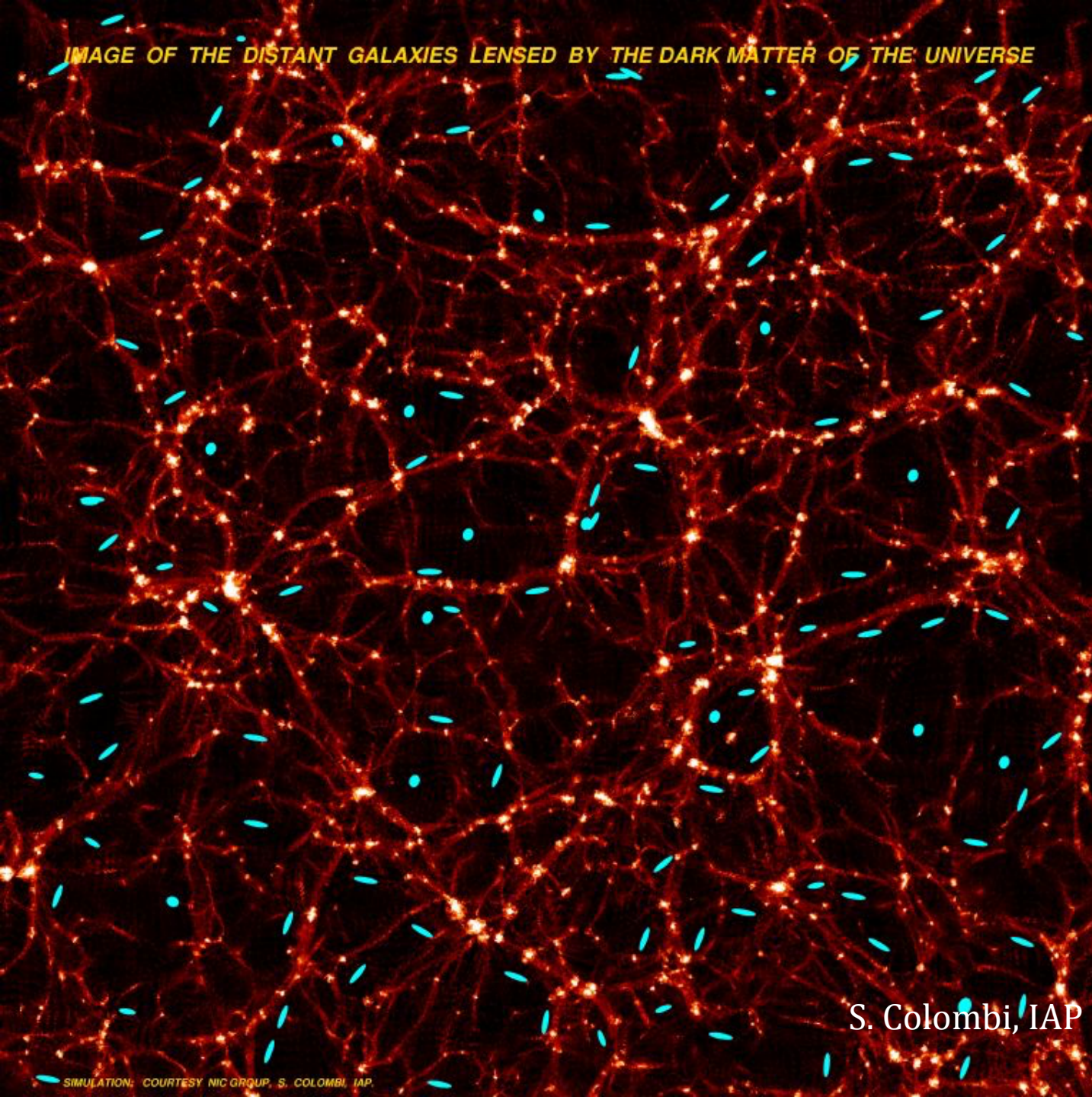


ENHANCED COSMIC SHEAR ANALYSIS WITH THE KILO DEGREE SURVEY

GETTING MORE COSMOLOGY FROM YOUR DATA

BENJAMIN GIBLIN
SUPERVISED BY CATHERINE HEYMANS & JOACHIM HARNOIS-DÉRAPS
DEX XIII TALK, 10TH OF JAN. 2017

IMAGE OF THE DISTANT GALAXIES LENSED BY THE DARK MATTER OF THE UNIVERSE



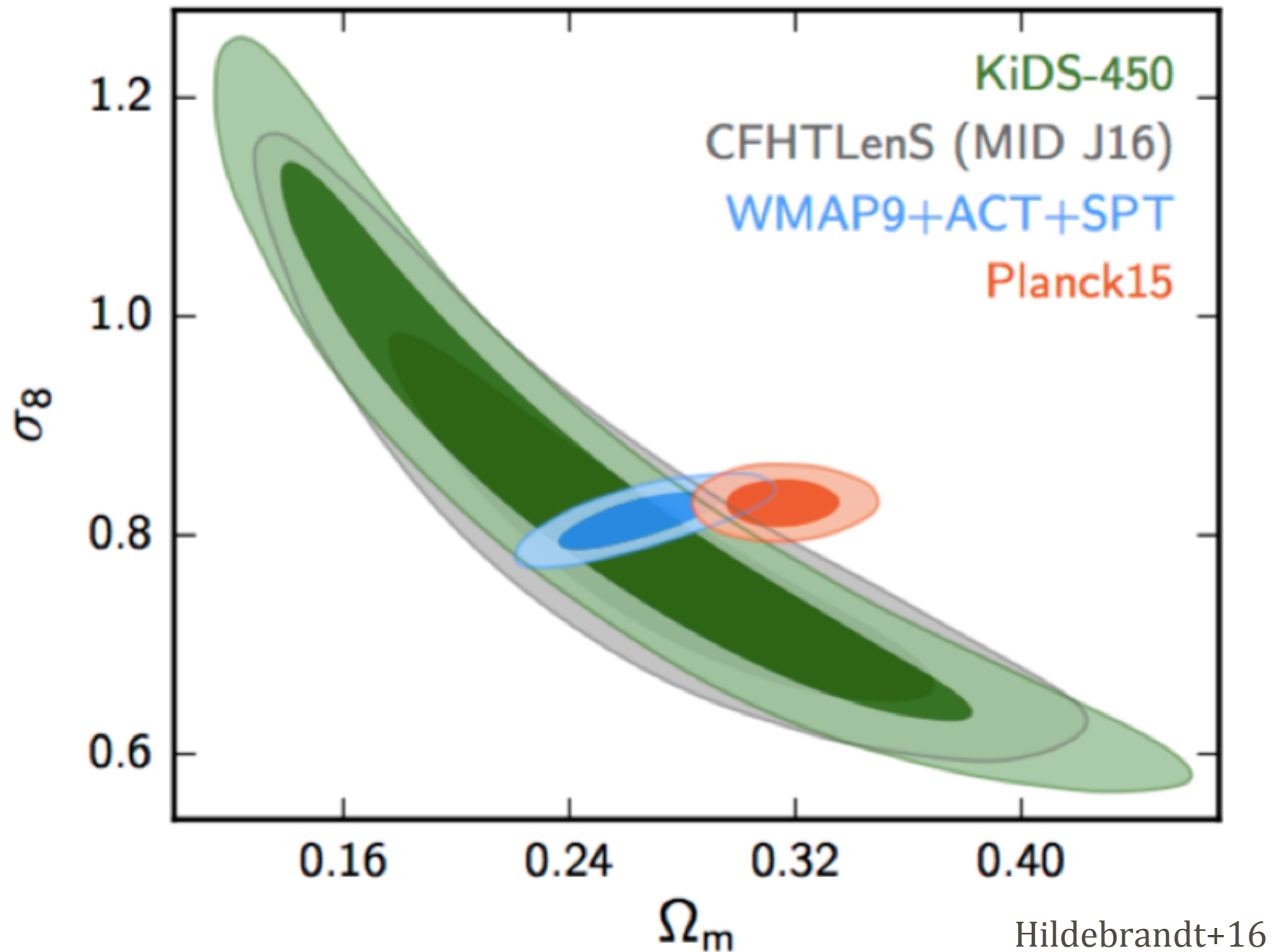
WEAK LENSING

S. Colombi, IAP

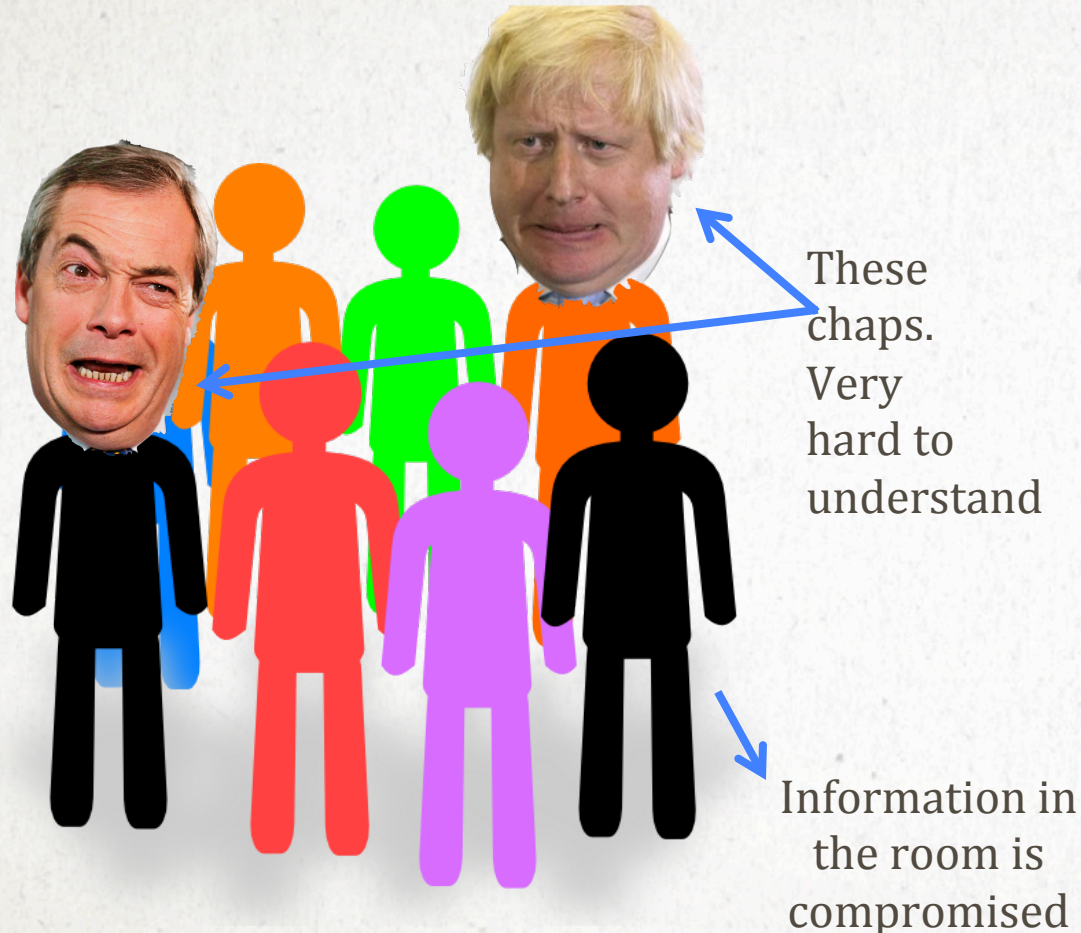
