

```
In [1]: from AtmoBuilder import AtmoBuilder

import numpy as np
import matplotlib.pyplot as plt
import copy

%matplotlib inline

/Users/joachim/anaconda/lib/python2.7/site-packages/IPython/kernel/__init__.py:13: ShimWarning: The
`IPython.kernel` package has been deprecated. You should import from ipykernel or jupyter_client instead.
"You should import from ipykernel or jupyter_client instead.", ShimWarning)

In [2]: ab = AtmoBuilder()

Found 16 MODTRAN files:
Pachon_MODTRAN.10.7sc
Pachon_MODTRAN.11.7sc
Pachon_MODTRAN.12.7sc
Pachon_MODTRAN.13.7sc
Pachon_MODTRAN.14.7sc
Pachon_MODTRAN.15.7sc
Pachon_MODTRAN.16.7sc
Pachon_MODTRAN.17.7sc
Pachon_MODTRAN.18.7sc
Pachon_MODTRAN.19.7sc
Pachon_MODTRAN.20.7sc
Pachon_MODTRAN.21.7sc
Pachon_MODTRAN.22.7sc
Pachon_MODTRAN.23.7sc
Pachon_MODTRAN.24.7sc
Pachon_MODTRAN.25.7sc
MODTRAN files have been read.

Read filter data from LSST software stack.
Filters: ['u', 'g', 'r', 'i', 'z', 'y4']
Read hardware data from LSST software stack.

In [3]: ab.readAll()

# Read 4855 MS stars from /Users/joachim/anaconda/opt/lsst/sims_sed_library/starSED/kurucz/
# Read 849 white dwarfs from /Users/joachim/anaconda/opt/lsst/sims_sed_library/starSED/wDs/
# Read 74 mlt stars from /Users/joachim/anaconda/opt/lsst/sims_sed_library/starSED/mlt/
# Generated 2520 galaxies at redshifts between 0.000000 and 3.000000
# Generated 76 quasars at redshifts between 0.000000 and 7.500000
# Generated 39 sn's at redshifts between 0.000000 and 1.200000 on days ['0', '20', '40']

In [4]: maxp = 1.2
minp = 0.8
airmass = 2.0
deltaGrey_obs = 12.0

def deltaGreyLimitPlot(comp, maxp=maxp, minp=minp, deltaGrey=deltaGrey_obs, deltaGreyRange=[-20.0, 2
0.0], err=5.0, componentBins=50, deltaGreyBins=51, regressionSed='mss'):

    prange, pnum = ab._componentCheck(comp, 20)

    atmo_std = ab.buildAtmo(ab.parameters, airmass)

    name_max = 'max_dGTest_allMS_OR' + str(int(maxp*100.0))
    name_min = 'min_dGTest_allMS_OR' + str(int(minp*100.0))

    ab.computeDeltaGreyFit(comp, deltaGrey, atmo_std, deltaGreyRange=deltaGreyRange, componentBins=co
mponentBins,
                           deltaGreyBins=deltaGreyBins, regressionSed=regressionSed, pickleString=name_
max, plotDmags=False, override=True, overrideValue=maxp)
    ab.computeDeltaGreyFit(comp, deltaGrey, atmo_std, deltaGreyRange=deltaGreyRange, componentBins=co
mponentBins,
                           deltaGreyBins=deltaGreyBins, regressionSed=regressionSed, pickleString=name_
min, plotDmags=False, override=True, overrideValue=minp)
    return
```

Components:

- H_2O
- O_2
- O_3
- Rayleigh
- Aerosol
- Alpha

H_2O

```
In [5]: deltaGreyLimitPlot('H2O')
```

```
Computing nonlinear regression for H2O.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2  
Observed atmosphere parameter for H2O: 1.0  
  
Fitting for H2O between 0.20 and 5.00 in 50 bins.  
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.  
  
Regression SEDs: 4855 Kurucz MS SEDs.  
  
Regressing 2550 parameter combinations per filter...  
Magnitude Error: 5.0 mmags  
  
Override triggered...  
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...  
  
Calculating best fit parameters for u filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_u_51dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for u filter.  
Saved Chi-Squared at best fit deltaGrey for u filter.  
Completed u filter.  
  
Calculating best fit parameters for g filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_g_51dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for g filter.  
Saved Chi-Squared at best fit deltaGrey for g filter.  
Completed g filter.  
  
Calculating best fit parameters for r filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_r_51dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for r filter.  
Saved Chi-Squared at best fit deltaGrey for r filter.  
Completed r filter.  
  
Calculating best fit parameters for i filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_i_51dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for i filter.  
Saved Chi-Squared at best fit deltaGrey for i filter.  
Completed i filter.  
  
Calculating best fit parameters for z filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_z_51dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for z filter.  
Saved Chi-Squared at best fit deltaGrey for z filter.  
Completed z filter.  
  
Calculating best fit parameters for y4 filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_y4_51dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for y4 filter.  
  
AtmoBuilder.py:892: FutureWarning: comparison to `None` will result in an elementwise object comparison in the future.  
    if sedkeylist == None:  
/Users/joachim/anaconda/lib/python2.7/site-packages/matplotlib/text.py:52: UnicodeWarning: Unicode equal comparison failed to convert both arguments to Unicode - interpreting them as being unequal  
        if rotation in ('horizontal', None):
```

Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, H2O, dG, logL, Chi-Squared):
u 0.98 12.00 7.64494494097e-06 1.52898898819e-05
g 0.98 12.00 1.68863936246e-05 3.37727872491e-05
r 0.98 12.00 5.20530198817e-05 0.000104106039763
i 0.98 12.00 3.61135399529e-05 7.22270799058e-05
z 0.98 12.00 0.00994754420287 0.0198950884057
y4 0.98 12.00 0.0715779548222 0.143155909644

Override best fit parameters (Filter, H2O, dG):
u 1.20 12.00
g 1.20 12.00
r 1.20 12.00
i 1.20 12.00
z 1.20 12.00
y4 1.20 12.00

Computing nonlinear regression for H2O.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for H2O: 1.0

Fitting for H2O between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit v alue...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_u_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_g_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_r_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_i_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_z_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_y4_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, H2O, dG, logL, Chi-Squared):
u 0.98 12.00 7.64494494097e-06 1.52898898819e-05

```

g 0.98 12.00 1.68863936246e-05 3.37727872491e-05
r 0.98 12.00 5.20530198817e-05 0.000104106039763
i 0.98 12.00 3.61135399529e-05 7.22270799058e-05
z 0.98 12.00 0.00994754420287 0.0198950884057
y4 0.98 12.00 0.0715779548222 0.143155909644

```

```

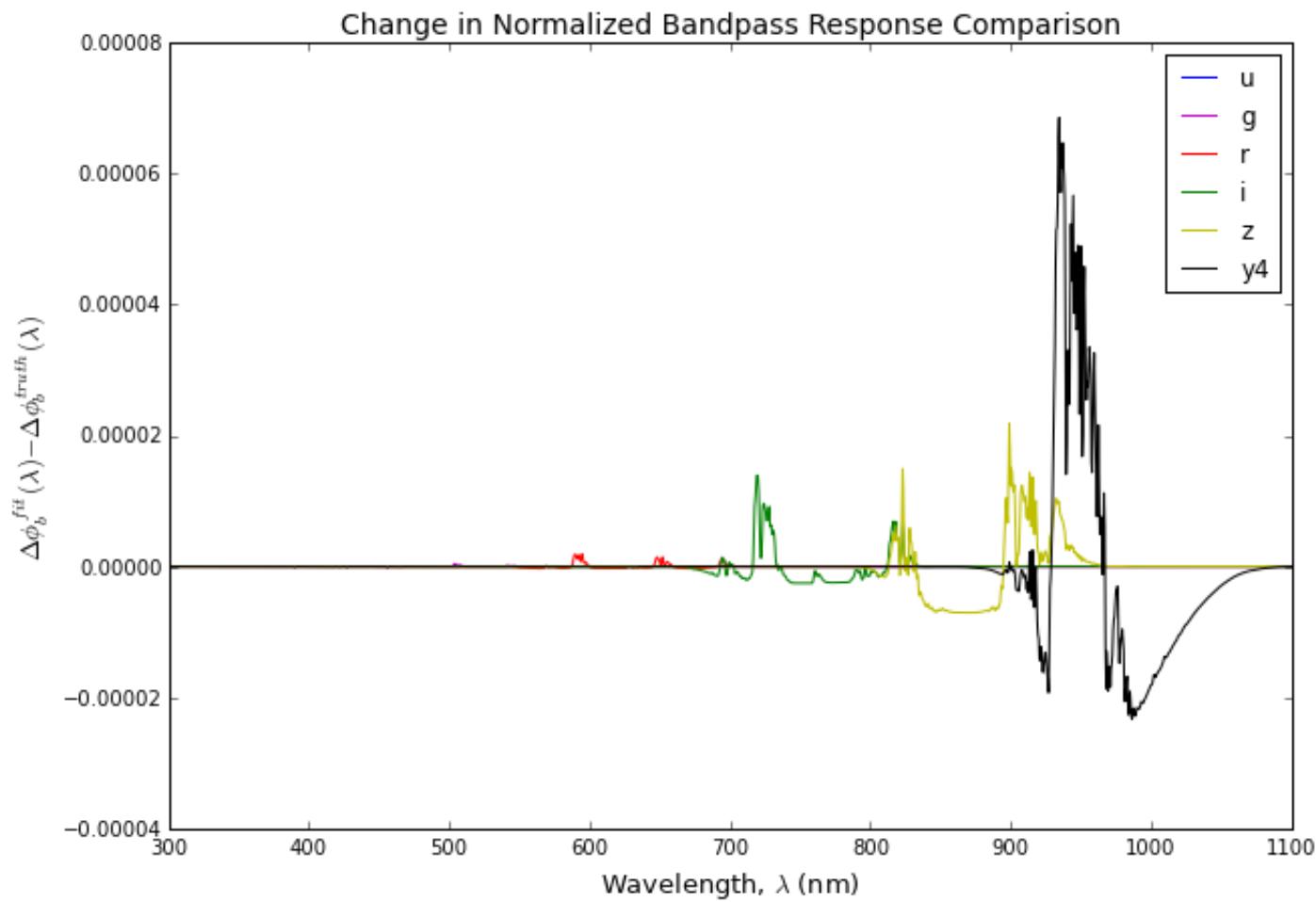
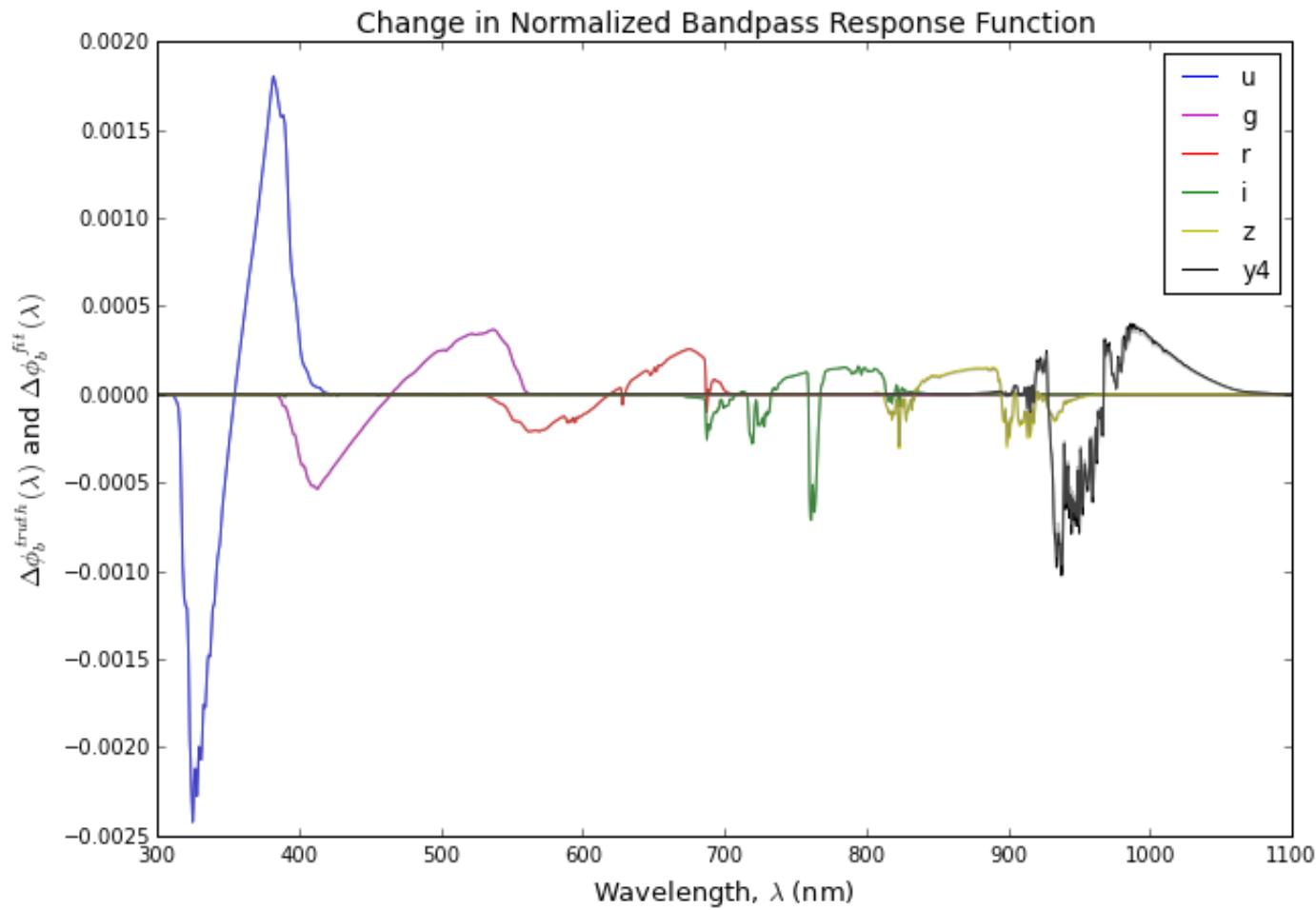
Override best fit parameters (Filter, H2O, dG):
u 0.80 12.00
g 0.80 12.00
r 0.80 12.00
i 0.80 12.00
z 0.80 12.00
y4 0.80 12.00

```

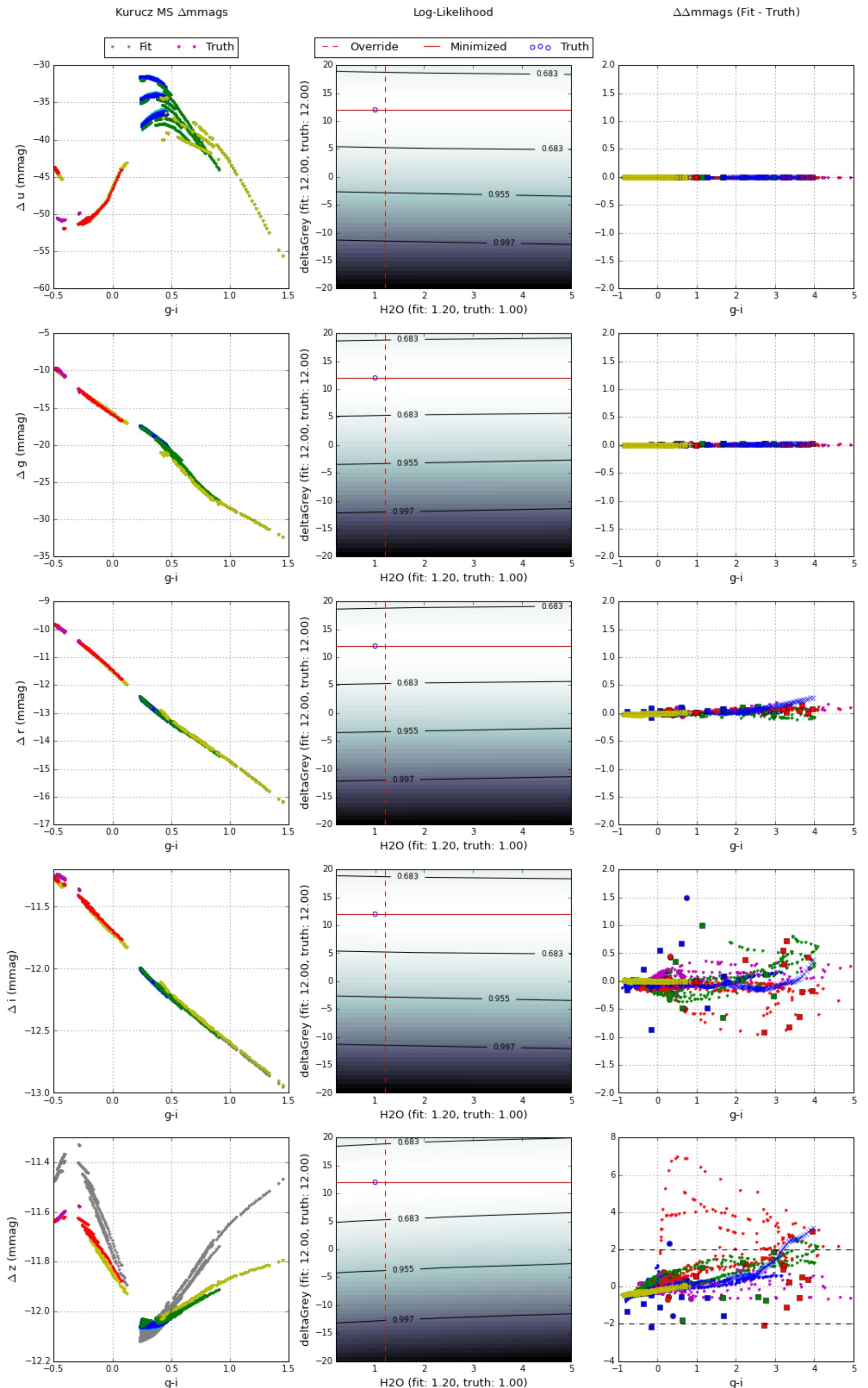
```

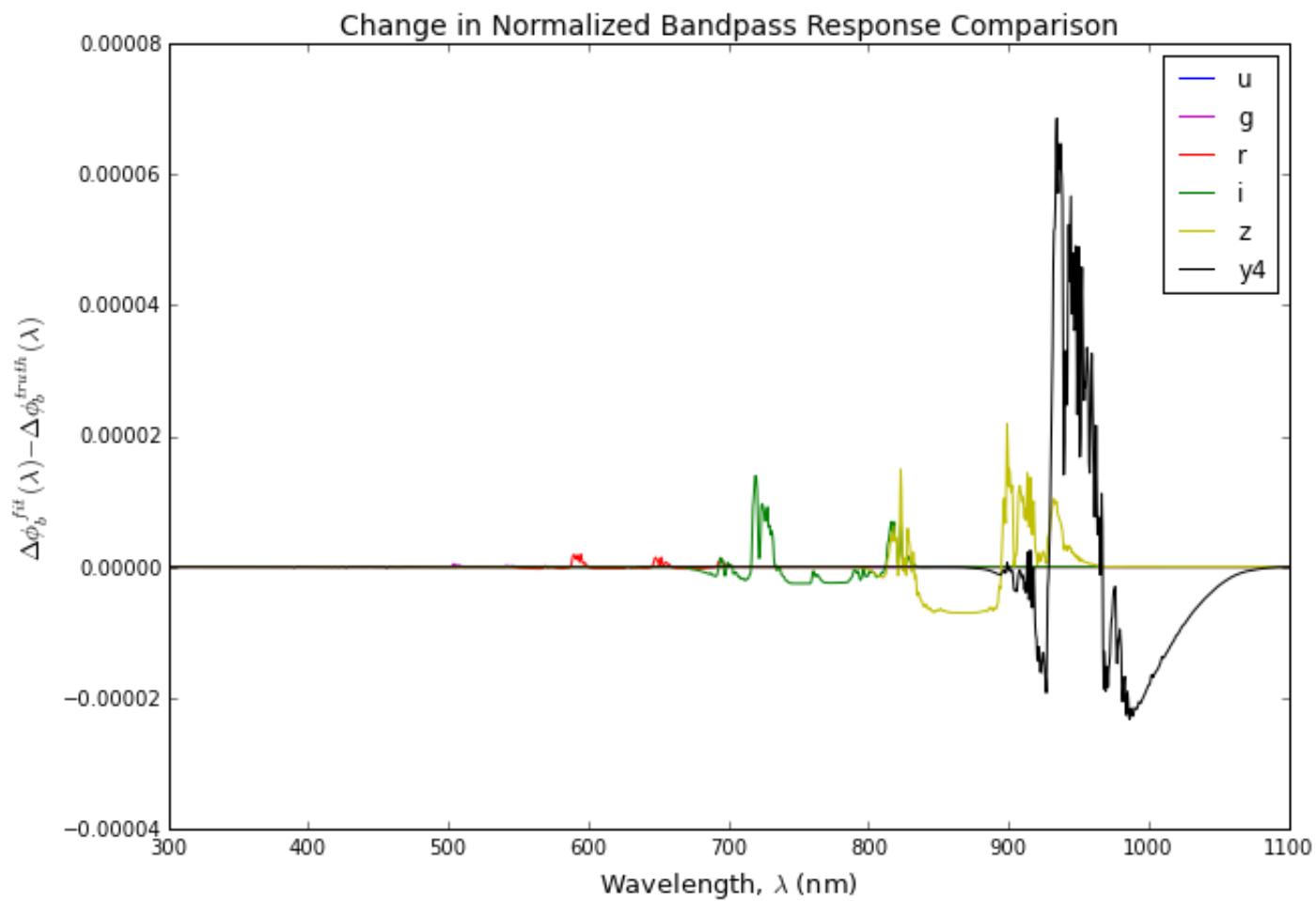
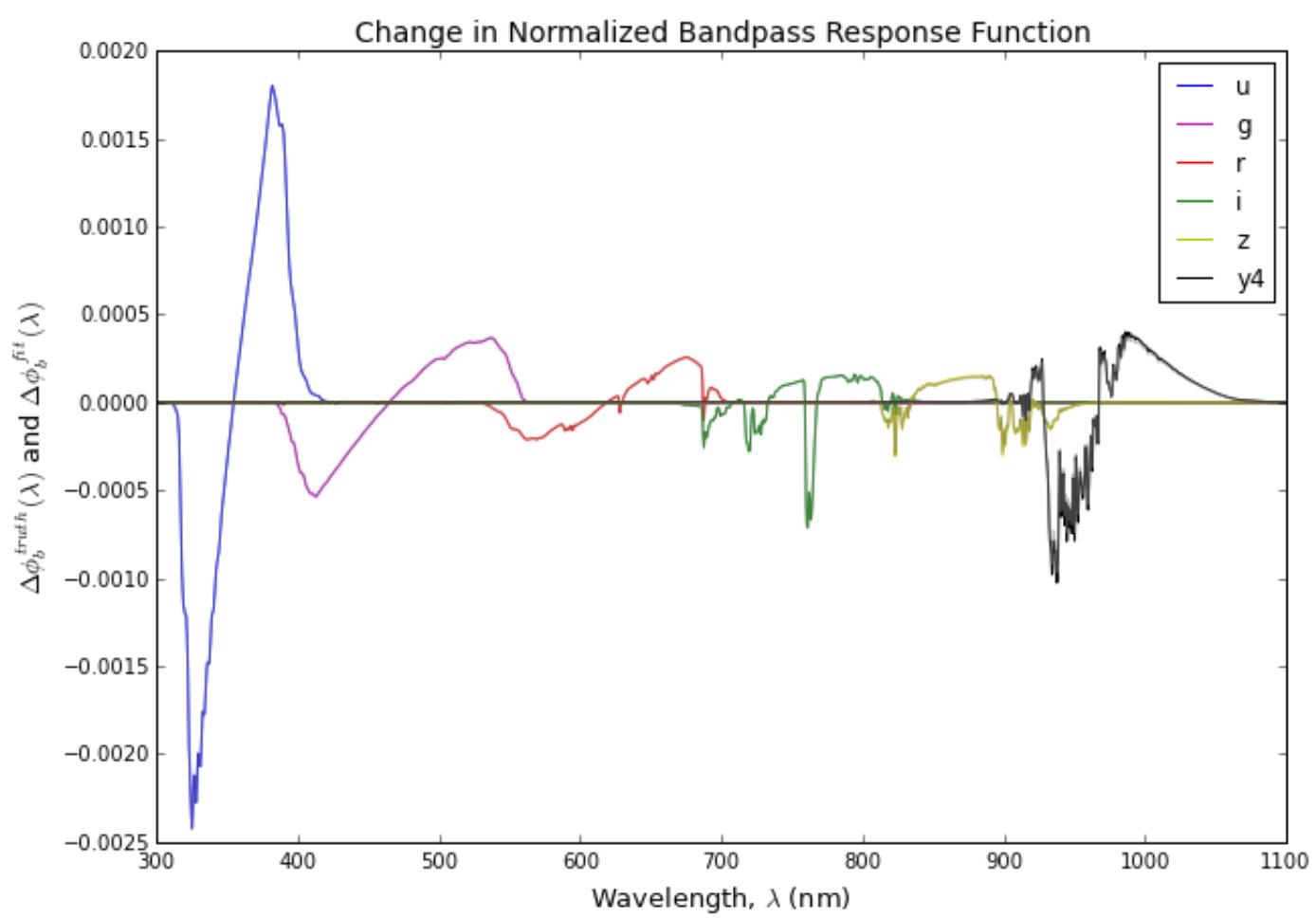
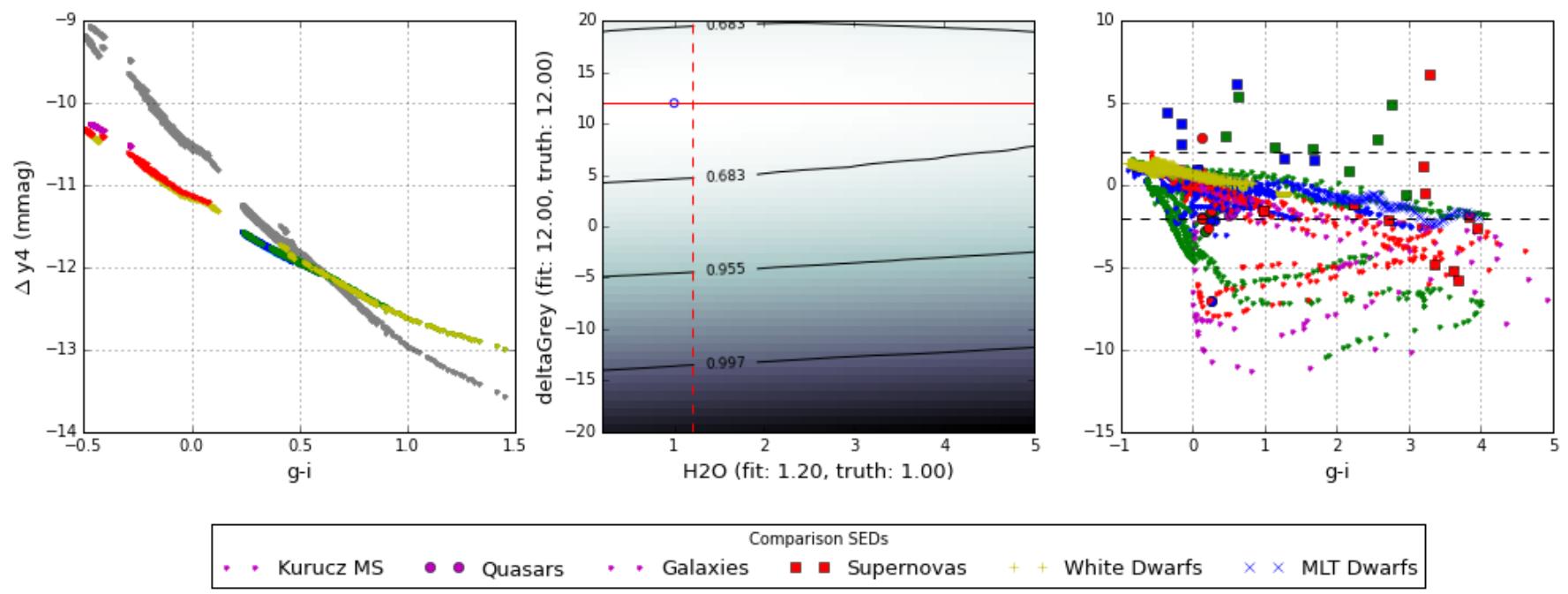
/Users/joachim/anaconda/lib/python2.7/site-packages/matplotlib/text.py:54: UnicodeWarning: Unicode equal comparison failed to convert both arguments to Unicode - interpreting them as being unequal
    elif rotation == 'vertical':

```

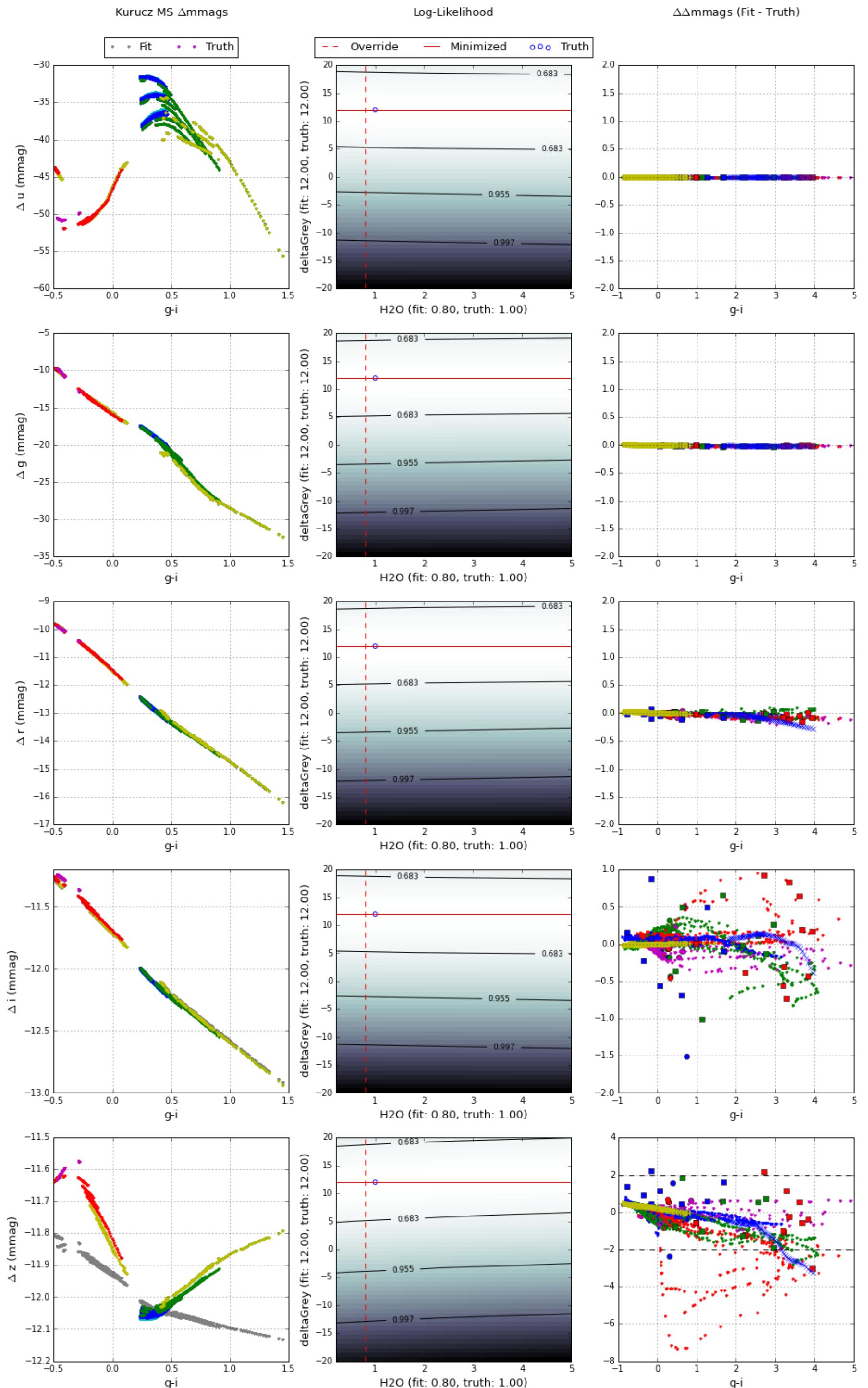


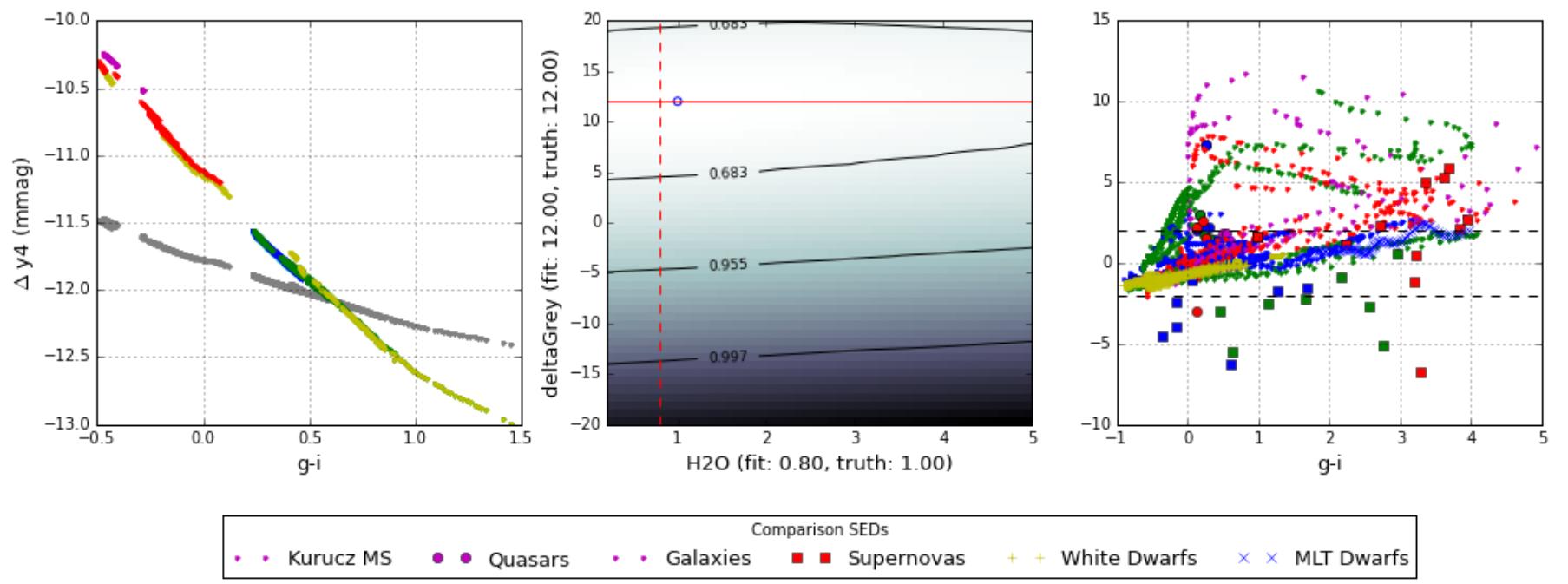
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





```
In [6]: deltaGreyLimitPlot('H2O',deltaGreyBins=50)
```

```
Computing nonlinear regression for H2O.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2  
Observed atmosphere parameter for H2O: 1.0  
  
Fitting for H2O between 0.20 and 5.00 in 50 bins.  
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.  
  
Regression SEDs: 4855 Kurucz MS SEDs.  
  
Regressing 2500 parameter combinations per filter...  
Magnitude Error: 5.0 mmags  
  
Override triggered...  
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...  
  
Calculating best fit parameters for u filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_u_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for u filter.  
Saved Chi-Squared at best fit deltaGrey for u filter.  
Completed u filter.  
  
Calculating best fit parameters for g filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_g_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for g filter.  
Saved Chi-Squared at best fit deltaGrey for g filter.  
Completed g filter.  
  
Calculating best fit parameters for r filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_r_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for r filter.  
Saved Chi-Squared at best fit deltaGrey for r filter.  
Completed r filter.  
  
Calculating best fit parameters for i filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_i_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for i filter.  
Saved Chi-Squared at best fit deltaGrey for i filter.  
Completed i filter.  
  
Calculating best fit parameters for z filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_z_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for z filter.  
Saved Chi-Squared at best fit deltaGrey for z filter.  
Completed z filter.  
  
Calculating best fit parameters for y4 filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-2020_E5_mss_y4_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for y4 filter.  
Saved Chi-Squared at best fit deltaGrey for y4 filter.  
Completed y4 filter.  
  
Best fit parameters (Filter, H2O, dG, logL, Chi-Squared):  
u 5.00 11.84 1.33978431344 2.67956862688  
g 0.20 11.84 2.19944083458 4.39888166917  
r 0.20 11.84 2.06235891372 4.12471782743  
i 3.82 11.84 1.35071832013 2.70143664027  
z 0.79 11.84 1.35424390957 2.70848781915  
y4 0.98 11.84 2.41763485434 4.83526970867  
  
Override best fit parameters (Filter, H2O, dG):  
u 1.20 11.84  
g 1.20 11.84  
r 1.20 11.84  
i 1.20 11.84  
z 1.20 11.84  
y4 1.20 11.84  
  
Computing nonlinear regression for H2O.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2
```

```
Observed atmosphere parameter for H2O: 1.0

Fitting for H2O between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit v
alue...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-
2020_E5_mss_u_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-
2020_E5_mss_g_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-
2020_E5_mss_r_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

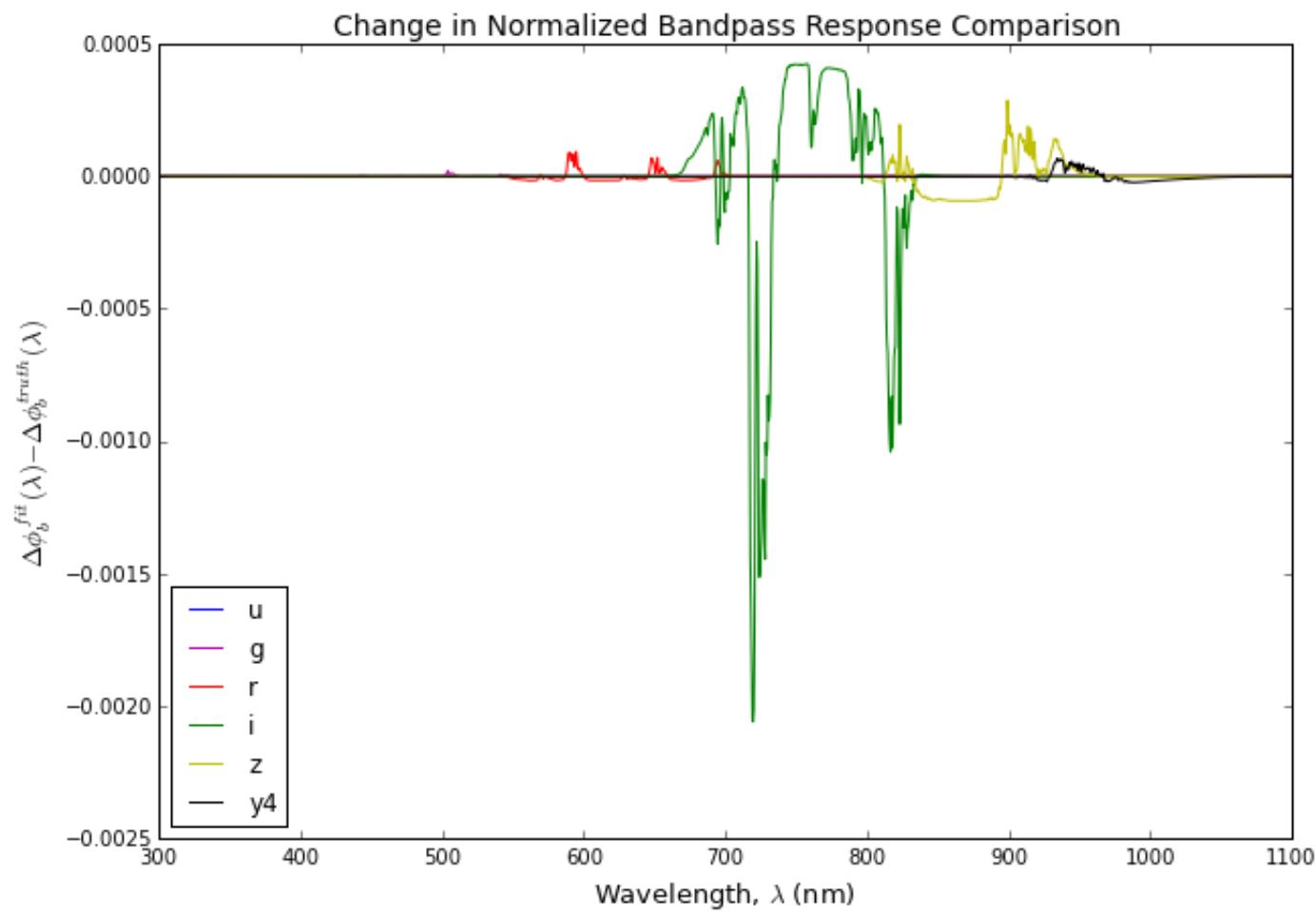
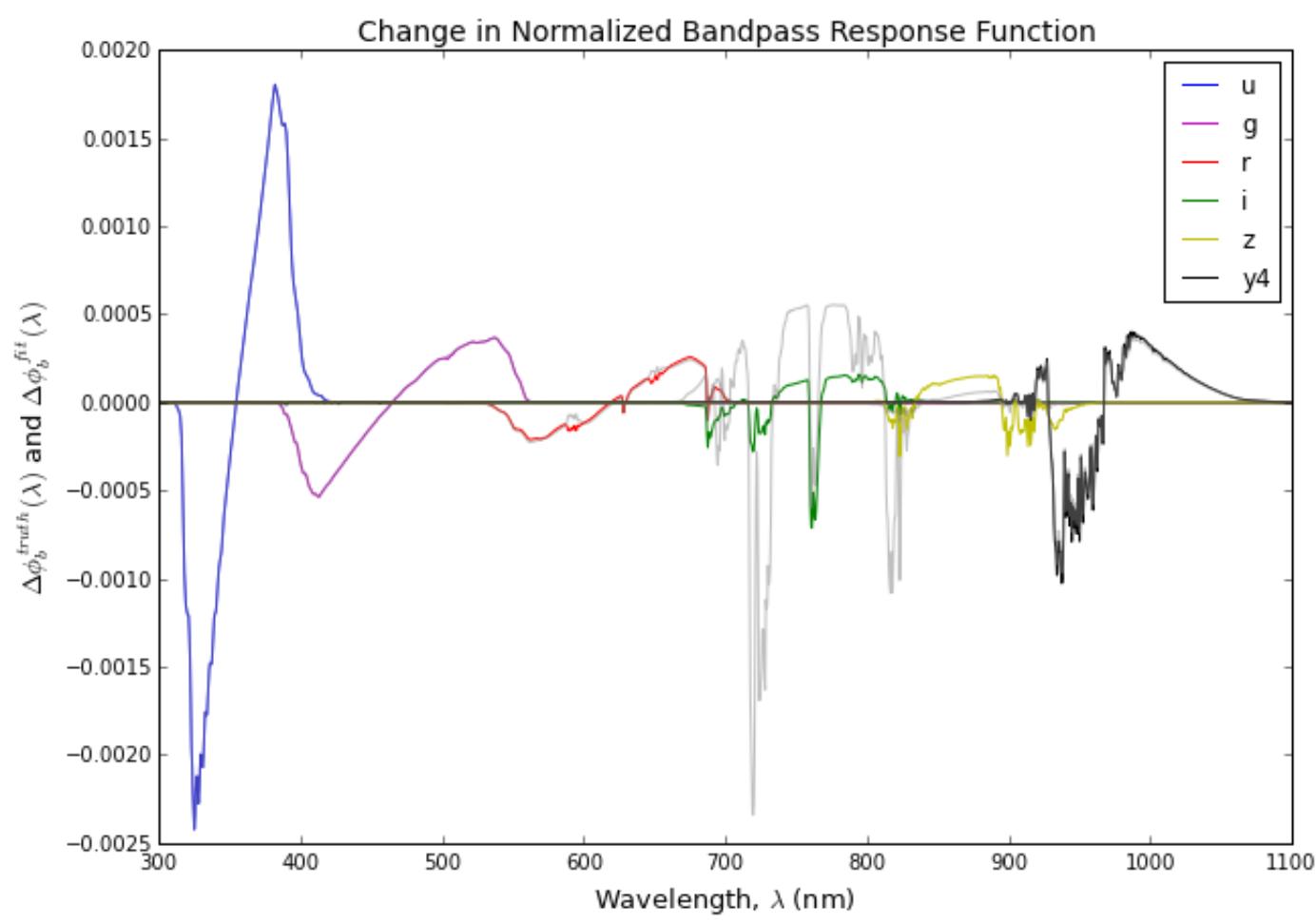
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-
2020_E5_mss_i_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-
2020_E5_mss_z_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

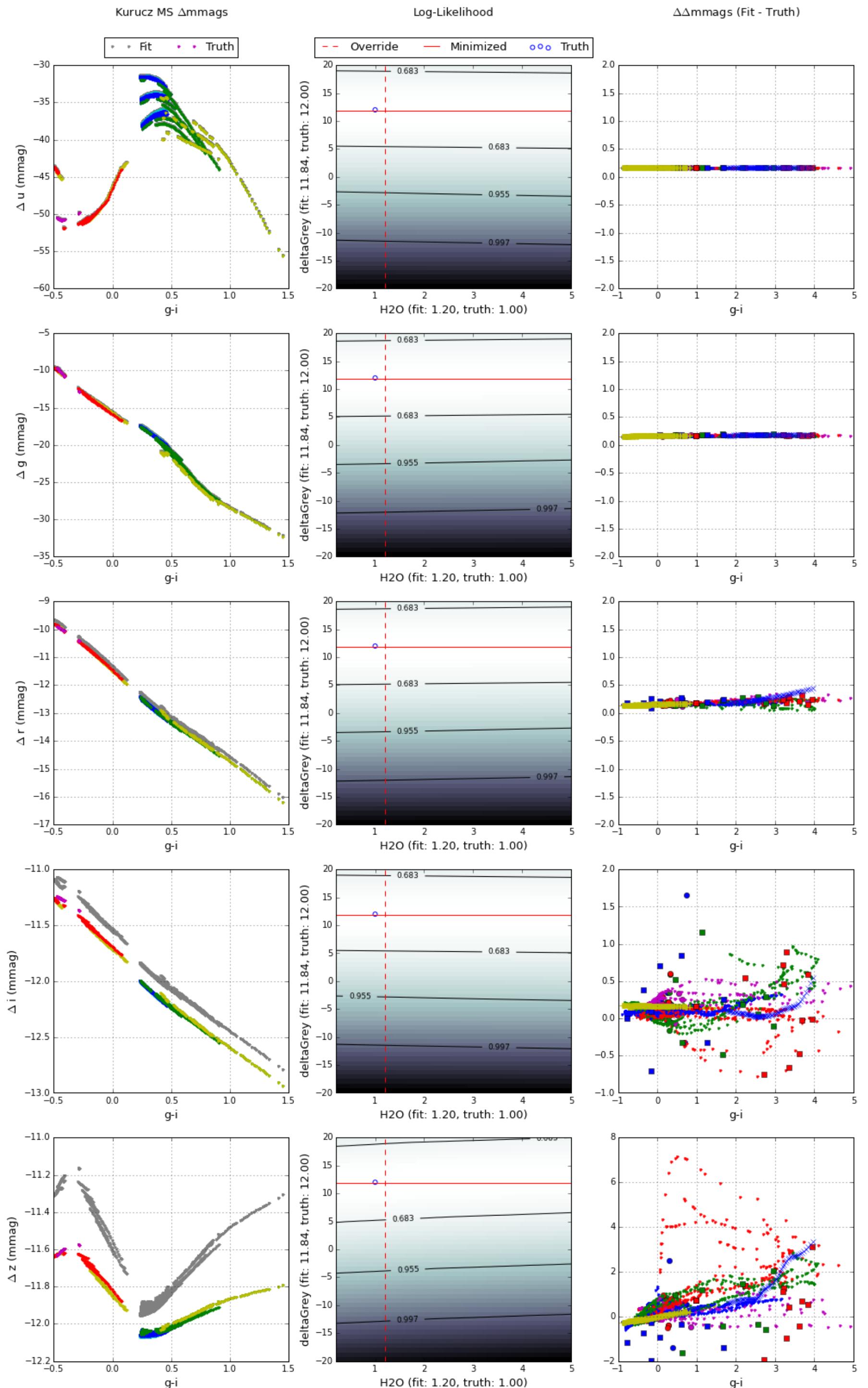
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_H2O_dG_XSTD12_DG120_DGR-
2020_E5_mss_y4_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

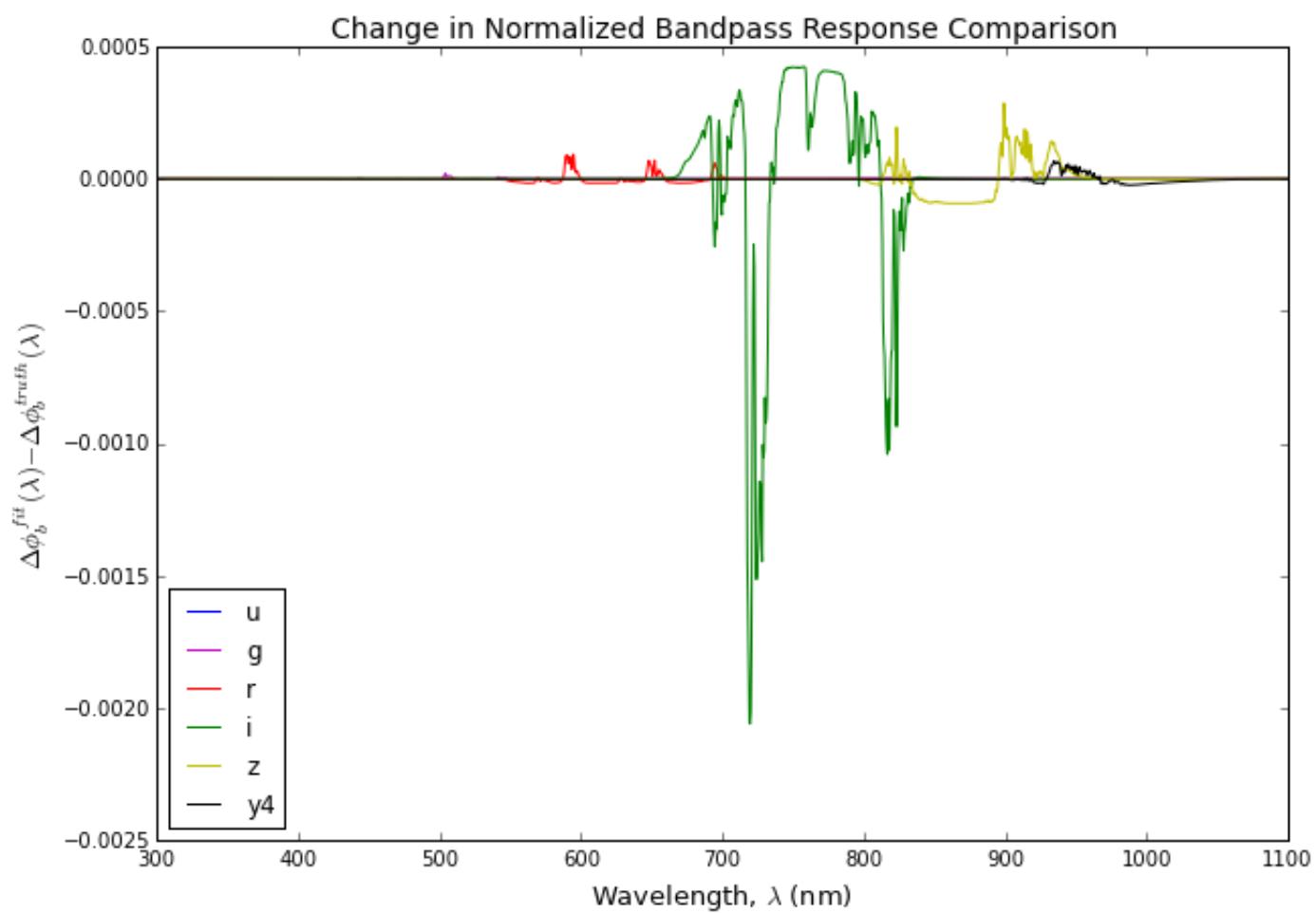
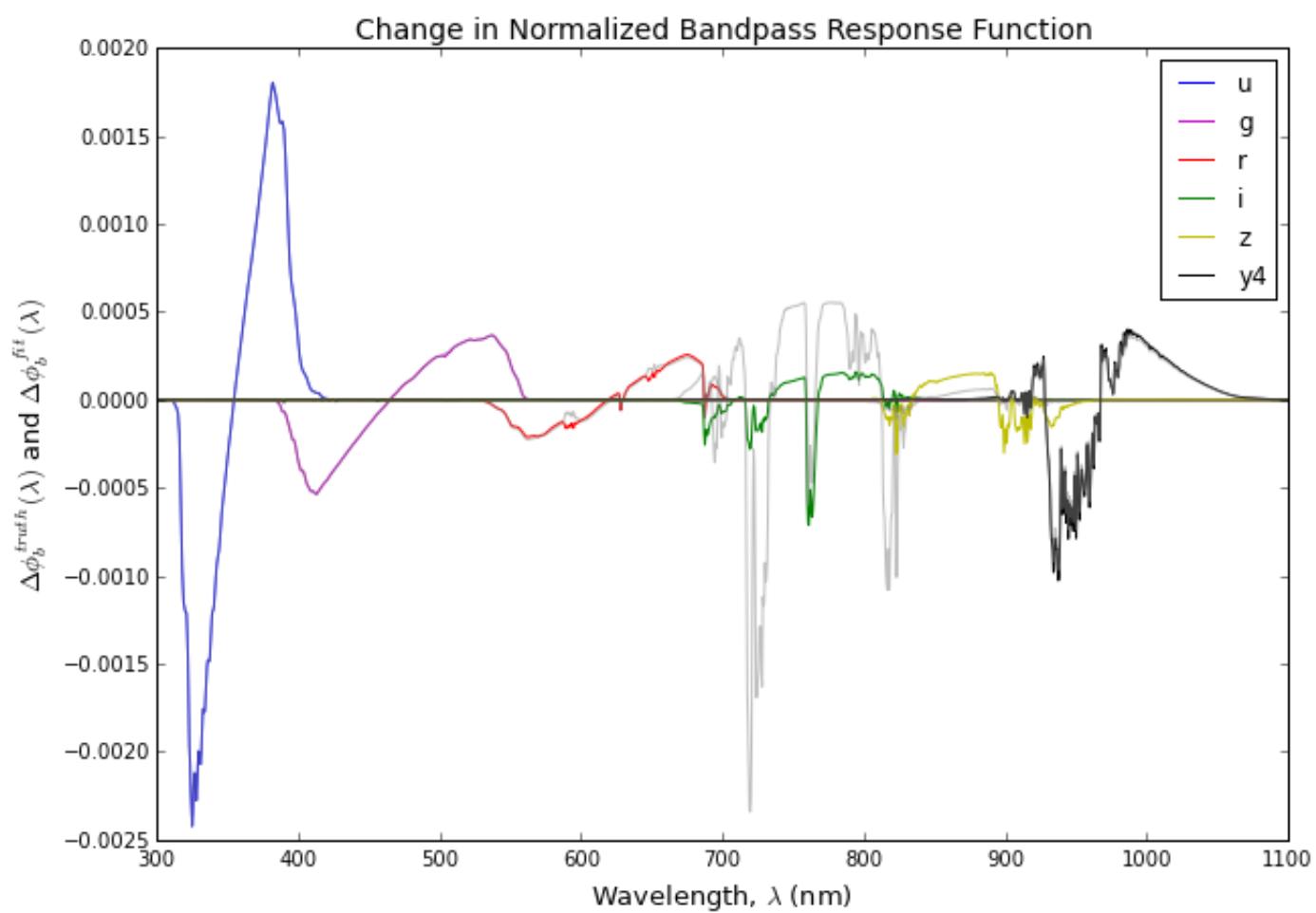
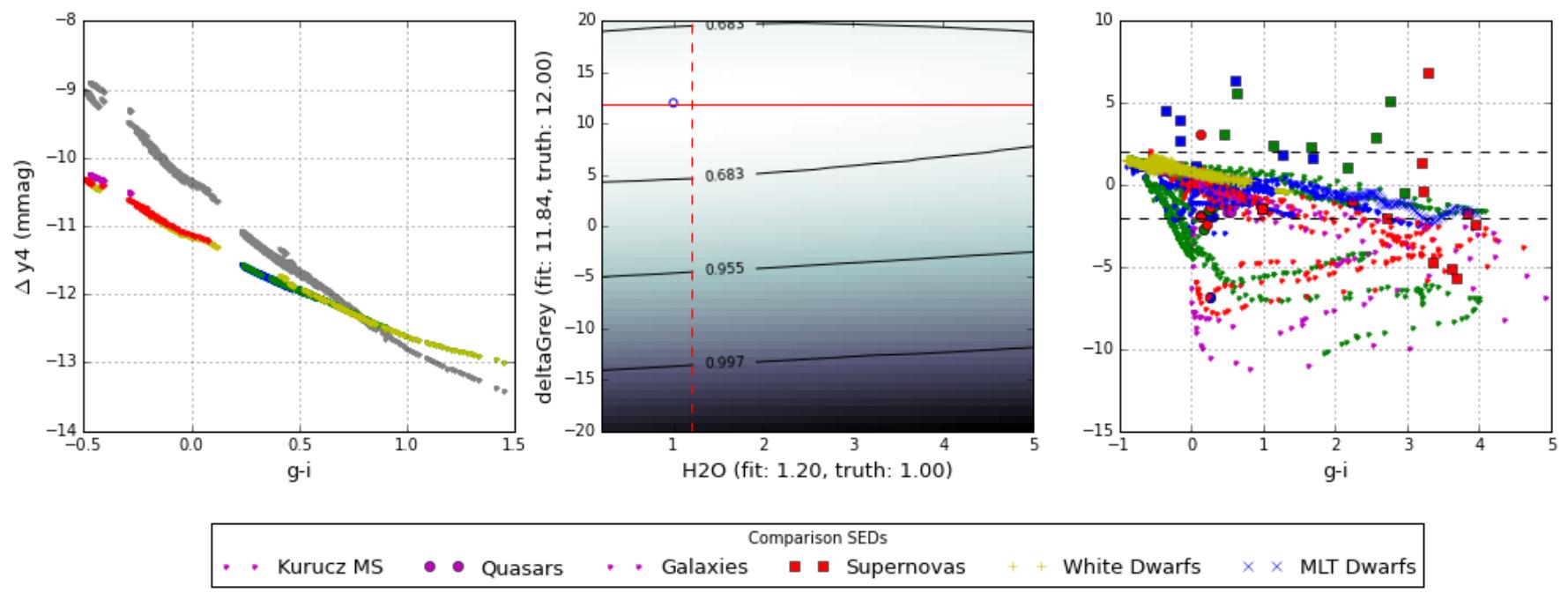
Best fit parameters (Filter, H2O, dG, logL, Chi-Squared):
u 5.00 11.84 1.33978431344 2.67956862688
g 0.20 11.84 2.19944083458 4.39888166917
r 0.20 11.84 2.06235891372 4.12471782743
i 3.82 11.84 1.35071832013 2.70143664027
z 0.79 11.84 1.35424390957 2.70848781915
y4 0.98 11.84 2.41763485434 4.83526970867

Override best fit parameters (Filter, H2O, dG):
u 0.80 11.84
g 0.80 11.84
r 0.80 11.84
i 0.80 11.84
z 0.80 11.84
y4 0.80 11.84
```

