

Study of NICMOS Non-linearity

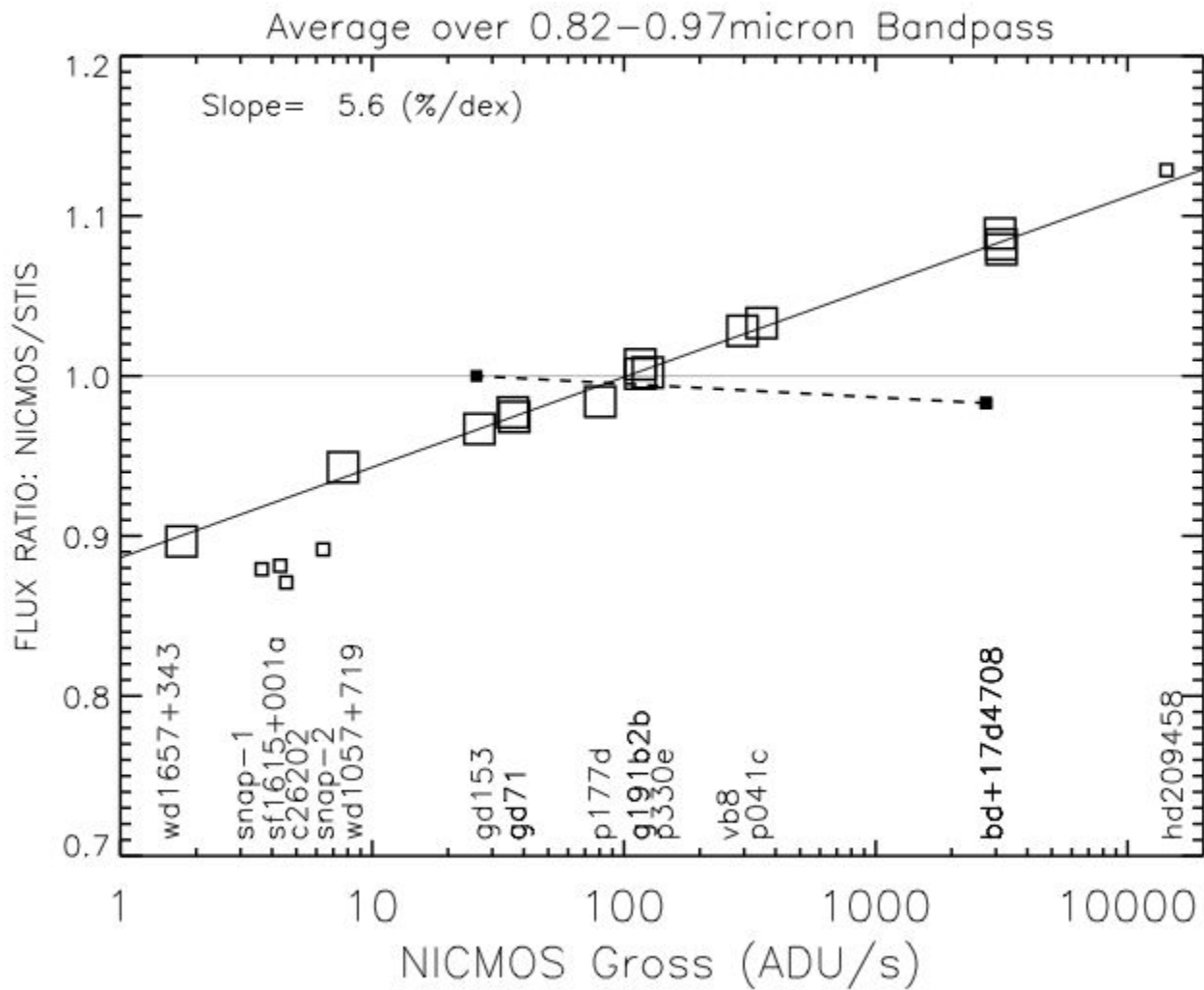
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S.Arribas, E.Bergeron, R.Bohlin,
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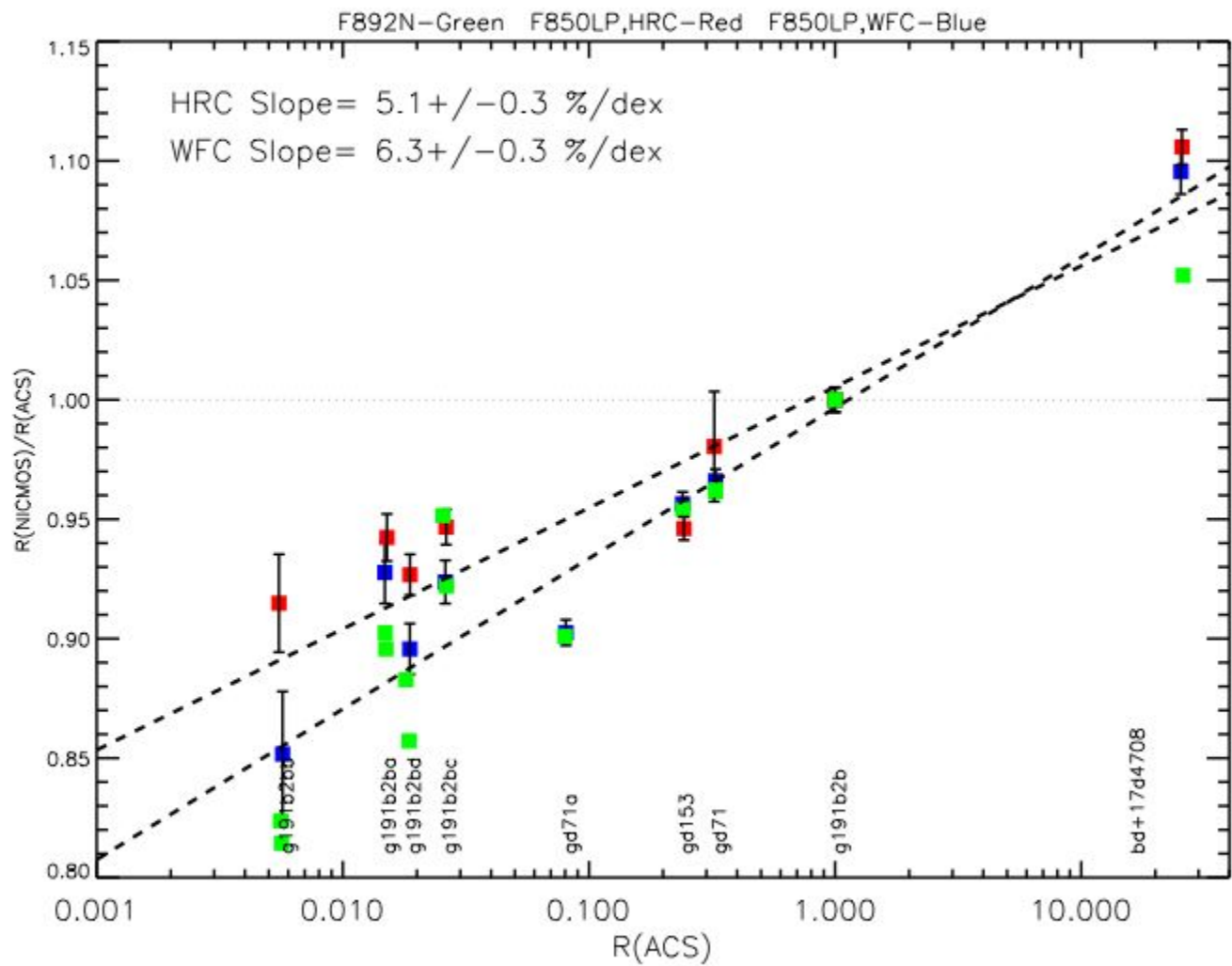
History

