Calibration and Data Quality Toolbox
WP 3520

March 17th 2015

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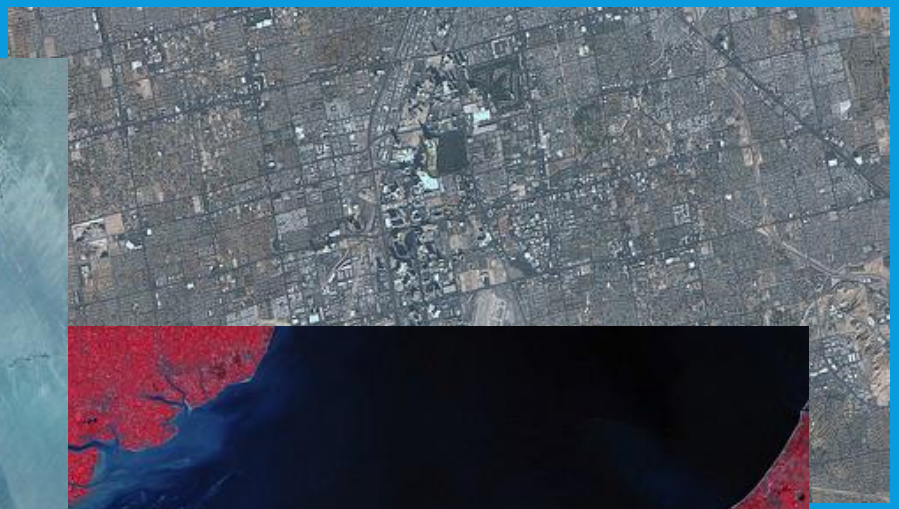
PRINCIPLES

- The basic idea is to monitor the data quality and calibration drift without using a calibration device or specific calibration images. Instead we use normal “heterogeneous” images.



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AREAS TO BE EXPLORED

- Signal to Noise Ratio (SNR) of sensors

Developing methods to assess the complete SNR curves automatically

- Relative Calibration Curve generation

Monitoring change in groups of detectors (detector equalisation)

- Single detector drift (striping)

Finding and automatically adjusting for individual detector drift

- Spectral drift (hyperspectral)

Monitoring small changes in wavelength position (MERIS for example)

- Spectral Features (diffuser effects)

Monitoring speckle effects from diffuser derived calibration curves

- Absolute Calibration drift

Determining the absolute calibration drift (annually for the moment)

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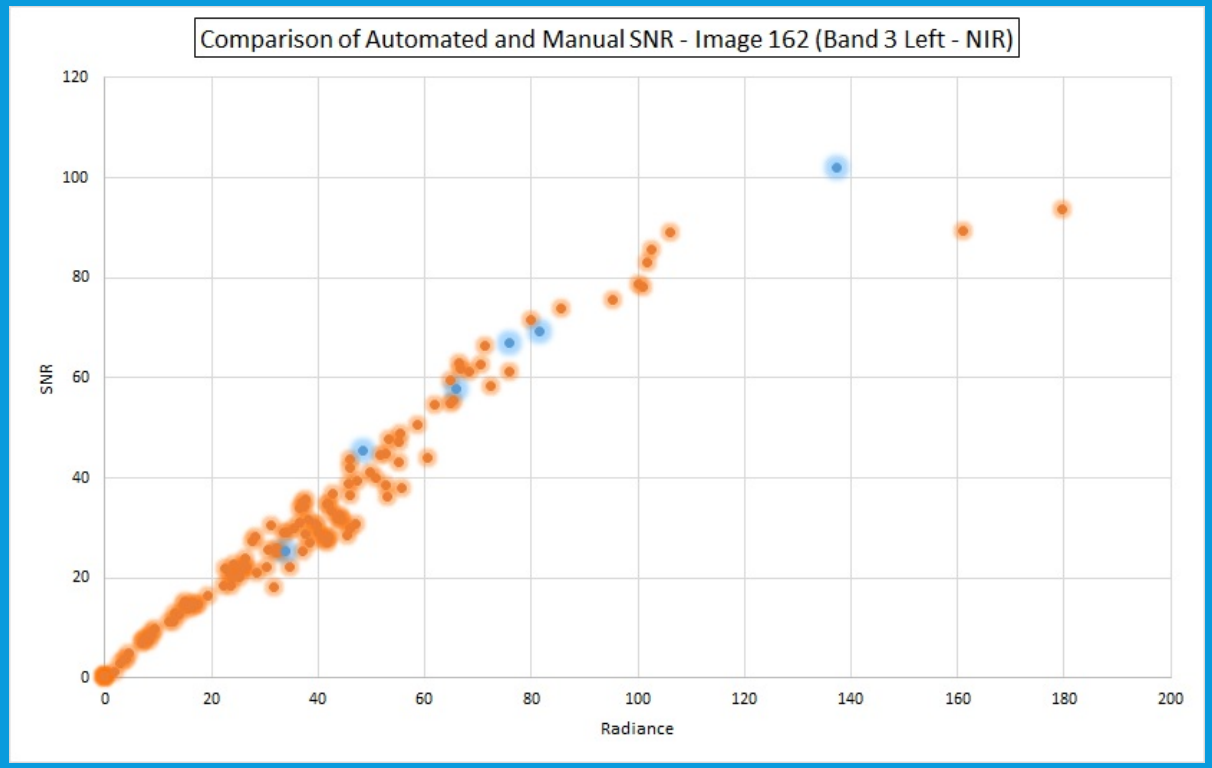
EXAMPLES – SIGNAL TO NOISE RATIO (SNR)