Benjamin Giblin, DEX XIII Talk, 10/01/2016

THE TENSION

- $\sim 2\sigma$ between Planck and lensing surveys.

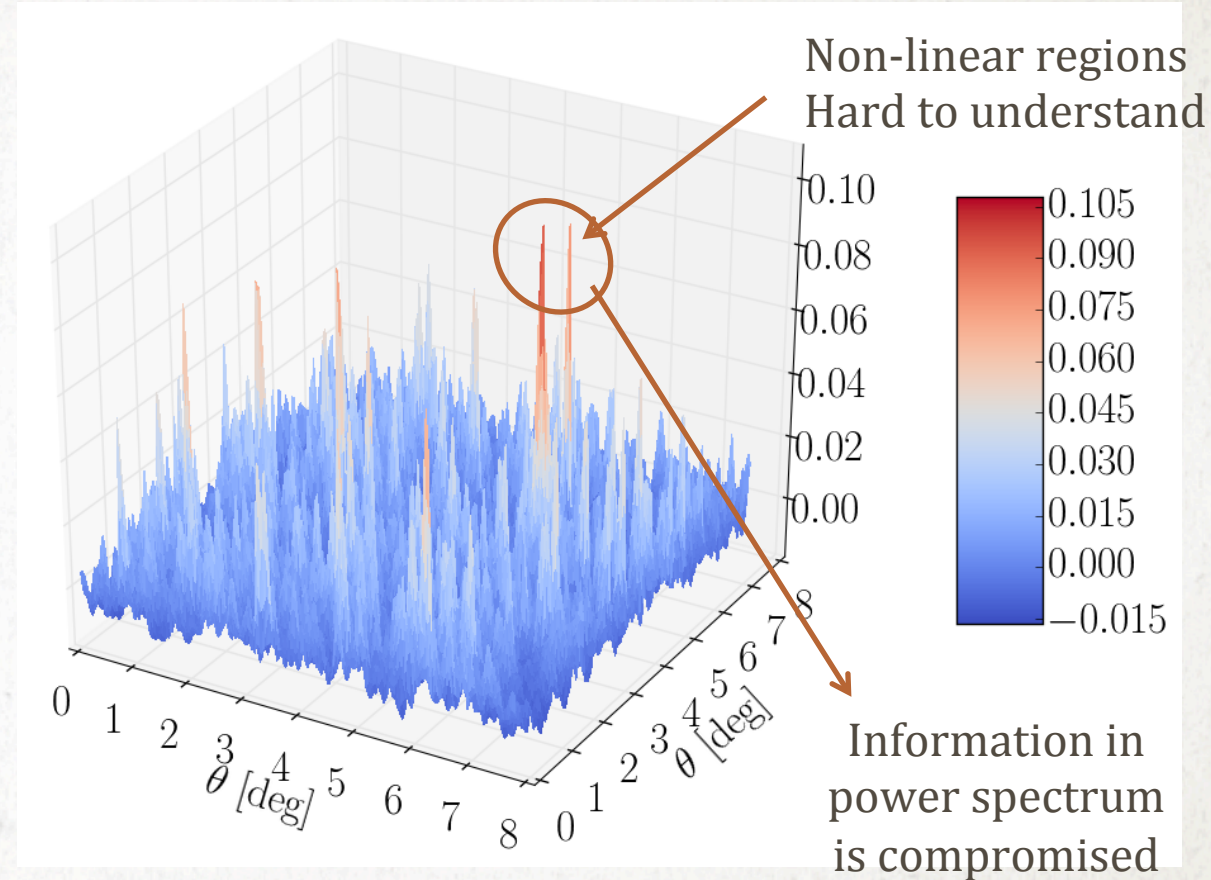


CLIPPING TRANSFORMATIONS → A BREXIT ANALOGY



These chaps.
Very hard to understand

Information in the room is compromised



Non-linear regions
Hard to understand

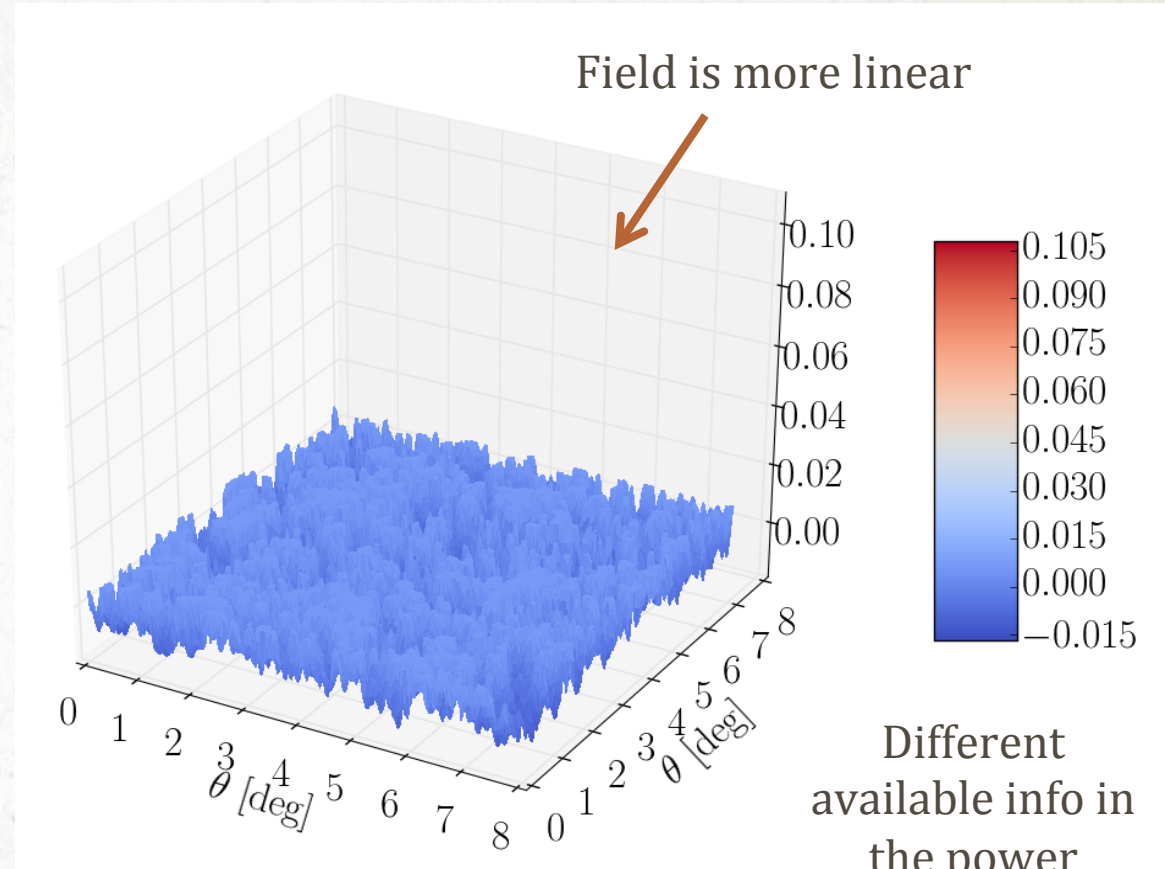
Information in power spectrum is compromised

