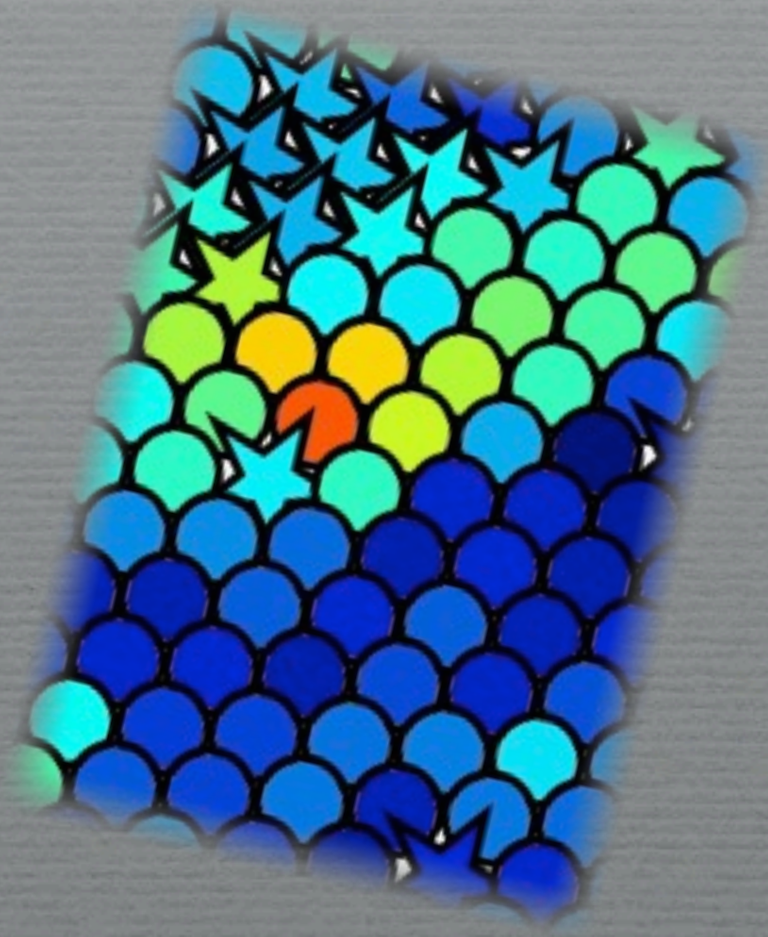
IPHAS
Global Photometric Calibration (GPC)
update



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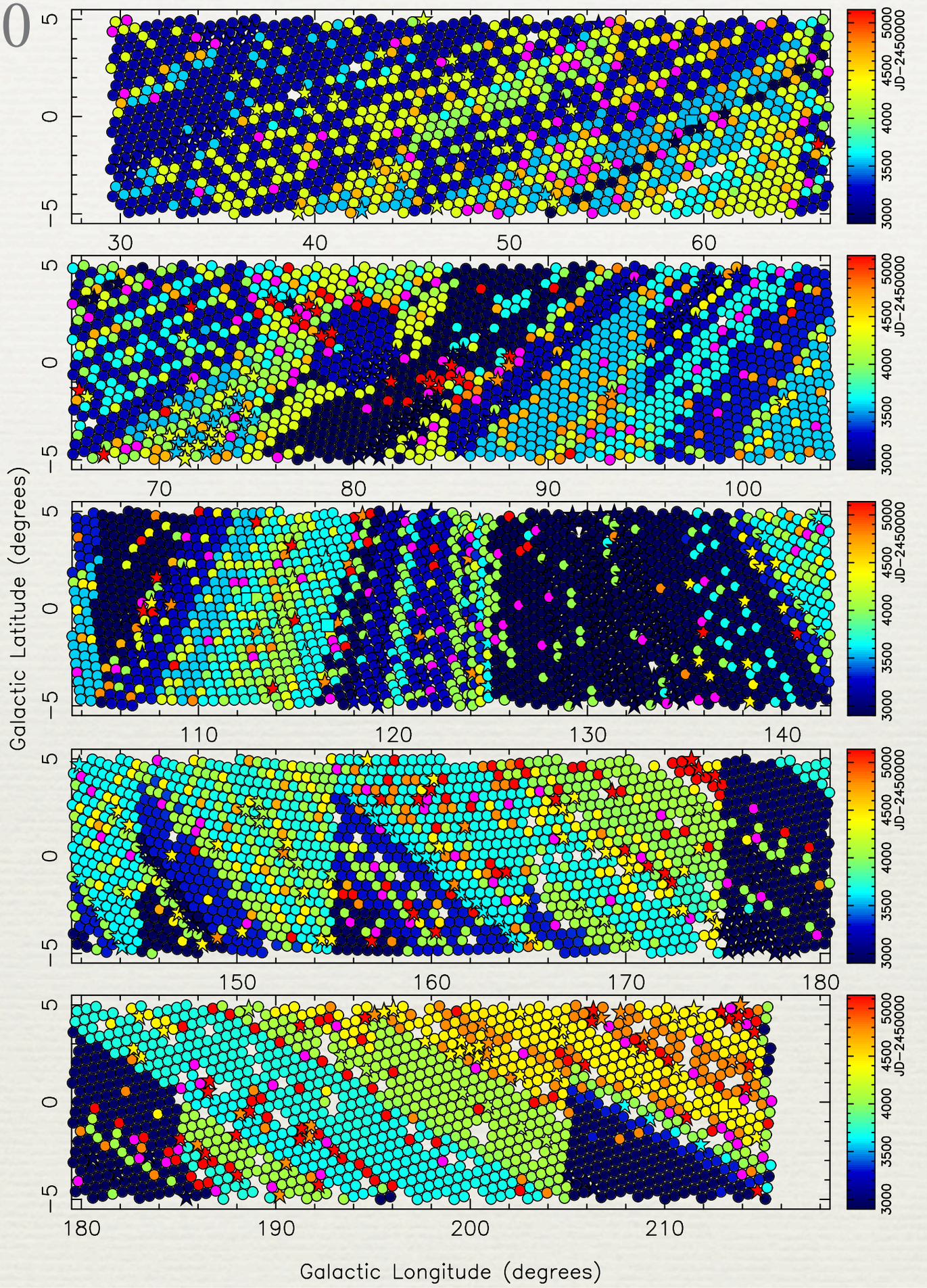
S·A·L·T

GPC Status

- Last calibration run done in April 2011
- (not the very best selection of fields, but very good)
- Binary tables (catalogue photometry) recently regenerated thanks to Eduaro Gonzalez-Solares
- Better band matching and photometric errors
- Global calibration of new tables is forthcoming...
- Miszalski, Drew et al. (in prep) - demonstrate the calibration works, but not final photometric catalogue
- Interim release with new calibration to be made before final IPHAS release

JD-2450000

- Survey is naturally quite heterogeneous (2003-2009)
- Most recent fields used + some modifications
- ~220 field pairs (2.9%) are from different runs (magenta)
- ~120 pairs missing (1.6%)



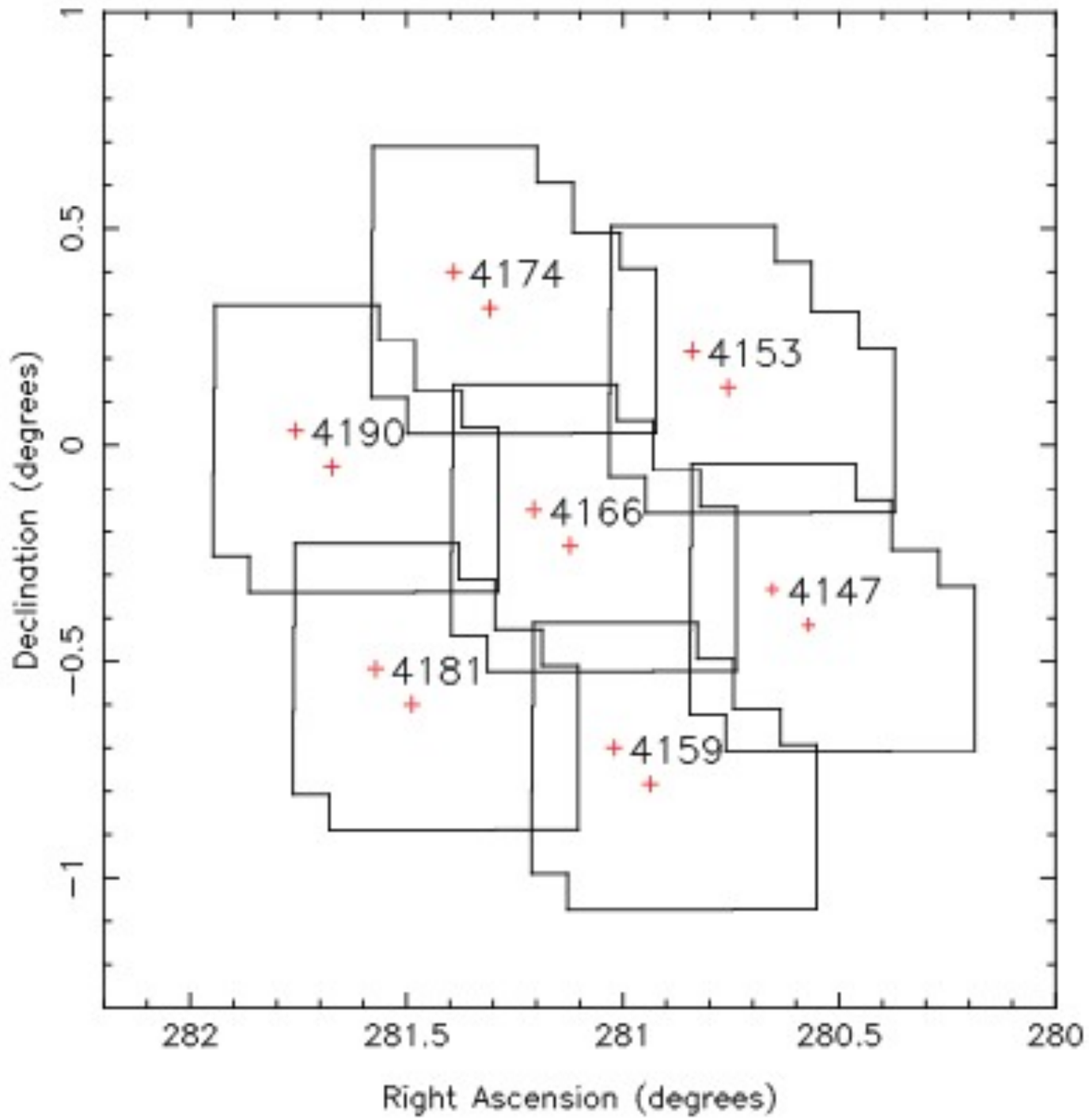


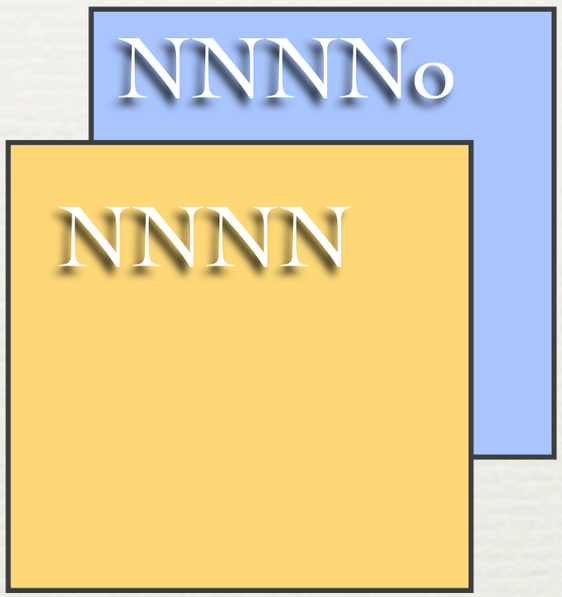
Figure 1. Individual survey fields (NNNN) and their offsets (NNNNo) are joined in the GPC to reduce the complexity of the problem.