Example of the type of SNR plot produced, in this case the automated plot values (orange) are plotted against manually calculated SNR values using homogeneous surfaces.

The algorithm has been tested on medium to high resolution sensors, but has been only recently applied to AATSR data.

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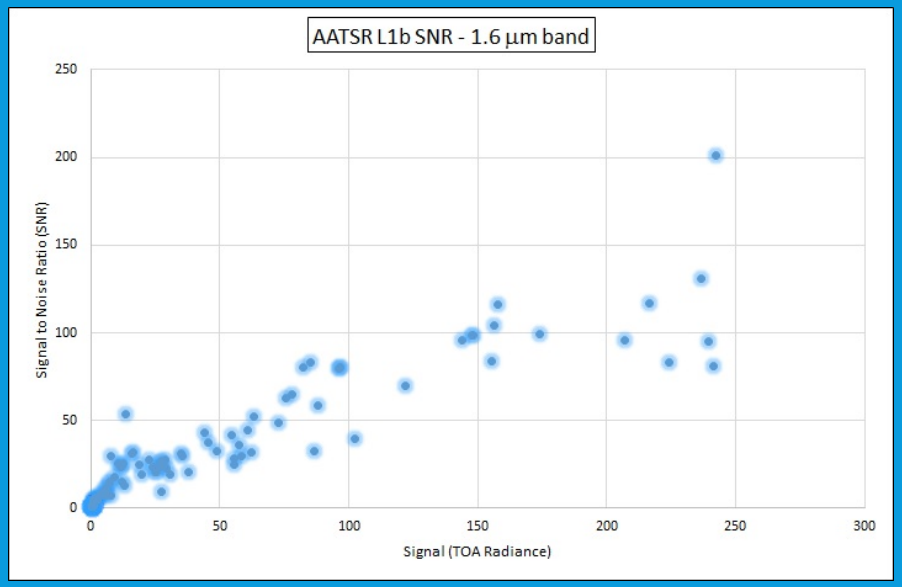
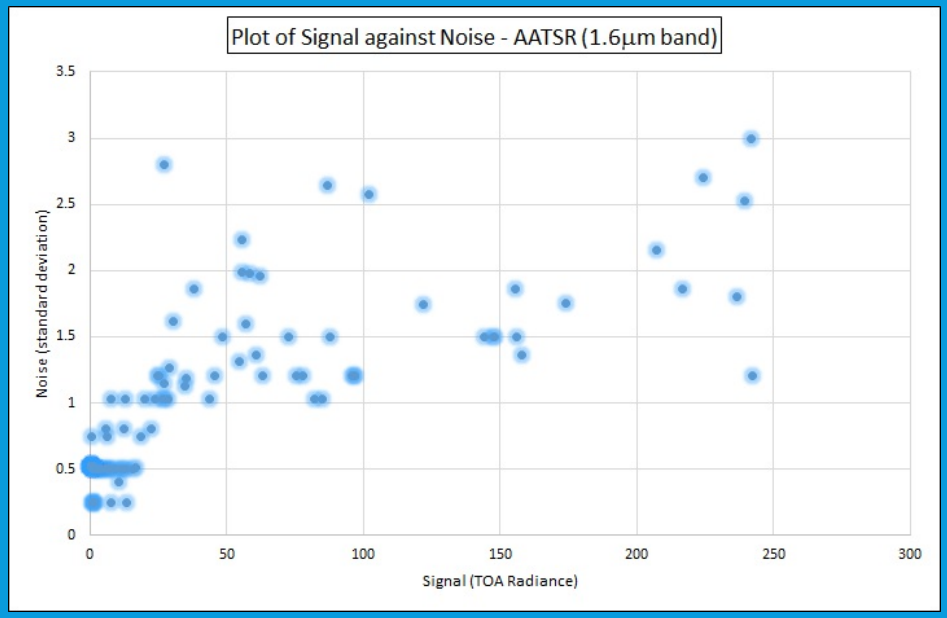
AATSR – SNR EXAMPLE

