CAL/FOS-043

FOS TARGET ACQUISITION HANDBOOK

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ABSTRACT

This handbook was written for the observer who must fill out Exposure Logsheets for FOS target acquisition. We summarize the different target acquisition modes and present a flow diagram which can be used to select the appropriate target acquisition according to the type of astronomical object. A table is given for calculating target acquisition exposure times, and example Logsheets and Target Lists are included at the end of the article. The handbook also includes a flow diagram which shows how to find or derive astrometric positions for different astronomical objects.

1. INTRODUCTION

The Faint Object Spectrograph (FOS) and FOS target acquisition are described in considerable detail in the *Faint Object Spectrograph Instrument Handbook* and in two STScI reports, CAL/FOS-023 and 027. In this handbook we recommend the appropriate target acquisition method as a function of target type and magnitude, and provide a table (Table 1) for calculating target acquisition exposure times. Our recommendations are summarized in § 2 and in a logic diagram (Figure 3) which uses the characteristics of the target to select the best method for centering the target in an FOS aperture. Each type of acquisition is described in sufficient detail to enable you to make a judgement as to how well it may work for a particular target. The descriptions of the acquisition methods also are intended to provide enough information for you to be able to fill out Exposure Logsheets during Phase II of the proposal entry process. In particular, we make recommendations on how and when to use the Wide Field and Planetary Camera (WF/PC) to assist FOS acquisitions. Sample logsheets are provided for each type of acquisition. We also include a flow diagram (Figure 4) which is meant to help you decide how to derive astrometric coordinates for your targets.

Three onboard acquisitions (Binary Search, Peak Up/Peak Down, and Firmware), an early acquisition (WF/PC Assisted), and an interactive acquisition (Mode I Make-A-Picture) are described below. During an onboard acquisition the telescope slews to the object, performs the acquisition, calculates the small offset required to center the target in a science aperture, makes the offset, and then begins the science exposure. A TDRSS contact is not required for an onboard acquisition. In contrast, during an interactive acquisition there must be a TDRSS contact and the observer must be present at the STScI to attempt interpreting the image. Because of the considerable possibility of real time confusion when looking at an FOS white light postage stamp picture, we believe that in nearly all cases a

WF/PC assisted target acquisition will be a better scientific choice than a Make-A-Picture acquisition. However, Make-A-Picture does provide an important means of verifying after the fact where the FOS aperture was positioned on the target during a science exposure.

The FOS acquisition aperture is $4''.3 \times 4''.3$ square. In order to have a 95% chance of placing a star in this aperture, the star *must* have an RMS positional error with respect to the guide stars which is less than $1.0''$. The FOS finds the star by deflecting its electronic image along the diode array (XSTEPing) and perpendicular to the diode array (YSTEPing). The acquisition aperture is 12 diodes wide and 3 diodes high, as illustrated below. Because the diodes are larger in Y than in X ($1''.4 \times 0''.35$),the two directions are treated differently in target acquisition.

2. METHODS OF ACQUISITION

2.1 BINARY SEARCH

During a Binary Search acquisition a camera mirror on the filter-grating wheel reimages the FOS focal plane onto a Digicon. Binary Search first finds the number of stars in the $4.3'' \times 4.3''$ acquisition aperture by integrating at three different positions in the y-direction. The program locates the target in one of the three strips, measures its count rate, and then positions the target on the Y edge of the diode array. Binary Search measures the centroid in the x-direction; it then deflects the image across the diode array in the y-direction through a geometrically decreasing sequence of y-deflections until the observed count rate from the star is half that when the object is fully positioned on the diode array. *Binary search is fast and very good for point sources.*

There will be small systematic errors in Binary Search y-positions when the star is projected on a sloping background or is near the $\sim 10^{th}$ magnitude brightness limit for direct imaging with the FOS. When there are two stars aligned in the y-direction and separated by less than 2.8″ (2 diodes) the program logic finds a y-position which is in error. We have used extensive simulations of acquisitions on artificial star fields to arrive at the following guidelines when there are two stars in the aperture. Figure 2 illustrates the roll angle constraint (which is much simpler than it sounds).

1. If the separation (R) of two stars is more than 2.9″ Binary Search will work when either star is the target.

2. When the two stars are separated by less than 2.9″ *and the target is the brightest star*, Binary Search will work provided the following conditions are satisfied:

$$0.45'' \leq R \leq 2.9''$$

$$\Delta m \geq 1$$

$$PA + sin^{-1}(0.45''/R) \leq PPA \leq PA + 180 - sin^{-1}(0.45''/R)$$

or

$$PA + 180 + sin^{-1}(0.45''/R) \leq PPA \leq PA - sin^{-1}(0.45''/R)$$

   where PA is the position angle of the line connecting the two stars and PPA is the permitted position angle of the FOS y-direction projected onto the sky. A Special Requirement **ORIENT**, which specifies the mean PPA and the range of acceptable values, must be included on the Exposure Logsheet.

3. If the conditions in 1) and 2) are not satisfied, a WF/PC assisted target acquisition should be used to acquire the target.

Complex targets can be acquired with Binary Search by first acquiring a nearby isolated star (the "offset star") and then offsetting to the target. This procedure will succeed with 95% confidence if the 1σ uncertainty in the position of the target relative to the offset star is less than D/4, where D is the diameter of the science aperture which will be used for the observation. When offsetting from a star to the target you must include the position of the offset star on the Target Logsheet and indicate the position of the target by using **RA-OFF, DEC-OFF,** and **FROM** relative to the offset star. A WF/PC assisted target acquisition, which is described elsewhere in this manual, is the procedure wherein the offsets from the star to the target are derived from a WF/PC image.

