

# 3 $\pi$ Photometric Classification with PanDisC

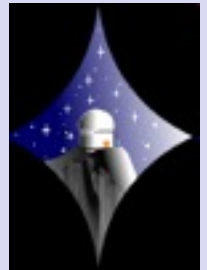
- Status of PCS: PanDisC  
*Automated Processes*
- Galaxy/Quasar/Star photometric classification in SAS  
*Physical classification of objects based on multicolor info*
- Joint morphological+photometric classification in SAS  
*Complementarity with respect to Star-Galaxy-Junk Class.*
- What we can expect for 3 $\pi$

Saglia et al., 2012, ApJ 744, 128



*R. Saglia - MPE/USM*

*(with the help of R. Senger)*



*Durham, KP12 PanSTARRS Meeting, 7.1.2013*

# PCS: the Photometric Classification Server

## Goals:

- Separation of Stars/Galaxies/Quasars (PanDiSCS, MPIA)
- Estimation of PhotoZ for galaxies (PanZ, MPE)
- Estimation of stellar parameters for stars (PanSTeP, MPIA)
- Automatic processing and publishing of data
- Serve the Science Projects

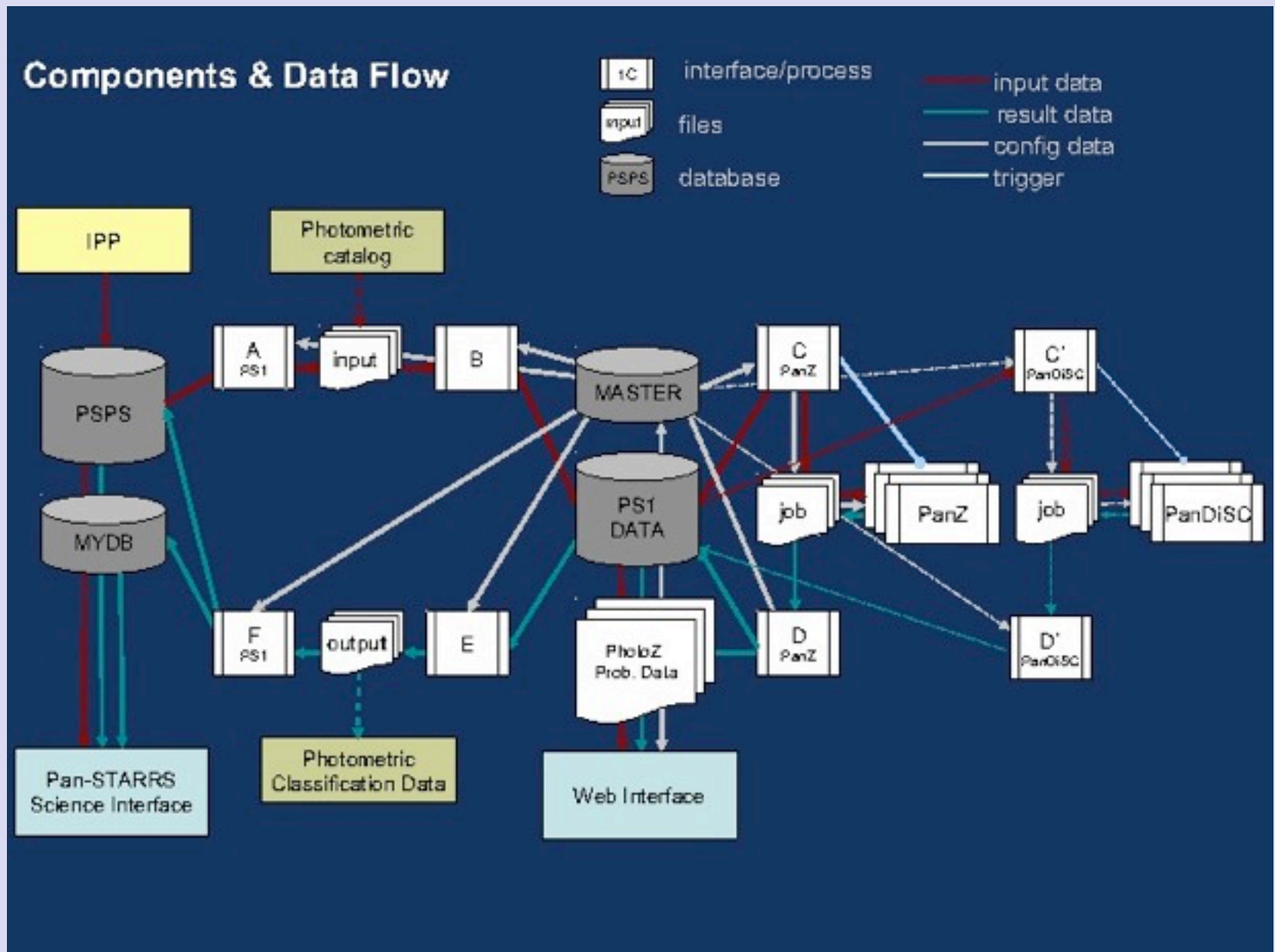
## Algorithms:

- Support Vector Machine Classifier (PanDiSCS)
- Bayesian PhotoZ estimation based on SED fitting (PanZ)
- Further algorithms possible

## Realization:

- MySQL based database system on Linux
- Linux cluster for parallel processing

# PCS: Database implementation



# PanDiSC: Star/QSO/Galaxy classification

Pan-STARRS Discrete Source Classifier

Provided by MPIA, Heidelberg, Bailer-Jones et al.,  
part of the software developed for GAIA

Support Vector Machine classifier

Input: magnitudes, colors and priors calibrated on a control sample

Output: posterior probability for Star/QSO/Galaxy

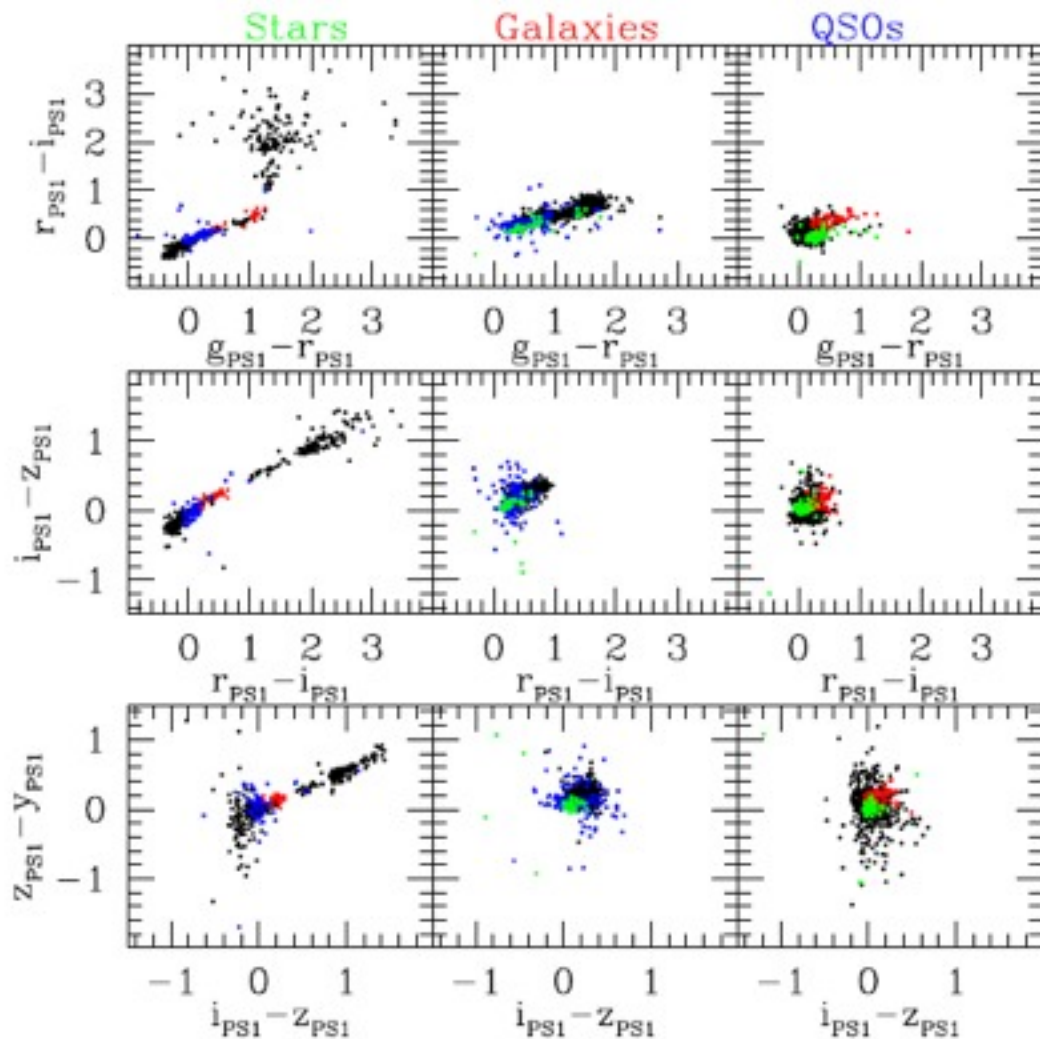
Future development: PanSTeP (Panstarrs Stellar Parametrizer)

