

QSIM for MUSE cubes



UT4, Yepun 2011

Martin Wendt

Muse Python Data Analysis Framework

Libraries

Unified Environment

Core Library

User Library

Software
Distribution

Versioning

Documentation

Bug Tracking

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mpdaf CoreLib 1.1.0 documentation »



mpdaf
muse python data analysis framework

Welcome to mpdaf CoreLib documentation!

Release: 1.1
Date: January 29, 2013

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 - Step 3: develop

Develop an user package with MPDAF

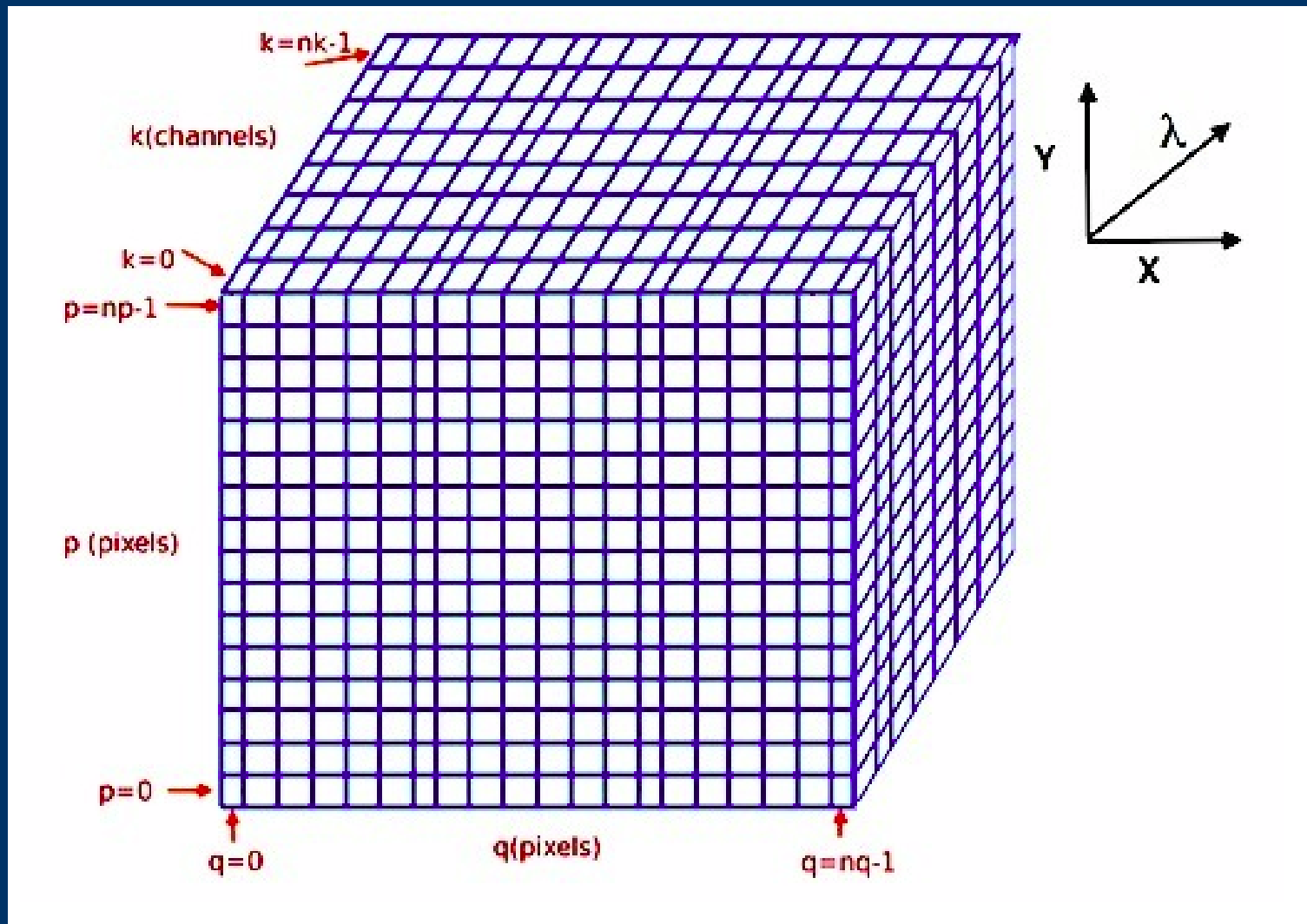
This page gives some directives to develop an user package in the MPDAF environment. The user developed packages are available for the consortium via an user library, labeled UserLib.

Coding

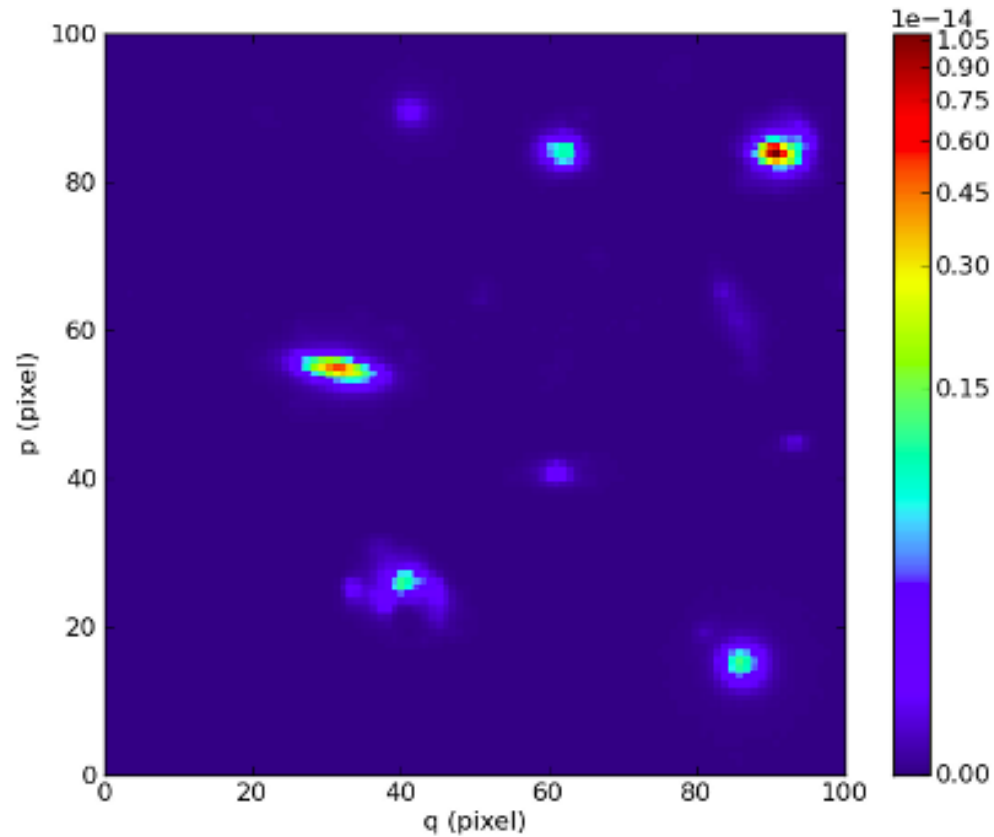
Requirements

- MPDAF package should be compatible with Python 2.6 or later (including 3.x version)
- MPDAF package should run on the following 64 bits system: Linux and Mac OS X
- MPDAF should be able to make an efficient use of multi-core CPU
- MPDAF shall be able to run on computer with limited memory and still be able to play with large datacube
- MPDAF shall be able to handle the following units:
 - Wavelength: nm, A
 - WCS: absolute coordinate in ra,dec deg,mn,sec, or relative coordinate in arcsec