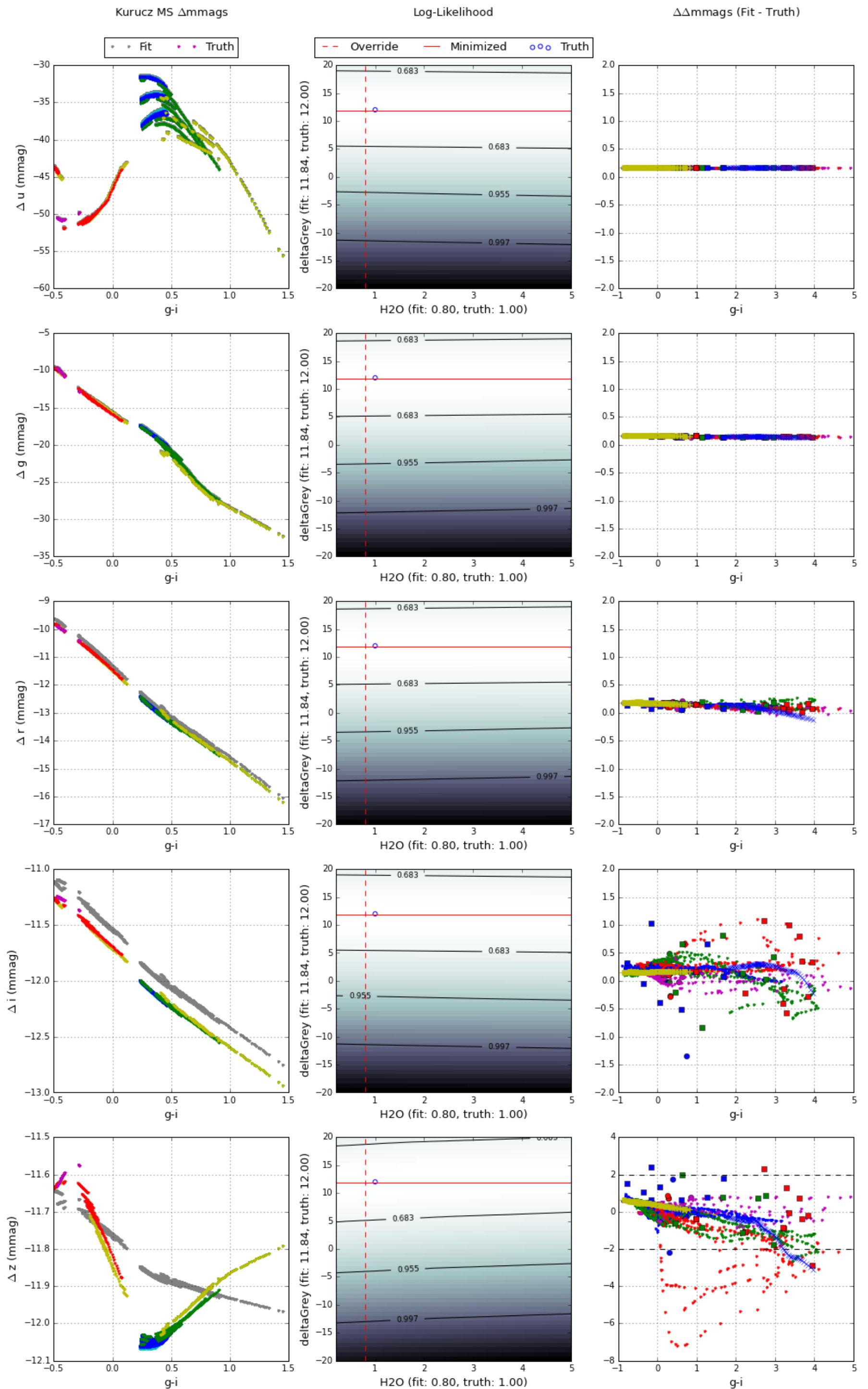


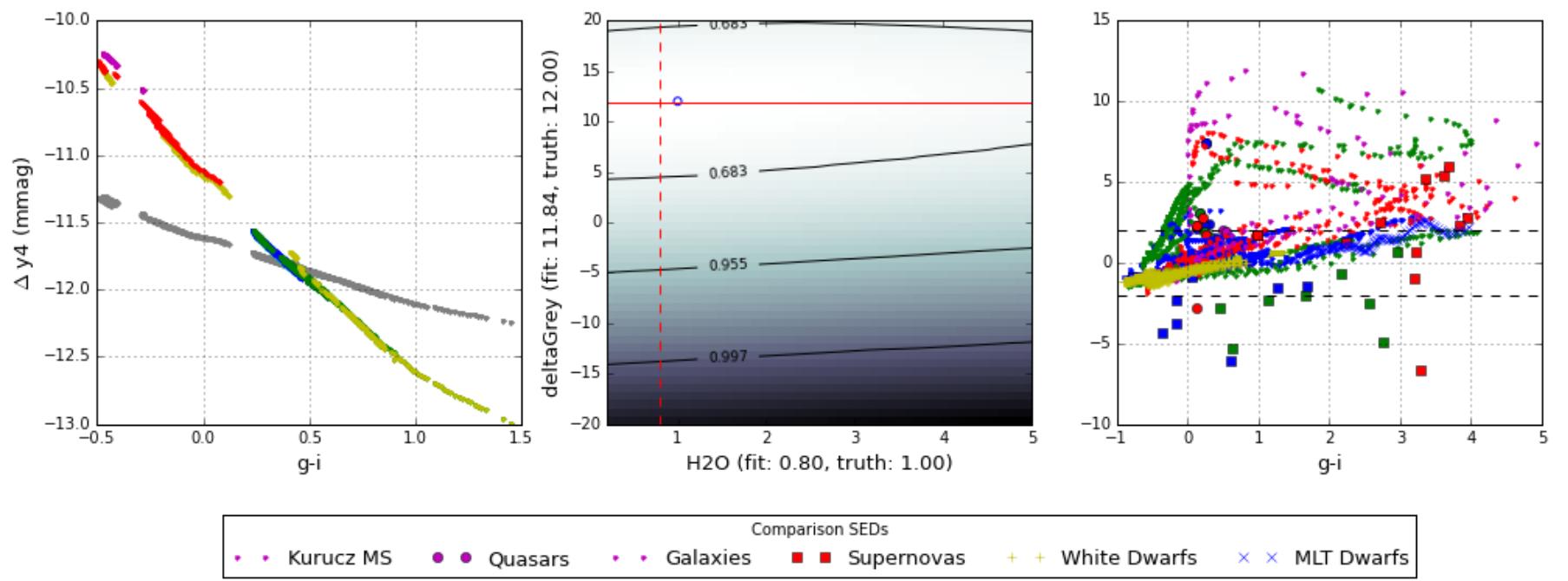
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





O_2

```
In [7]: deltaGreyLimitPlot('02')
```

```

Computing nonlinear regression for O2.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for O2: 1.0

Fitting for O2 between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2
020_E5_mss_u_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2
020_E5_mss_g_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2
020_E5_mss_r_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2
020_E5_mss_i_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2
020_E5_mss_z_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2
020_E5_mss_y4_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, O2, dG, logL, Chi-Squared):
u 0.98 12.00 4.2644197946e-07 8.52883958919e-07
g 0.98 12.00 3.59302403673e-08 7.18604807346e-08
r 0.98 12.00 0.005304616521 0.010609233042
i 0.98 12.00 8.88856251989e-05 0.000177771250398
z 0.98 12.00 1.09902713271e-08 2.19805426543e-08
y4 0.98 12.00 1.44853118926e-06 2.89706237852e-06

Override best fit parameters (Filter, O2, dG):
u 1.20 12.00
g 1.20 12.00
r 1.20 12.00
i 1.20 12.00
z 1.20 12.00
y4 1.20 12.00

Computing nonlinear regression for O2.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2

```

Observed atmosphere parameter for O2: 1.0

Fitting for O2 between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_u_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_g_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_r_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

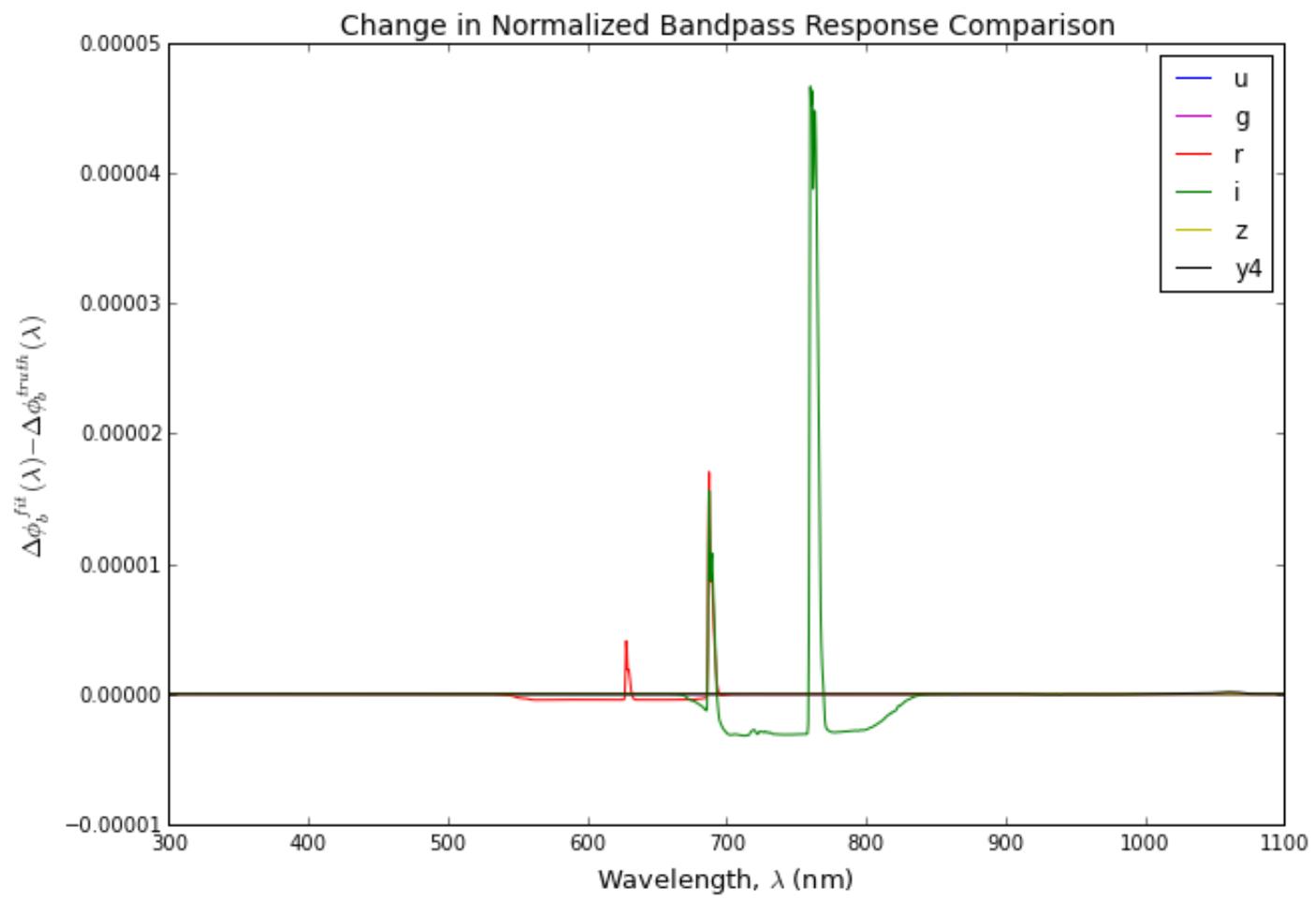
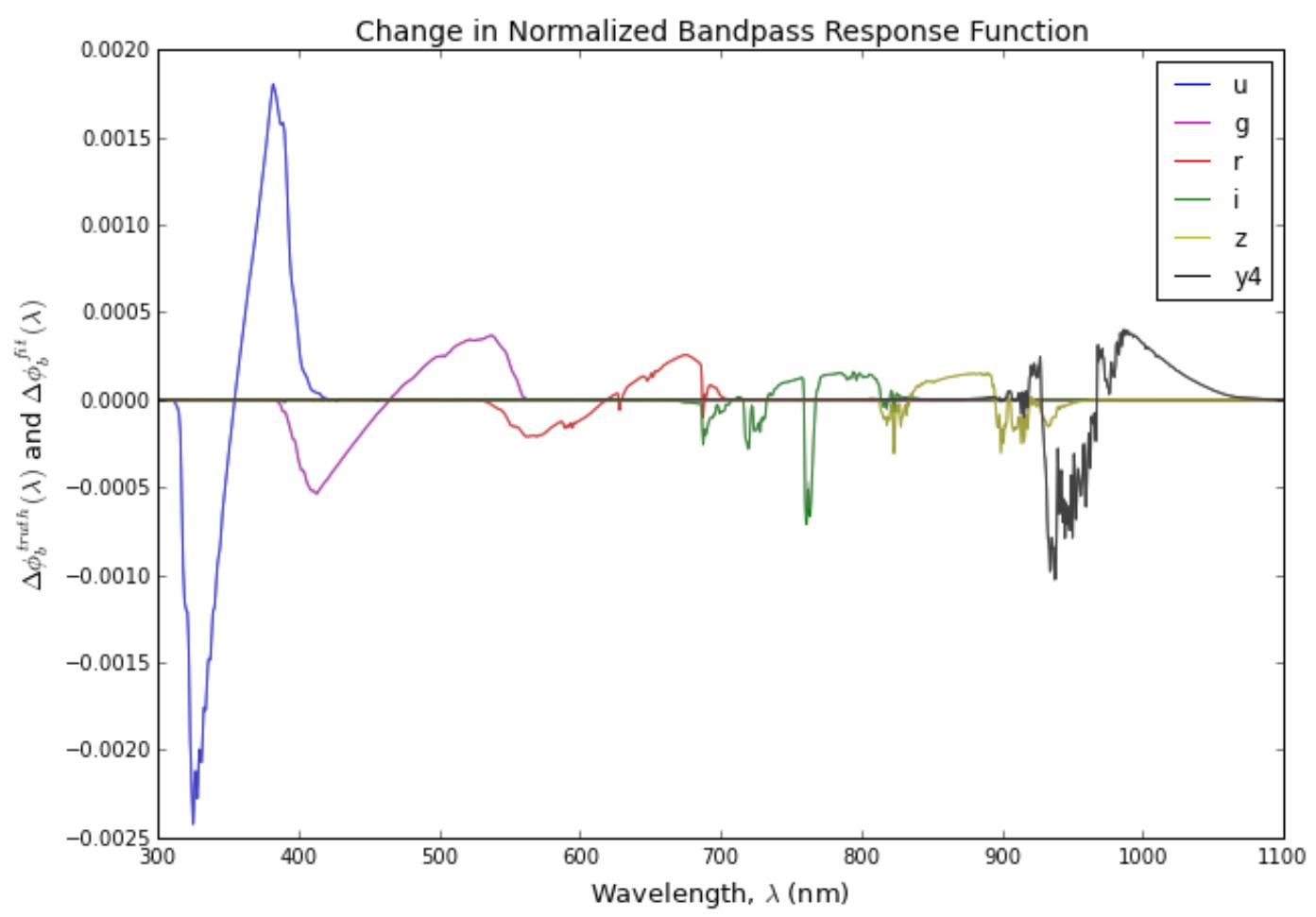
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_i_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_z_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

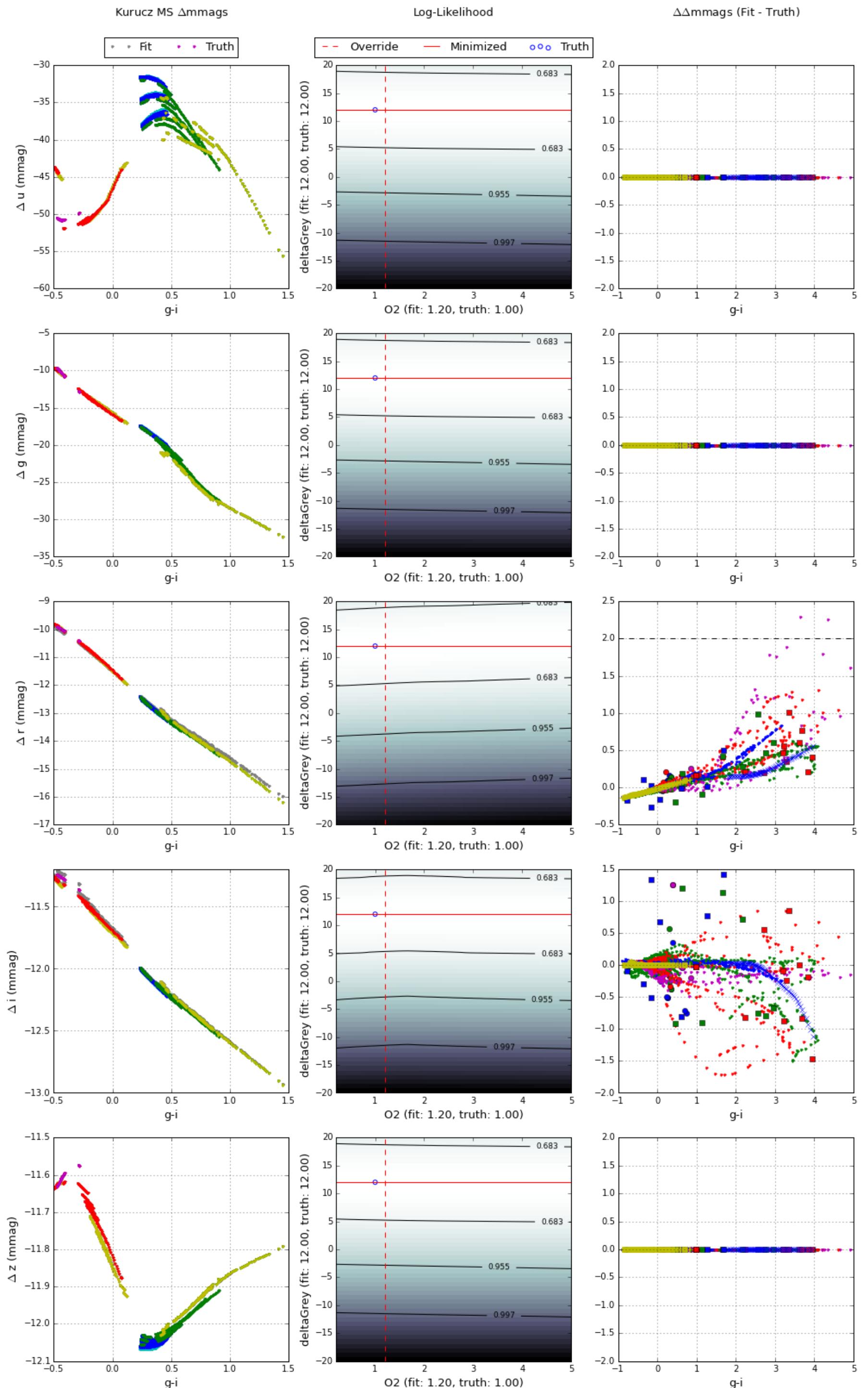
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_y4_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

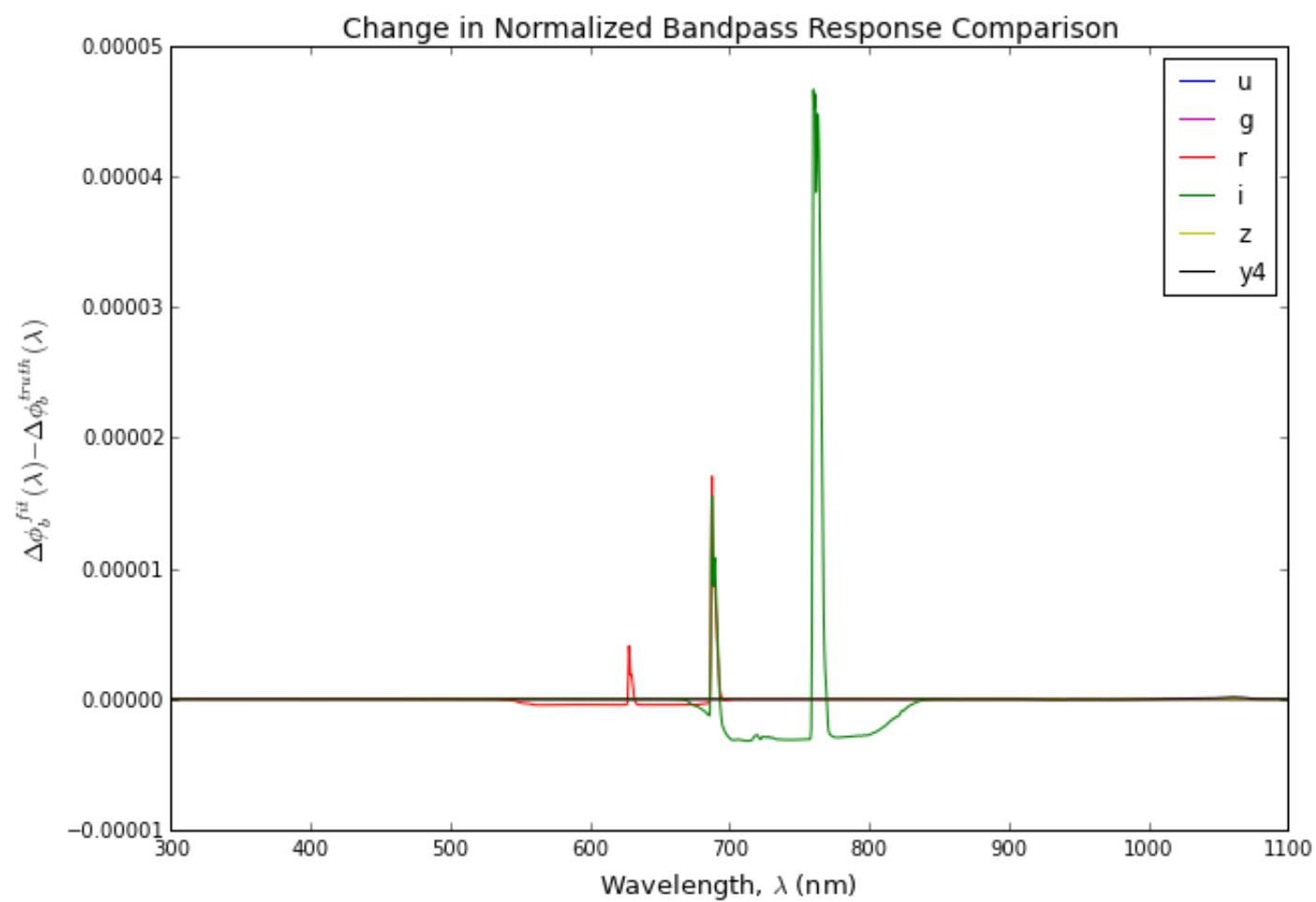
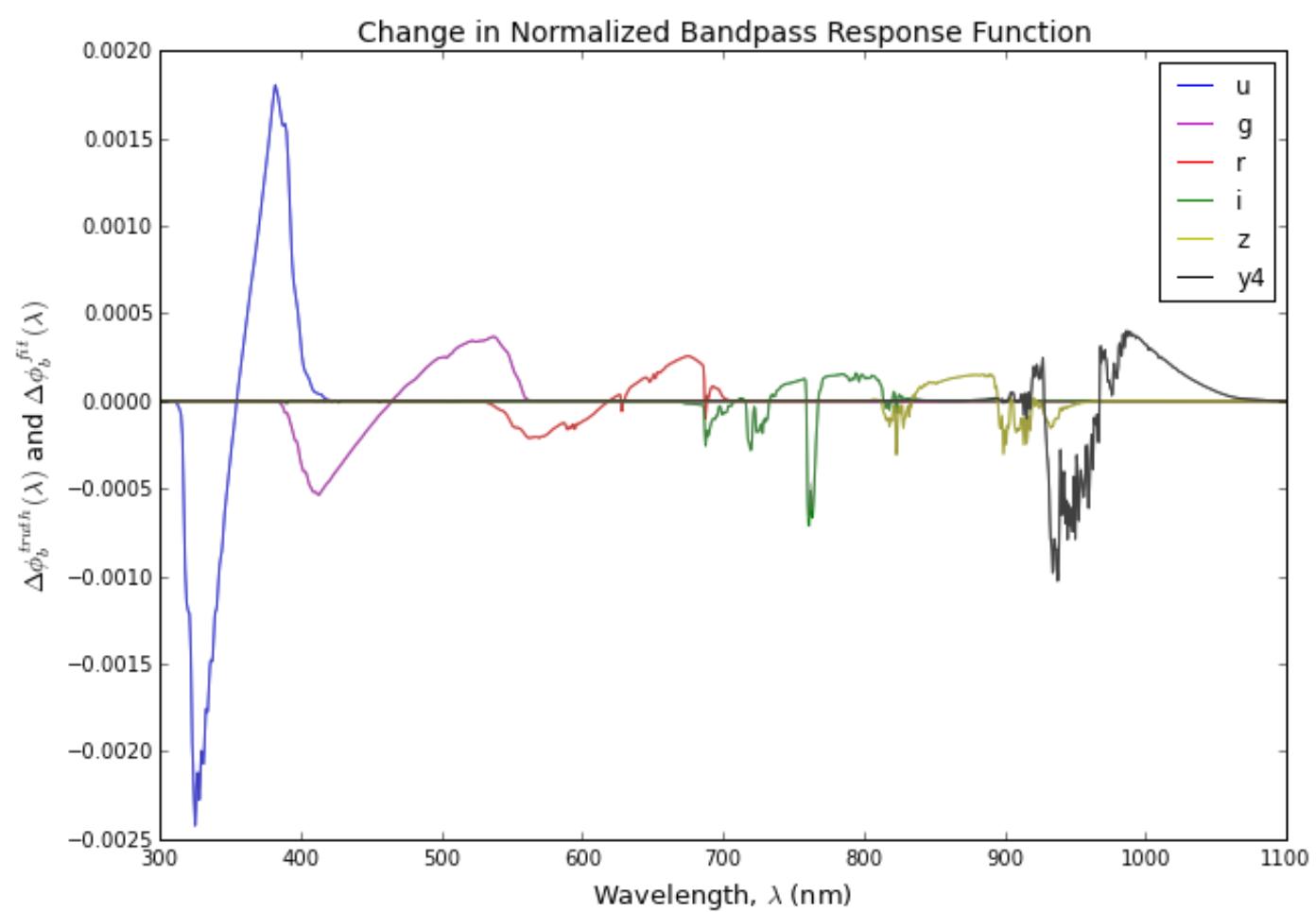
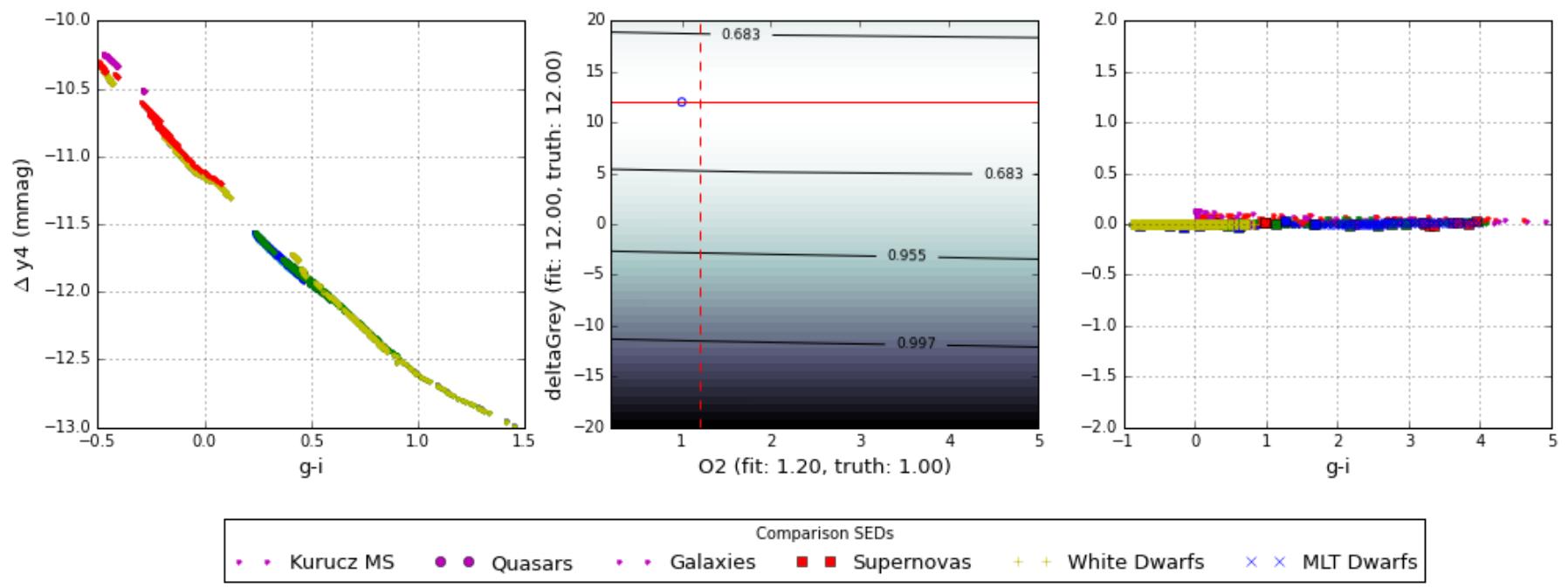
Best fit parameters (Filter, O2, dG, logL, Chi-Squared):
u 0.98 12.00 4.2644197946e-07 8.52883958919e-07
g 0.98 12.00 3.59302403673e-08 7.18604807346e-08
r 0.98 12.00 0.005304616521 0.010609233042
i 0.98 12.00 8.88856251989e-05 0.000177771250398
z 0.98 12.00 1.09902713271e-08 2.19805426543e-08
y4 0.98 12.00 1.44853118926e-06 2.89706237852e-06

Override best fit parameters (Filter, O2, dG):
u 0.80 12.00
g 0.80 12.00
r 0.80 12.00
i 0.80 12.00
z 0.80 12.00
y4 0.80 12.00

