

The PanSTARRS Archive



Rick White

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Brian McLean

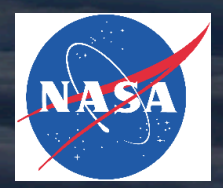
Patrick Taylor

Marc Postman

Jeff Valenti

... and many others

January 2018 MAST Users Group Meeting



14 institutions and 3 funding sources



Quick Facts

Observatory Location	Haleakala, Hawaii
Telescope	1.8m diameter
Field of View	3 degree diameter, 7 sq. deg. FOV
Filters	g,r,i,z,y
Detectors	60 orthogonal transfer arrays (1.4 Gigapixels)
Sky Coverage	All sky north of declination -30°
3 π stack depth (5σ)	grizy: <23.3, 23.2, 23.1, 22.3, 21.3
Single epoch depth (5σ)	grizy: <22.0, 21.8, 21.5, 20.9, 19.7
Median Seeing	1.31" (g) 1.19" (r) 1.11" (i) 1.07" (z) 1.02" (y)

Survey	Filters	Dates
3 π Steradian Survey	<i>grizy</i> _{P1}	2009 – 14
Medium Deep Survey	<i>grizy</i> _{P1}	2009 – 14
Solar System Survey	<i>W</i> _{P1}	2012 – 14
Pan-Planets Transit Survey	<i>I</i> _{P1}	2010 – 12
Pandromeda Survey (M31)	<i>r</i> _{P1} / <i>I</i> _{P1}	2010 – 12

Only 3 π Survey in archive.

The other Pan-STARRS surveys are not included in the archive at this time.

The PS1 public archive

- STScI is providing the public archive for PS1 data
- Services provided include:
 - **Catalog access**
 - Simple form interface
 - Web services (including VO-compatible interfaces)
 - SQL query interface
 - Bulk catalog downloads for selected subsets
 - **Image access**
 - Whole images
 - Image cutouts either as FITS files or JPEG previews
 - Interactive display
 - **We use products from the PS1 project with existing tools developed by MAST and PS1.**
 - **STScI's support for the PS1 archive comes from internal science research funds and from the Gordon and Betty Moore Foundation.**

URL: panstarrs.stsci.edu

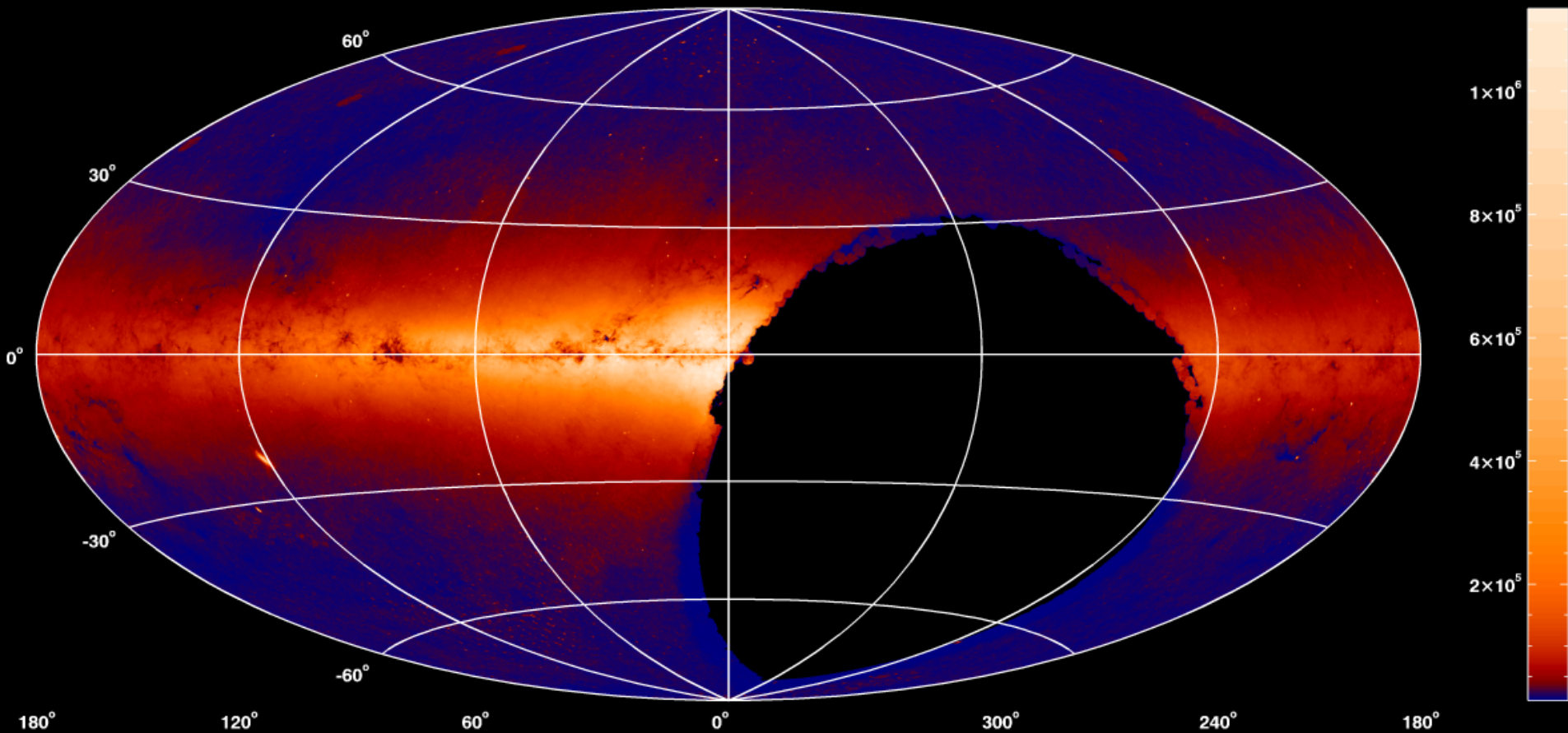
- Currently, two data releases have been funded:
 - DR1: “Static sky” = stacked images from 3π survey, mean object properties, objects detected on stacks
 - 1 million images (100 TB)
 - 11 billion objects (15 TB database)
 - Release date: December 19, 2016
 - DR2: All individual epochs in the 3π survey, including single-epoch images (“warps”) & object measurements
 - 22 million images (1.4 PB)
 - 11 billion objects, 74 billion detections (100 TB database)
 - Release date: May 2018 (tentative)