The plot for AATSR SNR (below) is more "ragged", but from only four orbits data and shows some effects of signal quantisation.





The plot above is of the signal against noise, note the clustering of values at specific noise intervals (0.25, 0.5, 0.75)

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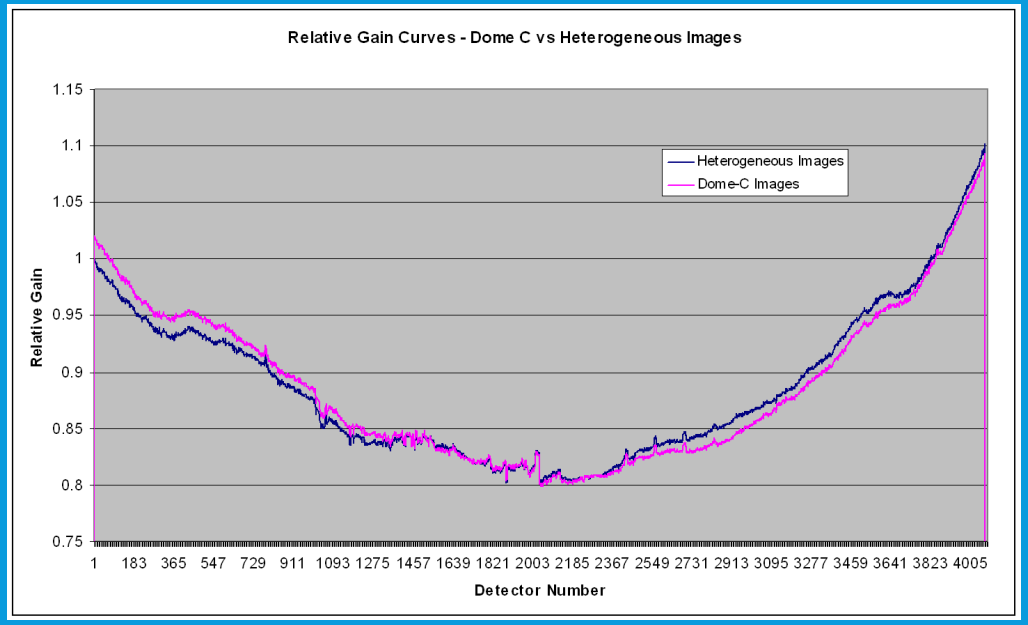
EXAMPLES – RELATIVE CALIBRATION CURVE

For pushbroom sensors we can derive the across-track variation in signal response.

This is applicable to sensors such as MERIS, Landsat 8 or the planned Sentinel-2 MSI and Sentinel-3 OLCI sensors.