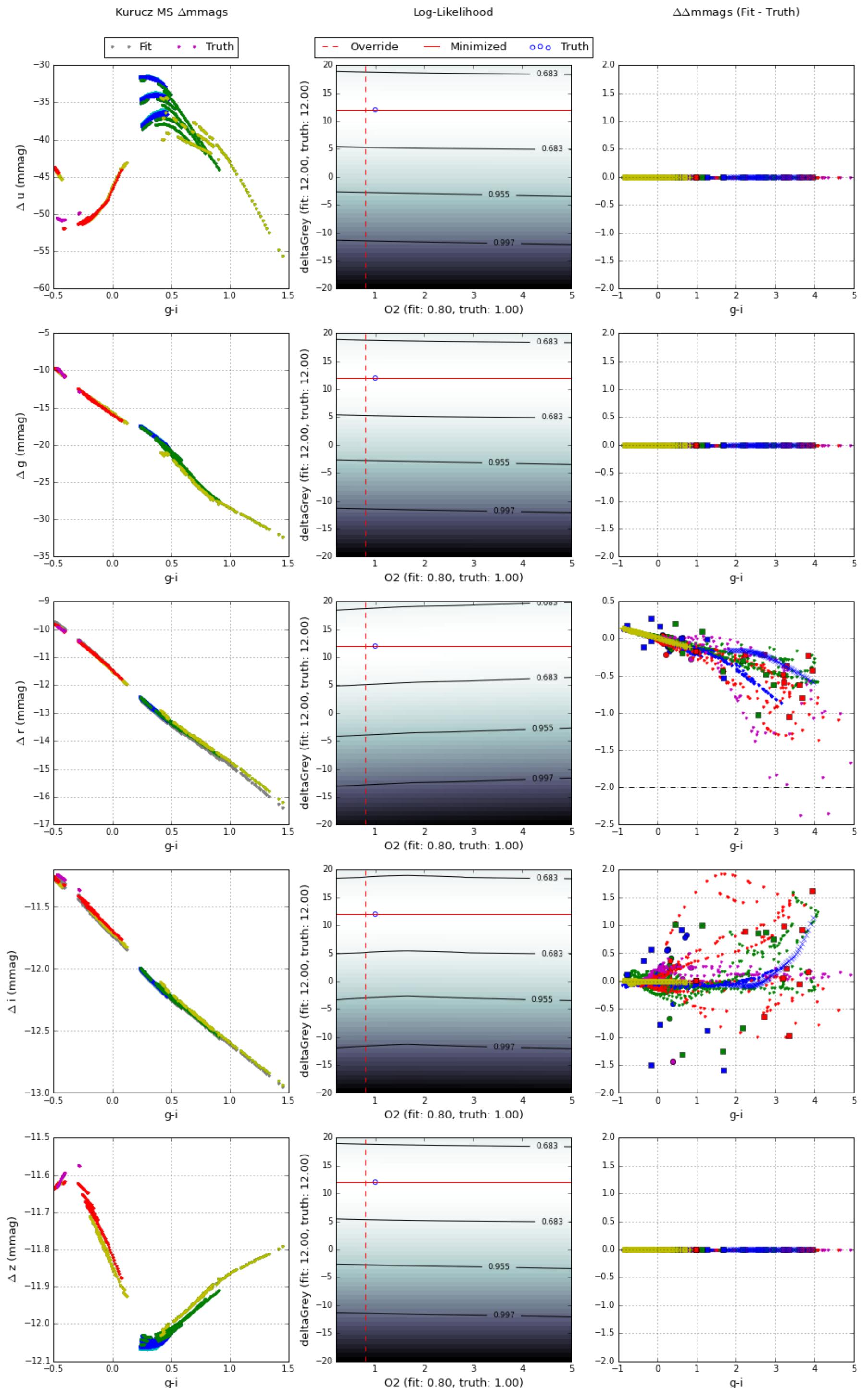


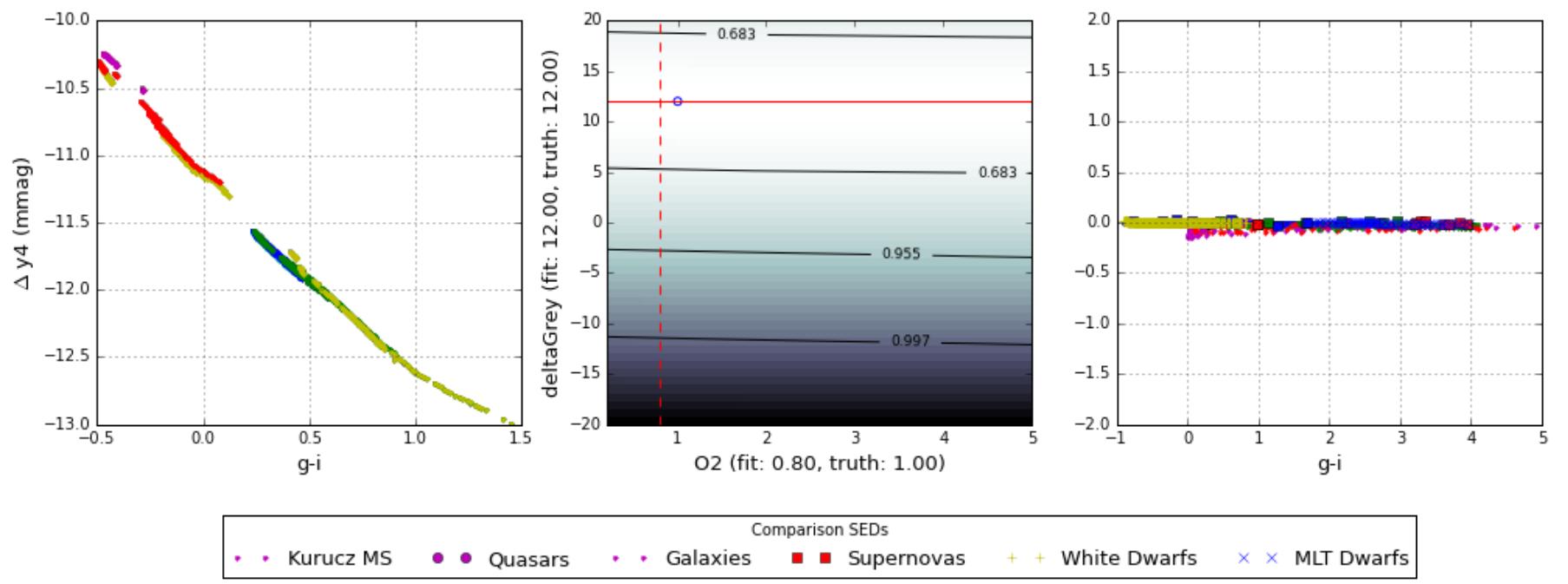
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





```
In [8]: deltaGreyLimitPlot('02',deltaGreyBins=50)
```

```
Computing nonlinear regression for O2.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2  
Observed atmosphere parameter for O2: 1.0  
  
Fitting for O2 between 0.20 and 5.00 in 50 bins.  
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.  
  
Regression SEDs: 4855 Kurucz MS SEDs.  
  
Regressing 2500 parameter combinations per filter...  
Magnitude Error: 5.0 mmags  
  
Override triggered...  
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...  
  
Calculating best fit parameters for u filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_u_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for u filter.  
Saved Chi-Squared at best fit deltaGrey for u filter.  
Completed u filter.  
  
Calculating best fit parameters for g filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_g_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for g filter.  
Saved Chi-Squared at best fit deltaGrey for g filter.  
Completed g filter.  
  
Calculating best fit parameters for r filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_r_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for r filter.  
Saved Chi-Squared at best fit deltaGrey for r filter.  
Completed r filter.  
  
Calculating best fit parameters for i filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_i_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for i filter.  
Saved Chi-Squared at best fit deltaGrey for i filter.  
Completed i filter.  
  
Calculating best fit parameters for z filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_z_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for z filter.  
Saved Chi-Squared at best fit deltaGrey for z filter.  
Completed z filter.  
  
Calculating best fit parameters for y4 filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_y4_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for y4 filter.  
Saved Chi-Squared at best fit deltaGrey for y4 filter.  
Completed y4 filter.  
  
Best fit parameters (Filter, O2, dG, logL, Chi-Squared):  
u 5.00 11.84 2.26333491835 4.5266698367  
g 5.00 11.84 2.50384471515 5.0076894303  
r 0.69 11.84 1.03452886293 2.06905772587  
i 0.20 11.84 0.933415824896 1.86683164979  
z 5.00 11.84 2.5632514429 5.12650288579  
y4 5.00 11.84 2.44415409692 4.88830819385  
  
Override best fit parameters (Filter, O2, dG):  
u 1.20 11.84  
g 1.20 11.84  
r 1.20 11.84  
i 1.20 11.84  
z 1.20 11.84  
y4 1.20 11.84  
  
Computing nonlinear regression for O2.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2
```

Observed atmosphere parameter for O2: 1.0

Fitting for O2 between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_u_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_g_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_r_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

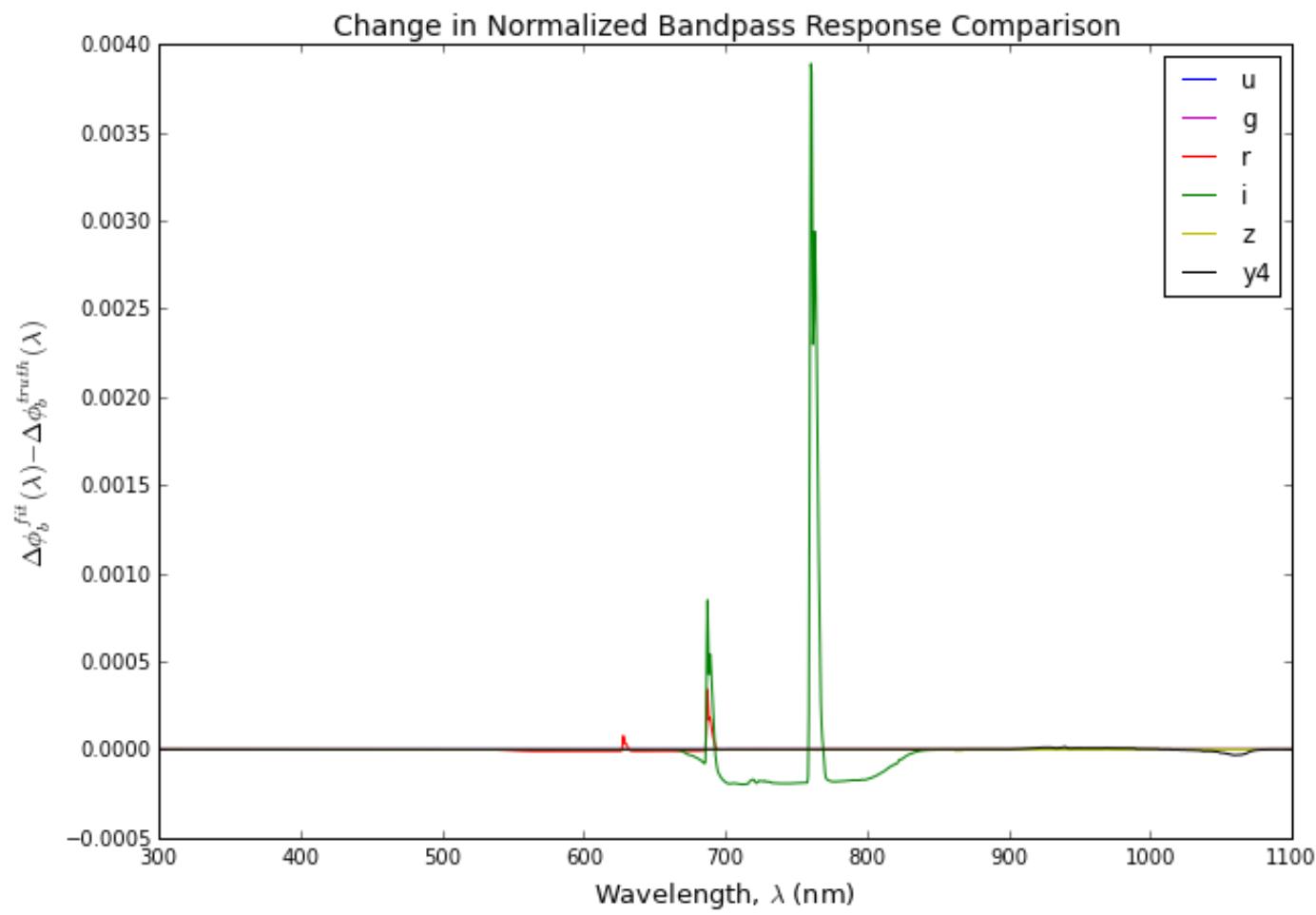
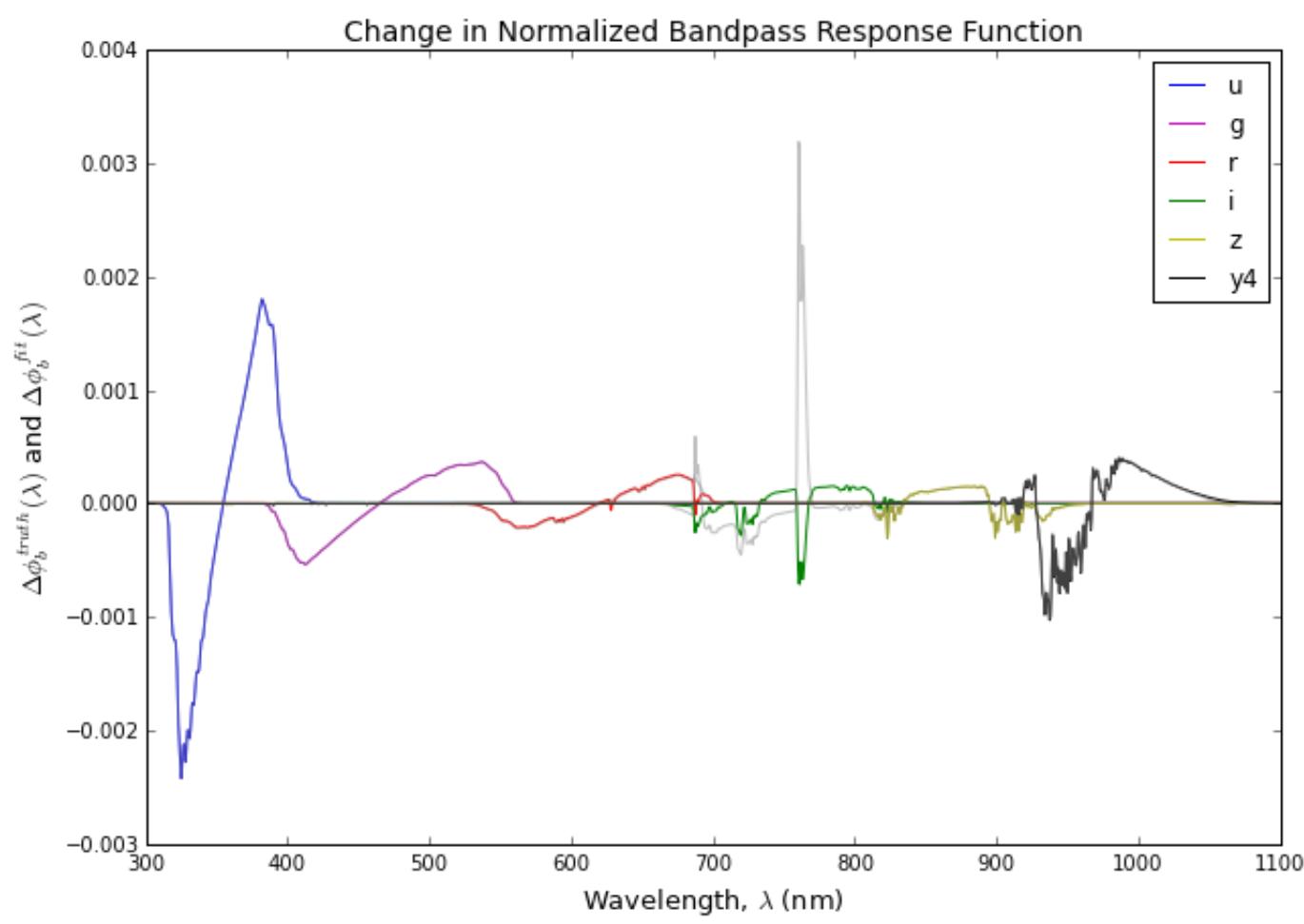
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_i_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_z_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

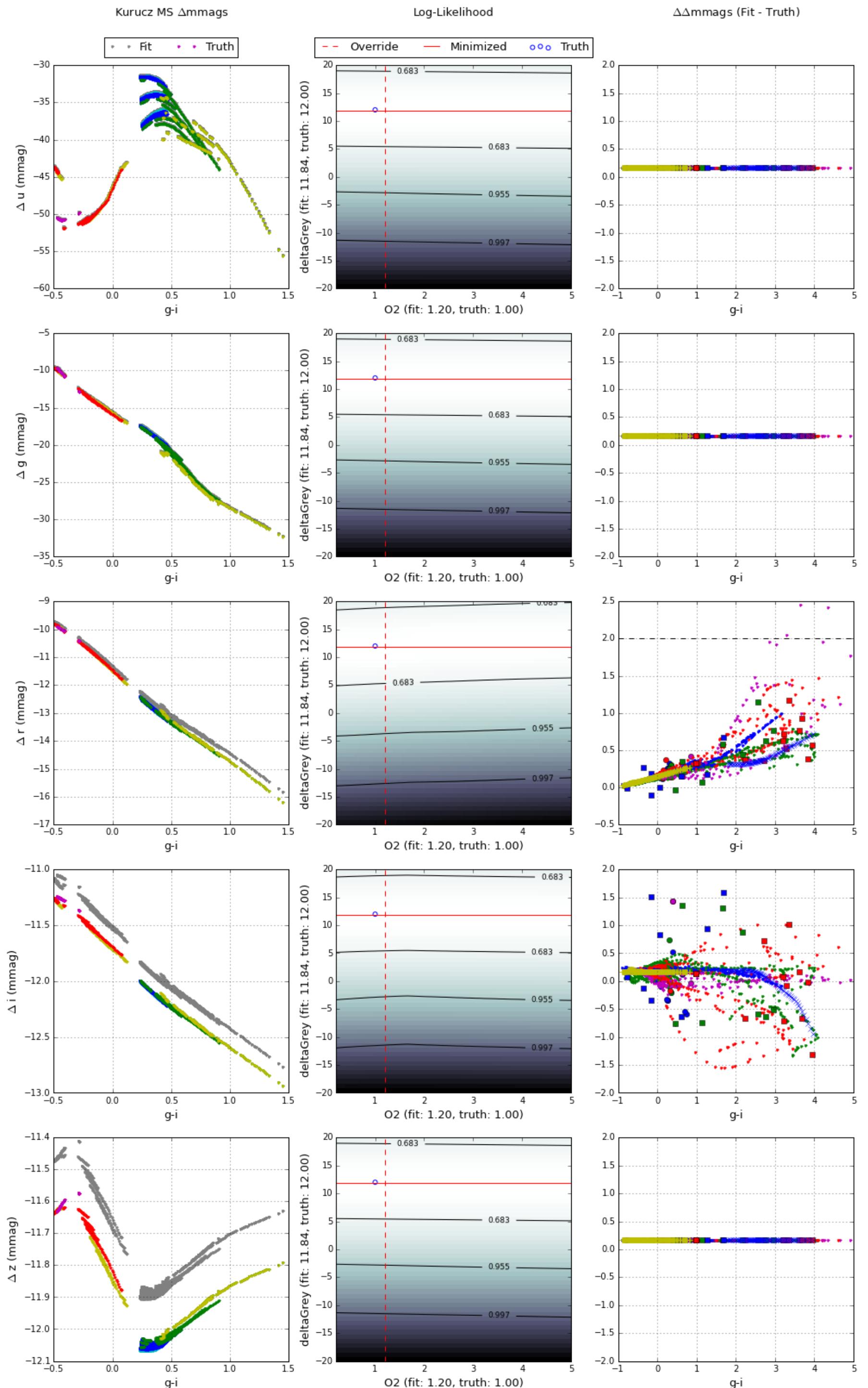
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O2_dG_XSTD12_DG120_DGR-2_020_E5_mss_y4_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

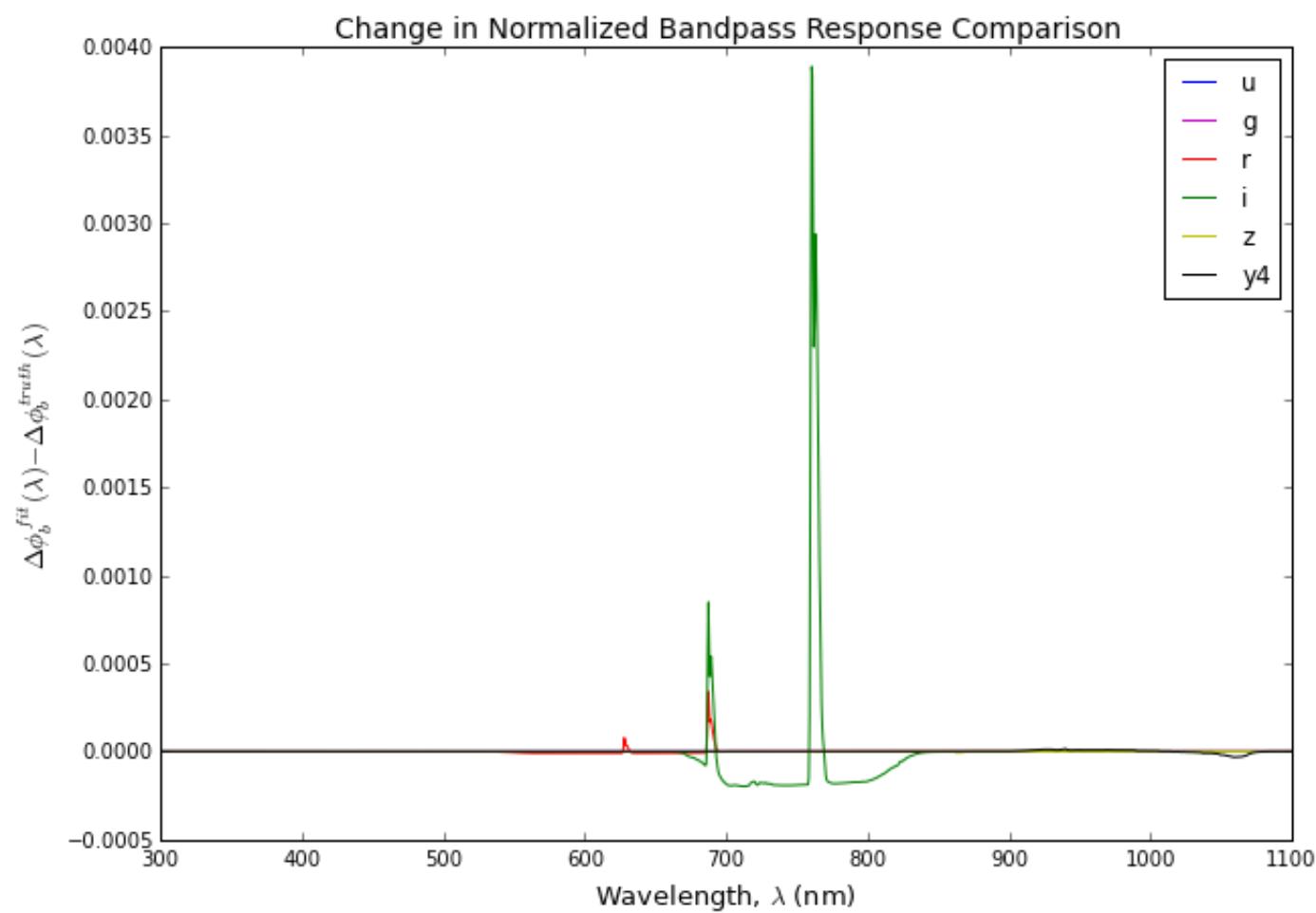
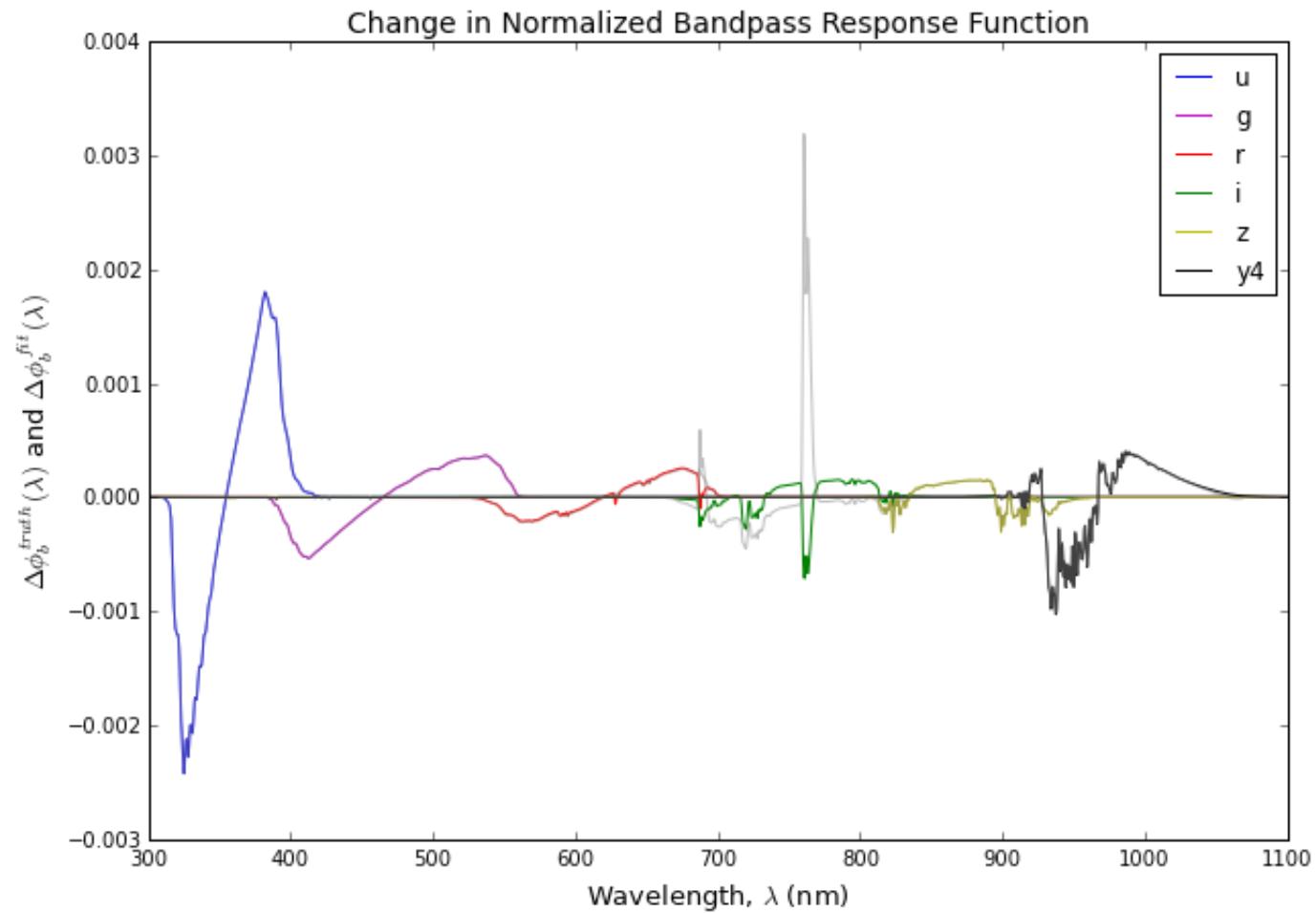
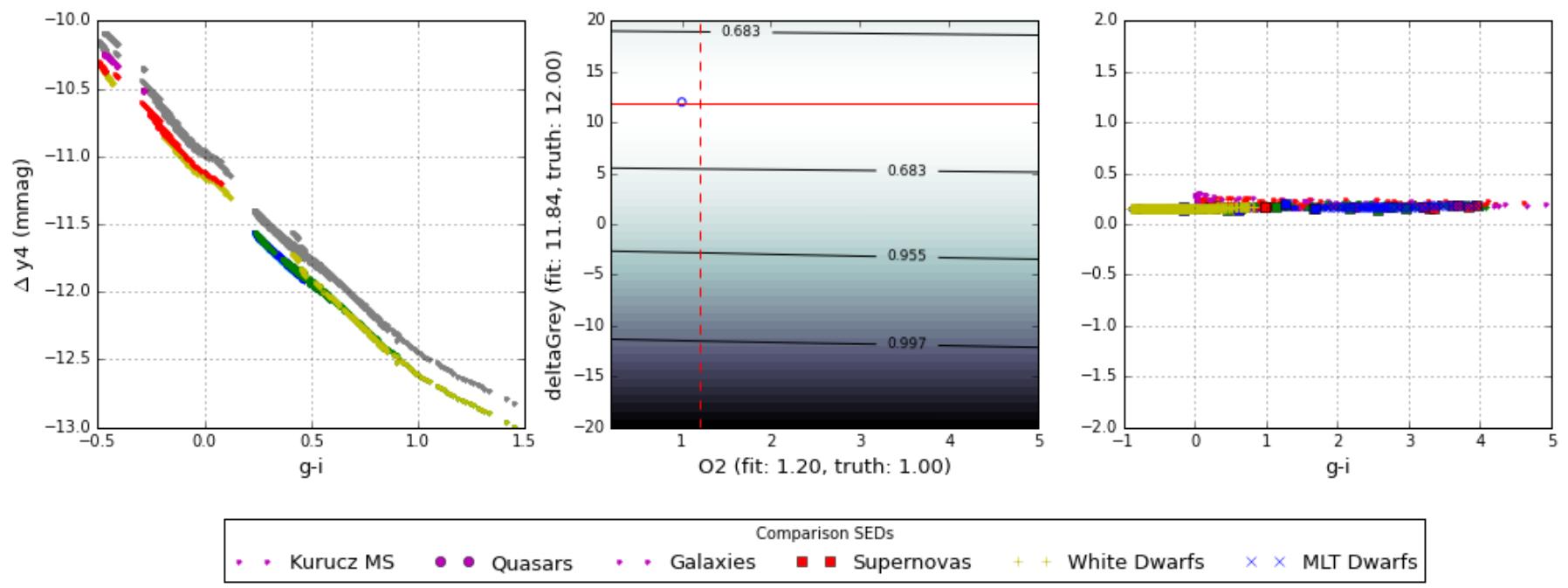
Best fit parameters (Filter, O2, dG, logL, Chi-Squared):
u 5.00 11.84 2.26333491835 4.5266698367
g 5.00 11.84 2.50384471515 5.0076894303
r 0.69 11.84 1.03452886293 2.06905772587
i 0.20 11.84 0.933415824896 1.86683164979
z 5.00 11.84 2.5632514429 5.12650288579
y4 5.00 11.84 2.44415409692 4.88830819385

Override best fit parameters (Filter, O2, dG):
u 0.80 11.84
g 0.80 11.84
r 0.80 11.84
i 0.80 11.84
z 0.80 11.84
y4 0.80 11.84

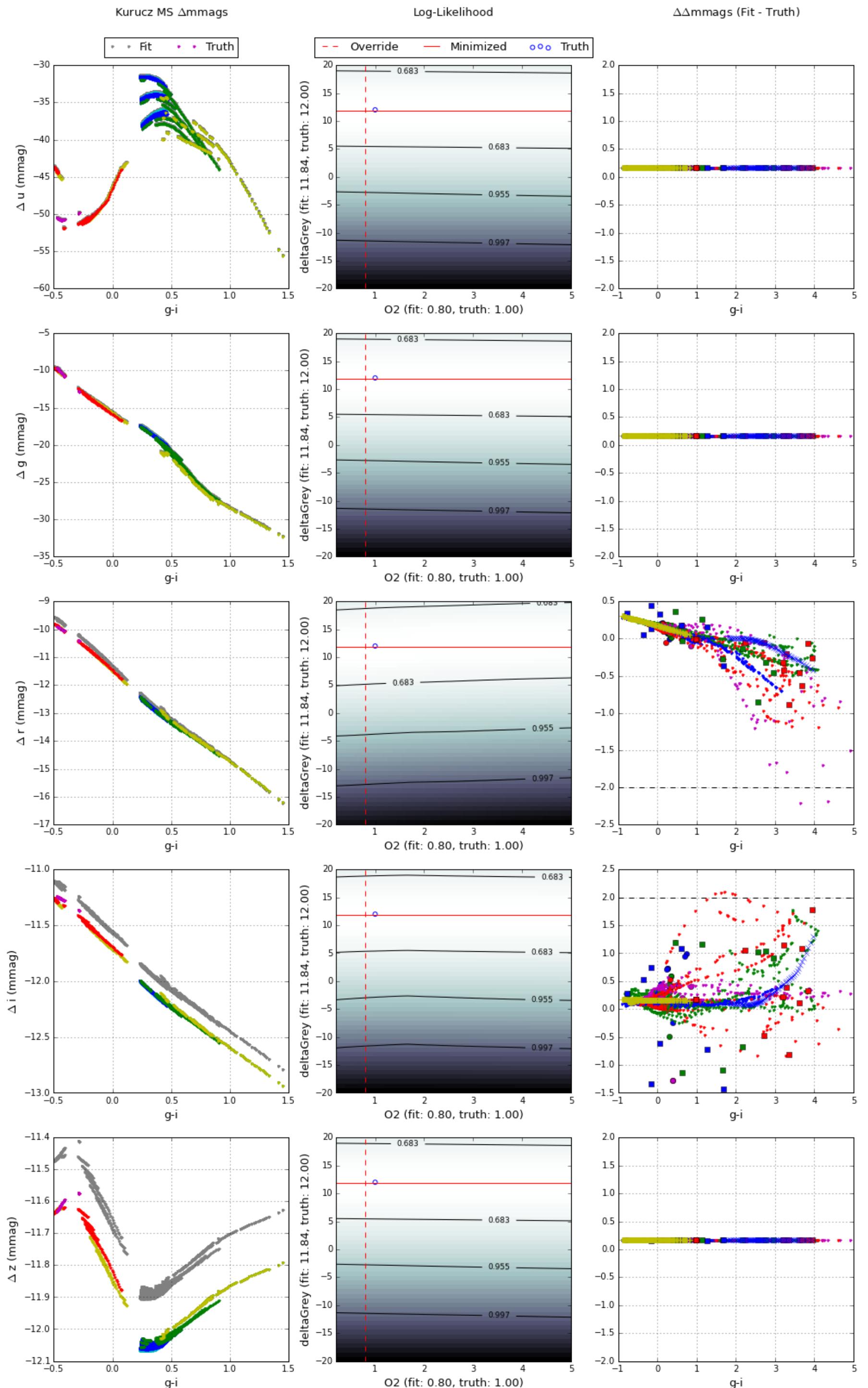


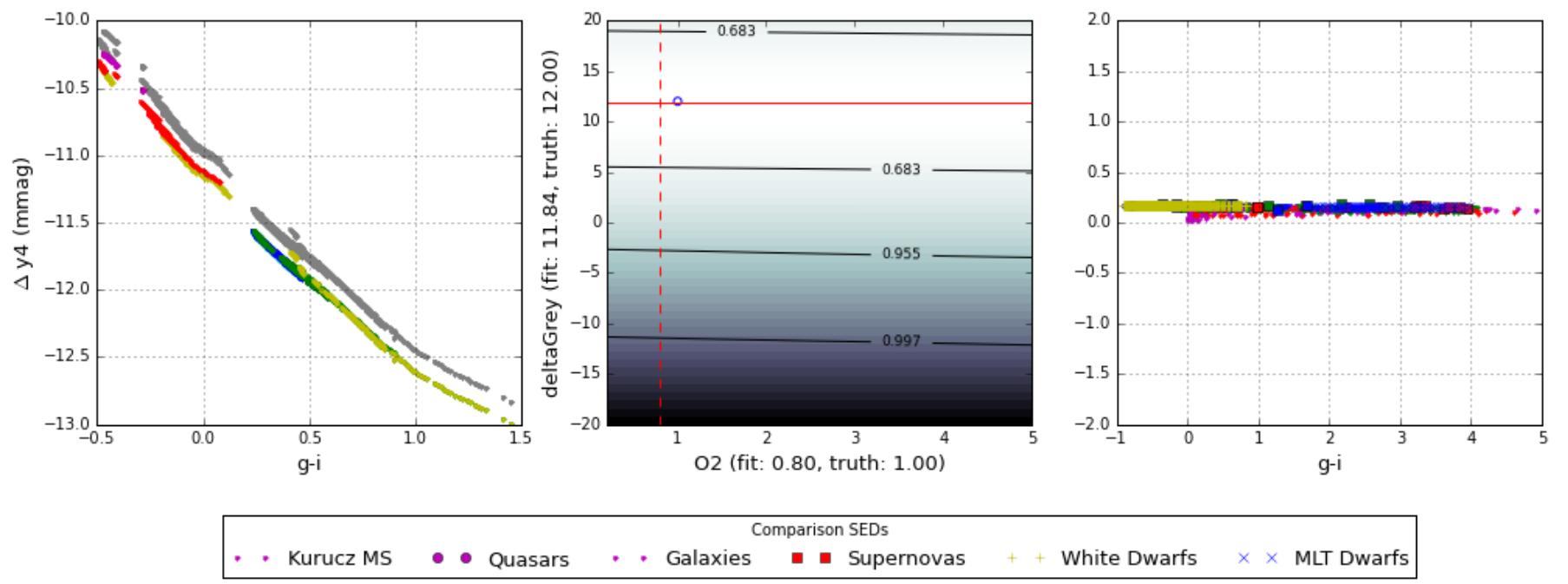
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





O_3

```
In [9]: deltaGreyLimitPlot('O3')
```

```
Computing nonlinear regression for O3.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for O3: 1.0

Fitting for O3 between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_u_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_g_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_r_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_i_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_z_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_y4_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, O3, dG, logL, Chi-Squared):
u 0.98 12.00 2.81727353519 5.63454707038
g 0.98 12.00 0.345354107788 0.690708215576
r 0.98 12.00 0.0506677385512 0.101335477102
i 0.98 12.00 0.000857937493447 0.00171587498689
z 0.98 12.00 9.75272388679e-06 1.95054477736e-05
y4 0.98 12.00 2.56904468369e-06 5.13808936738e-06

Override best fit parameters (Filter, O3, dG):
u 1.20 10.40
g 1.20 12.80
r 1.20 12.00
i 1.20 12.00
z 1.20 12.00
y4 1.20 12.00

Computing nonlinear regression for O3.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
```

```
Observed atmosphere parameter for O3: 1.0

Fitting for O3 between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit v
alue...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_u_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_g_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_r_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

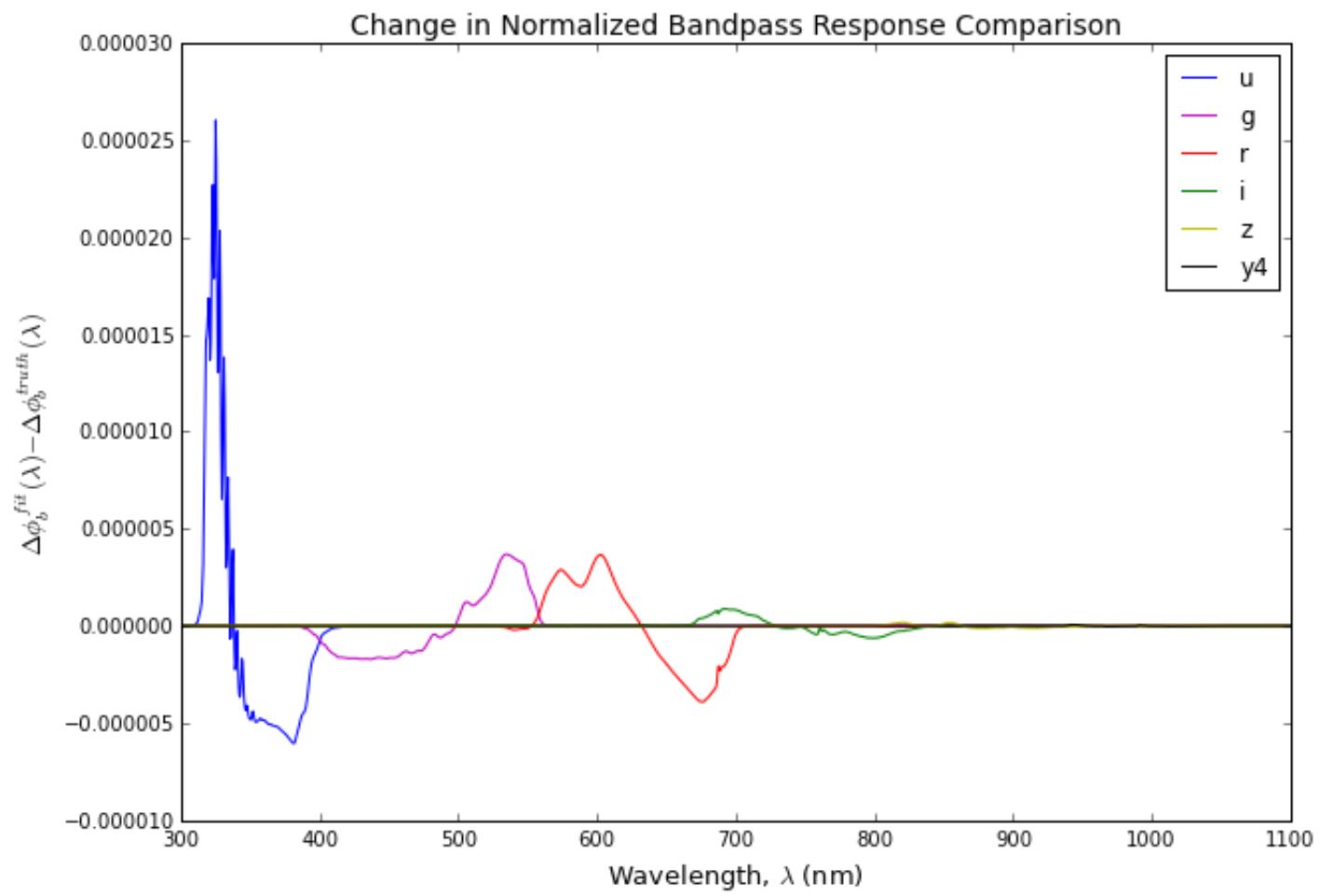
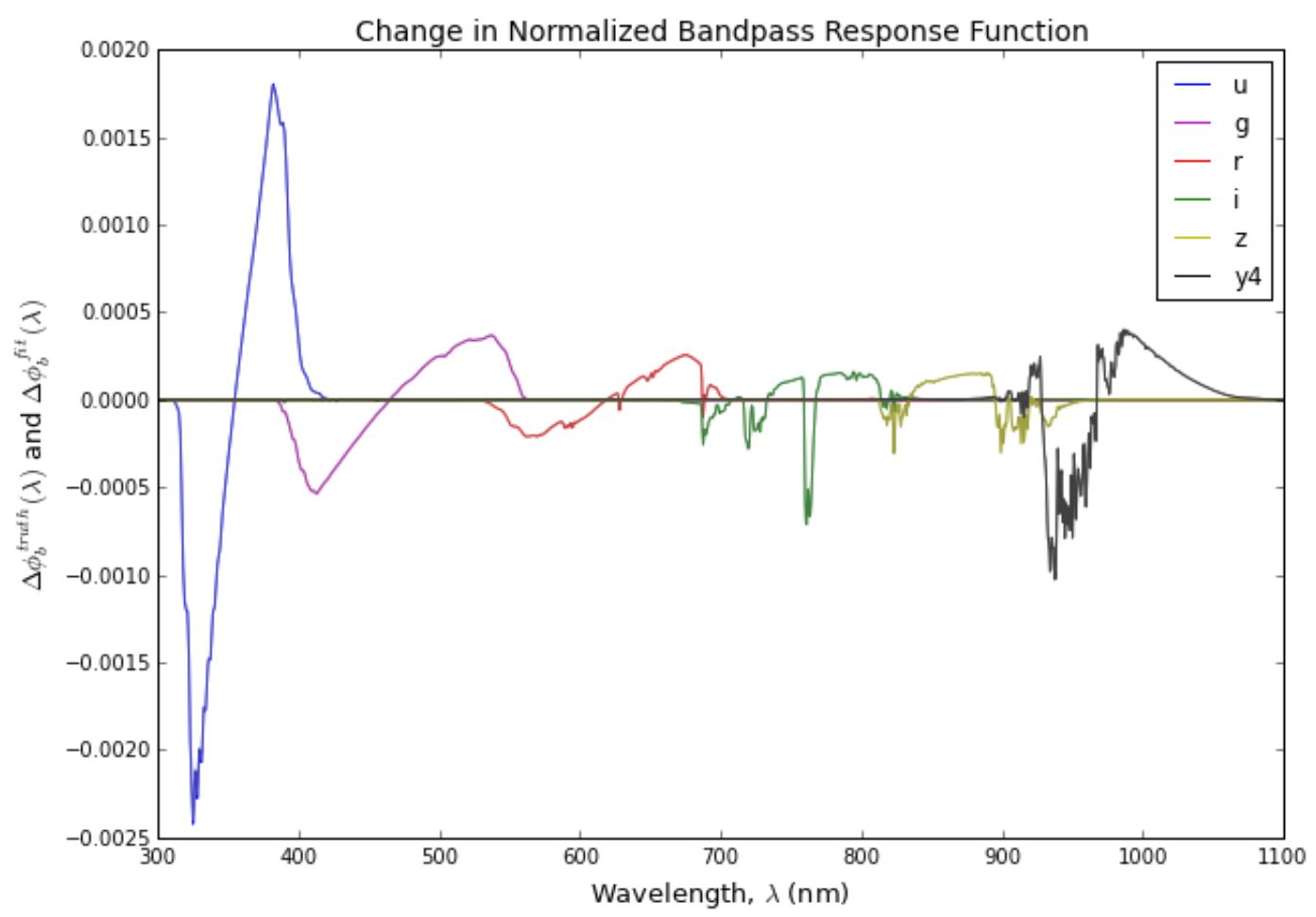
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_i_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_z_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

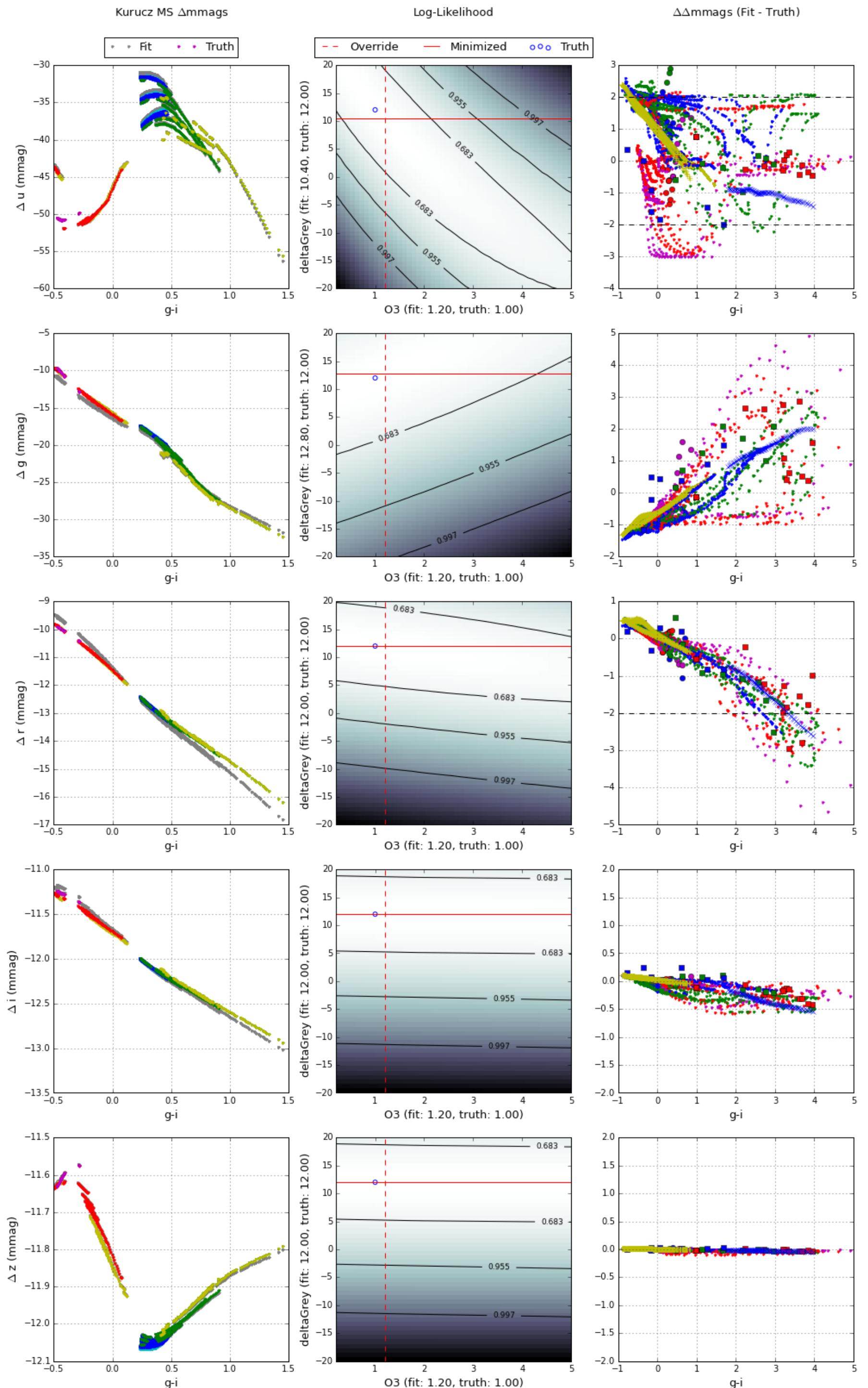
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_y4_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

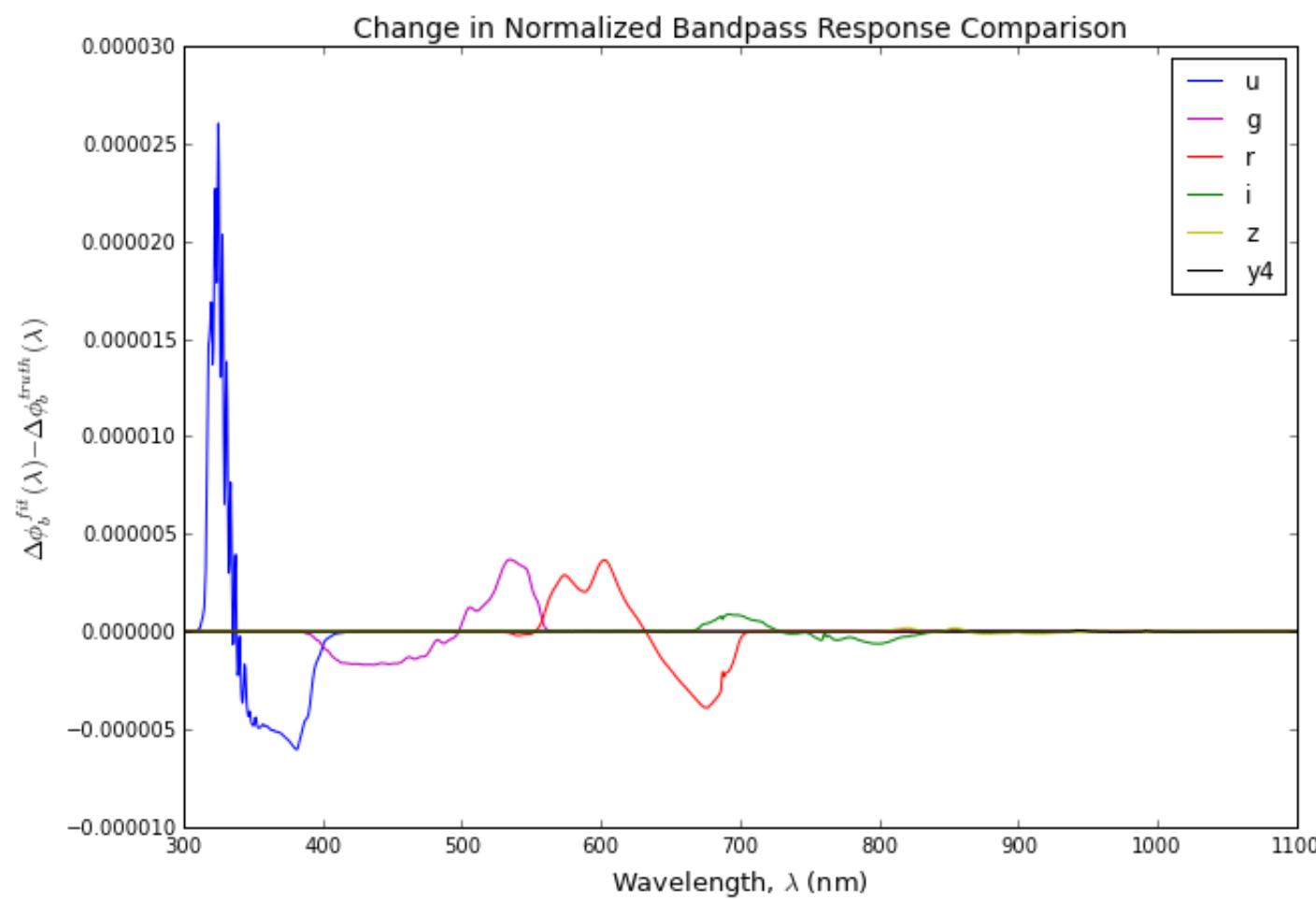
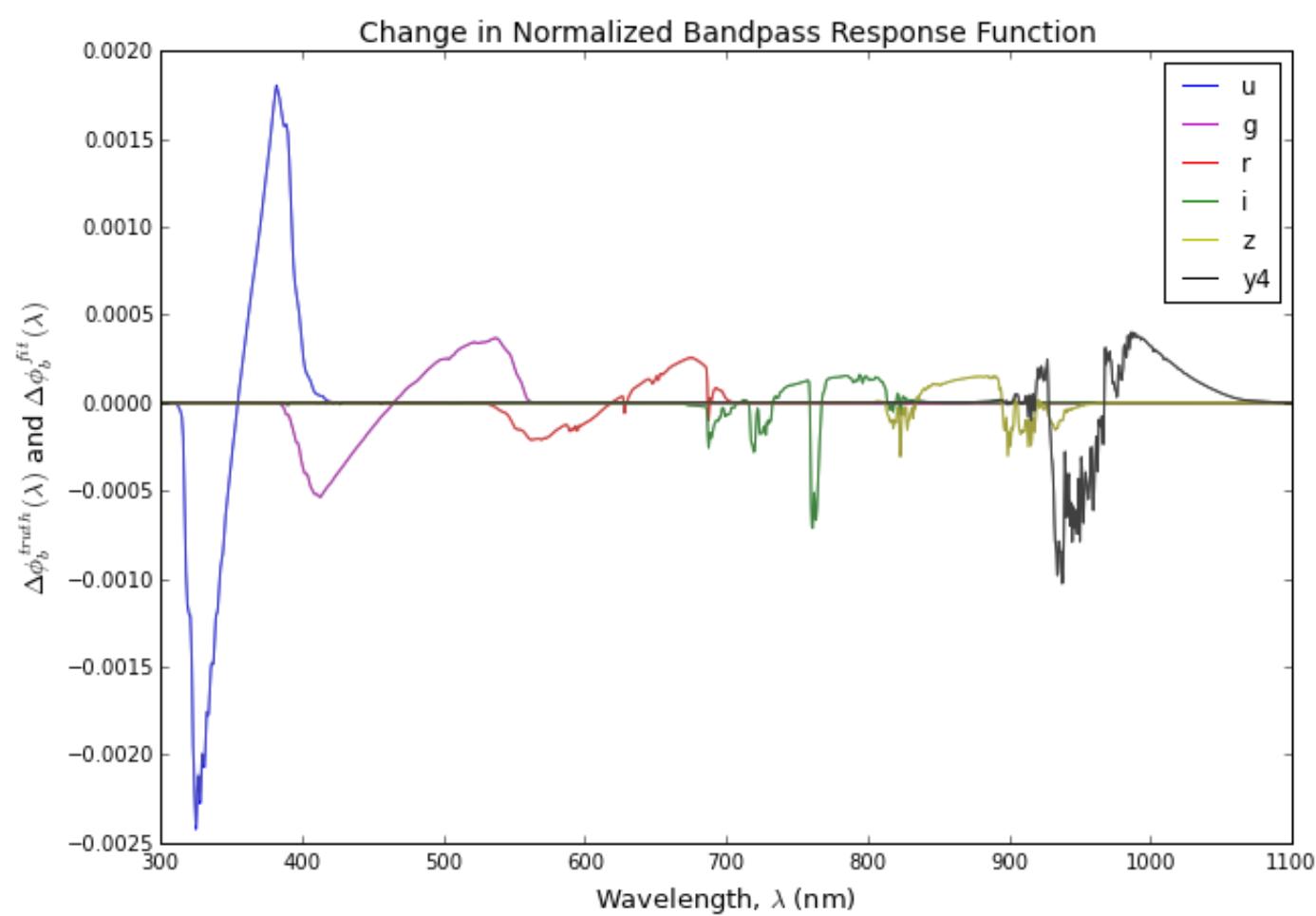
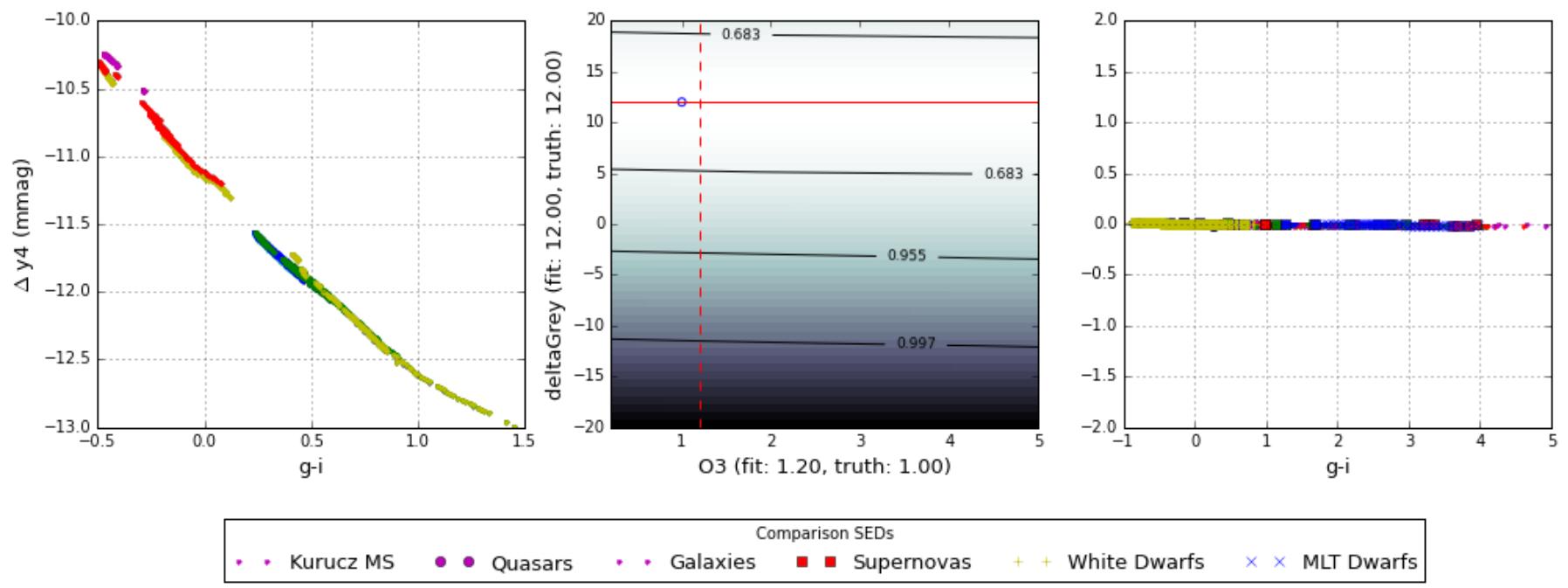
Best fit parameters (Filter, O3, dG, logL, Chi-Squared):
u 0.98 12.00 2.81727353519 5.63454707038
g 0.98 12.00 0.345354107788 0.690708215576
r 0.98 12.00 0.0506677385512 0.101335477102
i 0.98 12.00 0.000857937493447 0.00171587498689
z 0.98 12.00 9.75272388679e-06 1.95054477736e-05
y4 0.98 12.00 2.56904468369e-06 5.13808936738e-06

Override best fit parameters (Filter, O3, dG):
u 0.80 14.40
g 0.80 11.20
r 0.80 12.00
i 0.80 12.00
z 0.80 12.00
y4 0.80 12.00
```