PS1 archive highlights for 2017

- PS1 DR1 release was on December 19, 2016 (immediately after the previous MUG meeting)
- PS1 images available as background in Astroview (Portal v2.9, December 2016)
- PS1 FITS images discoverable in MAST searches (Portal v3.2, July 2017)
- 1.5 petabytes of image data migrated from original storage to new hardware (June 2017)
- Many documentation updates and user helpdesk questions answered

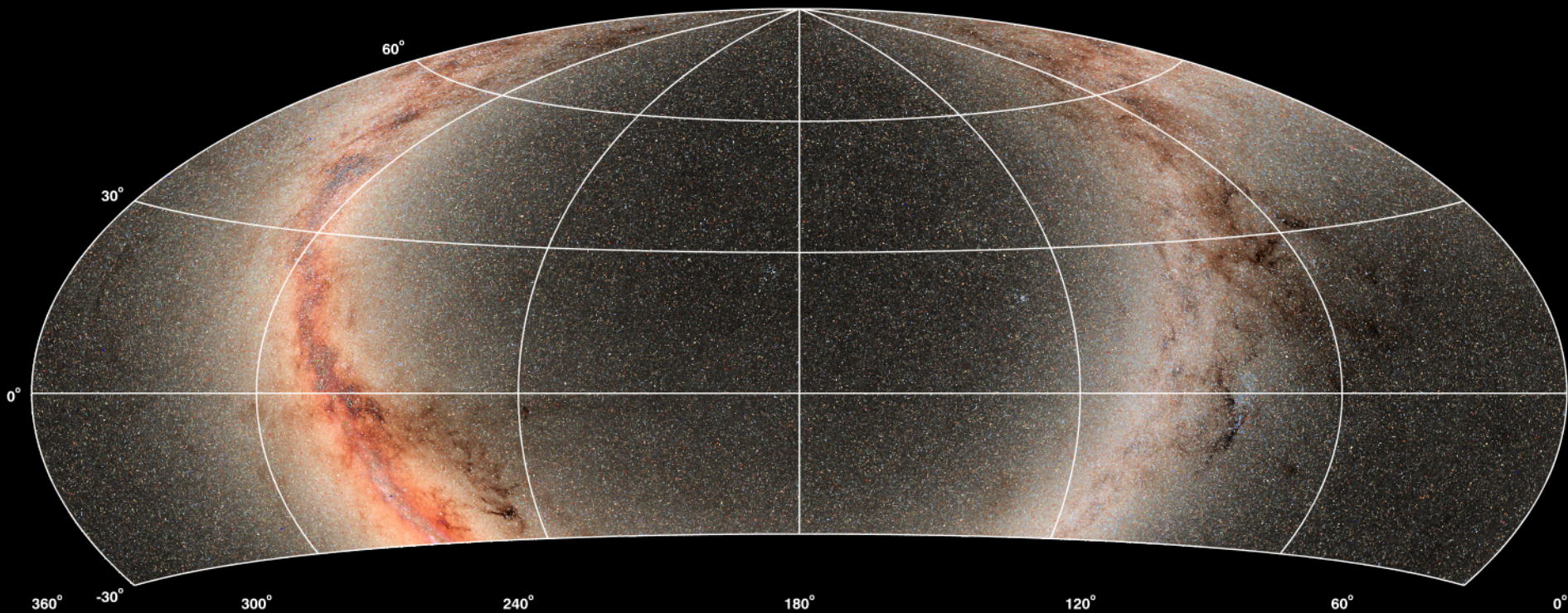
3PI Object counts, nDetections>2

1.9×10^9 objects




PS1 mean grz colors

8.63×10^8 objects with 5 colors



Simple PS1 Catalog Search Query Form:



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Target Name

Resolver

Radius (arcmin)

Right Ascension

Declination

Equinox

nDetections

Search Output Columns

objName
objID
raMean
decMean
raMeanErr
decMeanErr
nDetections
randomID
projectionID
skyCellID

Sort By:

Reverse
 Reverse
 Reverse

Display Coords: Sexagesimal Degrees Hours


Search Output Format

Remove Null Columns Make Rows Distinct Skip formatting

Maximum Records:

Records per Page:

Top of Page Copyright Email Questions or Suggestions Contacts Last Modified: Dec 16, 2018 17:23



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[Columns Help](#) / [Archive Status](#)

PANSTARRS Search Results

Object name [Abell 2261](#) resolved by [NED \(via SANTA cache\)](#) to ABELL 2261 (GC1str)
 RA: 17 22 27.10 Dec: 32 8 2.00 (J2000)

