EXPANDING IUE'S BETA RANGE

The IUE staff have continued to look for ways to counter the gradual loss of the upper and lower beta range for science observations as the solar arrays degrade. The OCC has been looking into ways of reducing the power required to run the satellite. They have been in frequent contact with the battery engineers to evaluate battery performance. The Telescope Operations staff have also been exploring ways of working around IUE's power constraints.

Saving power by turning off mirror heaters: We have frequently found it necessary to observe at the highest possible beta which is power positive. To do this, the TO may turn the primary mirror heaters off. Over a several hour period, the telescope focus drifts to very negative values. We have performed some preliminary tests which indicate that the focus at the cameras (i.e. the spectrum point-spread function) is actually somewhat better at lower focus step values. However the focus at the aperture plate, as viewed by the FES, is degraded. This could affect acquisitions and, in the worst case, result a loss of light through the apertures. Additional tests are planned to check on these potential effects.

Using VHF support: In some cases, we have found that we can extend the observable beta range using the VHF backup system. The VHF system uses less power than the normal S-band system, and can thus be used at higher and lower betas. However the VHF transmission rate is 4 times slower than required for camera reads and preps. Thus VHF can be used only to acquire a target and obtain an exposure. Then the spacecraft must be slewed to a target in the normal power positive range so that the S-band transmitter can be used for the read and prep. Because of the extra overhead required and the cycling of the antennas, this is most suitable for obtaining only one or two exposures during a shift. This would not be suitable for repeated observations of a target at a beta which requires VHF support. In addition, VHF support is not normally available and so must be scheduled in advance.

GOs who need to observe at marginal betas should consult with the RAs. If requested a few weeks in advance, it is usually possible to schedule the VHF support. To some extent, last minute requests can be handled. However if the VHF support has already been scheduled for another satellite, it is not available to IUE.

Currently the normal power positive range is about 33 to 106 degrees in beta, assuming that no mirror heaters are in use. This range varies with spacecraft power load (camera scanning, heaters on...) and is thus rather difficult to predict in advance. Using VHF, exposures can generally be obtained at betas as low as 28 and as high as 113. Of course these beta ranges are expected to shrink slowly with time as the solar arrays degrade. Please check with the RAs for the latest information on beta ranges.

New requirements for power negative observations: Advance approval for power negative observations has been required for some time, so that the observations can be scheduled to minimize impact on other GOs and so that the number of battery discharges can be kept within allowed limits. In addition, it is now necessary to schedule a backup tracking station to support power negative observations. This has become necessary because IUE no longer has on-call backup NASA tracking stations available. Backup support can usually be scheduled through the Santiago or VILSPA stations if arranged in advance. Thus this new requirement should have no impact except on last minute requests for targets-of-opportunity.

A SUCCESSFUL STRATEGY: THE RECENT CHANGES TO THE OBC HEATING RESTRICTIONS

Last year the IUE Project implemented new on-board computer (OBC) heating restrictions. The new directive permits longer observations when the OBC is hot (55.8 C) and thus gives GOs somewhat more flexibility in planning their observations. However after a prolonged heating period, the spacecraft must be slewed to a low beta to cool the OBC. In addition, the use of the OBC "halt" instruction was implemented to reduce power consumption and OBC heating.

The new policy and use of the "halt" instruction have been very successful so far. During the winter months, when OBC heating is particularly a problem, it was necessary to slew away to cool the OBC only about four times. This is a significant improvement over the winter months a year ago, when cooling the OBC was required every couple of days or so.

GYROS HANG TOUGH

Various rumors have been flying about the gyros, so here are the facts. Gyro 5, one of the two remaining gyros, has had a large drift rate for the last three years. That rate has gone up in the last year. Exactly what this means so far as the health of the gyro is not clear. The Operations Control Center (OCC) has examined what the drift rates of all the gyros have been since the launch of IUE. There is some tendency for a gyro's drift rate to go up, then come back down again, prior to a failure. However it is also known that each gyro failure has appeared to have a different cause - an electronics failure in one case, a sudden "seizing up" in another. Thus there is little reason why the gyro drift rate should indicate that a failure is imminent. If it does have any relevance, we can take some consolation that this pattern of rising and falling drift rate seems to occur over a couple of years, and Gyro 5's rate is still ascending and has not yet "turned over".