*Code promised for February 2013*

**Status:** reads from PSPS and runs, output not yet copied back to PPS (waiting for action from Hawaii)

# PanDiSC Results in the MDFs using SLOAN spectroscopy

True classes	$N_{tot}$	Star	Galaxy	Quasar
Star	449	381	21	47
		0.849	0.047	0.104
Galaxy	4750	38	4605	107
		0.008	0.970	0.022
Quasar	550	47	44	459
		0.085	0.080	0.835



False positives:

1% for galaxies

19% for stars  
(without galaxies: 10%)

28% for QSOs  
(without galaxies: 8.5%)

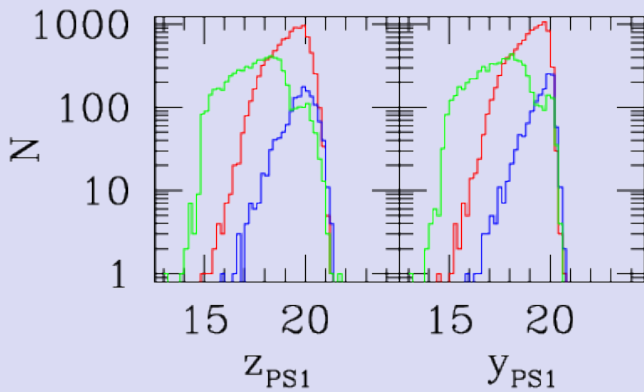
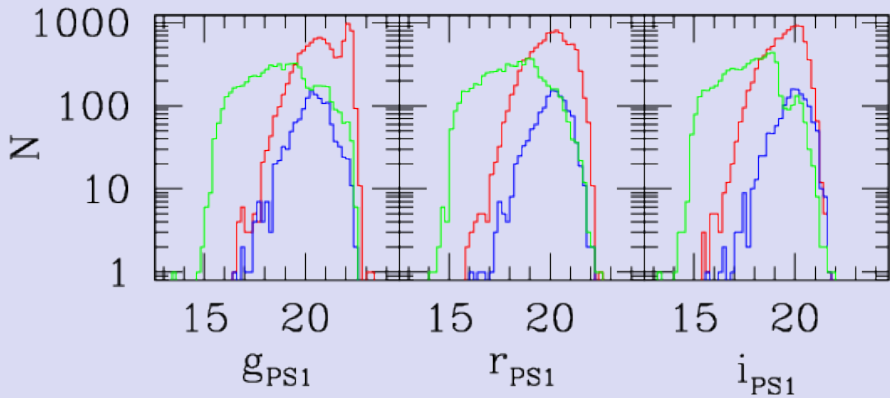
[based on Tonry's  
reduction of MDFs]

# PanDisC results for SAS-11

- grizy PSF mean mag from the Object table
- SDSS training set: 500 Galaxies, 500 QSOs, 500 Stars spectroscopically confirmed
- 17202 matches between SAS-11 and SDSS-DR9-Spec

		SDSS			Contam.
		Star	Gal	QSO	
PanDisC		6496	9361	1344	
	Star	90.86%	5.98%	8.56%	
		5902	560	115	10.39%
	Gal	3.35%	83.51%	17.78%	4.88%
		218	7817	239	
	QSO	5.79%	10.51%	73.66%	94.5%
	376	984	990		