number of rows returned = 759
 note: reload page if no results are shown

◀ Previous Next ▶ Page 1 of 2

objName	objID	raMean	decMean	raMeanErr	decMeanErr	nDetections	randomID	projectionID	skyCellID	objInfo
PSO J172227.172+320759.624	146562606132390563	17 22 27.167	+32 07 59.57	0.049	0.049	2	0.528243715435493	2064	4	31045
PSO J172227.263+320800.238	1465626061335690662	17 22 27.261	+32 08 00.20	0.023	0.023	2	0.357830811625189	2064	4	31045
PSO J172227.186+320757.250	146552606133419652	17 22 27.187	+32 07 57.19	0.011	0.015	89	0.108883042921203	2064	4	51202
PSO J172227.144+320756.800	146552606129219377	17 22 27.140	+32 07 56.76	0.029	0.029	3	0.487558770447559	2064	4	31045
PSO J172226.930+320756.319	146552606122689263	17 22 26.931	+32 07 56.32	0.056	0.056	2	0.788117995233905	2064	4	27734
PSO J172227.354+320807.665	146562606139603118	17 22 27.350	+32 08 07.62	0.023	0.023	2	0.8985340920263289	2064	4	31045
PSO J172227.594+320759.577	146562606149650437	17 22 27.590	+32 07 59.53	0.069	0.069	2	0.00504355878107581	2064	4	31045
PSO J172226.498+320758.341	146562606104780021	17 22 26.497	+32 07 58.30	0.063	0.063	2	0.653115817022618	2064	4	31045
PSO J172227.110+320811.090	146562606129494253	17 22 27.104	+32 08 11.12	0.011	0.017	65	0.645077342768272	2064	4	44491
PSO J172226.383+320754.454	146552606099198733	17 22 26.379	+32 07 54.36	0.011	0.016	83	0.689838382126613	2064	4	44491
PSO J172227.588+320749.776	146552606149687187	17 22 27.585	+32 07 49.74	0.013	0.016	63	0.379298684540483	2064	4	44491
PSO J172228.258+320759.517	146562606177160463	17 22 28.258	+32 07 59.45	0.003	0.010	88	0.47722847347821	2064	4	43652
PSO J172228.219+320808.204	146562606175693292	17 22 28.211	+32 08 08.16	0.035	0.035	3	0.442113935427846	2064	4	138419
PSO J172225.965+320807.613	146562606082013120	17 22 25.961	+32 08 07.56	0.016	0.016	2	0.378054927455312	2064	4	26851
PSO J172228.389+320805.005	146562606183092203	17 22 28.387	+32 08 04.96	0.061	0.061	2	0.514181606019085	2064	4	31045
PSO J172226.481+320747.105	146552606103496285	17 22 26.480	+32 07 47.06	0.020	0.020	2	0.285377978613021	2064	4	31045
PSO J172225.992+320748.850	146552606082926850	17 22 25.987	+32 07 48.86	0.014	0.024	74	0.193593663343781	2064	4	43652
PSO J172226.418+320744.676	146552606100875476	17 22 26.414	+32 07 44.65	0.004	0.012	93	0.524428801168156	2064	4	50363
PSO J172225.689+320809.770	146562606070073750	17 22 25.676	+32 08 09.66	2.729	3.055	7	0.893405381490854	2064	4	43652
PSO J172228.680+320800.640	146562606194930798	17 22 28.676	+32 08 00.58	0.072	0.072	4	0.655061533333349	2064	4	44475
PSO J172226.871+320823.628	146562606119138410	17 22 26.869	+32 08 23.61	0.022	0.015	78	0.807794066893333	2064	4	44491
PSO J172225.689+320815.285	146562606070415703	17 22 25.683	+32 08 15.33	0.017	0.024	59	0.453076970254143	2064	4	44491
PSO J172226.023+320820.497	146562606084837423	17 22 26.021	+32 08 20.48	0.008	0.011	81	0.6601151811518851	2064	4	44491
PSO J172226.495+320824.122	146562606103488632	17 22 26.493	+32 08 24.08	0.131	0.131	2	0.357488704246924	2064	4	30206
PSO J172228.993+320804.390	146562606207302014	17 22 28.989	+32 08 04.34	0.073	0.073	4	0.579024830441014	2064	4	43628
PSO J172229.042+320805.363	146562606209922363	17 22 29.038	+32 08 05.32	0.021	0.033	45	0.808780044139158	2064	4	44491
PSO J172227.812+320826.772	146562606158719510	17 22 27.807	+32 08 26.76	0.015	0.020	60	0.72116385374266	2064	4	43652
PSO J172226.126+320825.356	146562606088929110	17 22 26.125	+32 08 25.32	0.074	0.074	2	0.545423138463332	2064	4	31045
PSO J172227.120+320735.588	146552606130432417	17 22 27.116	+32 07 35.57	0.007	0.007	78	0.95109074558233	2064	4	44491
PSO J172228.898+320816.880	146562606204436169	17 22 28.896	+32 08 16.85	0.007	0.007	84	0.345464766347282	2064	4	44491
PSO J172226.161+320737.267	146552606090303039	17 22 26.158	+32 07 37.23	0.013	0.018	53	0.365431479518704	2064	4	44491
PSO J172226.817+320734.586	146552606117442130	17 22 26.813	+32 07 34.58	0.009	0.014	80	0.41853673019696	2064	4	44491

PanSTARRS Image Access

crab nebula

Filters: color g r i z y

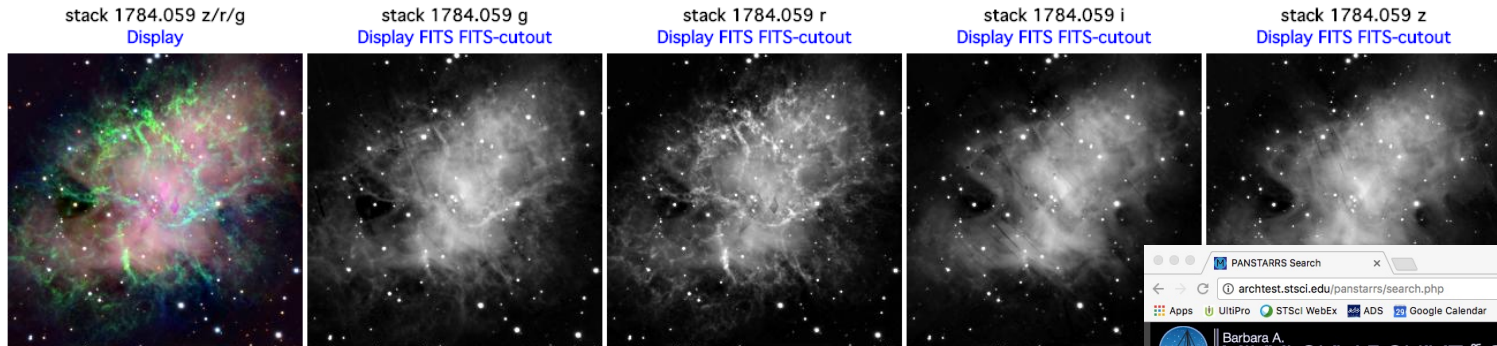
File types: stack warp

Auxiliary data: data mask wt exp expwt num

Cutout image size: 1280 pixels (320.00 arcsec) (sets spatial size of the FITS image)

JPEG display size: 256 pixels (sets resolution of the JPEG previews)

crab nebula (ra = 83.633210, dec = 22.014460)



Stacked (DR1) images are relatively easy for users to handle. Users likely to make requests for images as well as submit queries to the DR1 database.

