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Pan-STARRS Project Management System

IPP Postage Stamp Server

ICD

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1 Overview

The basic functionality of the postage stamp server is to accept lists of postage stamp requests, determine the corresponding images, extract the desired pixels from the images, and return the postage stamps to the user. The nominal mode of interaction as an interface to MOPS and the other Science Clients is for the postage stamp requests to be FITS tables which are placed as incoming data on the IPP Data Store (or the data store of the requesting system) and for the results to be placed back on the IPP Data Store, along with a FITS table description of the resulting output image files. For the generic user, the requests and the result may be accessed directly via a web server.

The basic information needed to by the postage stamp server (PSS) to honor a request consists of: 1) the image of interest and 2) the region on the image desired (ROI). This information may be represented in a number of ways which are discussed in section 2.1.

2 Postage Stamp Requests

Postage stamp requests are packaged for submission to the PSS in a file set containing one or more FITS binary tables called *request tables*. Each row in a request table contains a postage stamp request specification. Each request specification causes zero or more postage stamp jobs to be processed. Images are added to the output file set for each successful job.

The request specification give the parameters that the PSS uses to determine the images of interest and the Region of Interest.

2.1 Request Table Contents

The required header keywords for a request table are given in Table 1. The definition for the table's columns is in Table 2.

Table 1: Postage Stamp Request File Header Keywords

FITS Keyword	Datatype	Description
EXTNAME	string	PS1_PS_REQUEST
EXTVER	string	1
REQ_NAME	string	unique name of the request (see text)

The IPP will be configured to periodically query a set of Data Stores for new request file sets. We will refer to each Data Store as a *requester*. Each request table submitted must have a unique value for the keyword REQ_NAME. This value is used for the name of the request's output file set.

The postage stamp server supports three types of "postage stamp" job specified by the value the column JOB_TYPE. If the value is *stamp* postage stamp images will be extracted from the images of interest. If the value of JOB_TYPE is *get_image* the data from the selected images' "runs" with (satellite streaks removed) are bundled in and placed on the output file set.

2.1.1 Image Types

All requests need IMG_TYPE. This parameter selects the stage of the processing pipeline for the images of interest. The allowed values for IMG_TYPE are raw, chip, warp, diff, and stack.

Table 2: Postage Stamp Request Table Columns

Column Name	Datatype	Values	Notes
ROWNUM	U32		must be unique in file
PROJECT	string	gpc1	
JOB_TYPE	string	stamp or get_image	
OPTION_MASK	U32	see text	
REQ_TYPE	string	bycoord, byexp, byid, bydiff, or byskycell	
IMG_TYPE	string	raw, chip, warp, diff, or stack	
ID	string	depends on REQ_TYPE	
TESS_ID	string	see text	
COMPONENT	string	see text	
COORD_MASK	U32	[0 – 3] see text	not null if JOB_TYPE = stamp
CENTER_X	F64	see text	not null if JOB_TYPE = stamp
CENTER_Y	F64	see text	not null if JOB_TYPE = stamp
WIDTH	F64	see text	not null if JOB_TYPE = stamp
HEIGHT	F64	see text	not null if JOB_TYPE = stamp
DATA_GROUP	string	any	
REQFILT	string	any	
MJD_MIN	F64	Modified Julian Day	
MJD_MAX	F64		
COMMENT	string	copied to the results file	

2.1.2 Request Types

The method used to select the images of interest is determined by the value of the REQ_TYPE column. There are three allowed values.

- **bycoord** The center of the region of interest is specified in celestial coordinates. Images are selected by querying the project’s DVO database for images with the provided IMG_TYPE that contain the center. The set of images of interest may be limited by specifying certain criteria as described in Section 2.1.3.
- **byexp** The image of interest is the image resulting from a particular exposure name given by the value of the ID column.
- **byid** The image with given IMG_TYPE and ID is the image of interest. The ID parameter refers to IPP image database key that corresponds to the IMG_TYPE. e.g: either exp_id, chip_id, warp_id, diff_id, or stack_id.
- **bydiff** The image with given IMG_TYPE corresponding to the difference image whose diff_skyfile_id is equal to ID. This type is useful for requesting stamps based on difference detections.
- **byskycell** Images are selected from the skycell with skycell_id equal to the value for COMPONENT from the tessellation identified by TESS_ID. This request type may be used with IMG_TYPE warp, stack, and diff. The

set of images may be limited by filter and date as described in Section 2.1.3.

Note that at this time the REQ_TYPE byexp is not implemented for IMG_TYPE stack.

