TSR 2011-4: Comparison of Synphot and Pysynphot Bandpar Functionality

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COMPARISON OF SYNPHOT AND PYSYNPHOT BANDPAR FUNCTIONALITY

Abstract

Pysynphot attempts to replicate much of the functionality of the Synphot bandpar utility but sometimes uses different formulae and algorithms. This TSR collects the calculations used in Pysynphot, Synphot, the formulae described in the Synphot Manual in Section 5.1 on page 42, and the formulae in the Synphot help files.

RMS WIDTH - BANDW - PHOTBW

2.1 Summary

This value is added to image headers in the PHOTBW keyword.

Pysynphot

- *Function name*: SpectralElement.rmswidth
- *Source code*: spectrum.py
- *References*: *3 page 836*

Synphot

- *Bandpar name*: BANDW
- *Function name*: rmslam called by comppar called by **'bandpar'**_.
- *Source code*: rmslam.x
- *References*: *1 sections 5.1,7.1*, *2*

2.2 Synphot Equations

The Synphot Manual section 5.1 gives the equation for RMS bandwidth as

$$\lambda_{rms}^2 = \bar{\lambda}^2 \frac{\int P_\lambda \ln(\lambda/\bar{\lambda})^2 \, d\lambda/\lambda}{\int P_\lambda \, d\lambda/\lambda}$$

where

$$\bar{\lambda} = \exp\left[\frac{\int P_\lambda \ln(\lambda) \, d\lambda/\lambda}{\int P_\lambda \, d\lambda/\lambda}\right].$$

The Synphot function rmslam does appear to implement this procedure for calculating the RMS width of the bandpass. The source code references the WF/PC-1 Instrument Handbook as the source of the equation for RMS width and references Schneider, Gunn and Hoessel (1983 ApJ 264,337) as the source for the equation for mean wavelength.

A copy of the WF/PC-1 Instrument Handbook could not be found so it has not been verified that the Synphot code faithfully reproduces whatever may be documented there.

The bandpar help file gives the same equations as above for the RMS width but the Synphot Manual in section 7.1 gives different equations when describing bandpar. The equations in section 7.1 are the same as used by Pysynphot, shown below.

2.3 Pysynphot Equations

The Pysynphot rmswidth source code references Koornneef et al 1987, page 836 as the source for its RMS width calculation, which is

$$\lambda_{rms}^2 = \frac{\int P_\lambda (\lambda - \bar{\lambda})^2 \, d\lambda}{\int P_\lambda \, d\lambda}$$

where

$$\bar{\lambda} = \frac{\int \lambda P_\lambda \, d\lambda}{\int P_\lambda \, d\lambda}.$$

REFERENCES

1. Synphot Manual: http://stsdas.stsci.edu/stsci_python_epydoc/SynphotManual.pdf

2. Schneider, Gunn and Hoessel (1983 ApJ 264,337)

3. Koornneef et al., 1987