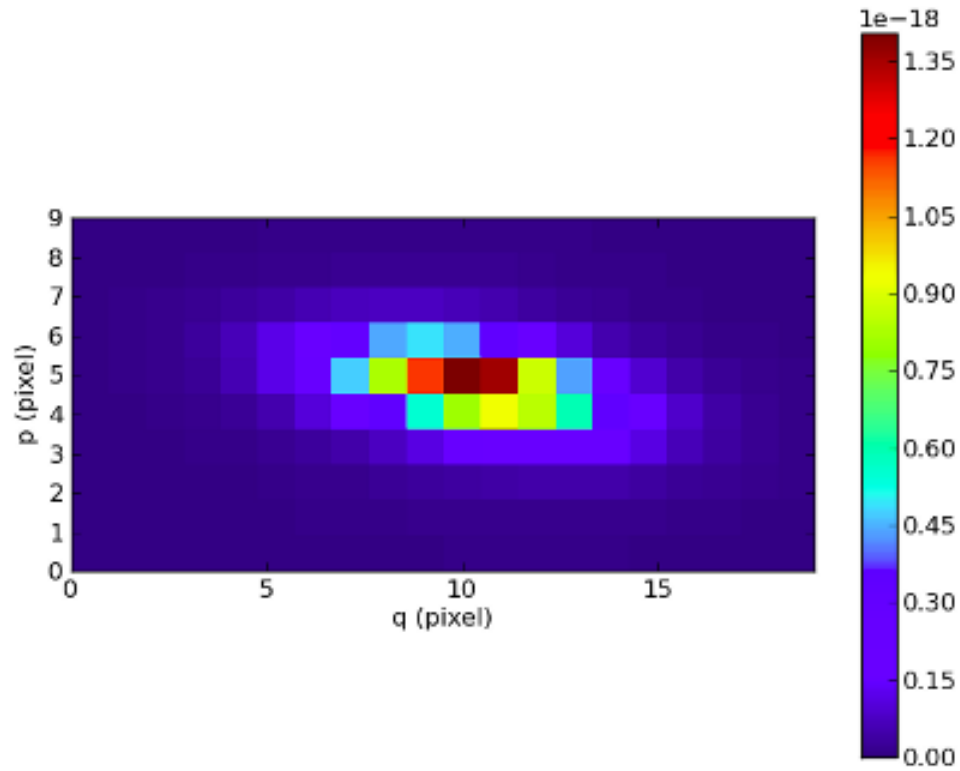
MPDAF



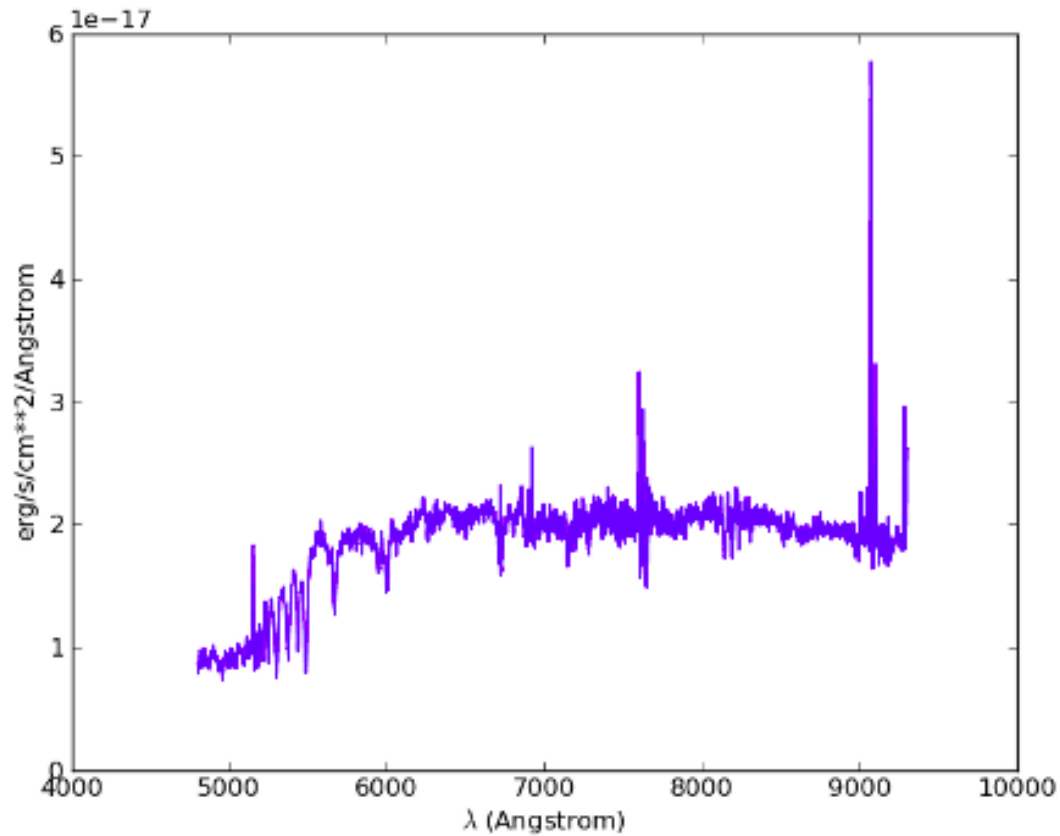
```
>>> ima = cube.sum(axis=0)  
>>> ima.plot(scale='arcsinh', colorbar='v')
```



```
>>> obj1 = cube[:,55-5:55+5,31-10:31+10]
>>> imal = obj1.mean(axis=0)
>>> imal.plot(colorbar='v')
```



```
>>> import matplotlib.pyplot as plt
>>> plt.figure()
>>> spl = obj1.sum(axis=(1,2))
>>> spl.plot()
```



fv: Binary Table of testscenigrus/mw

File Edit Tools Help

TYPE NAME FILE XPOS YPOS
 Select 2A 80A 80A E E
 All arcsec arcsec
 Invert Modify Modify Modify Modify Modify

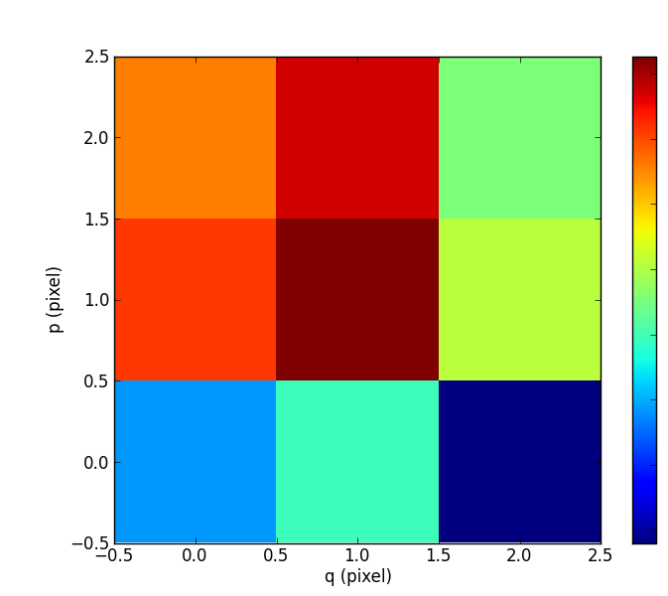
	TYPE	NAME	FILE	XPOS	YPOS
1	PS	star00	spectrum0051.fits	-4.637340E+00	-3.932356E+00
2	PS	star01	spectrum0051.fits	5.511707E+00	2.778614E+00
3	PS	star02	spectrum0051.fits	6.163502E+00	-4.678599E-01
4	PS	star03	spectrum0051.fits	3.206512E+00	4.438583E+00
5	PS	star04	spectrum0051.fits	-2.756421E+00	3.407542E+00
6	PS	star05	spectrum0051.fits	-2.623774E+00	-3.283157E+00
7	PS	star06	spectrum0051.fits	-6.169340E+00	-3.585157E-01
8	PS	star07	spectrum0051.fits	3.695964E+00	5.551650E+00
9	SG	Galaxy Type 1	00000000000018337.fits	-7.000000E+00	-8.000000E+00
10	SG	Galaxy Type 2	00000000000007122.fits	0.000000E+00	0.000000E+00
11	SG	Galaxy Type 3	00000000000008803.fits	-8.000000E+00	0.000000E+00

Go to: Edit cell:

Exemplary table of Test observation scene.

QSIM - *pointsources*

fv: Binary Table of testscenidrus/mw



	<input type="checkbox"/> FILE	<input type="checkbox"/> XPOS	<input type="checkbox"/> YPOS		
	80A	E	E		
		arcsec	arcsec		
	Modify	Modify	Modify		
spectrum0051.fits	-4.637340E+00	-3.932356E+00			
spectrum0051.fits	5.511707E+00	2.778614E+00			
spectrum0051.fits	6.163502E+00	-4.678599E-01			
spectrum0051.fits	3.206512E+00	4.438583E+00			
spectrum0051.fits	-2.756421E+00	3.407542E+00			
spectrum0051.fits	-2.623774E+00	-3.283157E+00			
spectrum0051.fits	-6.169340E+00	-3.585157E-01			
spectrum0051.fits	3.695964E+00	5.551650E+00			
8	PS	star07	spectrum0051.fits	3.695964E+00	5.551650E+00
9	SG	Galaxy Type 1	00000000000018337.fits	-7.000000E+00	-8.000000E+00
10	SG	Galaxy Type 2	00000000000007122.fits	0.000000E+00	0.000000E+00
11	SG	Galaxy Type 3	00000000000008803.fits	-8.000000E+00	0.000000E+00

Go to: Edit cell:

Exemplary table of Test observation scene.

QSIM – spiral galaxies

fv: Summary of 0000000000018337.fits in /home/grus/mwendt/qsim/

Index	Extension	Type	Dimension	View		
<input type="checkbox"/> 0	Primary	Image	0	Header	Image	Table
<input type="checkbox"/> 1	OST_IMA	Image	75 X 31	Header	Image	Table
<input type="checkbox"/> 2	OST_SED	Binary	2 cols X 3889 rows	Header	Hist	Plot
<input type="checkbox"/> 3	YST_IMA	Image	75 X 31	Header	Image	Table
<input type="checkbox"/> 4	YST_SED	Binary	2 cols X 3889 rows	Header	Hist	Plot
<input type="checkbox"/> 5	GAS_IMA	Image	75 X 31	Header	Image	Table
<input type="checkbox"/> 6	SLY_SED	Binary	2 cols X 134 rows	Header	Hist	Plot
<input type="checkbox"/> 7	GLY_SED	Binary	2 cols X 134 rows	Header	Hist	Plot

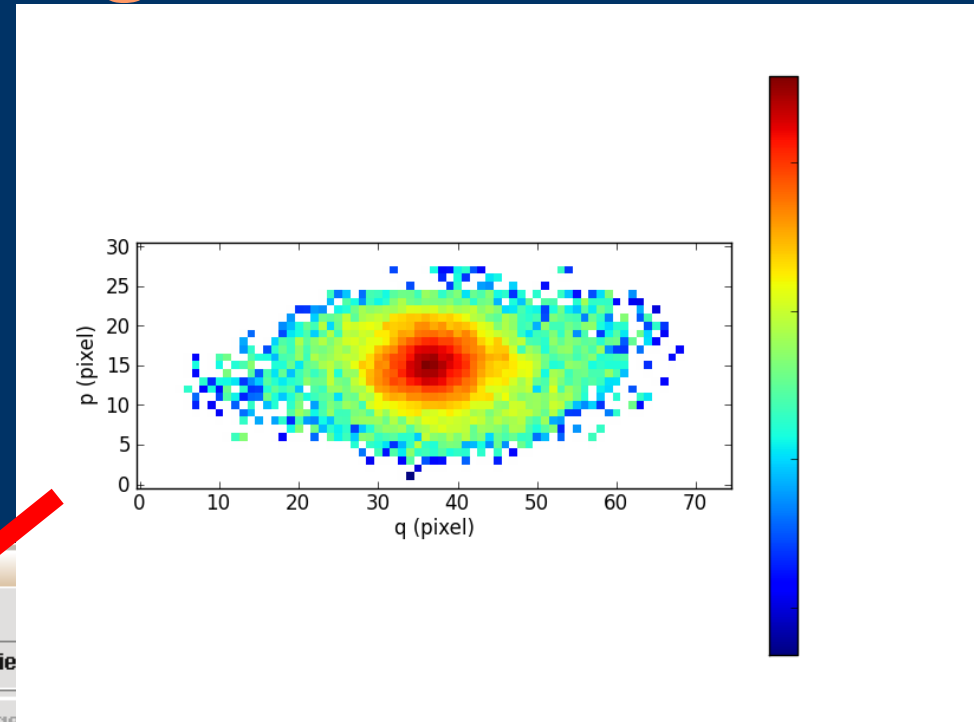
5	PS	star04	spectrum0051.fits	-2.756421E+00	3.407542E+00
6	PS	star05	spectrum0051.fits	-2.623774E+00	-3.283157E+00
7	PS	star06	spectrum0051.fits	-6.169340E+00	-3.585157E-01
8	PS	star07	spectrum0051.fits	3.695964E+00	5.551650E+00
9	SG	Galaxy Type 1	0000000000018337.fits	-7.000000E+00	-8.000000E+00
10	SG	Galaxy Type 2	0000000000007122.fits	0.000000E+00	0.000000E+00
11	SG	Galaxy Type 3	0000000000008803.fits	-8.000000E+00	0.000000E+00

Go to: Edit cell:

fv: Summary of 00000000000018337.fits in /home/grus/mwendt/qsim/

Index	Extension	Type	Dimension	View				
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<input type="checkbox"/> 1	OST_IMA	Image	75 X 31	Header	Image	Table		
<input type="checkbox"/> 2	OST_SED	Binary	2 cols X 3889 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 3	YST_IMA	Image	75 X 31	Header	Image	Table		
<input type="checkbox"/> 4	YST_SED	Binary	2 cols X 3889 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 5	GAS_IMA	Image	75 X 31	Header	Image	Table		
<input type="checkbox"/> 6	SLY_SED	Binary	2 cols X 134 rows	Header	Hist	Plot	All	Select
<input type="checkbox"/> 7	GLY_SED	Binary	2 cols X 134 rows	Header	Hist	Plot	All	Select