You get **some** but not **all** the information available

CLIPPING TRANSFORMATIONS → A BREXIT ANALOGY



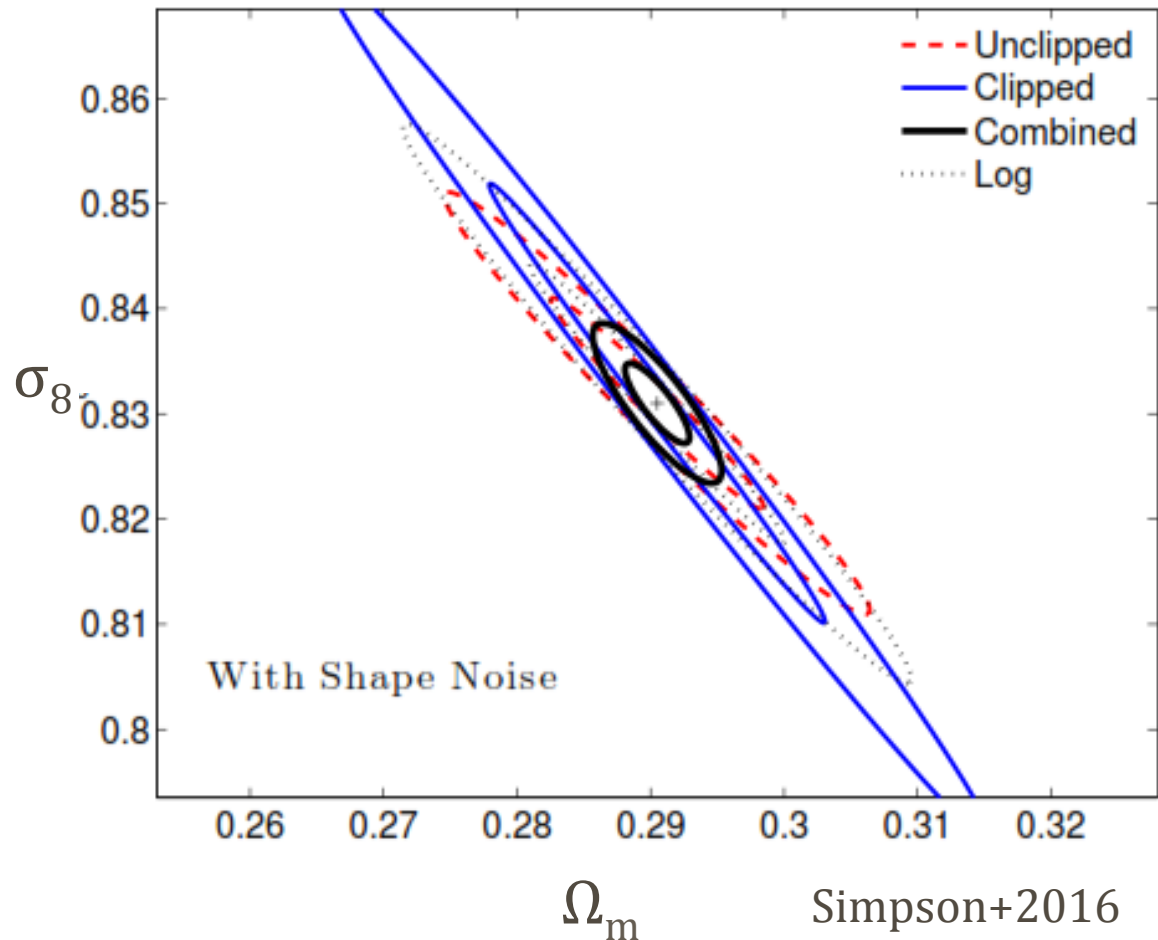
Different available info in the room



Different available info in the power spectrum

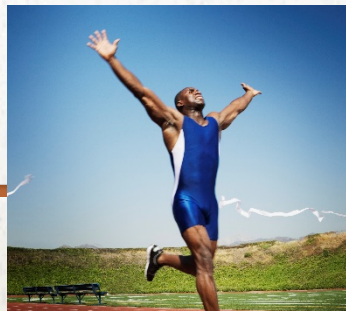
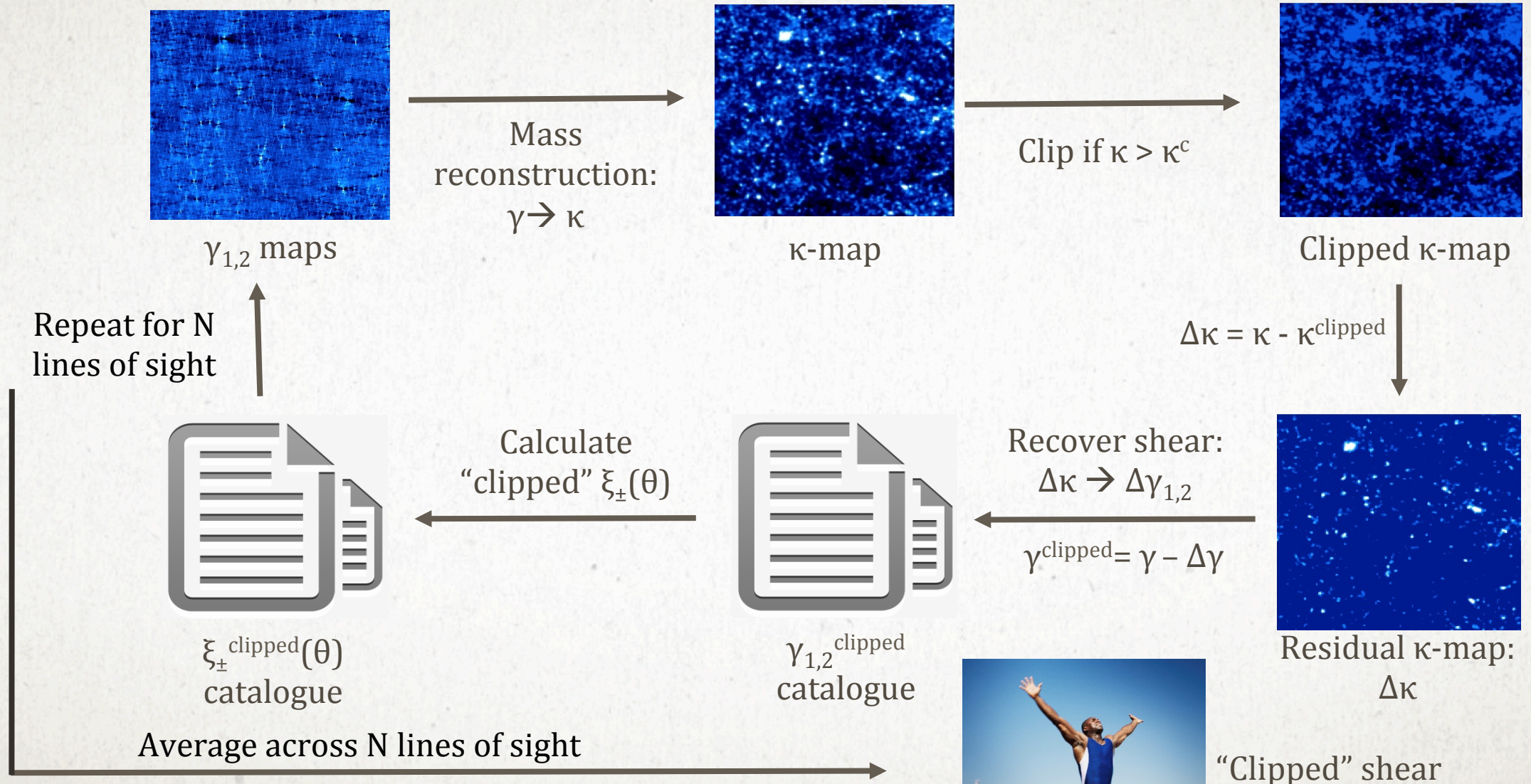
You get **some** but not **all** the information available

CLIPPING: DOES IT WORK?