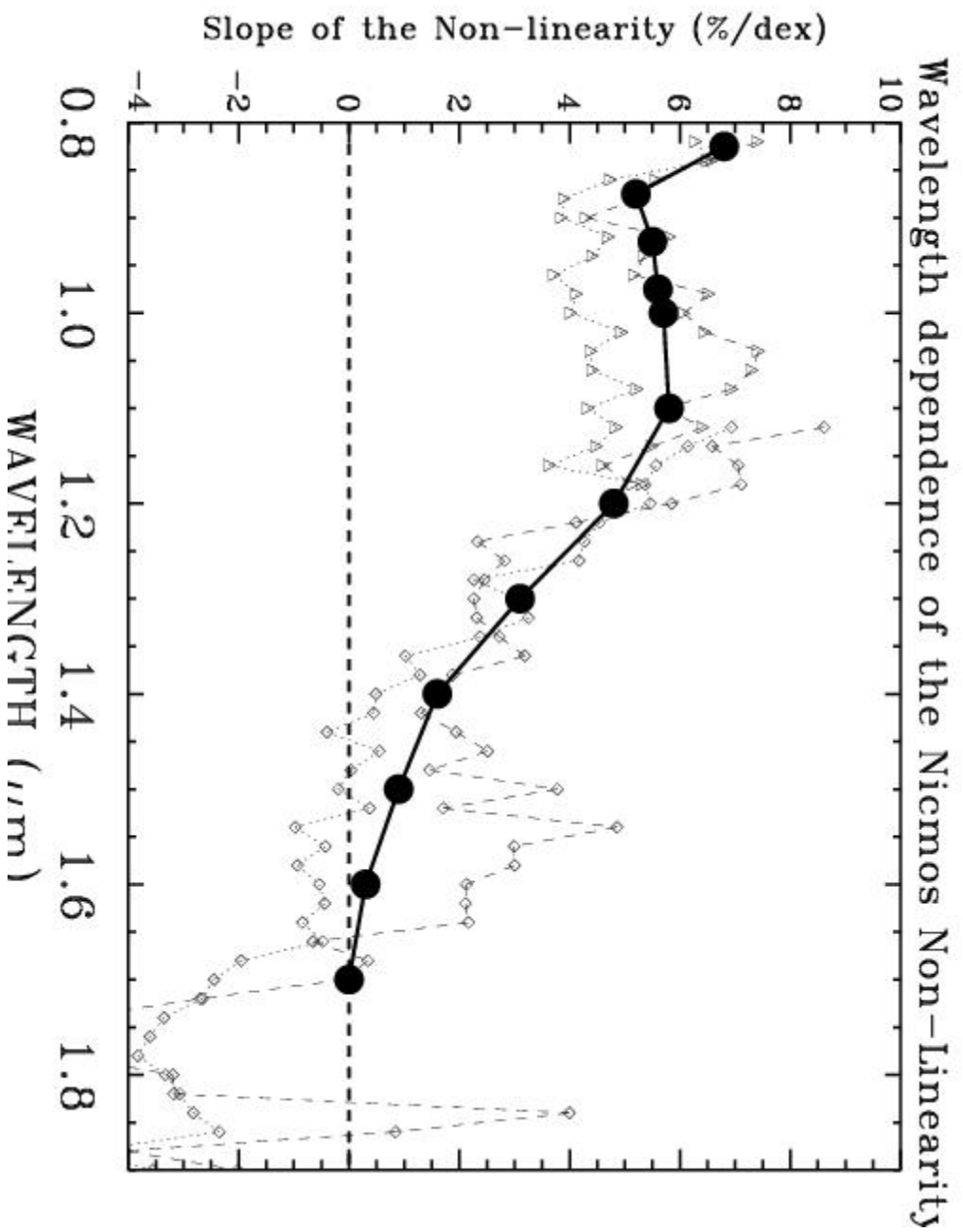
To extend the wavelength coverage of the HST spectro-photometric standard stars, a set of stars with luminosities in the range $V=10-16$ were observed by NICMOS grisms G096 and G141. A non-linearity of up to 5% per dex (at 1.2 micron) was found when comparing counts of common stars between
NICMOS/STIS/ACS

NICMOS vs. STIS/ACS

- NICMOS grism observations have extended the spec/phot wavelength range to $2\ \mu\text{m}$, using 16 STIS standard stars
- A discrepancy of up to 5% per dex is seen when comparing STIS and NICMOS fluxes in their overlapping region of $0.8\text{-}1.0\ \mu\text{m}$
- ACS spec/phot for two of these stars in the overlapping wavelengths agrees with STIS to 2%
- NICMOS fluxes in the range 10-16 mag may need corrections for non-linearity (at $1.2\ \mu\text{m}$) up to 3%







Questions

What is the origin of the non-linearity ?

How is NICMOS photometry compared to that from other near-IR detectors ?

Is there a zero-point problem
with NICMOS ?

How different reduction techniques affect photometry of faint galaxies ?

We need to compare photometry of
the same objects between NICMOS
and other near-IR detectors:

Allowing for differences in filter
shapes

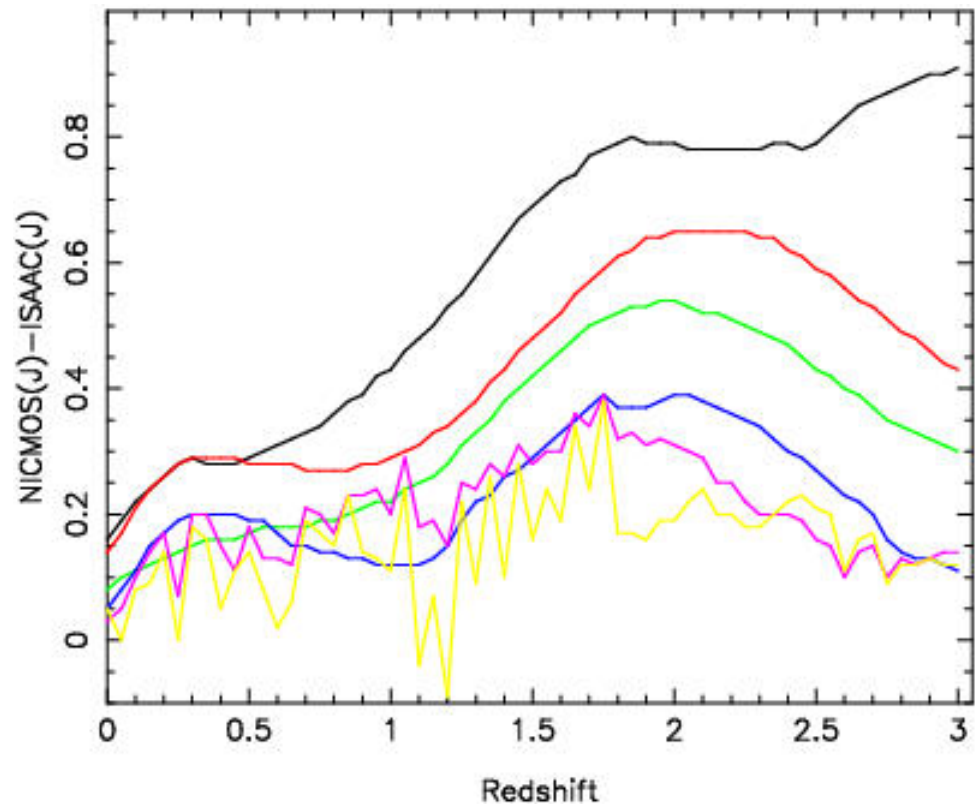
Covering as long a flux baseline as
possible

The Sample

At the bright end we use stars from Stephens et al (2000). At the faint-end we use HUDF galaxies for which both NICMOS and ground-based (ISAAC) data are available.