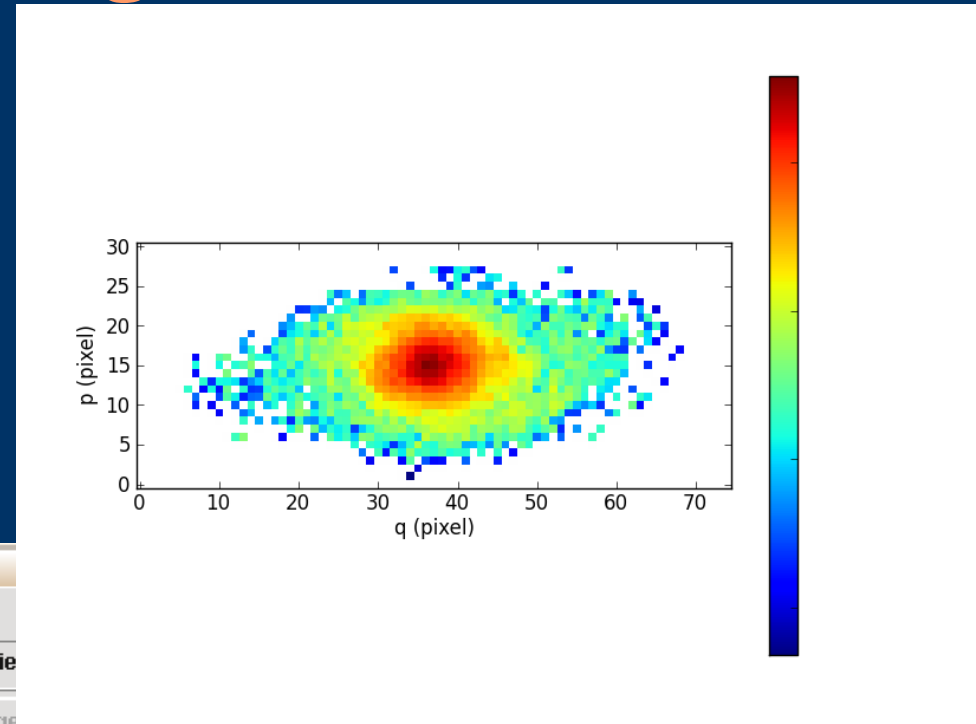
QSIM – spiral galaxies



fv: Summary of 0000000000018337.fits in /home/grus/mwendt/qsim/

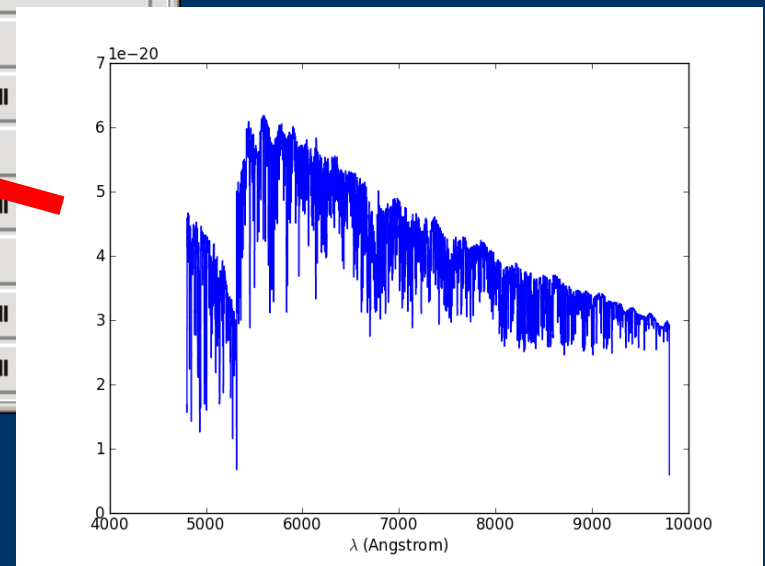
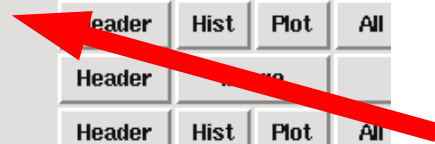
Index	Extension	Type	Dimension	View
<input type="checkbox"/> 0	Primary	Image	0	Header Image
<input type="checkbox"/> 1	OST_IMA	Image	75 X 31	Header Image Table
<input type="checkbox"/> 2	OST_SED	Binary	2 cols X 3889 rows	Header Hist Plot All Select
<input type="checkbox"/> 3	YST_IMA	Image	75 X 31	Header Image Table
<input type="checkbox"/> 4	YST_SED	Binary	2 cols X 3889 rows	Header Hist Plot All Select
<input type="checkbox"/> 5	GAS_IMA	Image	75 X 31	Header Image Table
<input type="checkbox"/> 6	SLY_SED	Binary	2 cols X 134 rows	Header Hist Plot All Select
<input type="checkbox"/> 7	GLY_SED	Binary	2 cols X 134 rows	Header Hist Plot All Select

QSIM – spiral galaxies

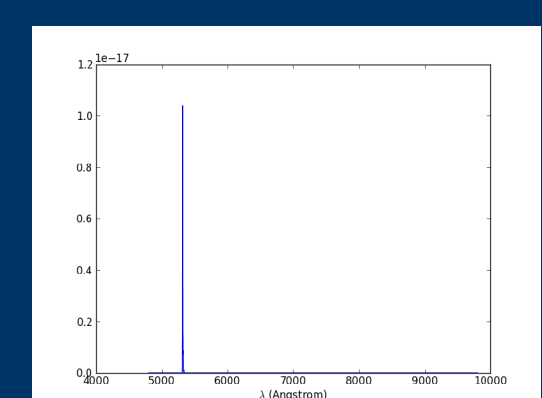
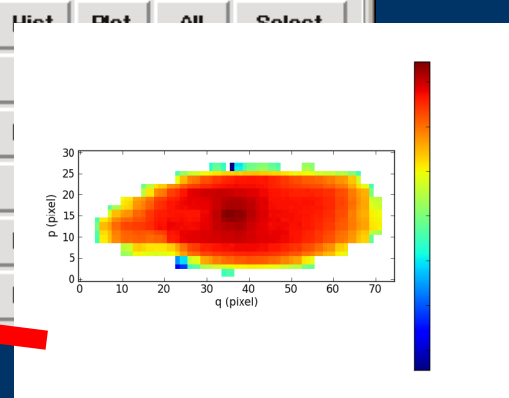
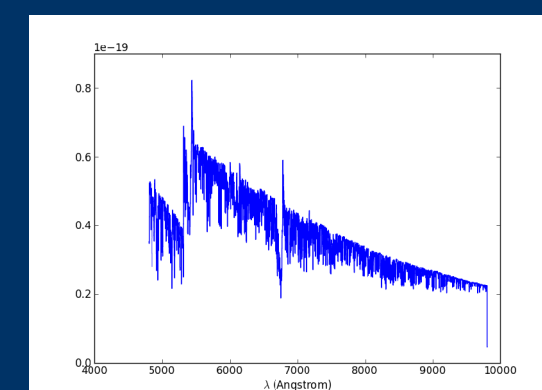
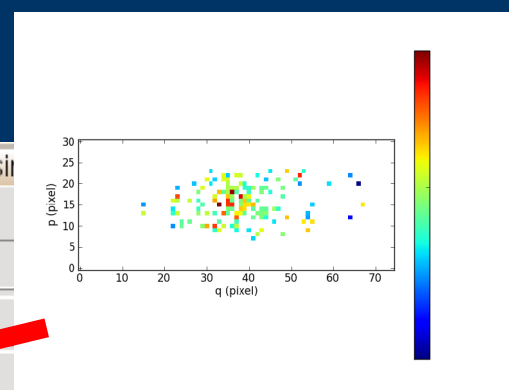
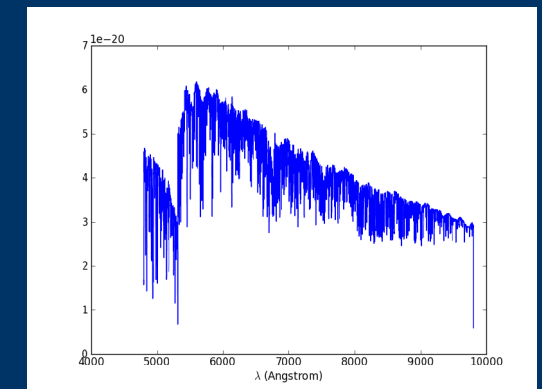
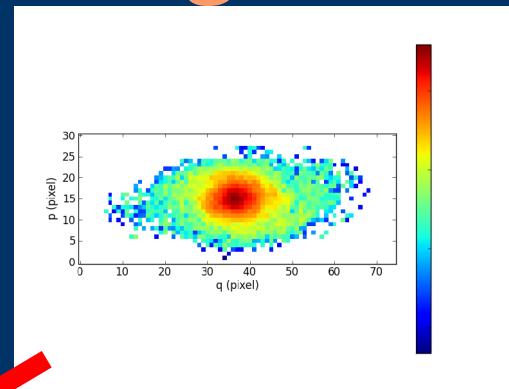


fv: Summary of 0000000000018337.fits in /home/grus/mwendt/qsim/

Index	Extension	Type	Dimension	View
<input type="checkbox"/> 0	Primary	Image	0	Header Image
<input type="checkbox"/> 1	OST_IMA	Image	75 X 31	Header Image
<input type="checkbox"/> 2	OST_SED	Binary	2 cols X 3889 rows	Header Hist Plot All
<input type="checkbox"/> 3	YST_IMA	Image	75 X 31	Header Image
<input type="checkbox"/> 4	YST_SED	Binary	2 cols X 3889 rows	Header Hist Plot All
<input type="checkbox"/> 5	GAS_IMA	Image	75 X 31	Header Image
<input type="checkbox"/> 6	SLY_SED	Binary	2 cols X 134 rows	Header Hist Plot All
<input type="checkbox"/> 7	GLY_SED	Binary	2 cols X 134 rows	Header Hist Plot All



