NHSC/PACS Webinar

PACS Extended Emission Data Processing

January 2013 Map-Making Workshop: Summary

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April 2013

THE WORKSHOP

- **Original discussion for having a Herschel mapmaking workshop started in March 2012 at the Herschel Calibration Workshop…**

- **after a lot of work (!), a joint Herschel Map-Making Workshop was held at ESAC on January 28th to 31st 2013 attended by ~60 participants**

http://herschel.esac.esa.int/2013Mapmaking.shtml

PHILOSOPHY OF PACS BENCHMARKING

Goal of the benchmarking is to test the *performance* of the participating map-making algorithms using both *real* and *simulated* Herschel data sets

Participating codes:

MADmap	HIPE/Java implementation
Scanamorphos	http://www2.iap.fr/users/roussel/herschel/
Jscanam	HIPE/Java implementation of Scanamorphos (→ HIPE 11)
SANEPIC	http://www.ias.u-psud.fr/sanepic/
Unimap	http://infocom.uniroma1.it/~lorenz/Unimap/
Tamasis	http://pchanial.github.com/tamasis-pacs/

ALL THESE MAPMAKING PACKAGES ARE PUBLICLY AVAILABLE (OR SOON WILL BE)

ABOUT THE PARTICIPATING CODES
(see Bruno Altieri's presentation later..)

MADmap	→	baseline fitting + GLS
Scanamorphos	→	destriper
Jscanam	→	destriper
SANEPIC*	→	GLS
Unimap	→	destriper + GLS
Tamasis	→	destriper + GLS

* Only 5 maps processed out of 36

REAL DATA SETS: SELECTION

The selection of the data set is performed to allow the coverage of a parameter space as large as possible in terms of:

- **source surface brightness**
- **background surface brightness**
- **depth (i.e. # of repetitions)**
- **size of covered sky area**
- **observing mode**

