

UNIVERSITY OF HAWAII AT MĀNOA

Institute for Astronomy

Pan-STARRS Project Management System

IPP Postage Stamp Server

ICD

Coop. Agreement No.	: FA9451-06-2-0338
Prepared For	: IPP
Prepared By	: Bill Sweeney
Document No.	: PSDC-940-xxx-DR
Document Date	: July 25, 2008
Revision	: DR

DISTRIBUTION STATEMENT

Approved for Public Release – Distribution is Unlimited

©Institute for Astronomy, University of Hawaii
2680 Woodlawn Drive, Honolulu, Hawaii 96822
An Equal Opportunity/Affirmative Action Institution

Submitted By:

[Insert Signature Block of Authorized Developer Representative]

Date

Approved By:

[Insert Signature Block of Customer Developer Representative]

Date

Contents

- 1 Overview 1
- 2 Postage Stamp Requests 1
 - 2.1 Request Table Contents 1
 - 2.1.1 Image Types 1
 - 2.1.2 Request Types 2
 - 2.1.3 Image Selection Filters 3
 - 2.2 The Region of Interest 3
- 3 Results File 4
 - 3.1 Results Table Contents 4

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. An image is 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 *requestor*. Each request table submitted by a given requestor 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* a copy of the selected image(s) with (satellite streaks removed) will be placed on the output file set. Finally if the JOB_TYPE is *list* the results file will list the input selected images but no postage stamps will be made.

2.1.1 Image Types

All requests need IMG_TYPE. This parameter selects the stage in 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	TBD	
JOB_TYPE	string	stamp or get_image	
STAMP_NAME	string	letters, numbers, '.', '' and '_'	
OPTION_MASK	U32	[0 - 5] see text	
REQ_TYPE	string	bycoord, byexp, or byid	
IMG_TYPE	string	raw, chip, warp, diff, or stack	
ID	string	depends on project and REQ_TYPE	
CLASS_ID	string	see text	not null for byid raw & byexp raw
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
REQFILT	string	any	used only for REQ_TYPE = bycoord
MJD_MIN	F64	Modified Julian Day	used only for REQ_TYPE = bycoord
MJD_MAX	F64		used only for REQ_TYPE = bycoord

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.

CLASS_ID 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
- IMG_TYPE=chip or IMG_TYPE=raw

2.1.3 Image Selection Filters

A request for given celestial coordinates 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.

The REQFLT parameter may be used to restrict the search for images taken with a given filter. XXX: What is the namespace for filter names. For example Megacam has filter names like U.9301 which IPP maps to u. Which name do we allow? Probably should use the mapped names g r i etc.

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 arcseconds
1	center in pixel coordinates; width and height in arcseconds
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 bitmask 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 mosaiced into a single image.)

Any fractional parts in pixel coordinate values are ignored.

The value of OPTION_MASK is used to select various other options. It is a bitwise or of the following values.

Table 4:

OPTION_MASK value	Description
1	create postage stamp of the image pixels
2	create postage stamp of the mask pixels
4	create postage stamp of the weight pixels
8	convert WCS to approximate linear transformation in the stamp images

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 5. The definition for the table's columns is in Table 6.

Table 5: 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.

If no STAMP_NAME is provided in the request specification 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 that the request specification generated. Mask images will be named ROWNUM_I.mk.fits and weight images will have the name ROWNUM_I.mk.fits

If STAMP_NAME is provided in the request specification, the name of the image mask and weight files will be ROWNUM_I_STAMP_NAME.mk.fits, ROWNUM_I_STAMP_NAME.wt.fits respectively.

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 one or more errors occurred processing the request specification. The value of ERROR_CODE is a bitwise or of the values given in the table 7.

In the case of an error parsing the request table a file containing a textual description of the error may be added to the resulting file set.

Table 6: Postage Stamp Results Table Columns

Column Name	Datatype	Values
ROWNUM	U32	identifier for this row in table
ERROR_CODE	U32	Error code (see text)
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	
CLASS_ID	string	
COORD_MASK	U32	
CENTER_X	F64	
CENTER_Y	F64	
WIDTH	F64	
HEIGHT	F64	
REQFLT	string	
MJD_MIN	F64	
MJD_MAX	F64	

Table 7: Postage Stamp Error Codes

Name	ERROR_CODE value	Description
NO_ERROR	0	
NO_MATCHING_IMAGE	1	No image matches the request specification
RA_DEC_NOT_ON_PIXEL	2	The central RA, DEC are on a blind area (for example a inter-chip gap)
RA_DEC_NOT_IN_FOV	4	Wrong position on sky for given MJD
NO_IMAGE_FOR_FILTER	8	Image is not in the filter requested
NOT_AVAILABLE_PERM	16	Image matched but is permanantly unavailable
NOT_AVAILABLE_TEMP	32	Image matched but is currently unaccessible
INVALID_REQUEST	64	request specification was invalid
SYSTEM_ERROR	128	system error