PANSTARRS Search

archtest.stsci.edu/panstarrs/search.php

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Barbara A. MIKULSKI ARCHIVE FOR SPACE TELESCOPES

PanSTARRS Catalog Search

Standard Form File Upload Form

Search Reset Clear Form

Target Name Resolver Radius (arcmin)

Right Ascension Declination Equinox J2000

nDetections > 1

Search Output Columns: objName, objID, projectionID, skyCellID, objInfoFlag, qualityFlag, raStack, decStack, raStackErr, decStackErr

Sort By: ang_sep (°), objID, null

Display Coords: Sexagesimal Degrees Hours

Search Output Format: HTML_Table

Remove Null Columns Make Rows Distinct Skip formatting

Maximum Records: 5001

Records per Page: 500

Search Reset Clear Form

Top of Page Copyright Email Questions or Suggestions Contacts Last Modified: Dec 08, 2016 13:48

MAST Catalog Query Form for DR1:

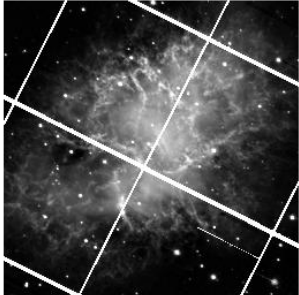


PanSTARRS1 3PI Image Access

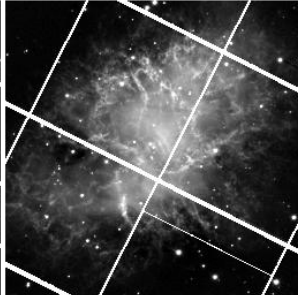
crab nebula
Filters: color g r i z y
File types: stack warp
Auxiliary data: data mask wt exp expwt num
Cutout image size: 1280 pixels (sets spatial size of the FITS image)
JPEG display size: 256 pixels (sets resolution of the JPEG previews)

crab nebula (ra = 83.633210, dec = 22.014460)

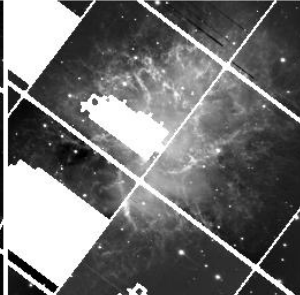
warp 1784.059 r 55180.48791
[Display FITS](#) [FITS-cutout](#)



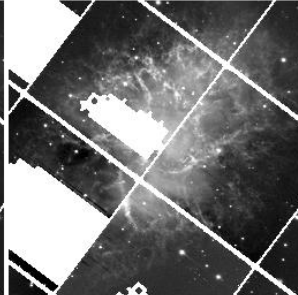
warp 1784.059 r 55192.32810
[Display FITS](#) [FITS-cutout](#)



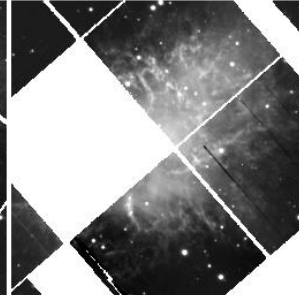
warp 1784.059 r 55811.61191
[Display FITS](#) [FITS-cutout](#)



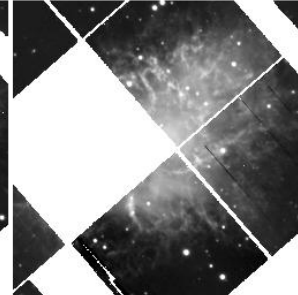
warp 1784.059 r 55814.57473
[Display FITS](#) [FITS-cutout](#)



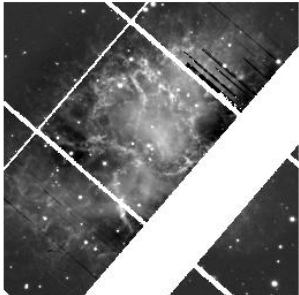
warp 1784.059 r 55891.58405
[Display FITS](#) [FITS-cutout](#)



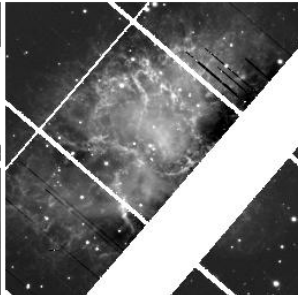
warp 1784.059 r 55891.59833
[Display FITS](#) [FITS-cutout](#)



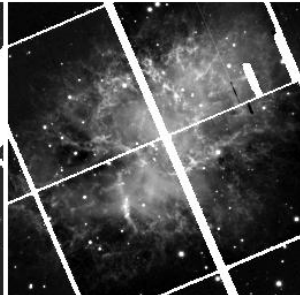
warp 1784.059 r 56238.58456
[Display FITS](#) [FITS-cutout](#)



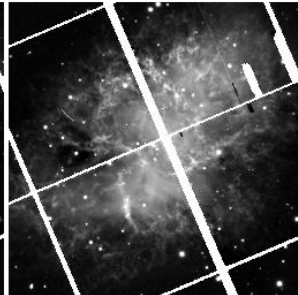
warp 1784.059 r 56238.59634
[Display FITS](#) [FITS-cutout](#)



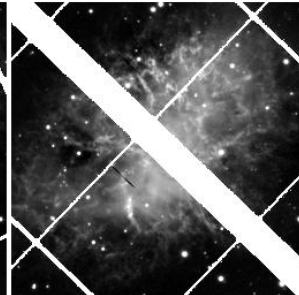
warp 1784.059 r 56310.40546
[Display FITS](#) [FITS-cutout](#)