- Field pairs are combined
- Deals with short-term weather variations
- Reduces overall problem complexity
- Shift `poorer' field to match `better' field (ZP closest to photometric value)

Processing (abridged)

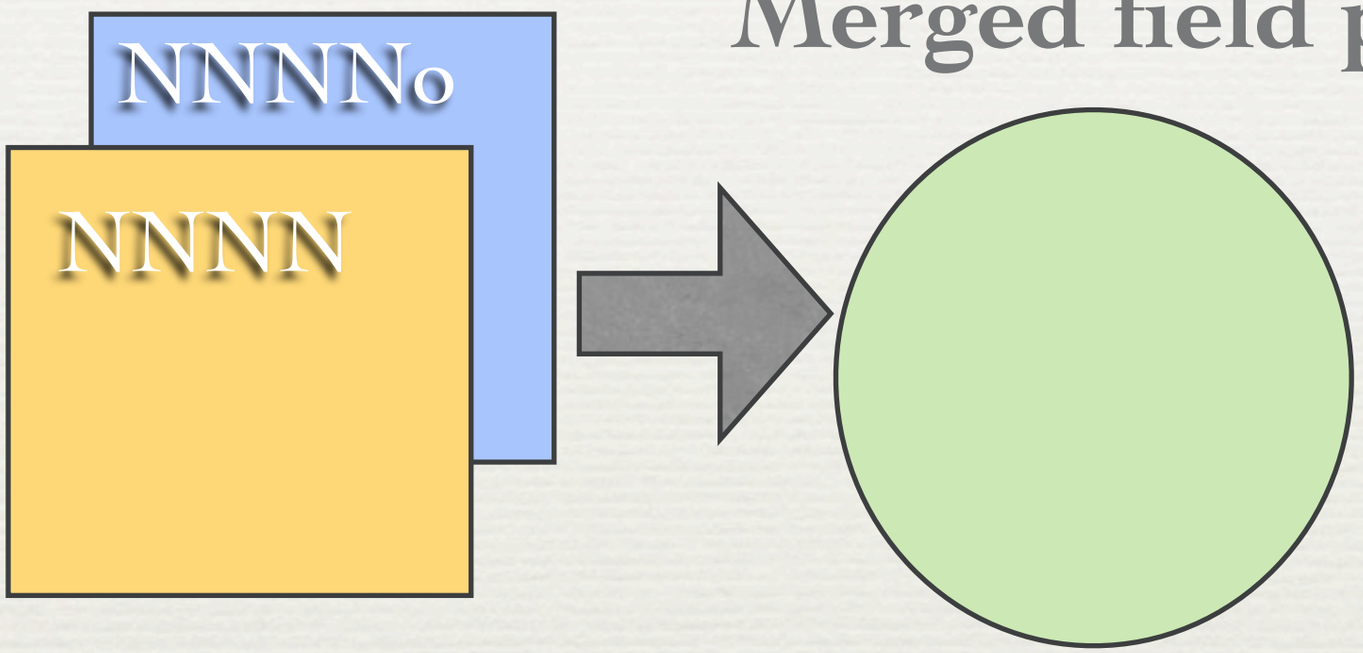
Processing (abridged)

Merged binary tables



Processing (abridged)

Merged binary tables



Processing (abridged)

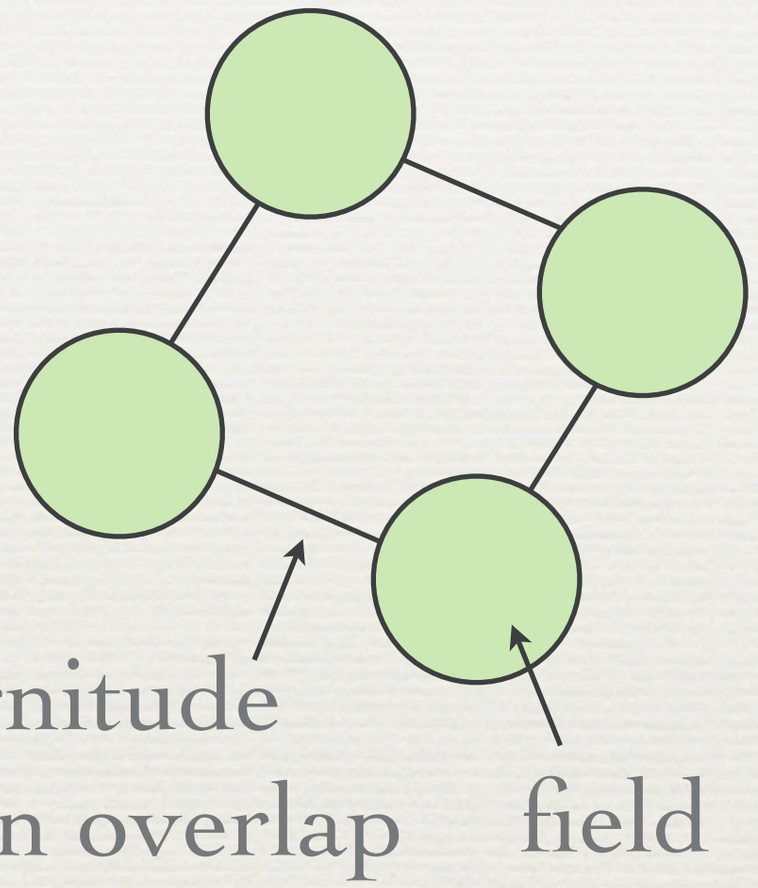
Merged binary tables

NNNNo

NNNN

Merged field pair

C++ Graph



magnitude

offset in overlap

field

Processing (abridged)

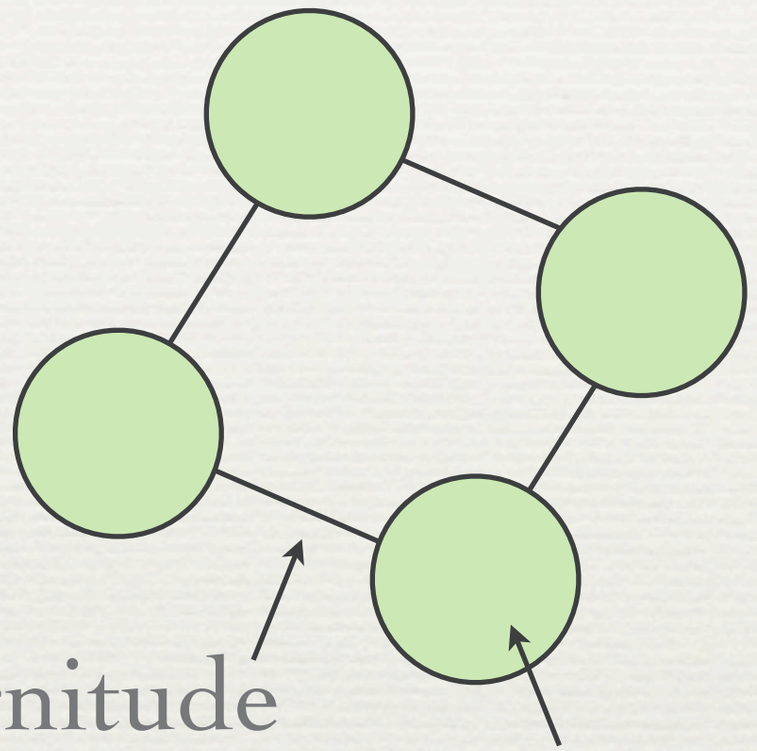
Merged binary tables

NNNNo

NNNN

Merged field pair

C++ Graph



STILTS xmatch with 0.4" radius

removed stars 12 pixels from edge + corner of chip 3

weighted mean for overlaps (15 < m < 18 mag)

apply Glazebrook et al. (1994) method to r',i',Hα

We utilise the general method introduced by Glazebrook et al. (1994) that finds the ZP shift to be applied to each field by minimising the sum:

$$S = \sum_{i=1}^{N} \sum_{j=1}^{N} w_{ij}\theta_{ij}(\Delta_{ij} + a_i - a_j)^2 \qquad (2)$$

where i denotes the field of interest, j an overlapping field, N the number of fields, a_i the ZP to solve for and a_j the ZP of an overlapping field ($\Delta \mathrm{ZP}_{ij} = a_i - a_j$), w_{ij} are weights (either unity or the error in Δ_{ij}) and θ_{ij} is an overlap function equal to either 1 if fields i and j overlap or 0 otherwise. Solving for a_i is equivalent to solving $\partial S/\partial a_i = 0$ which gives the matrix equation:

$$\sum_{j=1}^{N} A_{ij} a_j = b_j \qquad (3)$$

where

$$A_{ij} = \delta_{ij} \sum_{k=1}^{N} w_{jk}\theta_{jk} - w_{ij}\theta_{ij}, \qquad (4)$$

$$b_i = \sum_{j=1}^{N} w_{ij}\theta_{ij}\Delta_{ji} = -\sum_{j=1}^{N} w_{ij}\theta_{ij}\Delta_{ij}. \qquad (5)$$

Processing (more details)

Use iterative conjugate gradient method to calculate pseudo-inverse

=> apply solutions as shifts to zeropoints of each field

more details

- Use a sample of carefully selected anchors to tie down solution
- A few hundred carefully selected photometric field pairs with no obvious problems
- Calibrate each waveband separately
- Rely on anchors to provide (roughly) correct colour-colour planes
- minor tweaking may be required (e.g. G. Barentsen)