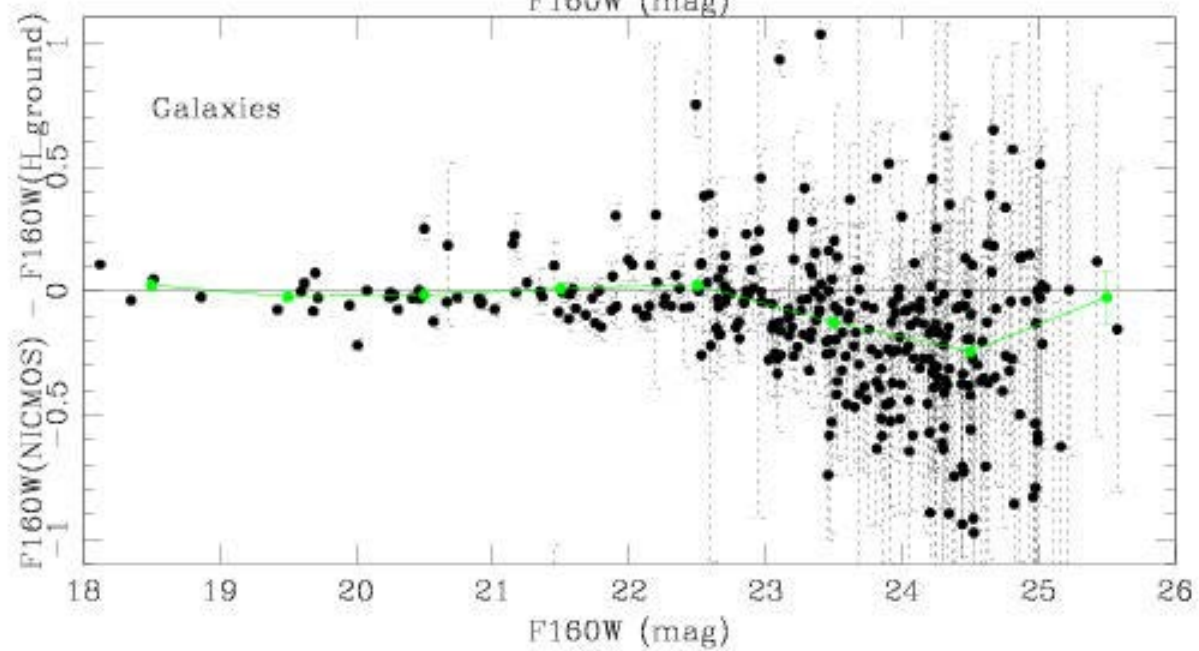
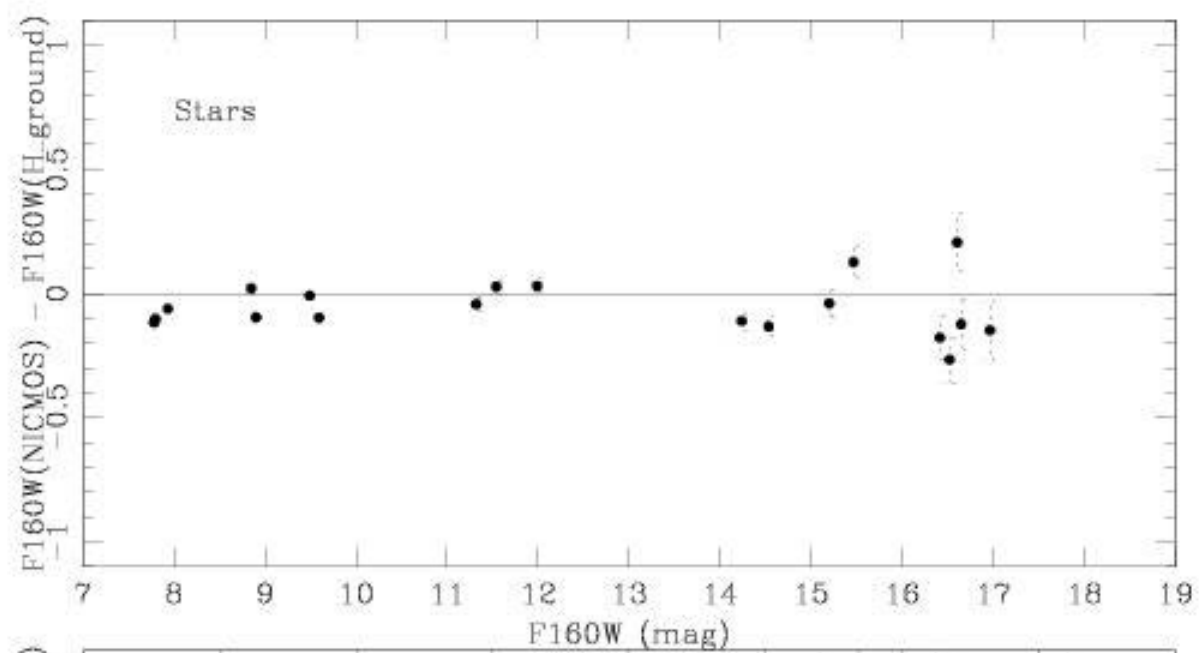
No corrections needed for H-band as these filters are close between NICMOS and ground-based filters

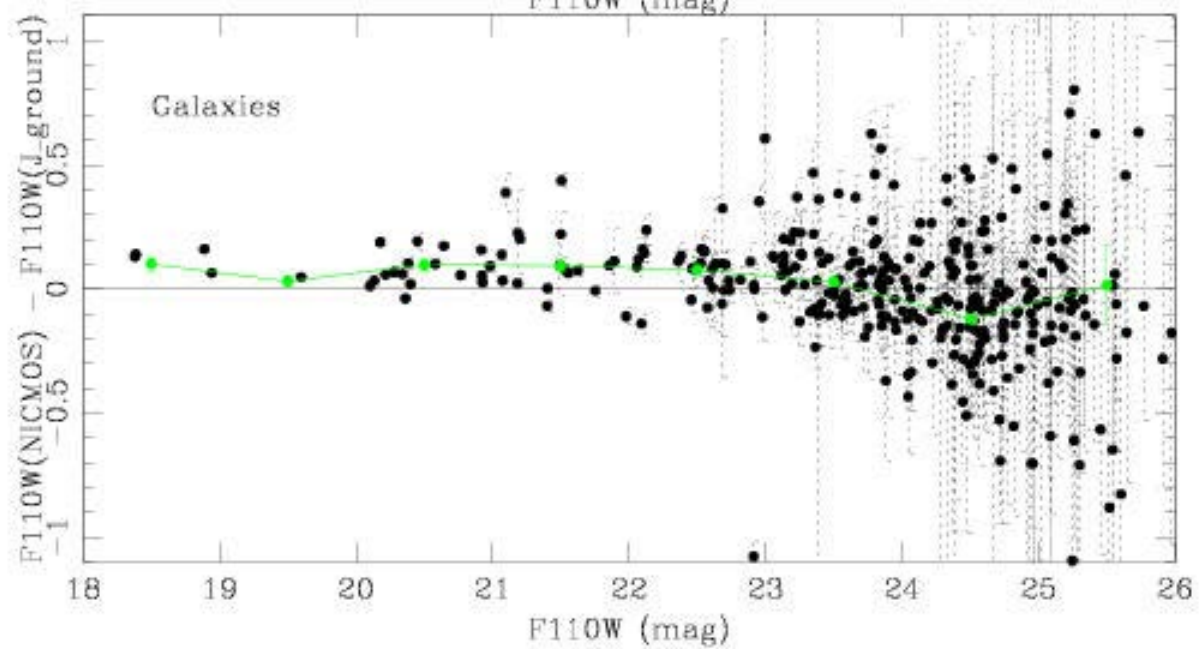
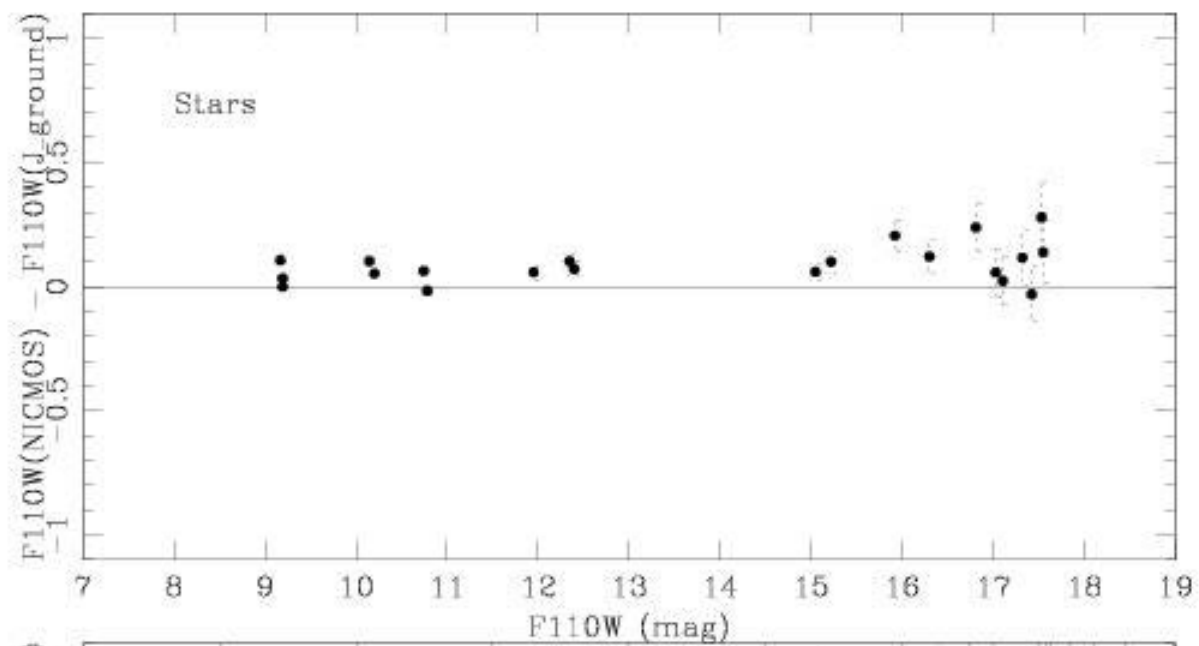
- The star J-band magnitudes were converted to NICMOS system using appropriate color corrections.
- We found 349 matches for galaxies between HUDF NICMOS and ISAAC.
- We verified ISAAC zero-points by comparing the magnitudes with 2MASS
- The galaxies J-band magnitudes were corrected for differences in filter shapes between NICMOS and ISAAC, using SED fitting technique, finding spectral types of galaxies
- For each galaxy, depending on its spectral type, a correction was derived and applied to its observed magnitude. This brings ISAAC and NICMOS magnitudes to the same scale