One final problem deserves a brief discussion, but does not require any action on the part of the observer. Because the FOS filter/grating wheel has small positioning errors the camera mirror images of the focal plane can move by a few microns from one selection of a camera mirror to the next. Consequently, when using apertures with diameters of 0.3" or smaller it is necessary to measure the projected position of the aperture on the Digicon before moving the star to the center of the aperture. This is accomplished by illuminating the FOS apertures with an LED and doing an acquisition on the illuminated aperture. This procedure, refered to as TALED, will be scheduled by the STScI whenever one of the small apertures is used, and the acquisition will show up in the data you get from the Institute.

Examples of a binary search on an offset star followed by an FOS observation of the target star, and binary search of the brighter of two stars with the roll angle constraint are given on the sample logsheets. A description of the targets is given in Table 2.

2.2 WF/PC ASSISTED TARGET ACQUISITION

We recommend using WF/PC assisted target acquisition when there will be more than two stars in the 4.3″ acquisition aperture or when there will be intensity variations across the acquisition aperture which are larger than a few percent of the mean background intensity. A WF/PC assisted target acquisition is accomplished by first measuring the positions of the target and an offset star in a WF/PC image and then (at least 2 months later) offsetting the FOS aperture onto the target after acquiring the offset star with Binary Search. Although the position of the target can be measured very accurately in the WF/PC image, the offset star is needed because there is only about a 30% chance that the same guide stars will be in the Fine Guidance Sensors (FGS's) when the subsequent FOS observations are made. With new guide stars, the 1σ uncertainty in any position is $0\overset{''}{.}3$.

The first step in a WF/PC assisted target acquisition is to use a Special Requirement on the Exposure Logsheets to specify the exposure as an EARLY ACQuisition which must be taken at least two months before the FOS observations. The camera (WFC or PC), exposure time, filter, and centering of the target in the image should be chosen such that the picture will show both the target and an isolated (no other star within $6''$) offset star which is brighter than $m_V = 20$ and more than 1 magnitude brighter than the background (magnitudes per square arcsecond). In order to insure that an appropriate offset star will be in the WF/PC image, we advise you to choose the centering of the target by measuring a plate or CCD image. The Target List should list the offset star with nominal coordinates and a comment to show that the position will be determined after the WF/PC EARLY ACQuisition image has been taken. (See example lines 4 and 5 on the Target List.) The Target List also should list the position of the offset star as **RA-OFF**, **DEC-OFF**, and **FROM** the target.

After the exposure has been taken and arrives in your mail box on tape, the next step is to get the picture onto an image display so you can i), choose an offset star, ii) measure its right ascension and declination, and iii) measure the right ascension and declination of the target relative to the offset star. We hope that by the time you must do this there will be a program in SDAS which will extract pointing and roll angle information from the WF/PC header and convert WF/PC pixels to right ascension and declination. If this program is not available, you will need to patch your WF/PC image into an astrometric catalog by measuring a common set of stars which appear in the WF/PC image and in a ground based CCD image or on a deep plate. Based on your choice of an offset star, the STScI will choose a pair of guide stars for the FOS observations which will stay in the "pickles" during the move from the offset star to the target. The probability that a suitable pair of guide stars can be found increases as the separation of the offset star and the target decreases. So, choose the offset star as close as possible to the target (but not so close as to violate the background rule in the preceding paragraph). The final step is to send the position of the offset star and the positional offsets to the STScI to update the proposal information for your succeeding FOS observations.

2.3 PEAK UP and PEAK DOWN

During Peak Up (or Peak Down) the telescope steps and integrates at a series of positions on the sky using one of the science apertures; at the end of Peak Up (or Peak Down) the telescope is pointed to the position which gave the most counts (or the least counts). Because Peak Up does not interpolate across the steps, the step size should be $\sim D/2$ when using apertures with diameters less than or equal to $0.5''$, where D is the diameter of the science aperture. A grating must be selected for Peak Up if the target is too bright for direct imaging onto the Digicons. The pattern of moves on the sky can be specified by the observer and can, for example, be a raster scan or just a series of moves in the Y direction. The default pattern is a 5×5 raster for Peak Up, or a 5 step linear scan in the Y direction for Peak Down.

Peak Up/Down is a very inefficient acquisition because a minimum of ~ 7 seconds is required for the telescope to make a step which is smaller than $1''$. Consequently, we expect this mode to be used primarily to position bright stellar sources on the bars of the occulting apertures in order to observe any surrounding nebulosity. An example of a Binary Search acquisition of a quasar followed by a Peak Down acquisition onto the occulting bar is given on lines 11, 12, and 13 of the sample Exposure Logsheets.

2.4 FIRMWARE

Firmware maps the camera-mirror image of the aperture in X and Y with small, selectable Y increments (YSTEPS). The FOS microprocessor filters the aperture map and then finds the y-positions of the peaks by fitting triangles through the data. Firmware is less efficient than Binary Search, and fails if more than one object is found in the preselected count-rate window. Firmware is more accurate than Binary Search when the target is superposed on a bright sloping background, such as the central 15″ of a typical elliptical galaxy in the Virgo cluster.

Because of the complexities of specifying parameters and supporting command loads for several types of target acquisition, *we do not plan to use Firmware acquisition* unless there are unforeseen problems with Binary Search. Consequently, Firmware is not shown in the target acquisition flow diagram.