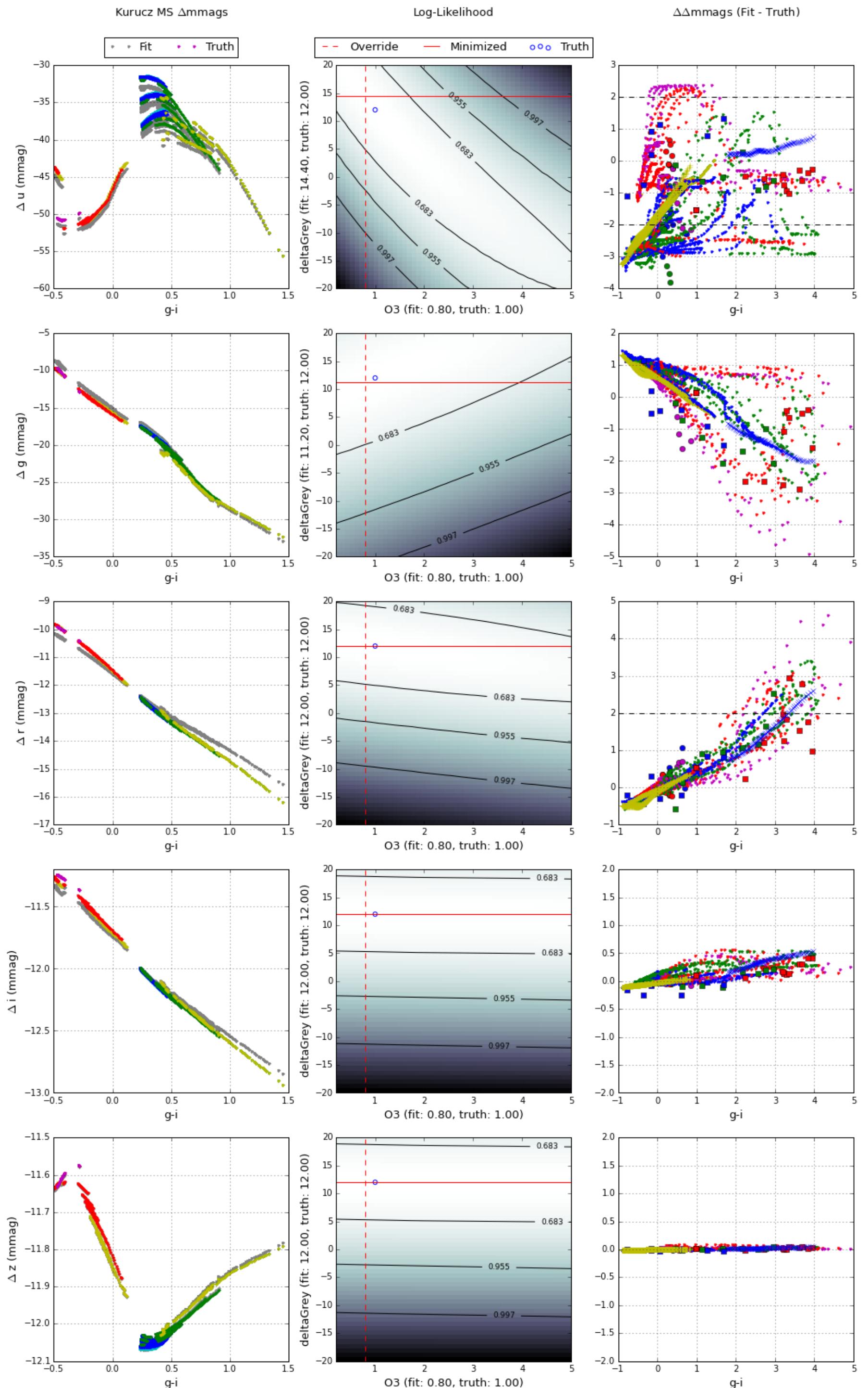


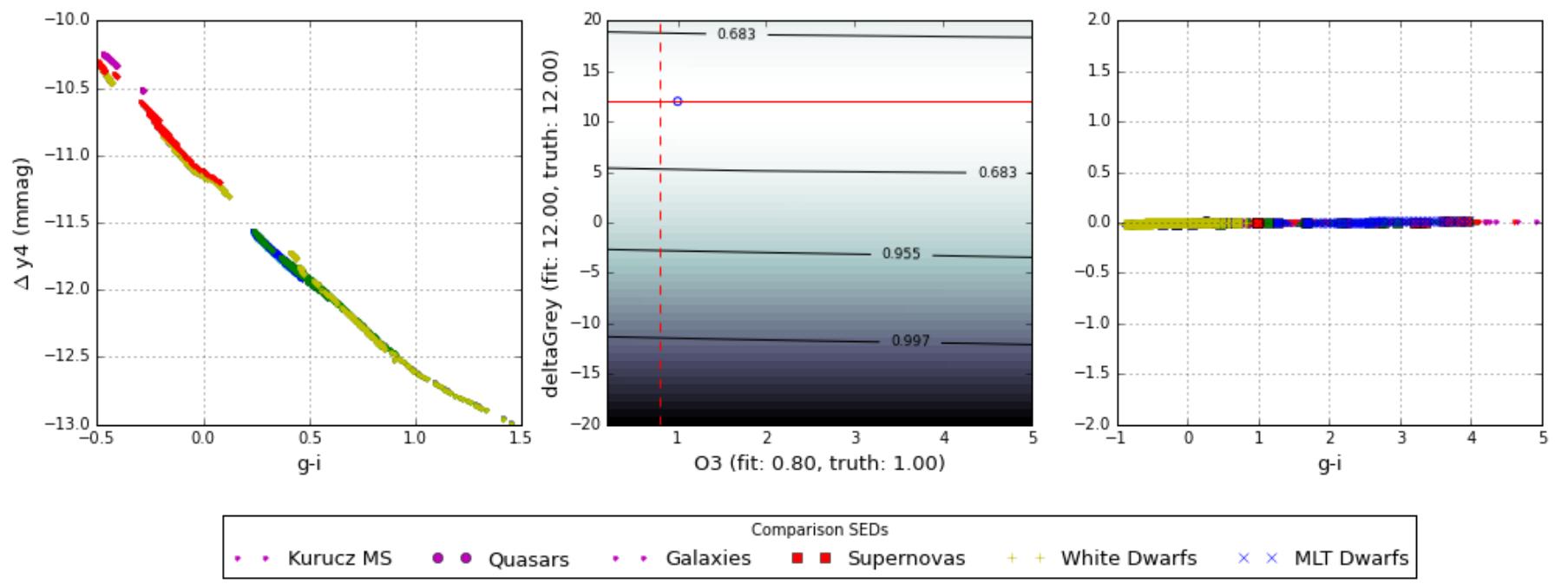
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





```
In [10]: deltaGreyLimitPlot('03',deltaGreyBins=50)
```

```
Computing nonlinear regression for O3.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2  
Observed atmosphere parameter for O3: 1.0  
  
Fitting for O3 between 0.20 and 5.00 in 50 bins.  
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.  
  
Regression SEDs: 4855 Kurucz MS SEDs.  
  
Regressing 2500 parameter combinations per filter...  
Magnitude Error: 5.0 mmags  
  
Override triggered...  
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...  
  
Calculating best fit parameters for u filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_u_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for u filter.  
Saved Chi-Squared at best fit deltaGrey for u filter.  
Completed u filter.  
  
Calculating best fit parameters for g filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_g_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for g filter.  
Saved Chi-Squared at best fit deltaGrey for g filter.  
Completed g filter.  
  
Calculating best fit parameters for r filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_r_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for r filter.  
Saved Chi-Squared at best fit deltaGrey for r filter.  
Completed r filter.  
  
Calculating best fit parameters for i filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_i_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for i filter.  
Saved Chi-Squared at best fit deltaGrey for i filter.  
Completed i filter.  
  
Calculating best fit parameters for z filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_z_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for z filter.  
Saved Chi-Squared at best fit deltaGrey for z filter.  
Completed z filter.  
  
Calculating best fit parameters for y4 filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2_020_E5_mss_y4_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for y4 filter.  
Saved Chi-Squared at best fit deltaGrey for y4 filter.  
Completed y4 filter.  
  
Best fit parameters (Filter, O3, dG, logL, Chi-Squared):  
u 1.08 11.02 8.06192700972 16.1238540194  
g 0.98 11.84 1.31079166488 2.62158332975  
r 1.08 11.84 1.24453205695 2.4890641139  
i 1.57 11.84 1.69460001177 3.38920002354  
z 5.00 11.84 1.56831244894 3.13662489787  
y4 5.00 11.84 2.12448056448 4.24896112896  
  
Override best fit parameters (Filter, O3, dG):  
u 1.20 10.20  
g 1.20 12.65  
r 1.20 11.84  
i 1.20 11.84  
z 1.20 11.84  
y4 1.20 11.84  
  
Computing nonlinear regression for O3.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2
```

```
Observed atmosphere parameter for O3: 1.0

Fitting for O3 between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit v
alue...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_u_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_g_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_r_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

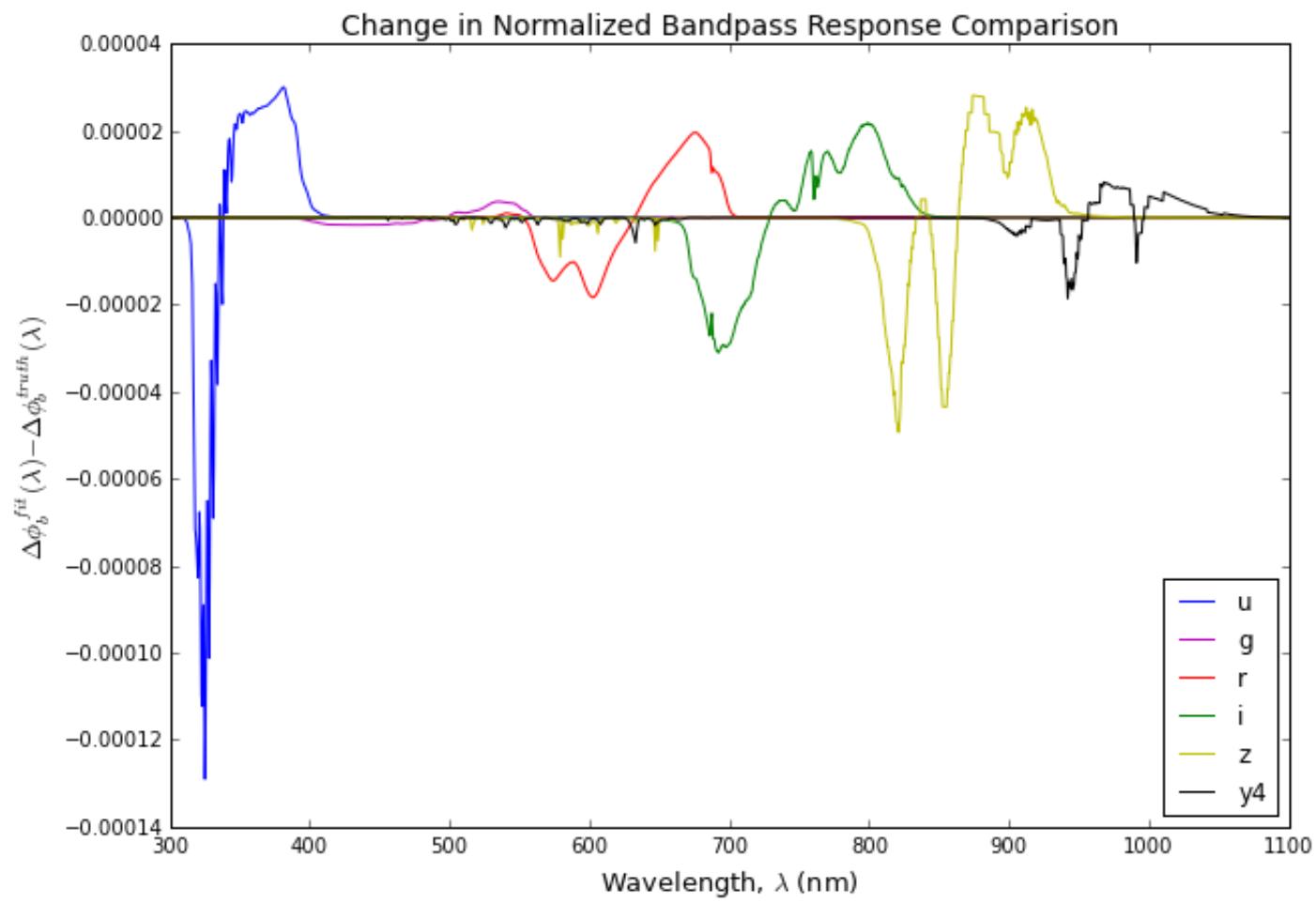
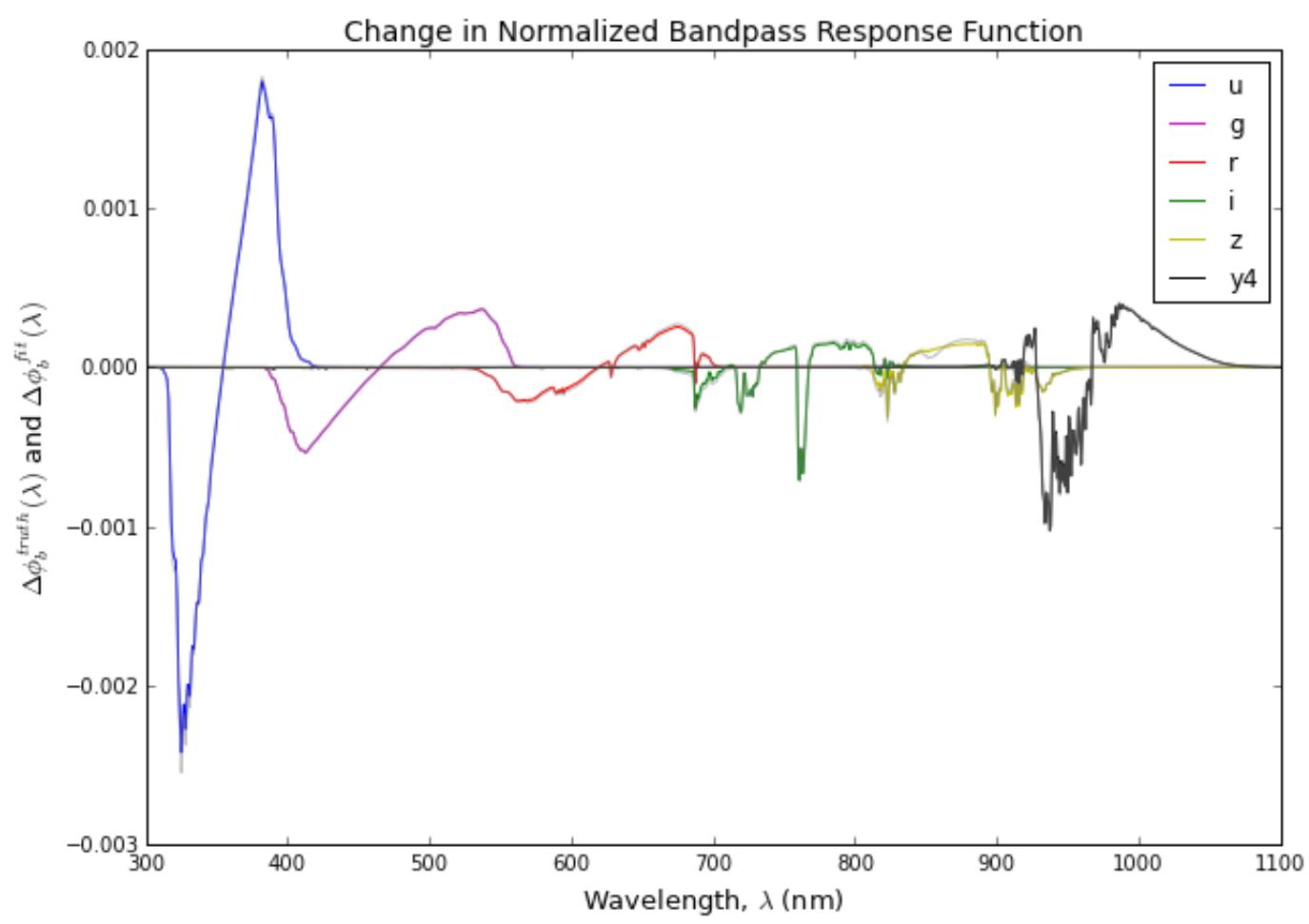
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_i_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_z_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

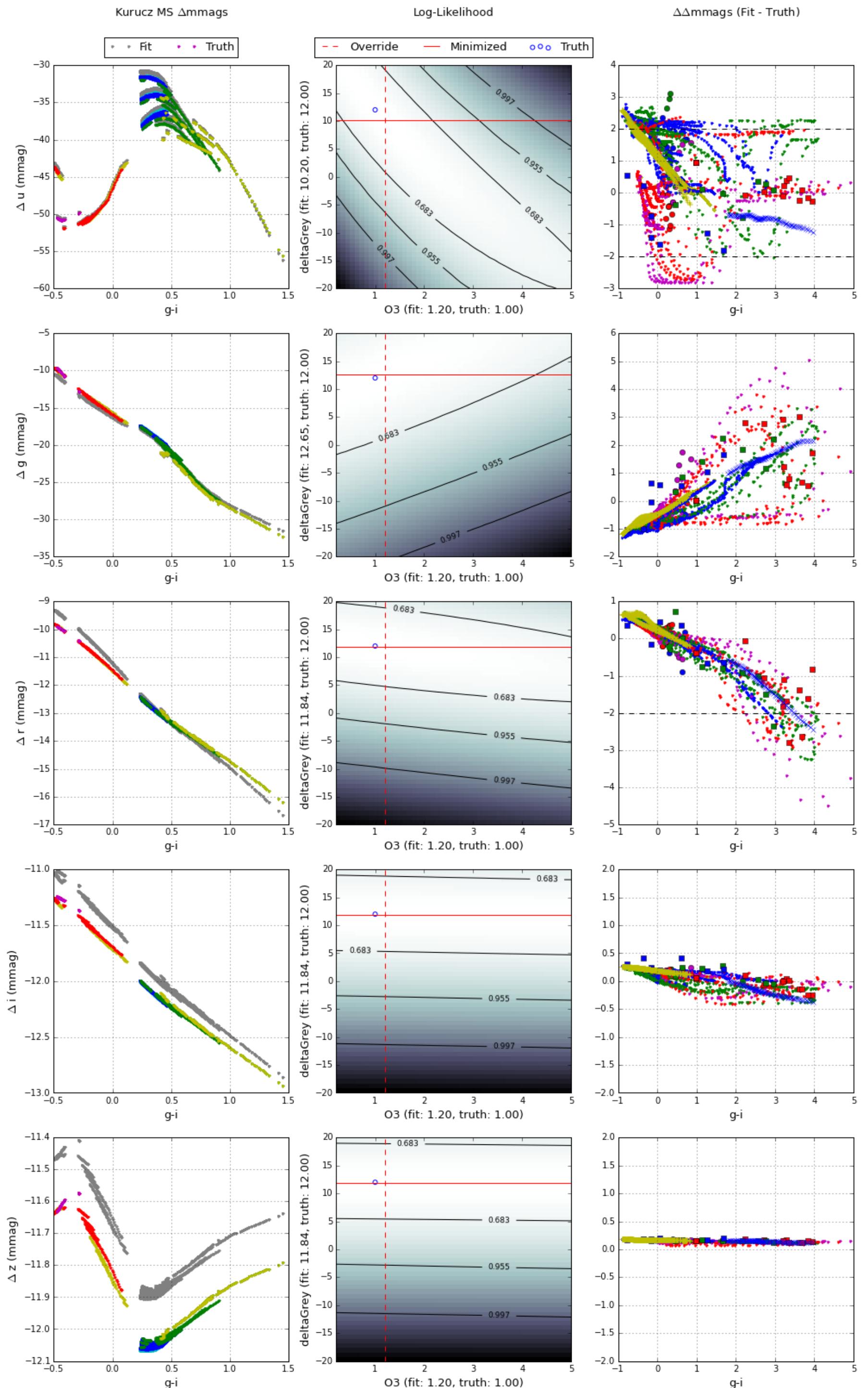
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_O3_dG_XSTD12_DG120_DGR-2
020_E5_mss_y4_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

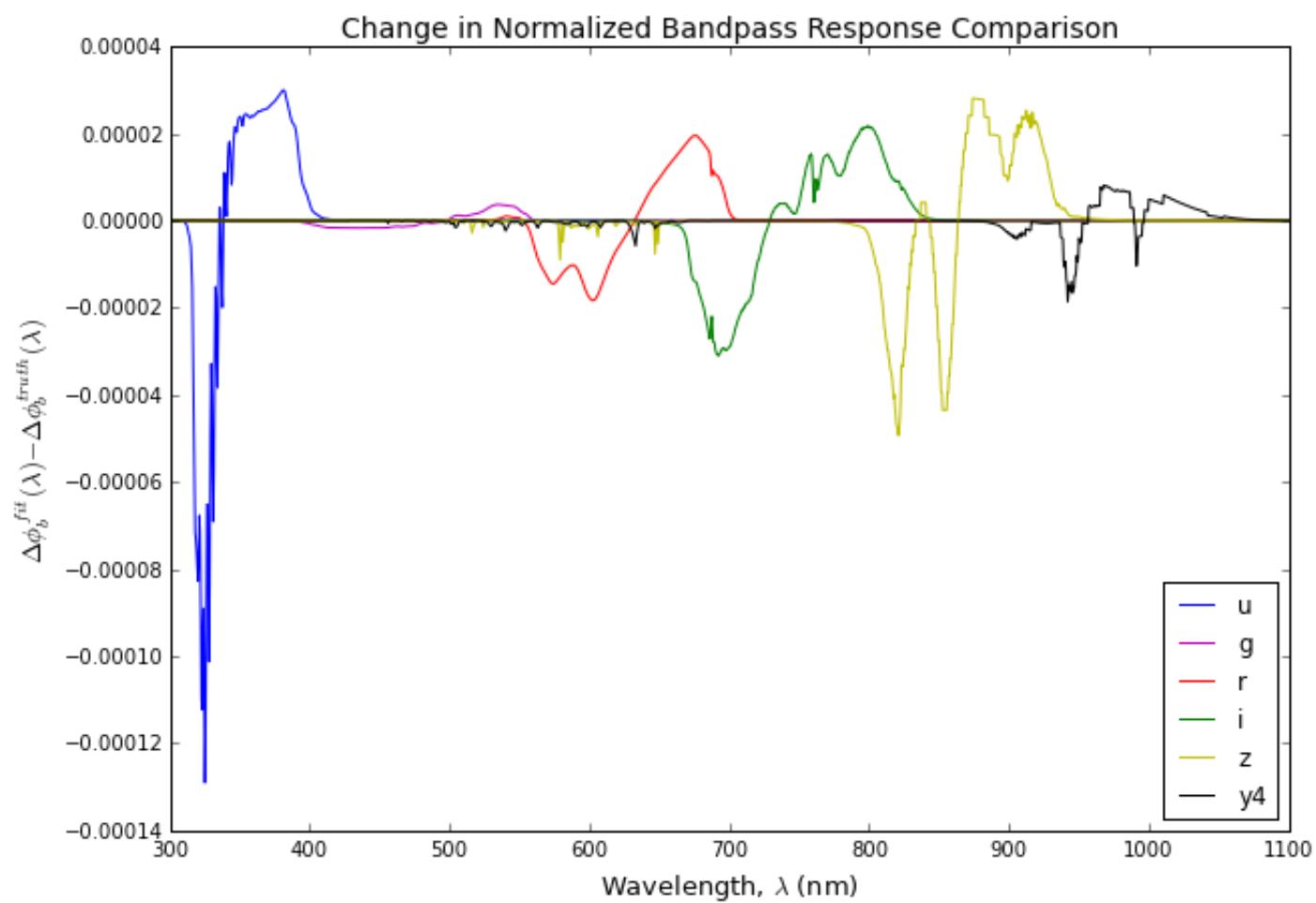
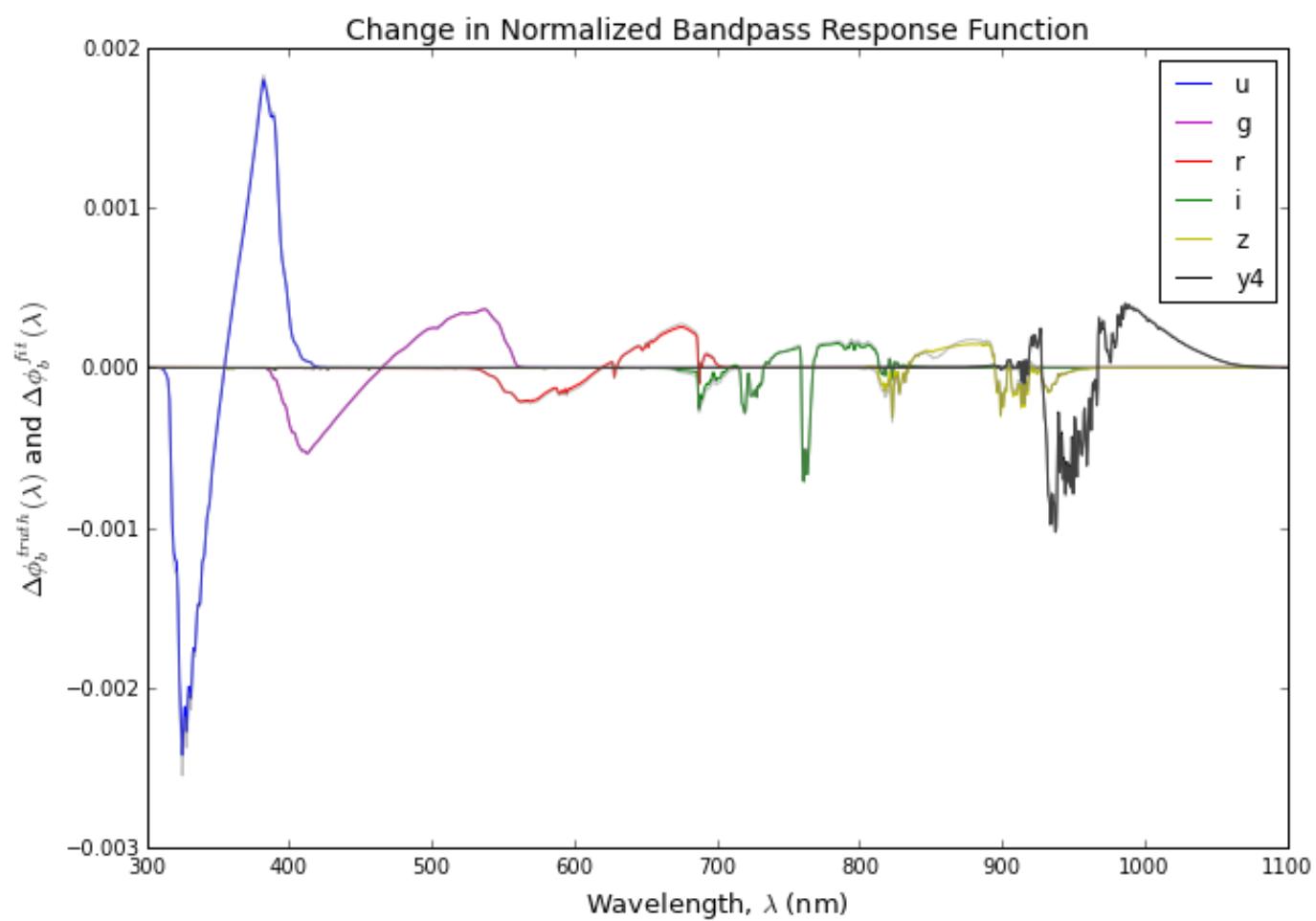
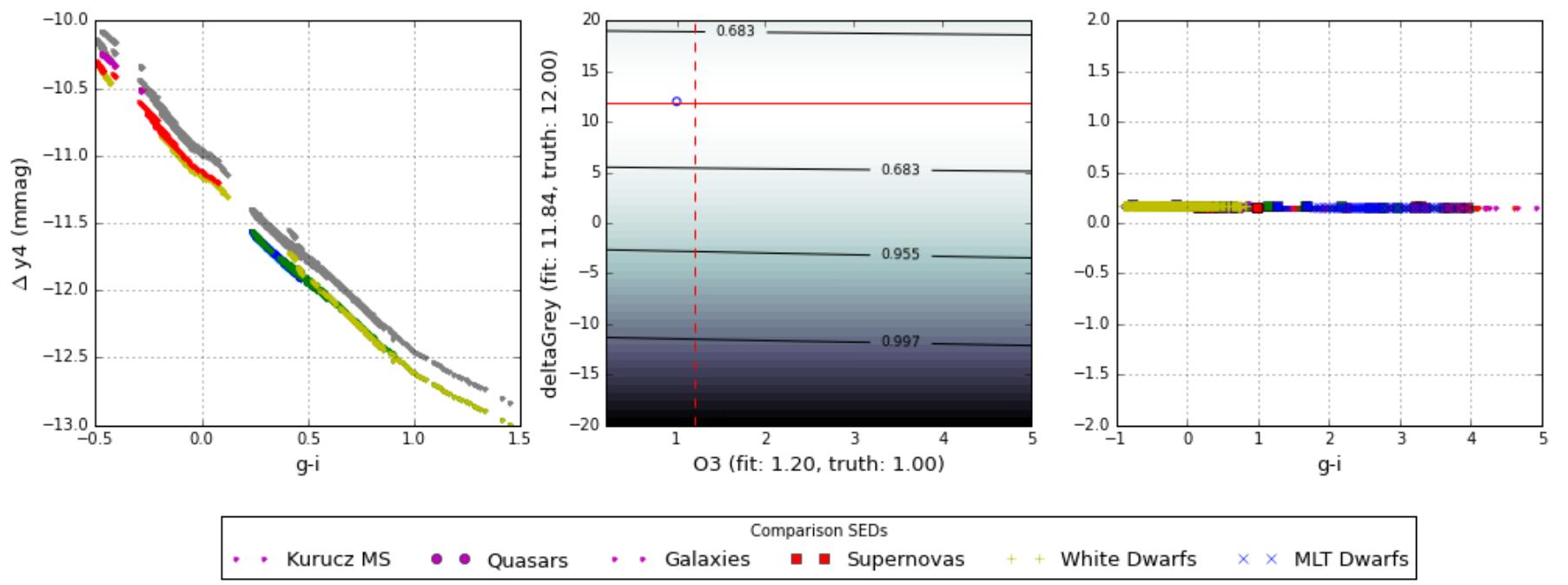
Best fit parameters (Filter, O3, dG, logL, Chi-Squared):
u 1.08 11.02 8.06192700972 16.1238540194
g 0.98 11.84 1.31079166488 2.62158332975
r 1.08 11.84 1.24453205695 2.4890641139
i 1.57 11.84 1.69460001177 3.38920002354
z 5.00 11.84 1.56831244894 3.13662489787
y4 5.00 11.84 2.12448056448 4.24896112896

Override best fit parameters (Filter, O3, dG):
u 0.80 14.29
g 0.80 11.02
r 0.80 11.84
i 0.80 11.84
z 0.80 11.84
y4 0.80 11.84
```

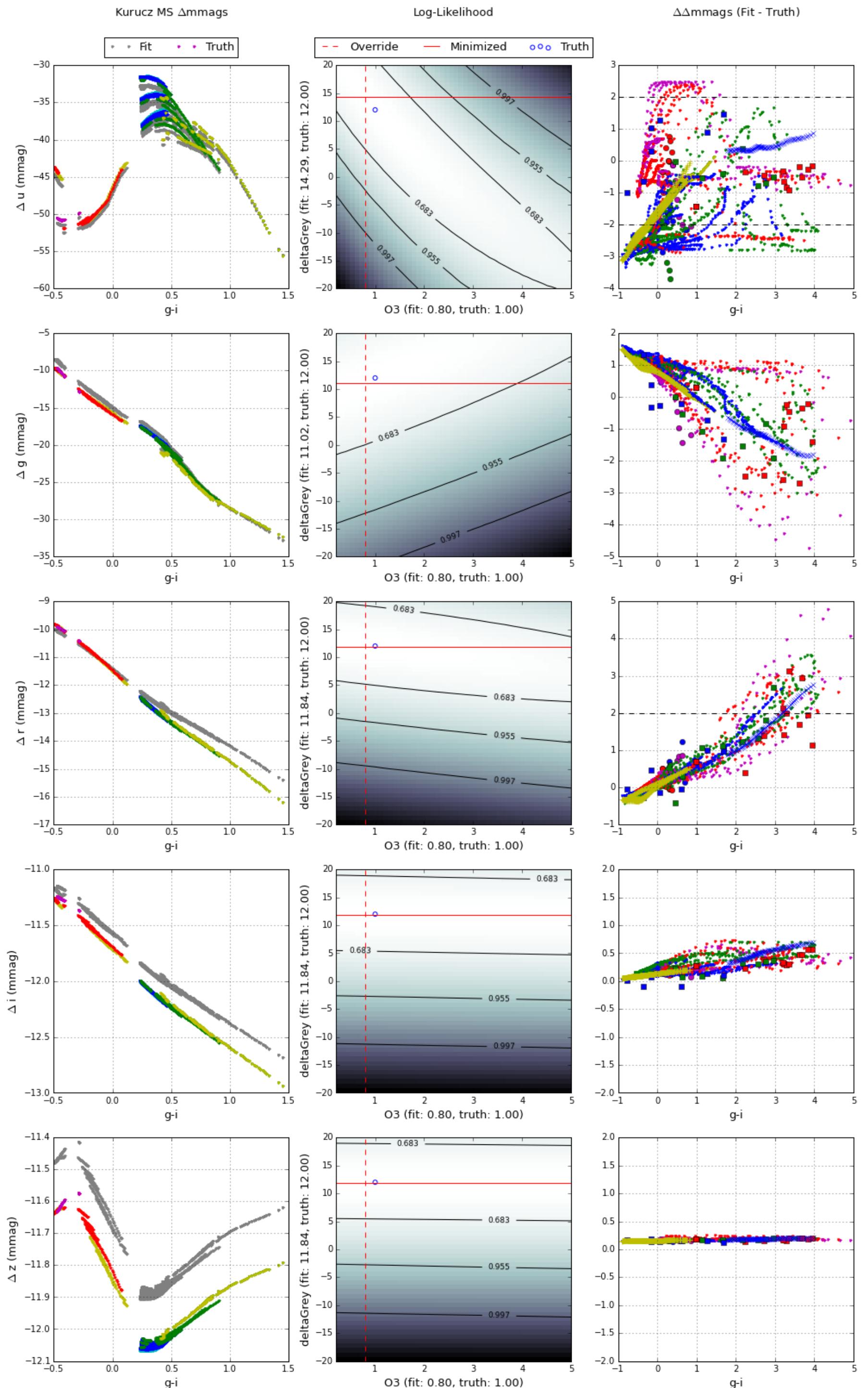


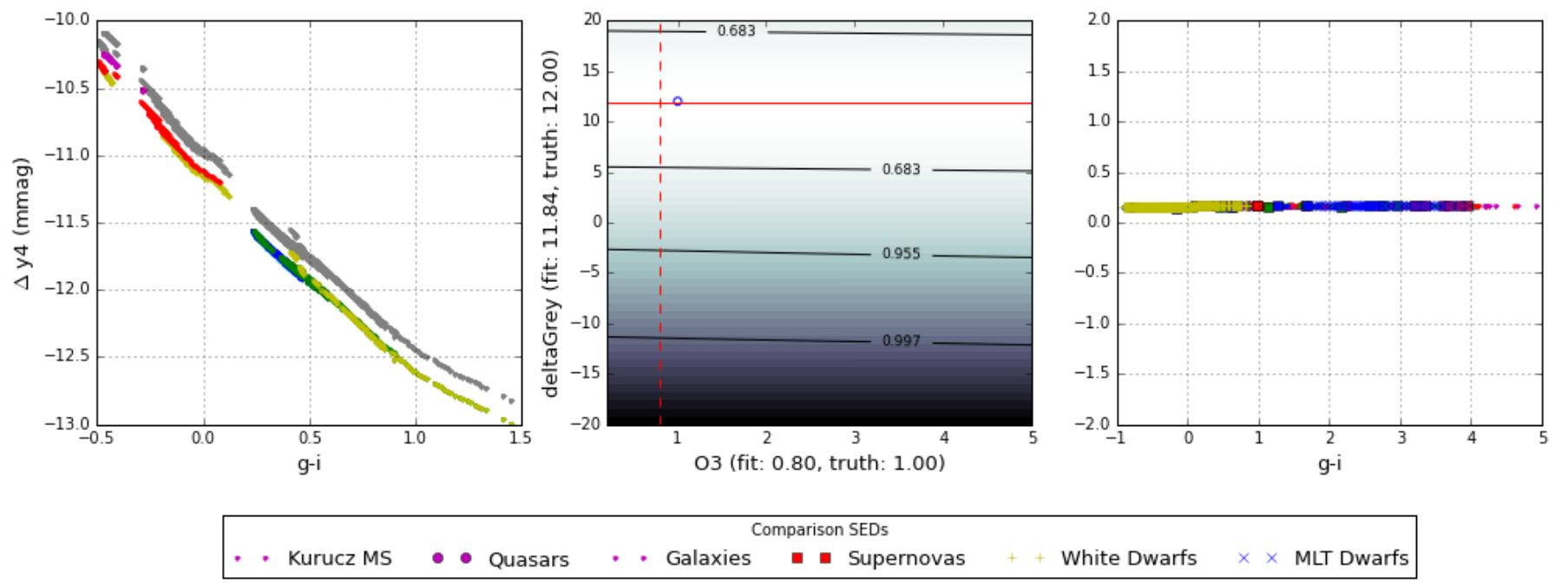
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Rayleigh

```
In [11]: deltaGreyLimitPlot('Rayleigh')
```

```

Computing nonlinear regression for Rayleigh.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for Rayleigh: 1.0

Fitting for Rayleigh between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_u_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_g_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_r_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_i_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_z_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_y4_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, Rayleigh, dG, logL, Chi-Squared):
u 0.98 12.80 24.9848974999 49.9697949998
g 0.98 12.00 12.4986566654 24.9973133308
r 0.98 12.00 0.111602953703 0.223205907405
i 0.98 12.00 0.00334245308404 0.00668490616808
z 0.98 12.00 0.000389588403898 0.000779176807796
y4 0.98 12.00 0.000282529919688 0.000565059839376

Override best fit parameters (Filter, Rayleigh, dG):
u 1.20 -2.40
g 1.20 8.00
r 1.20 12.00
i 1.20 12.00
z 1.20 12.00
y4 1.20 12.00

Computing nonlinear regression for Rayleigh.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2