COMPONENT must also be supplied for request specifications where all of the following are true

- the ROI center is specified in pixel coordinates
- JOB_TYPE=stamp
- REQ_TYPE=byexp or REQ_TYPE=byid

The special value 'all' may be used to select all component images but this is not recommended.

2.1.3 Image Selection Cuts

A request specification may refer to many images. The scope of the search can be limited to certain dates with the parameters MJD_MIN and MJD_MAX. The specified range is inclusive. Note: these cuts have no effect for stack stage requests.

DATA_GROUP restricts the search to runs with the given value. Note that the SQL database lookups are done with a "LIKE" comparison so SQL wild cards may be used.

The REQ_FILT parameter may be used to restrict the search for images taken with a given filter. If the filter is a single character (g, r, i, z, y) the server appends a '%' character to the sql query.

2.2 The Region of Interest

Postage stamps are extracted from a rectangular region on the input image. The region is defined by a center, width, and height.

The center is defined by the columns CENTER_X and CENTER_Y and the dimensions of the rectangle are the values of WIDTH and HEIGHT. The two least significant bits in value for the column COORD_MASK determine the type for the coordinates

Table 3:

COORD_MASK value	Description
0	center in RA/DEC; width & height in arc seconds
1	center in pixel coordinates; width and height in arc seconds
2	center in RA/DEC; width and height in pixels
3	center x/y, width, and height in pixel coordinates

Another way to describe this is that COORD_MASK is two bit mask that bit mask that determines the format of the ROI values. In the C language:

- #define PSTAMP_CENTER_IN_PIXELS 1

- `#define PSTAMP_RANGE_IN_PIXELS 2`

If `COORD_MASK` & `PSTAMP_CENTER_IN_PIXELS` is zero, `CENTER_X` is the right ascension of the ROI center in degrees and `CENTER_Y` is its declination in degrees.

If `COORD_MASK` & `PSTAMP_RANGE_IN_PIXELS` is zero, `WIDTH` and `HEIGHT` are measured in seconds of arc.

When pixel coordinates are used the coordinate system is that of the image. (For chip level images, before the stamps are created the cells are mosaicked into a single image.)

2.3 Request Options

For `JOB_TYPE` stamp the value of `OPTION_MASK` is used to select various other options. It is a bitwise OR of the following values.

Table 4:

C Macro name	Value	Description
<code>PSTAMP_SELECT_IMAGE</code>	1	create postage stamp of the image pixels
<code>PSTAMP_SELECT_MASK</code>	2	create postage stamp of the mask pixels
<code>PSTAMP_SELECT_VARIANCE</code>	4	create postage stamp of the variance pixels
<code>PSTAMP_SELECT_CMF</code>	8	return the sources file (.cmf) for the images' run
<code>PSTAMP_SELECT_PSF</code>	16	return the psf file for the images' run
<code>PSTAMP_SELECT_BACKMDL</code>	32	return the background model file for the images chipRun (applies only for chip)
<code>PSTAMP_SELECT_INVERSE</code>	1024	make stamps from inverse difference images (applies only for diff)
<code>PSTAMP_SELECT_UNCONV</code>	2048	make stamps from unconvolved stack images (applies only for stack)
<code>PSTAMP_USE_IMFILE_ID</code>	16384	for byid requests select images using image id instead of stage id
<code>PSTAMP_NO_WAIT_FOR_UPDATE</code>	32768	if images are not available because they have been cleaned don't wait

If a bit is set in the `OPTION_MASK` that doesn't apply to a particular `IMG_TYPE` it is silently ignored.

Note that bit zero is also currently ignored. A stamp of the image pixels is always included in the results.

For requests with `IMG_TYPE` diff or if `REQ_TYPE` is bydiff and the corresponding difference run is a 'bothways' diff the images are selected based on the inverse difference images if (`OPTION_MASK` & `PSTAMP_SELECT_INVERSE`) is non-zero. Otherwise from the images are selected based on the 'positive' images.

For `REQ_TYPE` byid normally the ID value is the "Stage ID" or "Run ID" of the requested image. If the bit `PSTAMP_USE_IMFILE_ID` is included in the `OPTION_MASK` for a byid request, the ID for the request is the "Image ID" instead of the "Stage ID". Table 5 gives the IPP database column that corresponds to these identifiers for the various stages. The "Image ID" is useful because it may be used to select component of a run. For example the `chip_imfile_id` values are recorded in the DVO image table so it is easy to create a postage stamp request from a DVO measurement. XXX: point to an example.