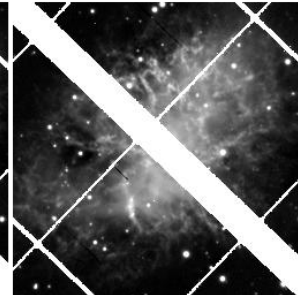
warp 1784.059 r 56310.41759
[Display FITS](#) [FITS-cutout](#)



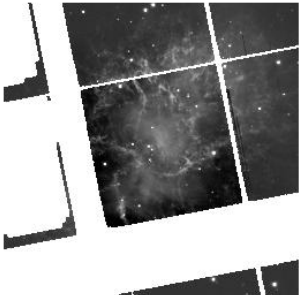
warp 1784.059 r 56323.35396
[Display FITS](#) [FITS-cutout](#)



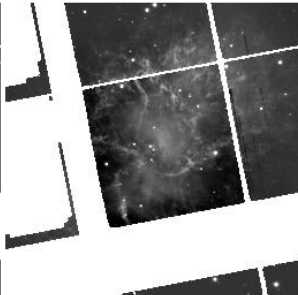
warp 1784.059 r 56323.36628
[Display FITS](#) [FITS-cutout](#)



warp 1784.059 r 56735.29197
[Display FITS](#) [FITS-cutout](#)



warp 1784.059 r 56735.29984
[Display FITS](#) [FITS-cutout](#)



Single-epoch (DR2) images are complex and will be challenging for users to analyze. Users, thus, likely to mostly rely on DR2 database for science.

STScI/JHU PS1 Archive Funding

- The PS1 archive is not funded by NASA
- Original support (2011) from STScI internal research funds for hardware
- Gordon & Betty Moore Foundation (2016)
 - 1.5 PB replacement storage to be integrated with our existing EMC Isilon system
 - 4 new database servers
- In-kind labor (from science staff members and JHU IT & MARCC staff)





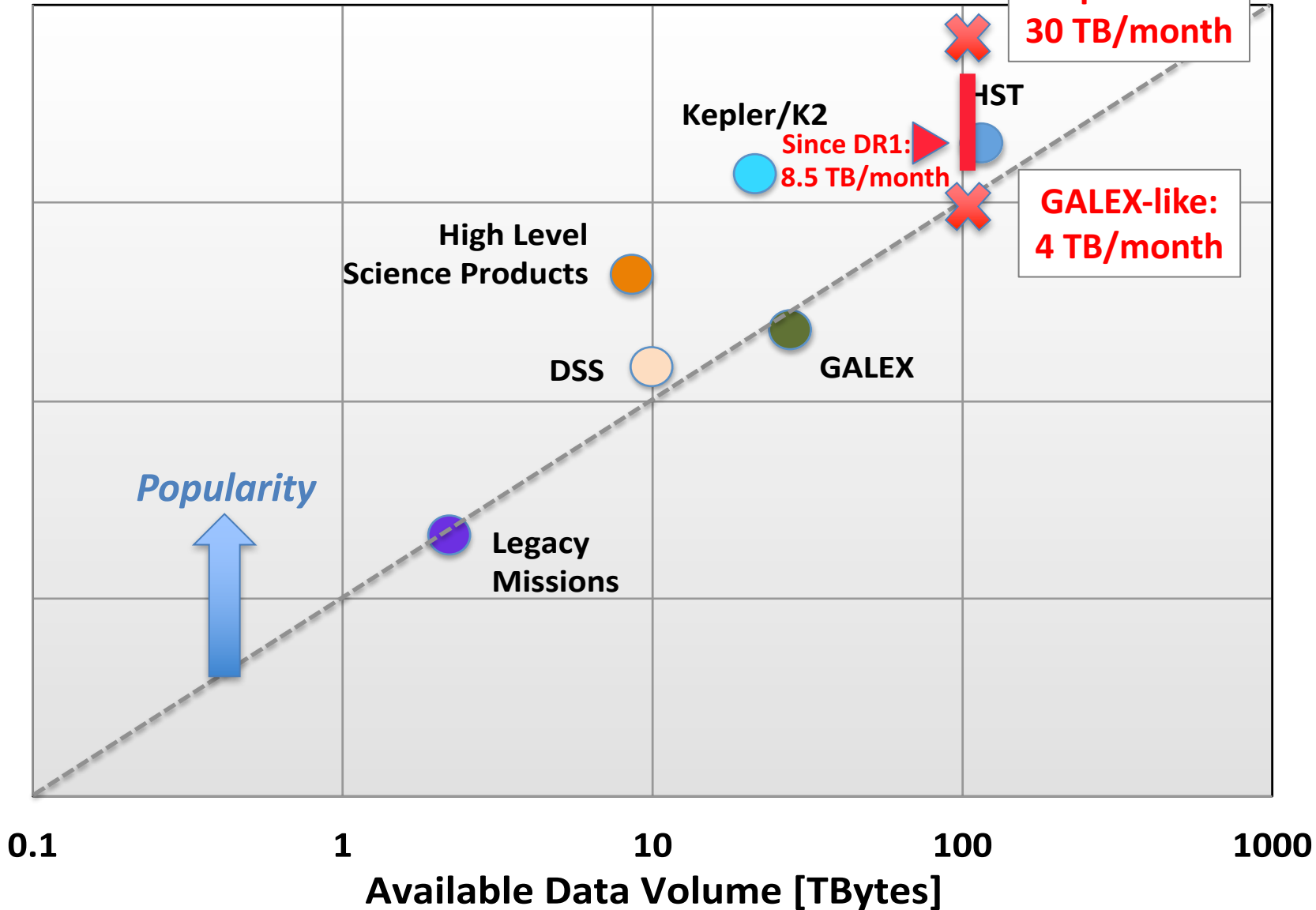
1000

PS1: Usage

PS1 DR1 accessed from over 13,000 unique IP addresses

Distributed Data Volume [TBytes]
(over 2 year period)