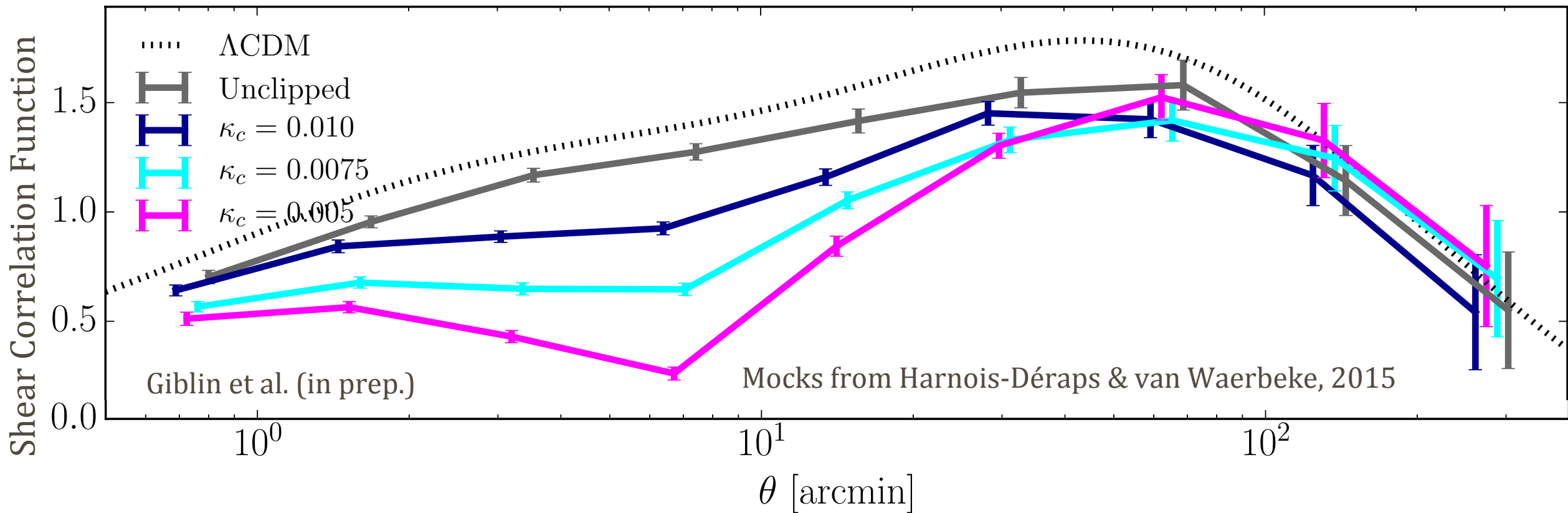
- Induced shift in Ω_m - σ_8 degeneracy.
 - Likelihood contours improved by up to a factor of 3. **No double counting.**
- But no theoretical prediction for clipped statistics → tied to N-body simulations.
- My Aims:
 - Measure “clipped” two-point shear correlation function. Constrain the cosmology of **KiDS-450**.

HOW WE DO CLIPPING

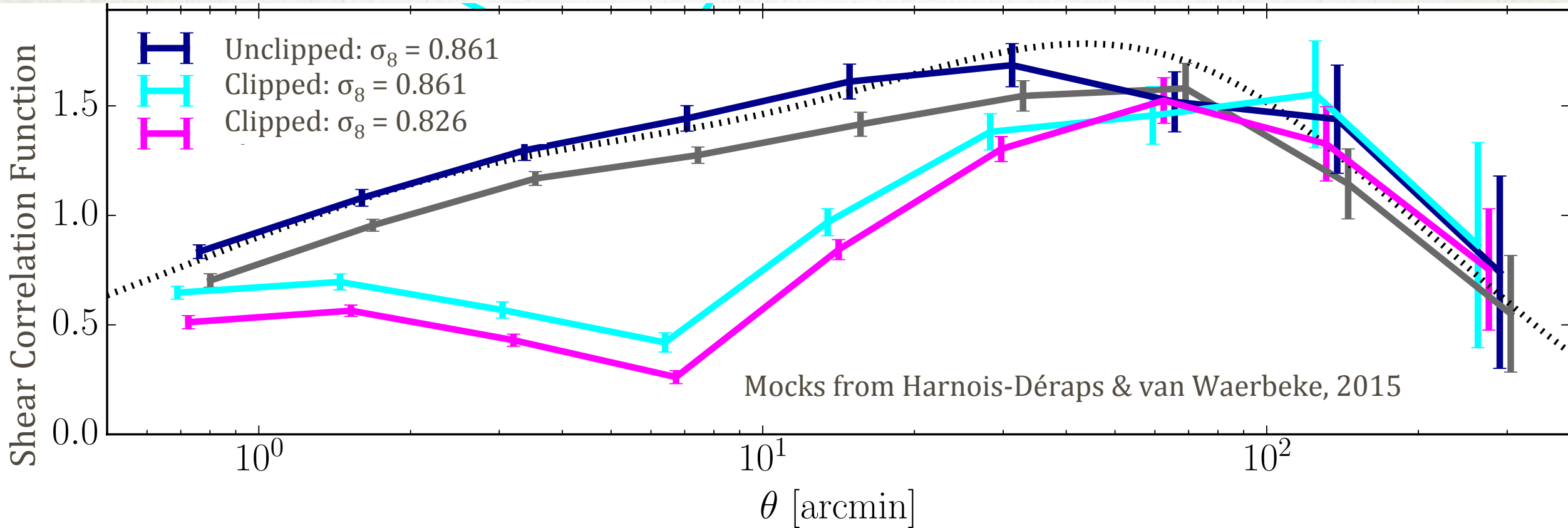


"Clipped" shear angular correlation function!!!

THE CLIPPED CORRELATION FUNCTION: DEPENDENCE ON CLIPPING THRESHOLD



THE CLIPPED CORRELATION FUNCTION: DEPENDENCE ON σ_8



CLIPPING KIDS-450: MASS MAPS

ESO SURVEY SHOWS DARK
MATTER TO BE PRETTY
“SMOOTH”

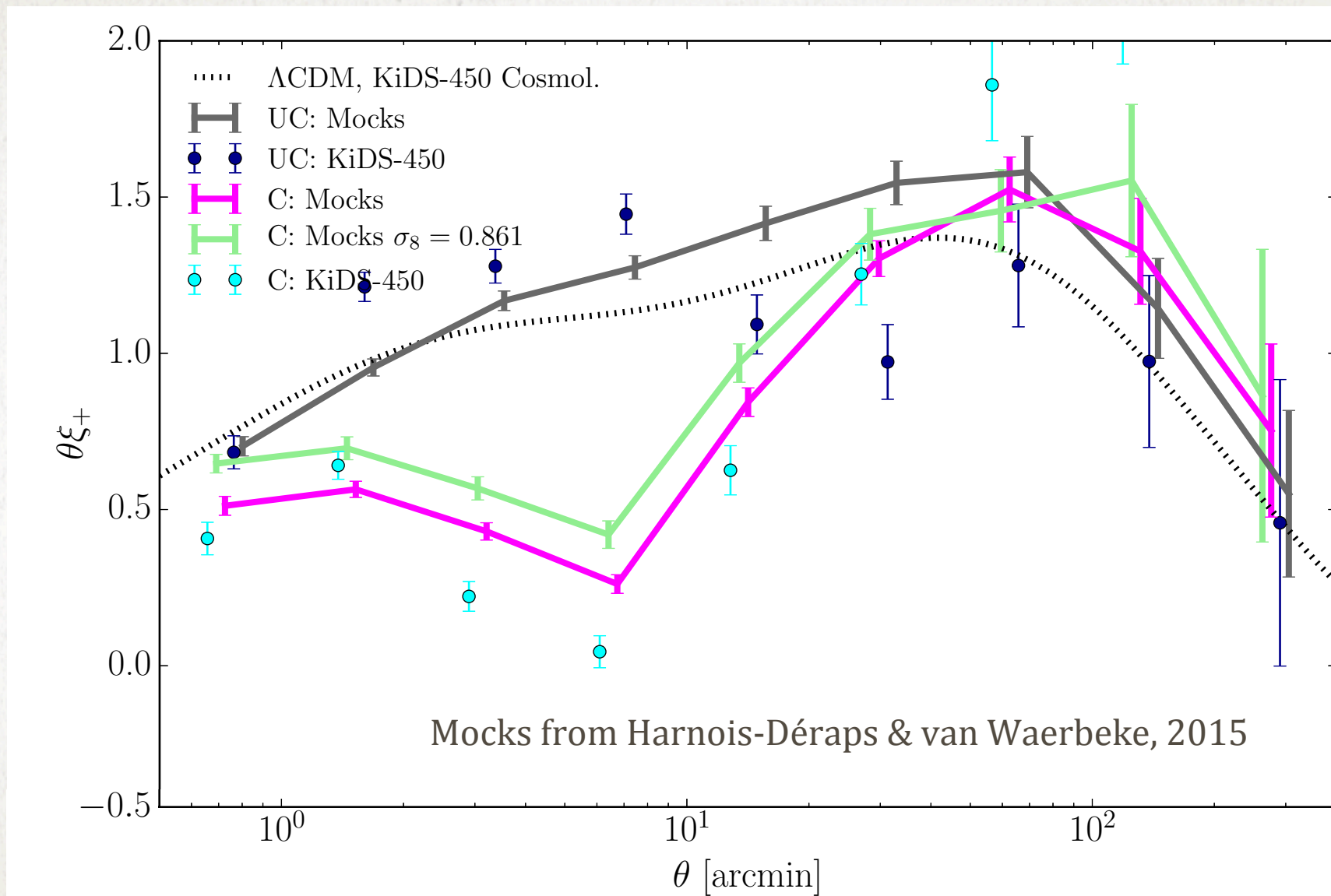
Not-So-Clumpy Dark Matter Poses Cosmological Challenge