The approach allows updating of the curve on a daily basis (depending on data volumes)



In this example the curve extracted from approximately fifty heterogeneous scenes is compared to that derived from a snow scene over Dome-C in Antarctica

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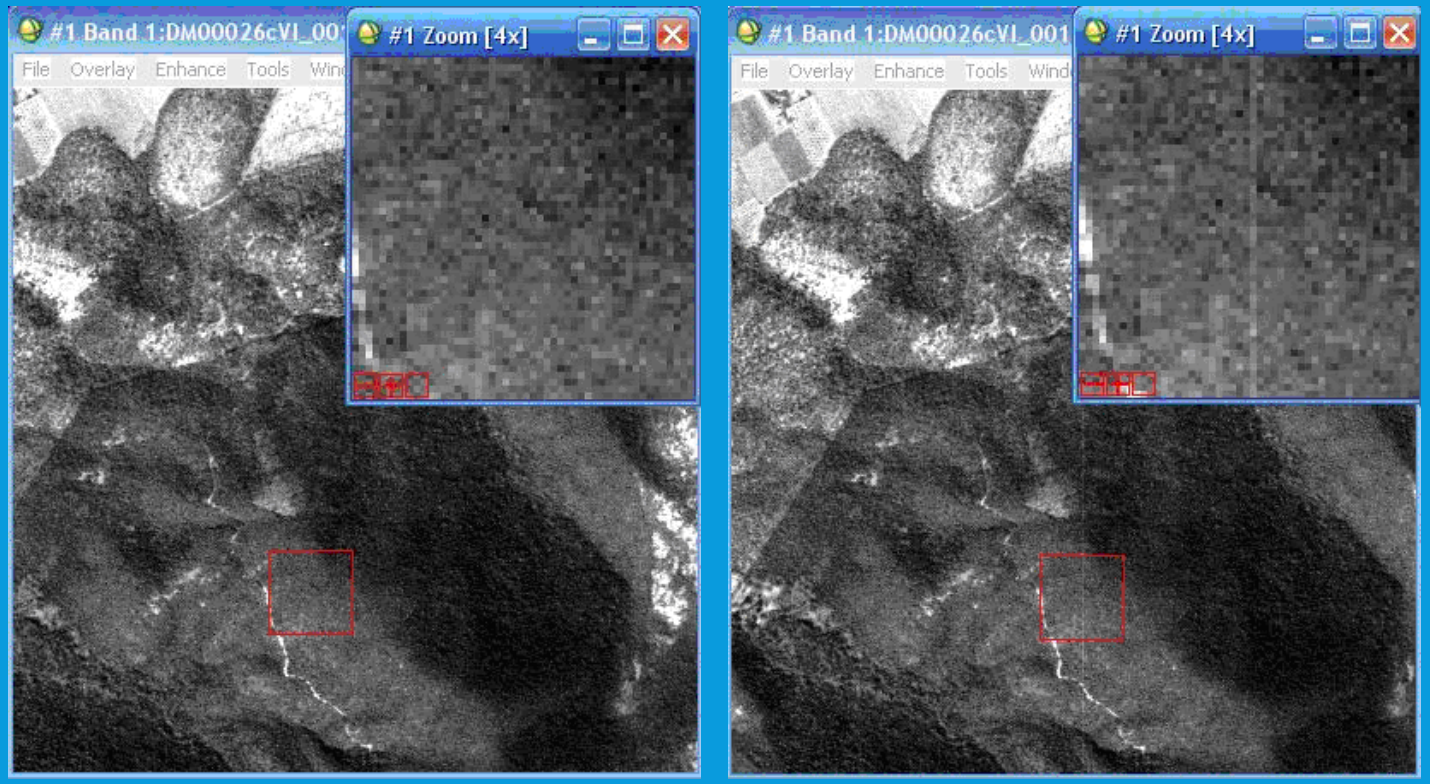
EXAMPLES – SINGLE DETECTOR EVENTS



At times single detectors can drift enough in response to induce striping in pushbroom imagers. The stripe (right) was “induced” by altering the gain. The same stripe at lower magnitude is in the left image but not visible.

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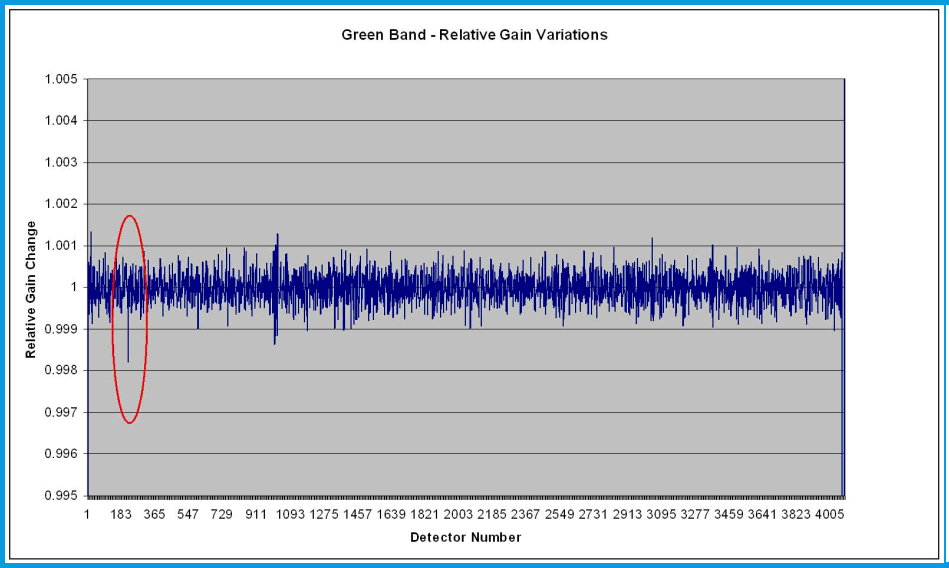
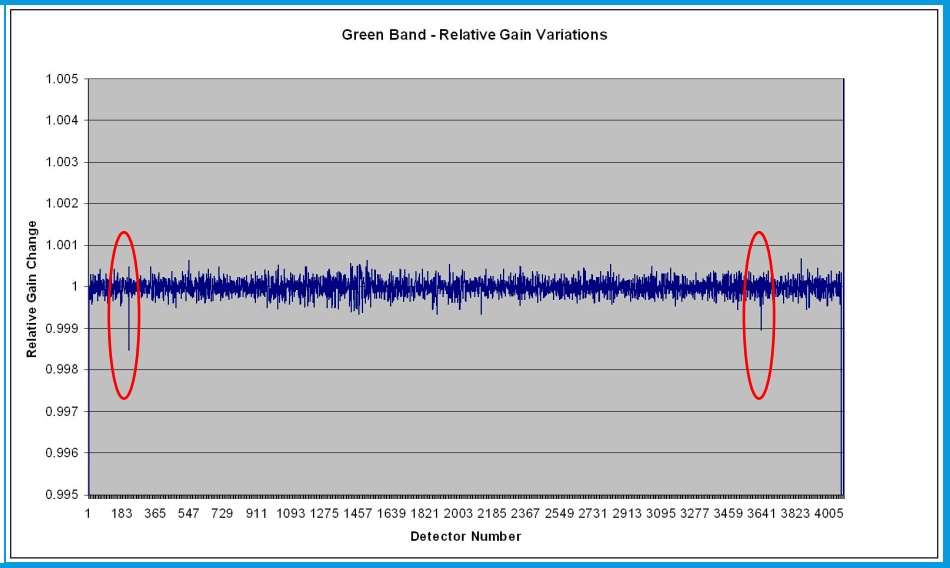
EXAMPLE – SINGLE DETECTOR EVENTS





The method was applied (left) and our created feature of magnitude of about 0.2% was found using only 10 heterogeneous scenes (red oval, left plot). If we increase the number we can see the feature better against the background (red oval left, right plot), but surprisingly during testing we found an even smaller “real” feature of about 0.1% in magnitude (red oval right, right plot).