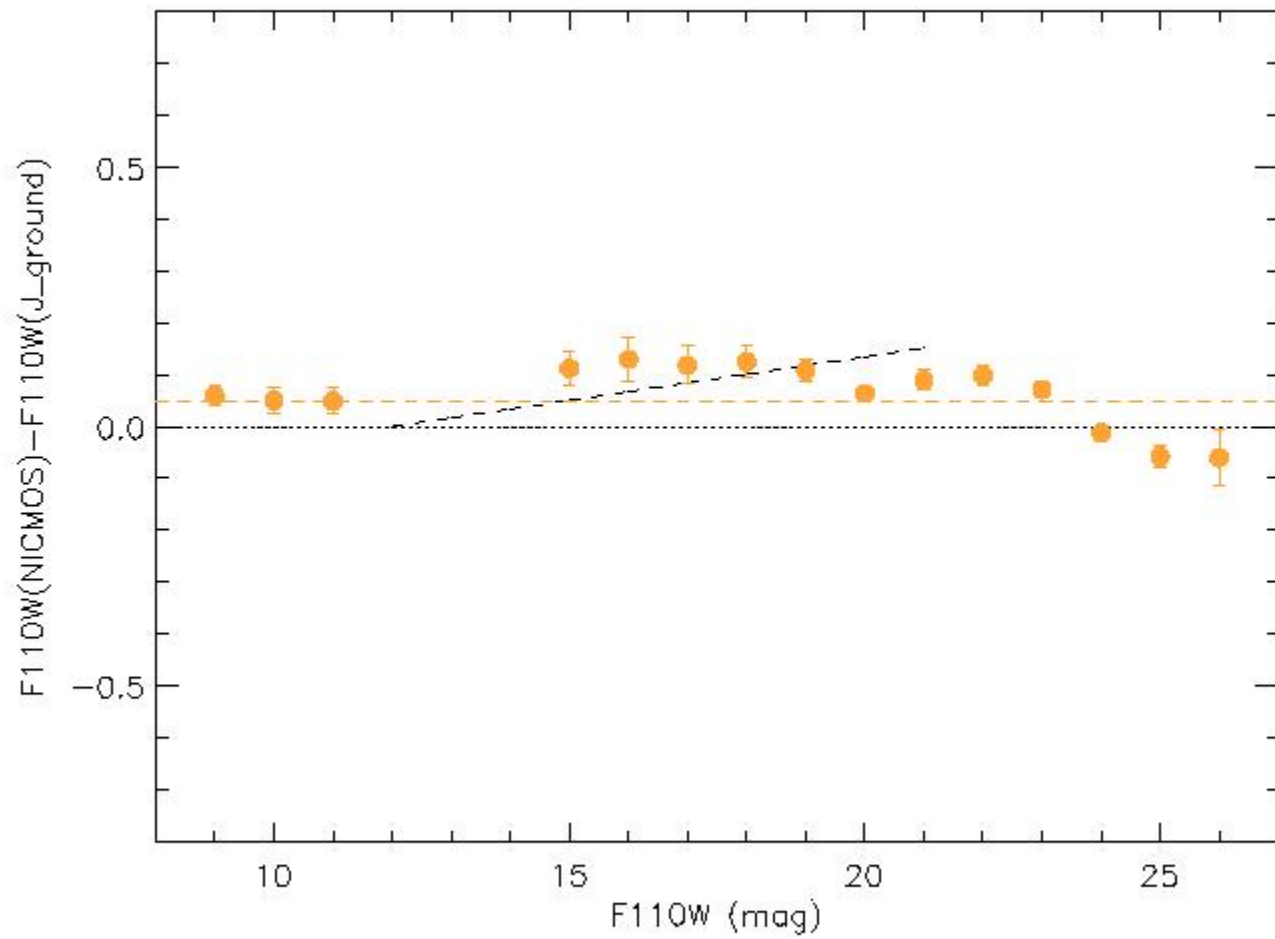


Results

- There is no significant difference between NICMOS and ISAAC magnitudes in the H-band even when no color correction applied
- Where the two datasets (stars and galaxies) meet (at 18th mag), no offset is apparent
- For F110W filter, to the first order, the data are consistent with linearity (at the level of 0.1 mag over the full range)
- A linear fit to the data gives no non-linearity but only an offset of 0.05 mag.