2.5 MODE I MAKE-A-PICTURE

Make-a-Picture maps the acquisition aperture and sends the image to the ground in real time. The elongation of stars in the y-direction caused by the 1.4″ height of the diodes is removed on the ground by multiplying the picture by an appropriate matrix. After the picture has been restored the astronomer measures the position of the target in the picture. The small offset required to move the target to the center of one of the science apertures is calculated from the measured position and uplinked to the telescope; after the slew is performed the science observations begin. Because real time acquisitions add scheduling constraints (you must have a TDRSS contact) and will be inefficient (you may be puzzled by the picture), we think that Make-a-Picture will be used almost exclusively after another type of acquisition to provide a picture which shows precisely where the Telescope ended up pointing in FOS detector coordinates.

The Exposure Logsheets provide an example (lines 5 - 8) of a Binary Search acquisition of an offset star followed by an offset onto the nucleus of M81. In this example, after the science observation is made a (white light) picture of the aperture is taken by using Make-A-Picture. This image, in combination with the LED acquisition of the small science aperture, would enable the observer to determine precisely where the FOS aperture was positioned on M81.

3. RECOMMENDATIONS

The following section summarizes our advice for acquiring different types of astronomical objects based on the strengths and weaknesses of the different target acquisition methods. This advice is summarized in the logic diagrams shown in Figure 3.

3.1 POINT SOURCES

Single Stars

Stars with visual magnitudes brighter than $10^{th}mag$ are too bright for FOS acquisitions with the camera mirror. The star can be acquired by using Peak Up with one of the high dispersion gratings instead of the camera mirror. If the visual magnitude of a single star or point source is fainter than $10^{th}mag$, use Binary Search for the acquisition. Firmware can also be used to acquire stars which are fainter than $10^{th}mag$. However, because Binary Search is more efficient than Firmware and will not fail when an unexpected faint source is found, we do not intend to support Firmware unless there are unanticipated problems with Binary Search.

Stars Projected on Bright Backgrounds

Binary Search can successfully find a star projected on a uniform background provided the target acquisition integration time is long enough to give $\sim$ 300 counts from the star per y-step and the star is at least a magnitude brighter than the background surface brightness in magnitudes per square arcsecond. If the magnitude difference between the star and background is less than 1, the star can still be acquired with Binary Search by increasing the integration time. The required integration time can be found on a case by case basis by running the FOS target acquisition simulator. Alternatively, the acquisition can be accomplished by using a WF/PC assisted acquisition.

A different problem arises when the background varies across the acquisition aperture. Because the logic in the Binary Search program drives the star to the edge of the diode array by finding the position which gives half the maximum number of counts, any change in the background in the y-direction will bias the derived y-position of the star. Simulations of acquisitions of stars projected onto bright galaxies such as NGC 3379 show that the shot noise in the star will determine the accuracy (rather than the variable background), provided the star is at least 15$''$ from the center of the galaxy. If in doubt, consult with the Institute staff, who will be able to simulate acquisitions for a reasonable number of cases. If there is any doubt about the success of Binary Search, you should plan a WF/PC assisted acquisition.

Two or More Stars

When there are two stars or points sources in the target acquisition aperture Binary

Search will be successful provided the criteria listed in the discussion of Binary Search are met. If the criteria are not met you should use a WF/PC assisted acquisition. As a general remark we note that if a target has any sub-arcsecond spatial complexity whatsoever, it will be a sound scientific decision to want to see a WF/PC image of the target before the FOS exposure is made.

When there are more than two stars in the $4.3'' \times 4.3''$ aperture the success of Binary Search becomes a complicated function of magnitudes, separations, and HST roll angle. Consequently, we recommend that you use a WF/PC assisted target acquisition in this case.

3.2 DIFFUSE SOURCES AND COMPLEX FIELDS

The FOS onboard acquisition methods were designed to acquire point sources. Consequently, diffuse sources and complex fields must be observed by first acquiring a star and then offsetting to the desired position in the source. The most accurate positioning of the FOS aperture on the source will be accomplished by using a WF/PC assisted target acquisition. In many programs the interesting positions in the source will be chosen on the basis of WF/PC images. If the imaging program is planned as described in the section on WF/PC assisted TAs, the science images can be used for the acquisition.

Nebulosity Around Bright Point Sources

The optimal FOS aperture position for a bright point source surrounded by a nebulosity will depend on the distribution and brightness of the nebulosity relative to the point source. If high spatial resolution pictures show that the nebulosity has a scale length of a few tenths of an arcsecond and is relatively symmetrical around the source, the signal-to-noise ratio may be maximized by placing the stellar source on the occulting bar of one of the occulting apertures and simultaneously observing the nebulosity on both sides of the occulting bar. When using this approach, you should first use Binary Search to position the source near the center of the occulting aperture. The second step is to use a Peak Down in the y-direction to position the stellar source on the occulting bar. An example is given in lines 11, 12, and 13 of the Exposure Logsheet.

If high resolution images show that the nebulosity is rather asymmetrical, the best approach may be to observe the nebulosity with one of the small circular apertures. In that case the bright stellar source would be acquired with Binary Search followed by an offset onto the nebulosity.

4. CALCULATING EXPOSURE TIMES

Simulations and calculations show that there should be at least 300 counts in each y-step of a Binary Search acquisition exposures. The maximum number of y-steps which can be taken during Binary Search is 11. Table 1 summarizes the total exposure time for a Binary Search Acquisition, *i.e.* the time per y-step multiplied by 11, for various types of stars. ***The exposure times in Table 1 are the times which should be entered in the Exposure Logsheets.*** For Binary Search, if the total exposure time is less than 11 seconds, we recommend that you "play safe" by using 11 seconds. If you do this, remember to specify a value for the optional parameter BRIGHT which will reflect the total number of counts you expect to get. The time per exposure for a Peak Up or a Peak Down are the time for Binary Search divided by 11. The times in Table 1 do not include the overhead involved in the initial setup of parameters or the analysis time, since that overhead should not be included on the Exposure Logsheet specifications.