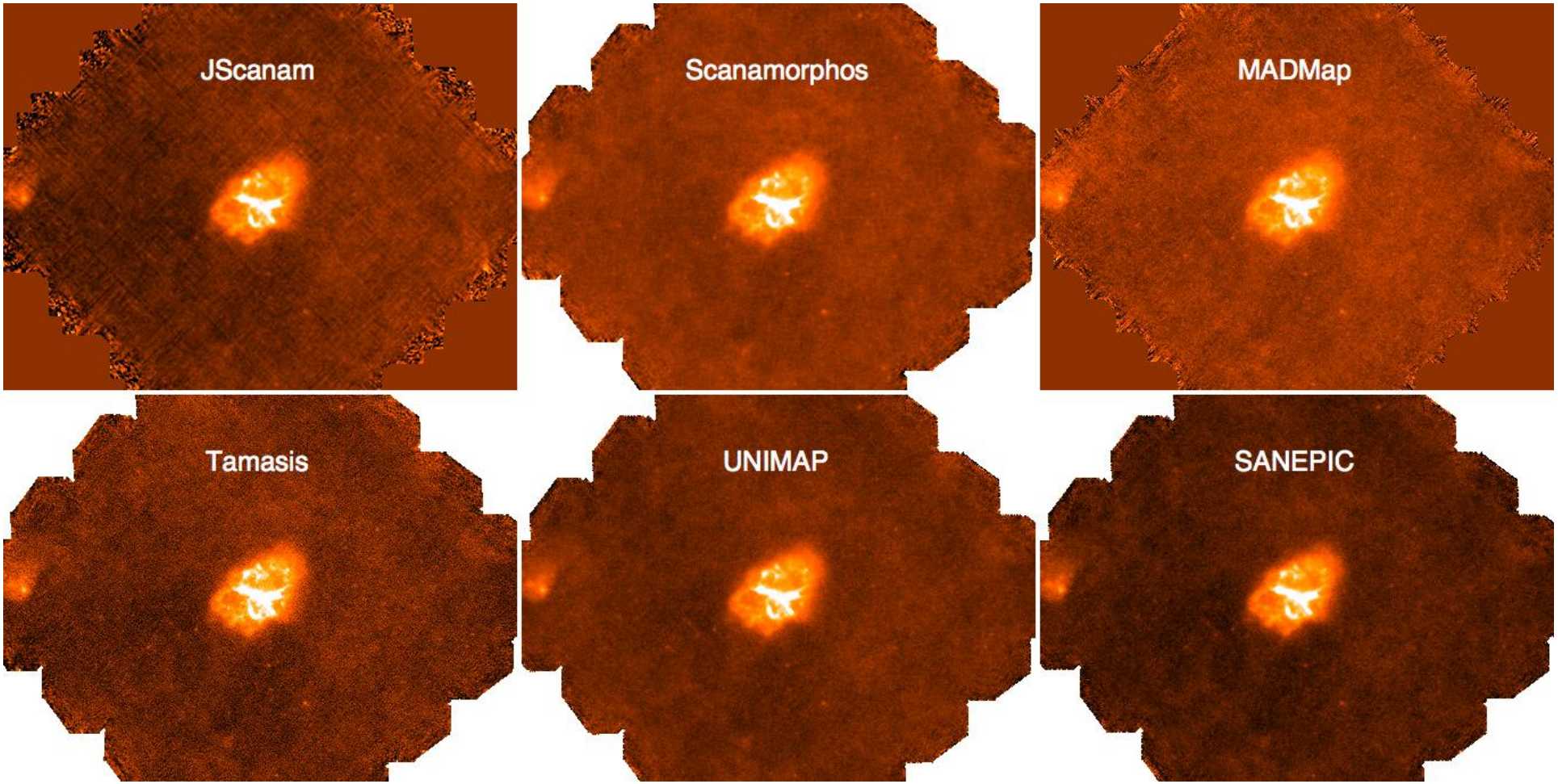
18 REAL DATA SETS

Field	Source	Background	Size	Coverage	AOT
Crab	Bright/ extended	Flat	Medium	Medium	Scan map
HiGAL l=30	Bright/fills the field	Bright	Large	Shallow	Parallel mode
GRB-110422A	Faint/point-like	Flat	Small	Deep	Scan map
IC 348	Bright/ extended (lots of point sources)	Bright/Flat	Small/ Medium	Deep	Scan map
Atlas	Faint point sources	Flat	Large	Shallow	Parallel
NGC 6946	Moderately extended	Flat	Medium	Medium	Scan map
NGC 6334	Bright/fills the field	Bright	Large	Shallow	Parallel mode
M31	extended	Flat-ish	Large	Deep	Parallel mode

18 REAL DATA SETS - *continued*

Field	Source	Background	Size	Coverage	AOT
M81	Moderately extended	Flat	Medium	Medium	Scan map
Polar Bear	Cirrus	Flat	Large	Medium/deep	Scan map
LDN1780	Faint/diffuse emission	Flat	Large	Medium	Parallel mode
HOPS Group 38	Bright/fills the field	Bright	Medium	Medium	Scan Map
Rosette	extended/fills the field	Bright	Large	Shallow	Parallel mode
HOPS Group 306	Bright/fills the field	Bright	Small	Medium	Scan map
Sa 187/188 MMS 3-5	Diffuse emission with lots of sources	Moderate	Medium	Shallow	Scan Map
HOPS Group 79	Very Bright point source	Flat-ish	Small	Medium	Scan map
Antennae	Moderately extended	Flat-ish	Medium	Medium	Scan Map

18 REAL DATA SETS – EXAMPLE: CRAB (red channel)



2 SIMULATED DATA SETS

Simulated *hybrid* data:

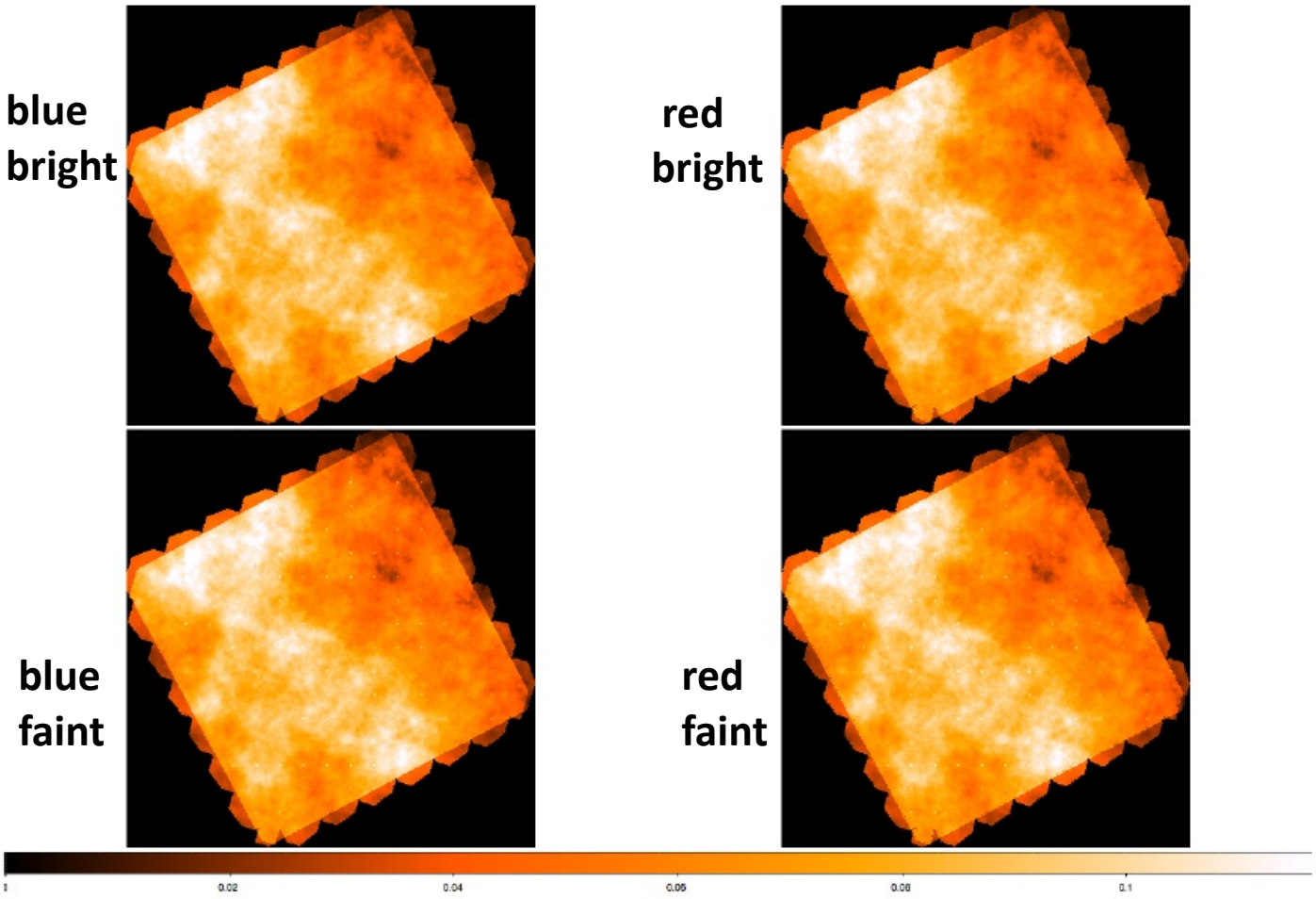
A) Simulated sky signal
(2D pink-noise)

+

B) pure instrument noise
(staring calibration observation)

Flux calibrated Level 1 detector timeline

2 SIMULATED DATA SETS - *continued*



PACS BENCHMARKING: METRICS

1. **Power spectrum estimation**
2. **Point Source photometry**
3. **Noise statistics**
4. **Difference matrix**
5. **Comparison with ancillary data I/II**

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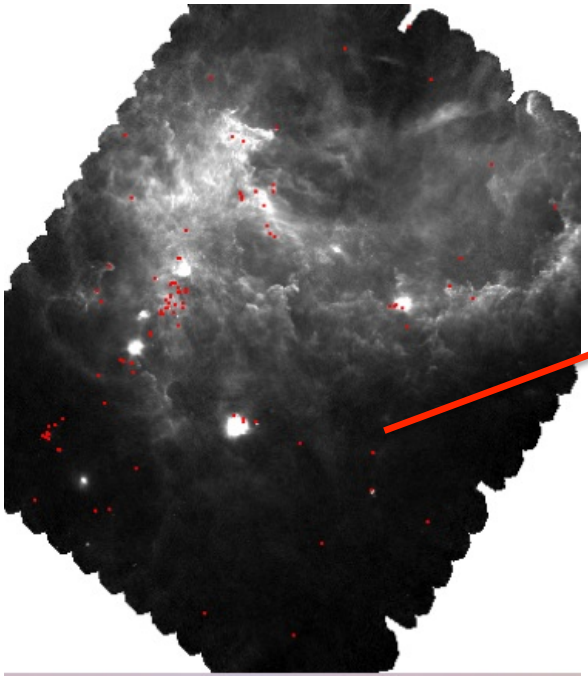
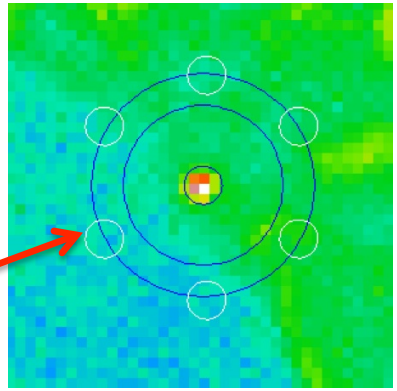
PACS BENCHMARKING:
Point Source Photometry