Effects of Different Reduction Techniques in NICMOS Photometry

Compare NICMOS photometry for
the faintest objects between two
independent reductions of NICMOS
images:

HUDF-NICMOS images reduced by
R.Thompson and E. Bergeron

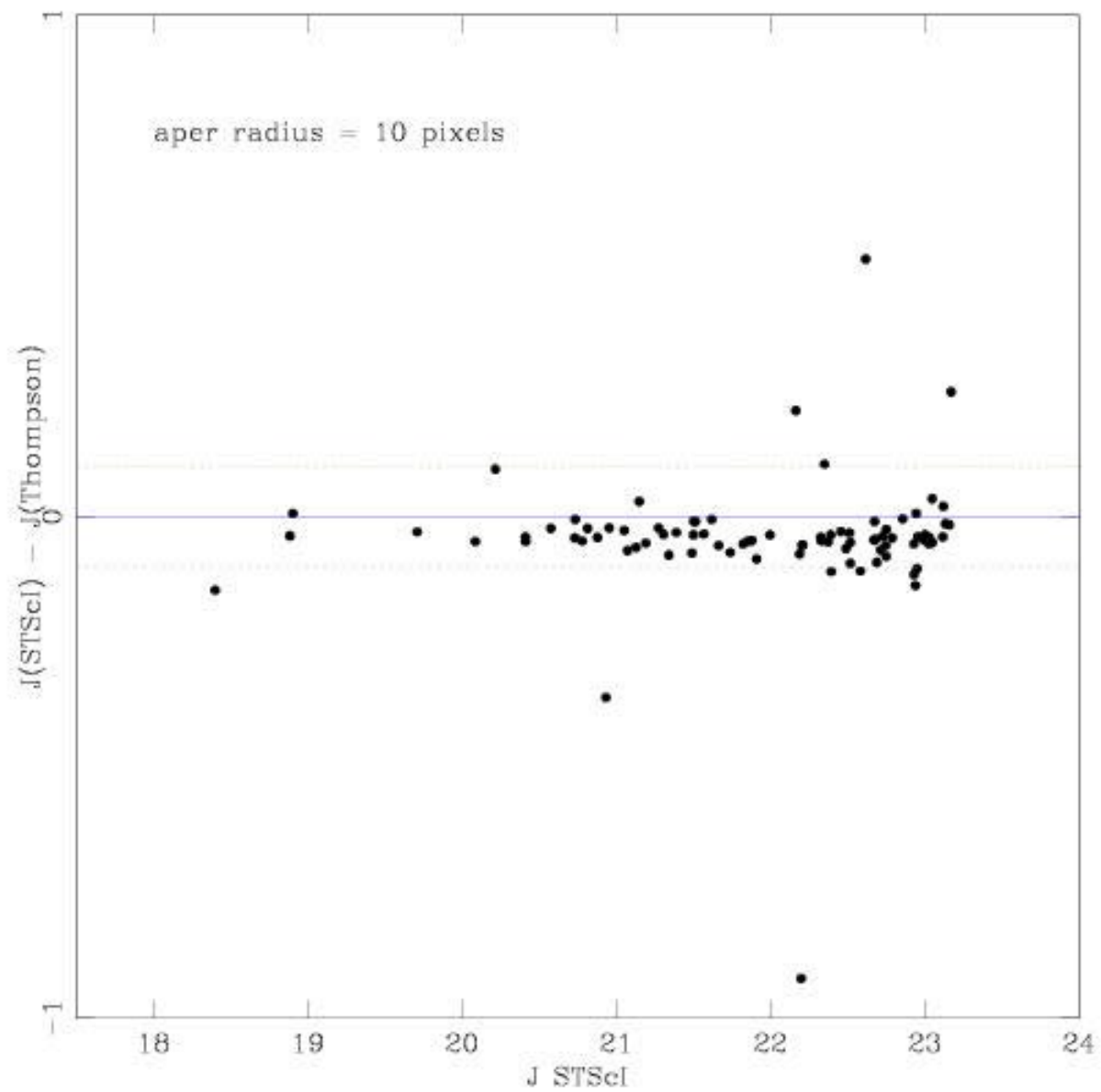
Do photometry on these in
EXACTLY the same way

