# PS1 Source extraction and catalogs

The PS1 data processing pipeline generates catalogs of discrete sources detected in the images. Each source may have measurements from one or more filters, and each filter may have measurements at one or more epochs. In the PS1 nomenclature, Detections are sources found in a single exposure, while Objects are either collections of Detections matched across exposures, or sources found in stacked images that combine multiple epochs to produce deeper detection limits. Only Objects were included in DR1; Detections are available in DR2. All source information (positions, magnitudes, morphological information, flags, etc.) is stored in the PS1 databases, which will be the starting point for most science using PS1 data.

**Contents**


- Overview
- DB tables


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

## Overview

PS1 data processing generated a sequence of tables describing the catalogs. Catalogs include Detections and Objects. Detections are found in individual exposures, while Objects are either collections of Detections found at compatible locations in multiple images, or sources found in in stacked images (PS1 Stack objects and photometry). Only Objects are included in DR1; Detections will be released in DR2. For each source, many different properties are measured via several different procedures; the information is organized into Tables, described in detail below.

Useful photometric measurements include: PS1 Aperture photometry of point sources, PS1 PSF photometry of detections, Kron photometry (especially relevant for non-point-sources), and PS1 Forced photometry of sources. Fixed apertures (corresponding to SDSS radii) are also provided. For sufficiently bright extended sources, the light distribution if fitted with de Vaucouleurs and Sersic models, with the parameters reported in the linked tables. The quality of the measurements is quantified in the PS1 Object Flags and PS1 Detection Flags.

Faint objects are detected only in the stacked images. The primaryDetection column can be used to select the best stack measurement for a given object. However, there are some cases where a single object has multiple entries in the StackObjectThin table in the DR1 database. See the PS1 Frequently asked questions for more information on this issue.

Due to weather and other factors, the PS1 Photometric Depth shows some spatial variation.

| PS1 depth | | |
|---|---|---|
| **filter** | **50%** | **98%** |
| **g** | 23.2 | |
| **r** | 23.2 | |
| **i** | 23.1 | |
| **z** | 22.3 | |
| **y** | 21.2 | |

Median 50% and 98% completeness for the PS1 grizy filters, determined with PSF photometry of stellar sources in the 3pi stacked images.

A PS1 Comparison of different photometric measures shows that the mean object magnitude have the smallest intrinsic scatter.

A simple way to separate stars from galaxies is to use the difference between PSFMag and KronMag, as discussed in Farrow et al. (2014). Also, the column psfLikelihood in StackObjectAttributes (or StackObjectView) can be used. For more informations, see How to separate stars and galaxies.

In the descriptions below, the table names are linked to pages that give full descriptions of the columns. Pages are also available that give descriptions of both tables describing the objects (including the ones below) and tables with higher-level metadata such as information on flag values and filters.

# DB tables

**PS1 ObjectThin table fields**: This is the master table for everything identified as an object in the 3pi survey (on both single and stacked exposures). An object associates single epoch detections and the stacked detections within a one arcsecond radius. The mean position from the single epoch data is used as the basis for coordinates when available, or the position of an object in the stack when it is not. The right ascension and declination for both the stack and single epoch mean is provided (weighted mean over all filters). The number of detections in each filter from single epoch data is listed, along with which filters the object has a stack detection. This table does not contain any photometric data and will usually be used in JOINs to other tables.

**PS1 MeanObject table fields:** Contains the mean photometric information for objects based on the single epoch data, calculated as described in Magnier et al (2013). To be included in this table, an object must be bright enough to have been detected at least once in an individual exposure. PSFMag, KronMag, and APMag (plus statistics) are listed for all filters. The information for all filters for a given object are joined into a single row. This table is designed to be JOINed to **PS1 ObjectThin table fields**, as it contains no positional information.

**PS1 Detection table fields:** Contains single epoch photometry of individual detections from a single exposure in a single filter. The identifiers connecting the detection back to the original image and to the object association are provided. PSFFlux, APFlux, and KronFlux fluxes are included, and basic shape parameters (moments, FWHM) along with sky and detector coordinate positions and observation date /time. Note: The **PS1 Detection table fields** table is not part of the DR1 data release; it will be included in the DR2 release.