→ **Simulated Data:** **it turned out that injected sources (150) were too faint with respect to the background**

→ **Real Data:** **here we will only talk about this case**

PACS BENCHMARKING:
Point Source Photometry – Rosette (red band)





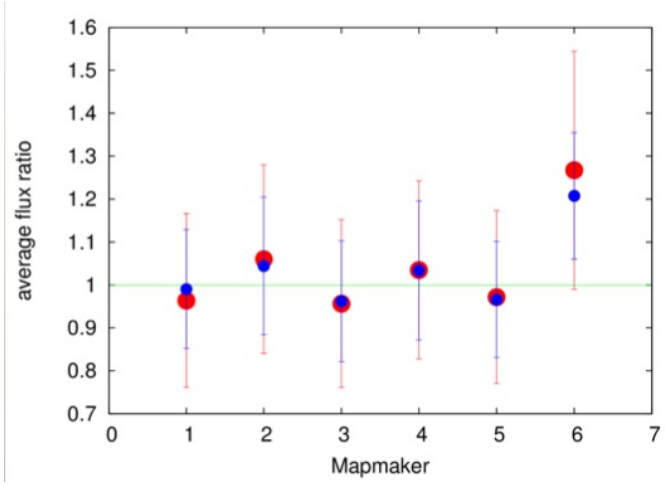
~100 sources – 0.3 – 50 Jy
(Hennemann et al. 2010)

- **Aperture Photometry**
- **HIPE 10 b2743**
- **Re-centering during phot**
- **Two source apertures: 12”/20”**
- **Sky aperture: 25” – 35”**
- **Error estimate: empty apertures around source**

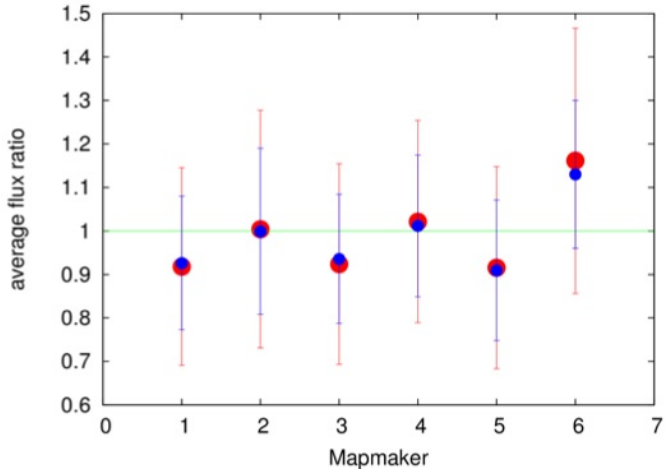
(credit: Zoltan Balog)

PACS BENCHMARKING:
Point Source Photometry – Rosette (red band)

R = 12”



R = 20”