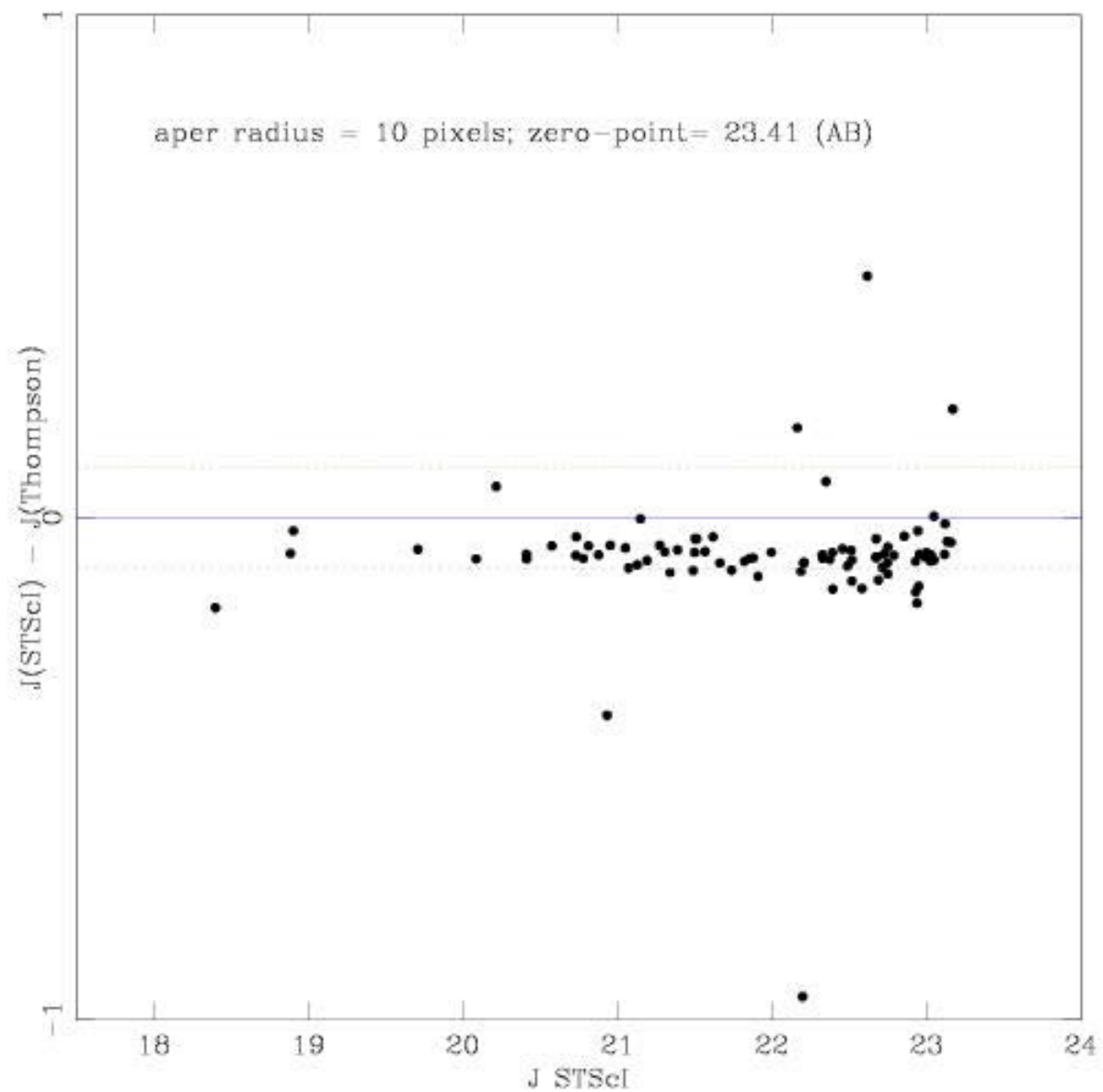
The latest HUDF NICMOS images
were used

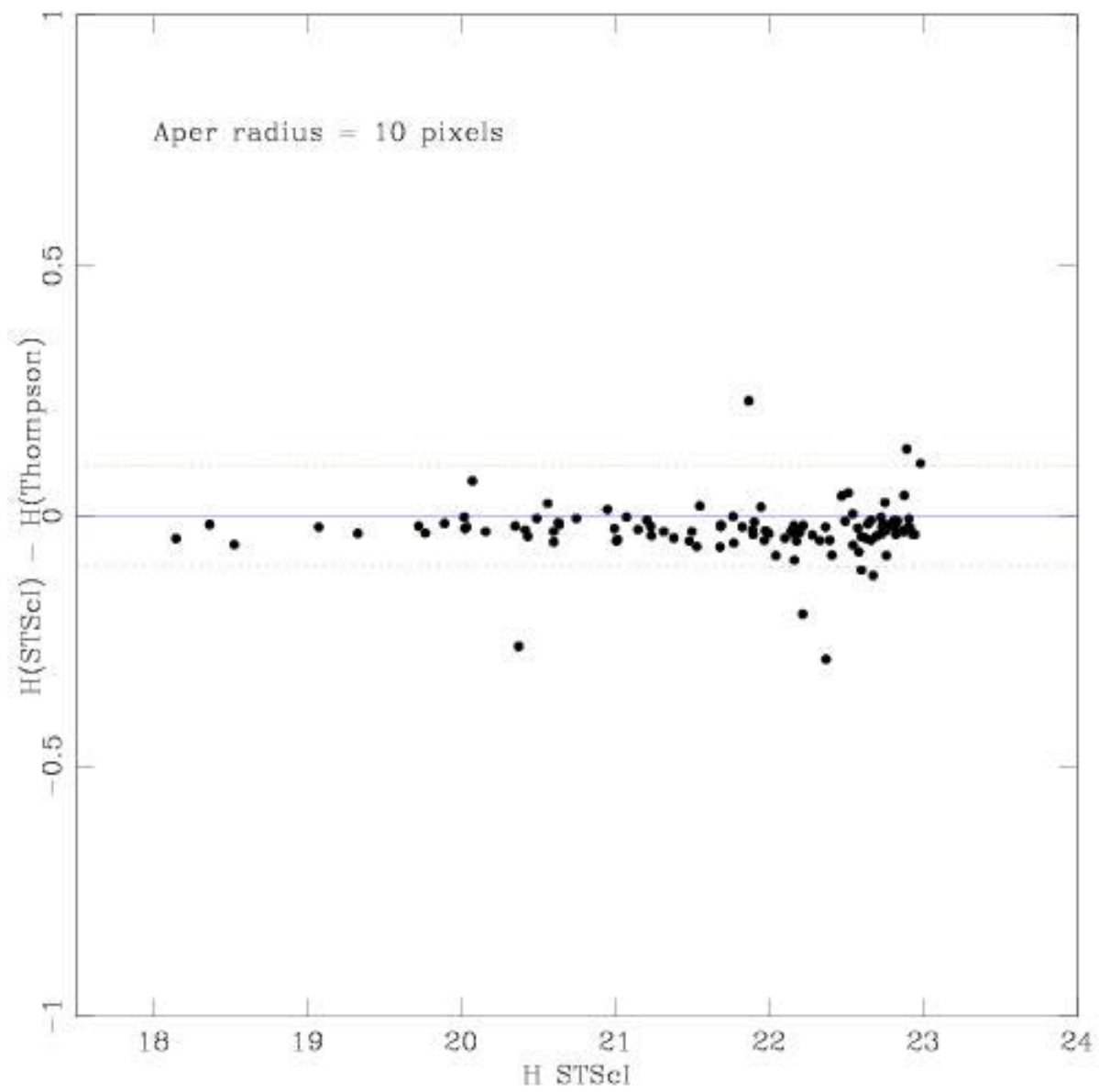
SExtractor was run on one image with
the sources detected

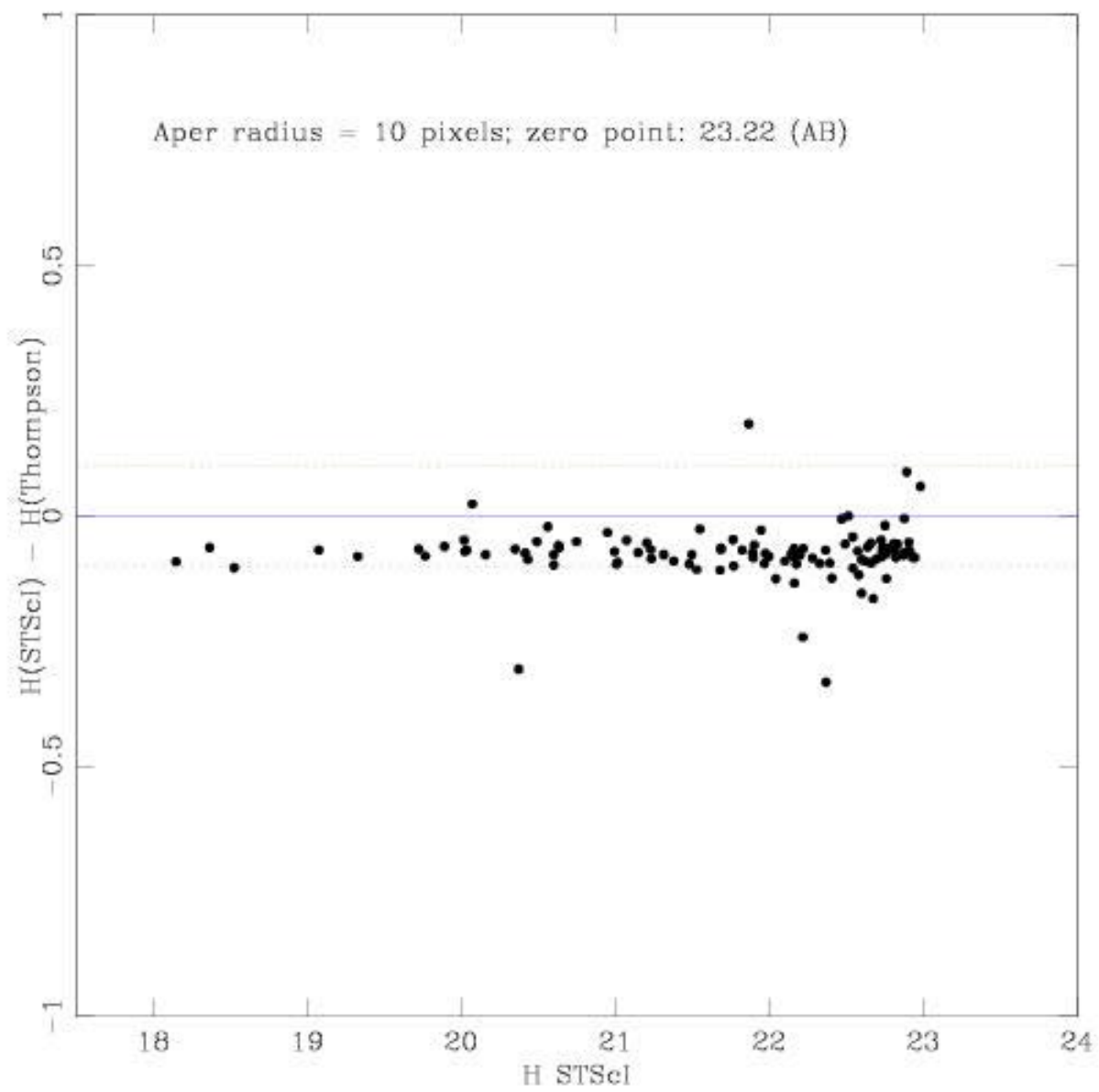
Aperture photometry was performed
on the position of detected sources on
both images in EXACTLY the same
way (the same aperture size, sky
subtraction etc)