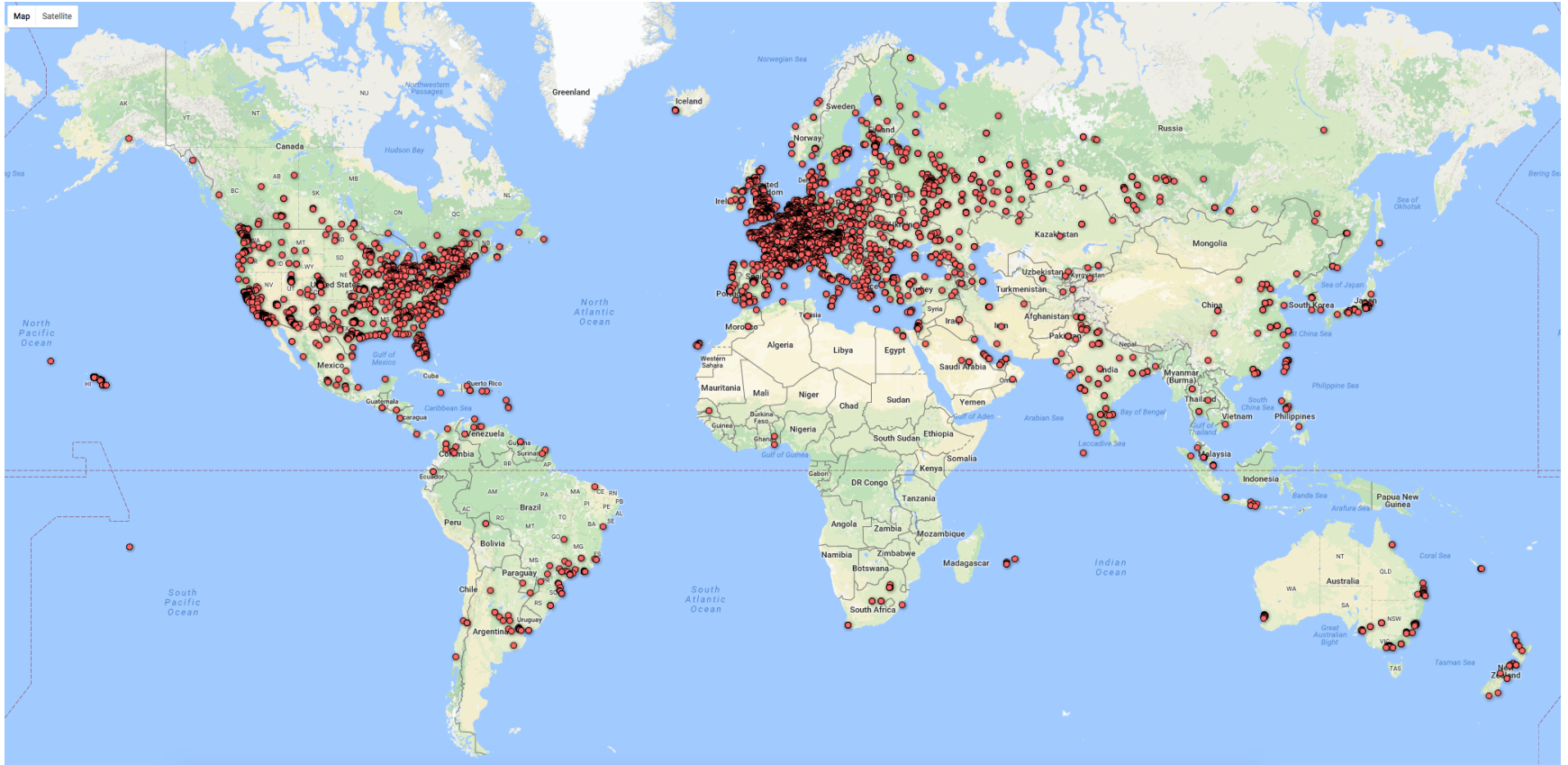
Popularity
↑





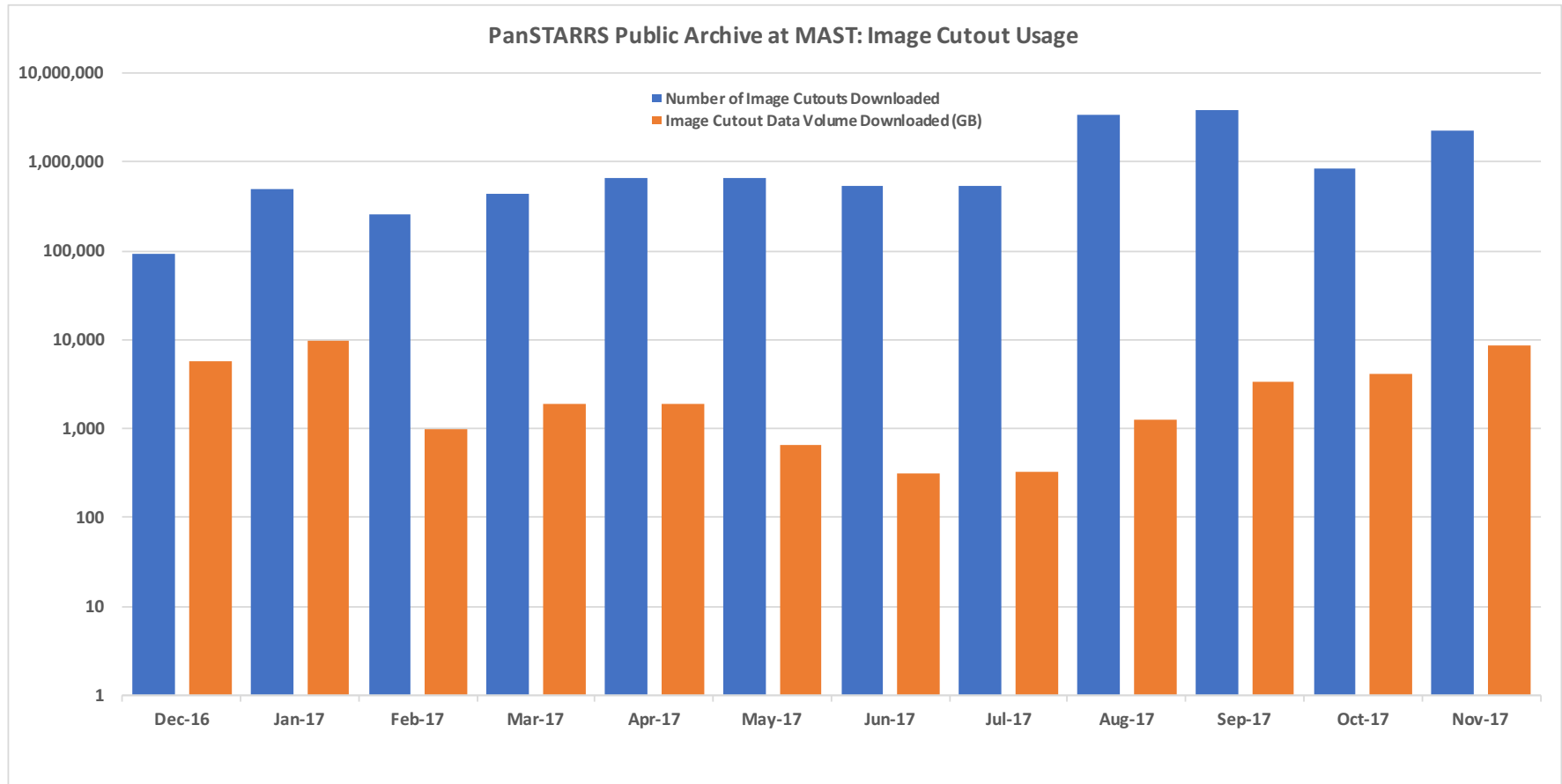
PS1: Global Interest

First 3 months after DR1





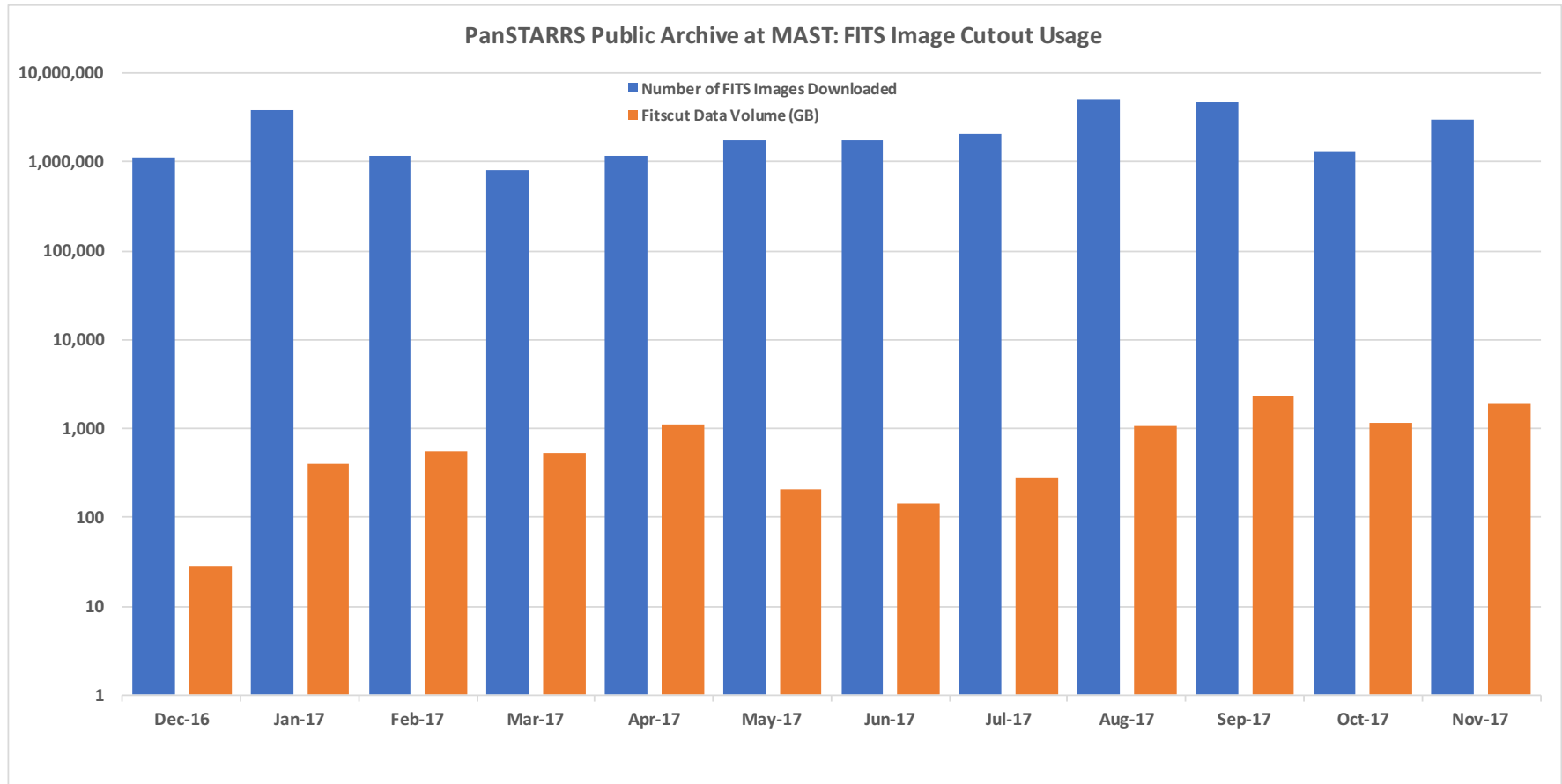
PS1 Image Download Statistics



**Total image downloads up to 2018 Jan 22:
61 TB (21 million images)**



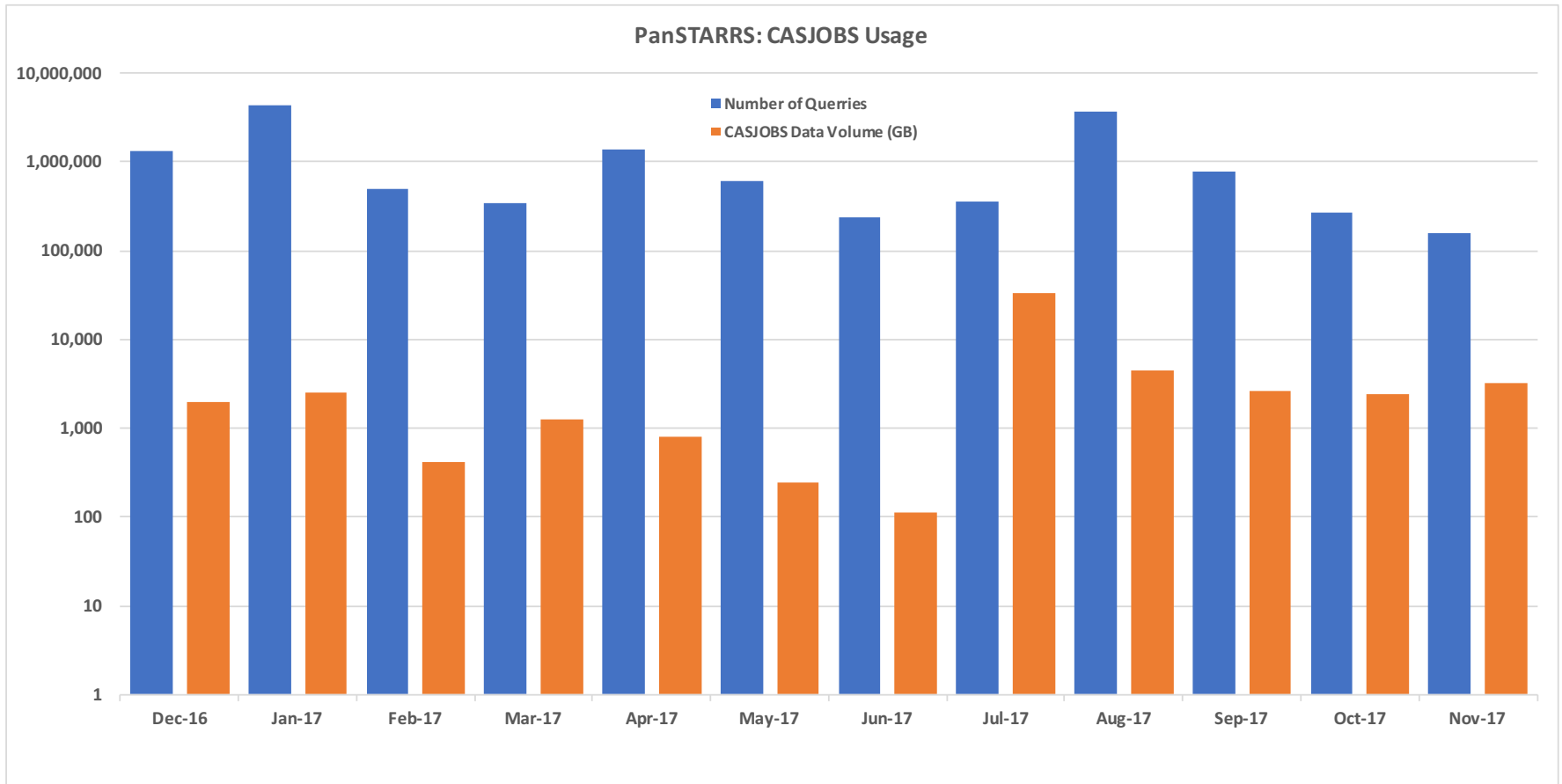
PS1 Image Cutout Statistics



**Total image cutouts up to 2018 Jan 22:
35 million ~ 1 cutout per second**



PS1 Casjobs (Catalog) Usage



**Average Casjobs usage (1/1/17 to 11/30/17):
1.1 million queries/month, 4.7 TB/month**

PS1 Data Archive Credits

Pan-STARRS Project

- Nick Kaiser
- John Tonry
- Ken Chambers
- Will Burgett
- Jeff Morgan
- Jim Heasley
- Ed Pier
- Larry Deneau
- Erik Small
- Richard Wainscoat