By: **Govert Schilling** | December 7, 2016

Dark Matter May be Smoother than Expected

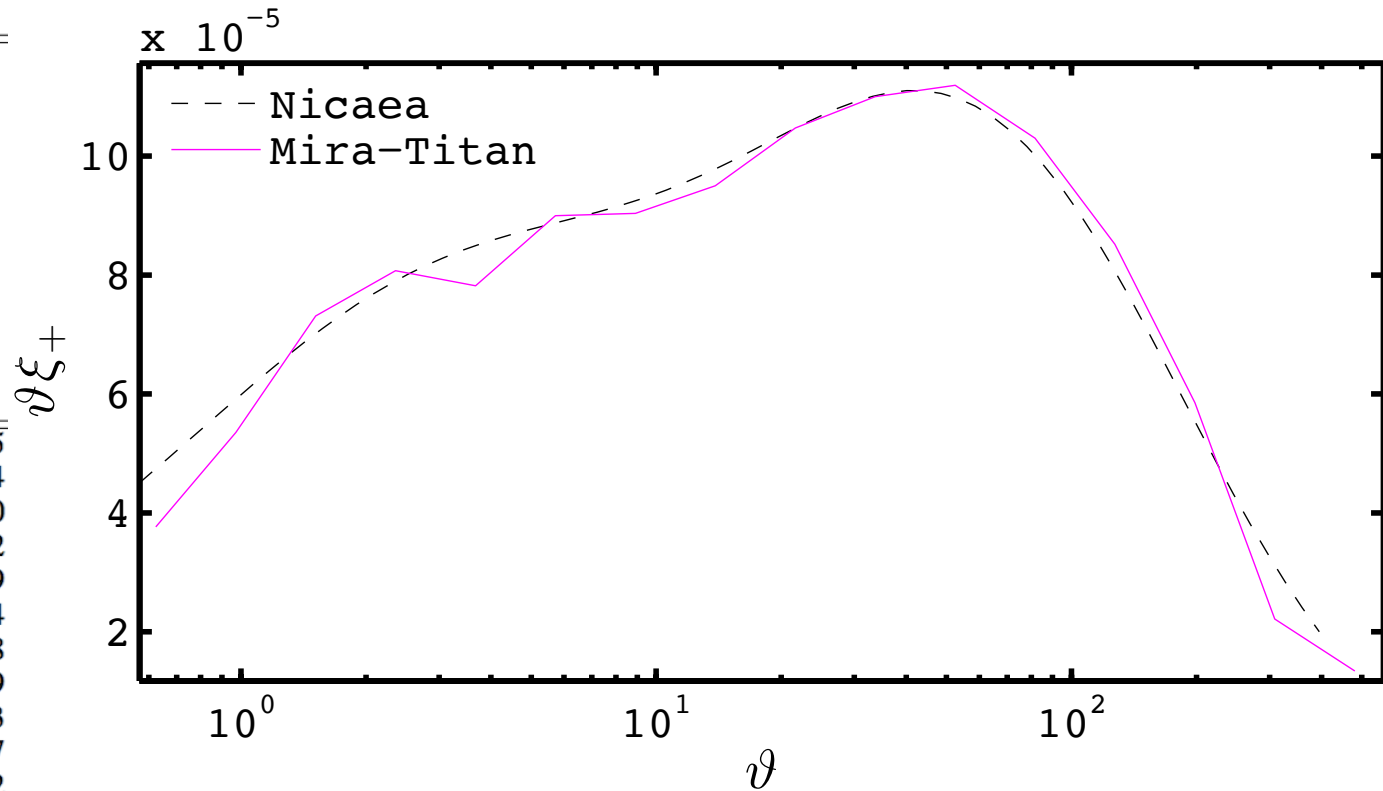
Careful study of large area of sky imaged by VST reveals intriguing result

CLIPPING KIDS-450: CORRELATION FUNCTION



NEXT STEPS: MIRA TITAN SIMULATIONS

Model	ω_m	ω_b	σ_8	h	n_s	w_0	w_a	ω_ν
M000	0.1335	0.02258	0.8	0.71	0.963	-1.0	0.0	0.0
M001	0.1472	0.02261	0.8778	0.6167	0.9611	-0.7000	0.67220	0.0
M002	0.1356	0.02328	0.8556	0.7500	1.0500	-1.0330	0.91110	0.0
M003	0.1550	0.02194	0.9000	0.7167	0.8944	-1.1000	-0.28330	0.0
M004	0.1239	0.02283	0.7889	0.5833	0.8722	-1.1670	1.15000	0.0
M005	0.1433	0.02350	0.7667	0.8500	0.9833	-1.2330	-0.04445	0.0
M006	0.1317	0.02150	0.8333	0.5500	0.9167	-0.7667	0.19440	0.0
M007	0.1511	0.02217	0.8111	0.8167	1.0280	-0.8333	-1.00000	0.0
M008	0.1200	0.02306	0.7000	0.6833	1.0060	-0.9000	0.43330	0.0
M009	0.1394	0.02172	0.7444	0.6500	0.8500	-0.9667	-0.76110	0.0
M010	0.1278	0.02239	0.7222	0.7833	0.9389	-1.3000	-0.52220	0.0
M011	0.1227	0.0220	0.7151	0.5827	0.9357	-1.0821	1.0646	0.000345
M012	0.1241	0.0224	0.7472	0.8315	0.8865	-1.2325	-0.7646	0.001204
M013	0.1534	0.0232	0.8098	0.7398	0.8706	-1.2993	1.2236	0.003770
M014	0.1215	0.0215	0.8742	0.5894	1.0151	-0.7281	-0.2088	0.001752
M015	0.1250	0.0224	0.8881	0.6840	0.8638	-1.0134	0.0415	0.002789
M016	0.1499	0.0223	0.7959	0.6452	1.0219	-1.0139	0.9434	0.002734
M017	0.1206	0.0215	0.7332	0.7370	1.0377	-0.9472	-0.9897	0.000168
M018	0.1544	0.0217	0.7982	0.6489	0.9026	-0.7091	0.6409	0.006419
M019	0.1256	0.0222	0.8547	0.8251	1.0265	-0.9813	-0.3393	0.004673
M020	0.1514	0.0225	0.7561	0.6827	0.9913	-1.0101	-0.7778	0.009777
M021	0.1472	0.0221	0.8475	0.6583	0.9613	-0.9111	-1.5470	0.000672



SUMMARY

- Clipping is a field transformation designed to improve the performance of two-point statistics.
- Improved cosmological constraints when clipped and unclipped are combined.
- **But** obtaining cosmological constraints requires a suite of N-body simulations.
- We're ready to apply this to Mira Titan and constrain KiDS-450!

