PS1 Detection properties

In PanSTARRS nomenclature, a **detection** is a source found in a single exposure or a stacked image. Each detection has associated quantities. Detections are combined into "objects" by spatial matching across different exposures and filters.

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The starting point for the PS1 data archive is at the Pan-STARRS1 data archive home page.

Definition - what is a "detection"?

In PanSTARRS nomenclature, a **detection** is a source found in a single exposure or a stacked image. Detections are matched across exposures to define **objects**.

Detections are identified through a standard peak-finding algorithm. The image is convolved with an approximation of the PSF and then divided by a smoothed version of the **variance image** to define the **significance image.** Peaks are defined as locations where the significance image exceeds a target threshold, representing the square of the desired signal-to-noise ratio. Peaks are then ordered in decreasing significance, and peaks are retained only if a significant valley separates them from brighter nearby peaks.

The process of identifying detections is complex and involves multiple steps:

1. Smooth the image with PSF (or a PSF estimate in the first pass)
2. Smooth the variance with PSF**2
   - To speed these up, a 1D Gaussian with FWHM matching the PSF is used.
   - That is much faster and is only marginally different.
   - If the difference matters, the image is of poor quality.
3. Create a **significance image** by dividing image**2 / variance.
4. Find all peaks above target S/N (squared).
5. Perform a footprint analysis
   - Generate isophotal footprint outlines (*N* sigma above sky).
   - Assign peaks to their containing footprints.
   - Cull insignificant peaks:
     - Cull in descending order of brightness.
     - A valid peak must be separated from a brighter peak by a significant valley.
     - As a recent improvement: on the second pass, cull on the unsubtracted image