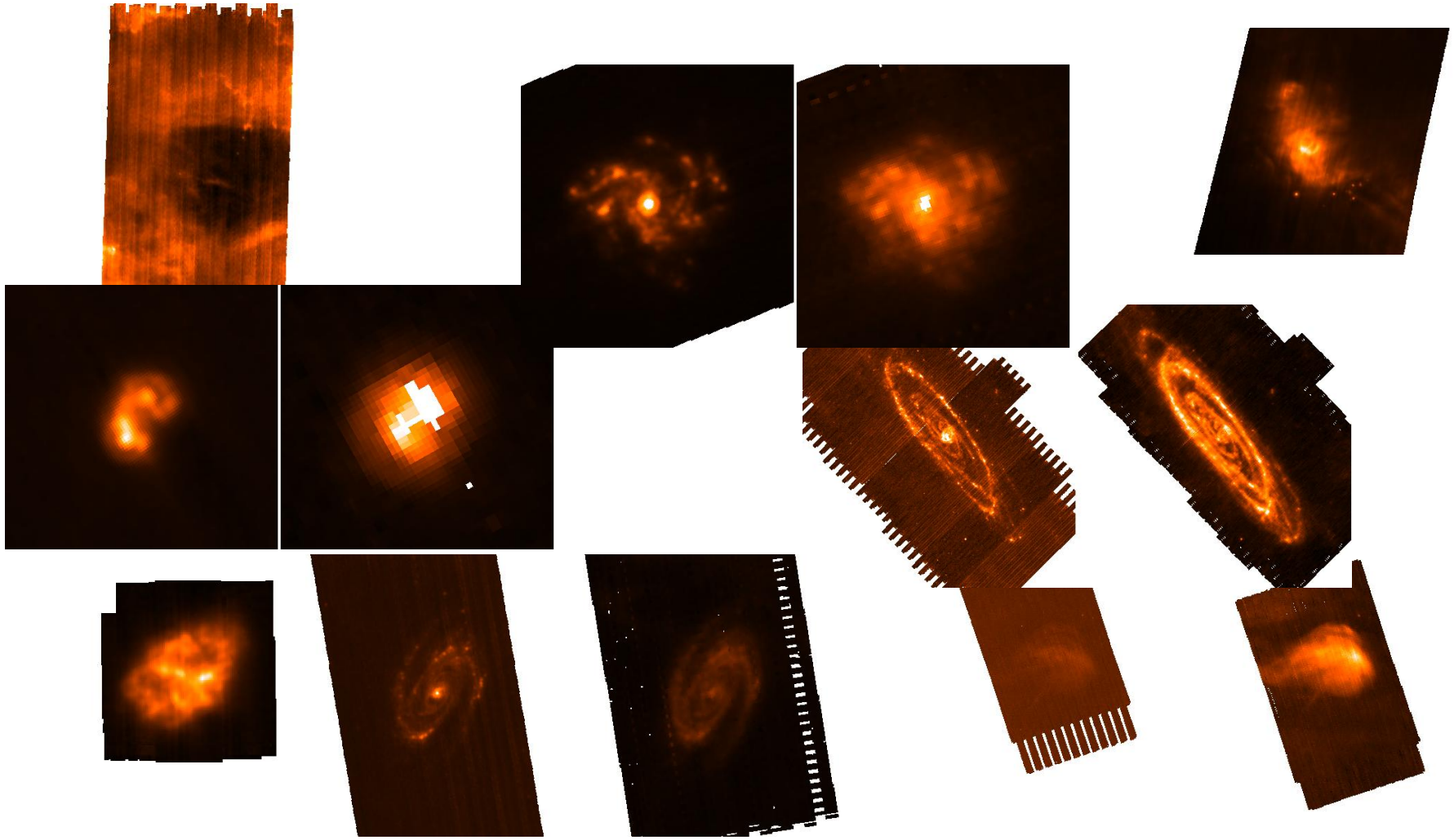


1) **Scanamorphos**
2) **Jscanam**
3) **UNIMAP**
4) **Tamasis**
5) **MADMap**
6) **SANEPIC**

NOTE: difference between smaller and larger aperture may suggest changes in the shape of the PSF

(credit: Zoltan Balog)

PACS BENCHMARKING:
Comparison with Ancillary Data – MIPS



PACS BENCHMARKING: Comparison with Ancillary Data – MIPS

Procedure:

1. for every PACS data set, extract corresponding area from MIPS data (→ 8 MIPS data sets, both 70 and 160 micron);