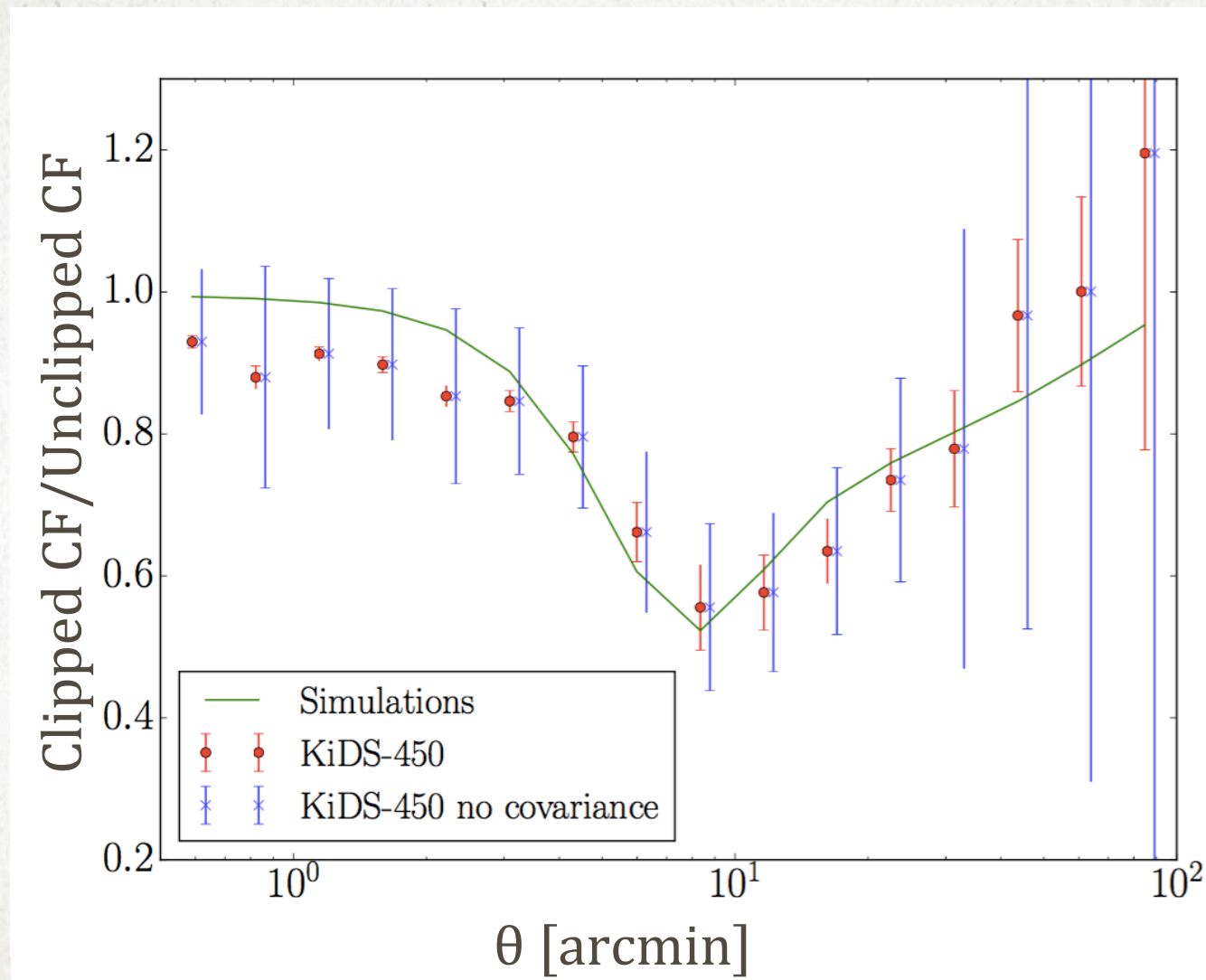
THANK YOU



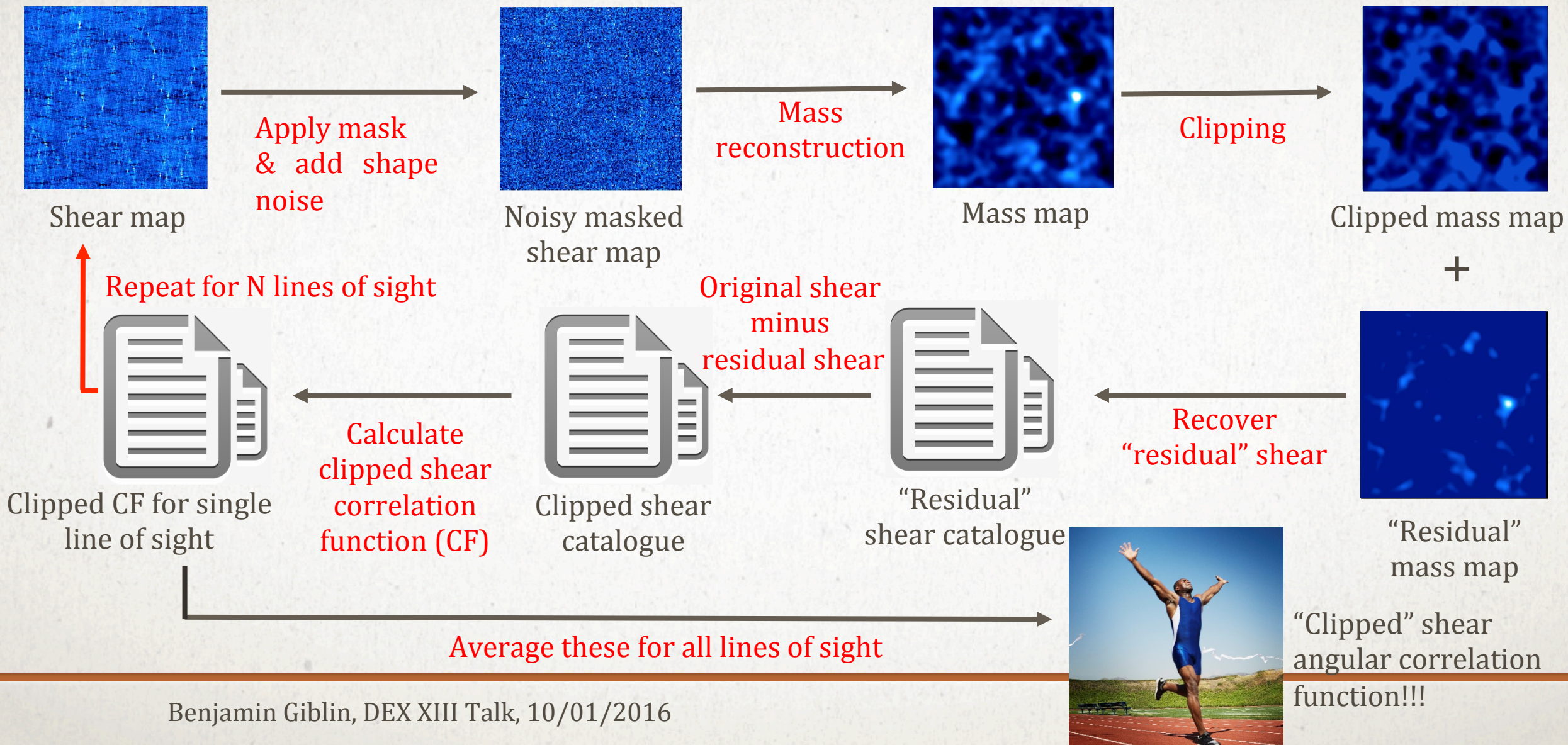
“Nobody said that sending Boris outside was a perfect solution...”

EXTRA SLIDES

CLIPPING KIDS-450: EXPLOITING NOISE CANCELATION

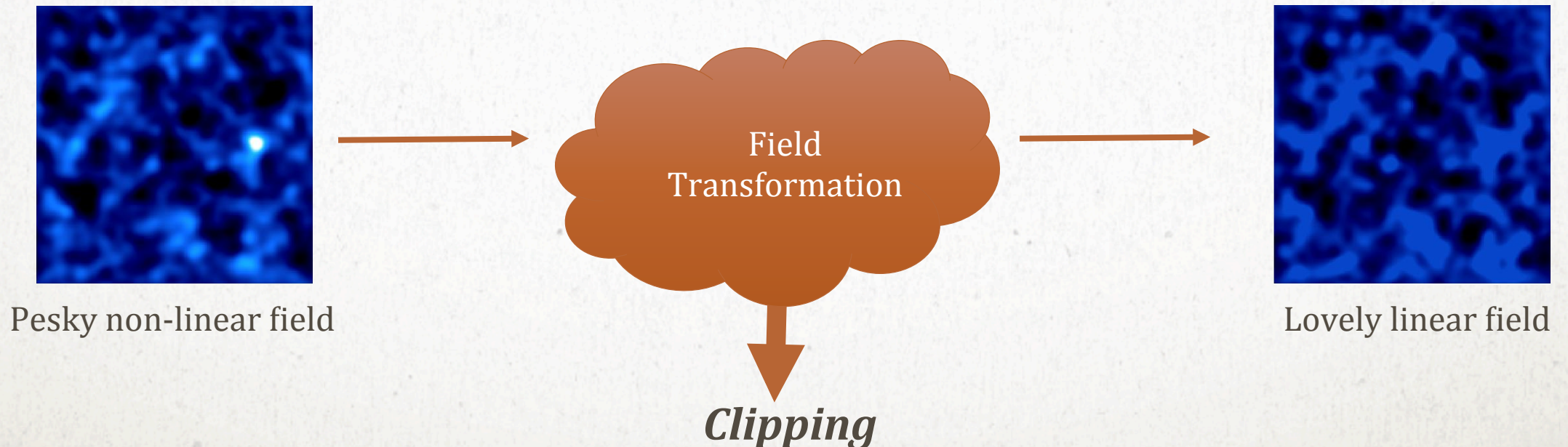


STEP 1: BUILD PIPELINE, CLIP SIMULATIONS



CONSTRAINING COSMOLOGY

- Two-point statistics (power spectra, correlation functions) are sub-optimal for extracting information from non-linear fields; this is *bad*.
- What if we could transform the field to make to more linear...? This could improve the performance of two-point statistics for extracting info!



CLIPPING MOCKS: TURNING THE DIALS

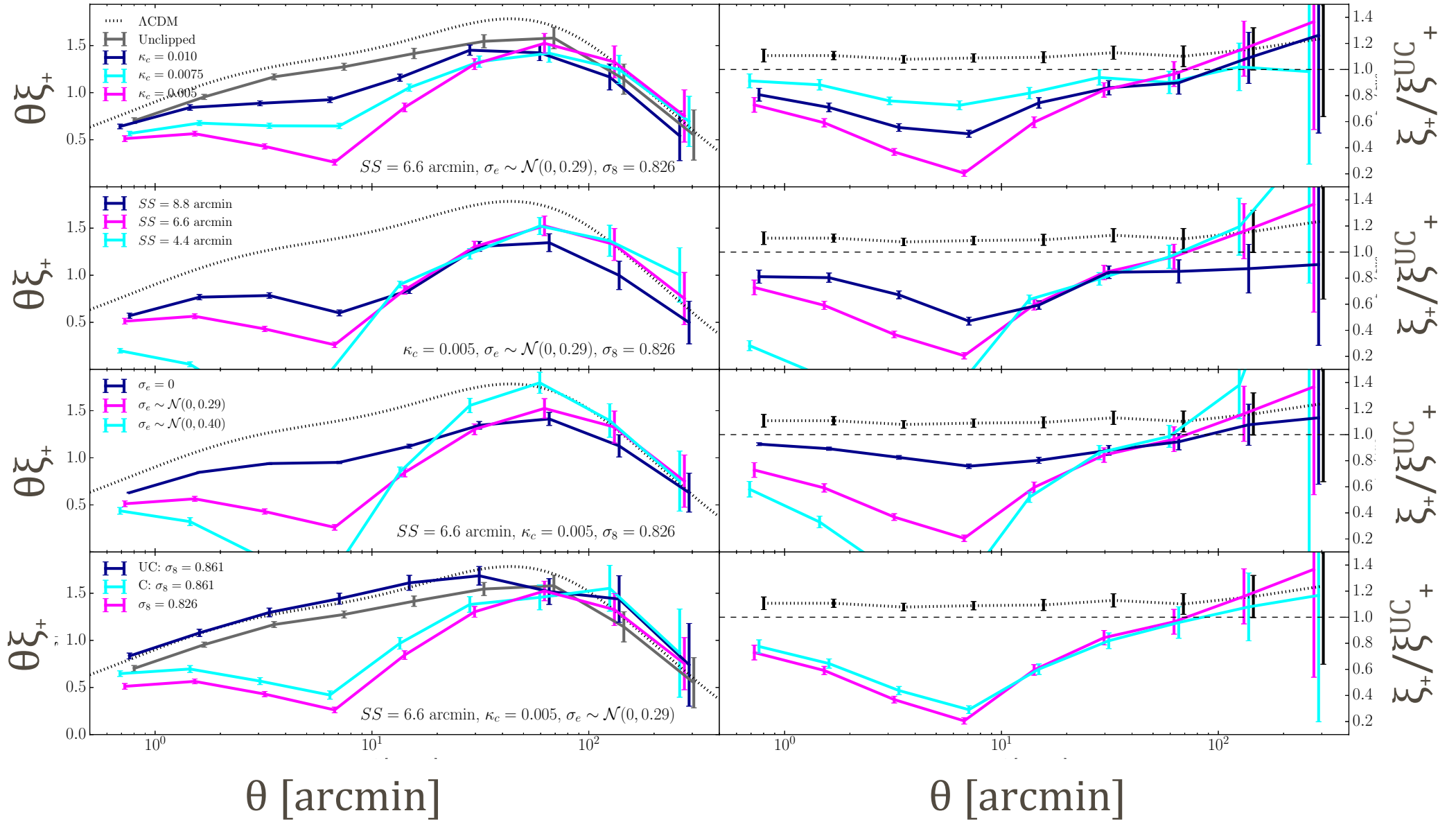
Varying...