Table 1

Total Exposure Times for FOS Binary Search and Firmware

Detector	Type of Spectrum	Exposure Time Binary Search	Exposure Time Firmware	Exposure Time Peak Up/Down
Red	K0III Star	1.40	1.98	0.127
Red	A1V Star	0.54	0.77	0.049
Red	B3V Star	0.23	0.33	0.021
Red	ν^{-1} Power Law	0.46	0.63	0.042
Blue	K0III Star	5.29	7.50	0.481
Blue	A1V Star	1.00	1.41	0.091
Blue	B3V Star	0.31	0.44	0.028
Blue	ν^{-1} Power Law	0.70	1.07	0.064

Note: Exposure time must be multiplied by $10^{0.4(V-15)}$ seconds.

Table 2

Summary of Exposure Logsheet and Target List Examples

Target No.	Logsheet Line No.	Type	Acquisition
1-2	1-2	ONBOARD ACQ	**Binary Search** on an offset star followed by FOS observation of target star.
3	3-4	ONBOARD ACQ	**Binary Search** on the brighter of two stars with roll angle constraint set by Special Requirement ORIENT. For the blue side ORIENT (PA-90° + 8.19°)+/-($90^\circ - sin^{-1}\left(\frac{0''45}{R}\right)$). For the red side ORIENT (PA-8.19°)+/-($90^\circ - sin^{-1}\left(\frac{0''45}{R}\right)$). For this example PA=90° and $sin^{-1}\left(\frac{0''45}{R}\right) = 30^\circ$
4-5	5-8	EARLY ACQ	**WF/PC Assisted TA.** An image is taken with WF followed ≈60 days later by an onboard acquisition of an offset star identified on the WF image. A map is used to verify the field after the exposure.
6	9-10	ONBOARD ACQ	**Peak-up** on a star too bright to image with the FOS mirror.
7-8	11-13	ONBOARD ACQ	**Peak-down.** 3C-273 is acquired with onboard acquisition. Peak-down is used to center the quasar behind the bar of the aperture and a science spectrum is taken.
9	14-15	ONBOARD ACQ	**Firmware.** A variable object is revisited several times. BRIGHT and FAINT are set explicitly to allow for a wide range in possible magnitudes. A separate ONBOARD ACQ is included for each visit since new guide stars are needed.
4	8		**Make-a-picture.** This is a map taken after an observation to verify the correct position. For a real time acquisition, INT ACQ must be written in the Special Requirement column.

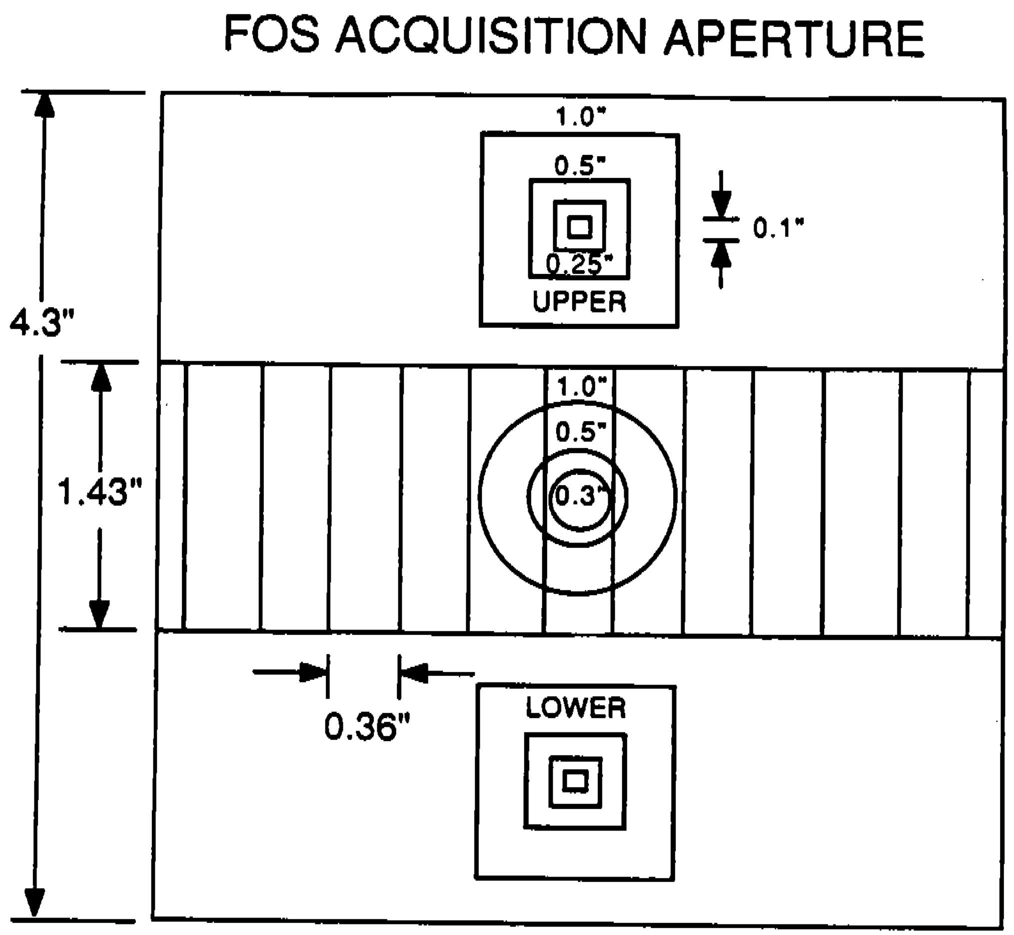


Figure 1. The FOS acquisition aperture with the science apertures overlaid. The diodes are $0''.36$ wide in the X direction, and $1''.43$ wide in the Y direction.

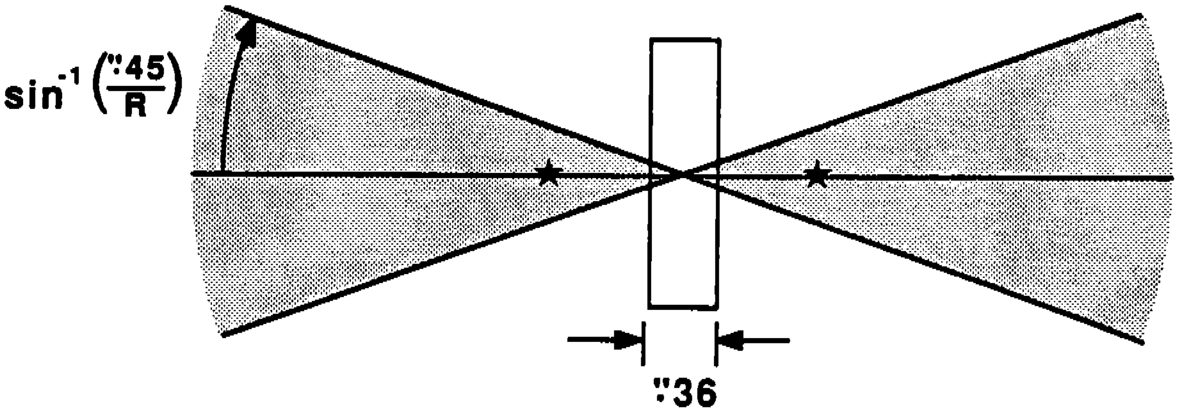
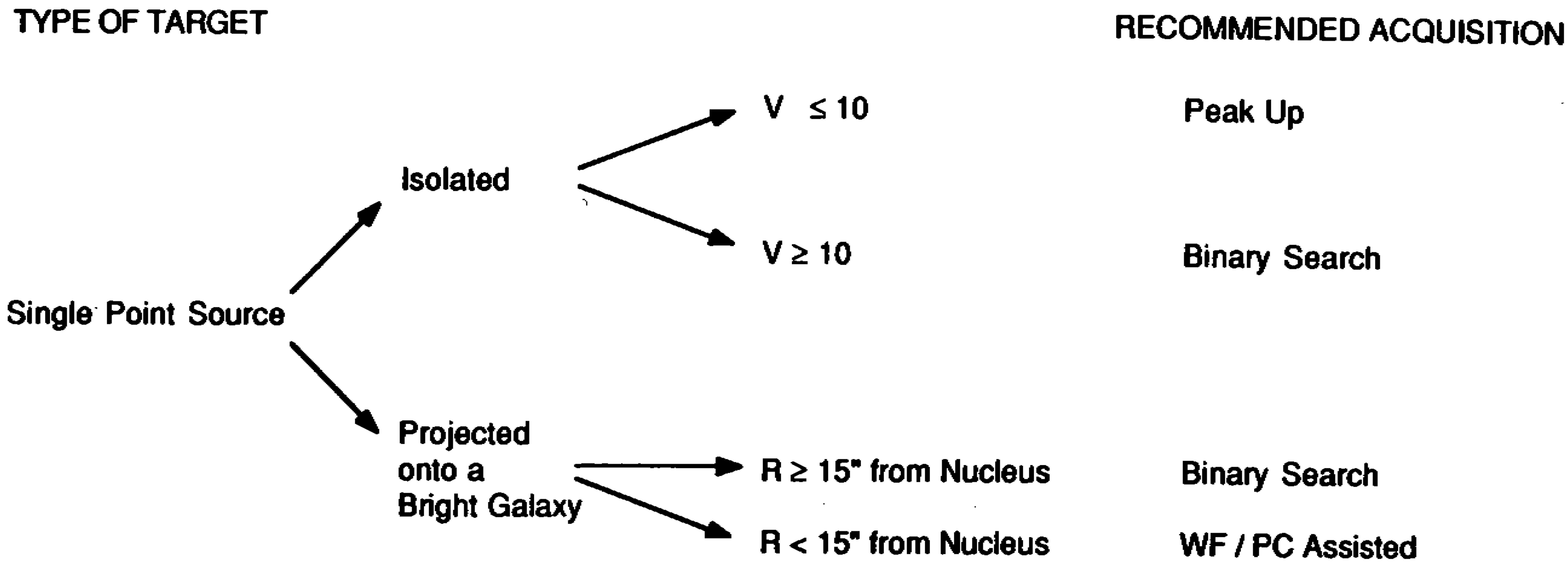
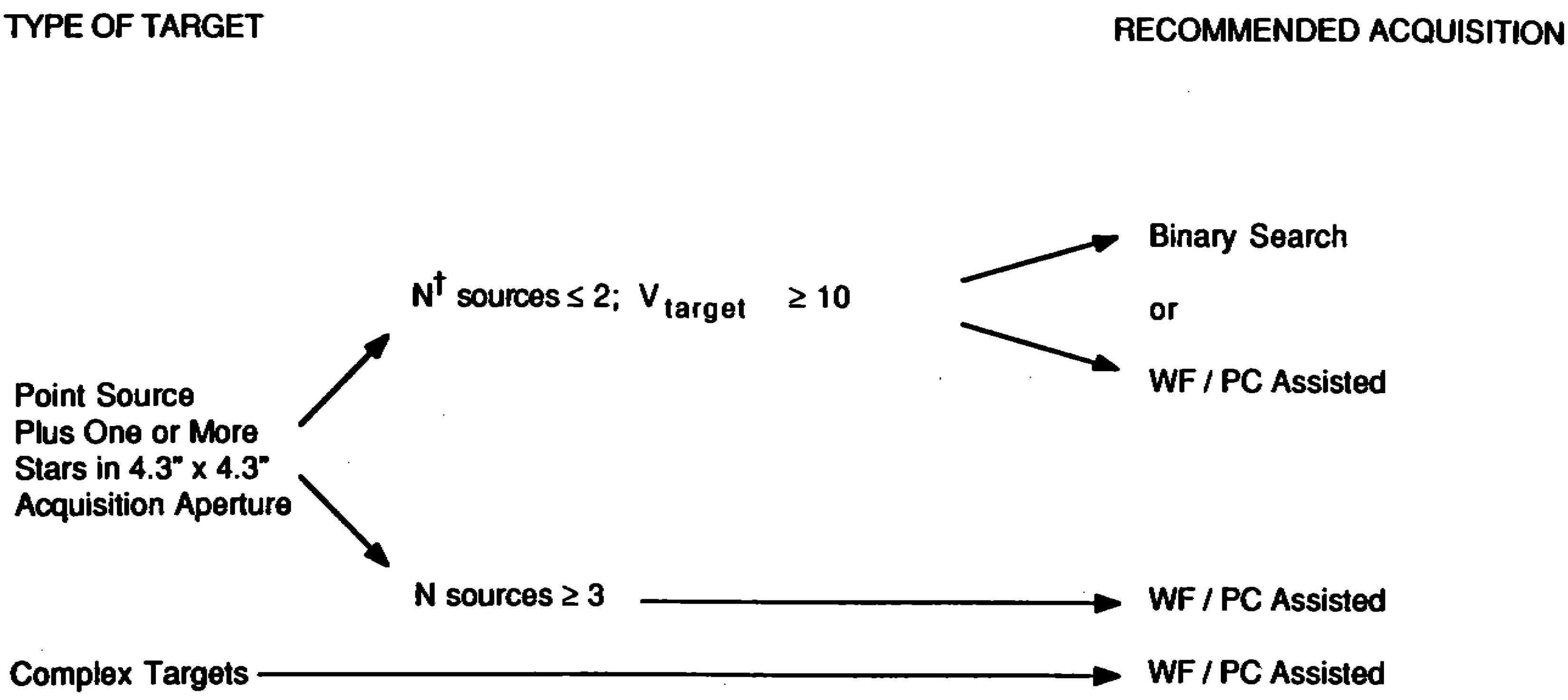