```

Observed atmosphere parameter for Rayleigh: 1.0

Fitting for Rayleigh between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_u_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_g_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_r_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

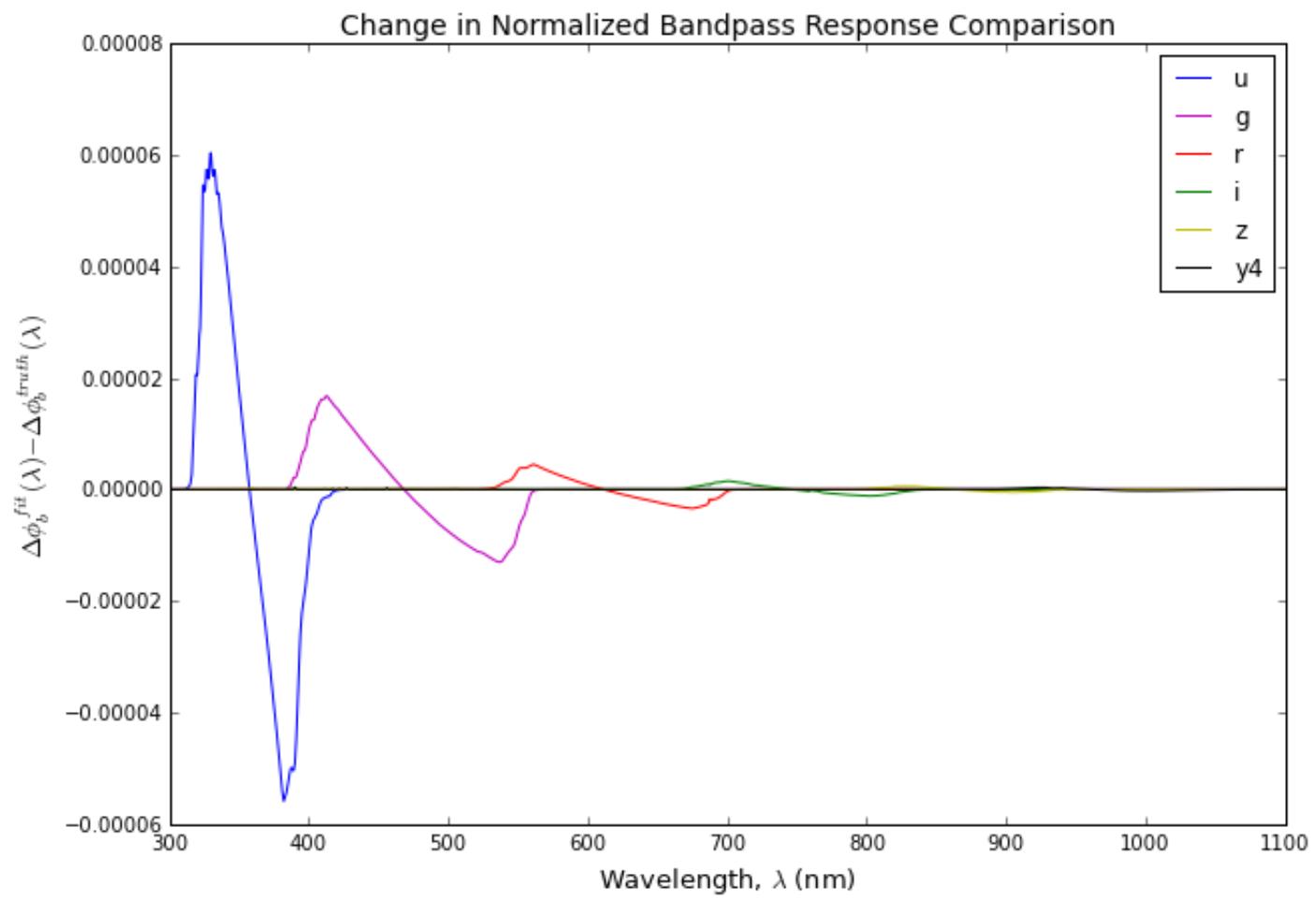
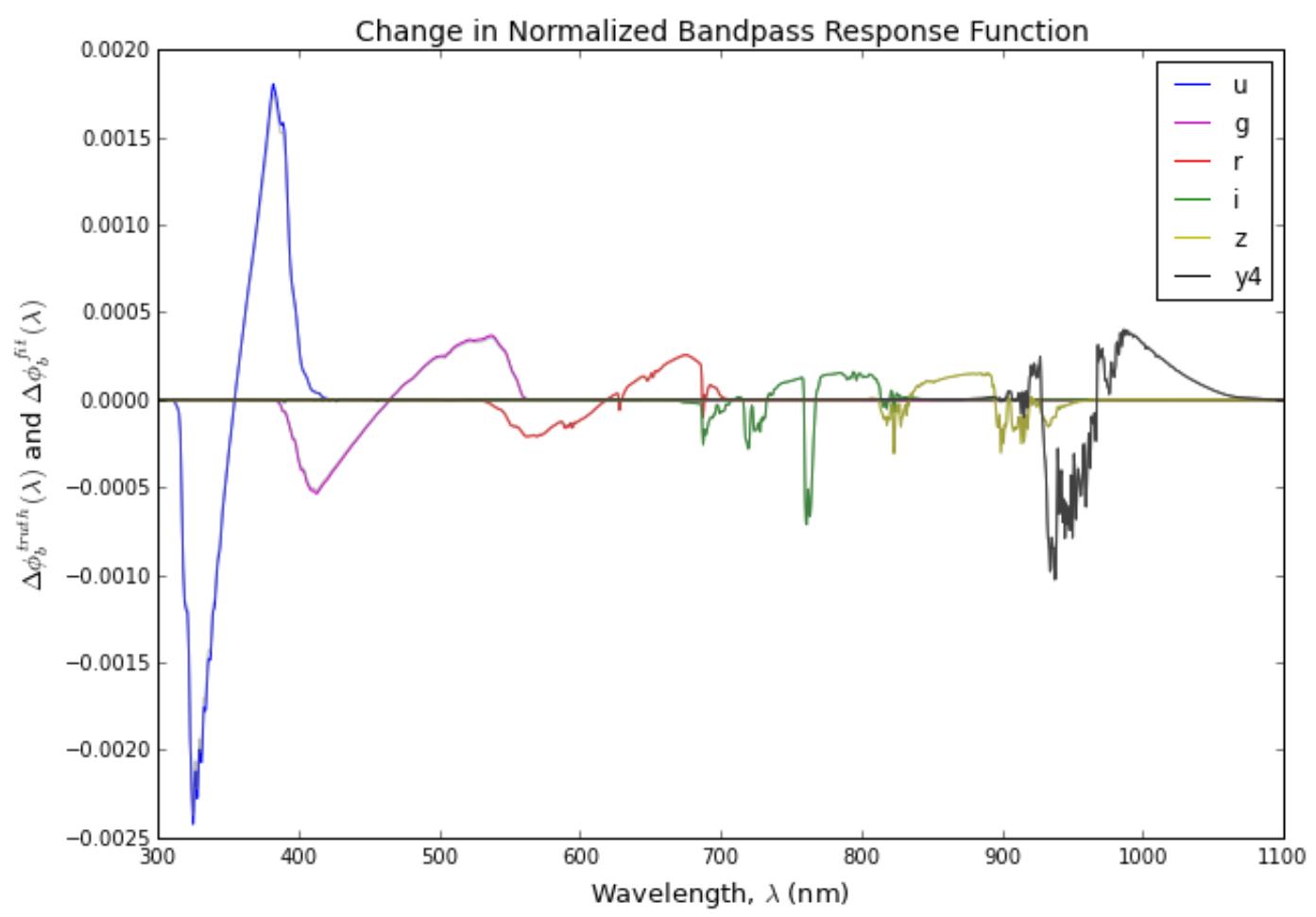
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_i_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_z_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

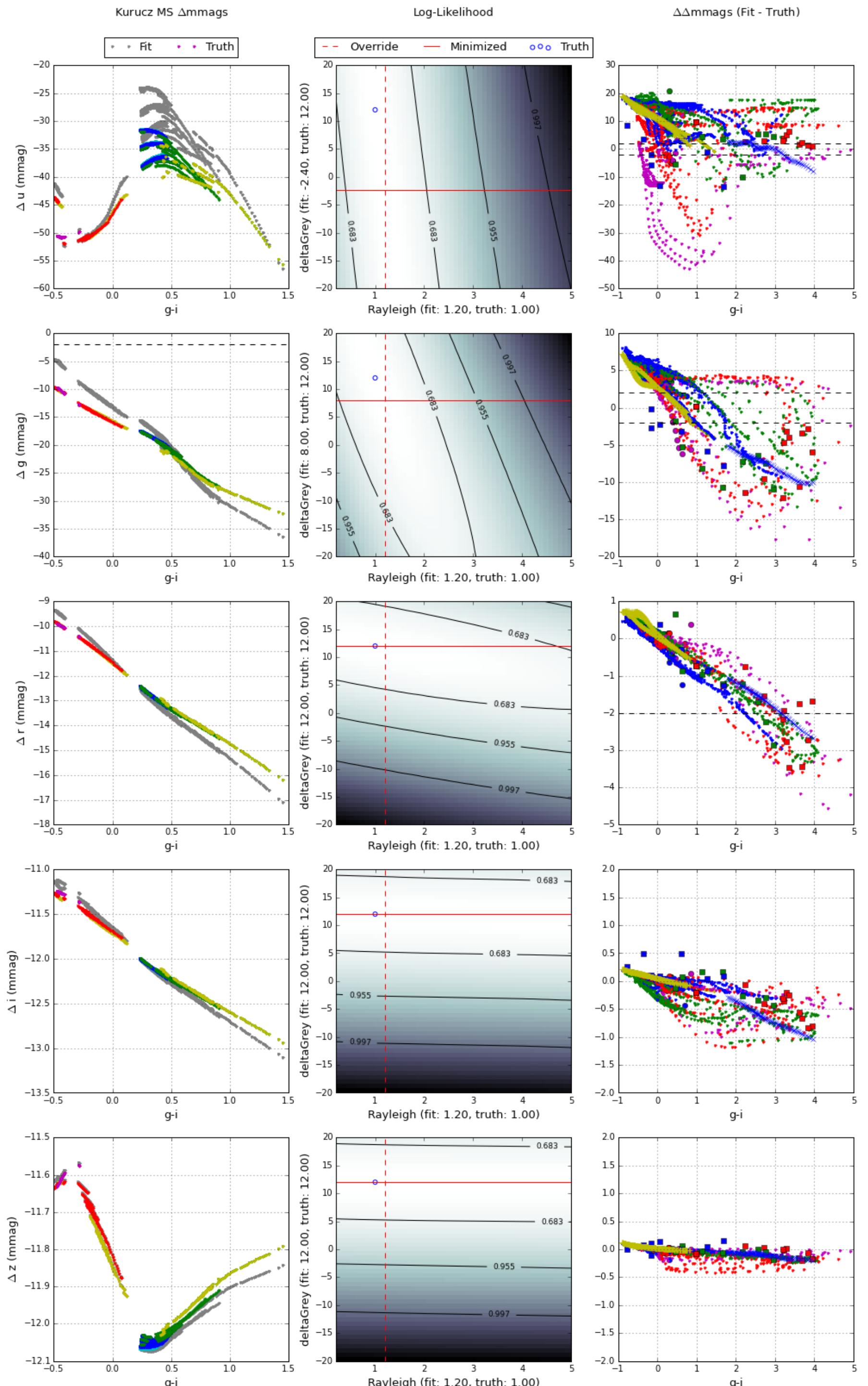
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_y4_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

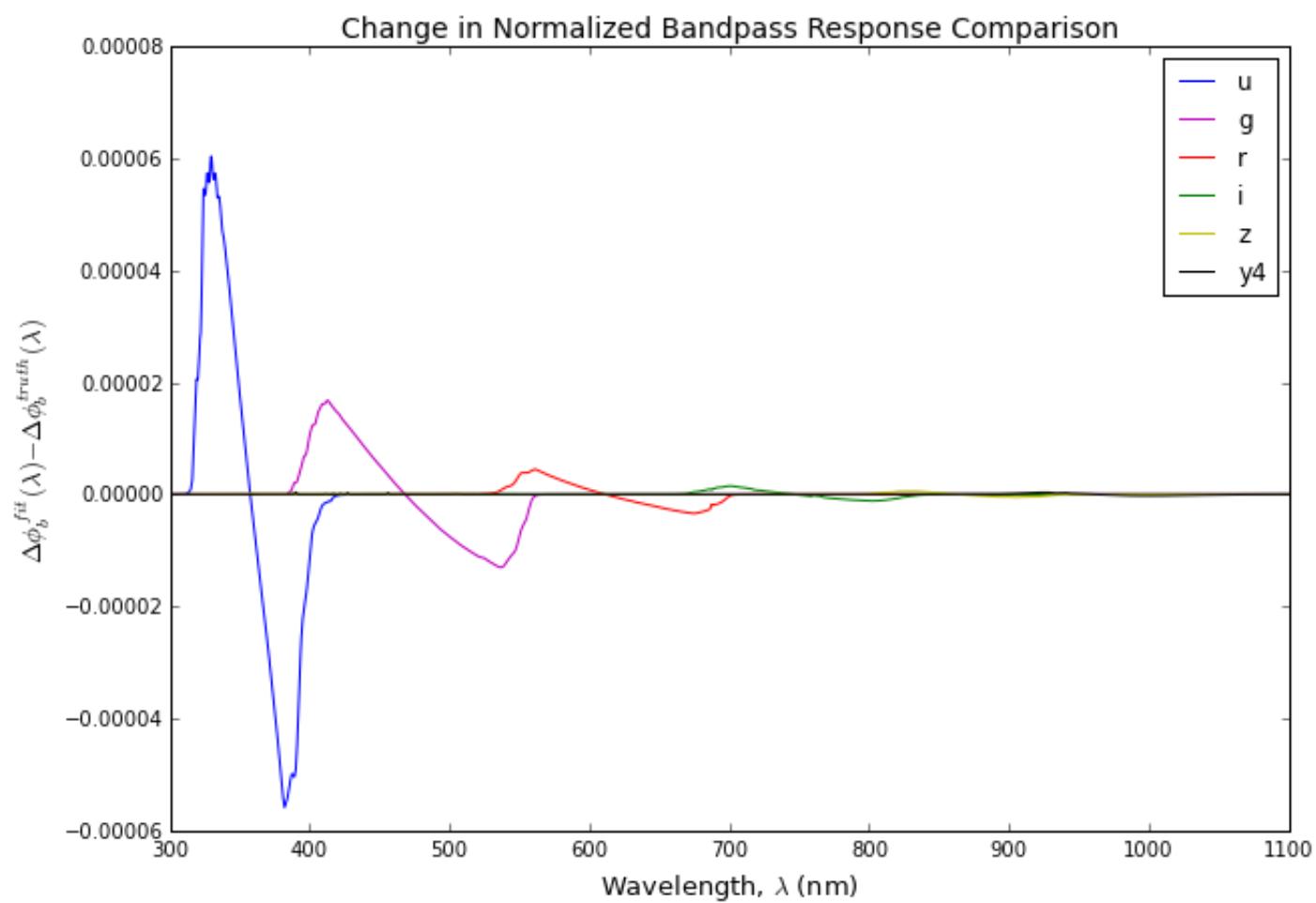
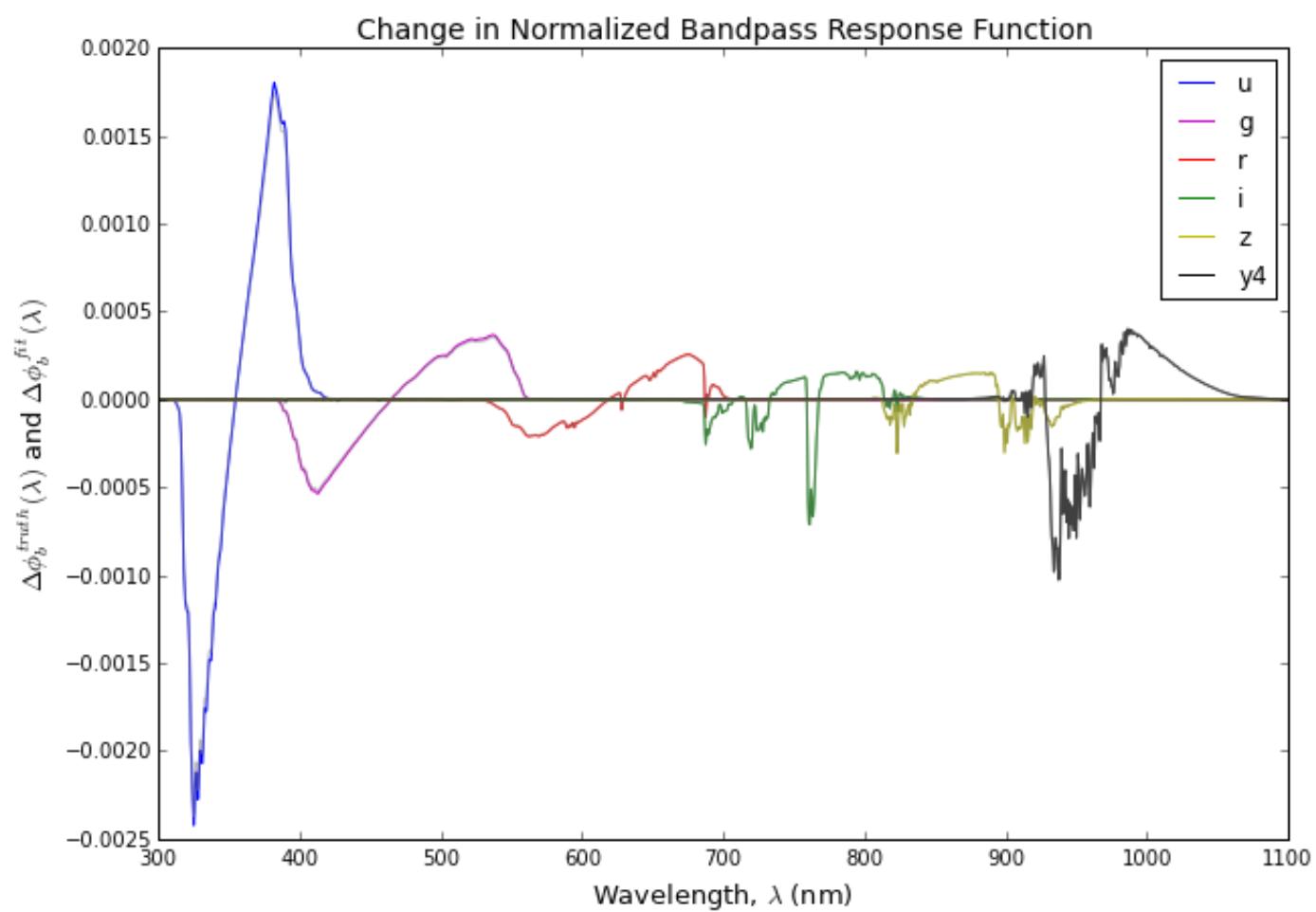
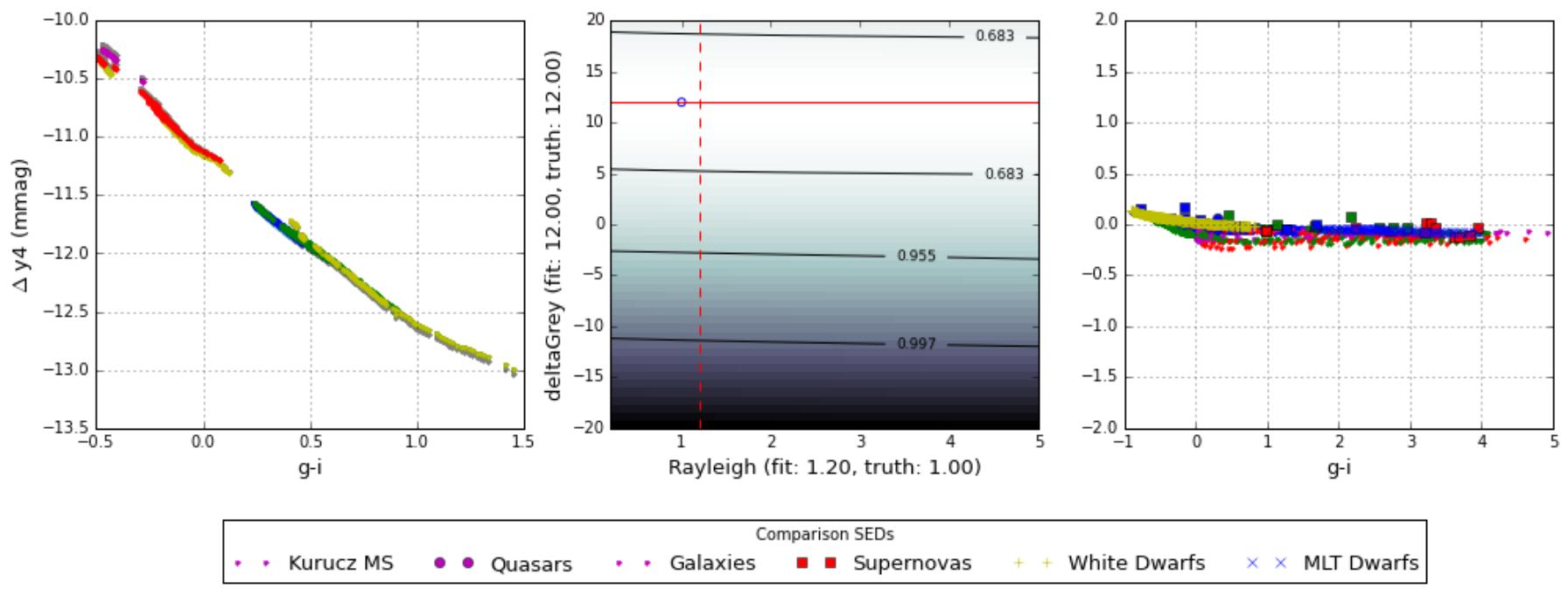
Best fit parameters (Filter, Rayleigh, dG, logL, Chi-Squared):
u 0.98 12.80 24.9848974999 49.9697949998
g 0.98 12.00 12.4986566654 24.9973133308
r 0.98 12.00 0.111602953703 0.223205907405
i 0.98 12.00 0.00334245308404 0.00668490616808
z 0.98 12.00 0.000389588403898 0.000779176807796
y4 0.98 12.00 0.000282529919688 0.000565059839376

Override best fit parameters (Filter, Rayleigh, dG):
u 0.80 20.00
g 0.80 16.00
r 0.80 12.00
i 0.80 12.00
z 0.80 12.00
y4 0.80 12.00

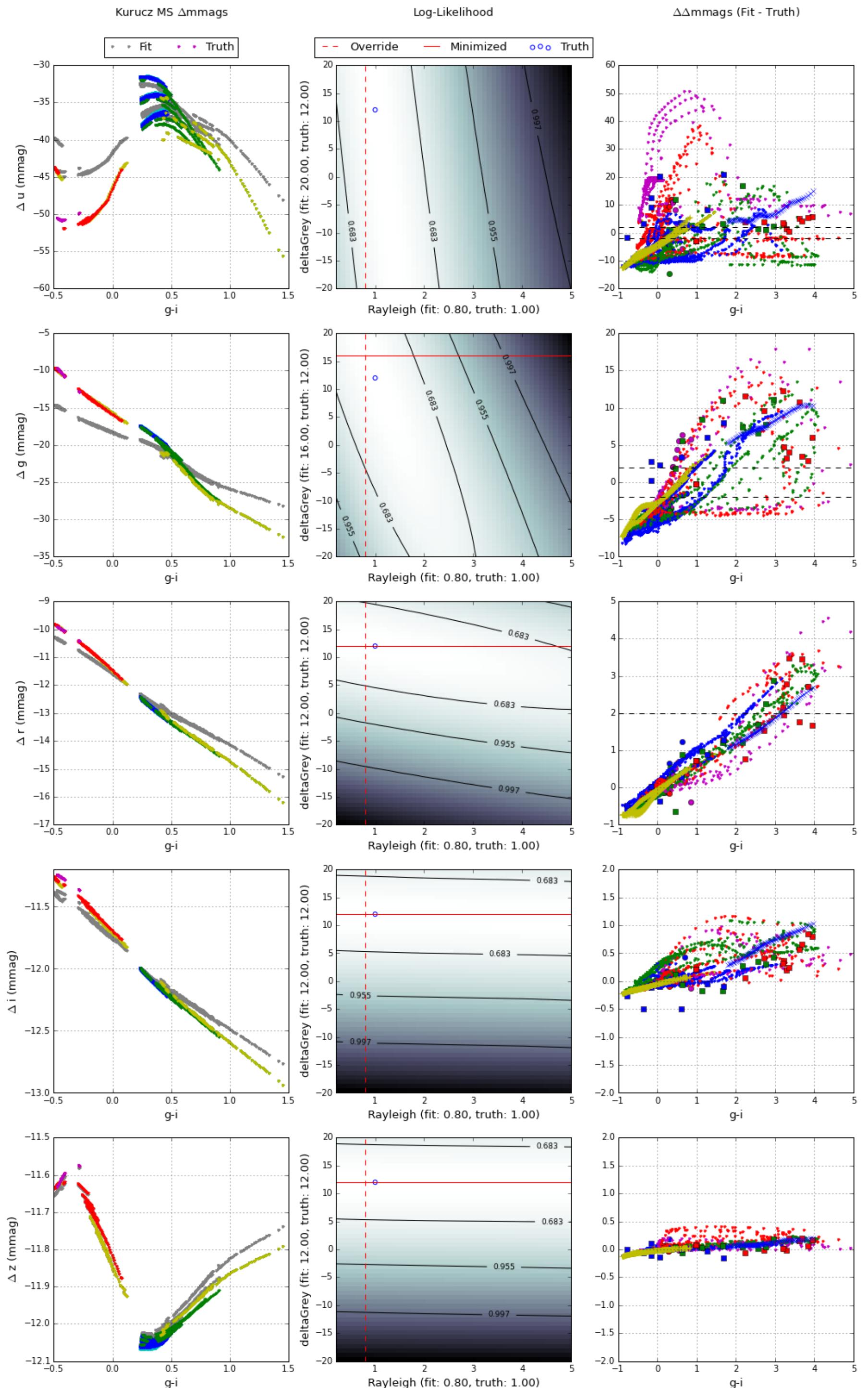


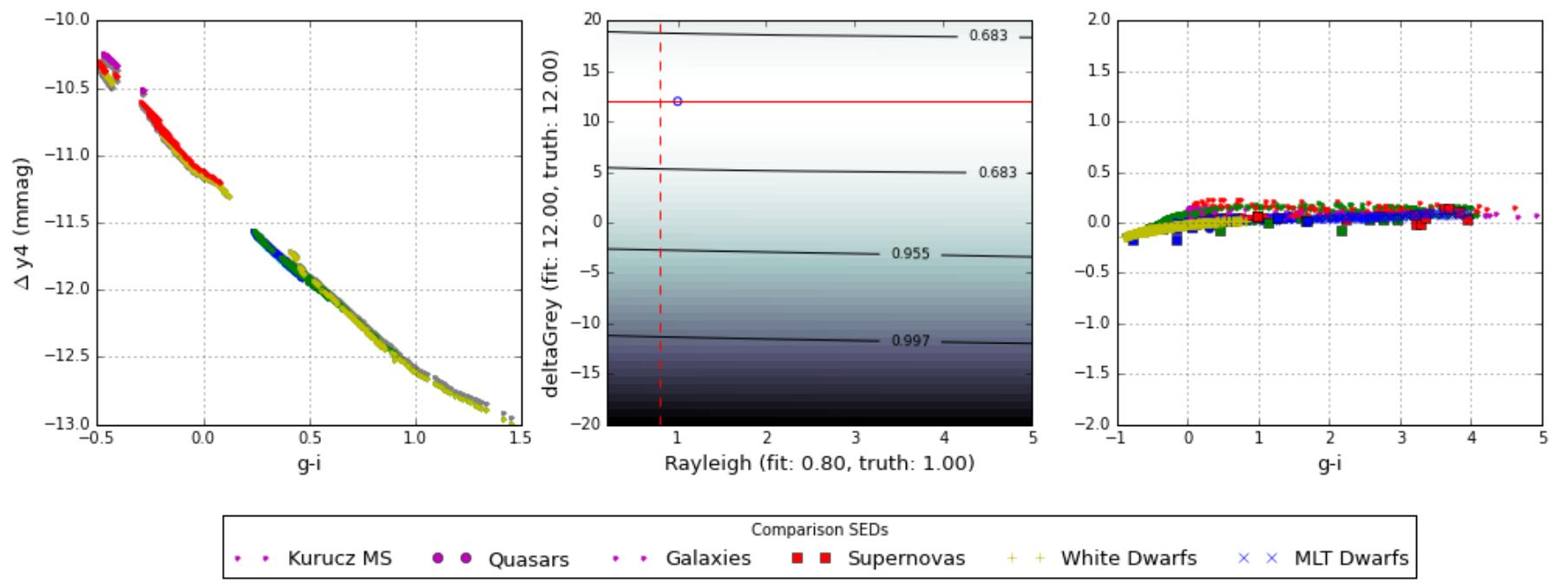
Δ mags, Regression Contours, $\Delta\Delta$ mags for each LSST filter (δ Grey: 12.0)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





```
In [12]: deltaGreyLimitPlot('Rayleigh',deltaGreyBins=50)
```

```
Computing nonlinear regression for Rayleigh.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2  
Observed atmosphere parameter for Rayleigh: 1.0  
  
Fitting for Rayleigh between 0.20 and 5.00 in 50 bins.  
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.  
  
Regression SEDs: 4855 Kurucz MS SEDs.  
  
Regressing 2500 parameter combinations per filter...  
Magnitude Error: 5.0 mmags  
  
Override triggered...  
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...  
  
Calculating best fit parameters for u filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_u_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for u filter.  
Saved Chi-Squared at best fit deltaGrey for u filter.  
Completed u filter.  
  
Calculating best fit parameters for g filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_g_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for g filter.  
Saved Chi-Squared at best fit deltaGrey for g filter.  
Completed g filter.  
  
Calculating best fit parameters for r filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_r_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for r filter.  
Saved Chi-Squared at best fit deltaGrey for r filter.  
Completed r filter.  
  
Calculating best fit parameters for i filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_i_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for i filter.  
Saved Chi-Squared at best fit deltaGrey for i filter.  
Completed i filter.  
  
Calculating best fit parameters for z filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_z_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for z filter.  
Saved Chi-Squared at best fit deltaGrey for z filter.  
Completed z filter.  
  
Calculating best fit parameters for y4 filter...  
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12_0_DGR-2020_E5_mss_y4_50dgb_50b_max_dGTest_allMS_OR120.pkl'  
Saved LogL at best fit deltaGrey for y4 filter.  
Saved Chi-Squared at best fit deltaGrey for y4 filter.  
Completed y4 filter.  
  
Best fit parameters (Filter, Rayleigh, dG, logL, Chi-Squared):  
u 0.98 13.47 22.0057067915 44.011413583  
g 0.98 12.65 14.0475571606 28.0951143212  
r 1.08 11.84 1.29248898555 2.5849779711  
i 1.28 11.84 1.58230943093 3.16461886186  
z 2.16 11.84 0.946195708444 1.89239141689  
y4 2.06 11.84 1.55183868155 3.1036773631  
  
Override best fit parameters (Filter, Rayleigh, dG):  
u 1.20 -2.04  
g 1.20 8.57  
r 1.20 11.84  
i 1.20 11.84  
z 1.20 11.84  
y4 1.20 11.84  
  
Computing nonlinear regression for Rayleigh.  
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Observed atmosphere airmass: 2.0  
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]  
Standard atmosphere airmass: 1.2
```

```
Observed atmosphere parameter for Rayleigh: 1.0

Fitting for Rayleigh between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit v
alue...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12
0_DGR-2020_E5_mss_u_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12
0_DGR-2020_E5_mss_g_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12
0_DGR-2020_E5_mss_r_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

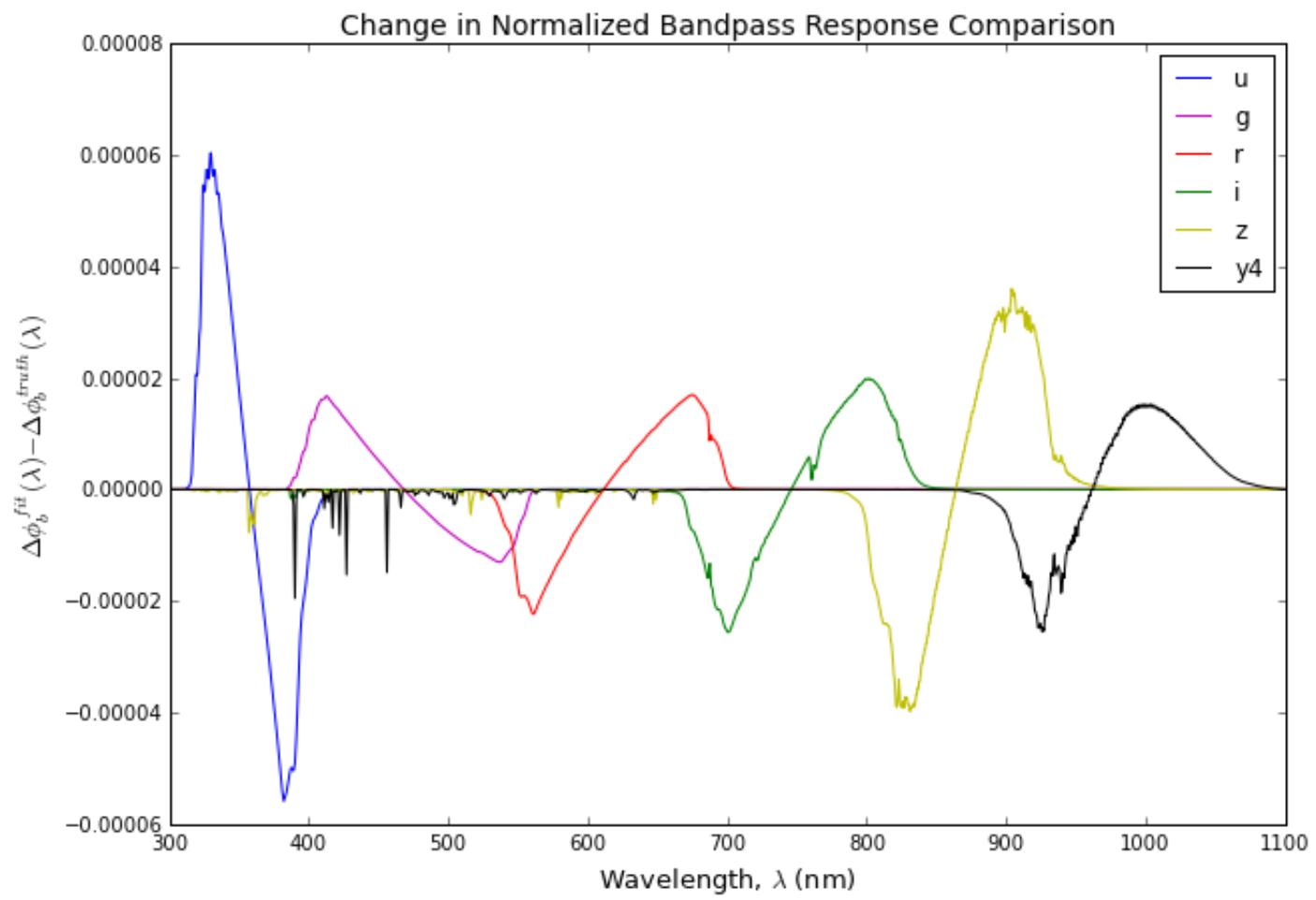
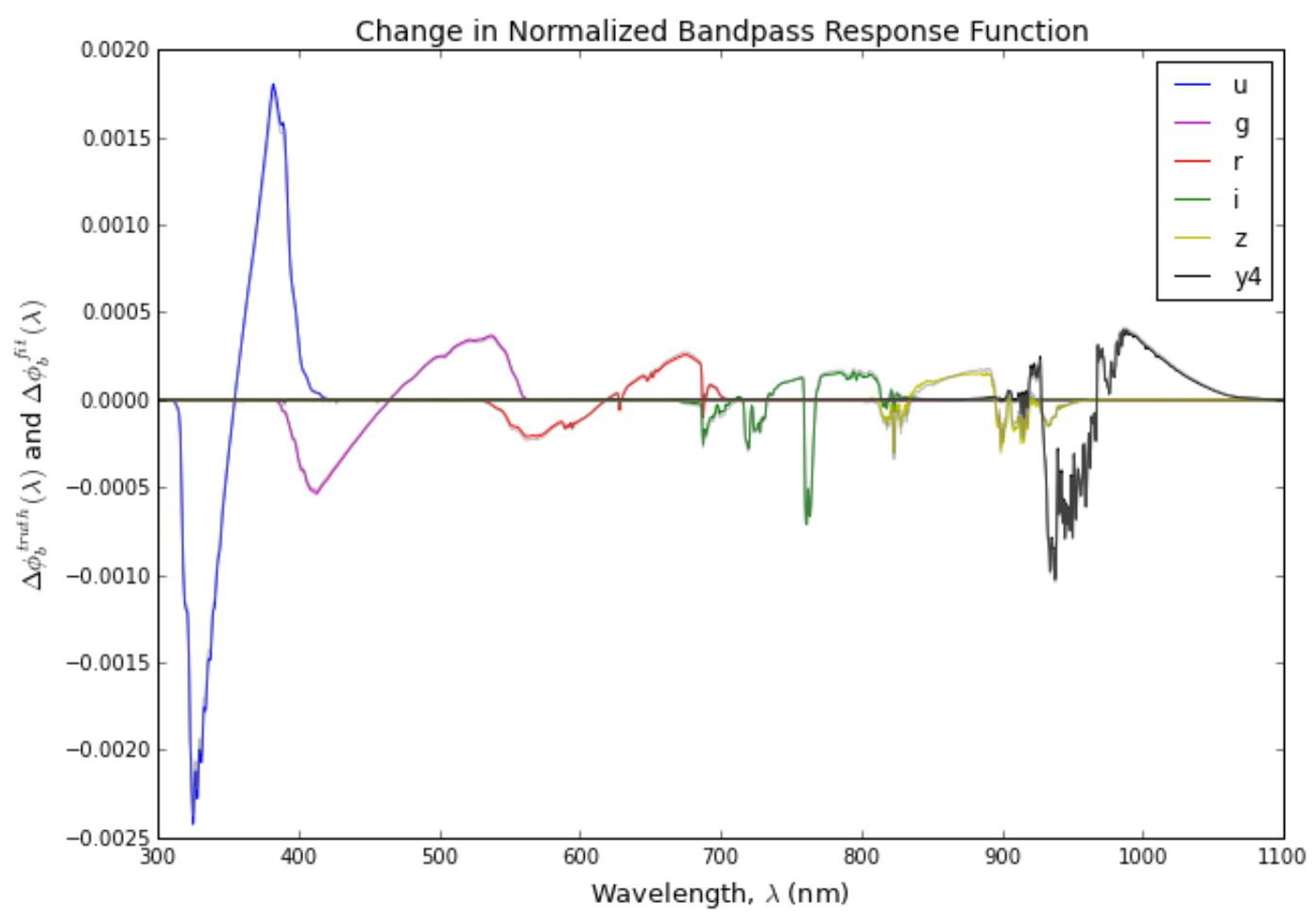
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12
0_DGR-2020_E5_mss_i_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12
0_DGR-2020_E5_mss_z_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

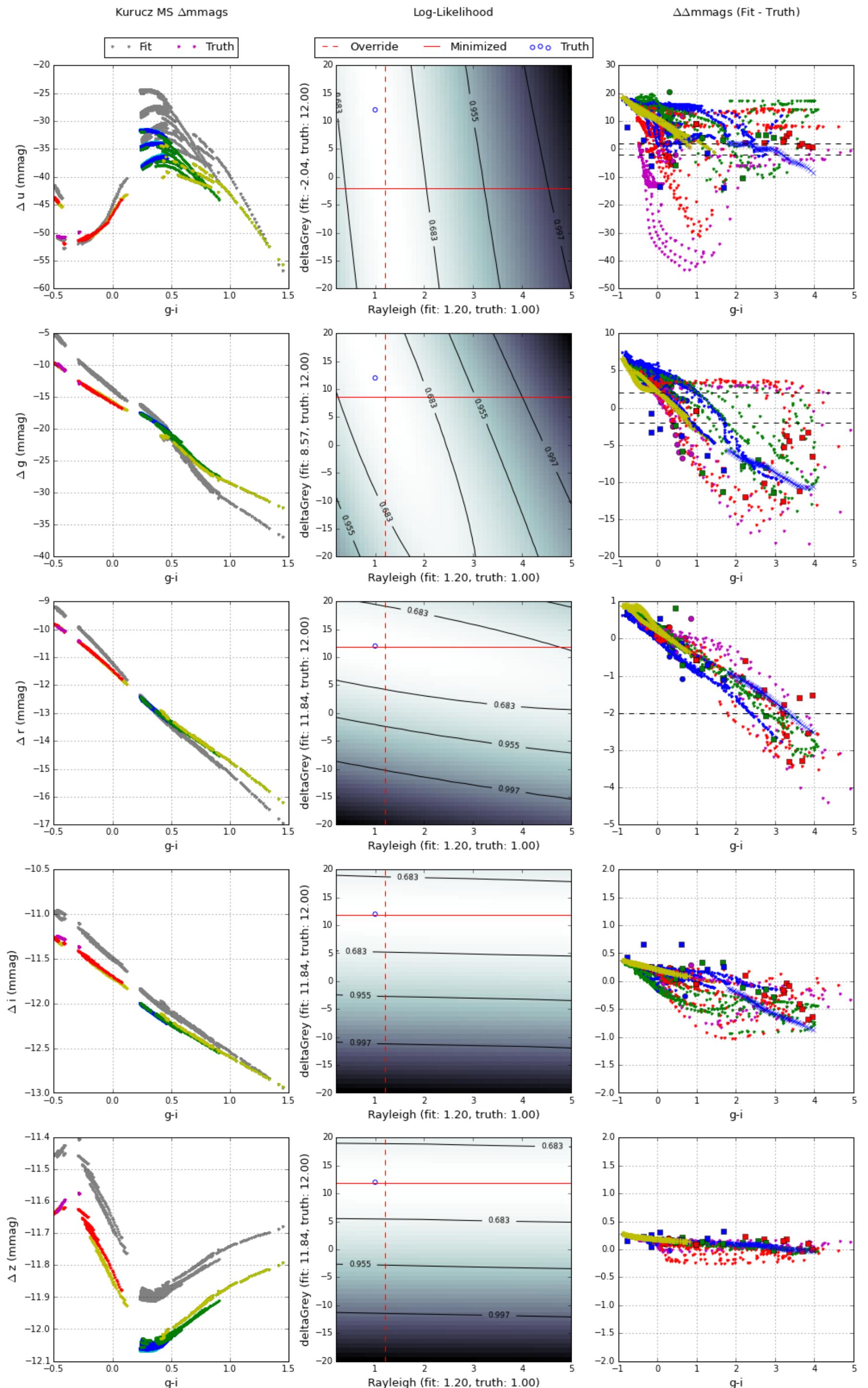
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Rayleigh_dG_XSTD12_DG12
0_DGR-2020_E5_mss_y4_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

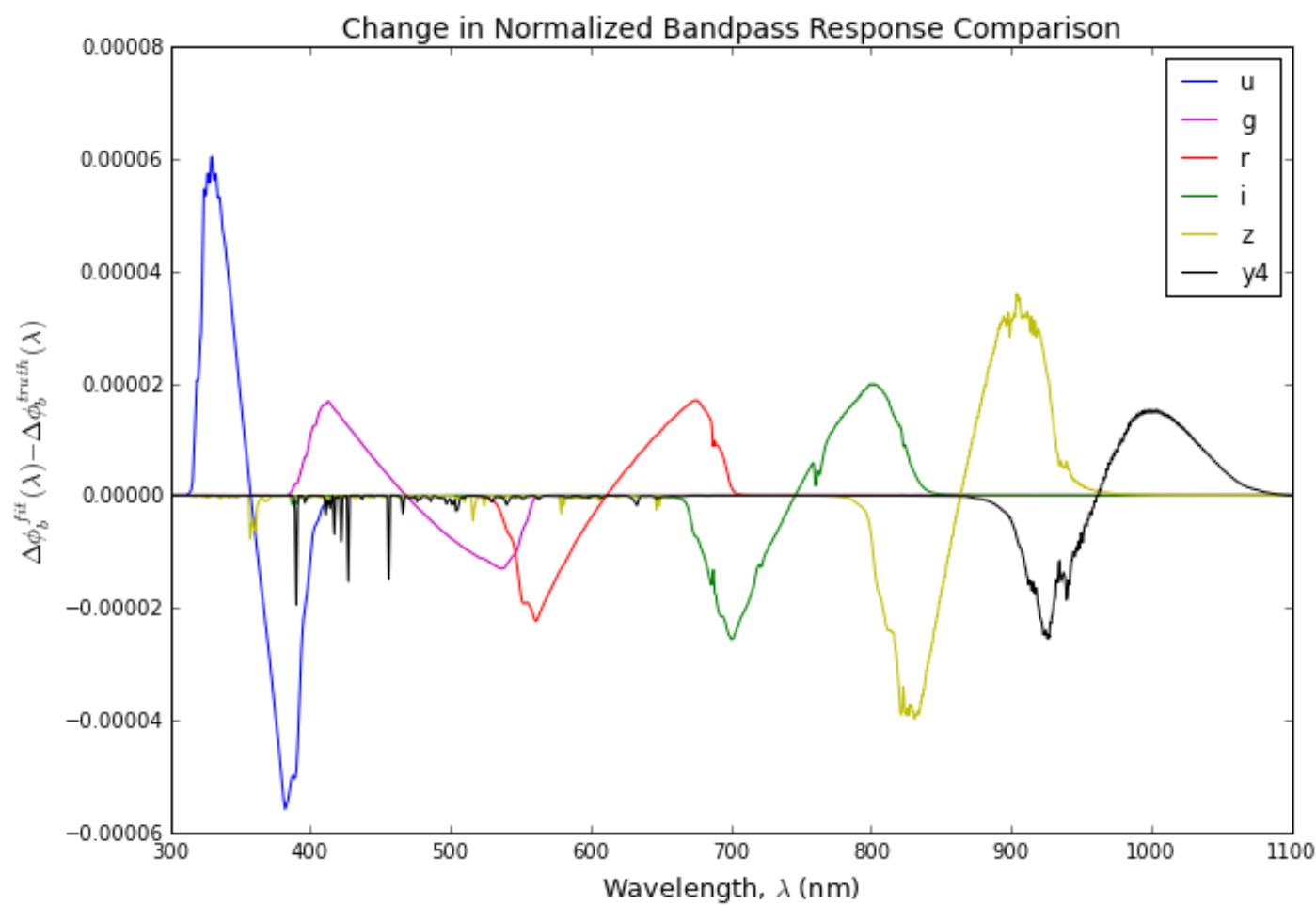
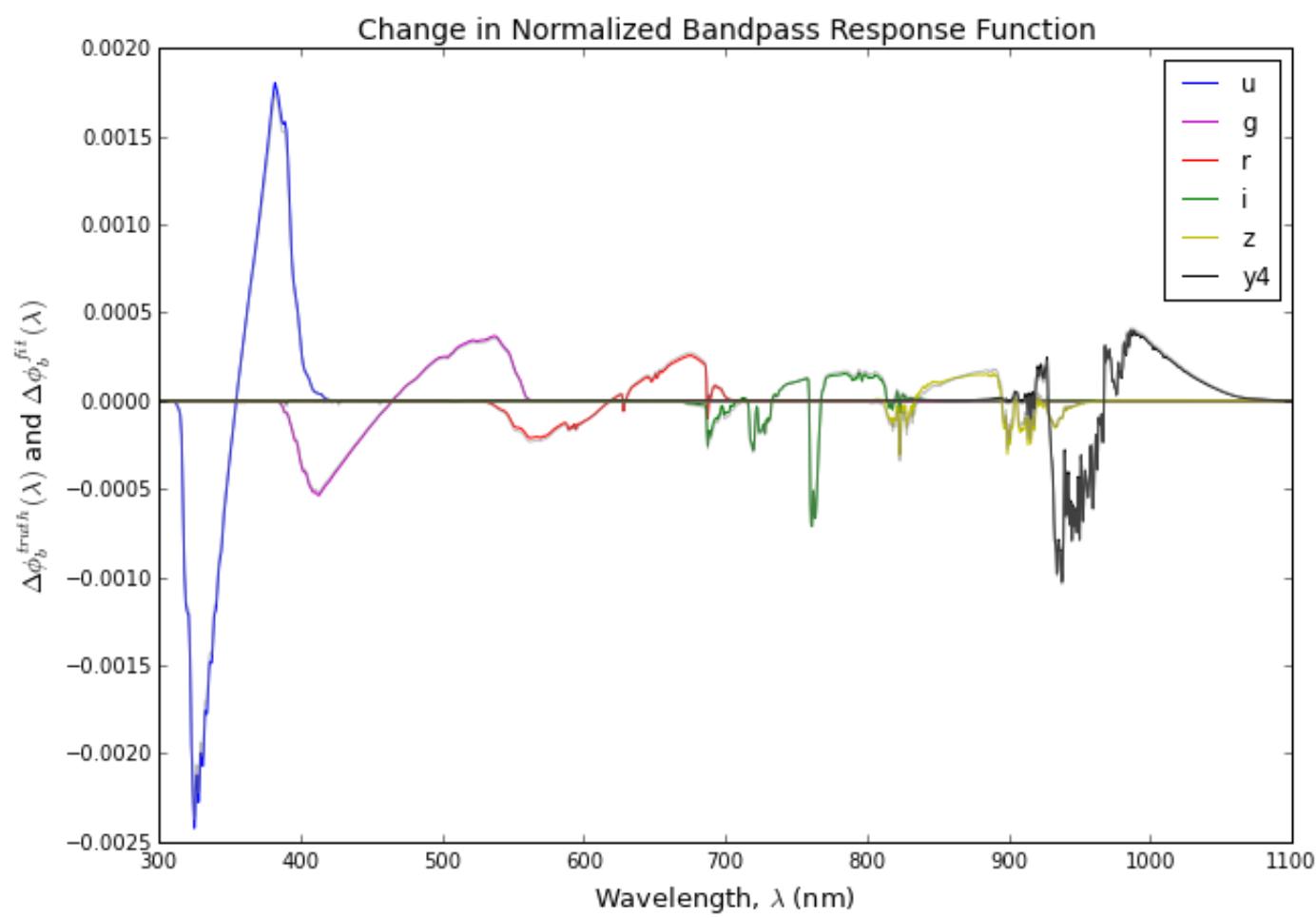
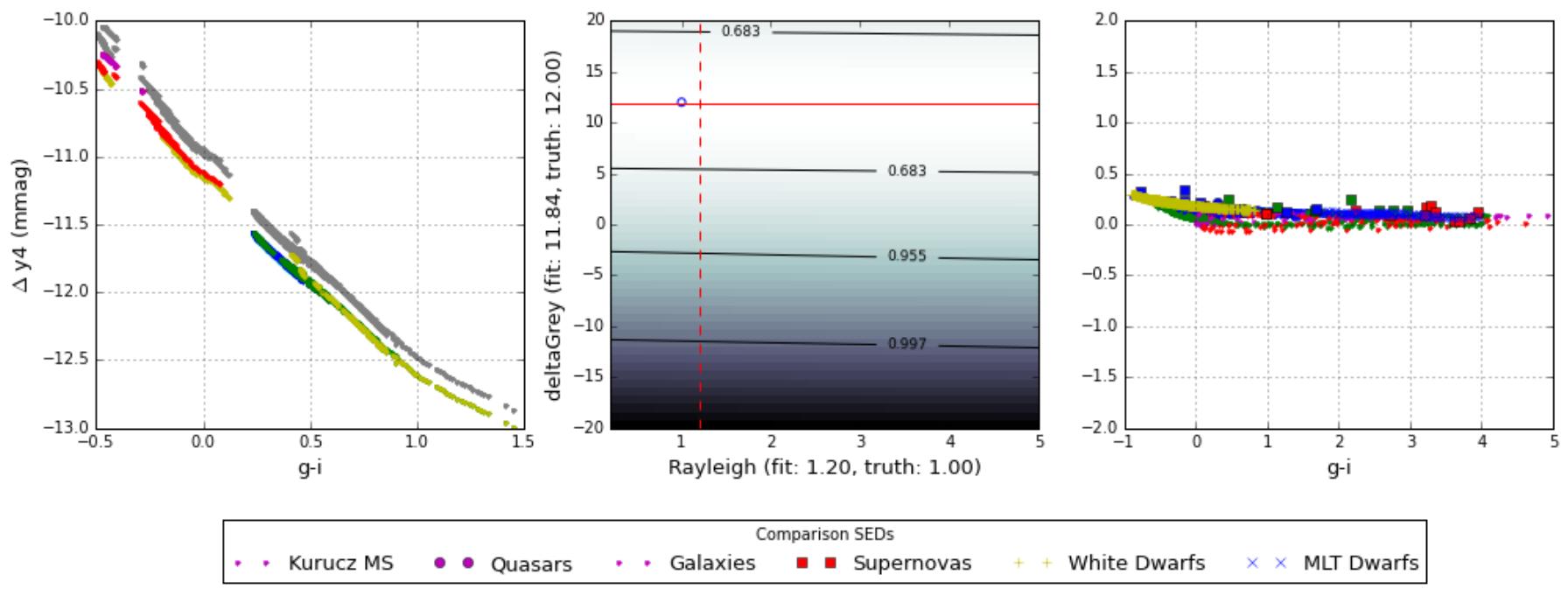
Best fit parameters (Filter, Rayleigh, dG, logL, Chi-Squared):
u 0.98 13.47 22.0057067915 44.011413583
g 0.98 12.65 14.0475571606 28.0951143212
r 1.08 11.84 1.29248898555 2.5849779711
i 1.28 11.84 1.58230943093 3.16461886186
z 2.16 11.84 0.946195708444 1.89239141689
y4 2.06 11.84 1.55183868155 3.1036773631

Override best fit parameters (Filter, Rayleigh, dG):
u 0.80 20.00
g 0.80 15.92
r 0.80 12.65
i 0.80 11.84
z 0.80 11.84
y4 0.80 11.84
```