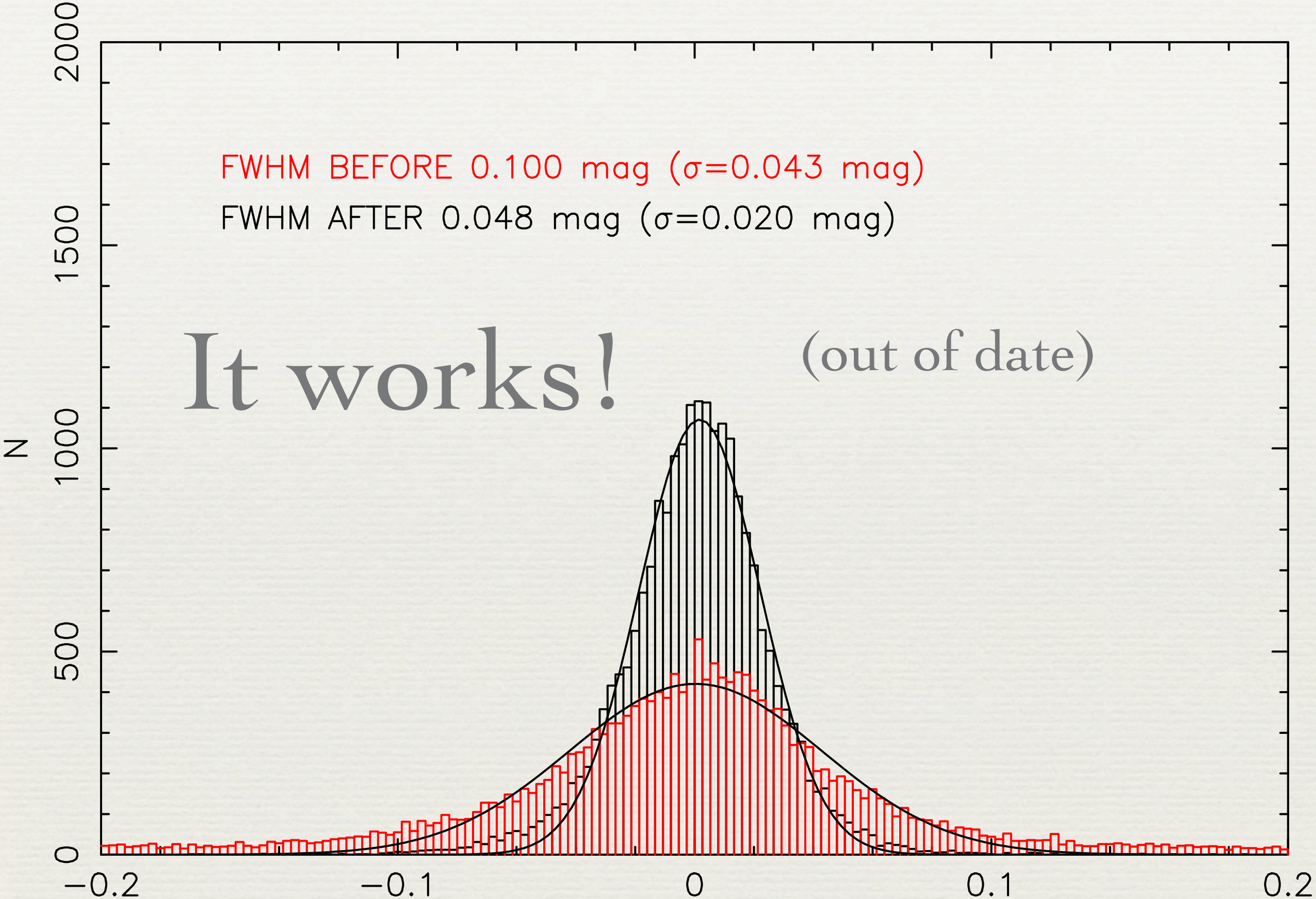
All Overlaps

FWHM BEFORE 0.100 mag (σ=0.043 mag)

FWHM AFTER 0.048 mag (σ=0.020 mag)

It works!

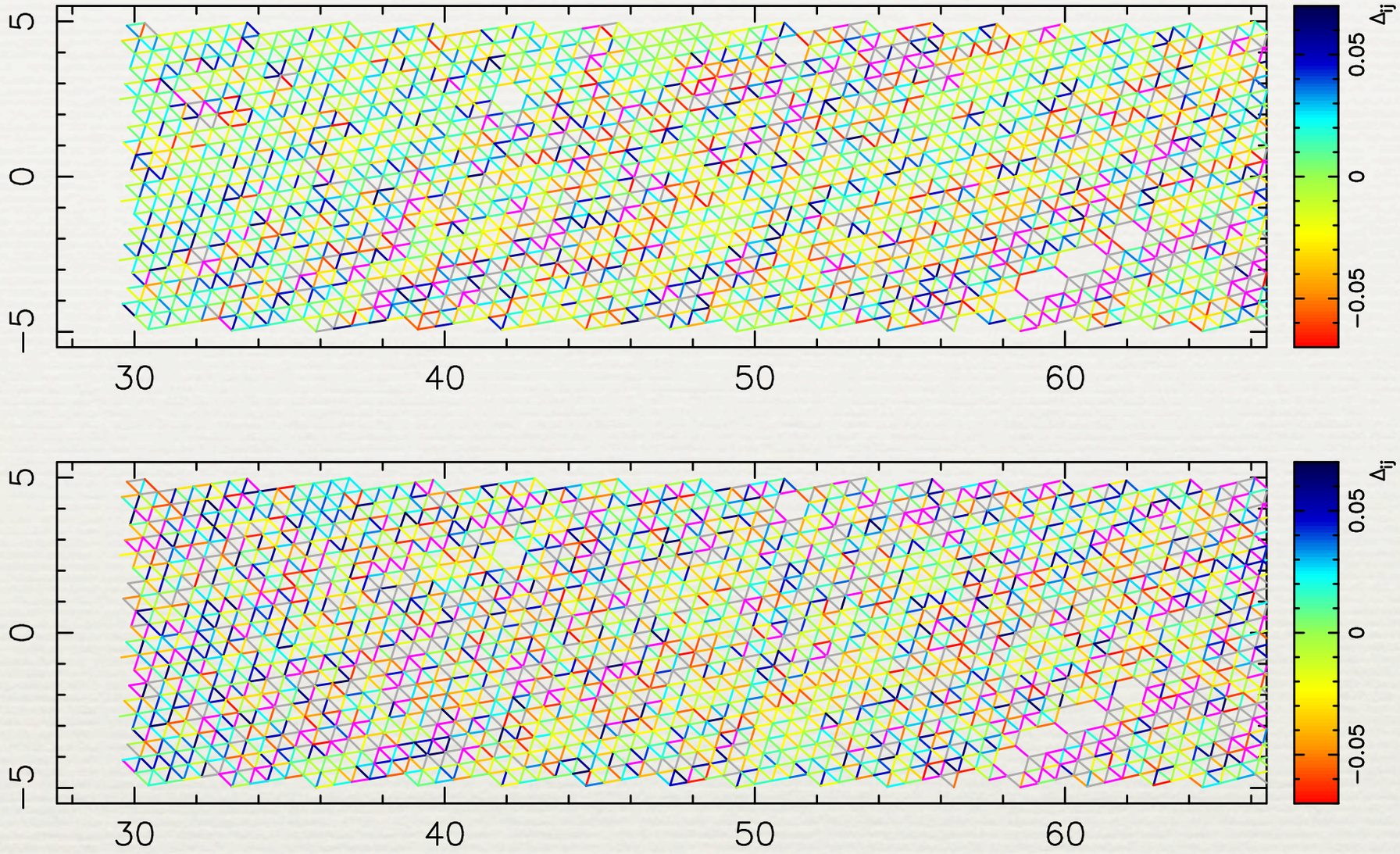
(out of date)



OVERLAP MAGNITUDE OFFSET

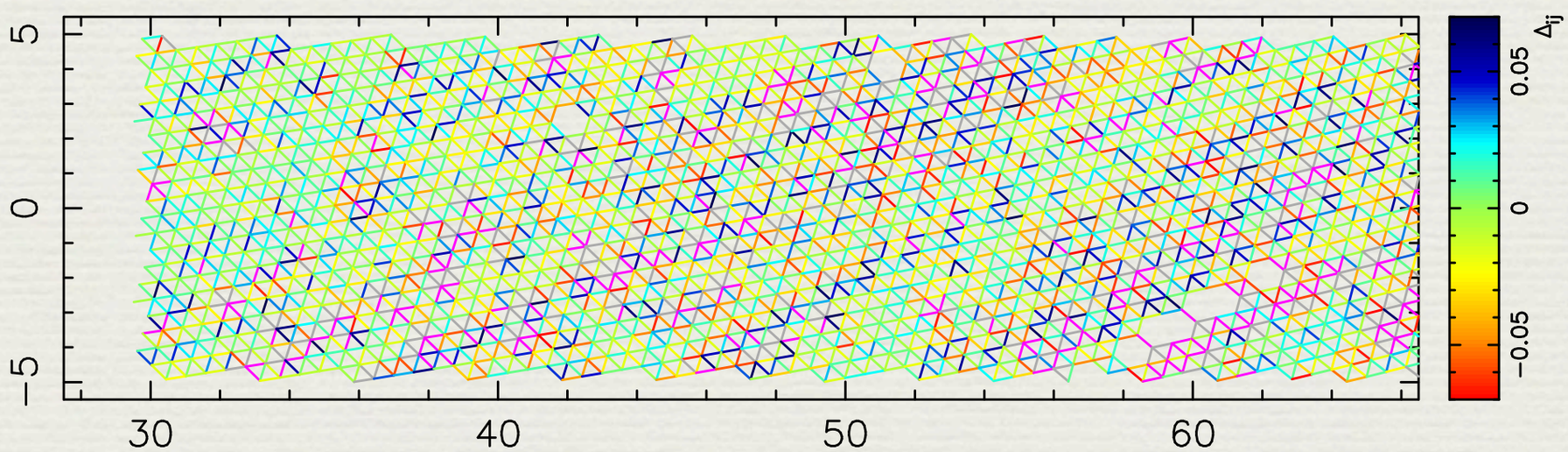
RMS (overlaps) (out of date)

Waveband	σ (before)	σ (after)
r’	0.048	0.020
i’	0.057	0.024
Hα	0.054	0.023


5
0
−5
30
40
50
60
Δ_{ij}
0.05
0
−0.05

r'

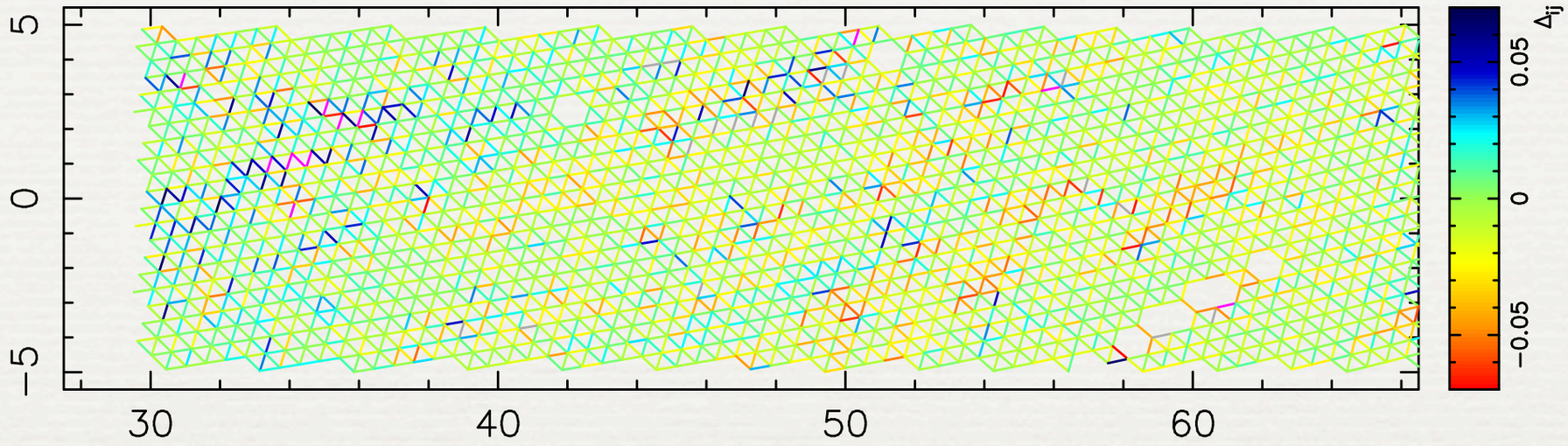
BEFORE


5
0
−5
30
40
50
60
Δ_{ij}
0.05
0
−0.05

i'