# SDSS Sample properties

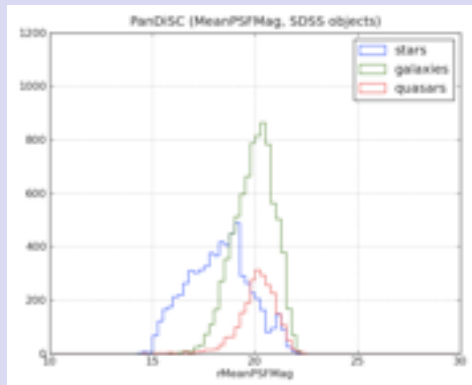
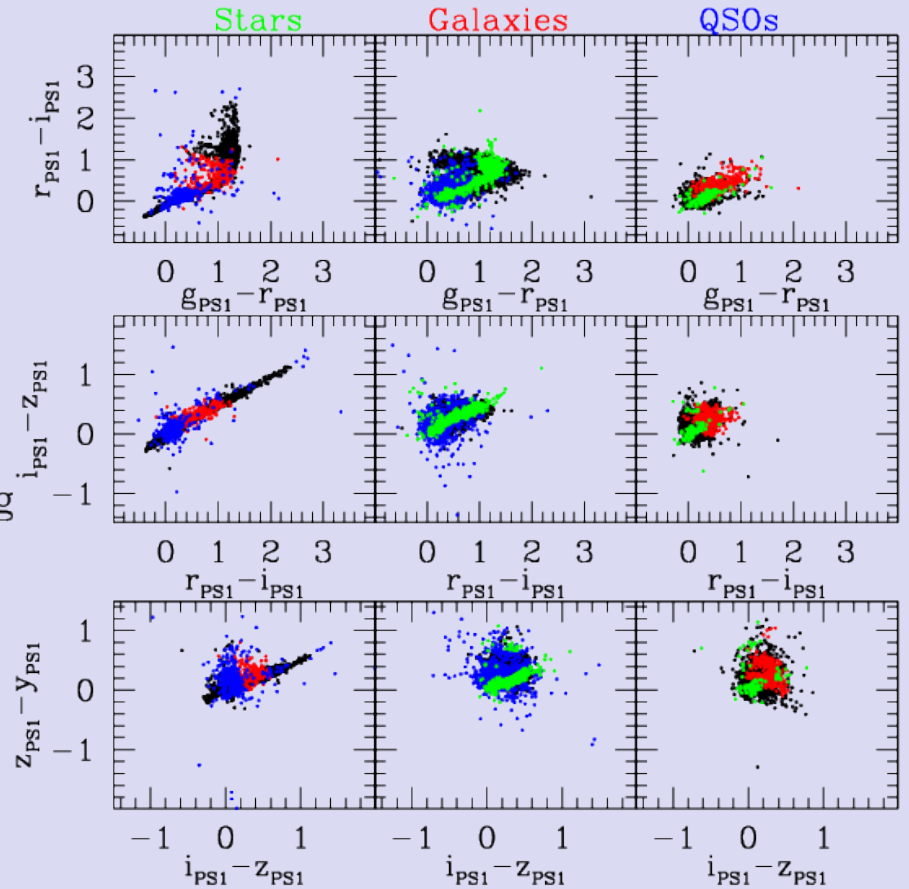


SAS PSFmag

STARS

GALAXIES

QSO



# Using StackPSFMag

14115 matches (+1500 training set): [similar quality](#)

SDSS

Contamin.

	Star	Gal	QSO
	4509	8457	1149
Star	90.15%	7.15%	11.66%
	4065	605	134
Gal	3.95%	85.01%	13.93%
	178	7189	160
QSO	5.9%	7.84%	74.41%
	266	663	855

16.3%

4%

80.8%

Pan-  
DisC



# Using StackKronMag

13600 matches (+1500 training set): **lower quality**

SDSS

Contam.

	Star	Gal	QSO
	4356	8149	1095
Star	81.43%	9.01%	11.78%
	3547	734	129
Gal	11.91%	82.73%	15.89%
	519	6742	174
QSO	6.66%	8.26%	72.33%
	290	673	792

