THE STDPSF FORMAT: A SIMPLE WAY TO STORE SPATIALLY VARIABLE EMPIRICAL PSFs

The PSFs provided here are be stored in what we will call the "standard" PSF format. The goal of this format is to store spatially variable PSFs in flexible format that can be used for all detectors.

The `STDPSF` format is a simple 3-dimensional `real*4` `fits` image. The first two dimensions are 101 and 101, corresponding to the ×4-supersampled (Δx, Δy) domain of the PSF extending from –12.5 to 12.5. The third dimension is `NAXIS3` = N_{PSFs} = $N_x \times N_y$, where N_x and N_y are the numbers of fiducial PSFs along x and y, respectively, and are stored in keywords `NXPSFs` and `NYPSFs`. There is space for up to ten fiducial PSFs along x and y, and the locations of these fiducial PSFs in the image frame are given by keywords `IPSFX01` through `IPSFX10` for x and `IPSFY01` through `IPSFY10`. The values of 9999 below simply mean that there is no fiducial PSF for that slot.

The lines below show the typical header for a STDPSF format image for WFC3/IR:

```
SIMPLE  =                    T      JPSFY01 =                    0
BITPIX  =                  -32      JPSFY02 =                  512
NAXIS   =                    3      JPSFY03 =                 1014
NAXIS1  =                  101      JPSFY04 =                 9999
NAXIS2  =                  101      JPSFY05 =                 9999
NAXIS3  =                    9      JPSFY06 =                 9999
DATE    = '2016-03-31'              JPSFY07 =                 9999
TIME    = '17:12:14'                JPSFY08 =                 9999
BSCALE  =               1.0000      JPSFY09 =                 9999
BZERO   =               0.0000      JPSFY10 =                 9999
NXPSFs  =                    3      COMMENT THIS PSF IS FOR WFC3/IR F105W
NYPSFs  =                    3      COMMENT IT WAS CONSTRUCTED FROM PID-13606 DATA
IPSFX01 =                    0      COMMENT OF THE OUTSKIRTS OF OMCEN ON DEC 13, 2013
IPSFX02 =                  512      END
IPSFX03 =                 1014
IPSFX04 =                 9999
IPSFX05 =                 9999
IPSFX06 =                 9999
IPSFX07 =                 9999
IPSFX08 =                 9999
IPSFX09 =                 9999
IPSFX10 =                 9999
```

In general, we read the 101×101×`NAXIS3` PSFs (Ψ_{3D}) into the four-dimensional Ψ_{4D} array using: Ψ_{4D}(*,*,NXPSF,NYPSF) = Ψ_{3D}(*,*,N3), where N3 = NXPSF + (NYPSF-1)*NXPSFs. To use the PSF, we can either extract a full 101×101-gridpoint PSF appropriate for a given location in an image (Ψ_{xy}), or we could interpolate the entire four-dimensional array every time we need to evaluate the PSF: $\psi(\Delta x,\Delta y;x,y)$. Appendices B through C of WFC3/ISR 2016-12 provide FORTRAN routines that perform the of `STDPSF` files. These one-page routines could very easily be translated into PYTHON or whatever code is needed.