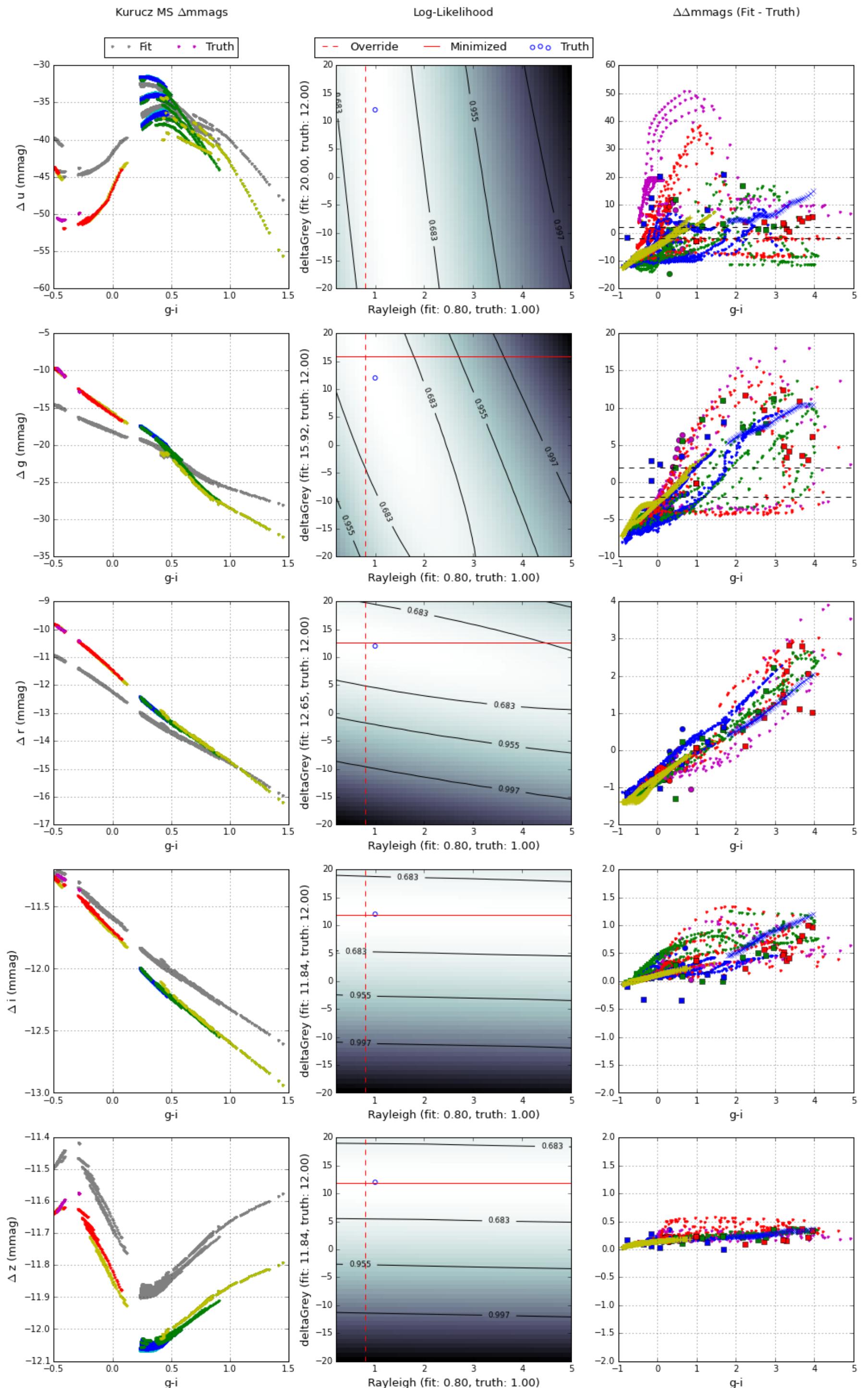


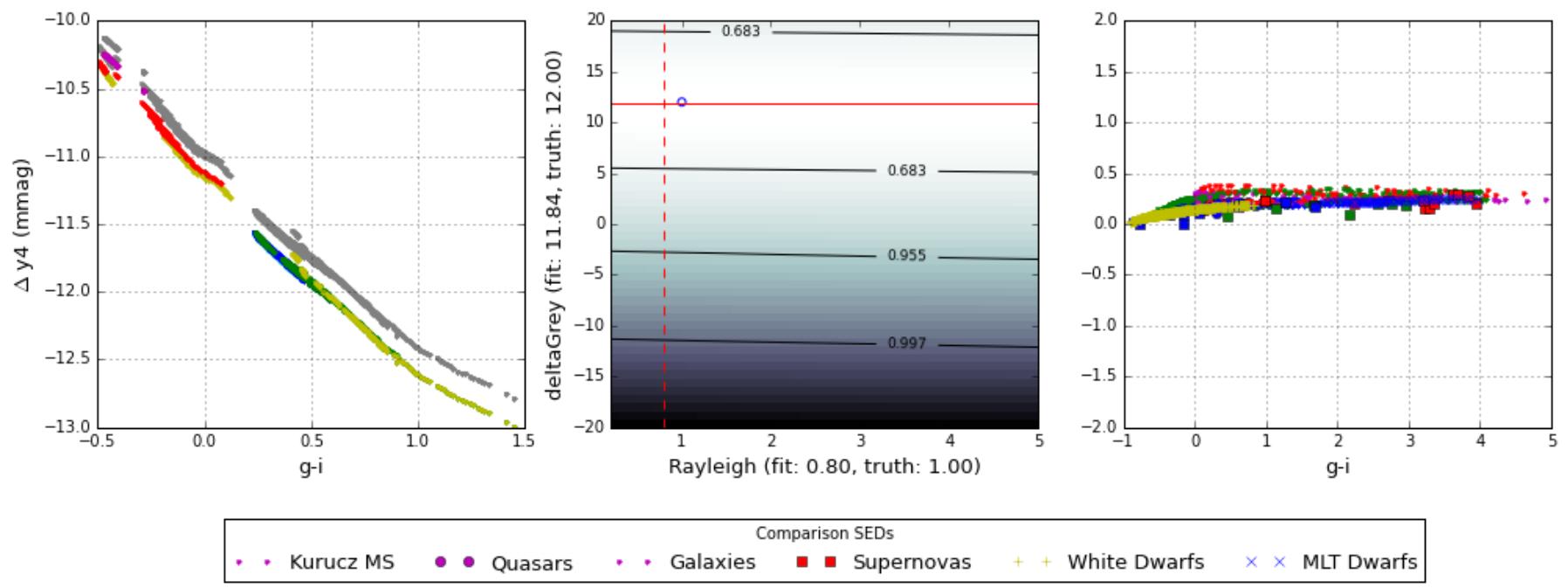
Δ mags, Regression Contours, $\Delta\Delta$ mags for each LSST filter (δ Grey: 12.0)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Aerosol

```
In [13]: deltaGreyLimitPlot('Aerosol')
```

```
Computing nonlinear regression for Aerosol.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for Aerosol: 1.0

Fitting for Aerosol between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12
0_DGR-2020_E5_mss_u_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12
0_DGR-2020_E5_mss_g_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12
0_DGR-2020_E5_mss_r_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12
0_DGR-2020_E5_mss_i_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12
0_DGR-2020_E5_mss_z_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12
0_DGR-2020_E5_mss_y4_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, Aerosol, dG, logL, Chi-Squared):
u 0.98 12.00 5.91899480672 11.8379896134
g 0.98 12.00 1.94718155899 3.89436311798
r 0.98 12.00 0.0648533340931 0.129706668186
i 0.98 12.00 0.00451459117309 0.00902918234618
z 0.98 12.00 0.000443328130606 0.000886656261212
y4 0.98 12.00 0.000291251926139 0.000582503852278

Override best fit parameters (Filter, Aerosol, dG):
u 1.20 8.80
g 1.20 10.40
r 1.20 12.00
i 1.20 12.00
z 1.20 12.00
y4 1.20 12.00

Computing nonlinear regression for Aerosol.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
```

Observed atmosphere parameter for Aerosol: 1.0

Fitting for Aerosol between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_u_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_g_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_r_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

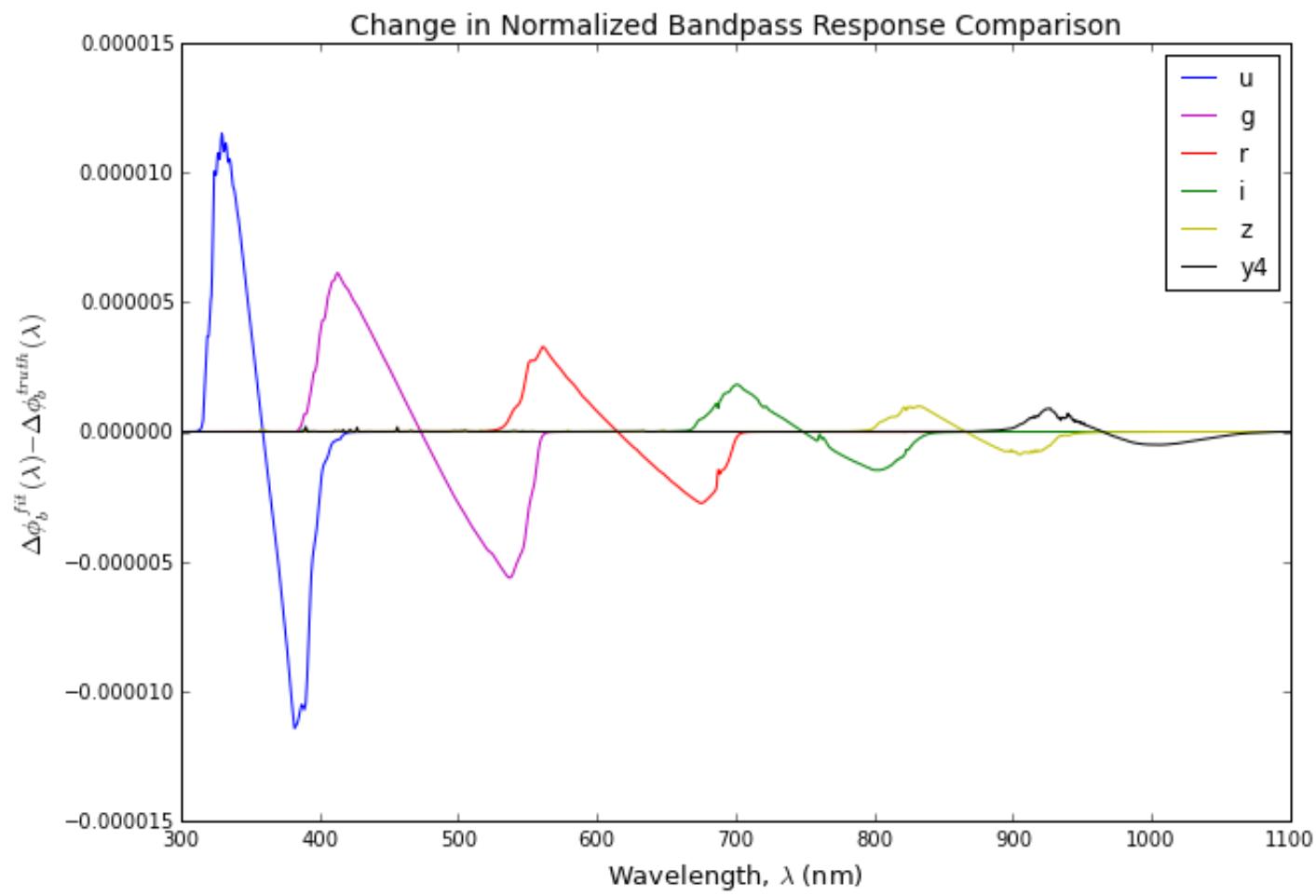
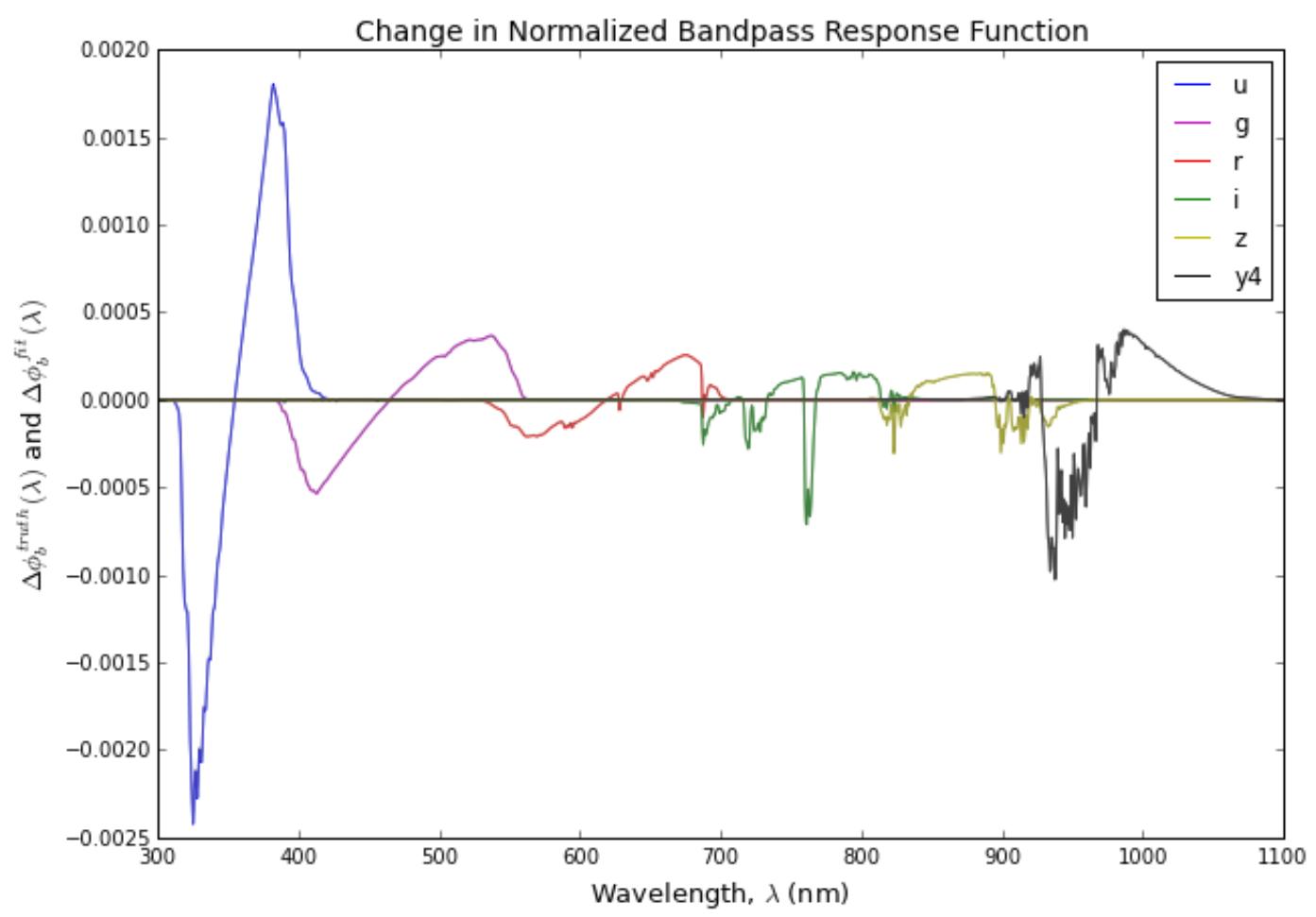
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_i_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_z_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

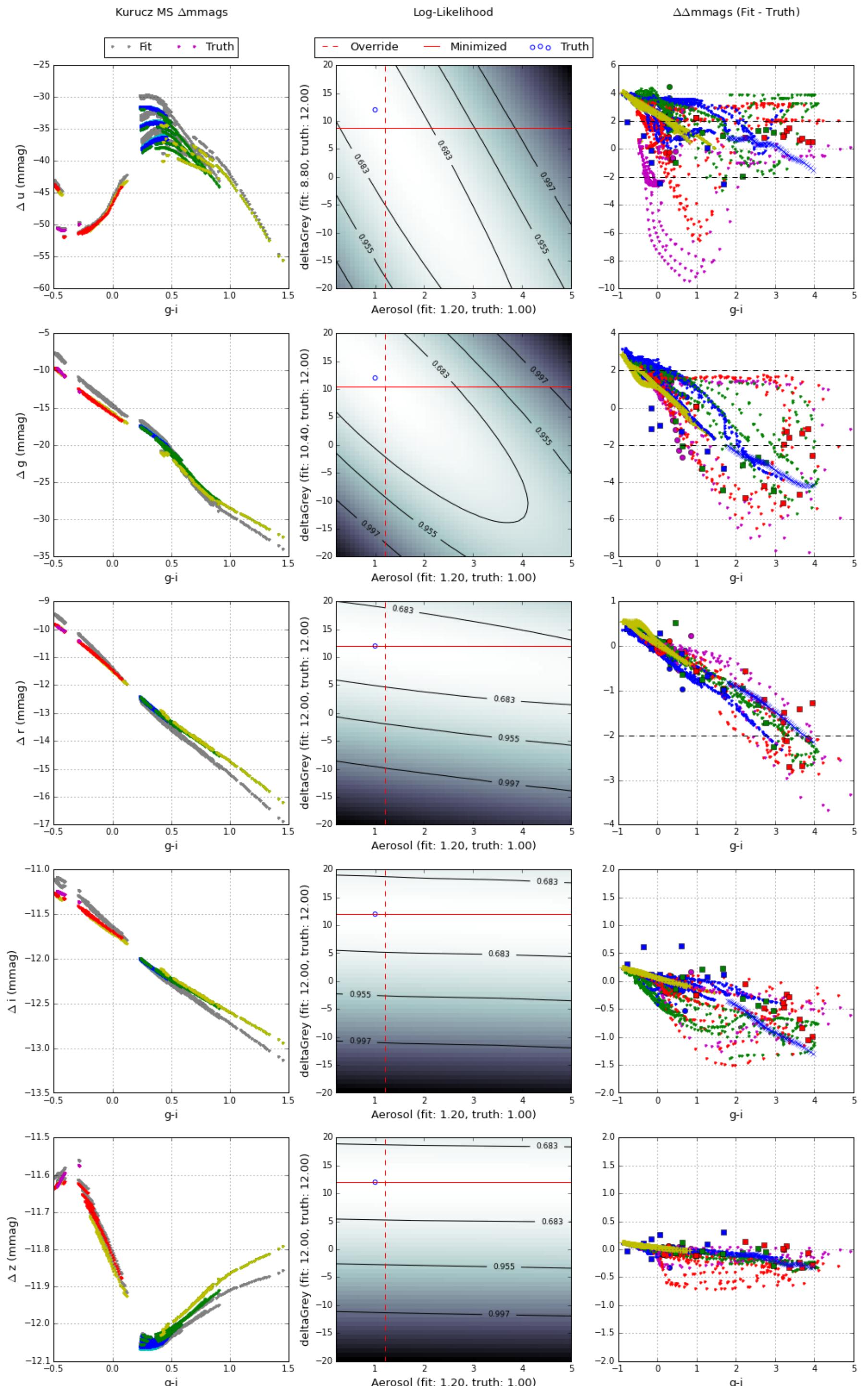
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_y4_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

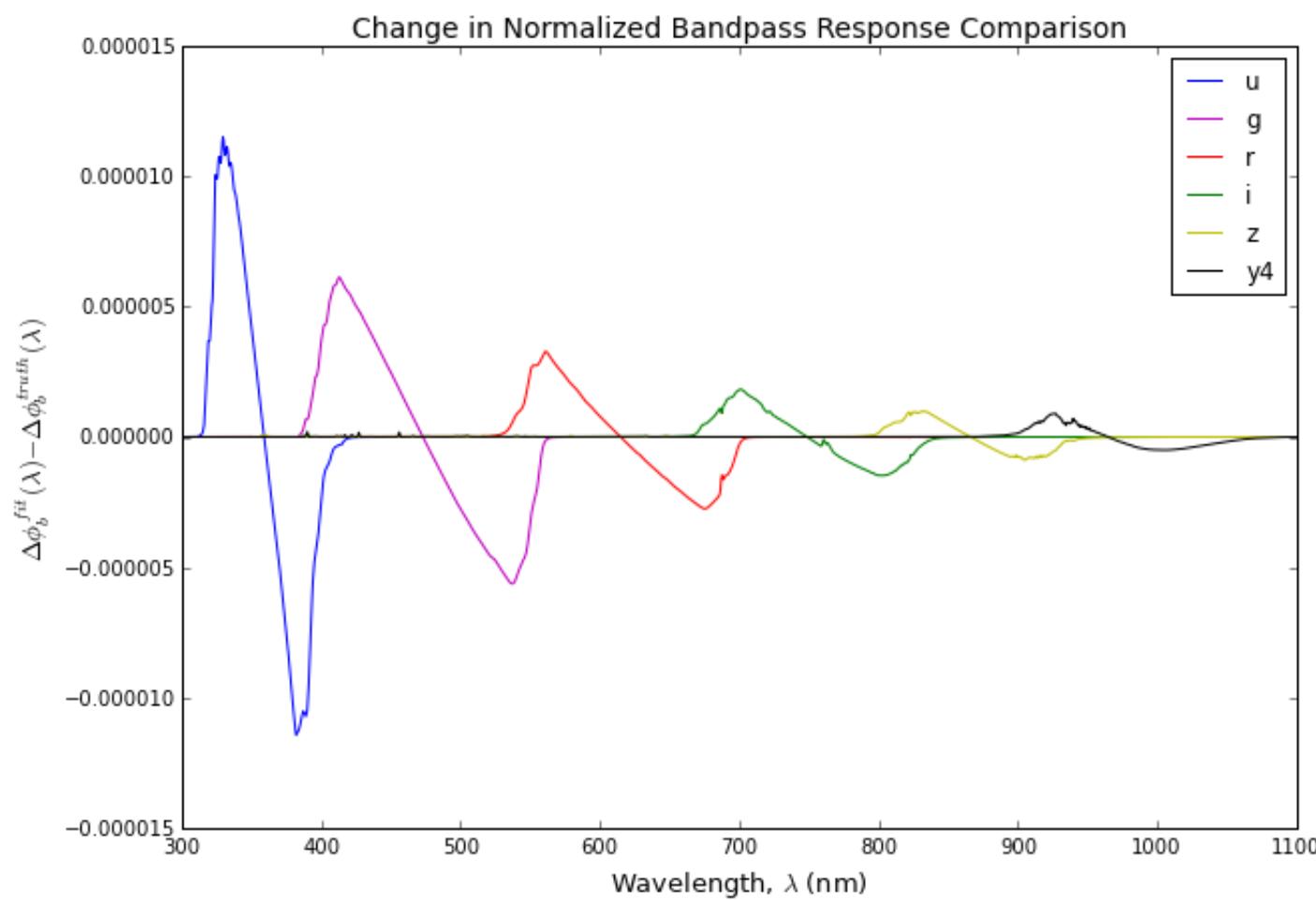
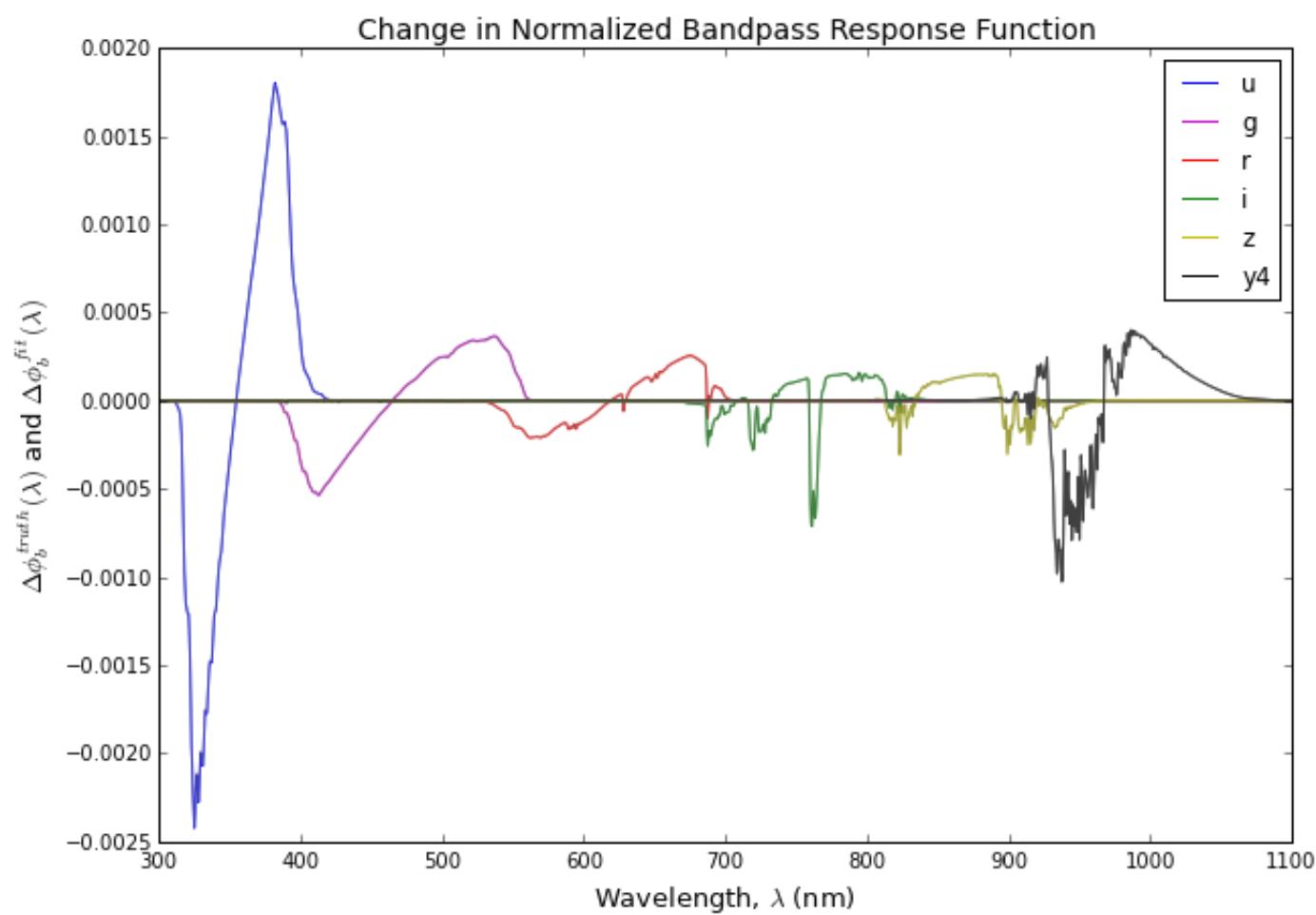
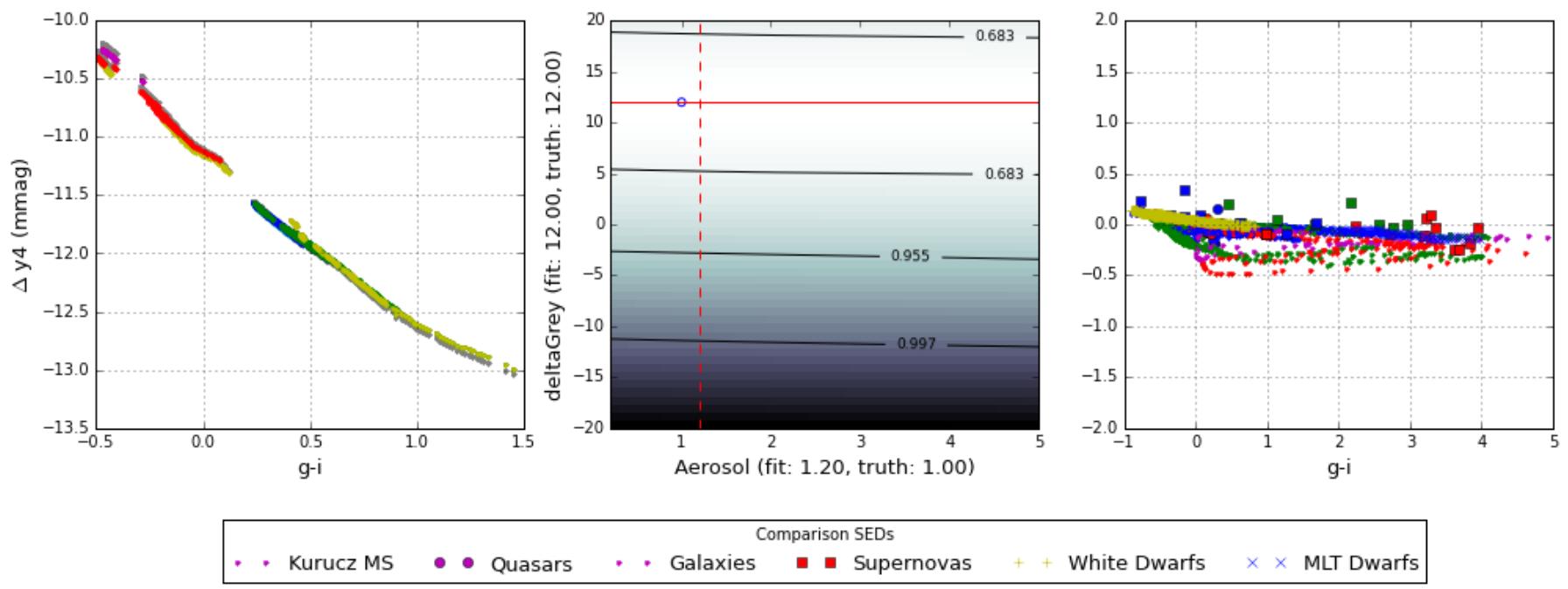
Best fit parameters (Filter, Aerosol, dG, logL, Chi-Squared):
u 0.98 12.00 5.91899480672 11.8379896134
g 0.98 12.00 1.94718155899 3.89436311798
r 0.98 12.00 0.0648533340931 0.129706668186
i 0.98 12.00 0.00451459117309 0.00902918234618
z 0.98 12.00 0.000443328130606 0.000886656261212
y4 0.98 12.00 0.000291251926139 0.000582503852278

Override best fit parameters (Filter, Aerosol, dG):
u 0.80 15.20
g 0.80 13.60
r 0.80 12.00
i 0.80 12.00
z 0.80 12.00
y4 0.80 12.00

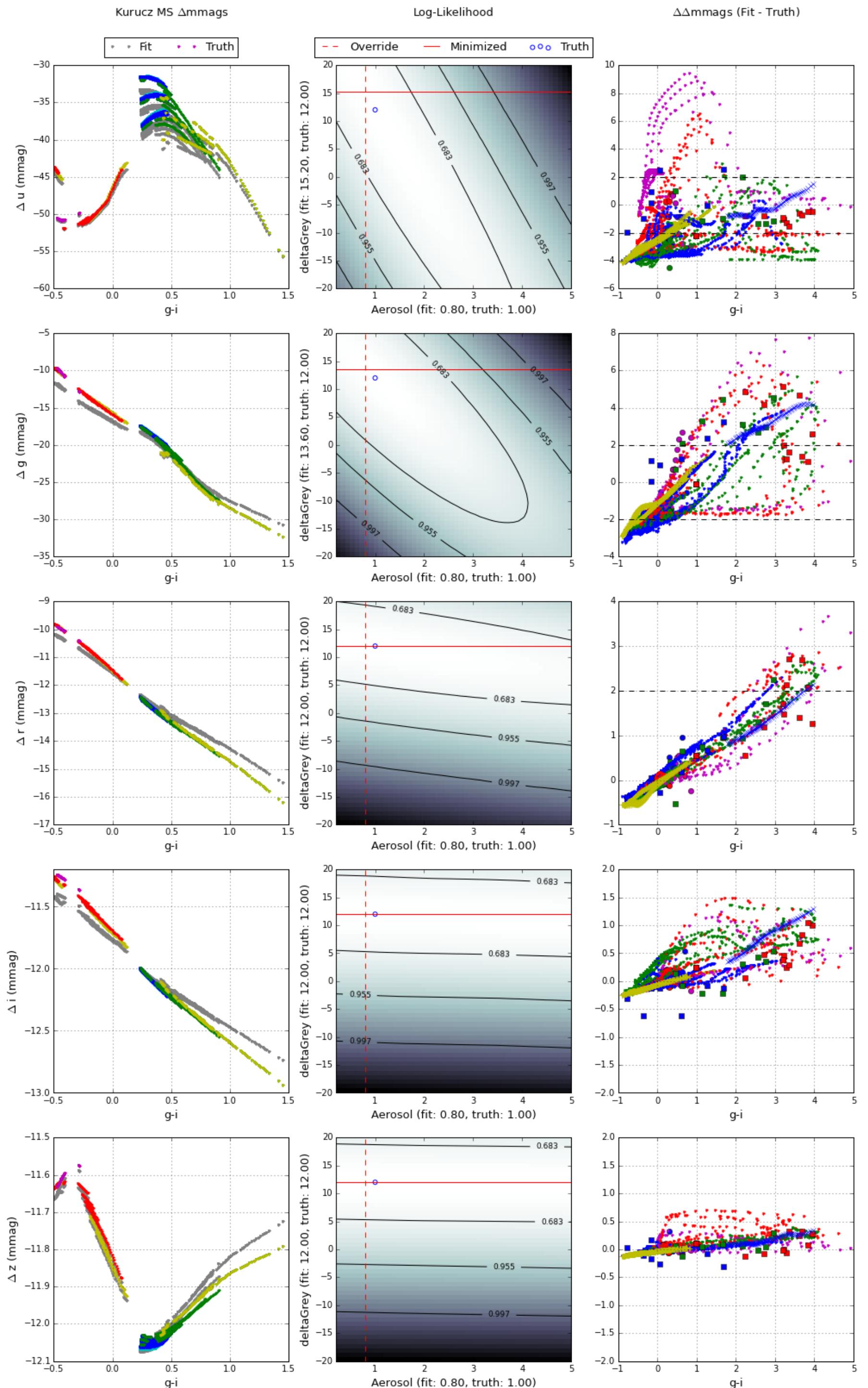


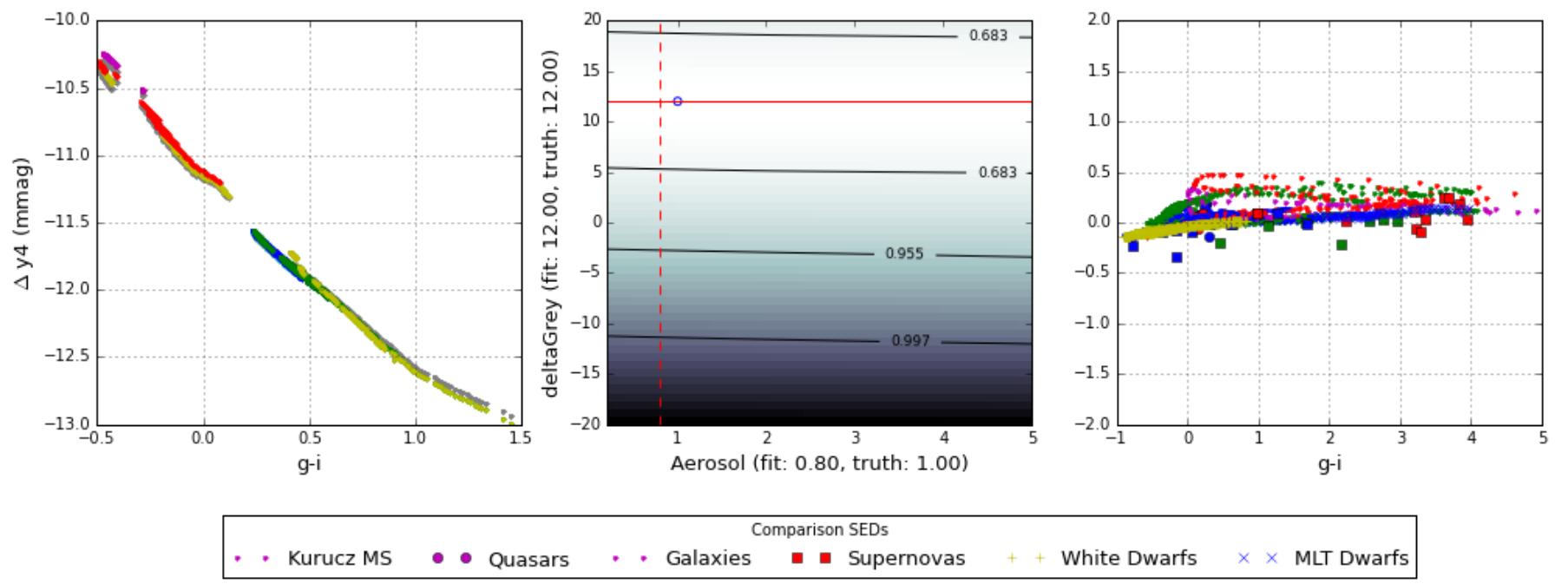
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





```
In [14]: deltaGreyLimitPlot('Aerosol',deltaGreyBins=50)
```

```
Computing nonlinear regression for Aerosol.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for Aerosol: 1.0

Fitting for Aerosol between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_u_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_g_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_r_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_i_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_z_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_y4_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, Aerosol, dG, logL, Chi-Squared):
u 0.98 11.84 15.9757623184 31.9515246369
g 0.98 11.84 8.45308970838 16.9061794168
r 1.08 11.84 1.11145070912 2.22290141824
i 1.28 11.84 1.71891276374 3.43782552749
z 1.87 11.84 1.33369527163 2.66739054326
y4 1.57 11.84 2.21429181165 4.4285836233

Override best fit parameters (Filter, Aerosol, dG):
u 1.20 9.39
g 1.20 10.20
r 1.20 11.84
i 1.20 11.84
z 1.20 11.84
y4 1.20 11.84

Computing nonlinear regression for Aerosol.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
```

