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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 created. 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.

Note: The value "null" for strings or 0 for numbers may be used to disable the application of certain parameters.

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	2
REQ_NAME	string	unique name of the request (see text)
ACTION	string	PROCESS
EMAIL	string	Email address of submitting user

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 two 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" are bundled in the format used by the IPP distribution system and are placed on the output file set.

Table 2: Postage Stamp Request Table Columns

Column Name	Datatype	Values	Notes
ROWNUM	U32		must be unique in file
PROJECT	string	gpc1	
SURVEY_NAME	string	PS1 survey names	see table 3
IPP_RELEASE	string	IPP release name	e.g. 3PI.PV1, 3PI.nightly
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		
RUN_TYPE	string	stack or diff type	deep, reference, nightly, warp-stack, etc.
FWHM_MIN	F64	minimum measured seeing (pixels)	
FWHM_MAX	F64	maximum measured seeing (pixels)	
COMMENT	string	copied to the results file	

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.

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 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 components (chips or skycells) of a run.

2.1.3 Image Selection Cuts

A request specification may refer to many images. The scope of the search can be reduced by providing the selection parameters.

SURVEY_NAME (new in version 2) restricts the queries to images for a given PS1 survey. Valid values are shown in the table below. The value "null" may also be used.

IPP_RELEASE (new in version 2) restricts the search for data from a particular "release" of IPP data. If "null" the system chooses data from the highest priority release ("best") of the given exposure or skycell.

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. With Version 2 of this specification use of DATA_GROUP is deprecated. It is ignored if a non null value for SURVEY_NAME or IPP_RELEASE is supplied.

Searches may be limited to certain dates with the parameters MJD_MIN and MJD_MAX. The specified range is inclusive. Note: For stack stage requests, these cuts will have no effect on queries for deep or reference stacks.

The REQFLT 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, w) the server appends a '%' character to the sql query. If "null" data from all filters is queried.

The optional parameter RUN_TYPE is used for specify the type of stack or difference images to consider as images of interest.

For difference images valid values are warp_warp warp_stack and stack_stack.

For stacks valid values are "deep", "reference", "nightly", and "notnightly". For stacks, this selector is only applied if SURVEY_NAME or IPP_RELEASE is supplied.

Table 3: PS1 SURVEYNAME Values

SURVEY_NAME	Description
3PI	PS1 3PI Survey
MD01	PS1 MD01 XMM-LSS-DXS 022224-043000
MD02	PS1 MD02 CDFS/GOODS/GEMS 033224-274800
MD03	PS1 MD03 IFA/Lynx 084300+444000
MD04	PS1 MD04 COSMOS 100000+021200
MD05	PS1 MD05 Lockman-DXS 110000+570000
MD06	PS1 MD06 NGC 4258 121857+471814
MD07	PS1 MD07 VISTA-Video1 140000+050000
MD08	PS1 MD08 EliasN1-DXS 160000+570000
MD09	PS1 MD09 Vimos4-DXS-SSA 220000+003000
MD10	PS1 MD10 Deep2 233000+000000
M31	PS1 M31 Andromeda 004242+411600
STS1	PS1 STS1 Outskirts of Bulge 195048+170339
STS2	PS1 STS2 Hyades 004000+150000
STS3	PS1 STS3 Praesepe 083000+200000
SSS	PS1 Solar System Survey

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 4:

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.)

Note: If the width and height are both equal to zero, the entire input image is included in the stamp. Otherwise values less than or equal to zero will generate an error.

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 5:

C Macro name	Value	Description
PSTAMP_SELECT_IMAGE	1	create postage stamp of the image pixels
PSTAMP_SELECT_MASK	2	create postage stamp of the mask pixels
PSTAMP_SELECT_VARIANCE	4	create postage stamp of the variance pixels
PSTAMP_SELECT_SOURCES	8	extract sources from the region of interest from the sources file (.cmf) for the image
PSTAMP_SELECT_PSF	16	return the psf file for the images' run
PSTAMP_SELECT_BACKMDL	32	return the background model file for the images chipRun (applies only for chipRun)
PSTAMP_SELECT_JPEG	64	return a jpeg format image of the stamp
PSTAMP_SELECT_UNCOMPRESSED	512	do not use FITS image compression
PSTAMP_SELECT_INVERSE	1024	make stamps from inverse difference images (applies only for diff)
PSTAMP_SELECT_UNCONV	2048	make stamps from unconvolved stack images (applies only for stack)
PSTAMP_RESTORE_BACKGROUND	4096	restore background correction to chip stage images before making stamp
PSTAMP_USE_IMFILE_ID	16384	for byid requests select images using image id instead of stage id
PSTAMP_NO_WAIT_FOR_UPDATE	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 6 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. In this case the row will receive the error code PSTAMP_NOT_AVAILABLE.

Table 6:

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 7. The definition for the table's columns is in Table 8.

Table 7: 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. aid.)

The column named PROJECT and following columns are copied 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 table9.

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 8: 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	Name 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
Values from corresponding row in the request file		
PROJECT	string	
SURVEY_NAME	string	
IPP_RELEASE	string	
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	
RUN_TYPE	string	
FWHM_MIN	F64	
FWHM_MAX	F64	
COMMENT	string	

Table 9: 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	Obsolete - No longer used
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
PSTAMP_NOT_AUTHORIZED	29	user is not allowed access to the selected data