Clipping threshold

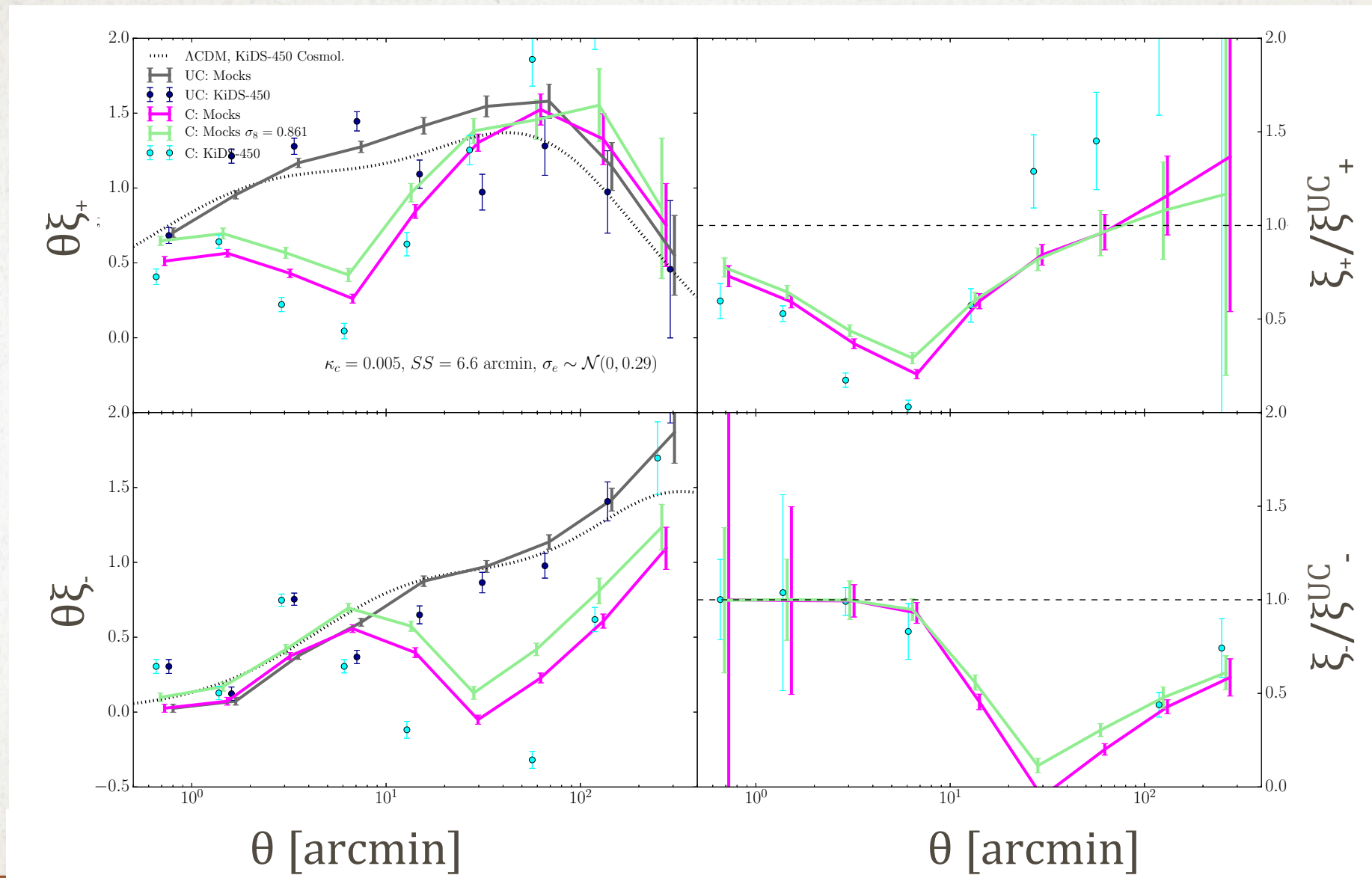
Smoothing Scale

Galaxy Shape Noise

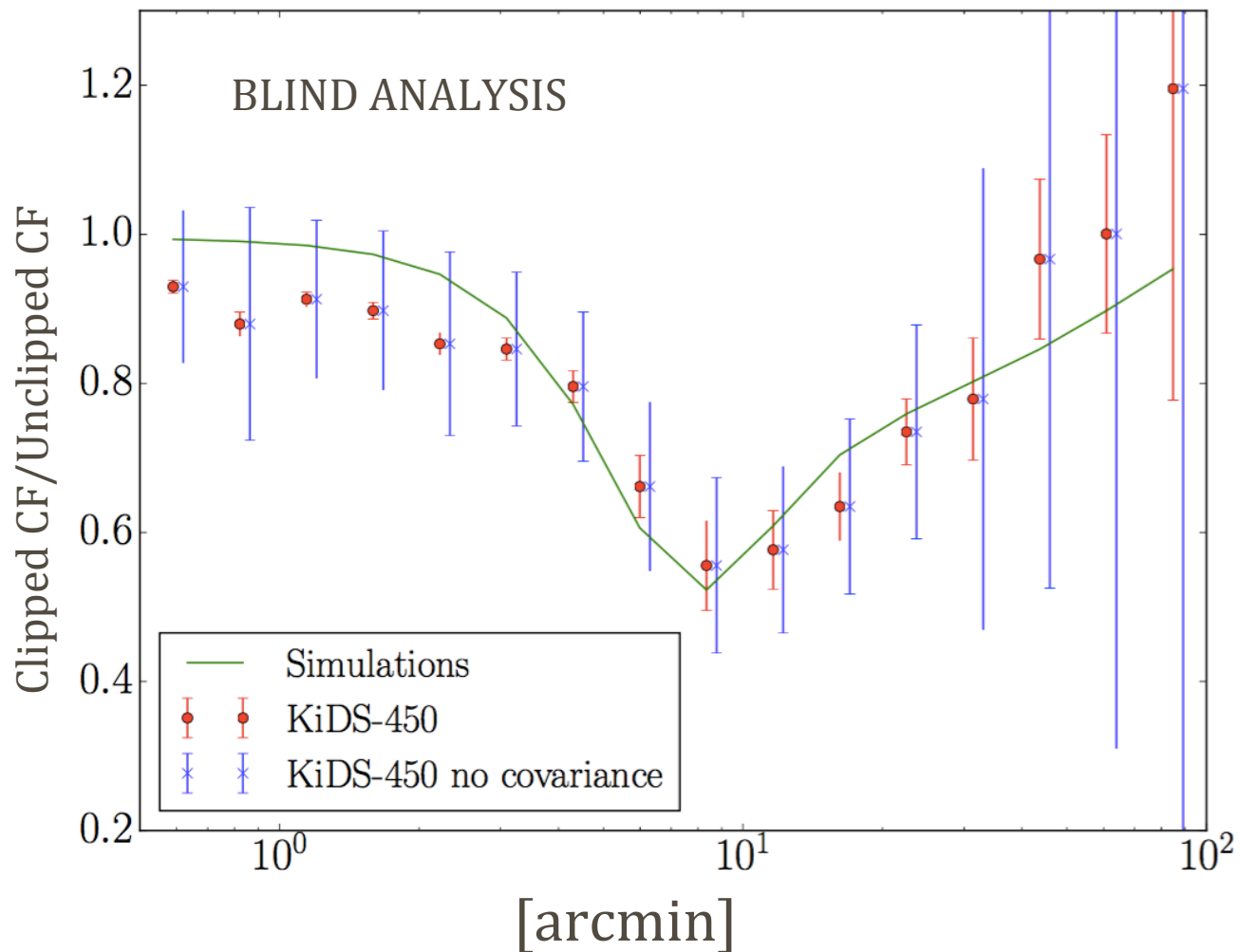
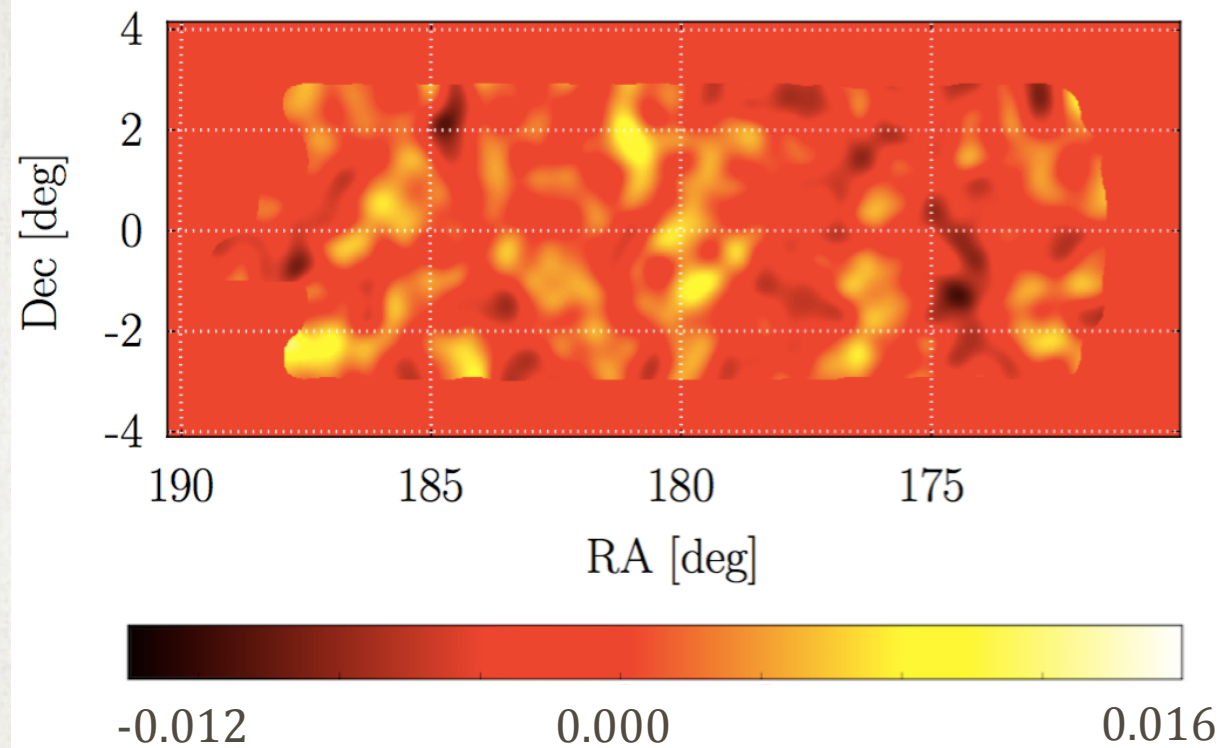
σ_8