Observed atmosphere parameter for Aerosol: 1.0

Fitting for Aerosol between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_u_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_g_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_r_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_i_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_z_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

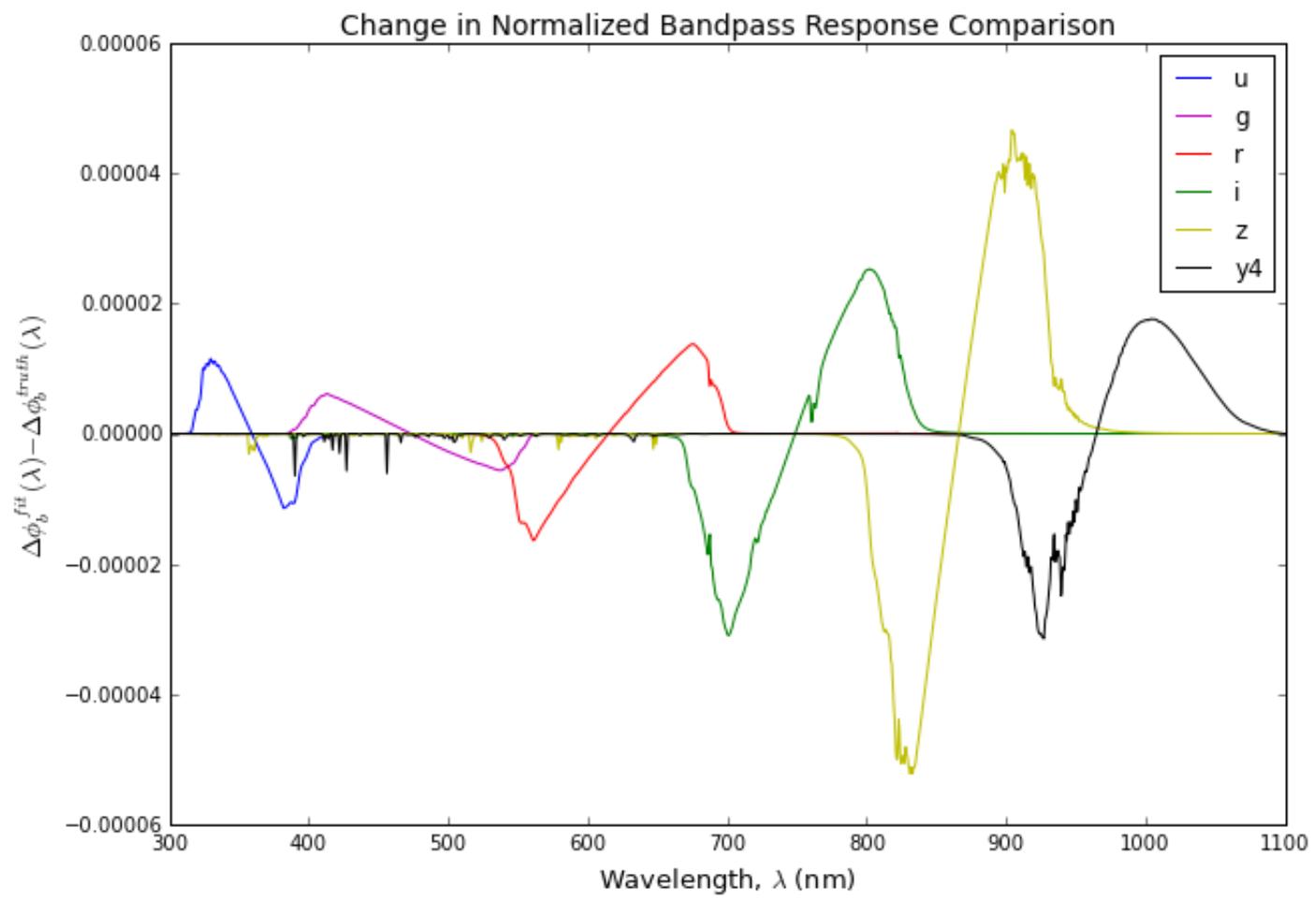
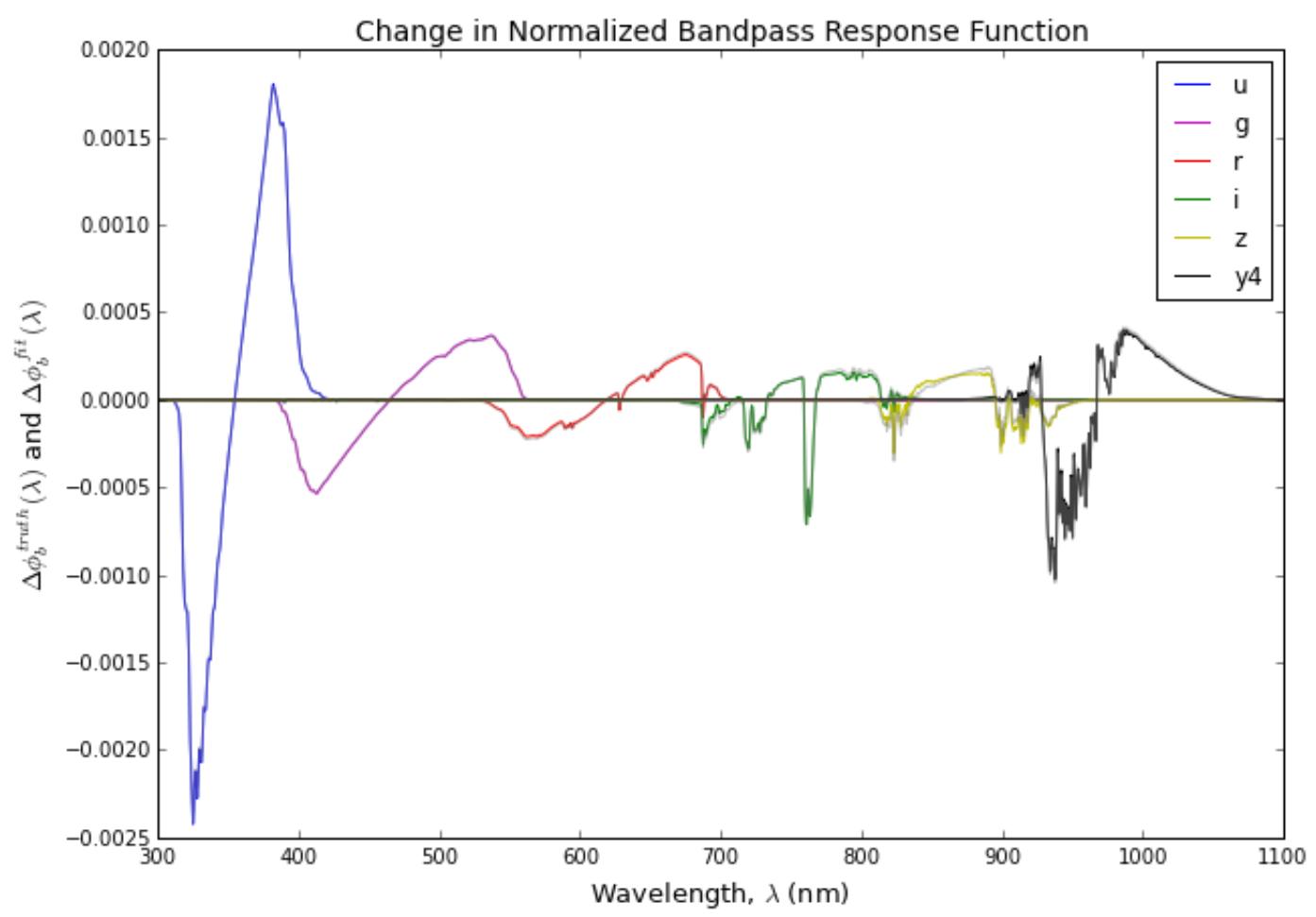
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Aerosol_dG_XSTD12_DG12_0_DGR-2020_E5_mss_y4_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, Aerosol, dG, logL, Chi-Squared):

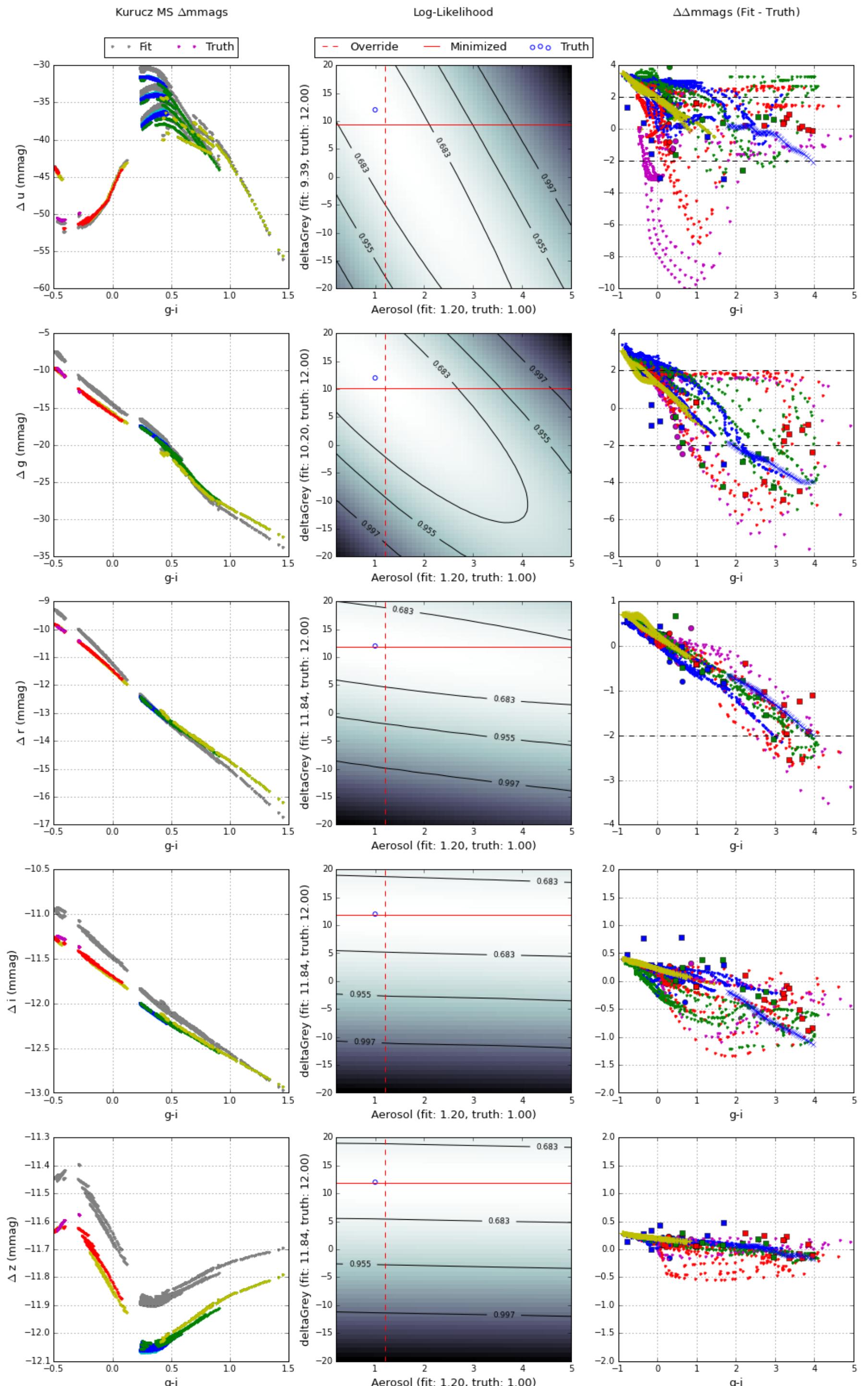
u	0.98	11.84	15.9757623184	31.9515246369
g	0.98	11.84	8.45308970838	16.9061794168
r	1.08	11.84	1.11145070912	2.22290141824
i	1.28	11.84	1.71891276374	3.43782552749
z	1.87	11.84	1.33369527163	2.66739054326
y4	1.57	11.84	2.21429181165	4.4285836233

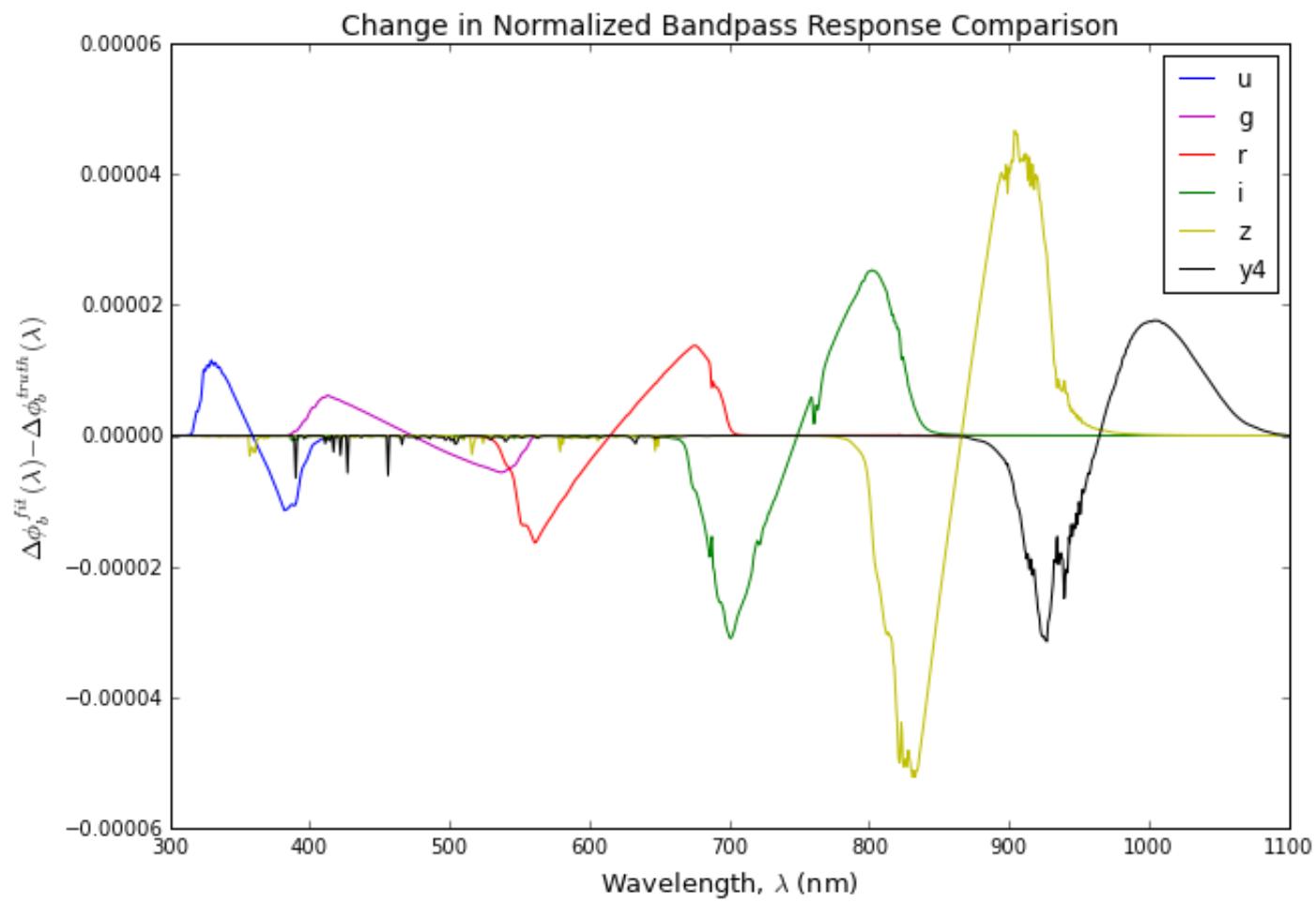
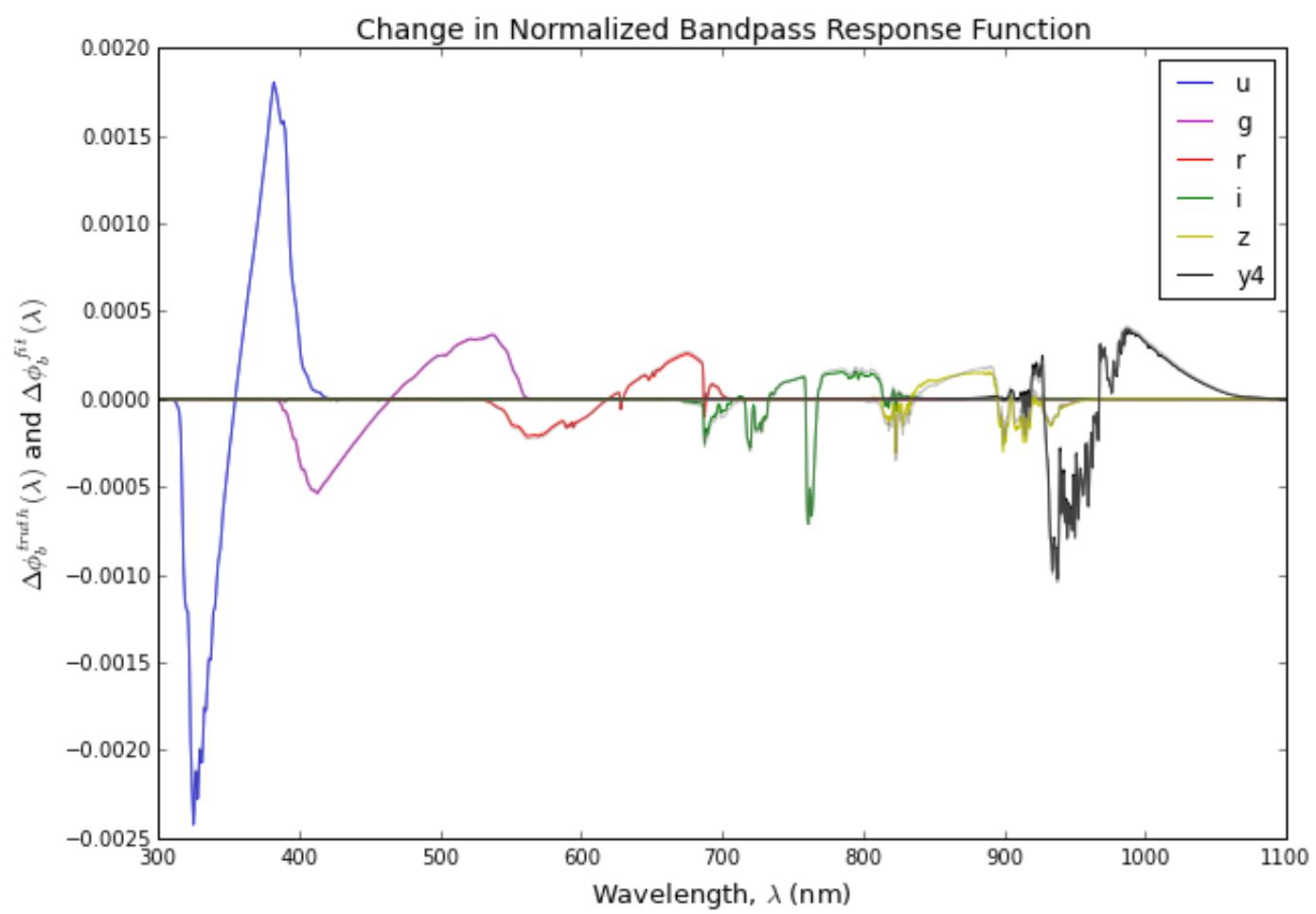
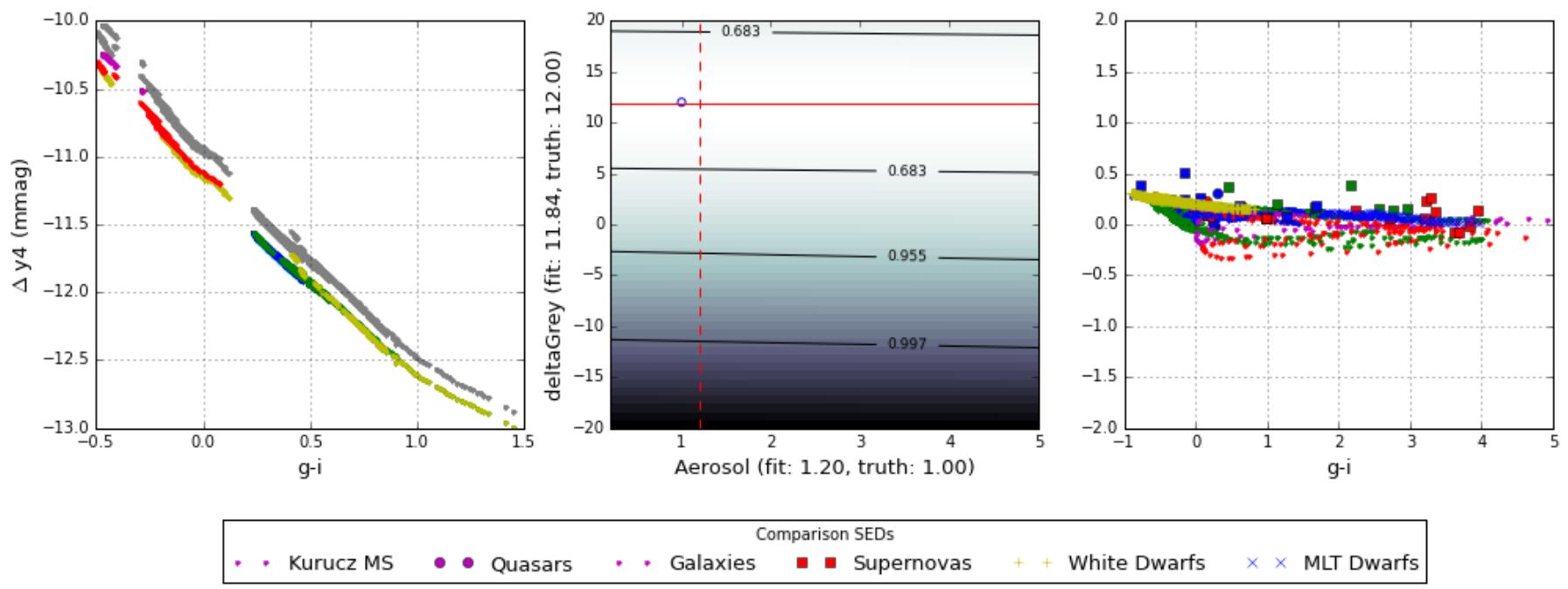
Override best fit parameters (Filter, Aerosol, dG):

u	0.80	15.10
g	0.80	13.47
r	0.80	11.84
i	0.80	11.84
z	0.80	11.84
y4	0.80	11.84

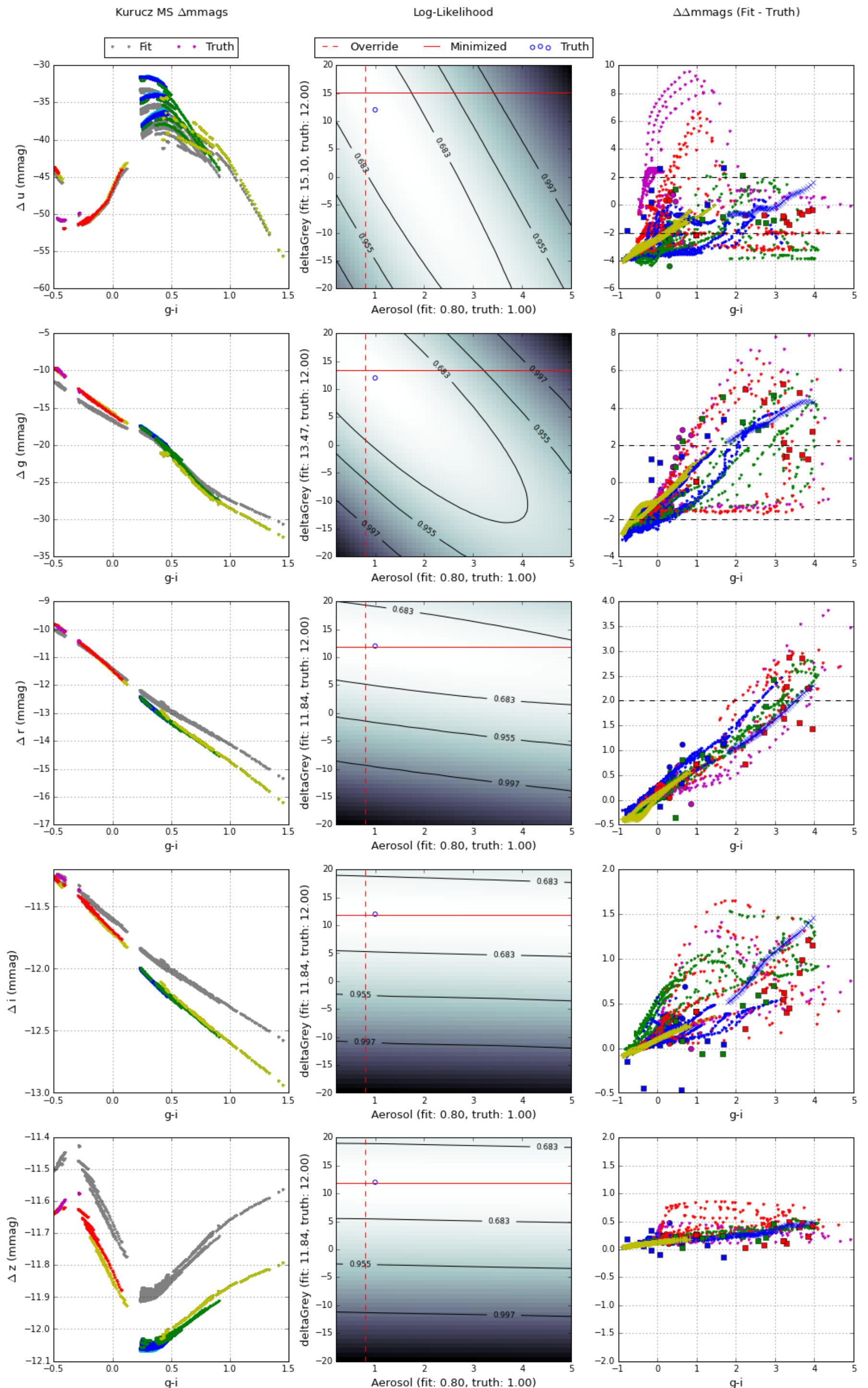


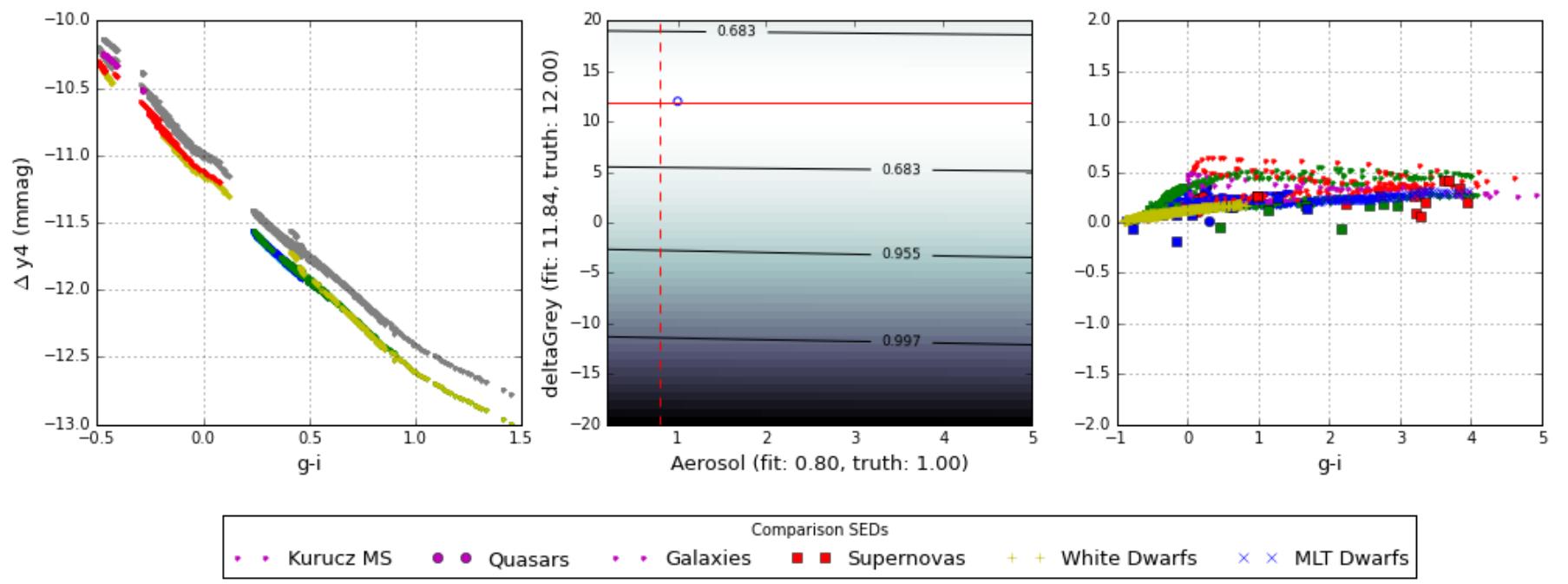
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





Alpha

```
In [15]: deltaGreyLimitPlot('Alpha')
```

```
Computing nonlinear regression for Alpha.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for Alpha: 1.7

Fitting for Alpha between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_u_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_g_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_r_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_i_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_z_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_y4_51dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, Alpha, dG, logL, Chi-Squared):
u 1.77 11.20 13.9092702578 27.8185405155
g 1.67 12.00 3.82554094856 7.65108189713
r 1.67 12.00 0.053569670344 0.107139340688
i 1.67 12.00 0.00142816021092 0.00285632042185
z 1.67 12.00 0.000101109475544 0.000202218951088
y4 1.67 12.00 7.87227808831e-05 0.000157445561766

Override best fit parameters (Filter, Alpha, dG):
u 1.20 18.40
g 1.20 14.40
r 1.20 12.00
i 1.20 12.00
z 1.20 12.00
y4 1.20 12.00

Computing nonlinear regression for Alpha.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
```

Observed atmosphere parameter for Alpha: 1.7

Fitting for Alpha between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 51 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2550 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_u_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_g_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_r_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

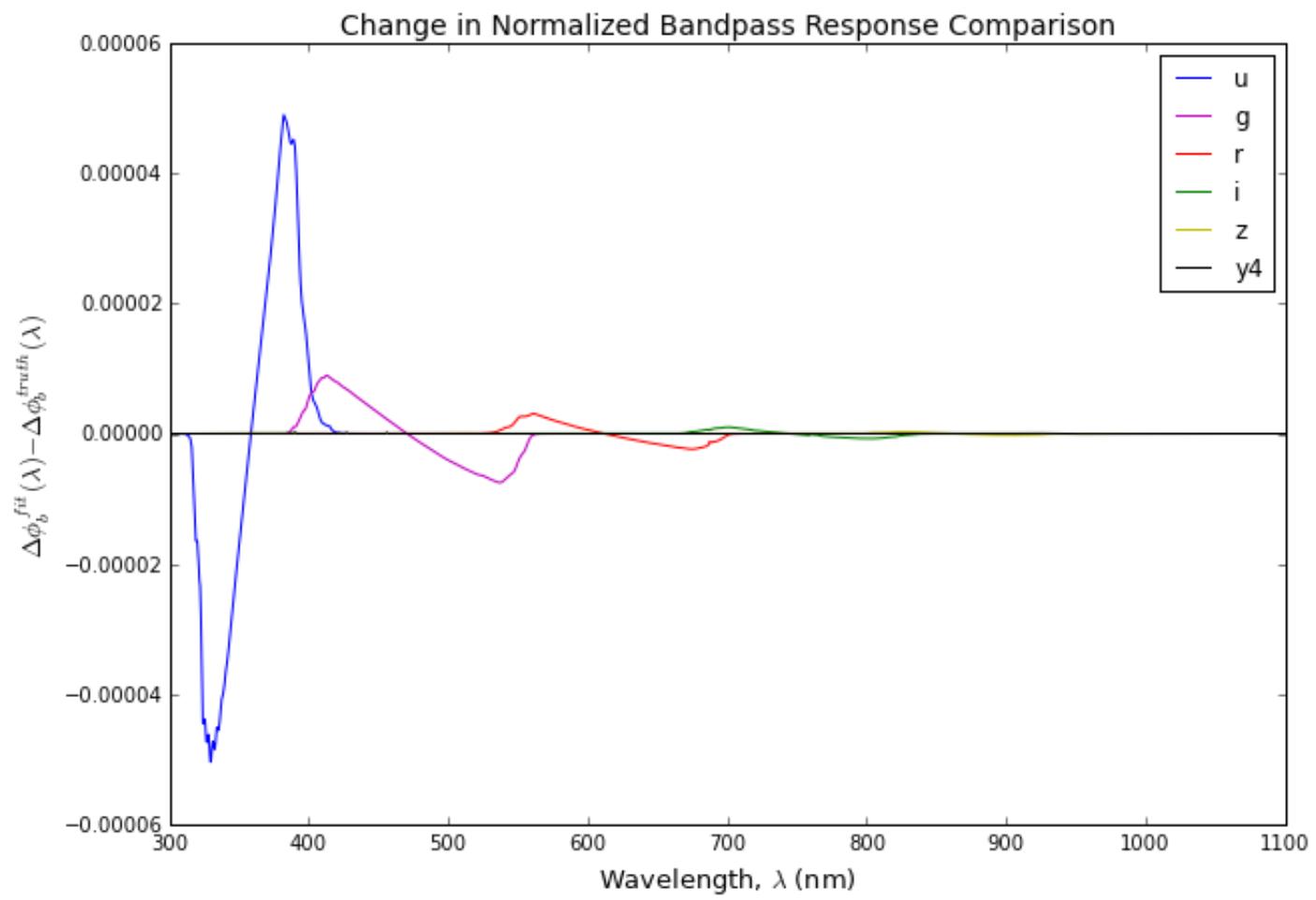
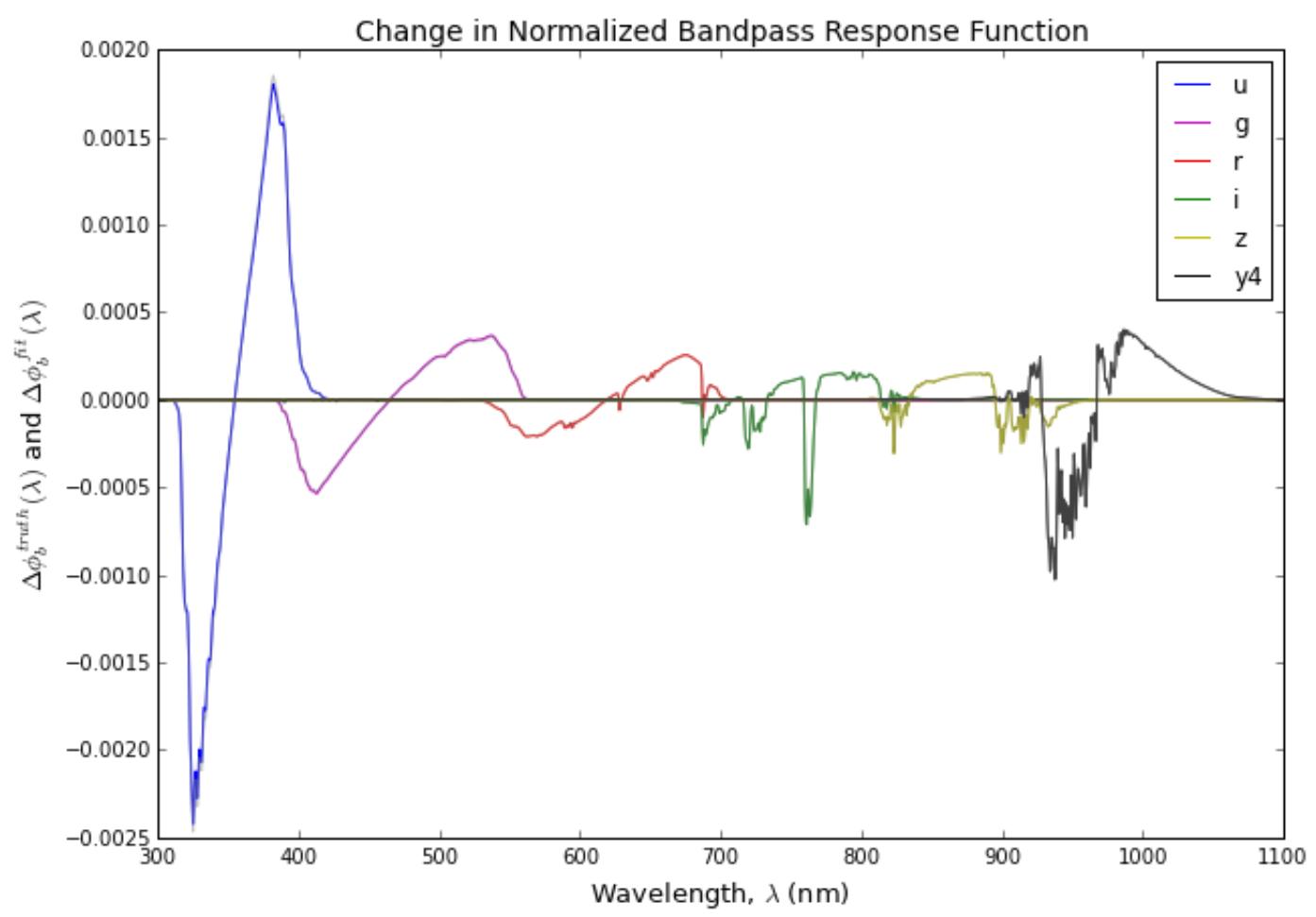
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_i_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_z_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

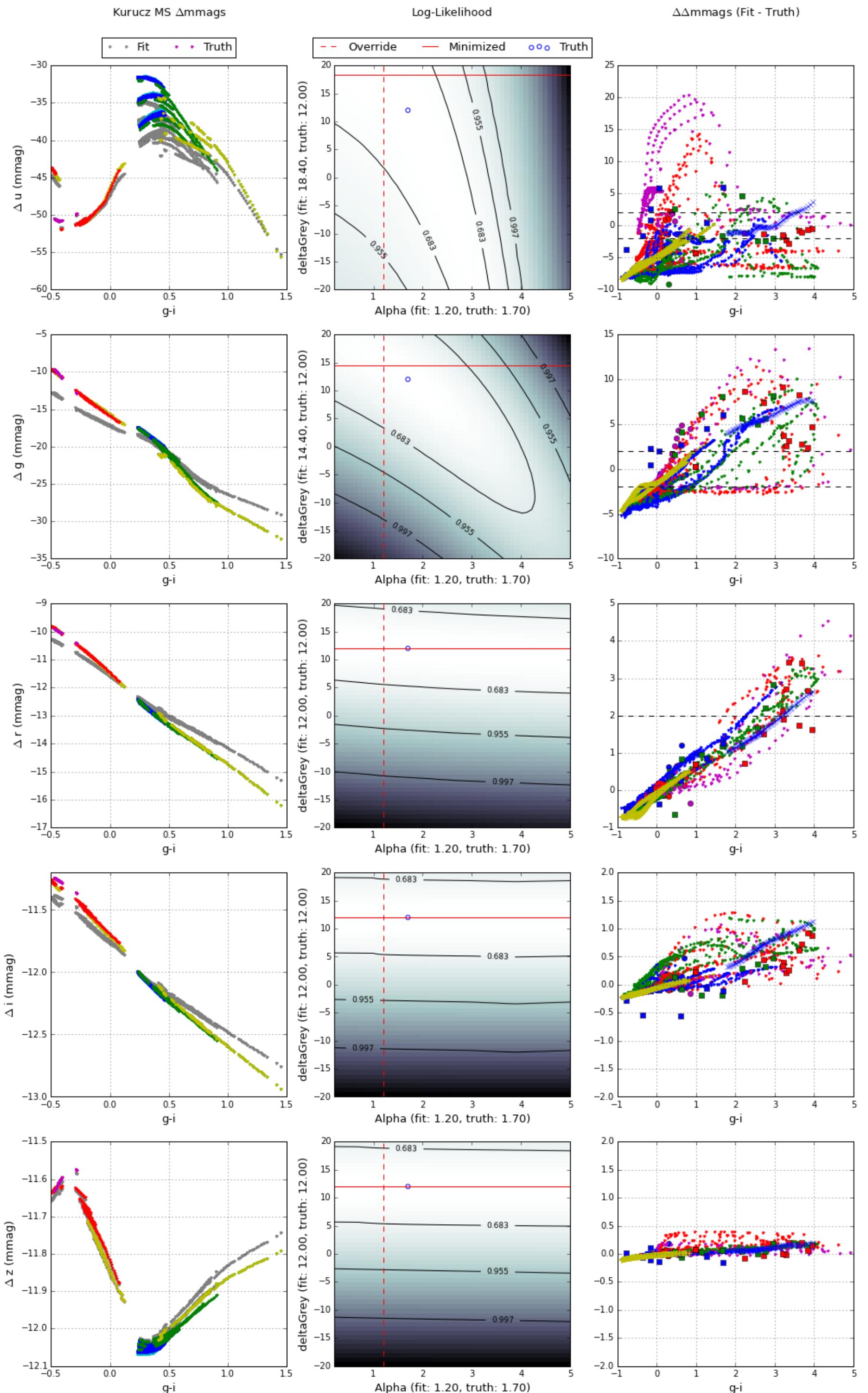
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_y4_51dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