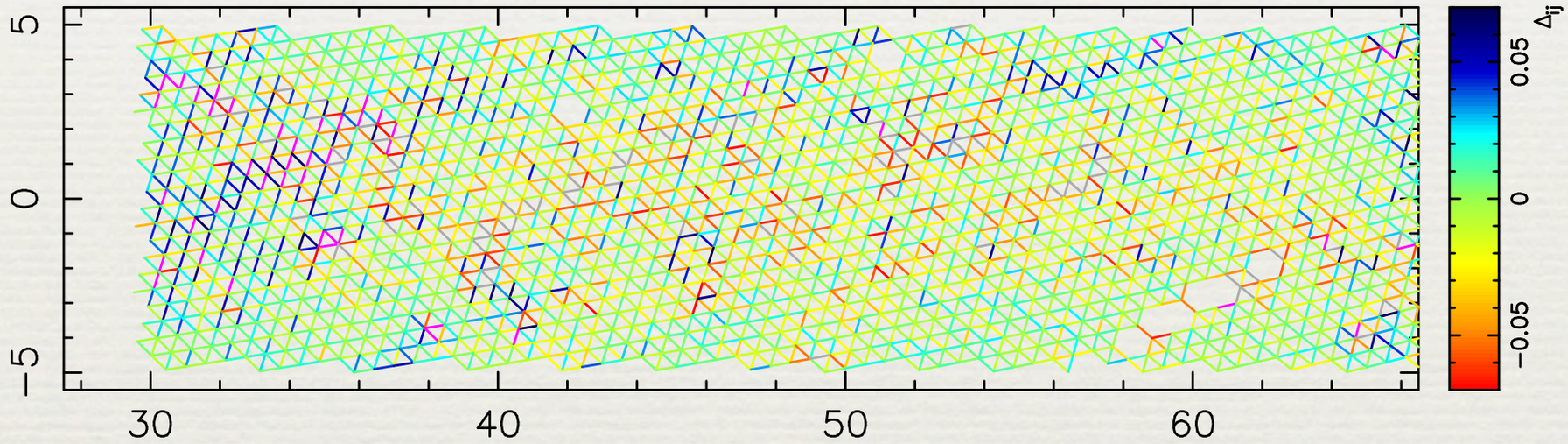
5
0
−5
30
40
50
60
Δ_{ij}
0.05
0
−0.05

Hα

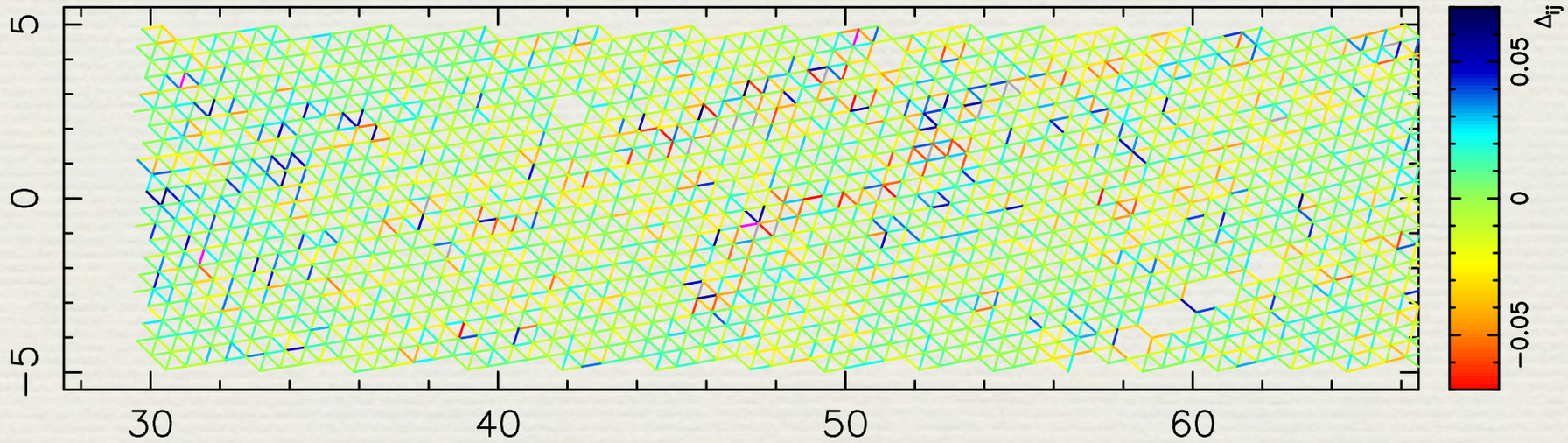

5
0
−5
30
40
50
60
Δ_{ij}
0.05
0
−0.05

r’