Figure 2. This diagram depicts two stars with one diode between them for scale. For an onboard acquisition the roll angle must be constrained so that the shaded region does not lie along the Y (tall) axis of the diodes.

SELECTION OF TYPE OF FOS TARGET ACQUISITION



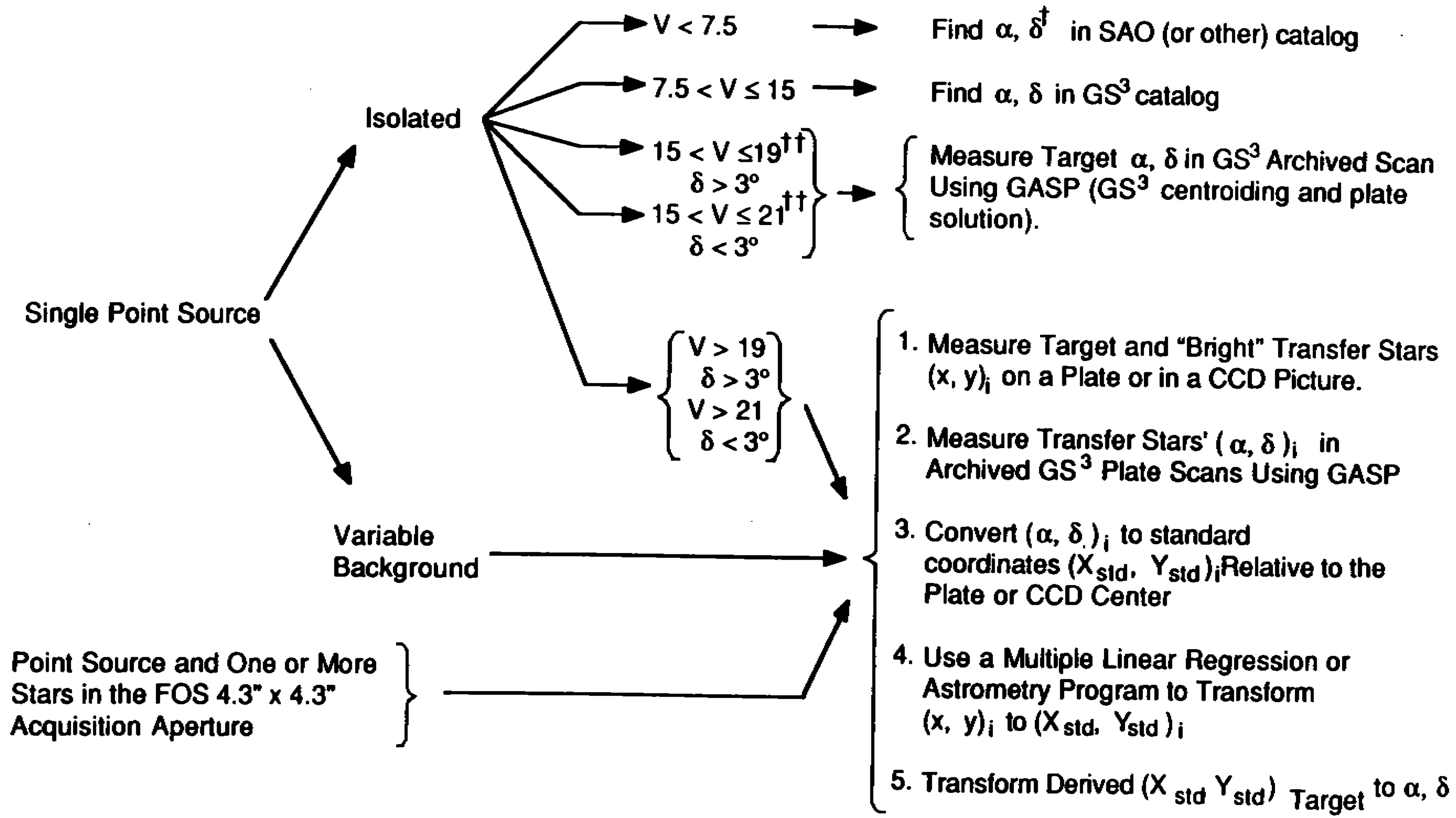


N = Total number of sources in the 4.3" x 4.3" aperture.

† The Astronomer must provide α, δ for the two stars (so a position angle can be calculated) and must specify whether the star with the largest or smallest count rate is the target.

DERIVATION OF TARGET α, δ IN THE GS^3 - J2000 COORDINATE SYSTEM

- Recommended for all acquisitions except WF / PC Assisted



† Coordinates Are Not In J2000 System

†† Positional Accuracy Will Decrease As The Plate Limit Is Approached

II. TARGET LIST a) FIXED TARGETS

PI: ______ Proposal title: ______ Page ______

List target information for fixed targets. These targets are referenced in the EXPOSURE LOGSHEET. See Instructions for explanation of columns

(1) TARGET NO	(2) TARGET NAME (include other names in parentheses)	(3) TARGET DESCRIPTION	(4) TARGET POSITION (RA, DEC, and uncertainties or offset from another target and target number from which to offset)	(5) EQUINOX FOR COORDINATES	(6) IS PROPER MOTION OR PARAL RELEV?	(7) RADIAL VELOCITY (km/s) OR RED SHIFT	(8) ACQUISITION PROBLEMS (Extended target, companion, background)	(9) SPECIAL PLATES Req	(9) SPECIAL PLATES Ava	(10) FLUX REF NO	(10) FLUX DATA (Specific format required See Instructions)
1	3C298	QUASAR	RA-OFF = 8.785' +/- 0.3", DEC-OFF = 20.9 +/- 0.3", FROM 2							1	V = 16.79, E(B-V) = 0.2
2	3C298-OFFSET	A5 STAR USED FOR OFFSET	RA = 14H 16M 30S +/- 1", DEC = +6D 42' 0 +/- 1"	1950						1	V = 15