Maui Operations

- Bob Calder
- Tom Melshiemer
- Richard Harris
- Donna Roher
- Rick Anderson

Support Staff & IT

- Gavin Seo
- Sifan Kihale
- Haydn Huntley

Camera Team

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- Sidik Isani
- Craig Rae
- Aaron Lee
- Robin Uyeshiro
- Greg Chung
- Lou Robertson

Observers

- Angie Schultz
- Shannon Waters
- Jacob Thiel
- Natalia Primak
- Tommy Goggia
- Mark Willman

PS1SC Board

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- Carlos Frenk
- Hans-Walter Rix
- Thomas Henning
- Ralf Bender
- Matt Holman
- Wen Ping Chen

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- Heather Flewelling
- Mark Huber
- Paul Price
- Bill Sweeney
- Chris Waters
- Conrad Holmberg
- Xin Thomas Chen

PS1SC

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- Peter Draper
- Stephen Smart
- Ken Smith
- Roberto Sagalia
- Doug Finkbiener
- Eddie Schafly

Admin

- Diane Tokumura
- Jill Kajikara-Kent
- Chris Kaukali

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- Annalisa Calamida
- Stefano Casertano
- Vera Gibbs
- Romeo Gourgue
- Philip Grant
- Mike Jackson
- Charles Keyes
- Anton Koekemoer
- Duy-Quang Le
- Dave Liska
- Knox Long
- Greg Masci
- Brian McLean
- Eugene Mindel
- Prem Mishra

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- Armin Rest
- Ron Russell
- Leyla Rutz
- Bernie Shiao
- David Soderblom
- Lou Strolger
- Patrick Taylor
- Randall Thompson
- David Unger
- Jeff Valenti
- Jeff Wagner
- Thomas Walker
- Rick White