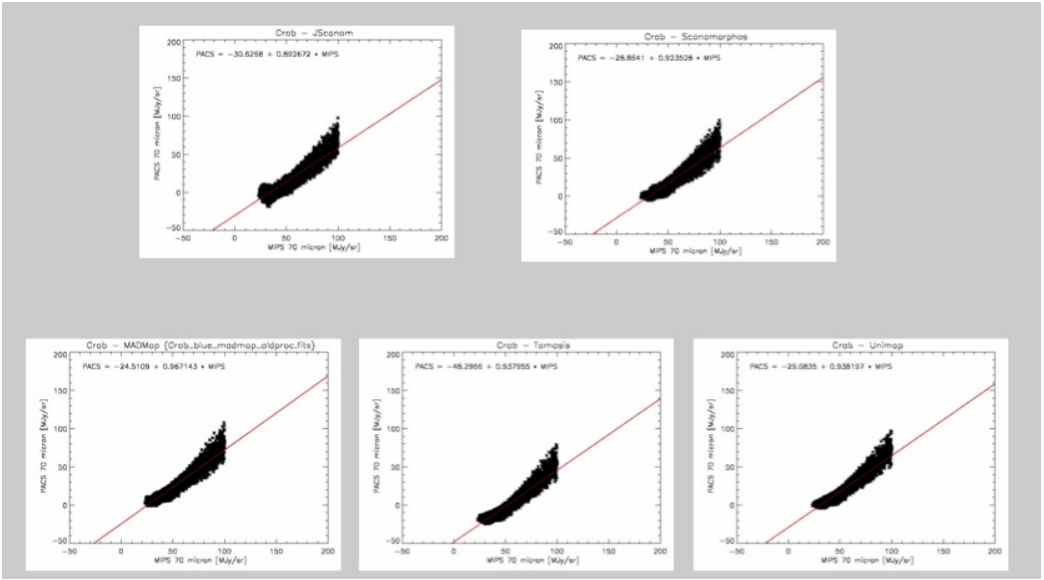
2. PACS maps are converted into MJy/sr;

3. apply scaling relation and color corrections;

4. Convolve and rebin PACS data to MIPS resolution;

5. generate and fit scatter plot from pixel-to-pixel distribution → derive *offset* and *gain*;

Ex: Crab – 70 micron



PACS BENCHMARKING: Comparison with Ancillary Data – MIPS

70 micron (gains)	JScanam	Scanamorphos	MADMap	Tamasis	Unimap
Antennae	1.13	1.09	1.09	1.09	1.10
Crab	0.89	0.92	0.97	0.94	0.94
IC348	-----	1.16	-1.06	0.88	1.07
LDN1780	-0.61	-0.52	-0.48	-0.47	-0.51
M31	1.13	1.33	1.31	1.34	1.31
M81	1.40	1.35	1.34	1.37	1.38
NGC6946	-----	1.38	1.39	1.39	1.42
Rosette	2.26	0.97	0.88	1.02	0.91

160 micron (gains)	JScanam	Scanamorphos	MADMap	Tamasis	Unimap
Antennae	0.68	0.79	0.78	0.73	0.81
LDN1780	0.77	0.87	-0.07	0.76	0.76
M31	0.92	1.03	0.94	0.89	0.88
M81	1.07	1.13	1.13	1.04	1.11
NGC6946	-----	0.63	0.75	0.71	0.63

These results take MIPS non-linearity into account !

THE FUTURE

Short Timescale (2/3 months)

- check current results (e.g. were the correct version of the processed maps used ?)
- "polish"/re-organize current results
- summarize current results into a *preliminary* report (~June)

Long Timescale (6 months/1 year)

- check/update simulations
- update metrics (e.g. for photometry, deep fields)
- release final report

ACKNOWLEDGEMENTS

PACS Map-Making Team

- Babar Ali (Roberta Paladini) → MADMap
- Helene Roussel → Scanamorphos
- Michael Wetzstein → Jscanam
- Pierre Chanial/Pasquale Panuzzo → Tamasis
- Alexandre Beelen → SANEPIC
- Lorenzo Piazzo → Unimap

PACS Benchmarking Team

- Babar Ali
- Bruno Altieri
- Vera Konyves
- Gabor Marton
- Roberta Paladini
- Lorenzo Piazzo
- Roland Vavrek
- Zoltan Balog

Today's Presentations will focus on:

→ Scanamorphos

→ UNIMAP

Both these packages are installed on the NHSC virtual machine And can be accessed by external users. To know more, check:

- https://nhscsci.ipac.caltech.edu/sc/index.php/CompSupport/ExternalUsers

and:

- https://nhscsci.ipac.caltech.edu/sc/index.php/Mapping/HomePage