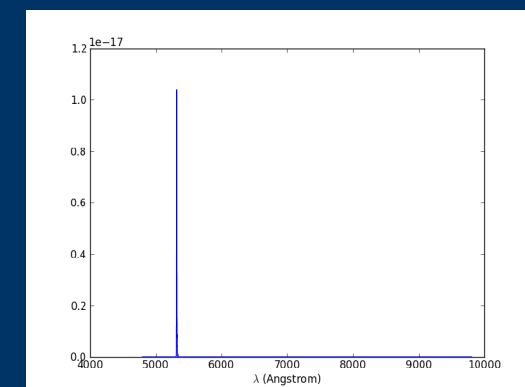
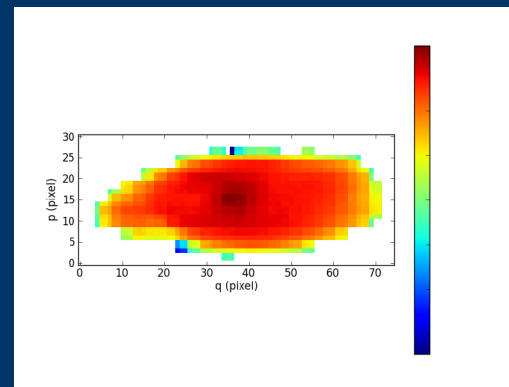
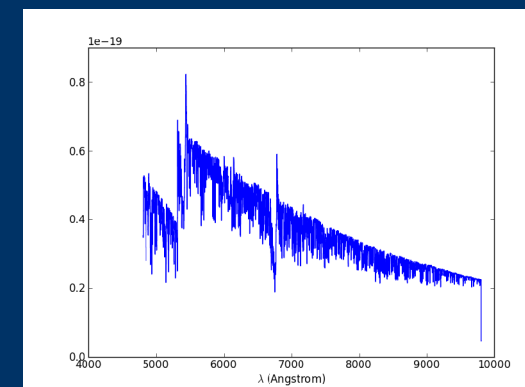
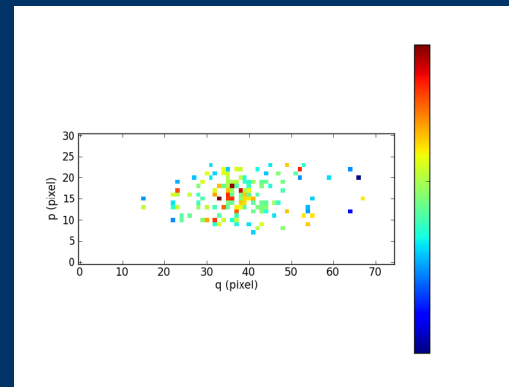
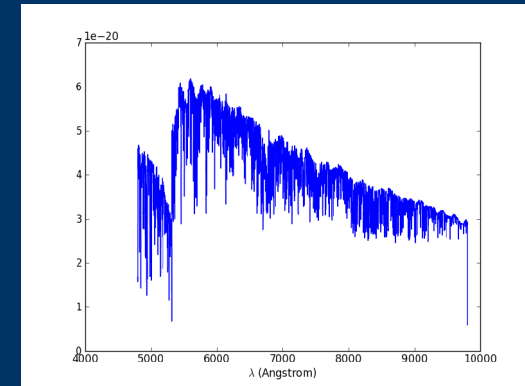
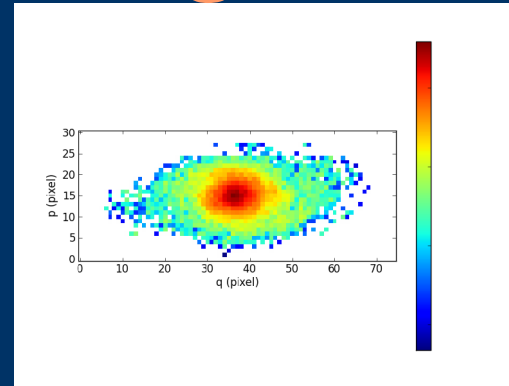
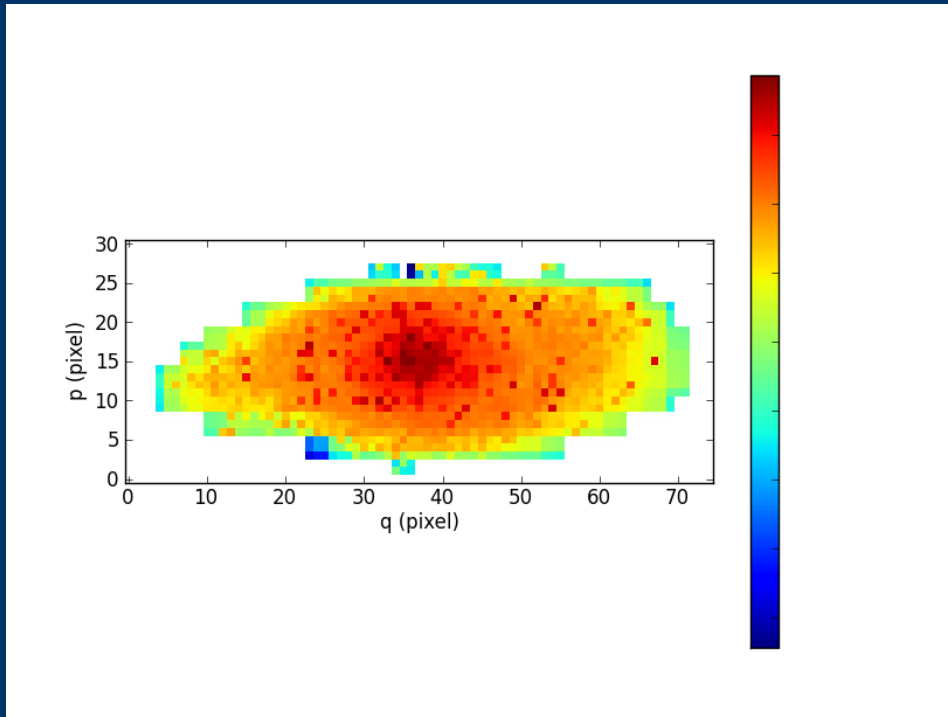
QSIM – spiral galaxies



fv: Summary of 0000000000018337.fits in /home/grus/mwendt/qsim

Index	Extension	Type	Dimension	Header
<input type="checkbox"/> 0	Primary	Image	0	Header
<input type="checkbox"/> 1	OST_IMA	Image	75 X 31	Header
<input type="checkbox"/> 2	OST_SED	Binary	2 cols X 3889 rows	Header
<input type="checkbox"/> 3	YST_IMA	Image	75 X 31	Header
<input type="checkbox"/> 4	YST_SED	Binary	2 cols X 3889 rows	Header
<input type="checkbox"/> 5	GAS_IMA	Image	75 X 31	Header
<input type="checkbox"/> 6	SLY_SED	Binary	2 cols X 134 rows	Header
<input type="checkbox"/> 7	GLY_SED	Binary	2 cols X 134 rows	Header

QSIM – spiral galaxies



QSIM – final cube

fv: Binary Table of testscenigrus/mw

File Edit Tools

TYPE NAME

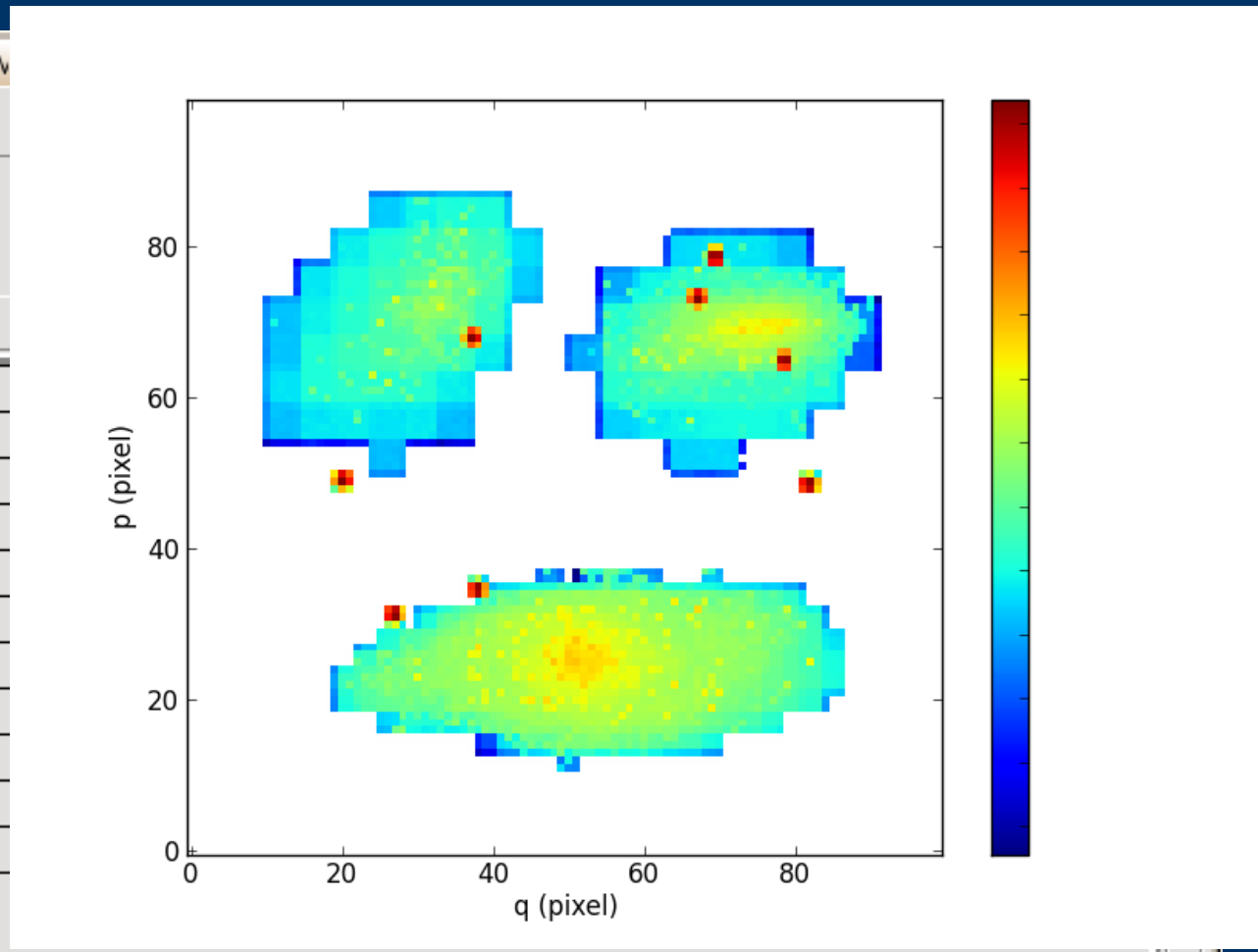
Select 2A 80A

All

Invert Modify Modify

1	PS	star00
2	PS	star01
3	PS	star02
4	PS	star03
5	PS	star04
6	PS	star05
7	PS	star06
8	PS	star07
9	SG	Galaxy Type 1
10	SG	Galaxy Type 2
11	SG	Galaxy Type 3

Go to: Edit cell:



RAW white image of cube.