3	HD1234	KOIII	RA = 13H 28M 16.1S +/- 2", DEC = -14D 51' 19" +/- 2"	1950						1	V = 9 +/- TYPE = KOIII, E(B-V) = .08
4	M81	SB GALAXY	RA = 9H 51M 30S +/- 10", DEC = +69D 18.3 +/- 10"	1950						1	V = 18, E(B-V) = 0.2
5	M81-OFFSET	TO BE FOUND OFFSET STAR	RA-OFF = +0' +/- 1', DEC-OFF = +0' +/- 1', FROM 4								
	COMMENT: TBD	- EARLY									
6	HR5709	OV STAR	RA = 2H 16M 28S +/- 1", DEC = +43D 51' 56" +/- 2"	1950						1	V = 15 TYPE = OV, E(B-V) = .5

II. TARGET LIST   a) FIXED TARGETS

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PI: ______ Proposal title: ______ Page ______

List target information for fixed targets. These targets are referenced in the EXPOSURE LOGSHEET. See Instructions for explanation of columns

(1) TARGET NO	(2) TARGET NAME (include other names in parentheses)	(3) TARGET DESCRIPTION	(4) TARGET POSITION (RA, DEC, and uncertainties or offset from another target and target number from which to offset)	(5) EQUINOX FOR COORDINATES	(6) IS PROPER MOTION OR PARAL RELEV?	(7) RADIAL VELOCITY (km/s) OR RED SHIFT	(8) ACQUISITION PROBLEMS (Extended target, companion, background)	(9) SPECIAL PLATES Req	(9) SPECIAL PLATES Ava	(10) FLUX REF NO	(10) FLUX DATA (Specific format required See Instructions)
7	3C273	QUASAR	RA = 12H 26M 33.2S +/- 1", DEC = +2D 19.7 +/- 1",	1950						1	V = 12.86
8	3C273-FUZZ	QUASAR HOST GALAXY	RA-OFF = +0' +/- 1', DEC-OFF = +0' +/- 1', FROM 7								
9	BLLAC	BLLAC	RA = 22H 00M 39.37S +/- 1S, DEC = + 42D 2' 8.5" +/- 1"	1950						1	V = 14.5

III. EXPOSURE LOGSHEET

PI: ______________ Proposal title: ______________ Page: ______

List all requested exposures (including acquisition and special calibrations, if any). Refer to targets from TARGET LIST. See Instructions for explanation of columns.