**PS1 StackObjectThin table fields:** Contains the positional and photometric information for all photometry of detections on the stacks. RA, Dec, PSFMag, APMag and KronMag are reported for each filter. The information for all filters are joined into a single row, with metadata indicating if this stack object represents the primary detection. Due to overlaps in the stack tessellations, an object may appear in multiple stack images, and so have several independent entries in this table. The primary detection is the unique detection from the stack image that provides the best coverage with minimal projection stretching. All other detections of the object in that filter are secondary, regardless of their properties. The detection flagged as best is the primary detection if that detection has a psfQf value greater than 0.98; if that is not met, then any of the primary or secondary detections with the highest psfQf value is flagged as best. This table can be used on its own as a primary source of stack photometry, although if you want mean positions you will need to JOIN to **PS1 ObjectThin table fields**.

**StackObjectAtrributes:** For all stack detections it contains the PSFFlux, KronFlux, and APFlux fluxes (as opposed to magnitudes) for all filters in a single row, along with point-source object shape parameters (e.g. FWHM, moments). Also sky statistics, exposure times, basic s/g separation parameter. Needs to be JOINed to **PS1 StackObjectThin table fields** to get positions.

**PS1 StackApFlx table fields:** Contains the unconvolved fluxes within the SDSS R5 (r = 3.00 arcsec), R6 (r = 4.63 arcsec), and R7 (r = 7.43 arcsec) circular apertures (Stoughton 2003). Convolved fluxes within these same apertures are also provided for images convolved to 6 sky pixels (1.5 arcsec) and 8 sky pixels (2.0 arcsec). All filters are matched into a single row, one row per stack detection. Needs to be JOINed to **PS1 StackObjectThin table fields** to get positions.

**PS1 StackApFlxExGalUnc table fields:** Contains the unconvolved fluxes within the SDSS R3 (r = 1.03 arcsec), R4 (r = 1.76 arcsec), R5 (r = 3.00 arcsec), R6 (r = 4.63 arcsec), R7 (r = 7.43 arcsec), R8 (r = 11.42 arcsec), R9 (r = 18.20 arcsec), R10 (r = 28.20 arcsec), and R11 (r = 44.21 arcsec) circular apertures for stack detections. All filters are matched into a single row. These measurements are only provided for objects in the extragalactic sky, i.e., they are not provided for objects near the Galactic plane because they are not useful in crowded areas. Needs JOINing to **PS1 StackObjectThin table fields** to get positions.

**PS1 StackApFlxExGalCon6 table fields:** Same as **PS1 StackApFlxExGalUnc table fields** but after the images have been convolved to a target of 6 sky pixels (1.5 arcsec).

**PS1 StackApFlxExGalCon8 table fields:** Same as **PS1 StackApFlxExGalUnc table fields** but after the images have been convolved to a target of 8 sky pixels (2.0 arcsec).

**PS1 StackModelFitExp table fields:** Contains the exponential fit parameters for stack detections brighter than some limit (is this a S/N cut or a mag limit?) outside the galactic plane. All filters are matched into a single row. Given are mag, radius, axial ratio, position angle, RA, Dec, chisq of fit.

**PS1 StackModelFitDeV table fields:** Contains the de Vaucouleurs fit parameters for stack detections brighter than some limit (is this a S/N cut or a mag limit?) outside the galactic plane. All filters are matched into a single row. Given are mag, radius, axial ratio, position angle, RA, Dec, chisq of fit.

**PS1 StackModelFitSer table fields:** Contains the Sersic fit parameters for stack detections brighter than magnitude 21.5 outside the galactic plane. All filters are matched into a single row. Given are mag, radius, axial ratio, Sersic index, position angle, RA, Dec, chisq of fit.

**PS1 StackModelFitExtra table fields:** Contains various shape parameters for stack detections brighter than some limit (is this a S/N cut or a mag limit?) outside the galactic plane. All filters are matched into a single row. Contains Smoothness, Total and Asymmetric residuals from a smooth ellipse, Bumpiness and half-light radius. Needs JOINing to **PS1 StackObjectThin table fields** to get positions.

**PS1 StackPetrosian table fields:** Contains the Petrosian (1976) magnitudes and radii for stack detections brighter than some limit (is this a S/N cut or a mag limit?) outside the galactic plane. All filters are matched into a single row. Contains radius, mag., 50% and 90% radii, coverage factor. Needs JOINing to **PS1 StackObjectThin table fields** to get positions.