QSIM – final cube

fv: Binary Table of testscenigrus/mw

File Edit Tools

TYPE NAME

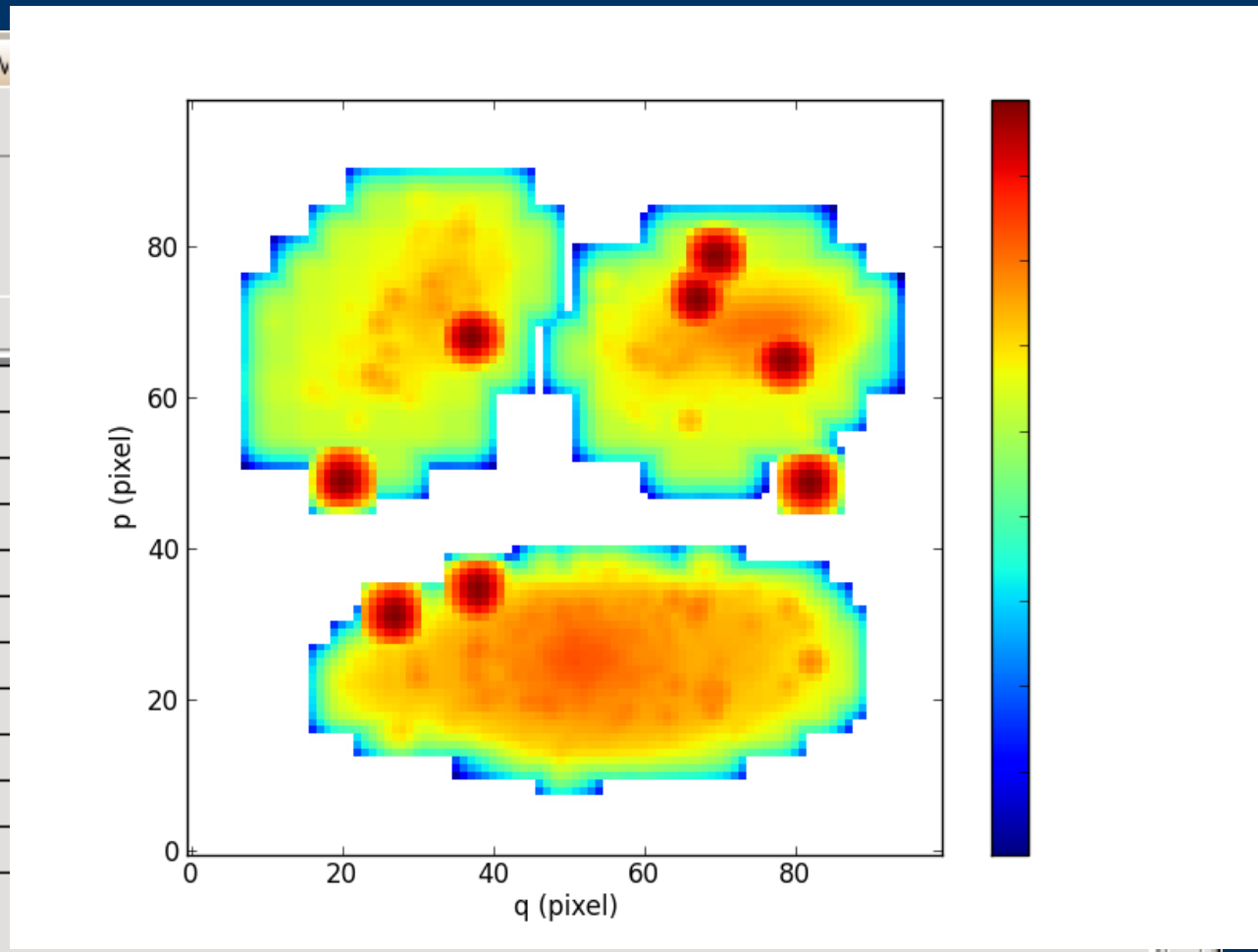
Select 2A 80A

All

Invert Modify Modify

1	PS	star00
2	PS	star01
3	PS	star02
4	PS	star03
5	PS	star04
6	PS	star05
7	PS	star06
8	PS	star07
9	SG	Galaxy Type 1
10	SG	Galaxy Type 2
11	SG	Galaxy Type 3

Go to: Edit cell:



White image of cube after PSF convolution.

QSIM – UDF objects

fv: Summary of cube-udf-00797.fits in /media/muse/2013/qsim/

Index	Extension	Type	Dimension	View		
<input type="checkbox"/> 0	Primary	Image	0	Header	Image	Table
<input type="checkbox"/> 1	NoName	Image	51 X 51 X 3885	Header	Image	Table
<input type="checkbox"/> 2	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 3	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 4	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 5	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 6	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 7	NoName	Image	51 X 51	Header	Image	Table

UDF object definition, fits file.

QSIM – UDF objects

fv: Summary of cube-udf-00797.fits in /media/

Index	Extension	Type	Dimension
<input type="checkbox"/> 0	Primary	Image	0
<input type="checkbox"/> 1	NoName	Image	51 X 51 X 388
<input type="checkbox"/> 2	NoName	Image	51 X 51
<input type="checkbox"/> 3	NoName	Image	51 X 51
<input type="checkbox"/> 4	NoName	Image	51 X 51
<input type="checkbox"/> 5	NoName	Image	51 X 51
<input type="checkbox"/> 6	NoName	Image	51 X 51
<input type="checkbox"/> 7	NoName	Image	51 X 51

```

mwendt@atlantis: /media/muse/2013/qsim
mwendt@atlantis:/media/muse/2013/qsim$ cat cube-udf-00797_h0.txt
SIMPLE =                               T / Written by IDL: Tue Aug 17 18:49:24 2010
BITPIX =                               8 / Number of bits per data pixel
NAXIS  =                               0 / Number of data axes
EXTEND  =                               T / FITS data may contain extensions
DATE    = 'Tue Aug 17 18:49:24 2010' /Creation date
COMMENT FITS (Flexible Image Transport System) format is defined in 'Astronomy
COMMENT and Astrophysics', volume 376, page 359; bibcode 2001A&A...376..359H
AUTHOR  = 'Jarle Brinchmann' /Origin of the file
FILETYP = 'UDF-GAL ' /
ID      = 'UDF-00797' /ID in Coe et al (2006) catalogue
BMAG    =                               22.3711 /
VMAG    =                               22.1823 /
ZMAG    =                               21.9912 /
REDSHIFT=                               21.5710 /
REDSHIFT=                               1.43600 /Object photometric redshift
X       =                               6589.71 /Pixel position in UDF image
Y       =                               2540.67 /Pixel position in UDF image
RA      =                               53.1499 /Ra(J2000) in degrees
DEC     =                               -27.8140 /Dec(J2000) in degrees
FSCALE  =                               1.00000E-20 /Flux scaling factor
END
mwendt@atlantis:/media/muse/2013/qsim$

```

Header	Image	Table
Header	Image	Table
Header	Image	Table
Header	Image	Table
Header	Image	Table
Header	Image	Table
Header	Image	Table

UDF object definition, fits file.

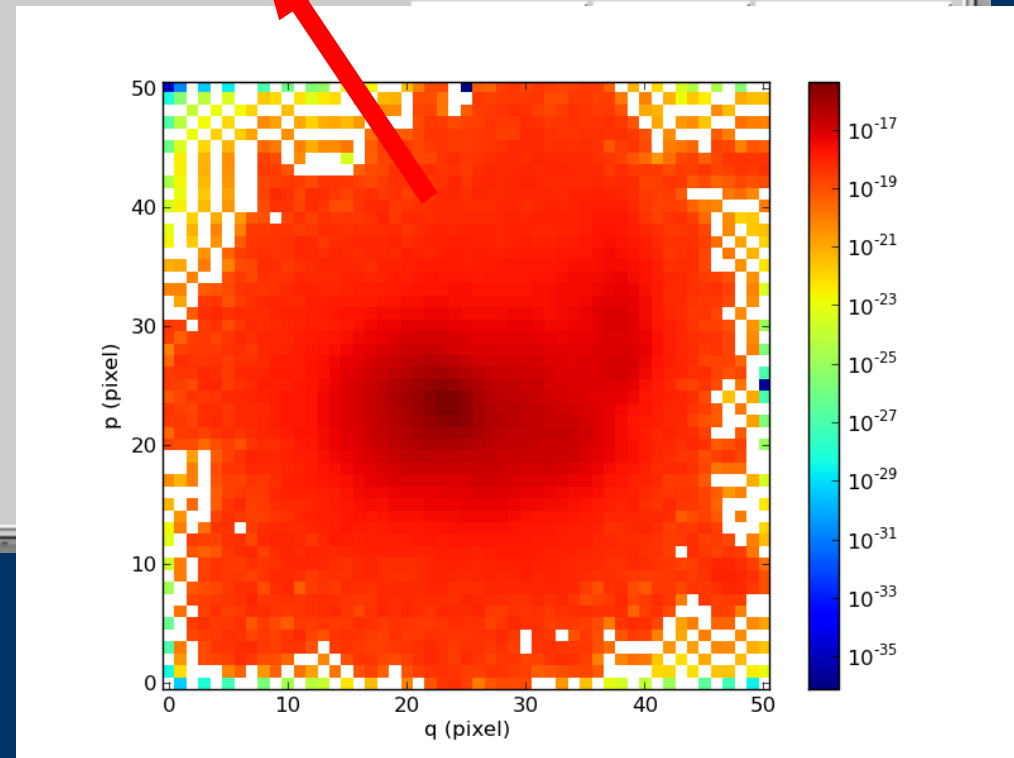
```
mwendt@atlantis: /media/muse/2013/qsim
mwendt@atlantis:/media/muse/2013/qsim$ cat cube-udf-00797_h0.txt
SIMPLE      =                T / Written by IDL:  Tue Aug 17 18:49:24 2010
BITPIX     =                8 / Number of bits per data pixel
NAXIS      =                0 / Number of data axes
EXTEND     =                T / FITS data may contain extensions
DATE       = 'Tue Aug 17 18:49:24 2010' /Creation date
COMMENT    FITS (Flexible Image Transport System) format is defined in 'Astronomy
COMMENT    and Astrophysics', volume 376, page 359; bibcode 2001A&A...376..359H
AUTHOR     = 'Jarle Brinchmann' /Origin of the file
FILETYP    = 'UDF-GAL '      /
ID         = 'UDF-00797'     /ID in Coe et al (2006) catalogue
BMAG_mus  =                22.3711 /
VMAG      =                22.1823 /
IMAG      =                21.9912 /
ZMAG      =                21.5710 /
REDSHIFT  =                1.43600 /Object photometric redshift
X         =                6589.71 /Pixel position in UDF image
Y         =                2540.67 /Pixel position in UDF image
RA        =                53.1499 /Ra(J2000) in degrees
DEC       =                -27.8140 /Dec(J2000) in degrees
FSCALE    =                1.00000E-20 /Flux scaling factor
END
mwendt@atlantis:/media/muse/2013/qsim$ █
```

QSIM – UDF objects

fv: Summary of cube-udf-00797.fits in /media/muse/2013/qsim/

File Edit Tools Help

Index	Extension	Type	Dimension	View
<input type="checkbox"/> 0	Primary	Image	0	Header Image Table
<input type="checkbox"/> 1	NoName	Image	51 X 51 X 3885	Header Image Table
<input type="checkbox"/> 2	NoName	Image		
<input type="checkbox"/> 3	NoName	Image		
<input type="checkbox"/> 4	NoName	Image		
<input type="checkbox"/> 5	NoName	Image		
<input type="checkbox"/> 6	NoName	Image		
<input type="checkbox"/> 7	NoName	Image		