19.8%

8.5%

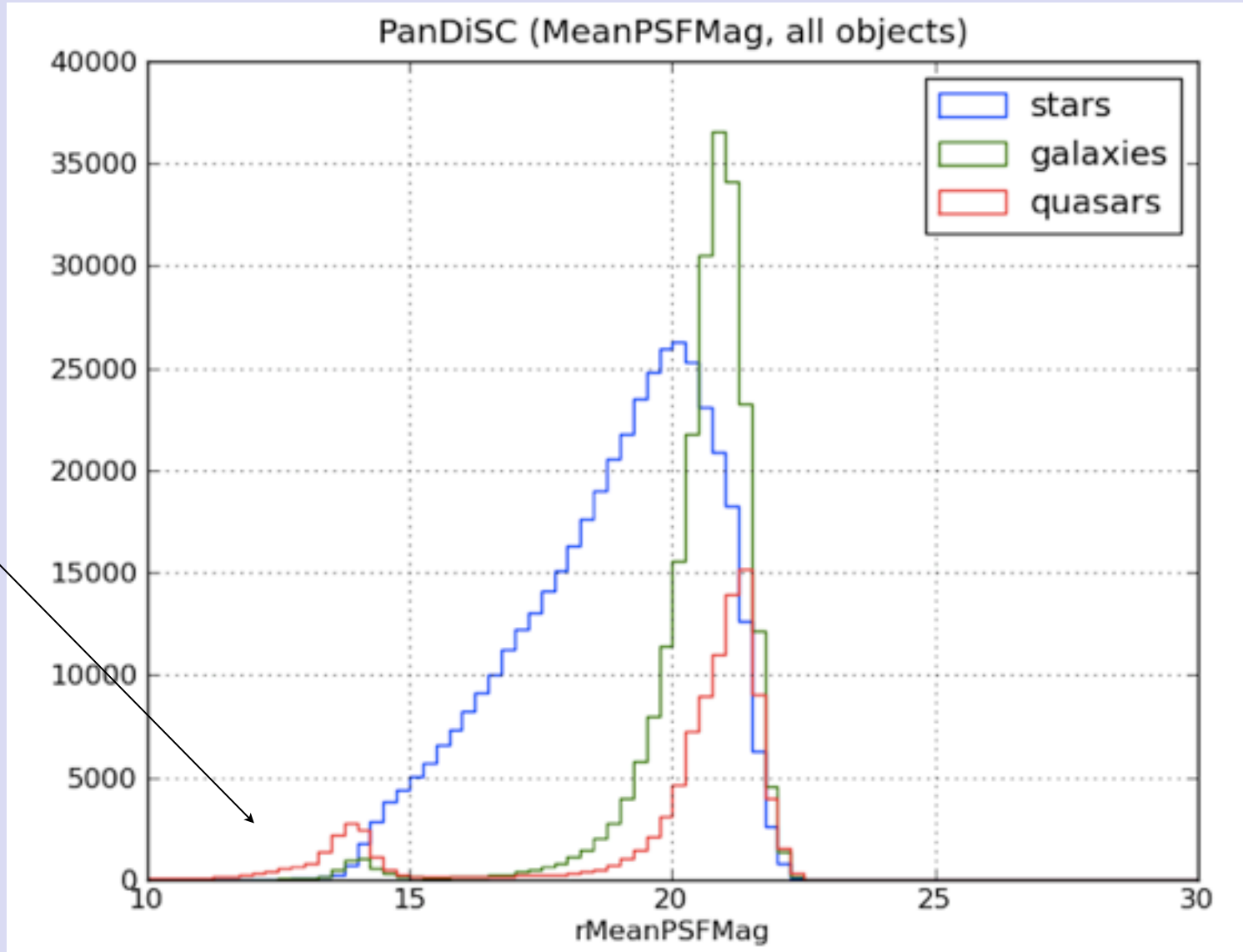
87.9%

Pan-  
DisC

(There are too few matched with aperture photometry R6)

# All 663165 SAS-11 objects

(no selection flags applied)



what is this?

# SDSS type - Morphology check

- Correlate PS1 morphology parameter (star/galaxy separator) with SDSS spectroscopic classification: 21889 matches

	SDSS Star	SDSS Gal	SDSS QSO
PS1 Morph Point	72.6% 6455	3.29% 292	24.0% 2140
PS1 Morph Ext	3.08% 401	94.32% 12263	2.60% 338

(pretty good correspondence)

# PanDisC-Morphology check

- Correlate PS morphology parameter with PanDisC classification (using MeanPSFMag) for SDSS objects (15792 matches)

	Phot Star	Phot Gal	Phot QSO
PS1 Morph Point	79.84% 5478	3.53% 242	16.63% 1141
PS1 Morph Ext	6.76% 604	82.99% 7412	10.25% 915

(not as good as before, but let's proceed)

# SDSS type - Morphology+Photometric Classification

- 15792 matches, MeanPSFMag
- Star = PhotoStar+Point, QSO: PhotoQSO+Point, Galaxy: PhotoGal+Ext;Uncl.:the rest