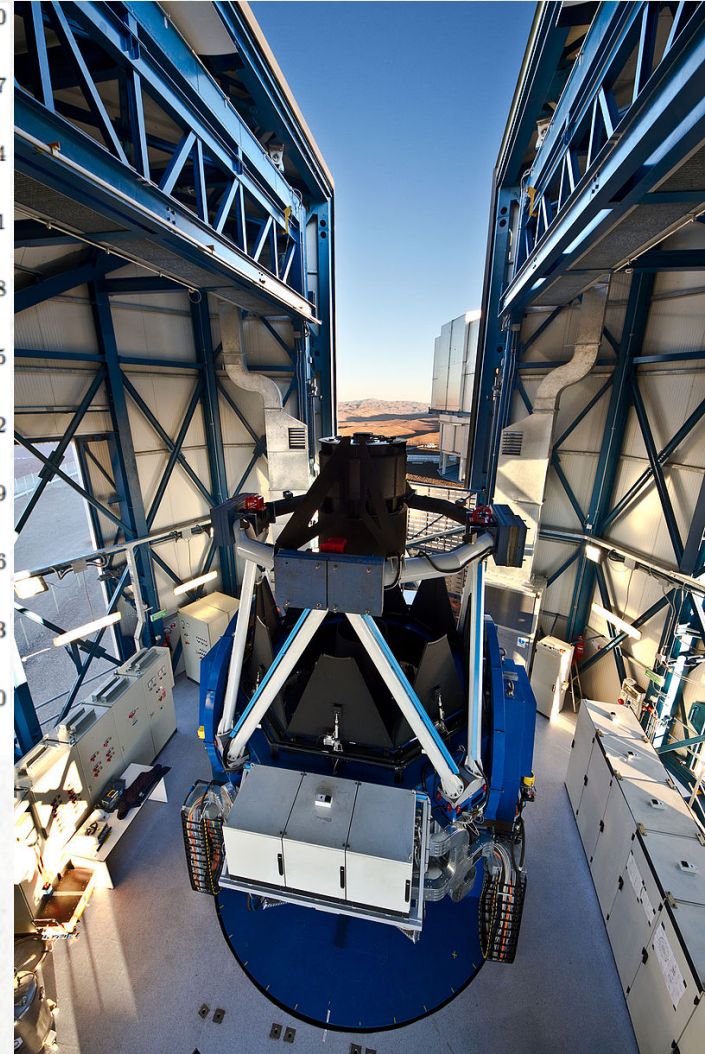
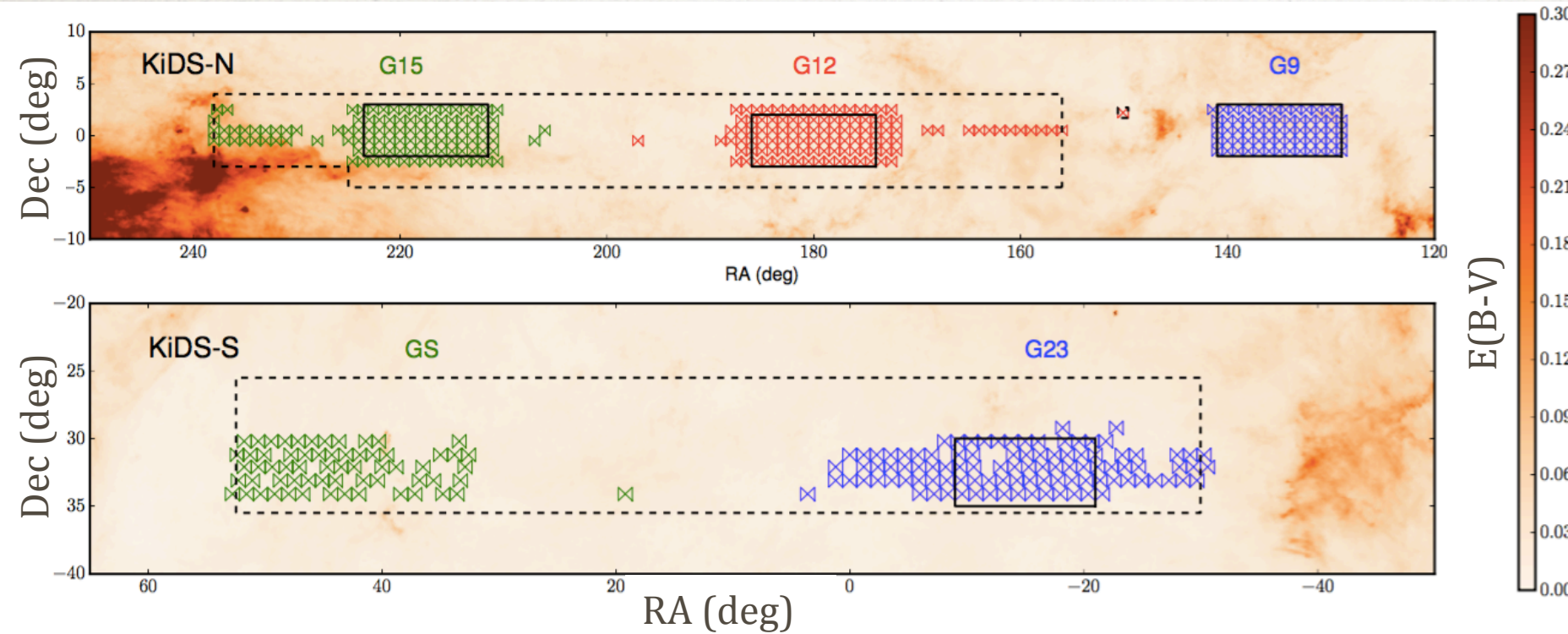
CLIPPING KIDS-450: CORRELATION FUNCTIONS



CLIPPING KiDS-450



WEAK LENSING IN THE KILO-DEGREE SURVEY (KiDS)



VLT Survey Telescope (VST)

- Aims to survey 1500 sq. deg. in the bands ugr_i; currently up to 450 in r-band.
- “KiDS-450” contains shear estimates for ~15 million galaxies out to $z=0.9$ (Hildebrandt+16).