QSIM – UDF objects

fv: Summary of cube-udf-00797.fits in /media/muse/2013/qsim/

Index	Extension	Type	Dimension	View		
<input type="checkbox"/> 0	Primary	Image	0	Header	Image	Table
<input type="checkbox"/> 1	NoName	Image	51 X 51 X 3885	Header	Image	Table
<input type="checkbox"/> 2	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 3	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 4	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 5	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 6	NoName	Image	51 X 51	Header	Image	Table
<input type="checkbox"/> 7	NoName	Image	51 X 51	Header	Image	Table

```

mwendt@atlantis: /media/muse/2013/qsim
mwendt@atlantis:/media/muse/2013/qsim$ cat cube-udf-00797_h3.txt
XTENSION= 'IMAGE'           /Image Extension created by MWRFITS v1.10
BITPIX =                   -32 / Number of bits per data pixel
NAXIS =                      2 / Number of data axes
NAXIS1 =                      51
NAXIS2 =                      51
PCOUNT =                      0 /
GCOUNT =                      1 /
SIMPLE =                      T / Written by IDL: Tue Aug 17 18:49:27 2010
DATE = '2010-08-17'         / Creation UTC (YYYY-MM-DD) date of FITS header
COMMENT FITS (Flexible Image Transport System) format is defined in 'Astronomy
COMMENT and Astrophysics', volume 376, page 359; bibcode 2001A&A...376..359H
LAMBDA =                      9083.41 /Wavelength of emission line
CRPIX1 =                      2923.50 /
CRPIX2 =                      1110.50 /
CRVAL1 =                      53.1227510000 /
CRVAL2 =                      -27.8050890000 /
CUNIT1 = 'RA---TAN'         /
CUNIT2 = 'DEC--TAN'         /
CDELT1 = -1.3888888888888889E-05
CDELT2 = 1.3888888888888889E-05
END
mwendt@atlantis:/media/muse/2013/qsim$
  
```

QSIM – UDF objects

fv: Summary of cube-udf-00797.fits in /media/muse/2013/qsim/

File Edit Tools Help

Index	Extension	Type	Dimension	View
<input type="checkbox"/> 0			0	Header Image Table
<input type="checkbox"/> 1			51 X 51 X 3685	Header Image Table
<input type="checkbox"/> 2			51 X 51	Header Image Table
<input type="checkbox"/> 3			51 X 51	Header Image Table
<input type="checkbox"/> 4			51 X 51	Header Image Table
<input type="checkbox"/> 5			51 X 51	Header Image Table
<input type="checkbox"/> 6			51 X 51	Header Image Table
<input type="checkbox"/> 7			51 X 51	Header Image Table


POW (Build 1.507)

File Edit Colors Tools Zoom Replot Help

cube-udf-00797.fits_3_0

Graph coordinates:
(X, X)
Physical pixel:
(X, X)
Image pixel:
(X, X)
Pixel value:
X ()

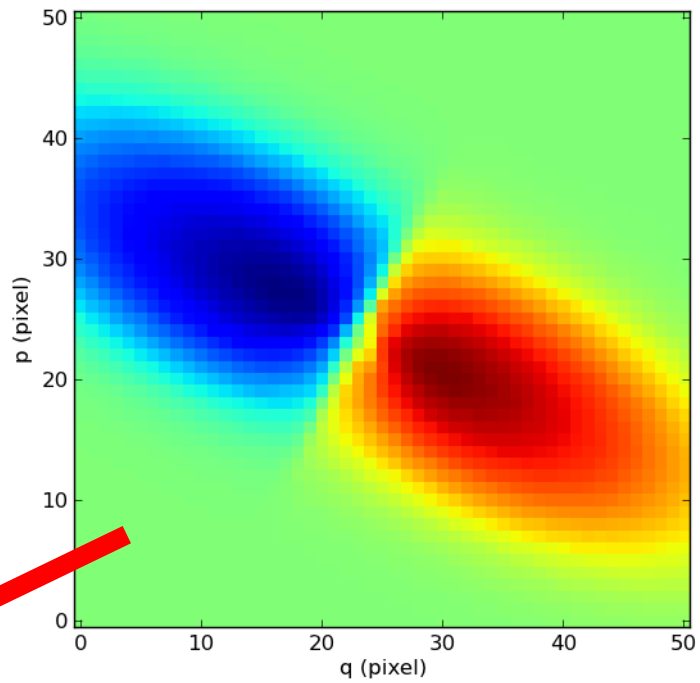
cube-udf-00797.fits_3
(DEC--TAN)



fv: Summary of cube-udf-00797.fits i

File Edit Tools

Index	Extension	Type	
<input type="checkbox"/> 0	Primary	Image	
<input type="checkbox"/> 1	NoName	Image	51
<input type="checkbox"/> 2	NoName	Image	
<input type="checkbox"/> 3	NoName	Image	
<input type="checkbox"/> 4	NoName	Image	
<input type="checkbox"/> 5	NoName	Image	
<input type="checkbox"/> 6	NoName	Image	51 X 51
<input type="checkbox"/> 7	NoName	Image	51 X 51

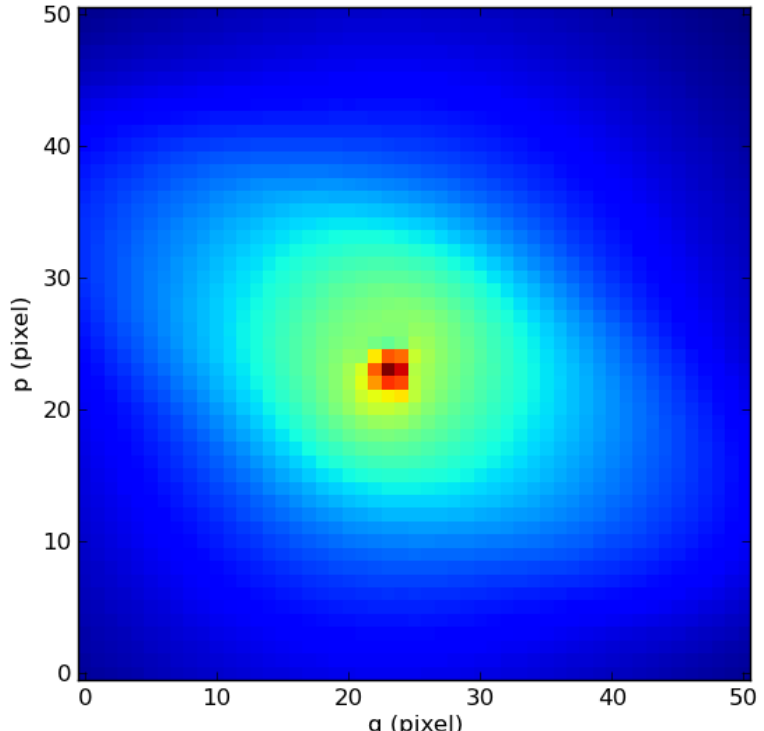


Header	Image	Table
Header	Image	Table
Header	Image	Table

fv: Summary of cube-udf-0079

File Edit Tools

Index	Extension	Type
<input type="checkbox"/> 0	Primary	Image
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<input type="checkbox"/> 4	NoName	Image
<input type="checkbox"/> 5	NoName	Image
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<input type="checkbox"/> 7	NoName	Image