AFTER

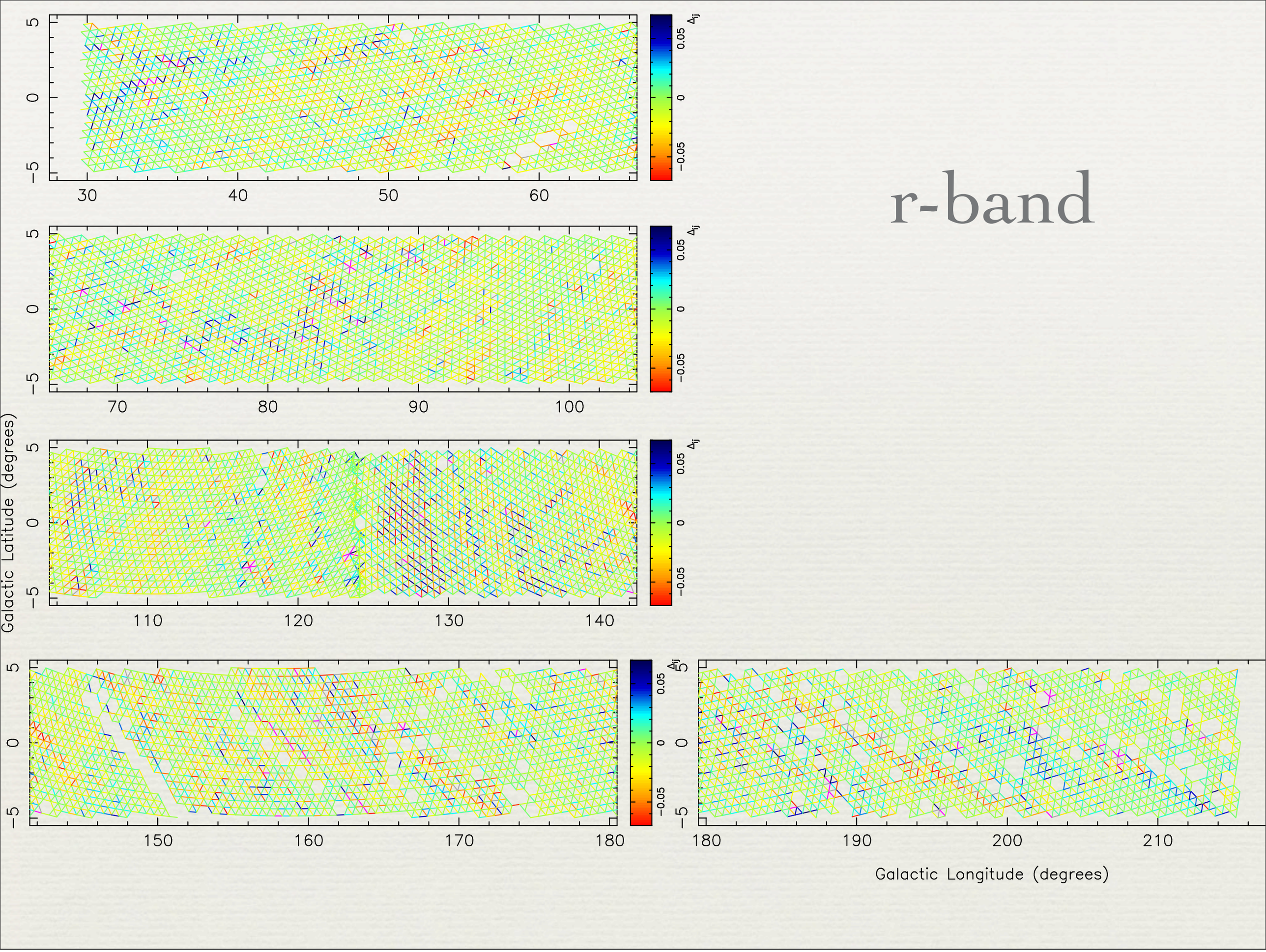

5
0
−5
30
40
50
60
Δ_{ij}
0.05
0
−0.05

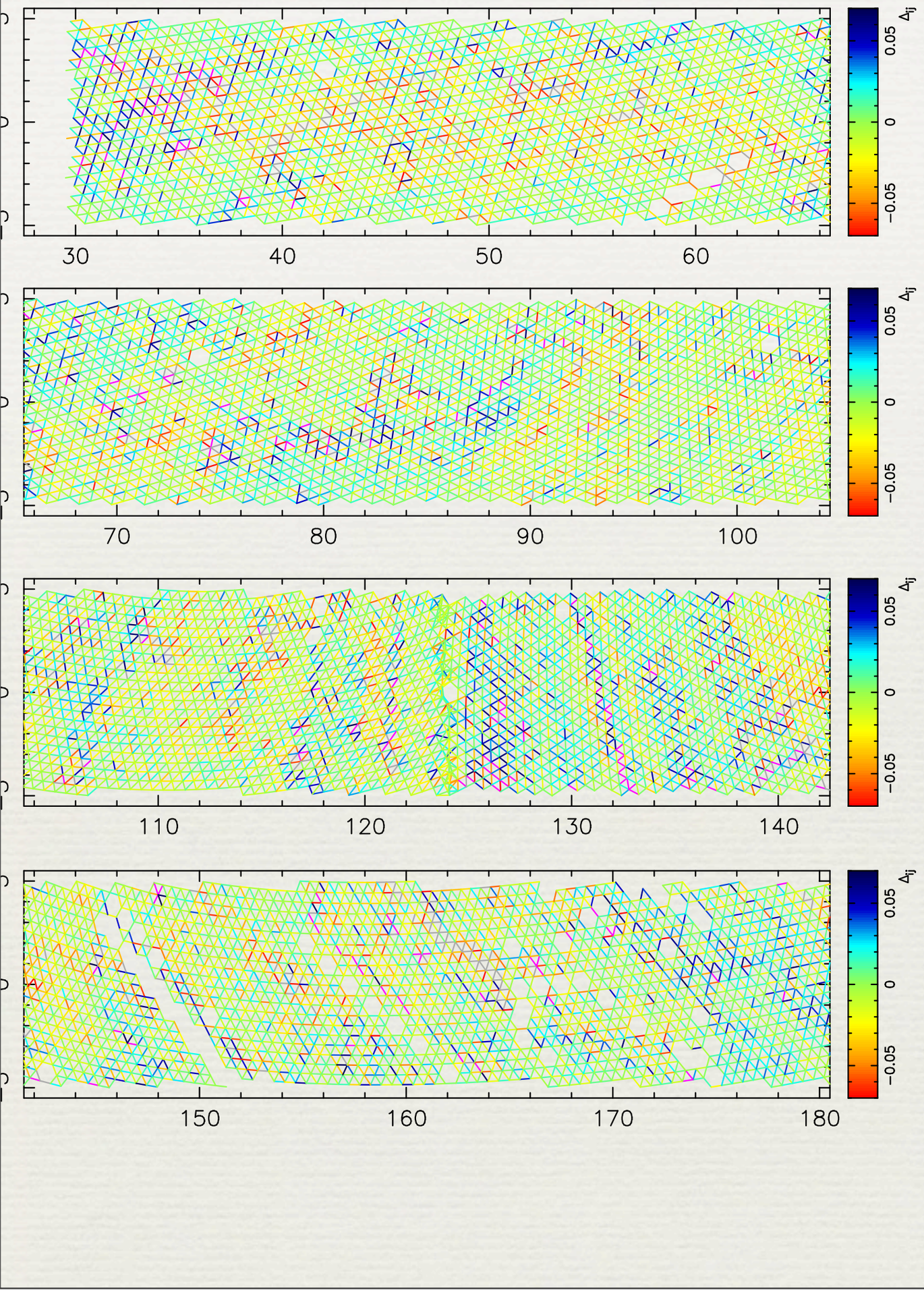
i’


5
0
−5
30
40
50
60
Δ_{ij}
0.05
0
−0.05

Hα

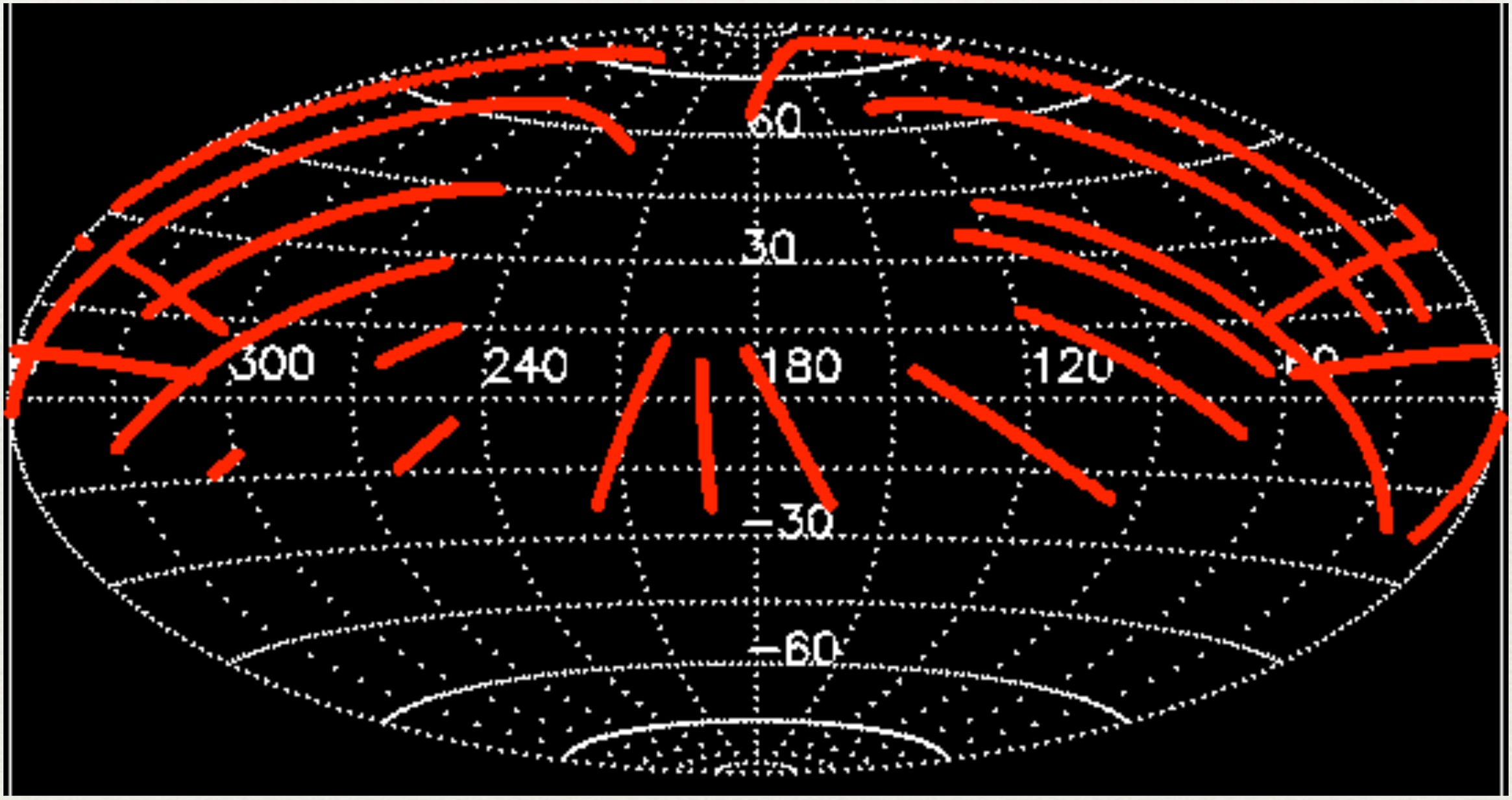
r-band


Galactic Latitude (degrees)
Galactic Longitude (degrees)
Δ_{ij}
0.05
0
−0.05
5
0
−5
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210


30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
180
190
200
210
5
0
−5
0.05
0
−0.05
Δ_{ij}
Galactic Longitude (degrees)

i-band

SDSS Segue strips



SDSS r' – IPHAS r' (BEFORE)

SDSS i' – IPHAS i' (BEFORE)

Galactic Latitude (degrees)

Galactic Latitude (degrees)

Tuesday 09 August 2011

SDSS r' – IPHAS r' (AFTER)

SDSS i' – IPHAS i' (AFTER)

70
81
94
110
130
150
178
187
203

0.031
0.018
0.051
0.025
0.047
0.022
0.033
0.016
0.040
0.013
0.046
0.021
0.031
0.015
0.031
0.032
0.027
0.014

0.006
0.020
0.042
0.031
0.032
0.024
0.015
0.022
0.037
0.026
0.025
0.020
0.019
0.022
0.015
0.036
0.028
0.022

−5
0
5

Galactic Latitude (degrees)

Galactic Latitude (degrees)

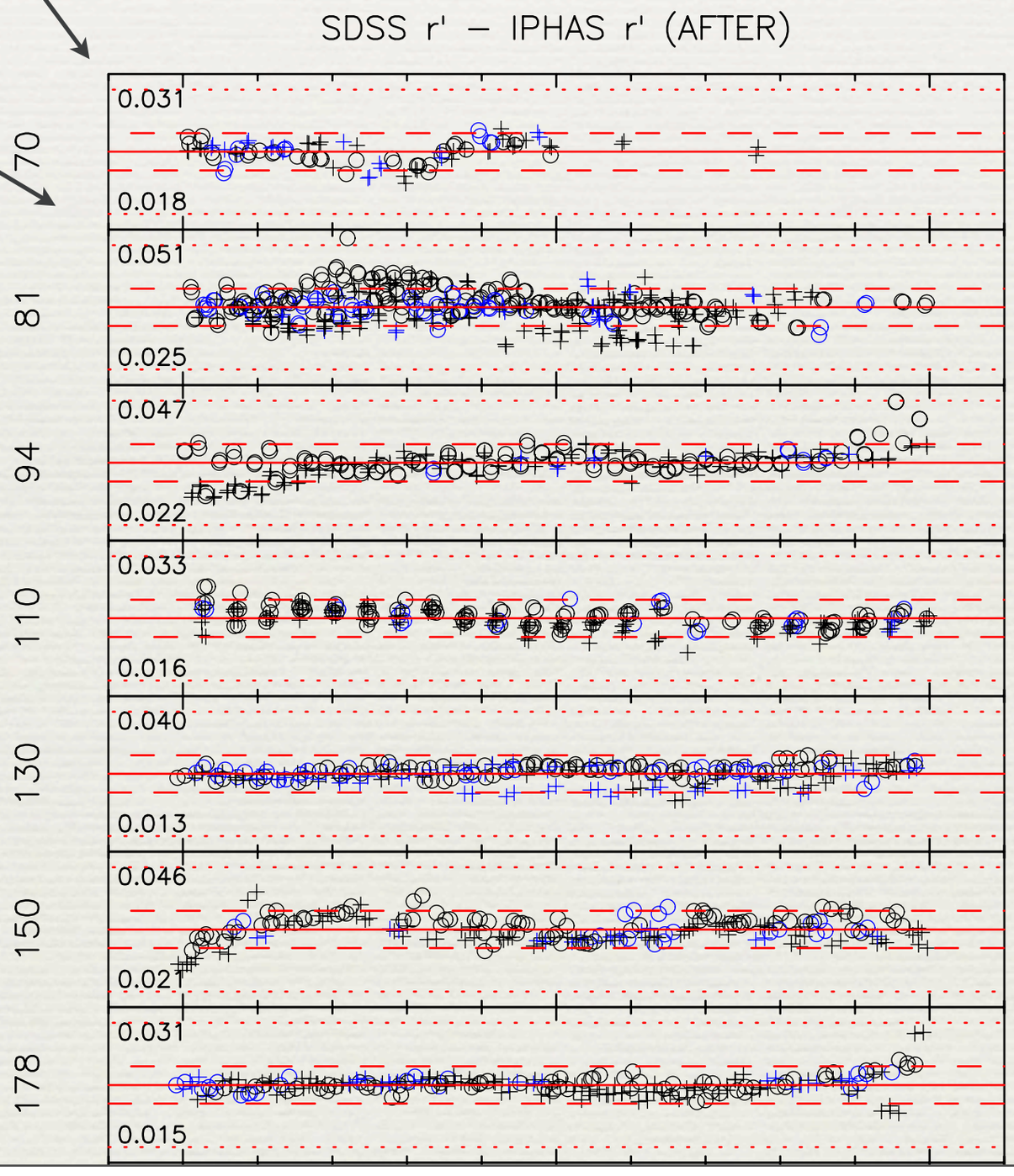
Tuesday 09 August 2011

average

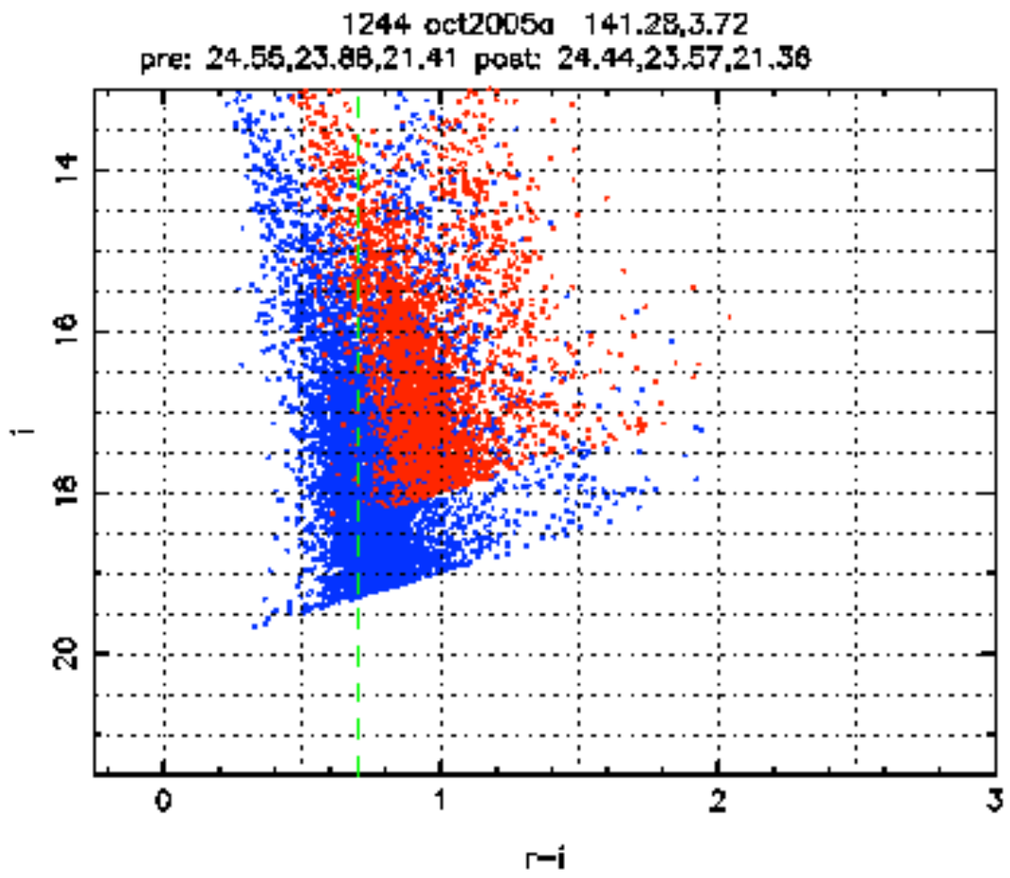
stdev

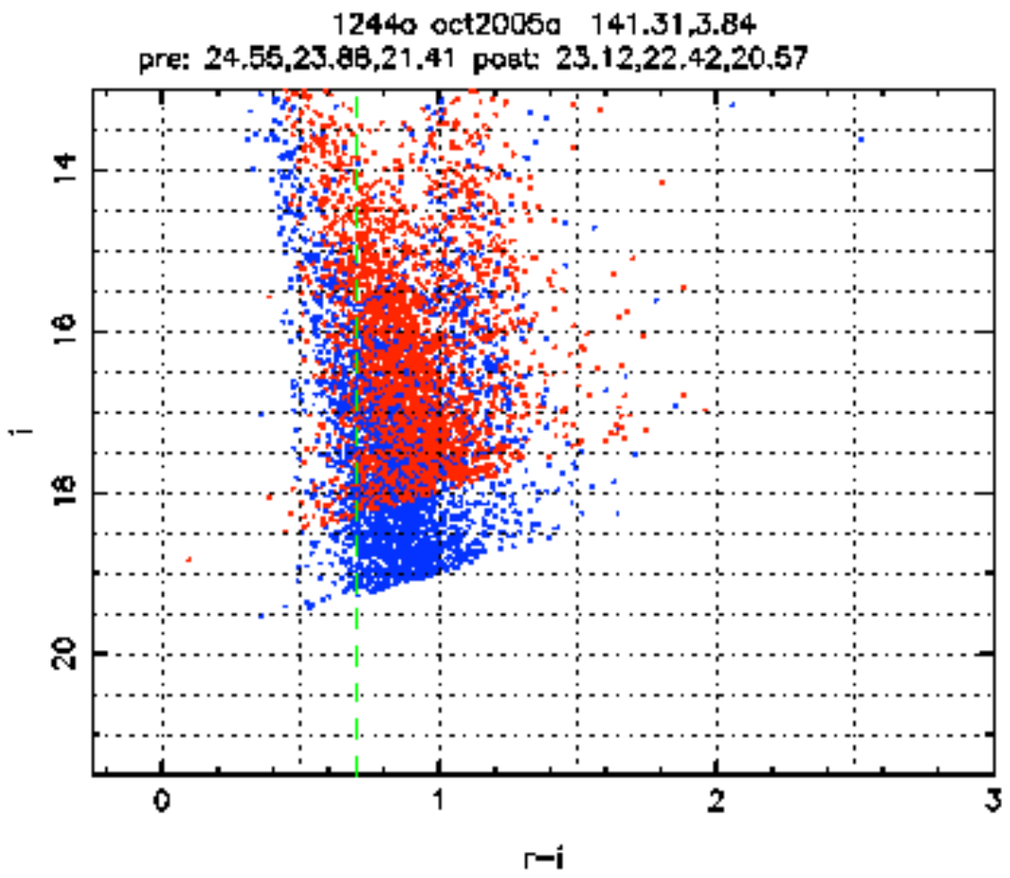
Dashed red line = +- 0.03 mag

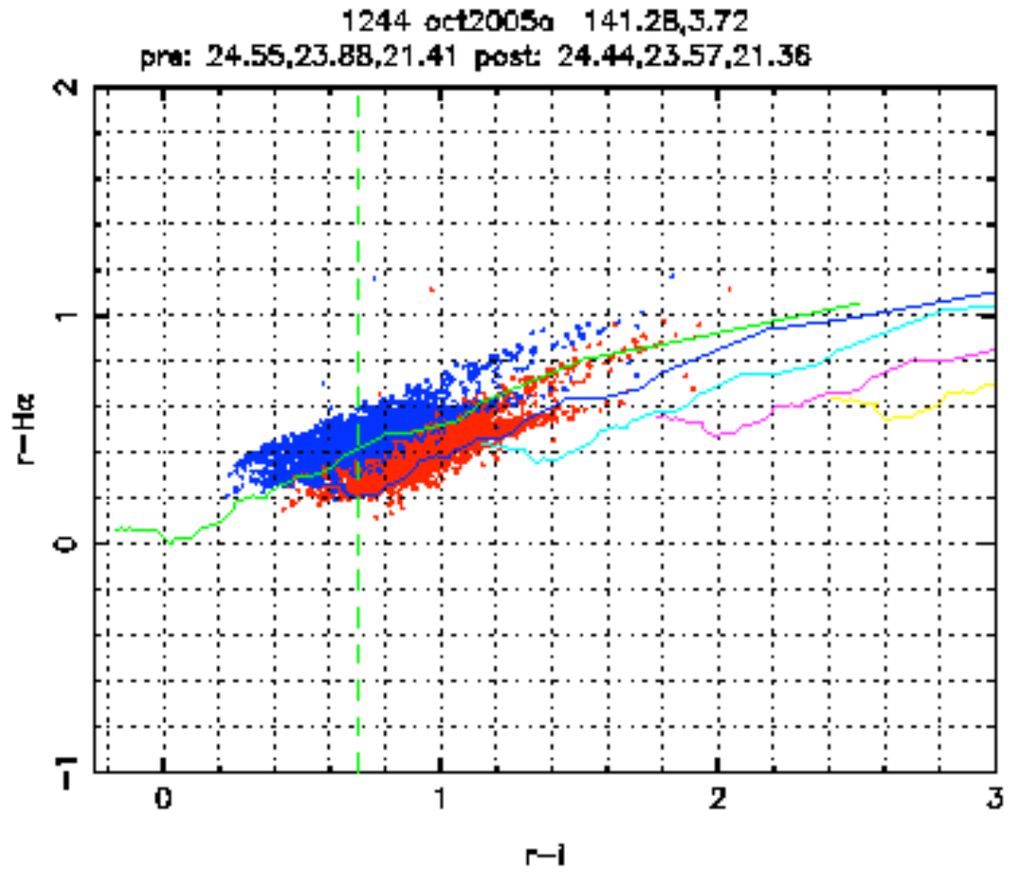
Dotted red line = +- 0.1 mag

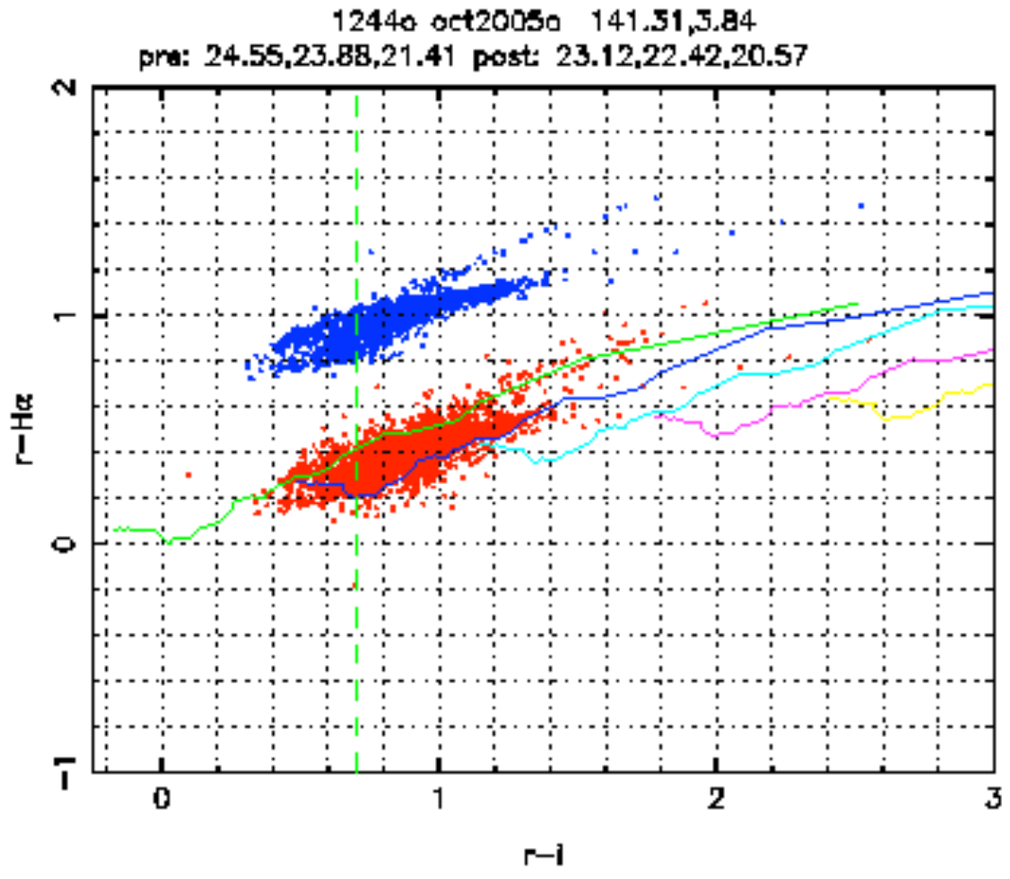


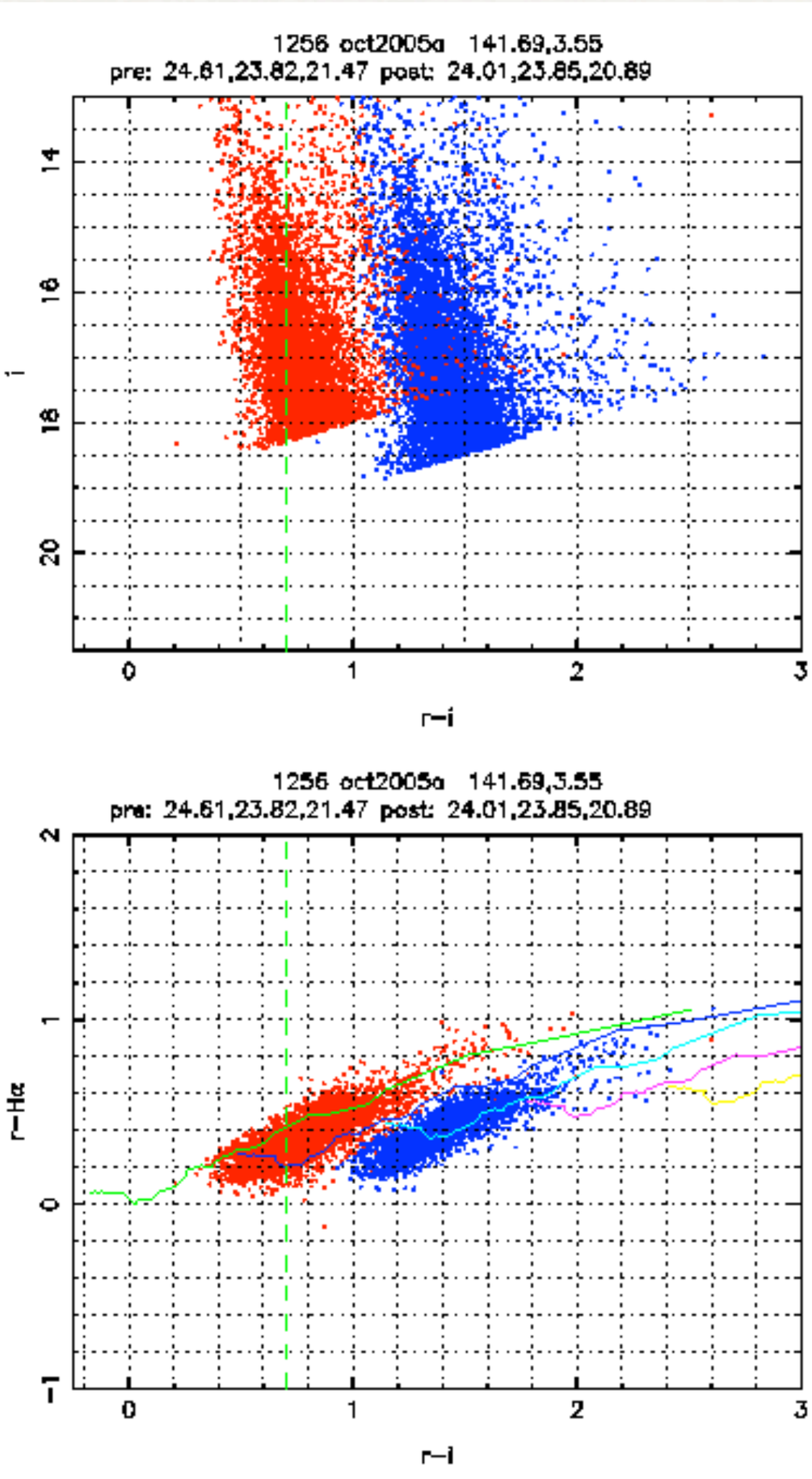
In the following CMDs
left panel = NNNN field
right panel = NNNNo field
of a pair
BLUE = before global calibration
RED = after global calibration

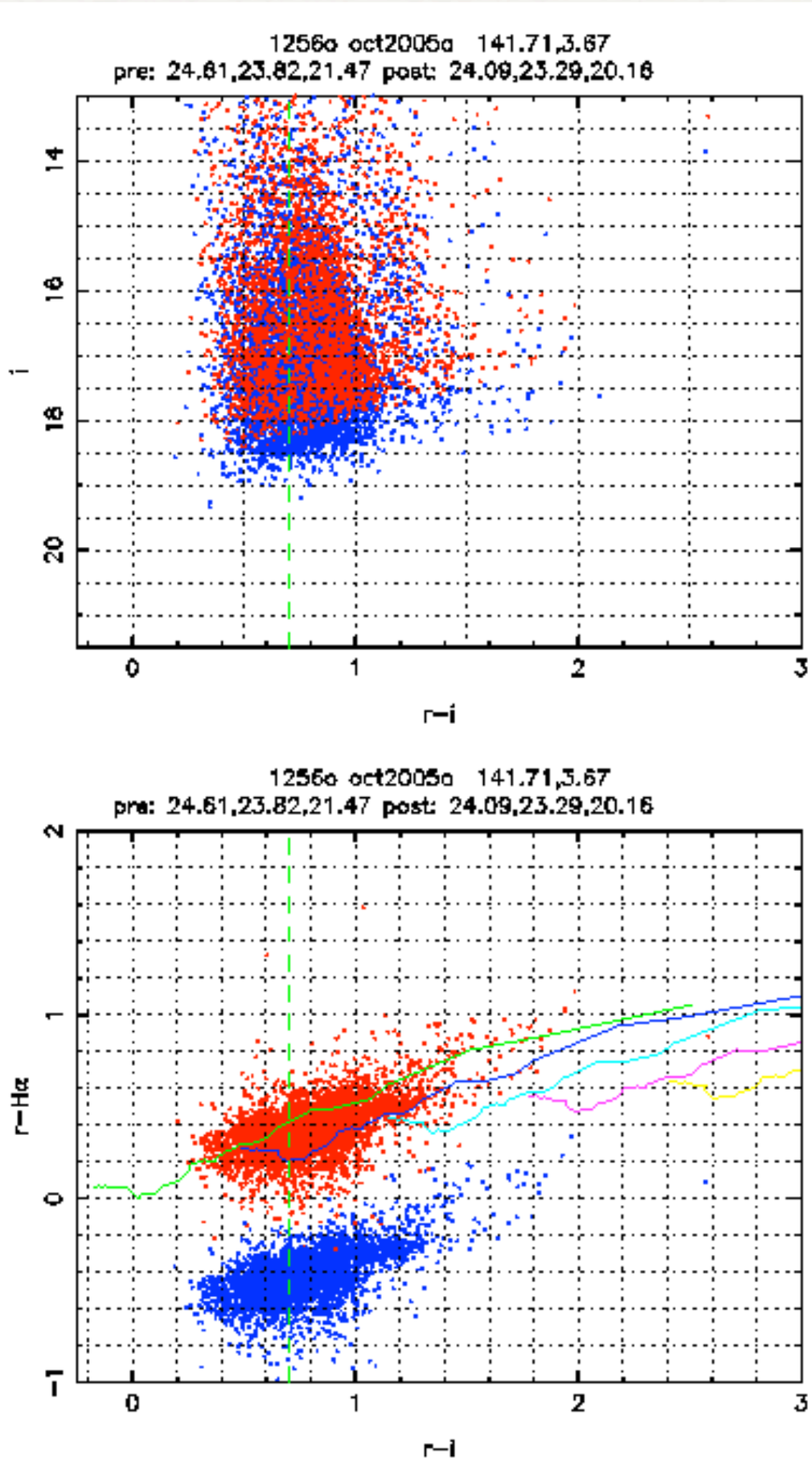

1244 oct2005a 141.28,3.72
pre: 24.55,23.88,21.41 post: 24.44,23.57,21.36
i
r−i

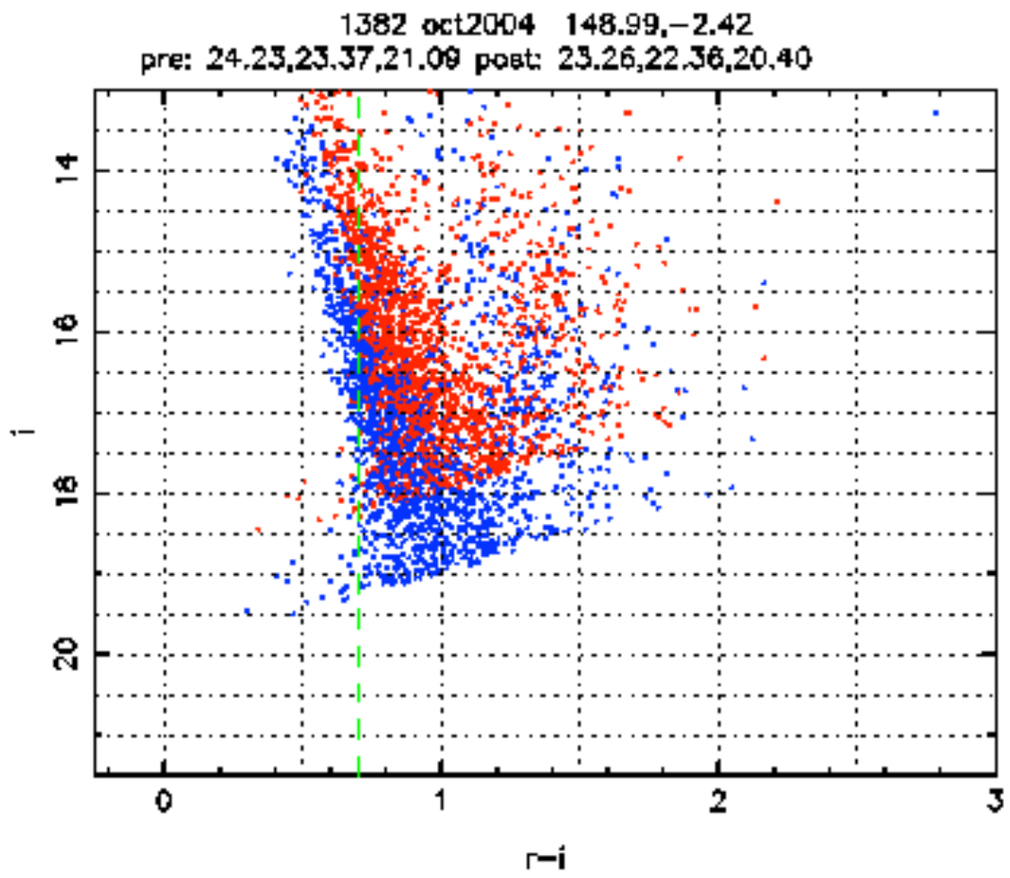

1244o oct2005a 141.31,3.84
pre: 24.55,23.88,21.41 post: 23.12,22.42,20.57
i
r−i

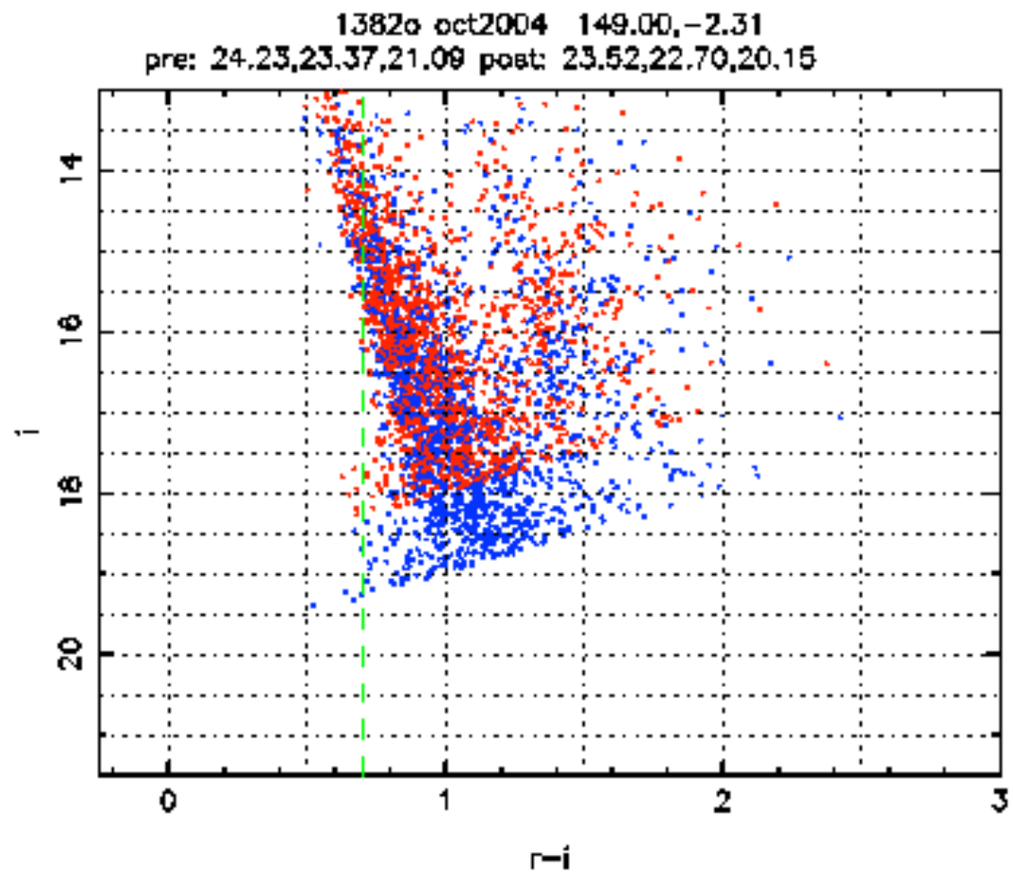

1244 oct2005a 141.28,3.72
pre: 24.55,23.88,21.41 post: 24.44,23.57,21.36
r−Hα
r−i


1244o oct2005a 141.31,3.84
pre: 24.55,23.88,21.41 post: 23.12,22.42,20.57
r−Hα
r−i


1256 oct2005a 141.69,3.55
pre: 24.61,23.82,21.47 post: 24.01,23.85,20.89
i
r−i
1256 oct2005a 141.69,3.55
pre: 24.61,23.82,21.47 post: 24.01,23.85,20.89
r−Hα
r−i


1256o oct2005a 141.71,3.67
pre: 24.61,23.82,21.47 post: 24.09,23.29,20.16
i
r−i
1256o oct2005a 141.71,3.67
pre: 24.61,23.82,21.47 post: 24.09,23.29,20.16
r−Hα
r−i


1382 oct2004 148.99,−2.42
pre: 24.23,23.37,21.09 post: 23.26,22.36,20.40
i
r−i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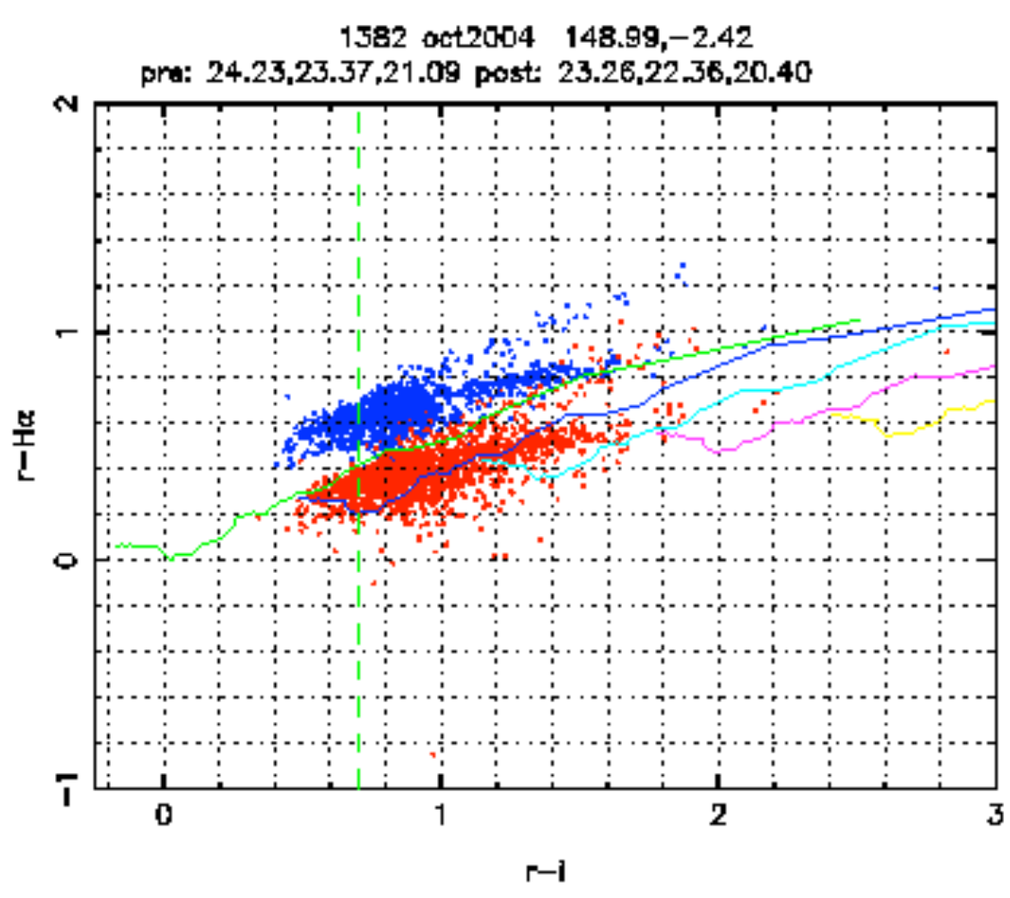
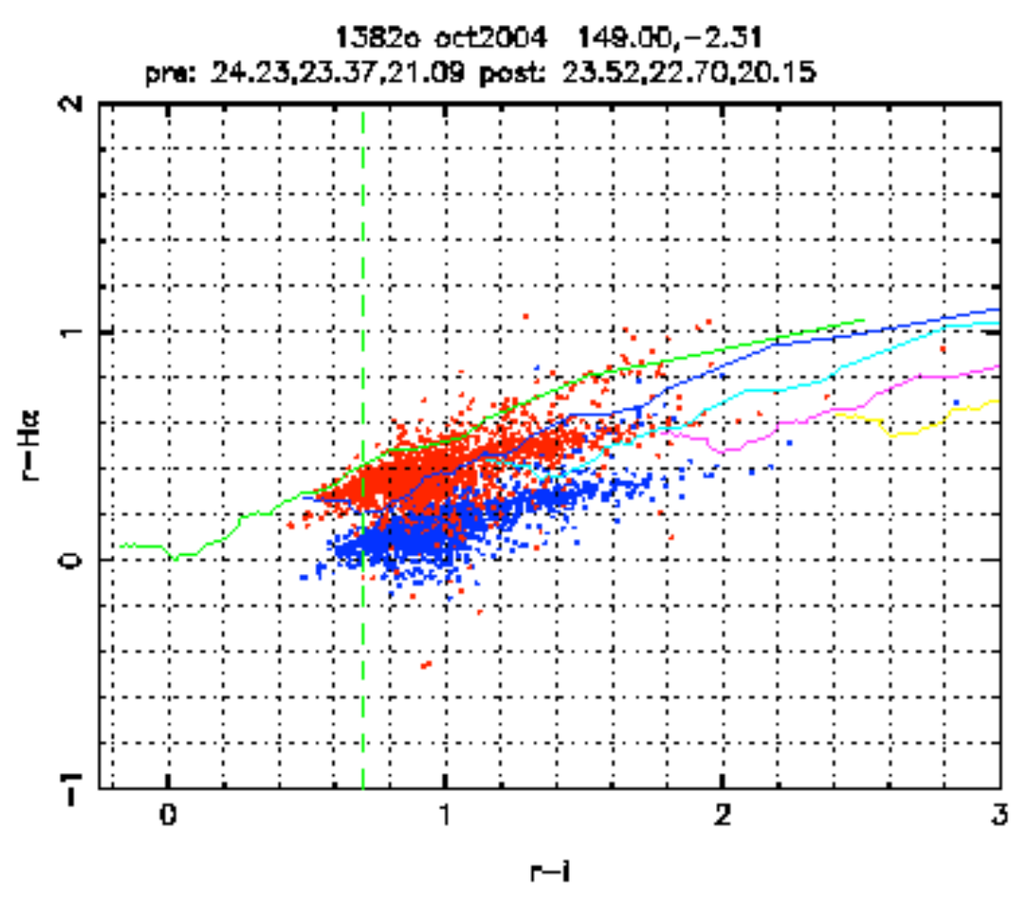
i
r−i


1382 oct2004 148.99,−2.42
pre: 24.23,23.37,21.09 post: 23.26,22.36,20.40
r−Hα
r−i


1382o oct2004 149.00,−2.31
pre: 24.23,23.37,21.09 post: 23.52,22.70,20.15
r−Hα
r−i

Thank you

- Janet Drew
- Eduardo Gonzalez-Solares, Mike Irwin
- Geert Barentsen, Hywel Farnhill, Stuart Sale
- Ralf Napiwotzki, Robert Greimel