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WFPC2 Two-Filter Spectral Parameters for the Archive

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ABSTRACT

We derive spectral parameters "pivot wavelength" and "FWHM" for WFPC2 filters used in pairs. The archive system should incorporate these two-filter parameters to allow more accurate searches when multiple filters are present.

Introduction

The HST archive / CDBS catalog uses a filter look-up table to populate spectral parameters such as the central wavelength and bandwidth for each image. This table is presented and described in some detail at http://www.stsci.edu/hst/wfpc2/documents/wfpc2_filters_archive.html. While most WFPC2 images are taken with a single filter, it is possible to use two filters simultaneously. Typical examples are pairings of a spectral filter with a polarizer, and the use of low-pass filters to restrict the bandpass of other filters. The current archive system, however, only looks at the first filter in the header when setting the spectral parameters – any second filter is ignored. This can lead to obvious problems when conducting archive searches. For example, if a polarizer and narrow filter are used together, the current system may report only the polarizer, which has a very broad spectral response (FWHM ~ 4600A), and completely ignore the narrow band filter which effectively defines the true bandpass. Similar large errors can occur if low-pass filters are used together with other filters. We therefore recommend modifying the archive system to accurately include the second filter, when present. Here in we derive and provide spectral parameters WFPC2 filter pairs.

Calculation of Parameters for Filter Pairs

We began this exercise by generating a list of all filter pairs currently utilized in the WFPC2 data archive. We then added additional pairings that we felt might possibly be used during the remaining months of the WFPC2 mission. This led to the list of filter pairs given in Table1.

In many cases the spectral parameters were computed using the BANDPAR task in the SYNPHOT package. For consistency with the current single-filter table, we chose to use the SYNPHOT "PIVWV" (pivot wavelength) for the central wavelength, and "FWHM" for the filter width. A complication is that the results are sometimes dependent on the wavelength limits chosen for the integration in BANDPAR, so to minimize these uncertainties, we chose to integrate only over the wavelength range between PIVWV-(2*FWHM) and PIVWV+(2*FWHM). The multiplier "2" was chosen, since it extends the integration well past the nominal bandpass, and appeared to accurately reproduce parameters in the single-filter table on the website noted above. In detail, the calculation becomes an iterative process: an initial guess is made for the PIVWV and FWHM, the wavelength limits are calculated and implemented using GENWAVE, then BANDPAR is run to generate new values of PIVWV and FWHM, and then the process is iterated. Iterations continue until the parameters cease to change by more than 0.5 Angstroms. The script "filter.cl" below was used for each iteration of the calculation.

```
procedure filter (modef, piv, bw)
# to run:
# stsdas
# hst
# syn
# task filter = "filter.cl"
string modef  {prompt = "Mode?"}
real   piv {prompt = "Pivot?"}
real   bw {prompt = "FWHM?"}
# example:
# modef = wfpc2,3,f122m,f130lp
# pivot = 5000
# bw = 2000
begin
real lower,upper,delta
lower=max(piv-2*bw,1)
upper=piv+2*bw
```

```
delta=1.
print (lower, upper, delta)
!rm wavexxxx*.tab
genwave("wavexxxx1.tab",lower,upper,delta)
bandpar (modef,photlis='pivwv,fwhm',wavetab='wavexxxx1')
end
```

In cases where a very broad filter was crossed with a very narrow one (e.g. POLQ x F502N), the values for the narrow band filter were simply re-used and copied from the single-filter table. For other cases where the bandpass has a very irregular shape, or has multiple peaks (e.g. F300W x F814W), or is not adequately constrained (FQCH4N x POLQ), we set the spectral parameters to "NULL."

Results and Conclusion

The results are given below in Table 1. While we give only one permutation of the filter names here, the results would be identical for the opposite permutation (e.g. identical for F1042M x F437N and F437N x F1042M). The archive should be able to support both permutations, as either may occur in the data headers.

Table 1. WFPC2 Two-Filter Spectral Parameters

FILTER1	FILTER2	PIVWV (A)	FWHM (A)
Standard and Low-Pass Filters:			
F1042M	F437N	NULL	NULL
F122M	F130LP	1434	486
F122M	F437N	4369	25
F122M	F439W	4285	468
F122M	F450W	4458	959
F122M	F487N	4865	26
F122M	F555W	5361	1227
F122M	F606W	5940	1535
F122M	F622W	6174	922
F122M	F658N	6591	28
F122M	F675W	6736	887
F122M	F814W	8335	1576