(1) LINE NO	(2) SEQUENCE DEFINITION OR USAGE (if relevant)	(3) TARGET NAME (from target list, principal name only)	(4) INSTRUMENT CONFIGURATION	(5) OPERATING MODE	(6) APERTURE OR FIELD OF VIEW	(7) SPECTRAL ELEMENT (specify which filter, grating, etc.)	(8) CENTRAL WAVELENGTH OR RANGE *IF GRATING OR PRISM IS USED* (Å, observer's frame)	(9) OPTIONAL PARAMETERS	(10) NO OF EXP	(11) TIME PER EXP. (h,m,or s)	(12) S/N (if relev. time if differs from exp. time)	(13) FLUX REF. NO. FOR S/N (from target list)	(14) EXP PRIO-RITY	(15) SPECIAL REQUIREMENTS (Specific format required. See Instructions)
1		3C298-OFFSET	FOS/RD	ACQ/BINARY	4.3	MIRROR			1	11S		1	3	ONBOARD ACQ FOR 2
2		3C298	FOS/RD	ACCUM	0.5	G780H	7800		1	60S	10	1	3	
3		HD1234	FOS/BL	ACQ/BINARY	4.3	MIRROR			1	11S		1	1	ONBOARD ACQ FOR 4; ORIENT 8.19D +/- 60D
	COMMENT:	ORIENTATION CAN ALSO BE 188.19D +/- 60D												
4		HD1234	FOS/BL	ACCUM	0.5	G190H	1900		1	30S	10	1	1	

III. EXPOSURE LOGSHEET

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PI: ________ Proposal title: ________ Page: ________

List all requested exposures (including acquisition and special calibrations, if any). Refer to targets from TARGET LIST. See Instructions for explanation of columns.

(1) LINE NO	(2) SEQUENCE DEFINITION OR USAGE (if relevant)	(3) TARGET NAME (from target list, principal name only)	(4) INSTRUMENT CONFIGURATION	(5) OPERATING MODE	(6) APERTURE OR FIELD OF VIEW	(7) SPECTRAL ELEMENT (specify which filter, grating, etc.)	(8) CENTRAL WAVELENGTH OR RANGE *IF GRATING OR PRISM IS USED* (Å, observer's frame)	(9) OPTIONAL PARAMETERS	(10) NO OF EXP	(11) TIME PER EXP. (h,m,or s)	(12) S/N (if relev. time if differs from exp. time)	(13) FLUX REF. NO. FOR S/N (from target list)	(14) EXP PRIORITY	(15) SPECIAL REQUIREMENTS (Specific format required. See Instructions)
5		M81	WFC	IMAGE	ALL	F606W			1	15S		1	1	EARLY ACQ FOR 6-8
6		M81-OFFSET	FOS/BL	ACQ/BINARY	4.3	MIRROR			1	11S				SEQ 6-8 NO GAP; ONBOARD ACQ FOR 7-8
7		M81	FOS/BL	ACCUM	0.3	G190H	1900		1	3000S	50	1	1	
8		M81	FOS/BL	ACQ	4.3	MIRROR			1	63S		1	1	
9		HR5709	FOS/RD	ACQ/PEAK	0.5	G570H	5700	TYPE = UP, SEARCH-SIZE =3	1	1S		1	2	ONBOARD ACQ FOR 10
10		HR5709	FOS/RD	ACCUM	0.5	G570H	5700		1	30S	20	1	2	

III. EXPOSURE LOGSHEET

PI: ______ Proposal title: ______ Page: ______

List all requested exposures (including acquisition and special calibrations, if any). Refer to targets from TARGET LIST. See Instructions for explanation of columns.

(1) LINE NO	(2) SEQUENCE DEFINITION OR USAGE (if relevant)	(3) TARGET NAME (from target list, principal name only)	(4) INSTRUMENT CONFIGURATION	(5) OPERATING MODE	(6) APERTURE OR FIELD OF VIEW	(7) SPECTRAL ELEMENT (specify which filter, grating, etc.)	(8) CENTRAL WAVELENGTH OR RANGE *IF GRATING OR PRISM IS USED* (Å, observer's frame)	(9) OPTIONAL PARAMETERS	(10) NO OF EXP	(11) TIME PER EXP. (h,m,or s)	(12) S/N (if relev. time if differs from exp. time)	(13) FLUX REF. NO. FOR S/N (from target list)	(14) EXP PRIO-RITY	(15) SPECIAL REQUIREMENTS (Specific format required. See Instructions)
11		3C273	FOS/RD	ACQ/BINARY	4.3	MIRROR			1	11S		1	1	ONBOARD ACQ FOR 12
12		3C273	FOS/RD	ACQ/PEAK	2.0-BAR	"		TYPE=DOWN	1	1S		1	1	ONBOARD ACQ FOR 13
13		3C273-FUZZ	FOS/RD	ACCUM	2.0-BAR	G570H	5700		1	3000S	15	1	1	
14		BLLAC	FOS/BL	ACQ/FIRMWARE	4.3	MIRROR		BRIGHT=20000, FAINT=20	1	16S		1	1	ONBOARD ACQ FOR 15
15		BLLAC	FOS/BL	ACCUM	0.3	G130H	1300			1500S	30	1	1	
16		BLLAC	FOS/BL	ACQ/FIRMWARE	4.3	MIRROR		BRIGHT=20000, FAINT=20	1	16S				ONBOARD ACQ FOR 17
17		BLLAC	FOS/BL	ACCUM	0.3	G130H	1300			1500S	30	1	1	AFTER 15 BY 180D +/- 1D