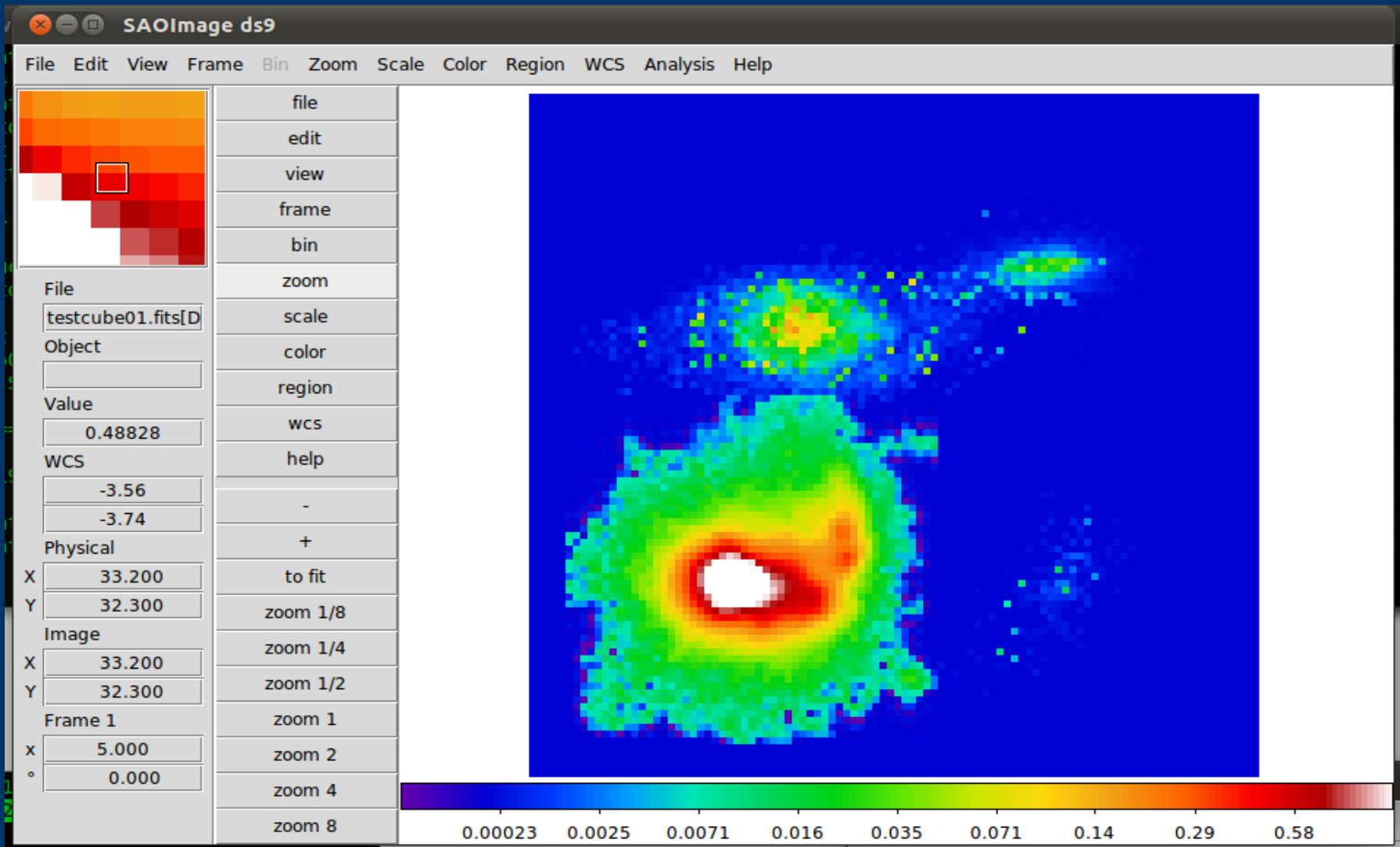
51 X 51

51 X 51

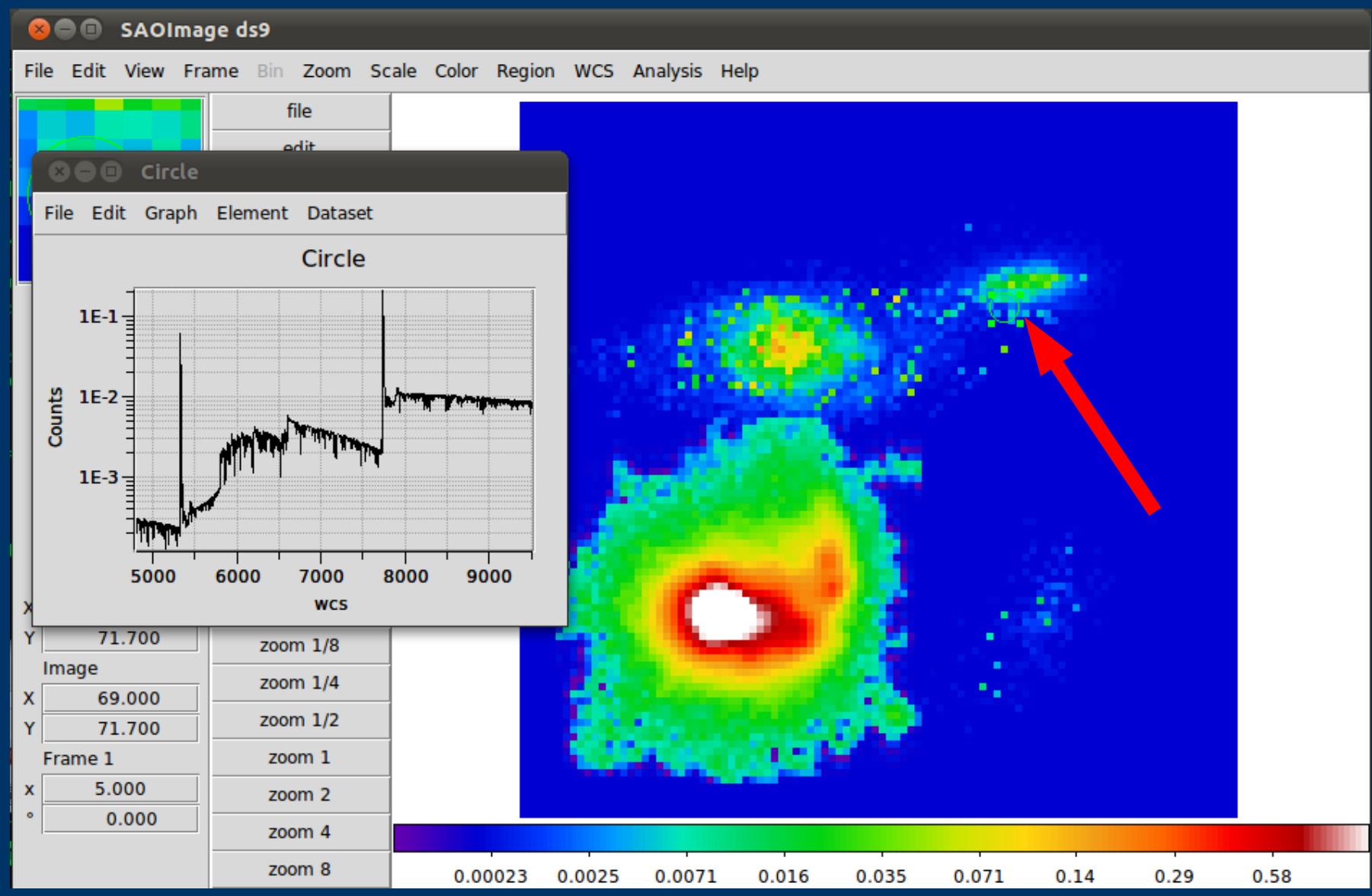
Header	Image	Table
Header	Image	Table

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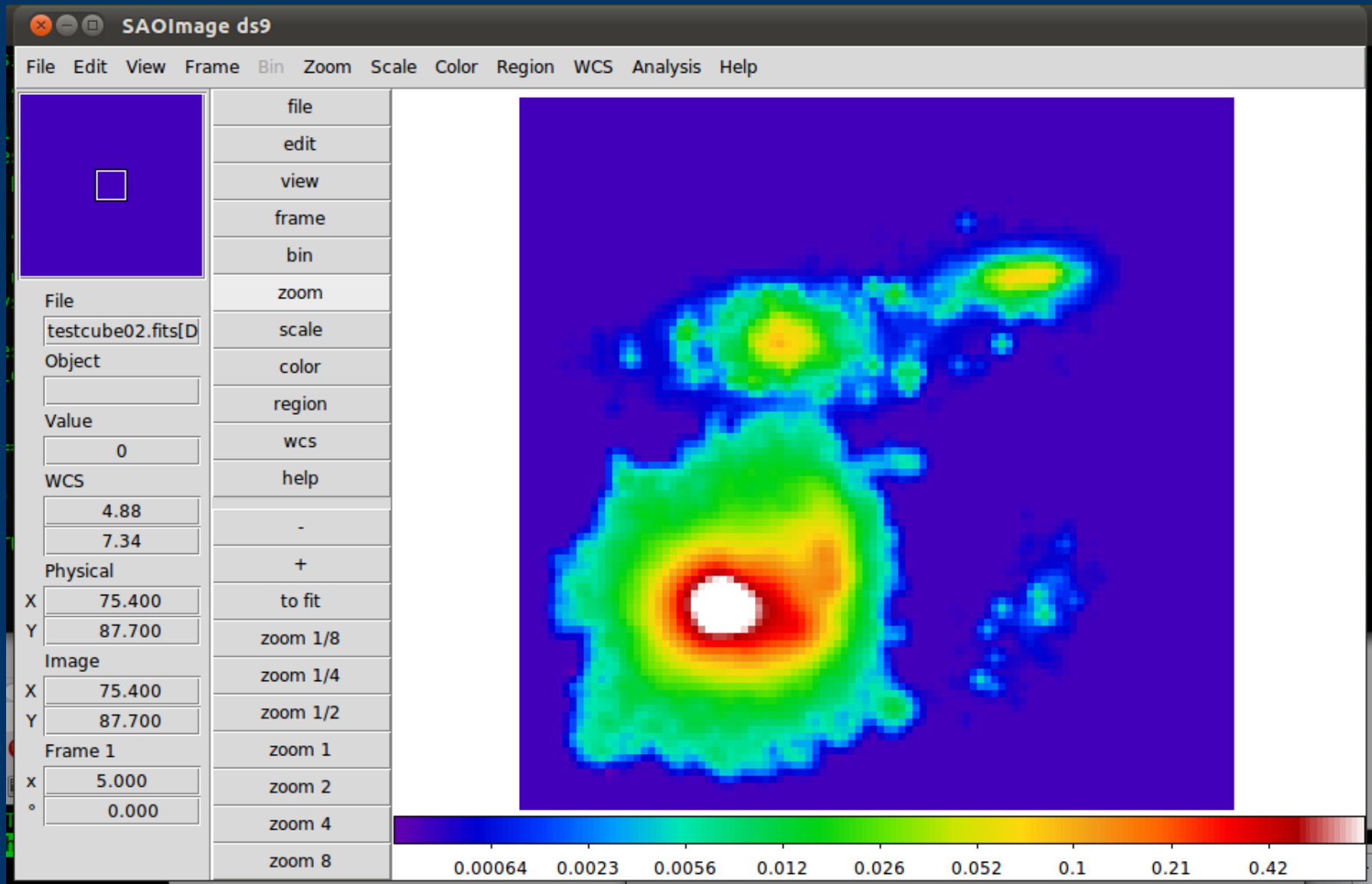
QSIM – cube in ds9