F130LP	F160BW	1550	447
F160AW	F122M	NULL	NULL
F160BW	F165LP	1817	238
F160BN15	F165LP	1817	238
F160BW	F185W	1841	201
F160BW	F450W	NULL	NULL
F160BW	F606W	NULL	NULL
F160BW	F814W	NULL	NULL
F170W	F450W	NULL	NULL
F170W	F606W	NULL	NULL
F170W	F814W	NULL	NULL
F185W	F450W	NULL	NULL
F185W	F606W	NULL	NULL
F185W	F814W	NULL	NULL
F218W	F450W	NULL	NULL
F218W	F606W	NULL	NULL
F218W	F814W	NULL	NULL
F255W	F450W	NULL	NULL
F255W	F606W	NULL	NULL
F255W	F814W	NULL	NULL
F300W	F336W	3284	340
F300W	F450W	NULL	NULL
F300W	F606W	NULL	NULL
F300W	F814W	NULL	NULL
F336W	F450W	3684	171
F336W	F606W	NULL	NULL
F336W	F814W	NULL	NULL
F555W	F606W	5562	1055
F791W	F814W	7901	1194
Polarizers:			
F300W	POLQ	3042	753
F300W	POLQN33	3042	753
F300W	POLQN18	3042	753
F300W	POLQP15	3042	753
F336W	POLQ	3355	374
F336W	POLQN33	3355	374
F336W	POLQN18	3355	374
F336W	POLQP15	3355	374
F375N	POLQ	3732	24

F375N	POLQN33	3732	24
F375N	POLQN18	3732	24
F375N	POLQP15	3732	24
F390N	POLQ	3888	45
F390N	POLQN33	3888	45
F390N	POLQN18	3888	45
F390N	POLQP15	3888	45
F410M	POLQ	4087	147
F410M	POLQN33	4087	147
F410M	POLQN18	4087	147
F410M	POLQP15	4087	147
F439W	POLQ	4308	475
F439W	POLQN33	4308	475
F439W	POLQN18	4308	475
F439W	POLQP15	4308	475
F469N	POLQ	4694	25
F469N	POLQN33	4694	25
F469N	POLQN18	4694	25
F469N	POLQP15	4694	25
F487N	POLQ	4865	26
F487N	POLQN33	4865	26
F487N	POLQN18	4865	26
F487N	POLQP15	4865	26
F502N	POLQ	5012	27
F502N	POLQN33	5012	27
F502N	POLQN18	5012	27
F502N	POLQP15	5012	27
F547M	POLQ	5481	482
F547M	POLQN33	5481	482
F547M	POLQN18	5481	482
F547M	POLQP15	5481	482
F555W	POLQ	5449	1230
F555W	POLQN33	5449	1230
F555W	POLQN18	5449	1230
F555W	POLQP15	5449	1230
F606W	POLQ	6034	1535
F606W	POLQN33	6034	1535
F606W	POLQN18	6034	1535
F606W	POLQP15	6034	1535

F656N	POLQ	6564	21
F656N	POLQN33	6564	21
F656N	POLQN18	6564	21
F656N	POLQP15	6564	21
F673N	POLQ	6732	47
F673N	POLQN33	6732	47
F673N	POLQN18	6732	47
F673N	POLQP15	6732	47
F675W	POLQ	6757	882
F675W	POLQN33	6757	882
F675W	POLQN18	6757	882
F675W	POLQP15	6757	882
F814W	POLQ	8139	1591
F814W	POLQN33	8139	1591
F814W	POLQN18	8139	1591
F814W	POLQP15	8139	1591
Quad Filters:			
FQUVN	F1042M	NULL	NULL
FQUVN	FR418N18	NULL	NULL
FQCH4N	POLQ	NULL	NULL
FQCH4N	FR680N	NULL	NULL
FQCH4N	FR680N18	NULL	NULL
FQCH4N	FR680N33	NULL	NULL
FQCH4N	FR868N	NULL	NULL
Linear Ramp Filters:			
F375N	FR418N	3732	24
F375N	FR418N18	3732	24
F375N	FR418N33	3732	24
F375N	FR418P15	3732	24
F390N	FR418N	3888	45
F390N	FR418N18	3888	45
F390N	FR418N33	3888	45
F390N	FR418P15	3888	45
F437N	FR418N	4369	25
F437N	FR418N18	4369	25
F437N	FR418N33	4369	25
F437N	FR418P15	4369	25
F469N	FR418N	4694	25
F469N	FR418N18	4694	25

F469N	FR418N33	4694	25
F469N	FR418P15	4694	25
F487N	FR533N	4865	26
F487N	FR533N18	4865	26
F487N	FR533N33	4865	26
F487N	FR533P15	4865	26
F502N	FR418N	NULL	NULL
F502N	FR533N	5012	27
F502N	FR533N18	5012	27
F502N	FR533N33	5012	27
F502N	FR533P15	5012	27
F588N	FR533N	5894	49
F588N	FR533N18	5894	49
F588N	FR533N33	5894	49
F588N	FR533P15	5894	49
F631N	FR680N	6306	31
F631N	FR680N18	6306	31
F631N	FR680N33	6306	31
F631N	FR680P15	6306	31
F656N	FR680N	6564	22
F656N	FR680N18	6564	22
F656N	FR680N33	6564	22
F656N	FR680P15	6564	22
F658N	FR680N	6591	29
F658N	FR680N18	6591	29
F658N	FR680N33	6591	29
F658N	FR680P15	6591	29
F673N	FR680N	6732	47
F673N	FR680N18	6732	47
F673N	FR680N33	6732	47
F673N	FR680P15	6732	47
F953N	FR868N	9545	53
F953N	FR868N18	9545	53
F953N	FR868N33	9545	53
F953N	FR868P15	9545	53