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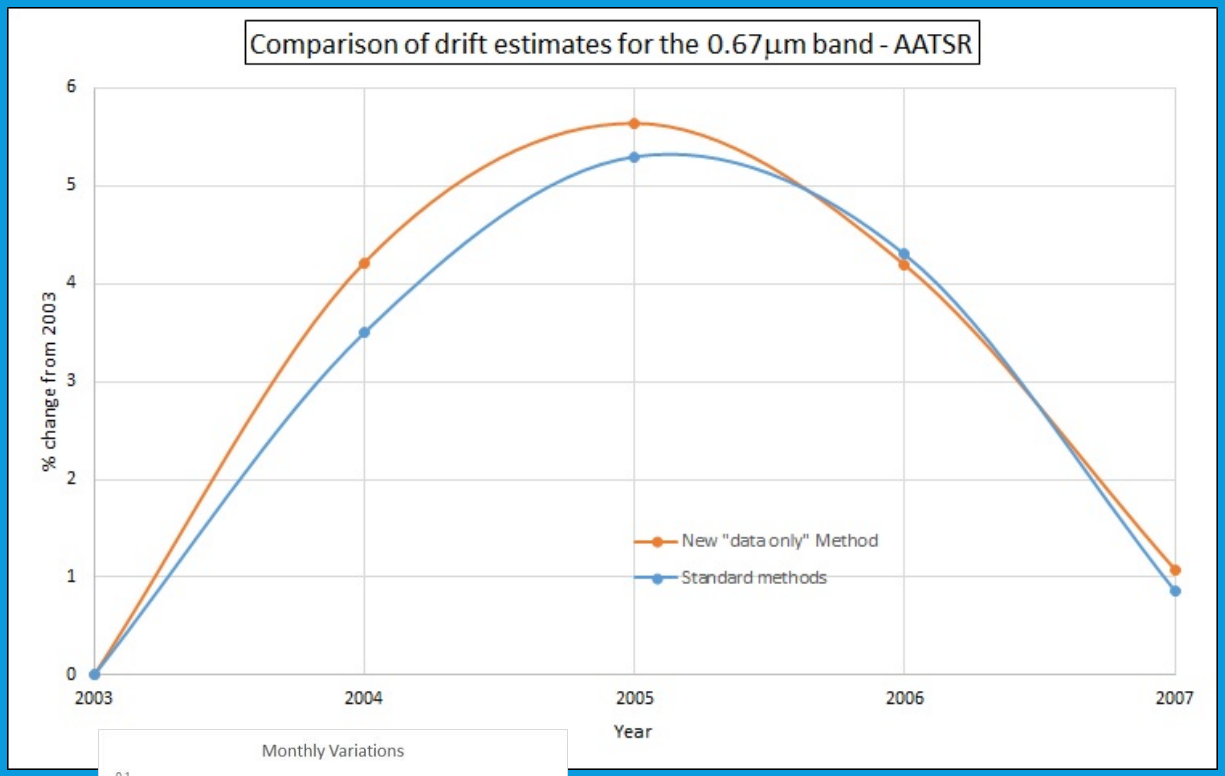
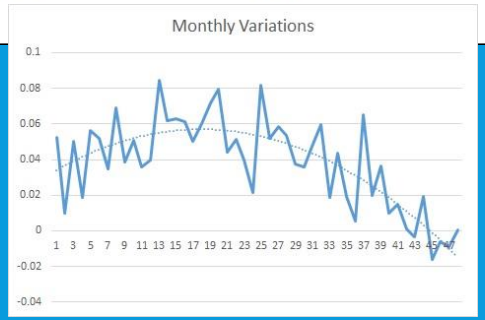
EXAMPLES – ABSOLUTE CALIBRATION DRIFT





The drift line in blue was generated from analysis of multiple images taken over calibration sites in the North African Desert and over Dome-C and referencing them against another sensor.

The drift line in orange was based on comparing the on-board calibrator against the RAW data alone using normal heterogeneous images (no specific calibration data).

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NEXT STEPS

- The algorithms using this “data driven” approach are being modified for use on proxy sensors in preparation for the Sentinel Missions.
- So we have
  - AATSR for Sentinel 3 SLSTR
  - MERIS for Sentinel 3 OLCI
  - Landsat 8 for Sentinel-2 MSI
- By testing on proxy sensors we can determine their effectiveness and limitations and possible improvements to deal with the specific sensor designs of both the proxy instruments and the Sentinel Mission Sensors.

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