Due to limited space on the IPP cluster, images files are deleted some time after they are created. Data in this state is referred to as "cleaned". By default the postage stamp server will automatically regenerate the pixels for requested images, if possible. This is referred to as the update process. If the user does not wish to wait for the updates to complete he should include `PSTAMP_NO_WAIT_FOR_UPDATE` in the `OPTION_MASK`.

Table 5:

IMG_TYPE/stage	stage ID	Image ID
raw	exp_id	raw_imfile_id
chip	chip_id	chip_imfile_id
warp	warp_id	warp_skyfile_id
diff	diff_id	diff_skyfile_id
stack	stack_id	stack_id

3 Results File

Each request specification (each row in a request file) results in zero or more postage stamp jobs to be queued and executed. Each job results in a row in the Postage stamp server results table.

3.1 Results Table Contents

The required header keywords for a results table are given in Table 6. The definition for the table's columns is in Table 7.

Table 6: Postage Stamp Results File Header Keywords

FITS Keyword	Datatype	Description
EXTNAME	string	PS1_PS_RESULTS
EXTVER	string	1
REQ_NAME	string	name of the request the results correspond to)
REQ_ID	S64	internal postage stamp id for the request

Each line in the results file corresponds to a job to create a postage stamp image. ROWNUM gives the corresponding row in the request file. Note that if more than one bit is set in the OPTION_MASK, a single job may generate multiple images and so there may be multiple rows in the results file with the same value of ROWNUM.

IMG_NAME give the name of the image in the Data Store file set.

The image file names will be in the form ROWNUM_I.fits where I is an integer that ranges from 1 to the number of jobs generated for the row's request specification.

Mask images will be named ROWNUM_I.mk.fits and variance images will have the name ROWNUM_I.mk.fits

JOB_ID is the value of the postage stamp server's internal job id. (This is provided primarily as a debugging aid.)

The column named PROJECT and following columns are copies from the input request specification.

If ERROR_CODE is non-zero an error occurred when processing the request specification or the job. The values for ERROR_CODE are listed in table 8.

If parsing of the request specification file results in error output, the contents will be placed in the file 'parse_error.txt' in the resulting file set.

Table 7: Postage Stamp Results Table Columns

Column Name	Datatype	Values
ROWNUM	U32	identifier for this row in table
ERROR_CODE	U32	Error code (see text)
ERROR_STR	U32	String corresponding to ERROR_CODE
IMG_NAME	string	Name of image in Data Store file set
JOB_ID	S64	Internal postage stamp server job id that produced this image
RA_DEG	F64	RA of stamp center in degrees
DEC_DEG	F64	Declination of stamp center in degrees
MJD_OBS	F64	actual start time of exposure
RA_OBS	F64	J2000 field center RA at start of exposure MJD
DEC_OBS	F64	J2000 field center Dec at start of exposure MJD
FILTER	string	Actual filter retrieved (may differ from REQFLT)
EXPTIME	F64	exposure time of parent image
FPA_ID	string	original FPA_ID used at injection
PROJECT	string	Values from initial request specification
JOB_TYPE	string	
REQ_TYPE	string	
IMG_TYPE	string	
TESS_ID	string	
COMPONENT	string	
COORD_MASK	U32	
CENTER_X	F64	
CENTER_Y	F64	
WIDTH	F64	
HEIGHT	F64	
REQFLT	string	
MJD_MIN	F64	
MJD_MAX	F64	
DATA_GROUP	string	
COMMENT	string	

Table 8: Postage Stamp Error Codes

Name	ERROR_CODE value	Description
PSTAMP_SUCCESS	0	No errors
PSTAMP_SYSTEM_ERROR	10	some unspecified system error occurred during processing
PSTAMP_NOT_IMPLEMENTED	11	Feature not yet implemented
PSTAMP_UNKNOWN_ERROR	12	Unknown error
PSTAMP_DUP_REQUEST	20	Request name is a duplicate
PSTAMP_INVALID_REQUEST	21	Error in a request specification. See parse_error.txt
PSTAMP_UNKNOWN_PRODUCT	22	Unknown product in request specification
PSTAMP_NO_IMAGE_MATCH	23	No images matched the request
PSTAMP_NOT_DESTREAKED	24	Image matched, but not yet de-streaked
PSTAMP_NOT_AVAILABLE	25	Image not available (temporary)
PSTAMP_GONE	26	Image is no longer available
PSTAMP_NO_JOBS_QUEUED	27	Request specification yielded no jobs. See parse_error.txt
PSTAMP_NO_OVERLAP	28	Center coordinates are not contained in any image of interest