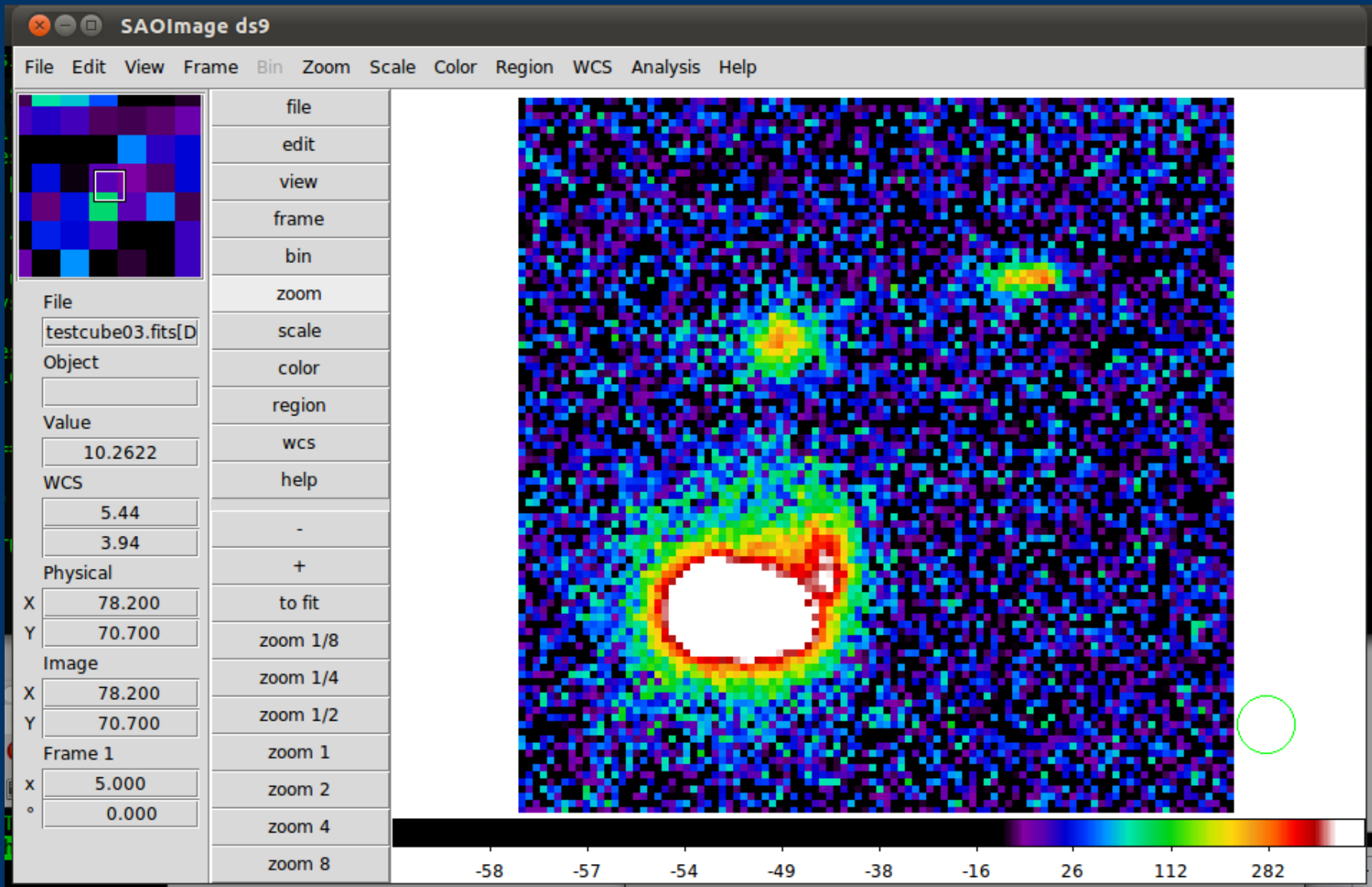
QSIM – cube in ds9



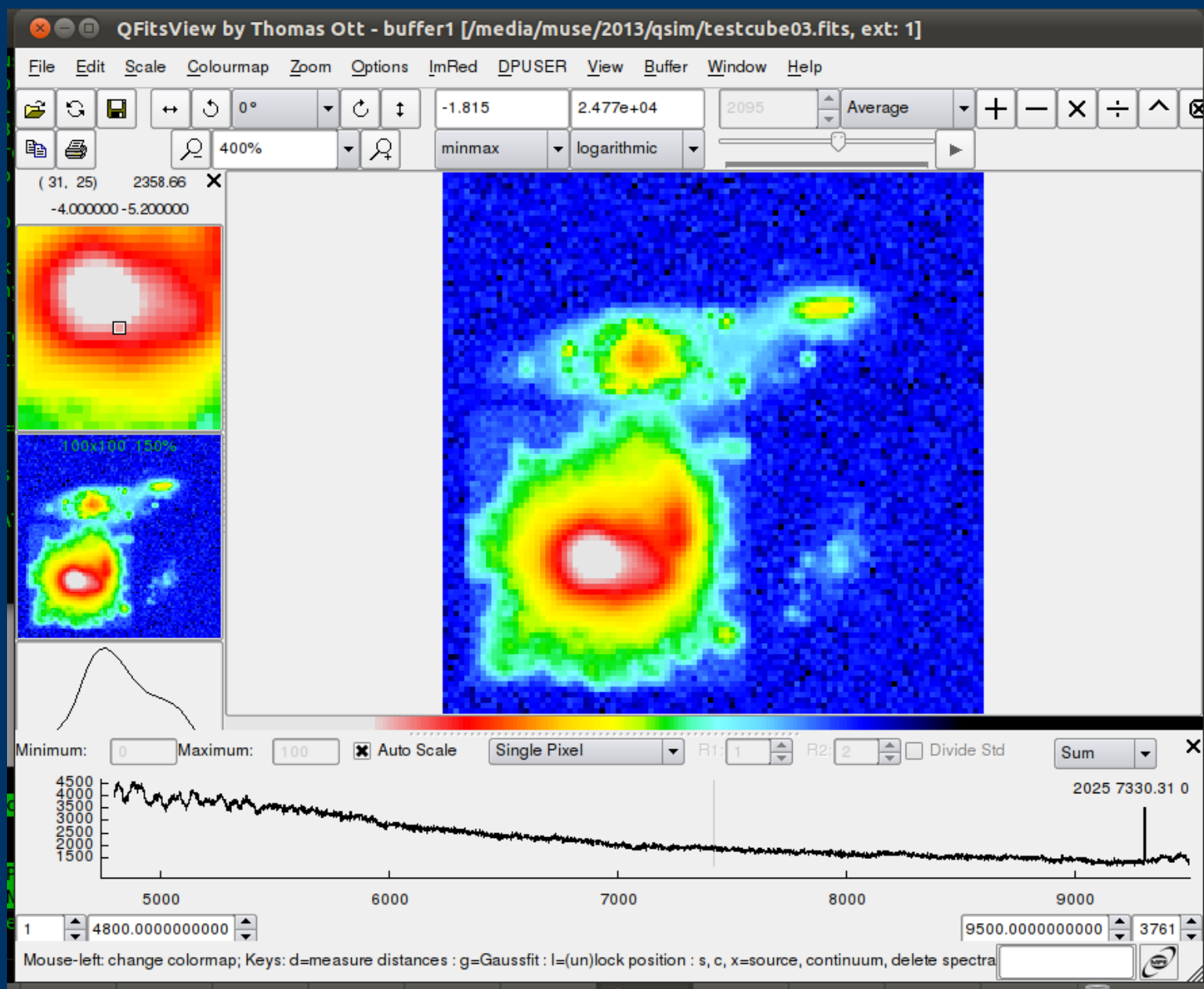
QSIM – cube in ds9



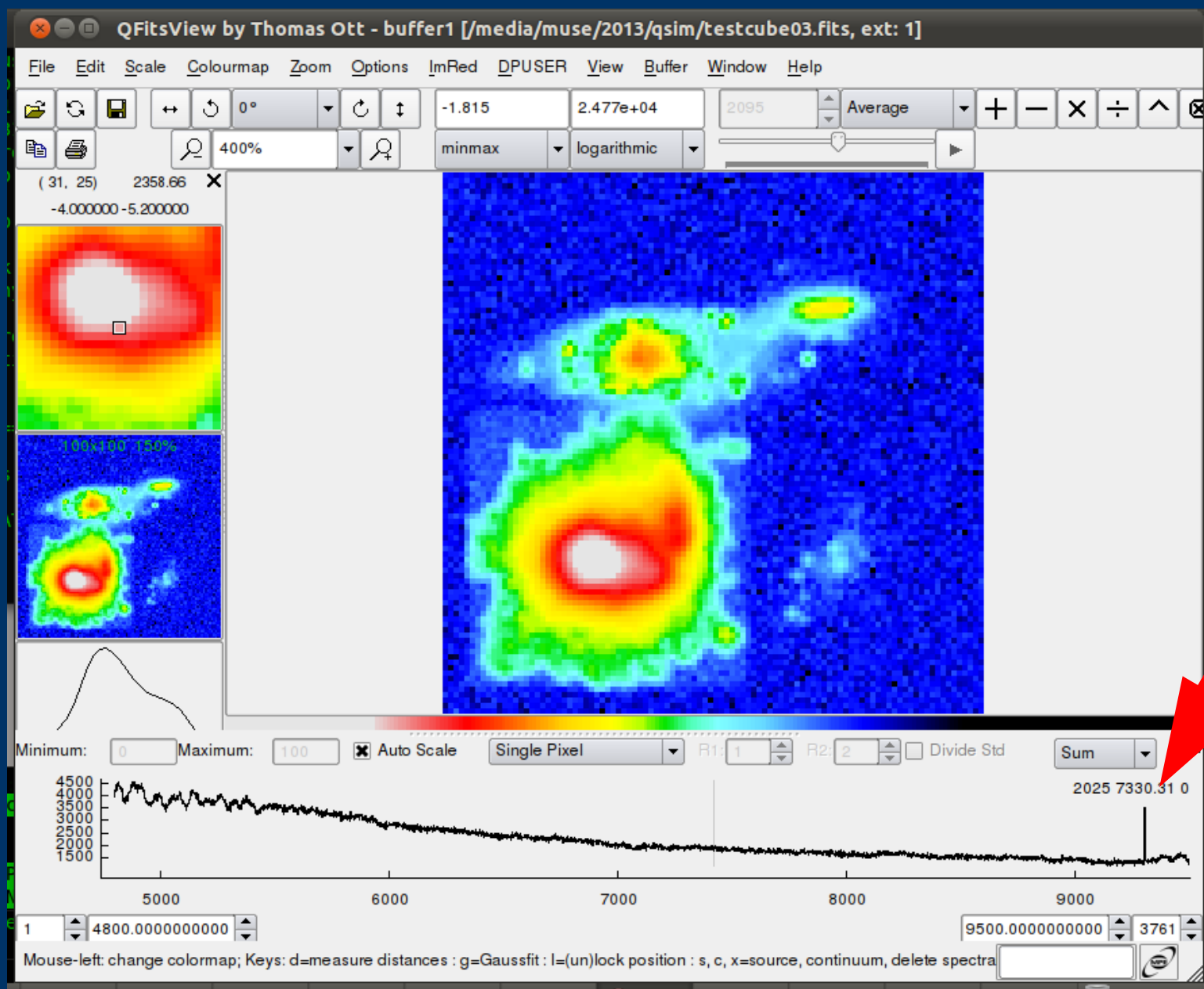
QSIM – cube in ds9



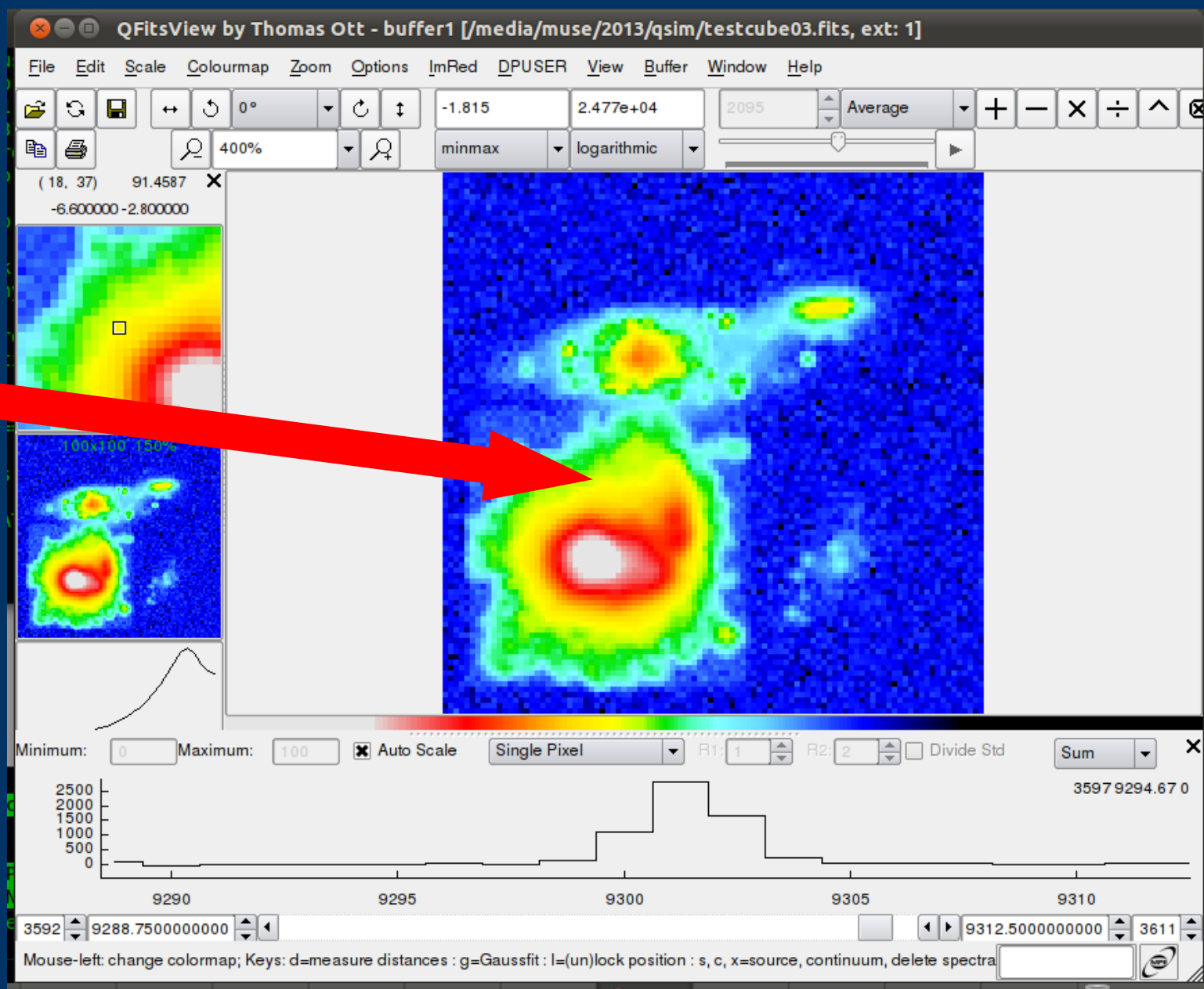
QSIM – cube in QFitsView



QSIM - cube in QFitsView



QSIM - cube in QFitsView



QSIM - cube in QFitsView