The same zero-points were used









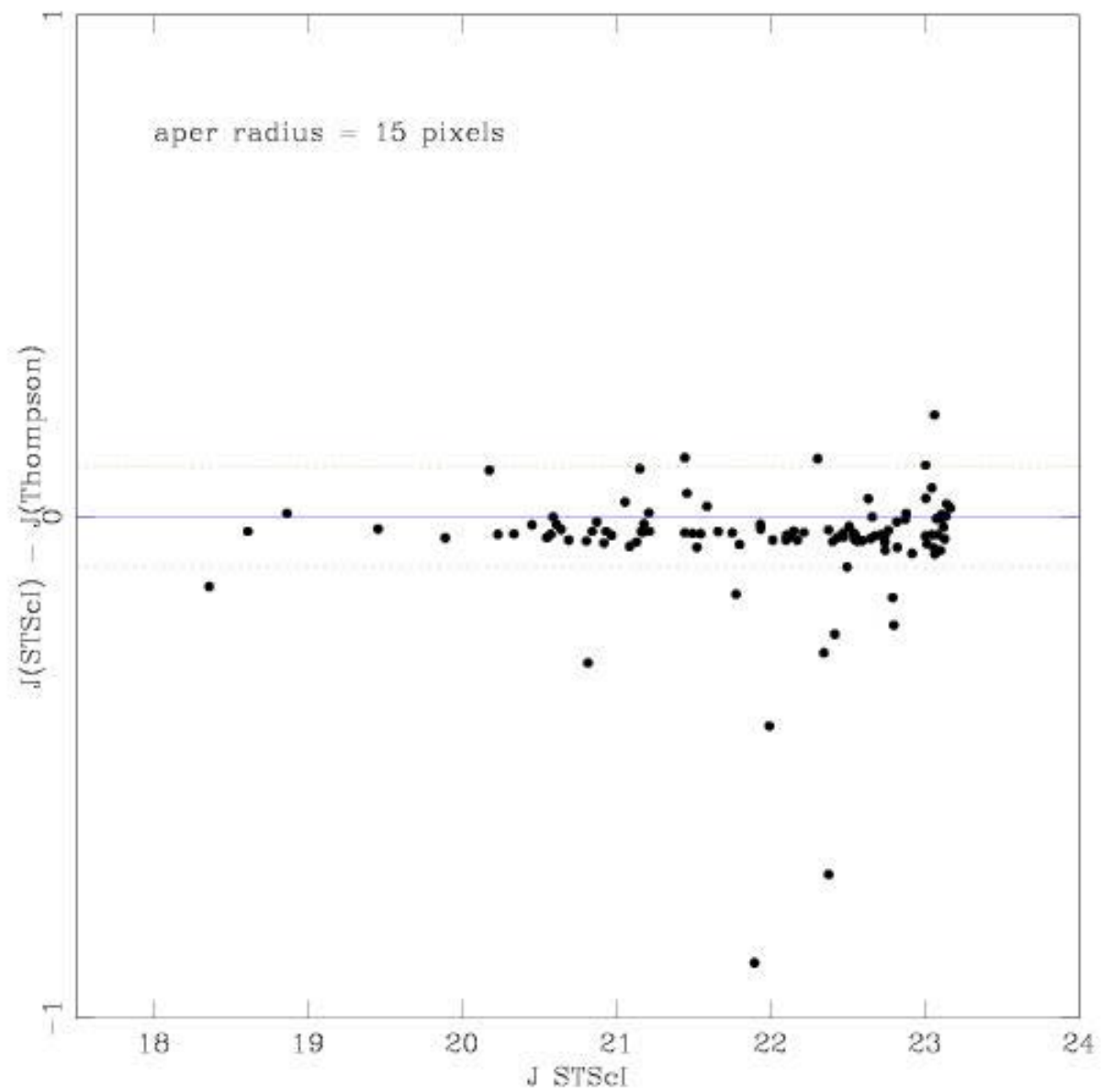
Conclusions

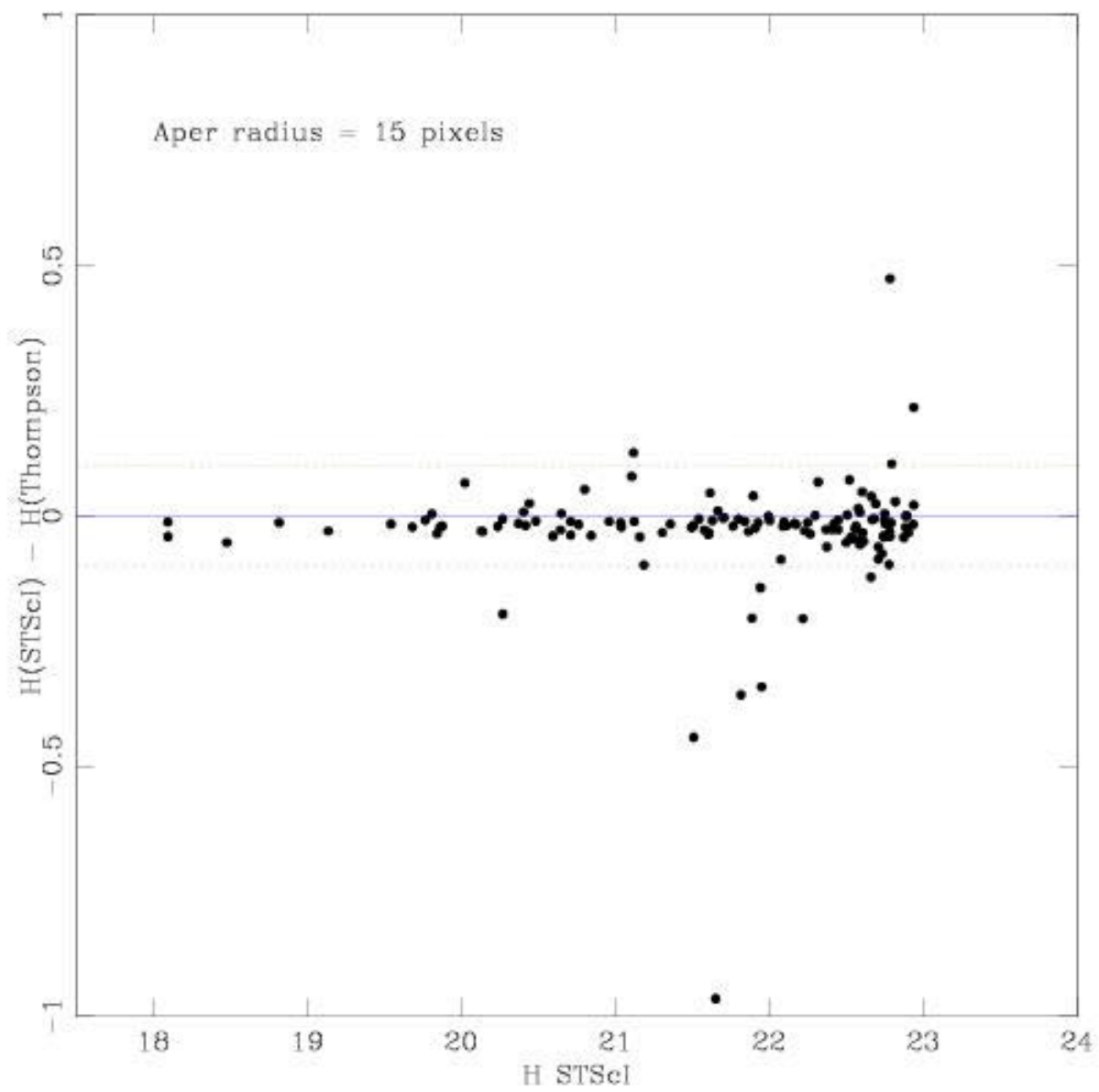
A linear offset is observed between
NICMOS F110W and ground-based
J-band data

