README for HST Catalog for Lennon F1 2j Field

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Overview

This proper motion catalog is for the F1-2j pointing of the Lennon program (GO-12915, 13771). It contains 2 epochs of observations obtained in 2012 and 2015.

Several columns are 2D; they have 2 entries for each row. For these columns, the first value is for the 2012 epoch and the second value is for the 2015 epoch.

Following Hosek+22, the final astrometric uncertainties are the original HST measurement uncertainties and the transformation uncertainties (calculated via bootstrap) added in quadrature.

Reference Frame: Gaia EDR3

Astrometry is aligned into an absolute reference frame (ICRF) using Gaia EDR3, using 28 Gaia reference stars.

Positions are reported **in angular de-projected units** relative to the following position:

RA: 17:45:32.12
DEC: -28:56:12.66

Calculating Positions in RA/DEC

To calculate the RA/DEC positions of the stars in the catalog, one needs to project the positions onto the celestial sphere. In other words, the RA_0 position offsets in the catalog are actually RA * cos(DEC). No correction for projection is needed in the DEC direction. So:

RA = RA_zp + (RA_0 / cos(DEC))
DEC = DEC_zp + DEC_0

Where RA_zp, DEC_zp is the position noted above and RA_0, DEC_0 are the positions in the catalog. Remember that the catalog positions are in units of arcsecs.

Column Definitions

These don't describe every column, but these are most of them and the others can be ignored.

name: star name
x: The X position of the star in the Gaia frame in each epoch (arcsecs)
y: The Y position of the star in the Gaia frame in each epoch (arcsecs)
m: The *instrumental* magnitude of the star in each epoch
xe: Error in x from HST measurements only (arcsecs)
ye: Error in y from HST measurements only (arcsecs)
me: error in m (mag)

F139M_ave: average F139M across both epochs, converted to Vega mags (see note below)

Name_in_list: array with the star-names in each individual starlist

t: time of each of the entries in each 2D column

x_orig: The X position of the star in each epoch (HST pixels)
y_orig: The Y position of the star in each epoch (HST pixels)
xe_orig: The X position error of the star from HST measurements only (HST pixels)
ye_orig: The Y position error of the star from HST measurements only (HST pixels)

Use_in_trans: boolean array indicating if star was designated as a reference star
Used_in_trans: array of booleans indicating which stars were actually used as references for each epoch (since not all reference stars detected in each epoch)

N_detect: number of epochs the star was detected in across all epochs

Xe_align_abs: bootstrap trans error in xpos (arcsecs)
Ye_align_abs: bootstrap trans error in ypos (arcsecs)

Xe_final_abs: combined xpos absolute error (xe and xe_align_abs combined in quadrature; arcsecs)
Ye_final_abs: combined ypos absolute error (ye and ye_align_abs combined in quadrature; arcsecs)

X0_final: x0 from linear proper motion fit (xe_final_abs used; arcsecs)
Y0_final: y0 from linear proper motion fit (ye_final_abs used; arcsecs)
Vx_final: vx from linear proper motion fit (xe_final_abs used; arcsecs/yr)
Vy_final: vy from linear proper motion fit (ye_final_abs used; arcsecs/yr)
t0_final: t0 of linear proper motion fit (decimal years)

X0e_final: formal error on x0_final from PM fit (arcsecs)

Y0e_final: formal error on y0_final from PM fit (arcsecs)
Vxe_final: formal error on vx_final from PM fit (arcsecs/yr)
Vye_final: formal error on vy_final from PM fit (arcsecs/yr)

N_vfit_final: number of epoch used in proper motion fit

Additional Information

Photometric Zeropoints

Photometry is measured using Jay Anderson's KS2 code. Since it is PSF-fit photometry (3x3 pixel box), the photometric zeropoints are not necessarily equal to the "infinite aperture" or "0.4" aperture" zeropoints published by STSci. So, we need to derive new zeropoints for the photometry.

The KS2 photometric zeropoint for the F139M filter was derived by Hosek+18 (see their Figure 3 and associated text). To apply this:

Vega_mag = instrument_mag + ZP

ZP_F139M = 23.2835