SDSS

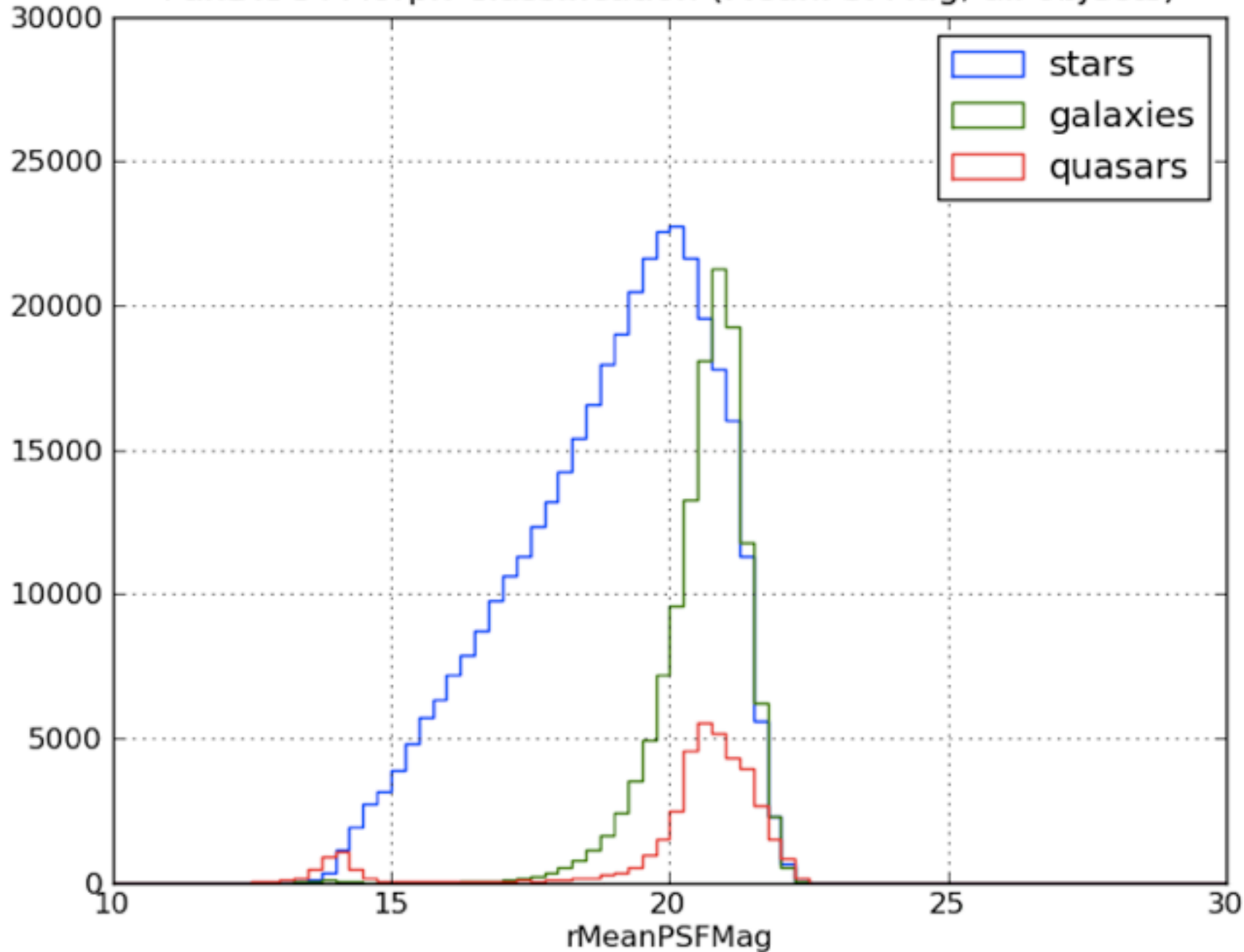
	Star	Galaxy	QSO	Comp.	Cont.
	5914	8629	1249		
Star	5259	113	106	88.9%	3.7%
Galaxy	64	7262	86	84.2%	1.7%
QSO	248	40	853	68.3%	23%
Uncl.	343	1214	204		

PanDisc+  
Morphology

# All 661768 SAS11 objects (MeanPSFMAG)

	Phot Star	Phot Gal	Phot QSO
SDSS	37%	55%	8%
PS1 Morph Point 488882	77.16% 377225 57%	14.74% 72083	8.09% 39574 6%
PS1 Morph Ext 172882	5.58% 9649	72.85% 125933 19%	21.57% 37300

PanDiSC+Morph Classification (MeanPSFMag, all objects)



# Conclusions

Photometric classification of 3 $\pi$  data is ready to start industrial production with reasonably high accuracy, possibly to be improved when selection flags are used (but remember that SAS has 12 pointings, while 3 $\pi$  the will have only 8). Further improvements perhaps possible when PanZ classification is also taken into account.

The generation of the results can follow the pace of PSPS data ingestion, so by end of March 2013 they could become available and distributed through PSPS (pending action from Hawaii).