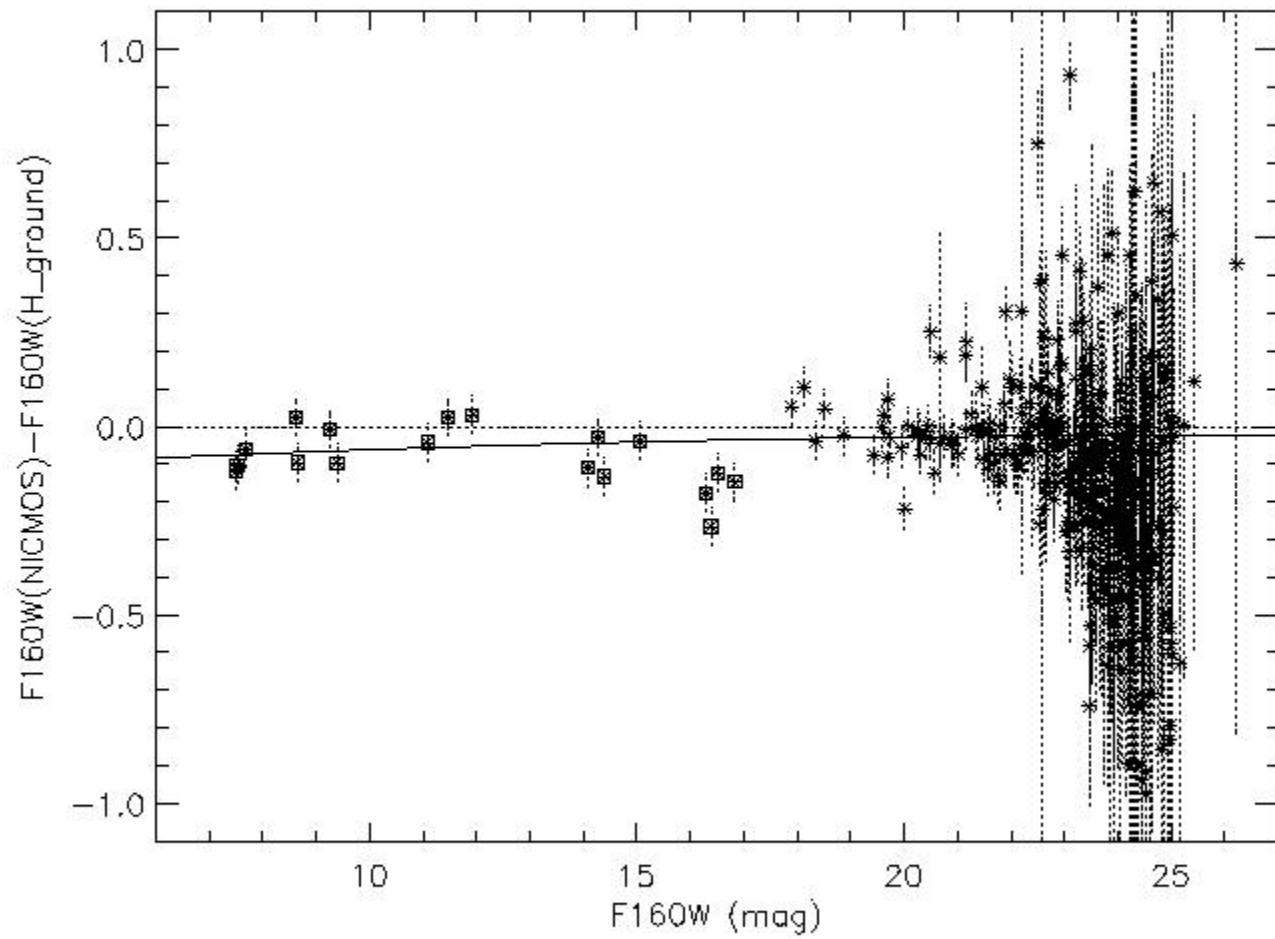
No offset or non-linearity seen
between F160W and ground-based H-
band data

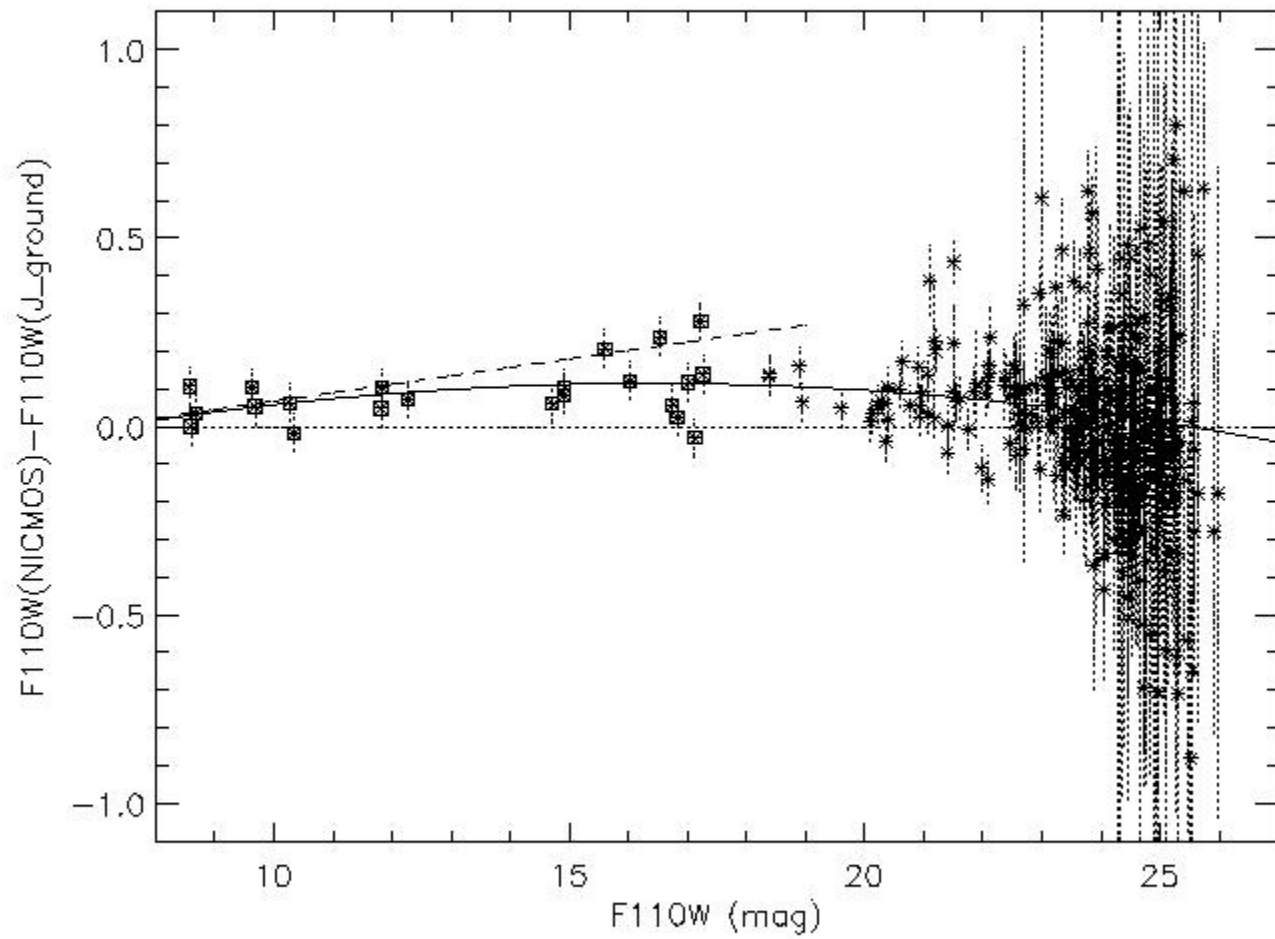
There is a difference ~ 0.04 to 0.08
mag in photometry of faint galaxies
with NICMOS-HUDF

Make sure using consistent zero-
points and aperture corrections









Comparison of NICMOS counts with independent datasets

To examine the observed non-linearity, we compiled a sample of objects with available near-IR observations from NICMOS and other (ground-based) surveys.

To extend the flux range to fainter regimes, we combined a sample of stars and galaxies, spanning a range of 16 magnitudes

Aims: Search for non-linearity in F110W and F160W over the largest dynamic range possible for NICMOS (from 7th to 26th magnitude).

Over this range, the observed non-linearity, extrapolated to fainter magnitudes changes the magnitudes of the faintest sources by > 0.3 mag.

Method: We compared the observed NICMOS and ground-based magnitudes, carefully correcting for differences in source SEDs

Non-linear non-linearity ?

- We see evidence for a non-linearity in the direction of Bohlin effect and of a similar scale at the bright-end
- However, at low count levels, this non-linearity levels off
- The photometry may be consistent with the Bohlin effect as that sample only covers the brighter end of our dynamic range and over 10 magnitudes. At fainter end, there is little change in magnitudes (0.05 mag), if any. This has no effect on the science based on faint sources.
- No non-linearity is observed in F160W filter