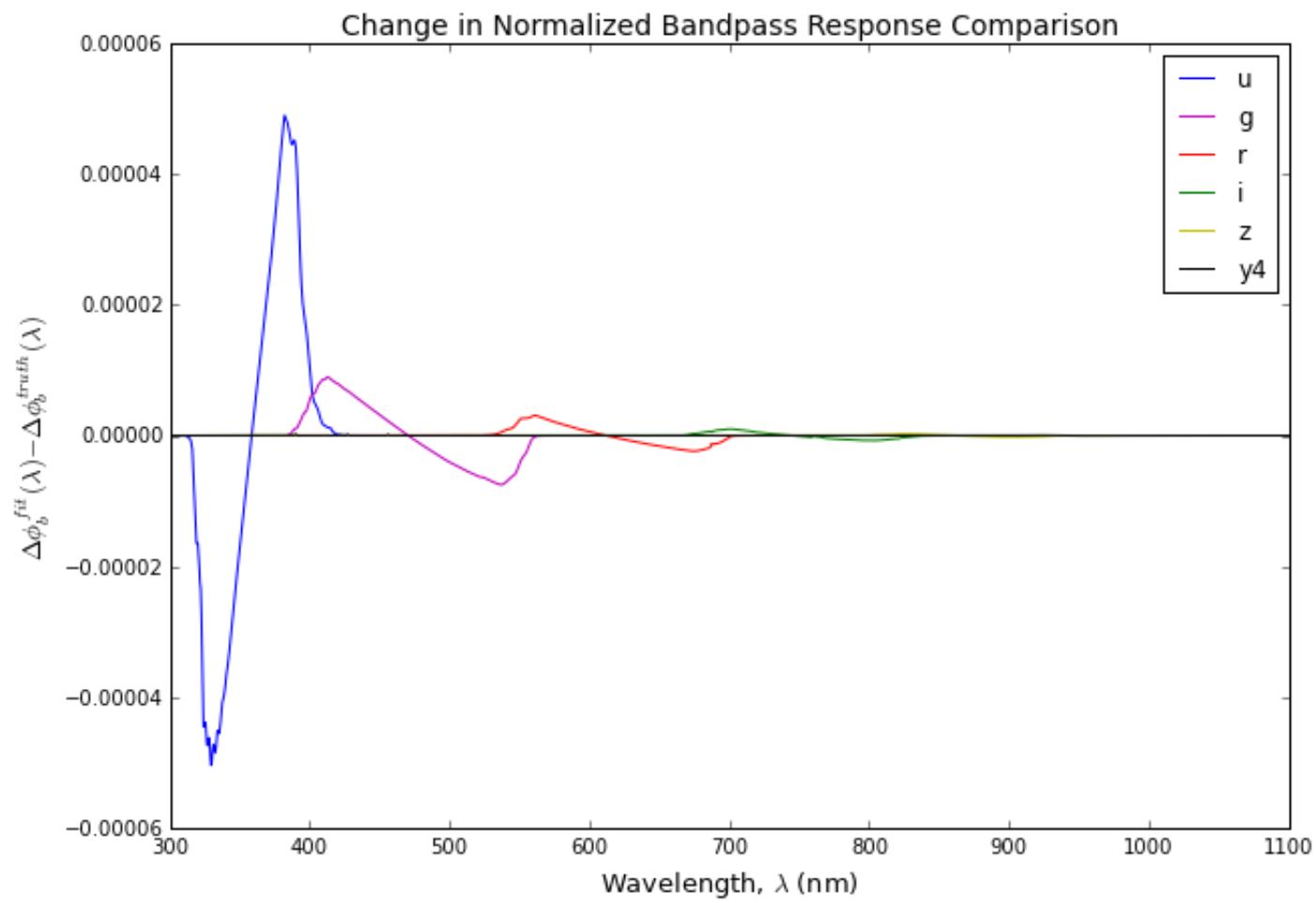
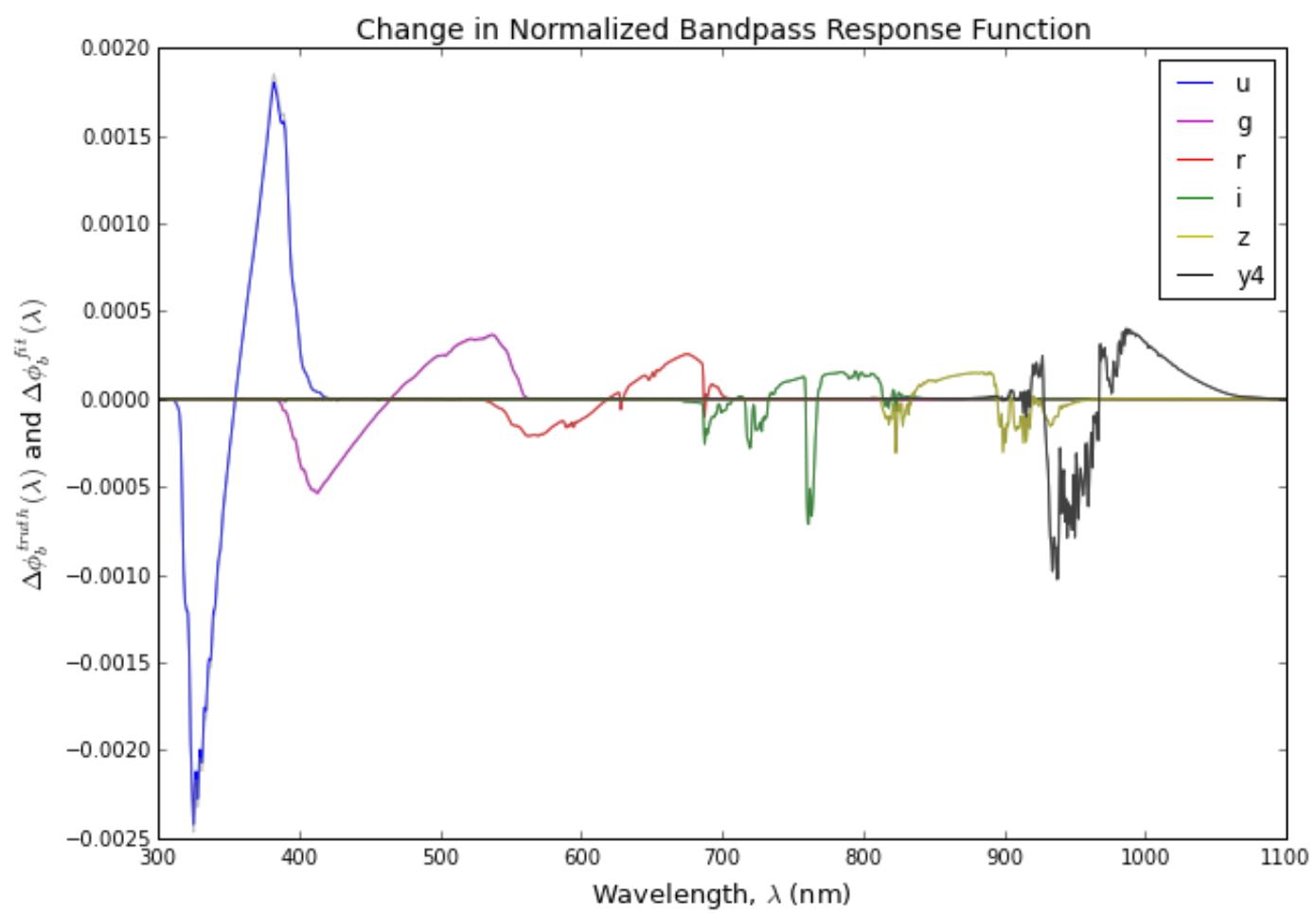
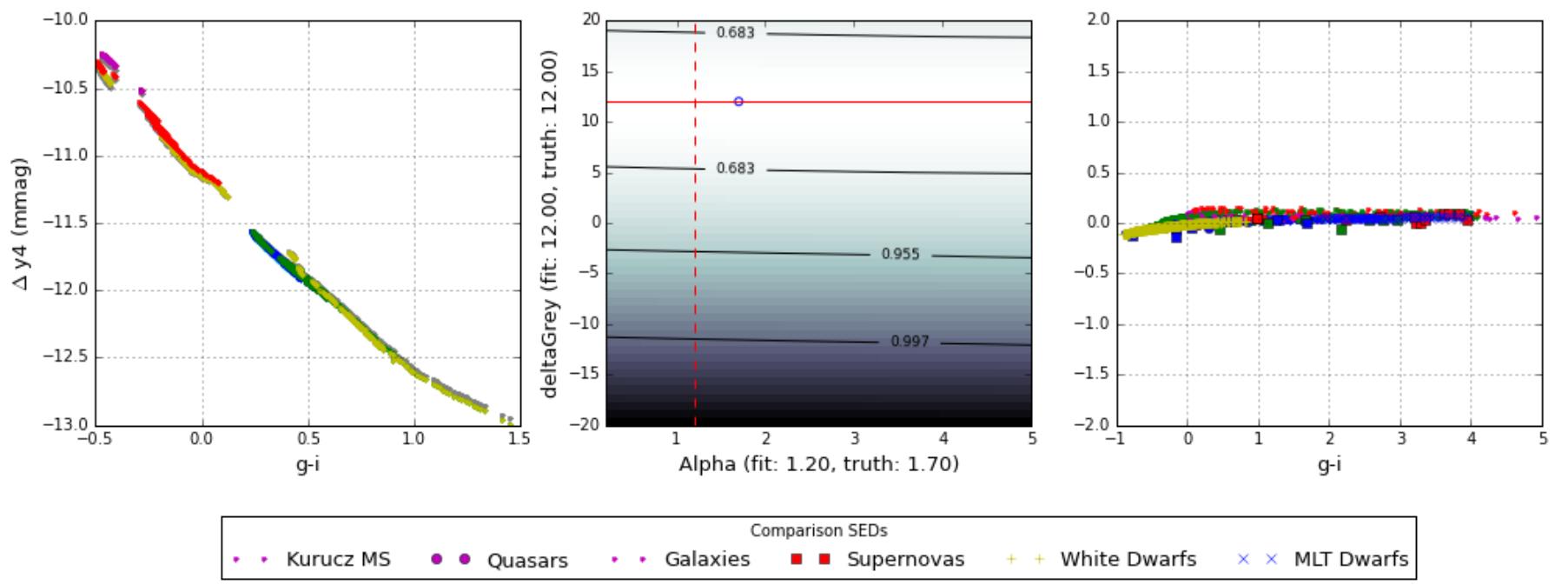
Best fit parameters (Filter, Alpha, dG, logL, Chi-Squared):
u 1.77 11.20 13.9092702578 27.8185405155
g 1.67 12.00 3.82554094856 7.65108189713
r 1.67 12.00 0.053569670344 0.107139340688
i 1.67 12.00 0.00142816021092 0.00285632042185
z 1.67 12.00 0.000101109475544 0.000202218951088
y4 1.67 12.00 7.87227808831e-05 0.000157445561766

Override best fit parameters (Filter, Alpha, dG):
u 0.80 20.00
g 0.80 16.80
r 0.80 12.80
i 0.80 12.00
z 0.80 12.00
y4 0.80 12.00

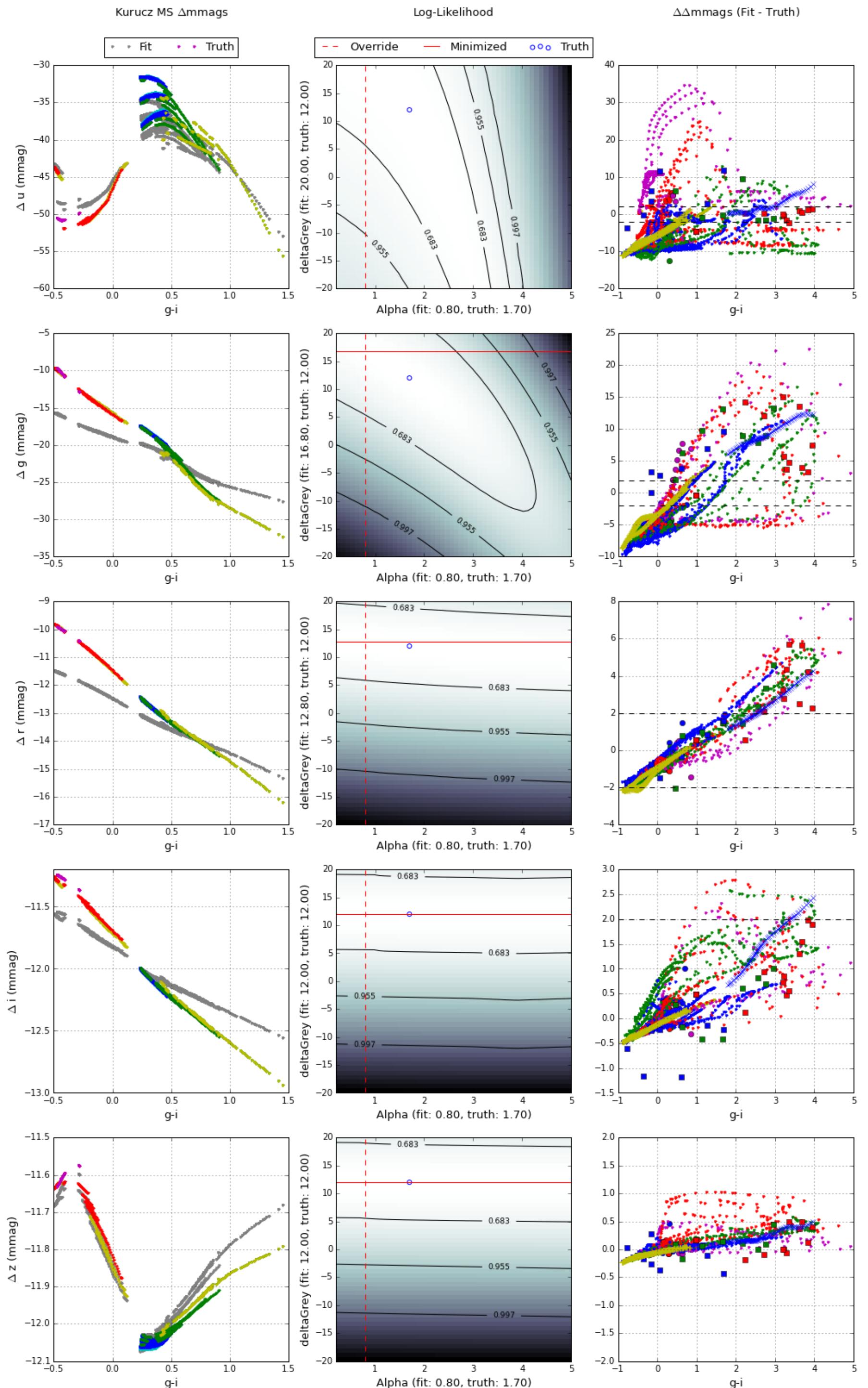


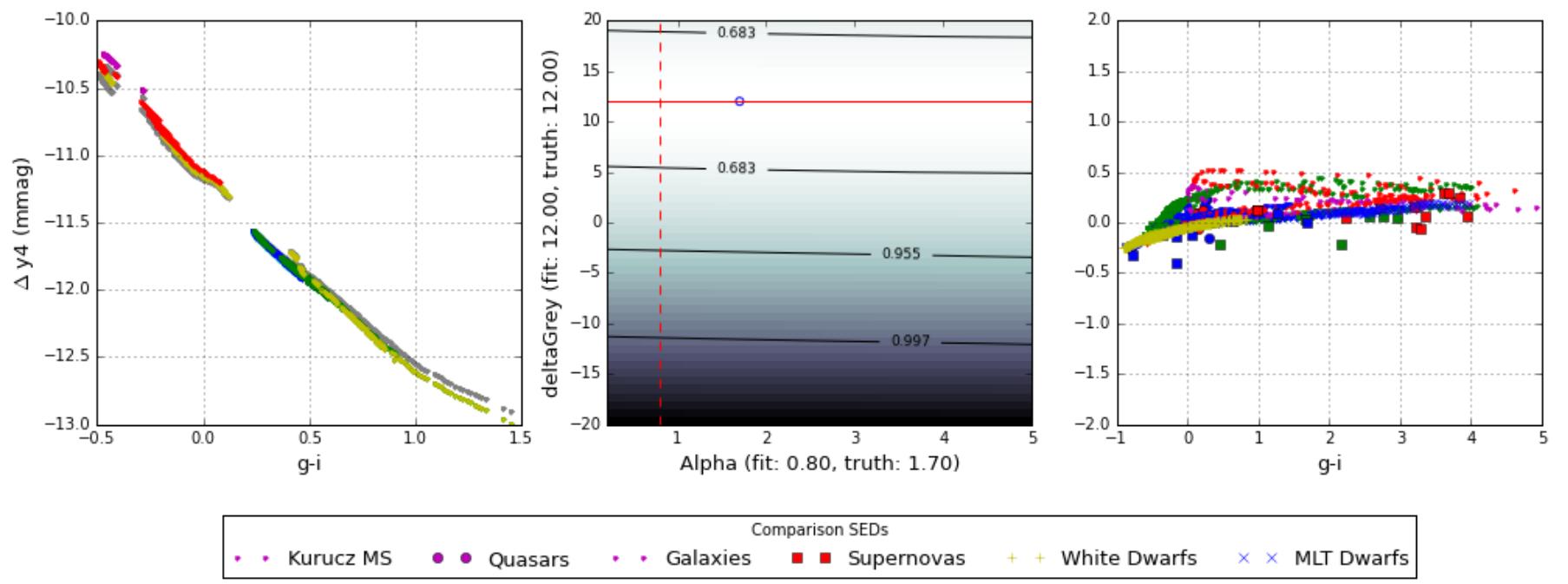
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter (δGrey : 12.0)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





```
In [16]: deltaGreyLimitPlot('Alpha',deltaGreyBins=50)
```

```
Computing nonlinear regression for Alpha.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
Observed atmosphere parameter for Alpha: 1.7

Fitting for Alpha between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_u_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_g_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_r_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_i_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_z_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_y4_50dgb_50b_max_dGTest_allMS_OR120.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

Best fit parameters (Filter, Alpha, dG, logL, Chi-Squared):
u 1.67 12.65 6.10019712163 12.2003942433
g 1.77 11.84 9.33592310151 18.671846203
r 1.87 11.84 1.096725045 2.19345009001
i 4.90 11.84 1.20888955527 2.41777911054
z 5.00 11.84 1.45861644248 2.91723288495
y4 5.00 11.84 0.93786641176 1.87573282352

Override best fit parameters (Filter, Alpha, dG):
u 1.20 18.37
g 1.20 14.29
r 1.20 12.65
i 1.20 11.84
z 1.20 11.84
y4 1.20 11.84

Computing nonlinear regression for Alpha.
Observed atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Observed atmosphere airmass: 2.0
Standard atmosphere parameters: [1.0, 1.0, 1.0, 1.0, 1.0, 1.7]
Standard atmosphere airmass: 1.2
```

Observed atmosphere parameter for Alpha: 1.7

Fitting for Alpha between 0.20 and 5.00 in 50 bins.
Fitting for deltaGrey between -20.00 and 20.00 mmags in 50 bins.

Regression SEDs: 4855 Kurucz MS SEDs.

Regressing 2500 parameter combinations per filter...
Magnitude Error: 5.0 mmags

Override triggered...
Override value detected, proceeding with deltaGrey best-fit minimization at new component best-fit value...

Calculating best fit parameters for u filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_u_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for u filter.
Saved Chi-Squared at best fit deltaGrey for u filter.
Completed u filter.

Calculating best fit parameters for g filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_g_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for g filter.
Saved Chi-Squared at best fit deltaGrey for g filter.
Completed g filter.

Calculating best fit parameters for r filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_r_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for r filter.
Saved Chi-Squared at best fit deltaGrey for r filter.
Completed r filter.

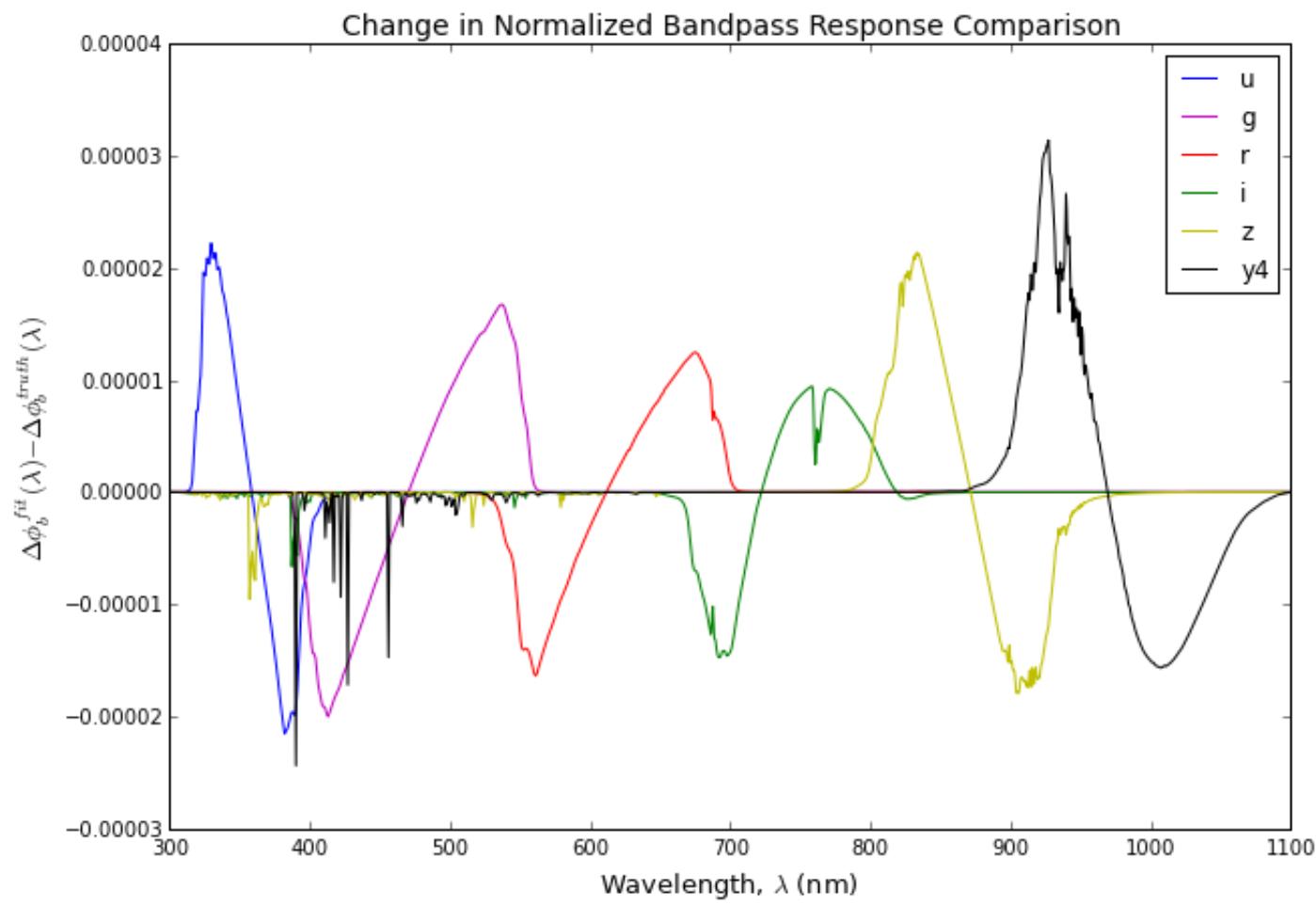
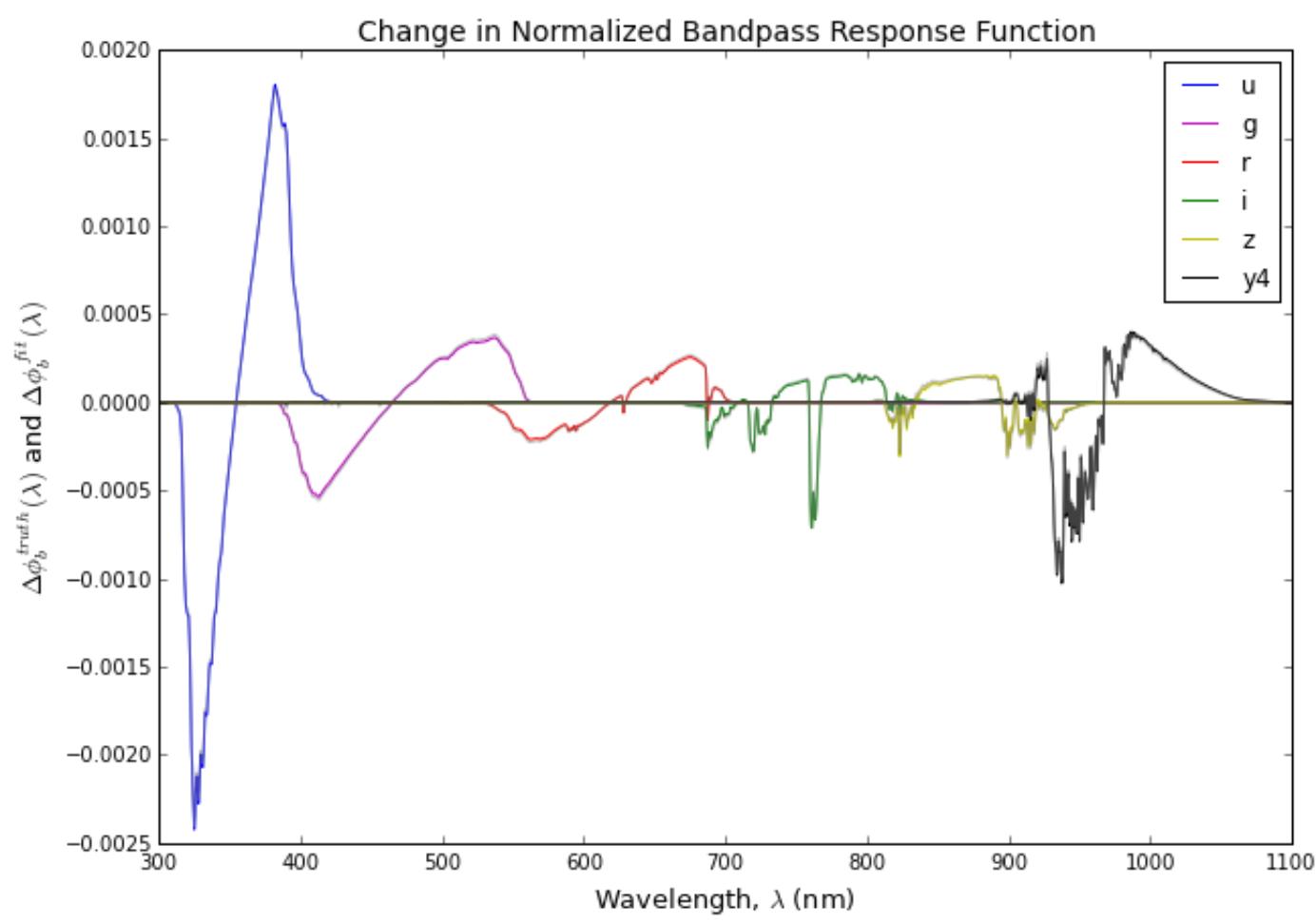
Calculating best fit parameters for i filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_i_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for i filter.
Saved Chi-Squared at best fit deltaGrey for i filter.
Completed i filter.

Calculating best fit parameters for z filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_z_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for z filter.
Saved Chi-Squared at best fit deltaGrey for z filter.
Completed z filter.

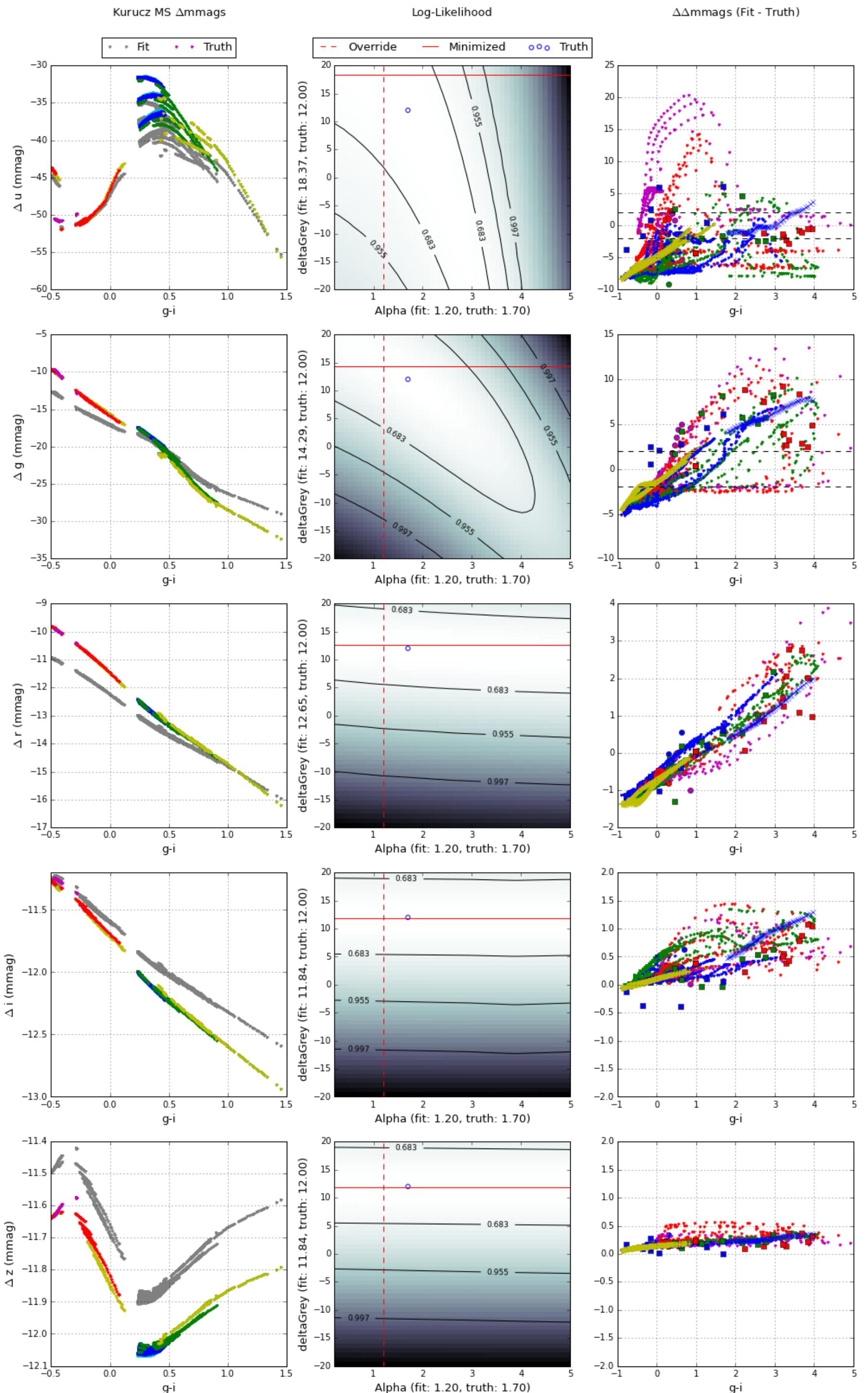
Calculating best fit parameters for y4 filter...
@pickle_results: computing results and saving to 'pickles/X20_P101010101017_Alpha_dG_XSTD12_DG120_DG_R-2020_E5_mss_y4_50dgb_50b_min_dGTest_allMS_OR80.pkl'
Saved LogL at best fit deltaGrey for y4 filter.
Saved Chi-Squared at best fit deltaGrey for y4 filter.
Completed y4 filter.

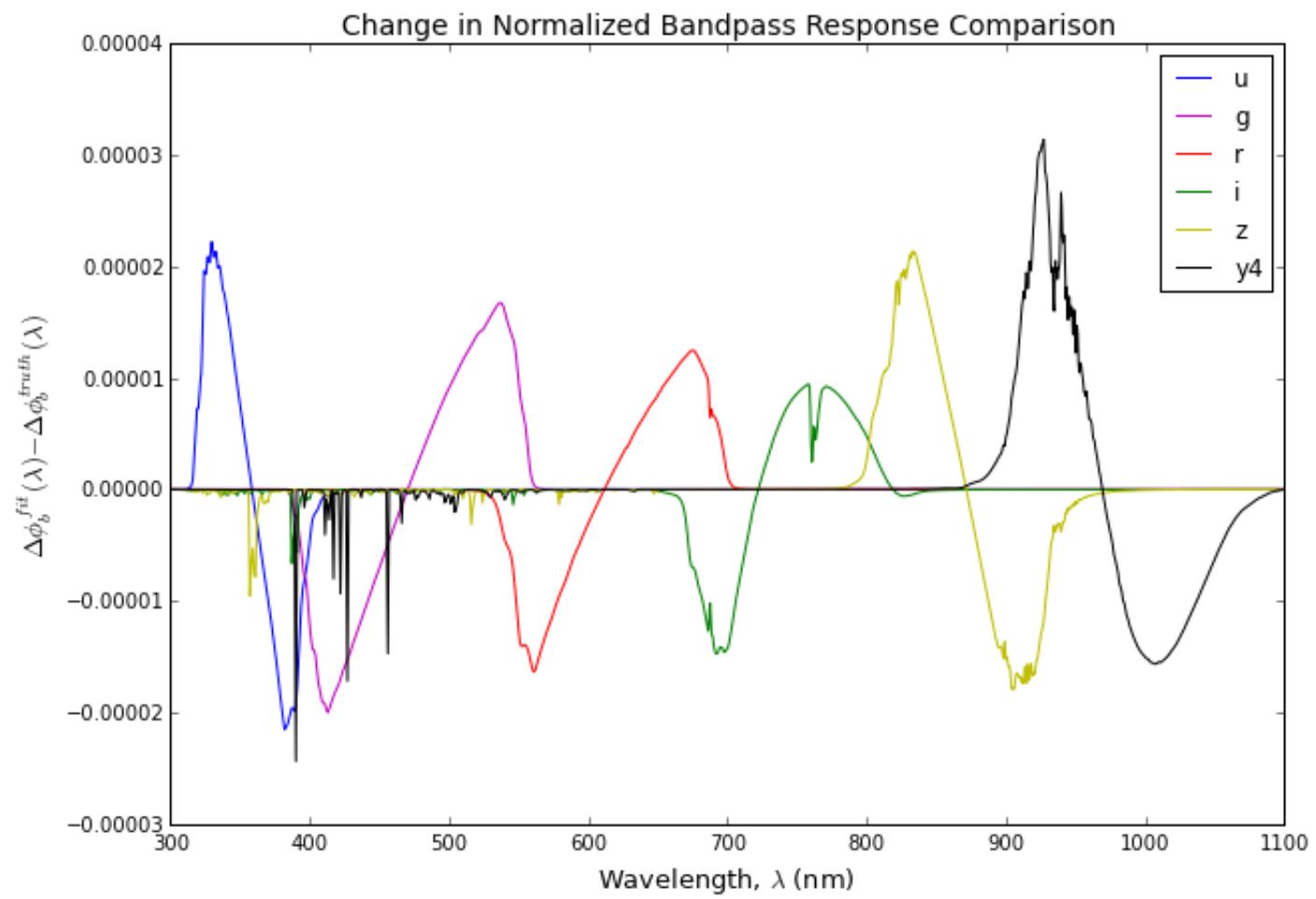
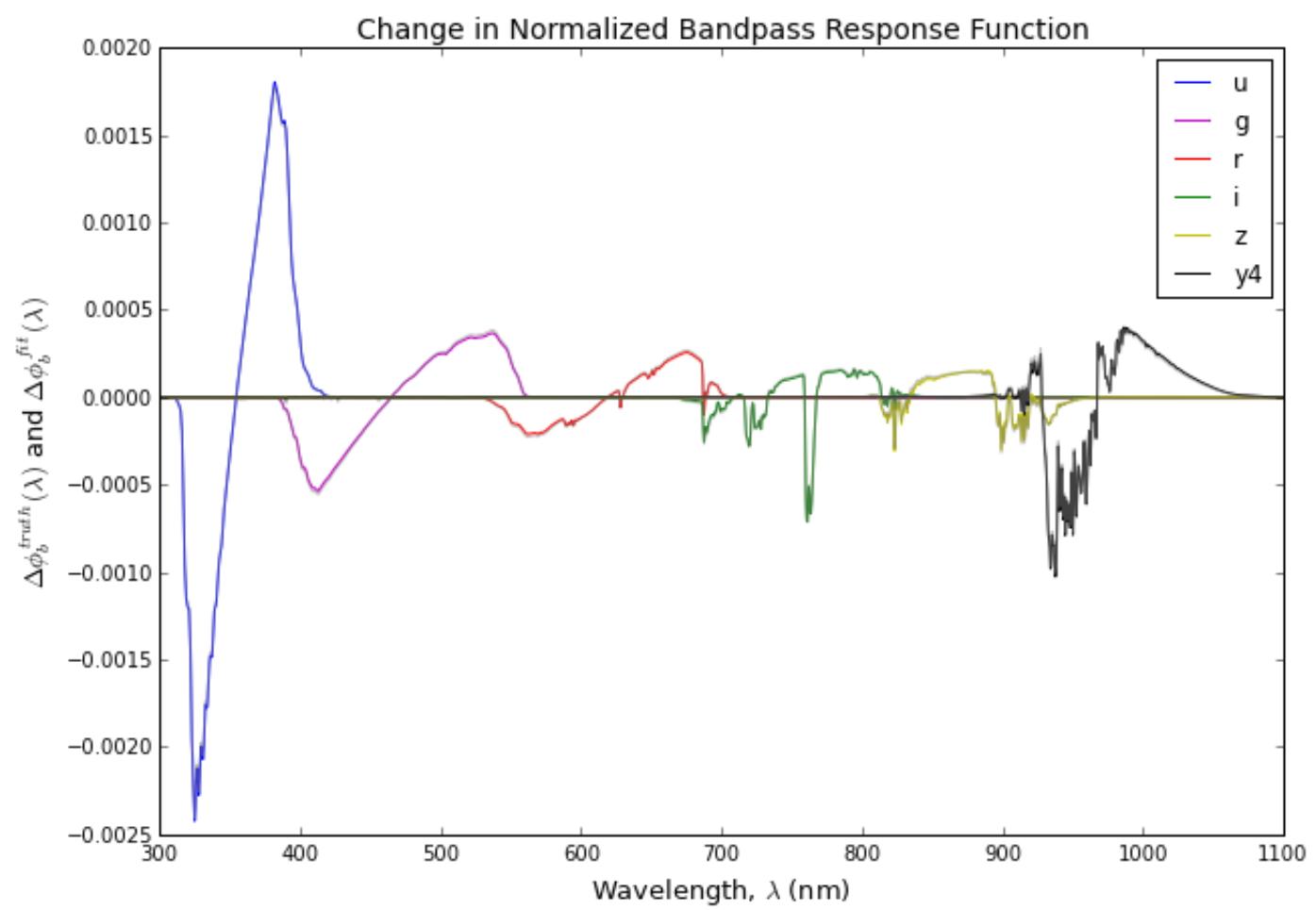
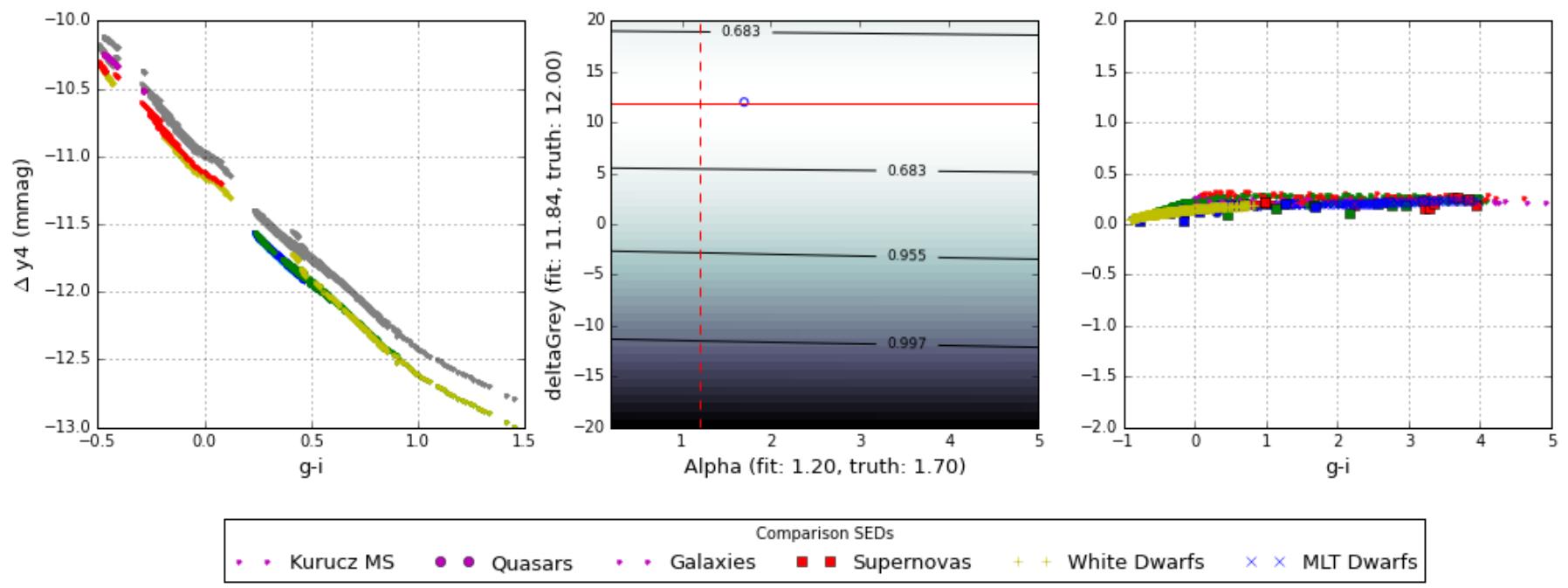
Best fit parameters (Filter, Alpha, dG, logL, Chi-Squared):
u 1.67 12.65 6.10019712163 12.2003942433
g 1.77 11.84 9.33592310151 18.671846203
r 1.87 11.84 1.096725045 2.19345009001
i 4.90 11.84 1.20888955527 2.41777911054
z 5.00 11.84 1.45861644248 2.91723288495
y4 5.00 11.84 0.93786641176 1.87573282352

Override best fit parameters (Filter, Alpha, dG):
u 0.80 20.00
g 0.80 16.73
r 0.80 12.65
i 0.80 11.84
z 0.80 11.84
y4 0.80 11.84

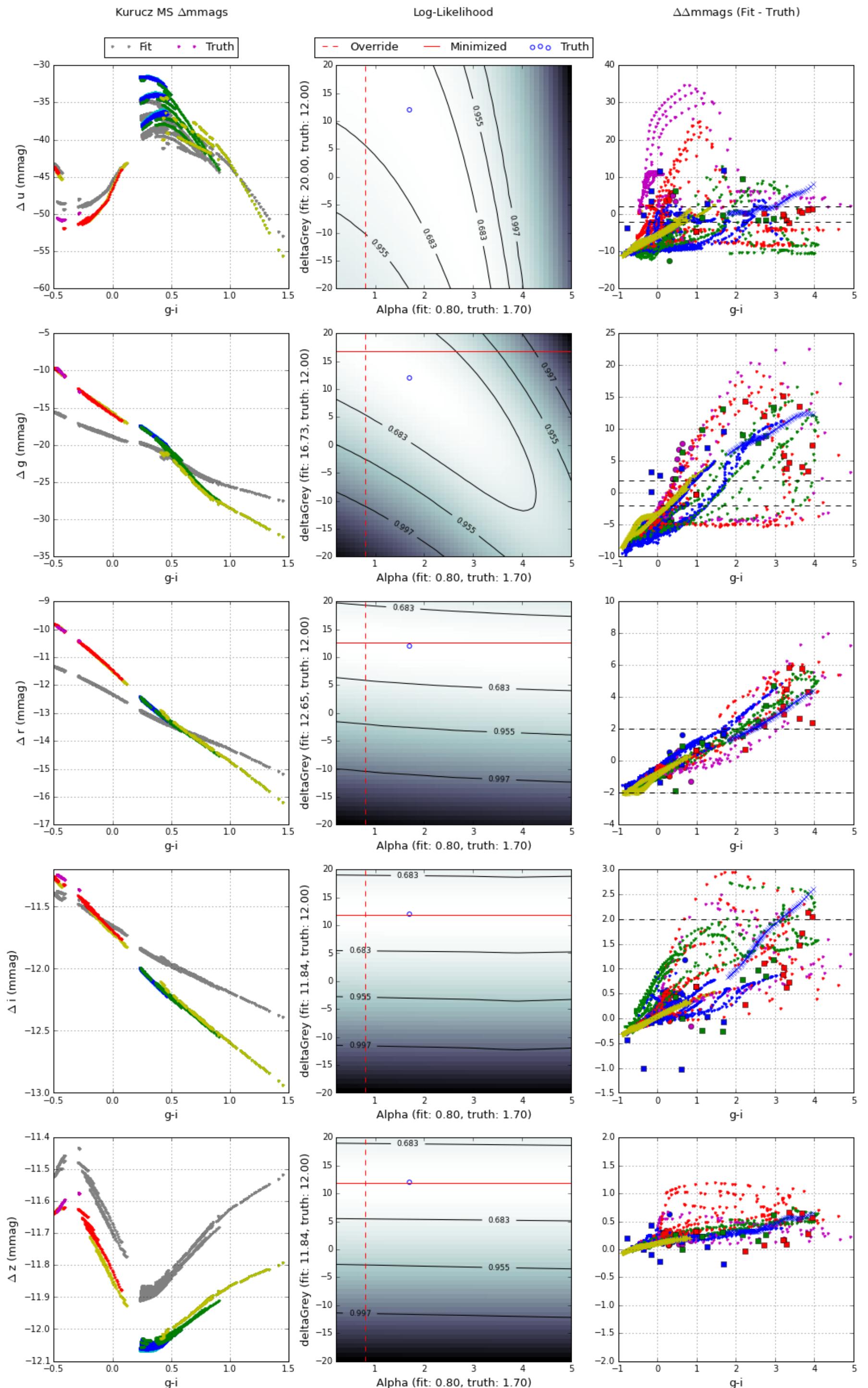


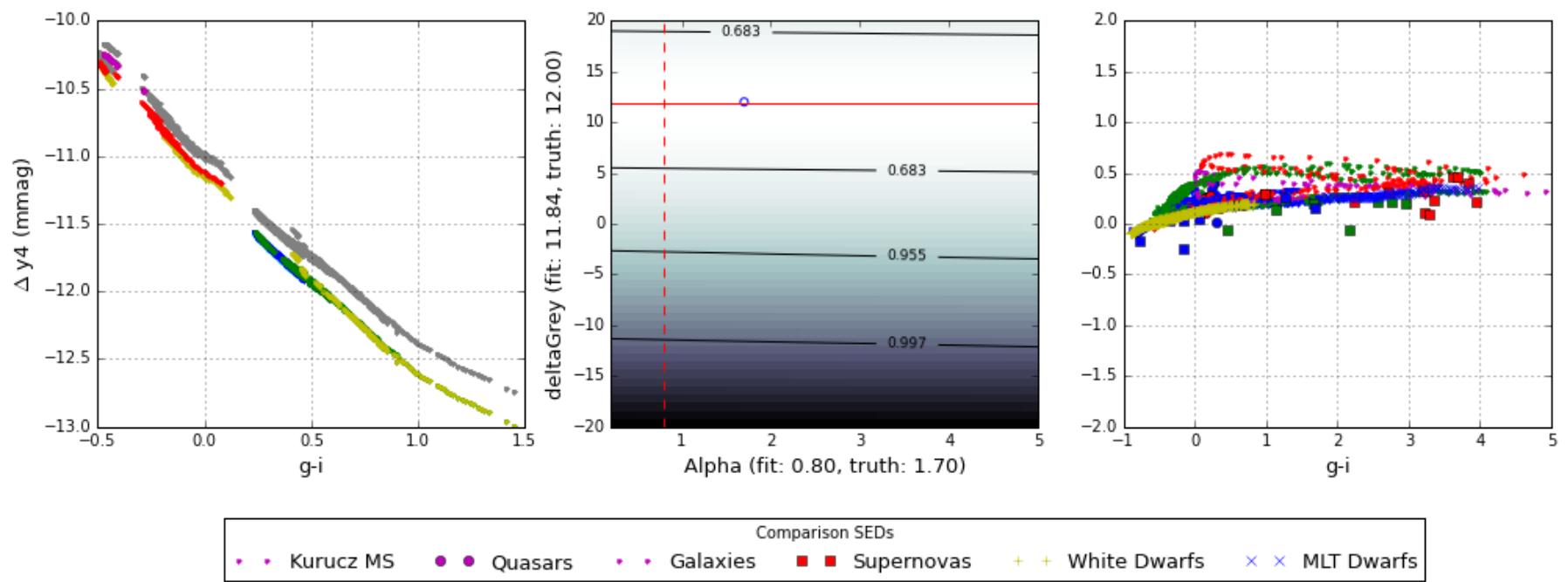
Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter (δGrey : 12.0)





Δmmags , Regression Contours, $\Delta\Delta\text{mmags}$ for each LSST filter ($\delta\text{Grey} = 12.0$)





In []: