Introducing HSC-i2 Filter

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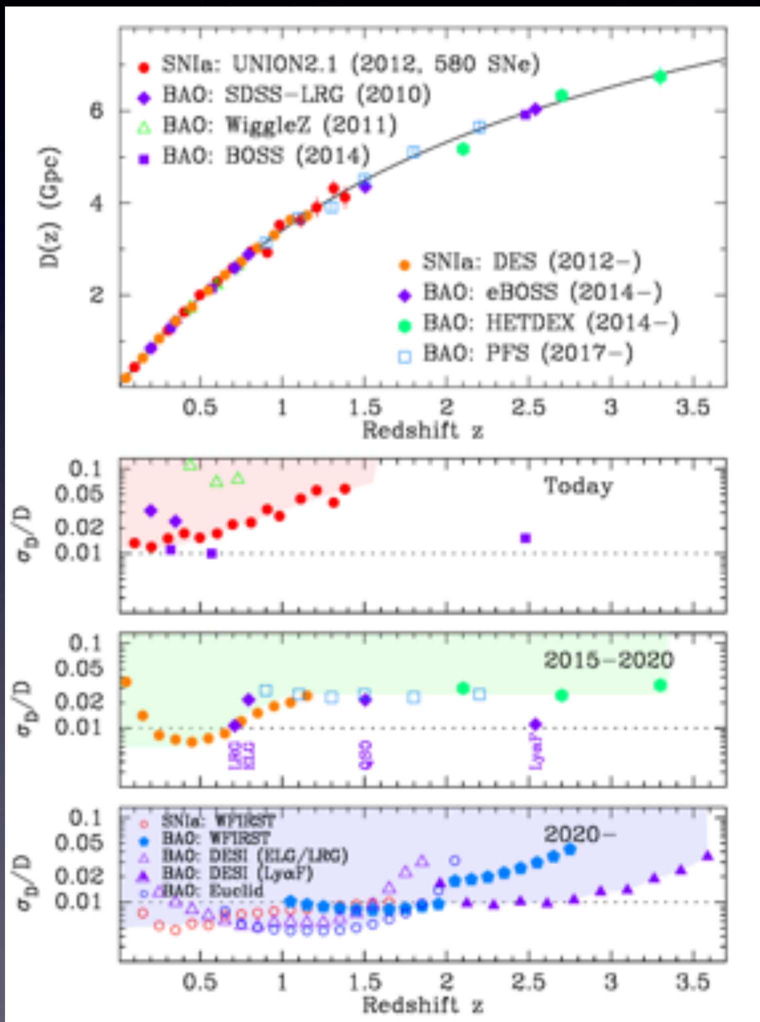
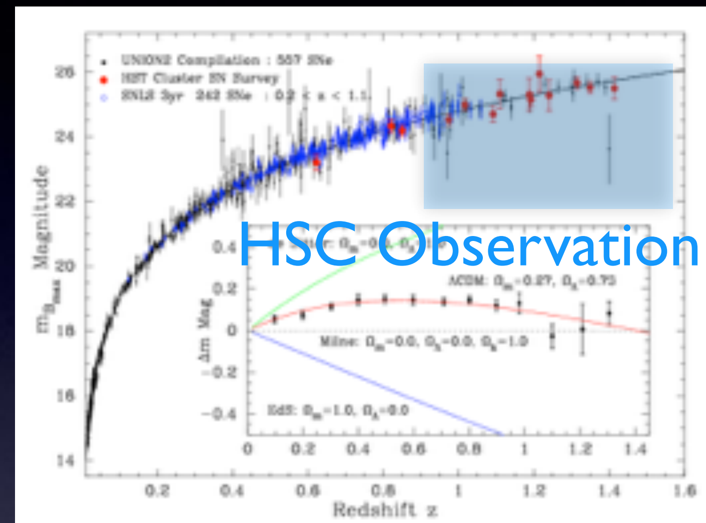
- Brief History of HSC-i Filter
- Why HSC-i filter is not good enough
- HSC-i2 Filter
- Expectations & Engineering Test
- Schedule

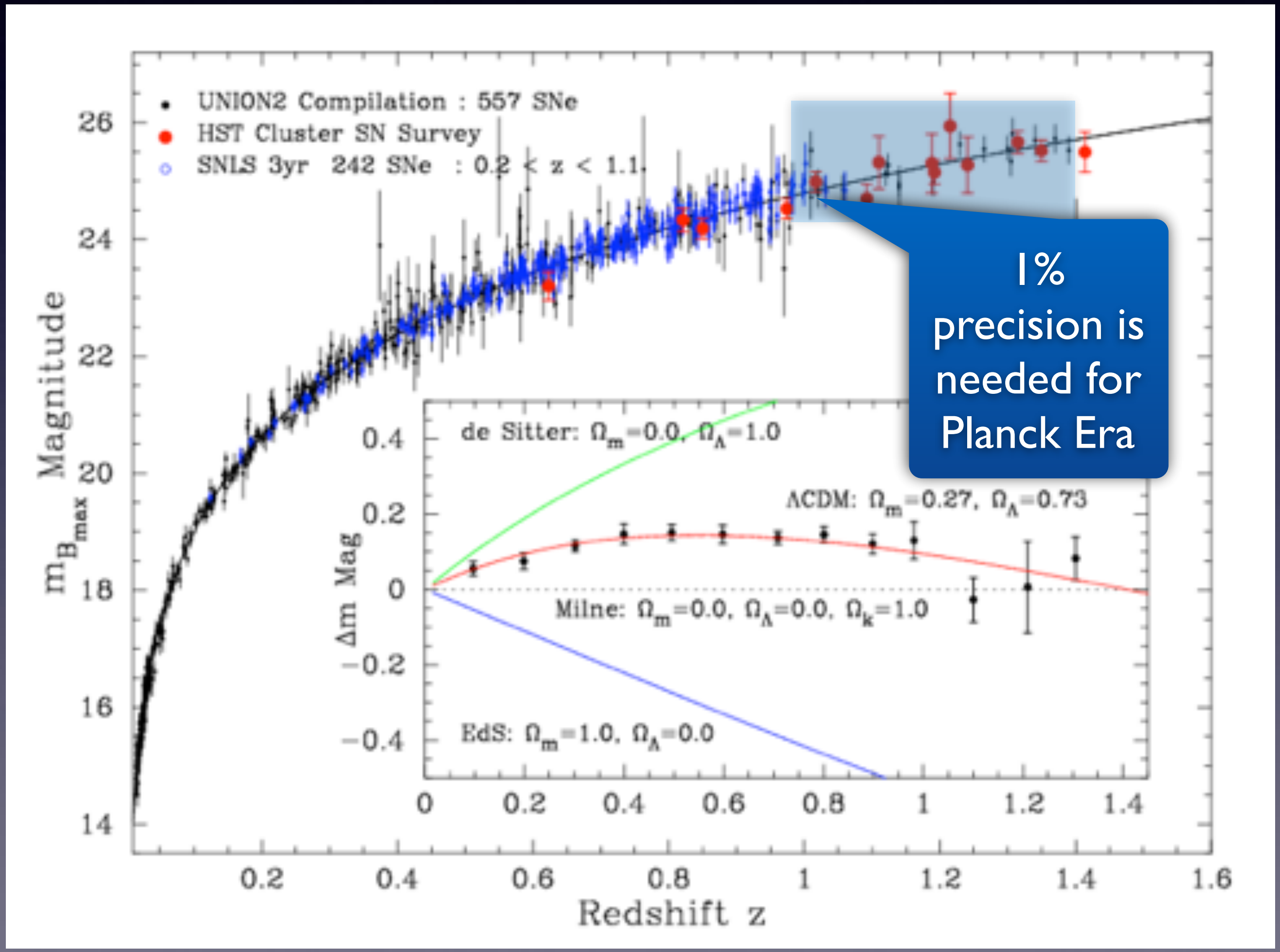
HSC SNIa Cosmology in 2017

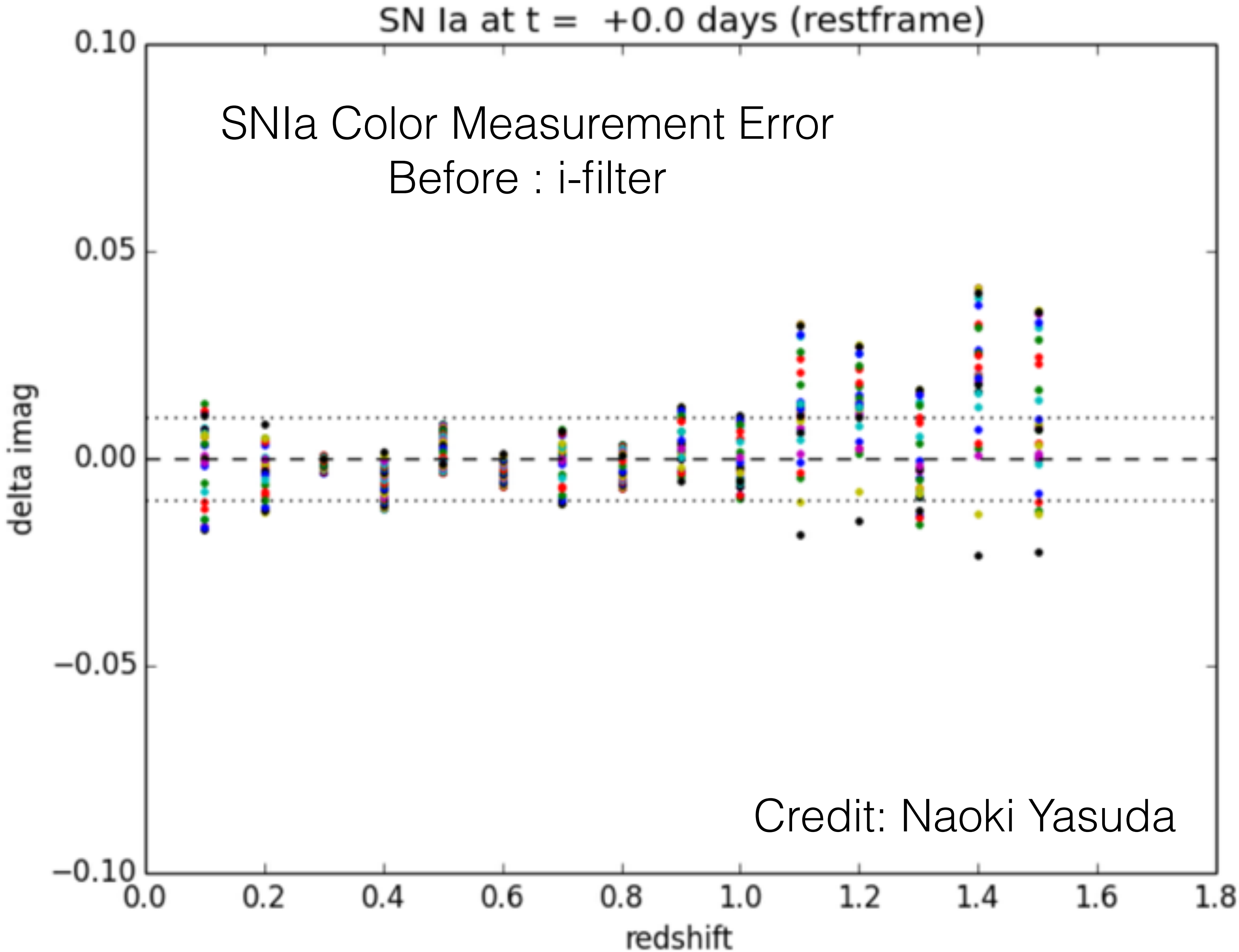




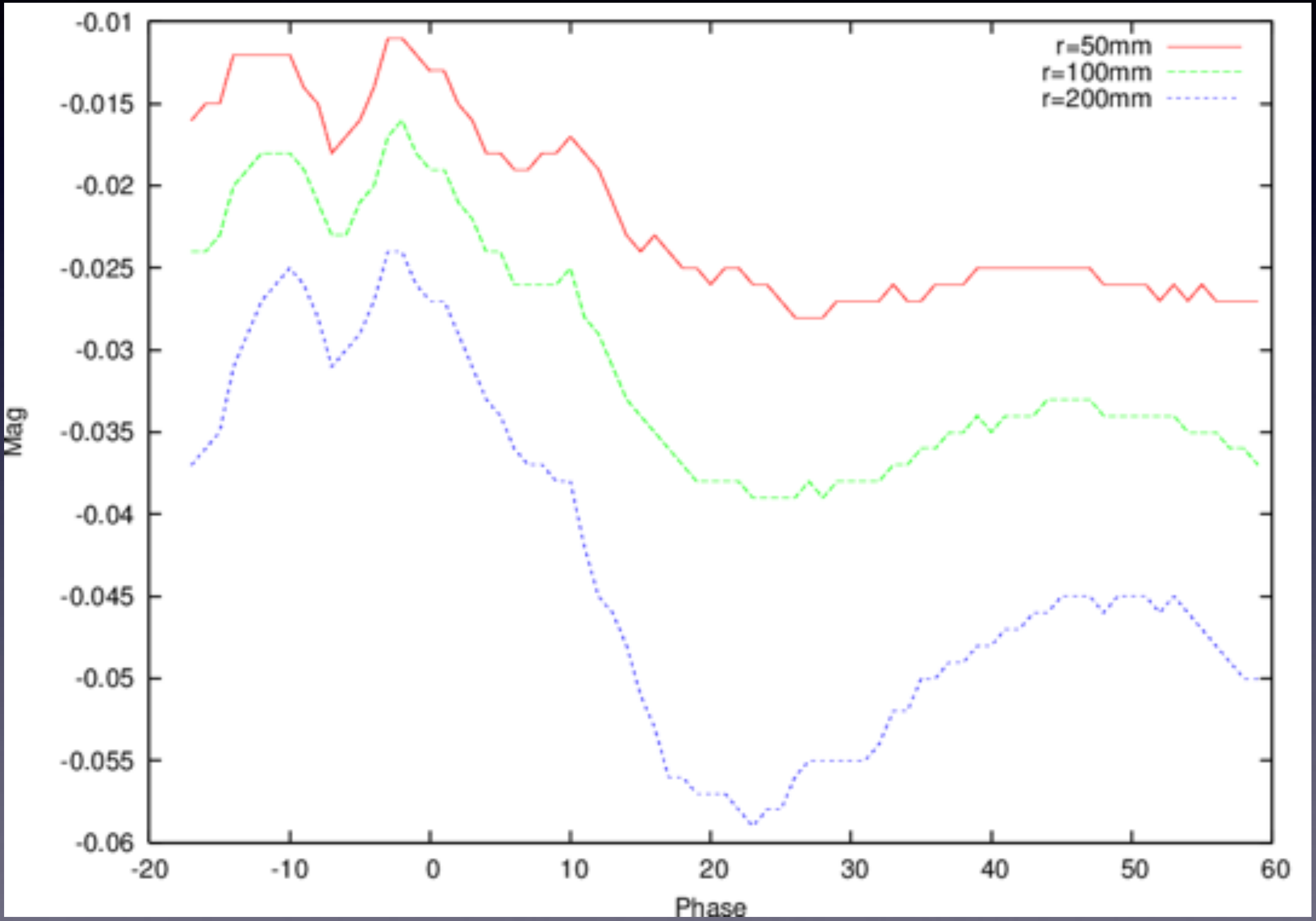
- UD : 6 Months monitor
- 1.0 < z < 1.4 70-100 SNeIa
- Keck/VLT/Gemini/HST Follow-up
- Stat Error in 2% (distance), 4%(mag
- mag err x β x dμ = dm x 2.4 x 0.46=

SSP Supernova Follow-up
z=1.0-1.4 SNIa (24-25th mag)




SN Ia at t = +0.0 days (restframe)
SNIa Color Measurement Error
Before : i-filter
Credit: Naoki Yasuda
delta imag
redshift
0.10
0.05
0.00
−0.05
−0.10
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

SNIa : Phase vs Color Error



Photometry is very important

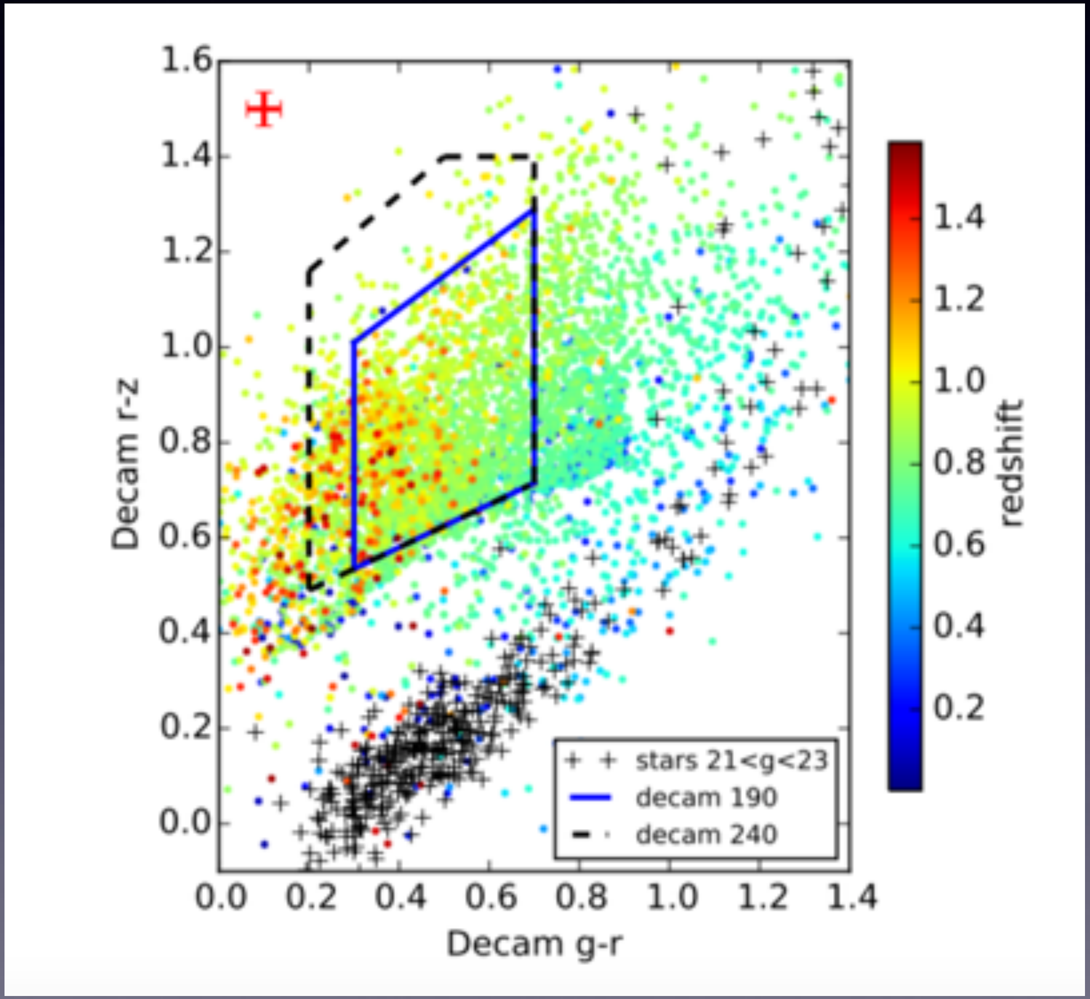
SDSS-IV Dawson et al (arxiv 1508.04473)

Table 7
Comparison of expected eBOSS performance compared to requirements for high-level BAO measurements.

	LRG	CMASS	Clustering Quasars	UgrizW1 ELG	DECaM ELG
Redshift Range	$0.6 < z < 1.0$	$0.6 < z < 1.0$	$0.9 < z < 2.2$	$0.6 < z < 1.0$	$0.7 < z < 1.1$
Target Density and Fiber Density					
Density of Targets (deg^{-2})	60	23	115	180	240
Density of Previously Observed Objects	0	23	25	0	0
Density of Objects Assigned Fibers	52	0	85	171	228
Efficiency of Redshift Classification					
Density Expected Confirmed Tracers (deg^{-2})	36	23	67	121	179
Number of Required Confirmed Tracers	300,000	–	435,000	190,000	190,000
Number of Expected Confirmed Tracers	266,000	174,000	500,000	182,000	197,000
Statistical Accuracy of Redshift Estimates					
Required Redshift Accuracy (kms^{-1})	< 300	< 300	$< 300 + 400[z - 1.5]$	< 300	< 300
Expected Redshift Accuracy (kms^{-1})	58	35	$< 300 + 400[z - 1.5]$	< 300	< 300
Unrecognized Redshift Classification Failures					
Catastrophic Failures Requirement	$< 1\%$	$< 1\%$	$< 1\%$	$< 1\%$	$< 1\%$
Catastrophic Failures Expected	0.6%	$< 1\%$	0.8%	TBD	TBD
Uniformity Over Targeting Area					
Uniform Area in Imaging Systematics	92%	–	90%	TBD	TBD
$\Delta n/\Delta(0.01 mag)$ Zeropt error	6.2%		0.86%	TBD	TBD
Uniform Area in zeropoint errors	86.7%	–	100%	TBD	TBD

The final ELG selection remains undecided, so it is not yet possible to present the expected performance for this target class. We do have estimates for the number density using several techniques presented in Section 4.2. We present the statistics we can estimate for two of those samples in Table 7. We report the statistics for the Fisher UgrizW1 covering 1500 deg^2 and the high density DECam selection covering 1100 deg^2. Because the emission lines are narrow, we expect to easily meet the requirement of $< 300\,\mathrm{kms}^{-1}$ redshift precision, although we do not have a specific estimate at this time. More challenging will be robust identification of sources; catastrophic failures due to line confusion and sky subtraction residuals pose a risk to this class of target. We postpone discussion of the catastrophic failure rate and the expected uniformity until a future publication.

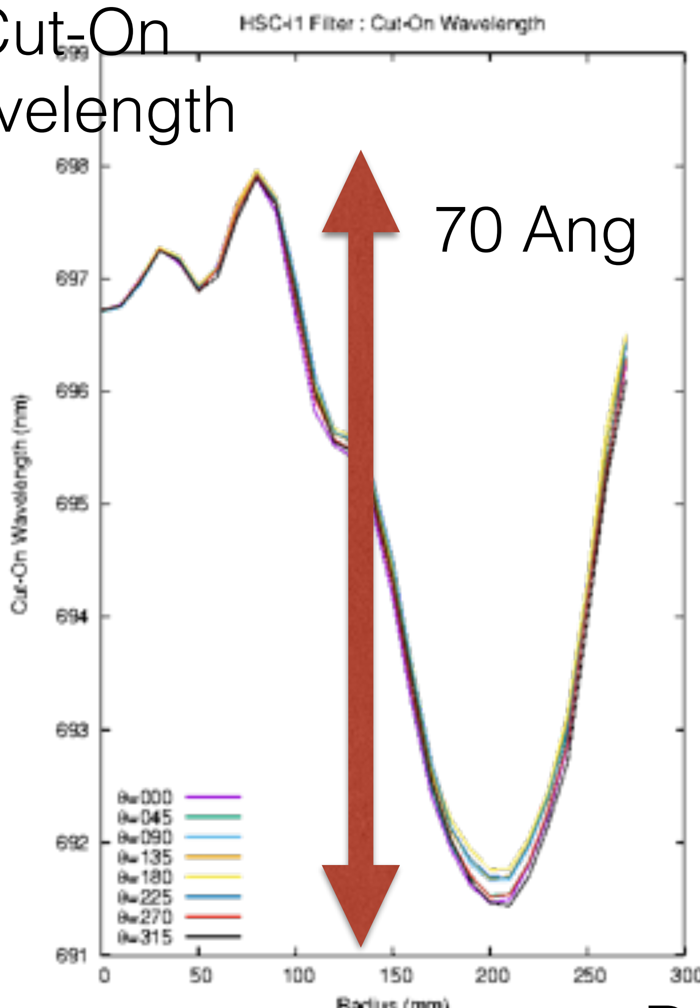
Target Selection is sensitive to the colors Comparat et al (arxiv.1509.05045)

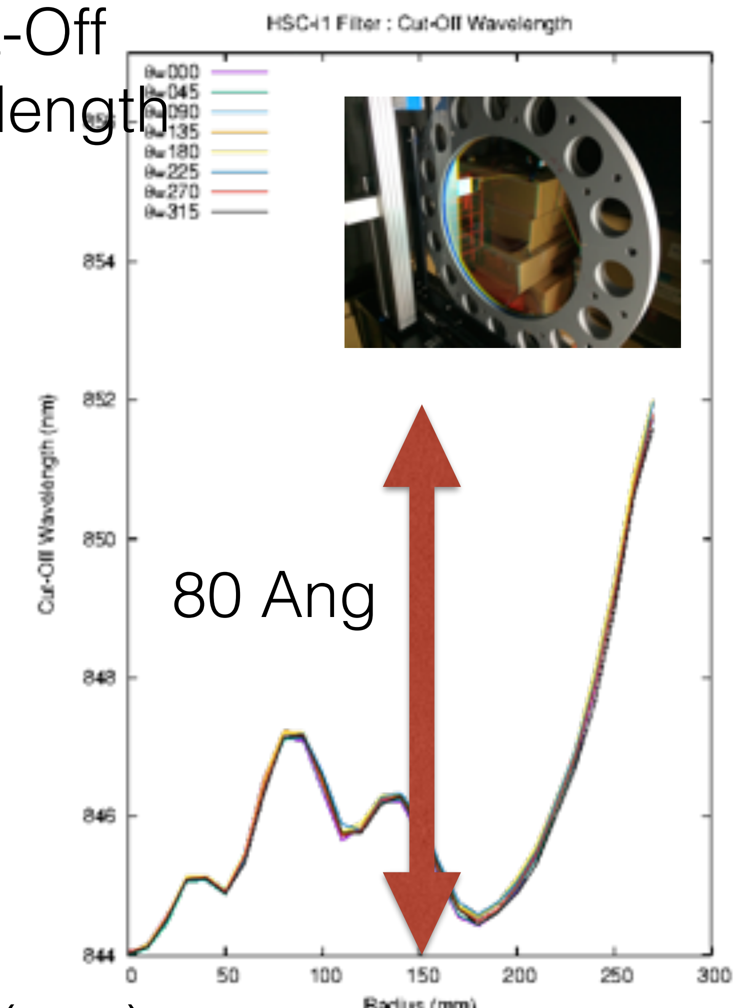


Materion Co. BOSTON

- Asahi Bunko did an excellent job on HSC-g band filter
- They are busy for making dichroic of PFS (4 x blue and 4 x Red)
- We have asked Materion
- Funding from JSPS and CREST (JST)

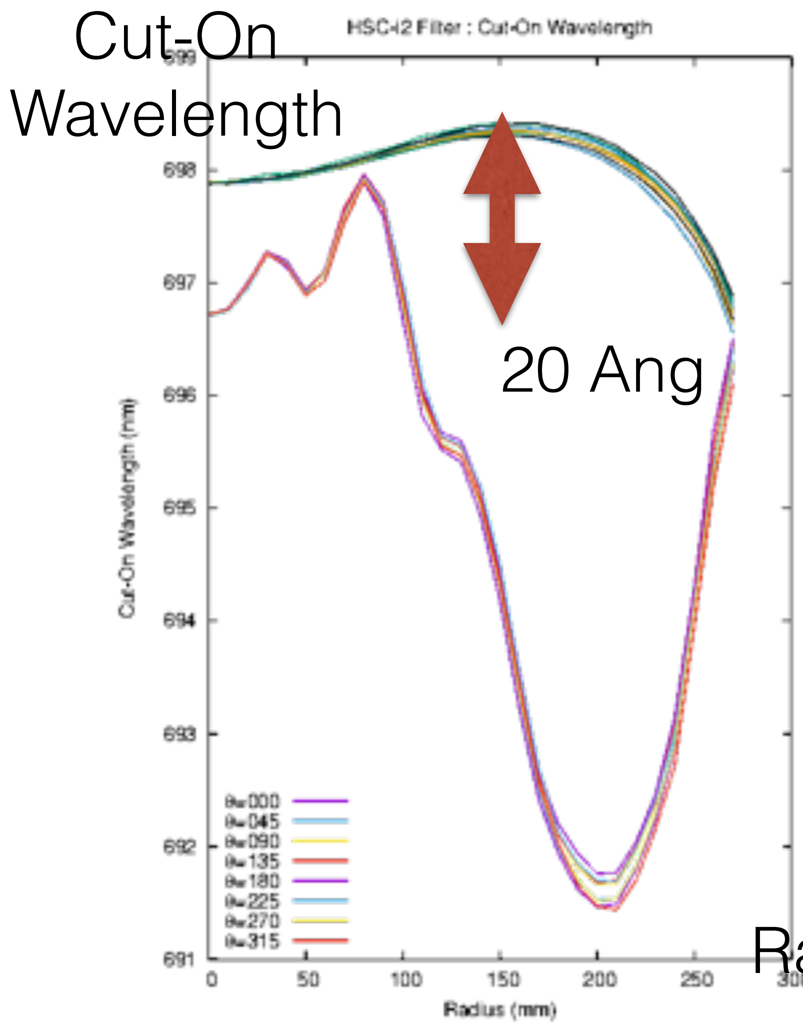
Before: HSC-i Filter

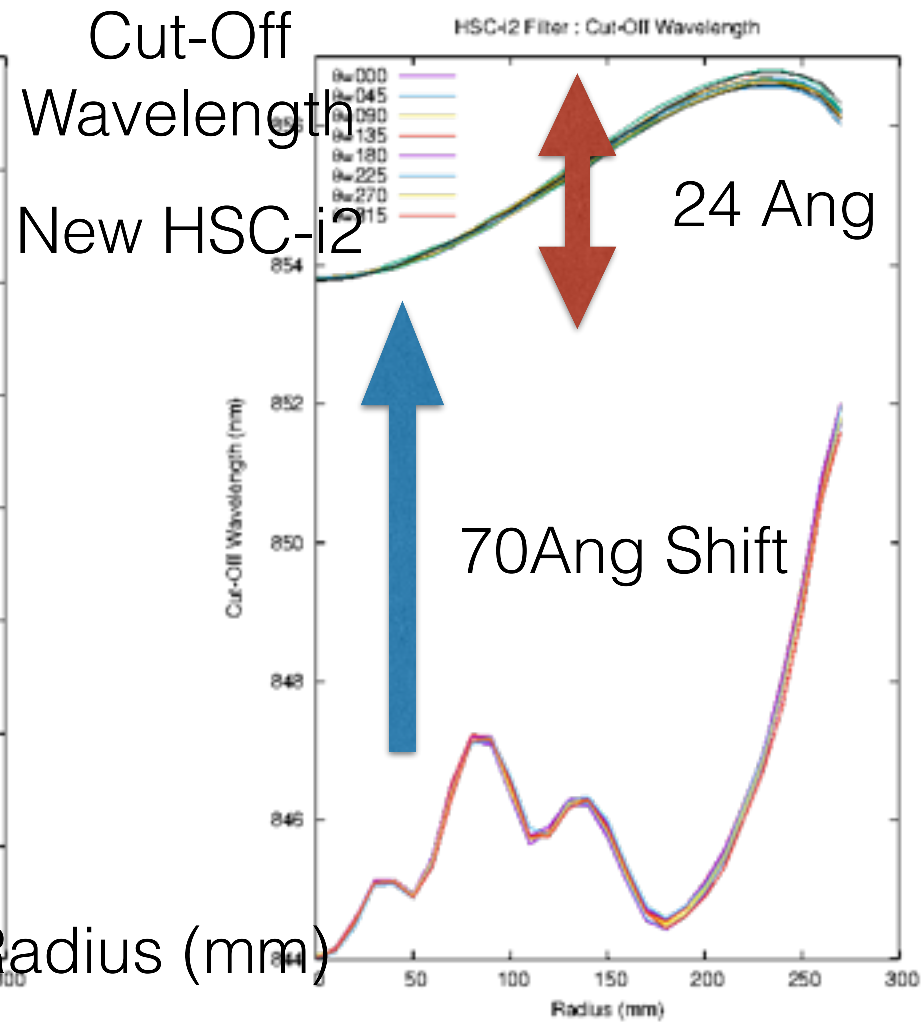




Radius (mm)

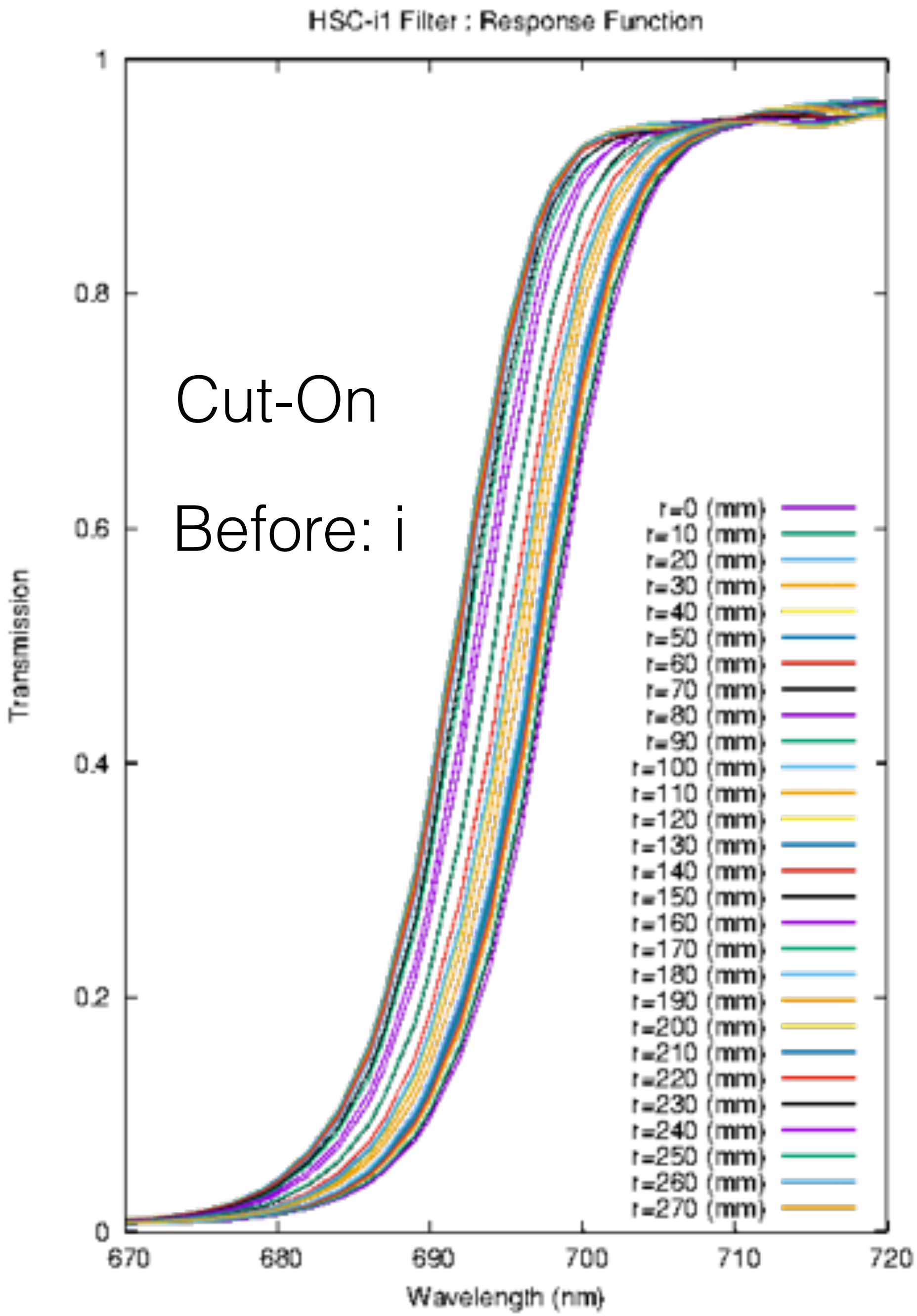
After : HSC-i2 Filter

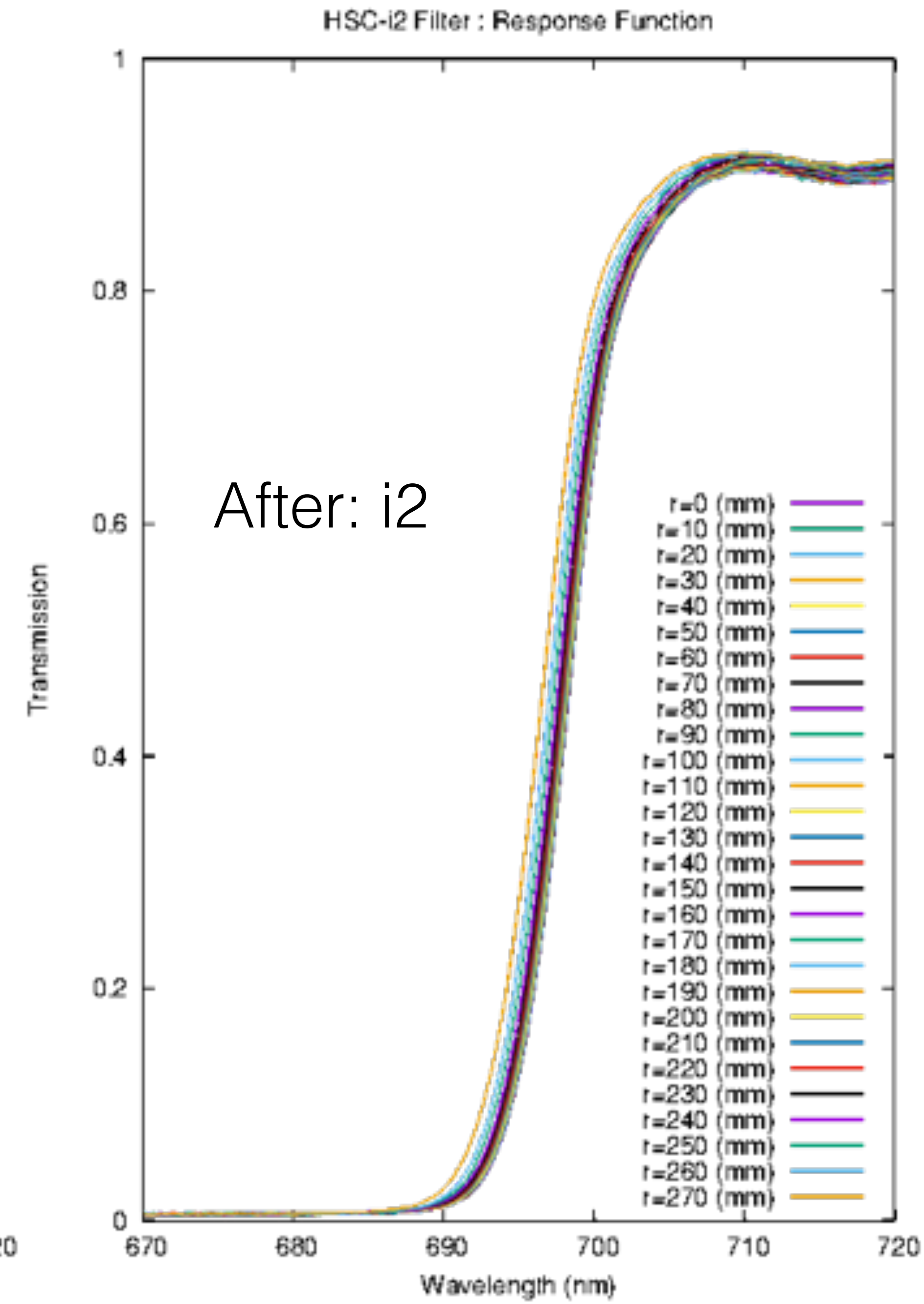


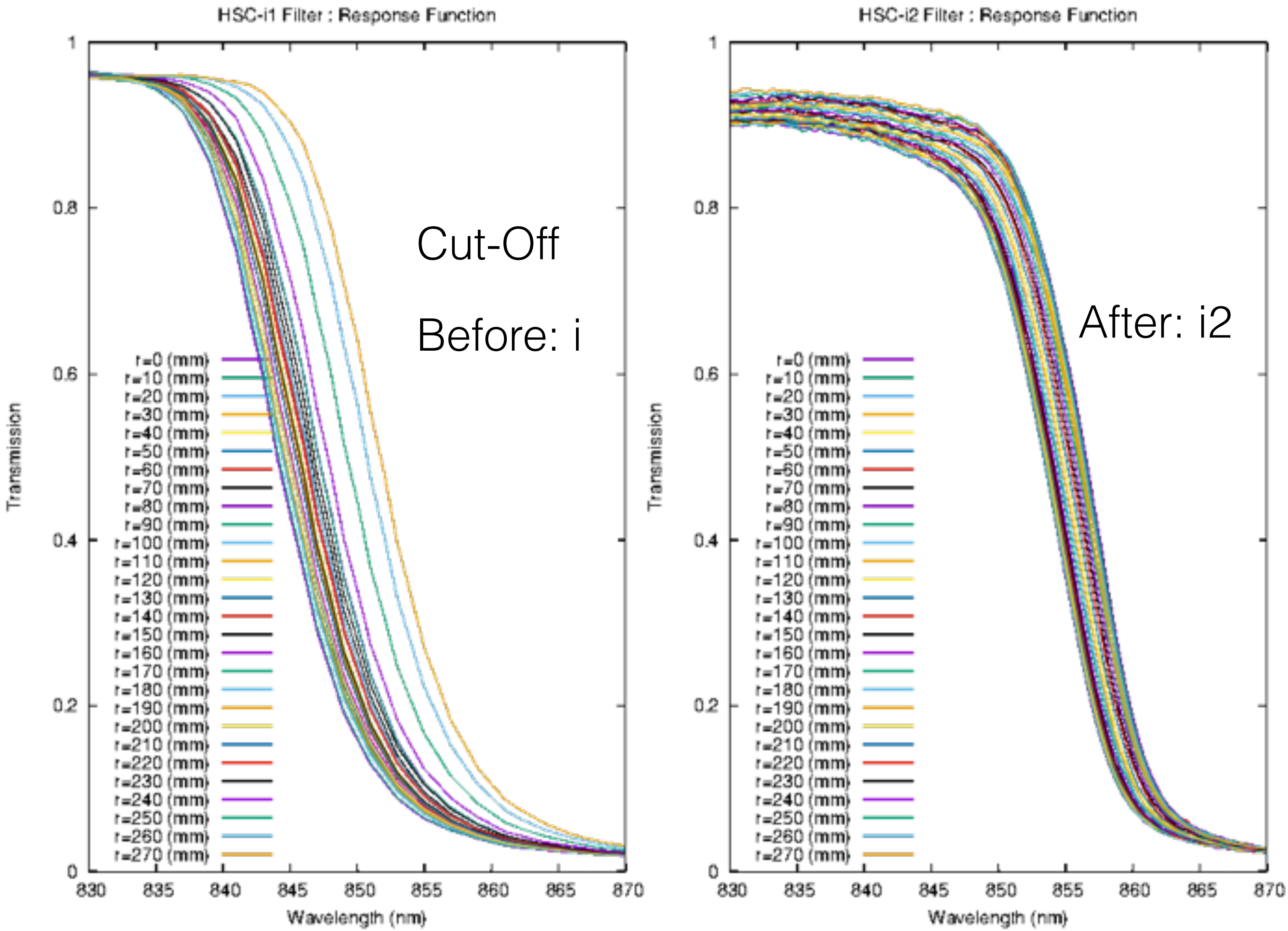


Radius (mm)

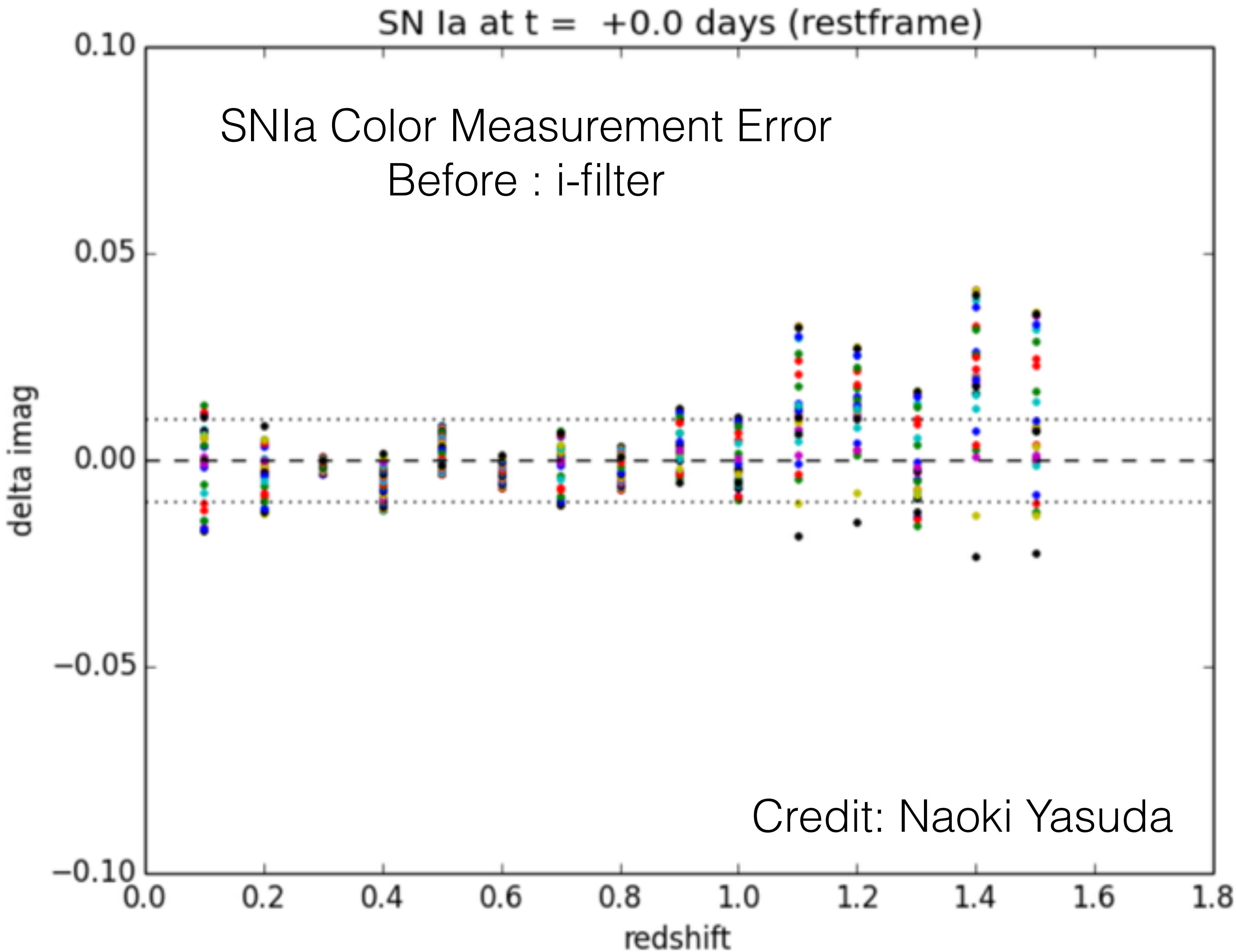
Measurement by Kawanomoto san

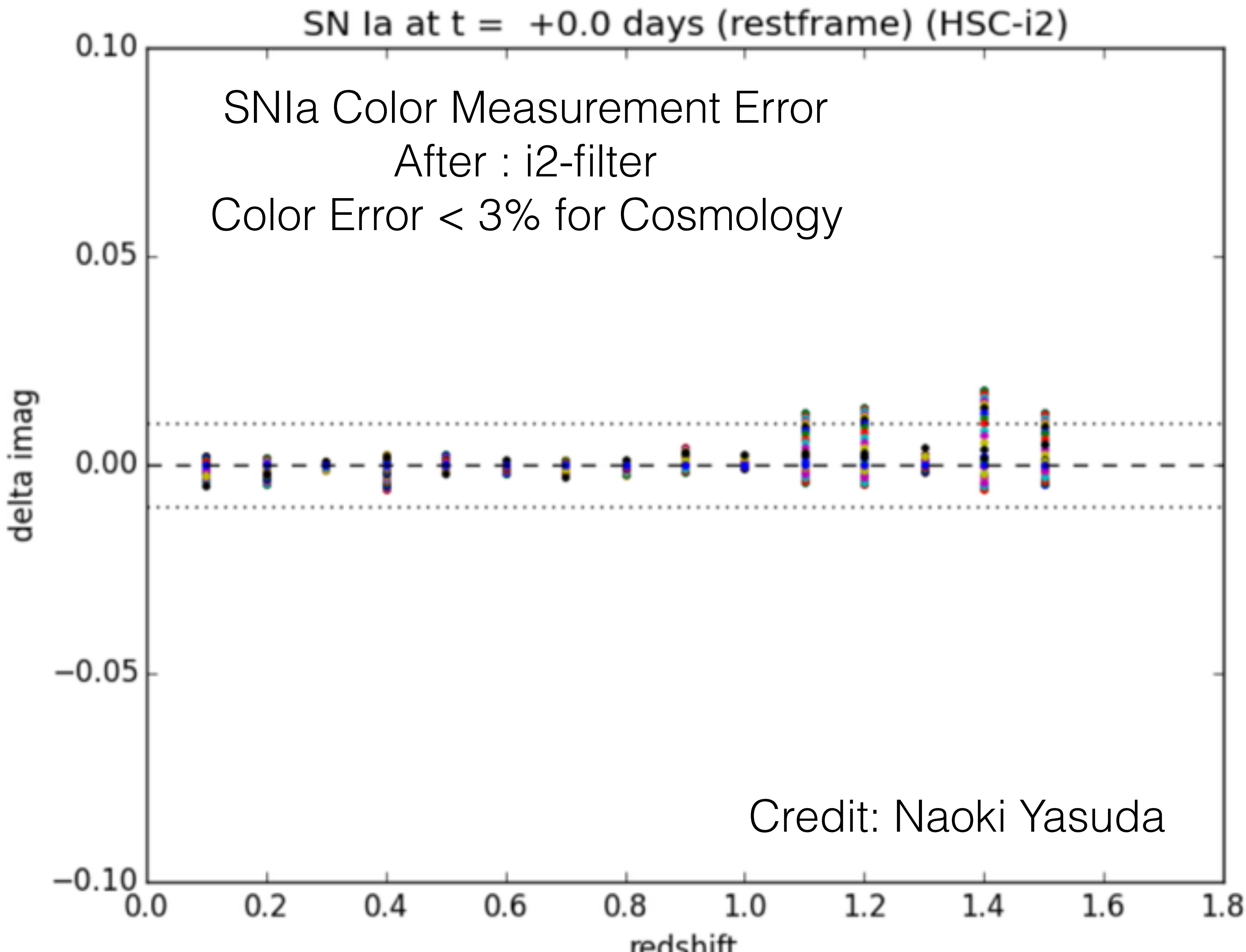

HSC-i1 Filter : Response Function
Cut-On
Before: i
Transmission
Wavelength (nm)
r=0 (mm)
r=10 (mm)
r=20 (mm)
r=30 (mm)
r=40 (mm)
r=50 (mm)
r=60 (mm)
r=70 (mm)
r=80 (mm)
r=90 (mm)
r=100 (mm)
r=110 (mm)
r=120 (mm)
r=130 (mm)
r=140 (mm)
r=150 (mm)
r=160 (mm)
r=170 (mm)
r=180 (mm)
r=190 (mm)
r=200 (mm)
r=210 (mm)
r=220 (mm)
r=230 (mm)
r=240 (mm)
r=250 (mm)
r=260 (mm)
r=270 (mm)


HSC-i2 Filter : Response Function
After: i2
Transmission
Wavelength (nm)
r=0 (mm)
r=10 (mm)
r=20 (mm)
r=30 (mm)
r=40 (mm)
r=50 (mm)
r=60 (mm)
r=70 (mm)
r=80 (mm)
r=90 (mm)
r=100 (mm)
r=110 (mm)
r=120 (mm)
r=130 (mm)
r=140 (mm)
r=150 (mm)
r=160 (mm)
r=170 (mm)
r=180 (mm)
r=190 (mm)
r=200 (mm)
r=210 (mm)
r=220 (mm)
r=230 (mm)
r=240 (mm)
r=250 (mm)
r=260 (mm)
r=270 (mm)



HSC-i1 Filter : Response Function
Cut-Off
Before: i
HSC-i2 Filter : Response Function
After: i2
Transmission
Wavelength (nm)
0
0.2
0.4
0.6
0.8
1
830
835
840
845
850
855
860
865
870
r=0 (mm)
r=10 (mm)
r=20 (mm)
r=30 (mm)
r=40 (mm)
r=50 (mm)
r=60 (mm)
r=70 (mm)
r=80 (mm)
r=90 (mm)
r=100 (mm)
r=110 (mm)
r=120 (mm)
r=130 (mm)
r=140 (mm)
r=150 (mm)
r=160 (mm)
r=170 (mm)
r=180 (mm)
r=190 (mm)
r=200 (mm)
r=210 (mm)
r=220 (mm)
r=230 (mm)
r=240 (mm)
r=250 (mm)
r=260 (mm)
r=270 (mm)


SN Ia at t = +0.0 days (restframe)
SNIa Color Measurement Error
Before : i-filter
Credit: Naoki Yasuda
0.10
0.05
0.00
−0.05
−0.10
delta imag
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
redshift

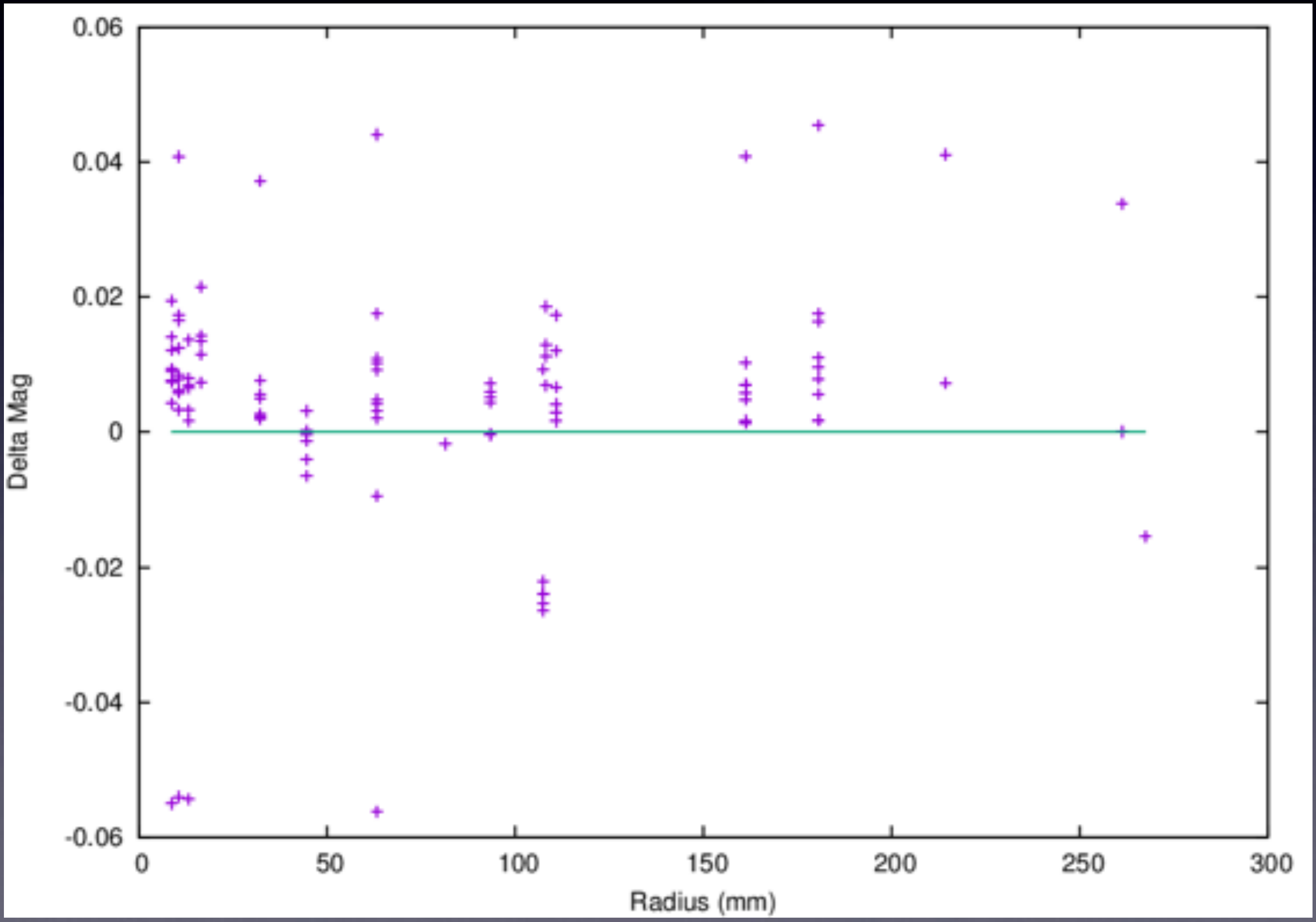

SN Ia at t = +0.0 days (restframe) (HSC-i2)
SNIa Color Measurement Error
After : i2-filter
Color Error < 3% for Cosmology
Credit: Naoki Yasuda
delta imag
redshift
0.10
0.05
0.00
−0.05
−0.10
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

Nov 9th Engineering Test

- SDSS SEGUE region was taken
- We aim to test if radius vs color has improved

- Unfortunately, it was not photometric and it is hard to see the difference…
- One of the best combination suggests no color dependence in radius

SDSS i-z = 0.5 : Delta Mag=Obs-Expected



Schedule

- HSC-i2 is ready to install
- Engineering Night didn't show any problem with the shape of the stars
- Engineering night was not photometryic but suggests color depedence was removed
- Let's use HSC-i2 for SSP from Feb 2016
- We'll provide a revised Response Curve
- PASJ/PASP paper to be written

SNIa : Color-Mag Locus & Red & Faint most likely SNIa