There are two things that we are sure of: (1) some day a gyro will fail, and (2) we will be ready with a one-gyro backup mode!

For those interested in IUE trivia, Gyro 6 failed on April 17, 1979, Gyro 1 on March 2, 1982, Gyro 2 on July 27, 1982, and Gyro 3 on August 17, 1985. In August we hope to celebrate the fifth anniversary of the two-gyro backup mode. This mode has been in use on IUE for about as long as the spacecraft itself was expected to last!

DEVELOPMENT OF THE ONE-GYRO/FSS SYSTEM

The RAs are conducting testing of the one-gyro plus FSS mode using the ground computer simulator. The primary goal is to work out the operational procedures to perform target acquisitions, which will be more complex on this system than on the two-gyro/FSS mode.

Science operations under the one-gyro mode is expected to be more complicated. Both FESs will be used, since one will be needed for pointing control while an image is collected with the other. The FESs will also be used for pointing control during acquisition as well as offset guiding during the exposures. The RAs have mapped out all the holes and slots in the aperture plate. This is necessary because, during acquisition, the star will be moving across the FES field of view. If the star falls into a slot, accurate pointing control would be lost. The locations of the various hazards will be incorporated into software used to assist in performing acquisitions.

It is expected that many checks and calculations, such as those needed to avoid the hazards in the FES field of view, will be needed during one-gyro operations. The IUE Project is studying the possible replacement of the current observing console equipment, known as the EDS. The new EDS would utilize a workstation with image display capabilities and access to on-line software tools. The improved capabilities of such a system should permit IUE to remain as efficient as possible for science observations, despite whatever limitations which may arise due to the one-gyro system or other changes. This would also reduce the problems caused by the aging EDS hardware, which experiences relatively frequent failures and is difficult to maintain.

Currently the one-gyro mode could be used to control the spacecraft in the event of a gyro failure, but some further testing would be needed before science operations could begin. Contingency plans are being made to deal with a gyro failure, including implementation plans, notification of staff members and GOs, rescheduling science programs, and so forth.

NEW TOC STAFF MEMBERS

There have been many recent changes among the TOC staff recently. Among the RAs, Chris Shrader is transferring from IUE to work on the Gamma Ray Observatory Science Support Center here at Goddard. Jim Webb has taken over Chris' scheduling duties. In addition, Bruce McCollum has joined us from the University of Michigan to become the IUE Science Scheduler. Once Bruce has learned how to juggle everyone's IUE programs, he will become our full time scheduler and will be available during the normal work week. Joining us as a new RA is Lloyd Rawley. Lloyd comes from Princeton and has worked locally on GRO, COBE, and Crustal Dynamics VLBI projects. Later this summer new RAs Cathy Mansperger and Jeff Newmark, from Ohio State and Penn State respectively, will come on board at IUE. Ron Pitts, Rich Arquilla, and Mario Perez round out the team of RAs.

Several of our TOs have moved on to other positions in support of ST and COBE, so we have several new members of the TO crew. Scott Snell, from the University of Maryland, joined us a few months ago. More recently Andy Groebner has joined us, coming from the University of Nebraska. Nancy Eaton hails from the University of Massachusetts. Tom Walker graduated from the University of Rochester and has been working at the James Clerk Maxwell Telescope in Hawaii for the past couple of years. Gwyn Fireman, Charlie Loomis, and Lyle Huber continue in the TO chair. Later this summer Lyle will be going on to graduate school at the University of New Mexico, and Gwyn will moving into new duties in IUE telescope operations.

Denise Taylor, from the University of Massachusetts, occupies the newly invented position of Telescope Operations Assistant, which means that she is available during the day to help GOs with special requests, tracking down history replays, sending out IUE documentation, and other questions and activities.

You can contact any of the TOC staff members at (301) 286-7537 or by sending e-mail to IUESOC on SPAN. A general e-mail account which may also be used is IUESOC::IUEMAIL.