HERMES

HerMES - Herschel Multi-tiered Extragalactic Survey

To study the evolution of galaxies in the distant Universe
The biggest project on the Herschel Space Observatory
A European Space Agency mission

Astronomy Technology Centre
California Institute of Technology
Cardiff University
CEA, Saclay
Cornell
ESAC
Godard Space Flight Centre
Imperial College, London
Infrared Processing Analysis Centre
Institut d'Astrophysique de Paris
Institut d'Astrophysique Spatiale
Institute Astrophysica Canarias
Jet Propulsion Lab.
Laboratory of Astrophysics of Marseilles
Mullard Space Science Laboratory
OAPd University of Padova
UC Irvine
University of British Columbia
University of Colorado
University of Hertfordshire
University of Sussex

HERMES

Outline

- Motivation
- SDP Data
- Preliminary science with Herschel only
- Preliminary science adding in other data
- Conclusion

The Team

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Faculty & Researchers PostDocs PhD Students

Plus engineers, instrument builders, software developers etc.

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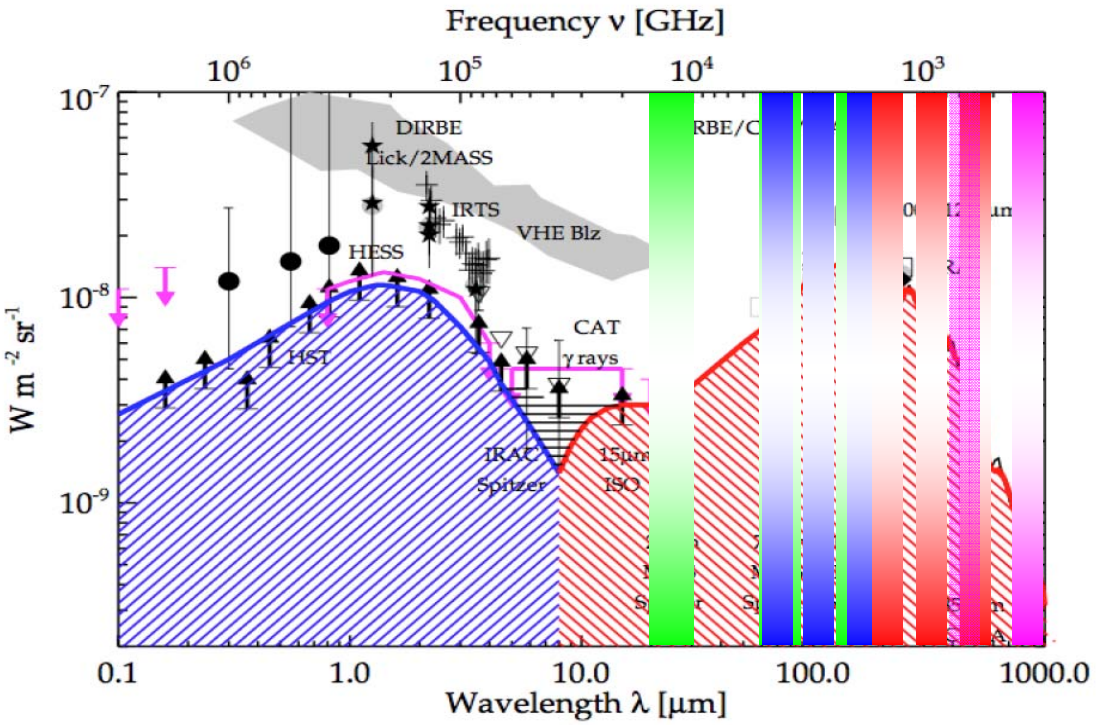
Cosmic Far-Infrared Background Radiation



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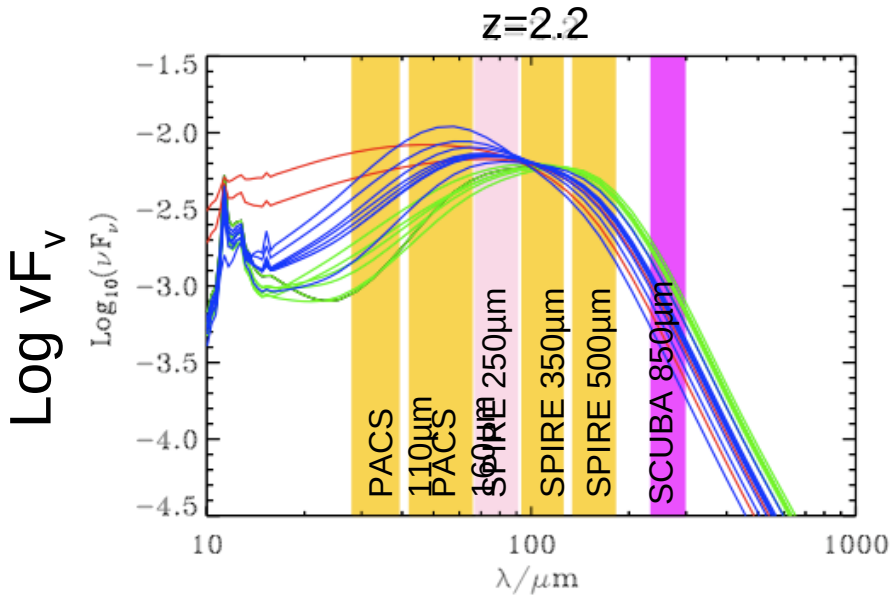
Constraining Bolometric Luminosity



Normalised to have same FIR Luminosity

Rest-frame wavelength

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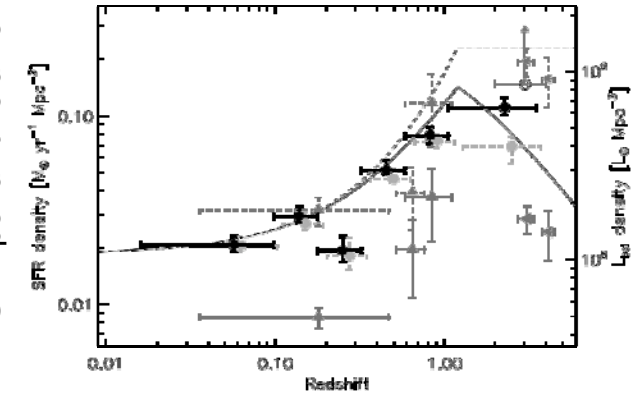
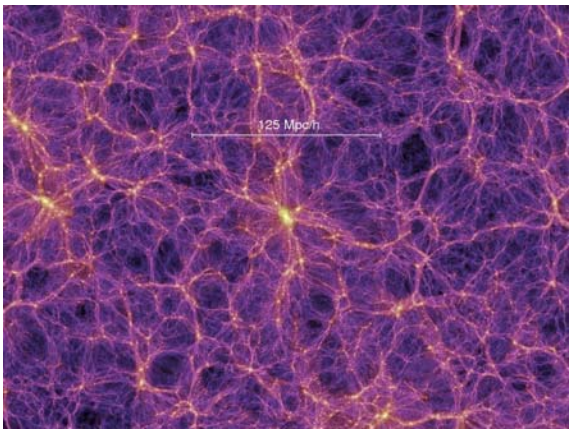
Mapping SFH

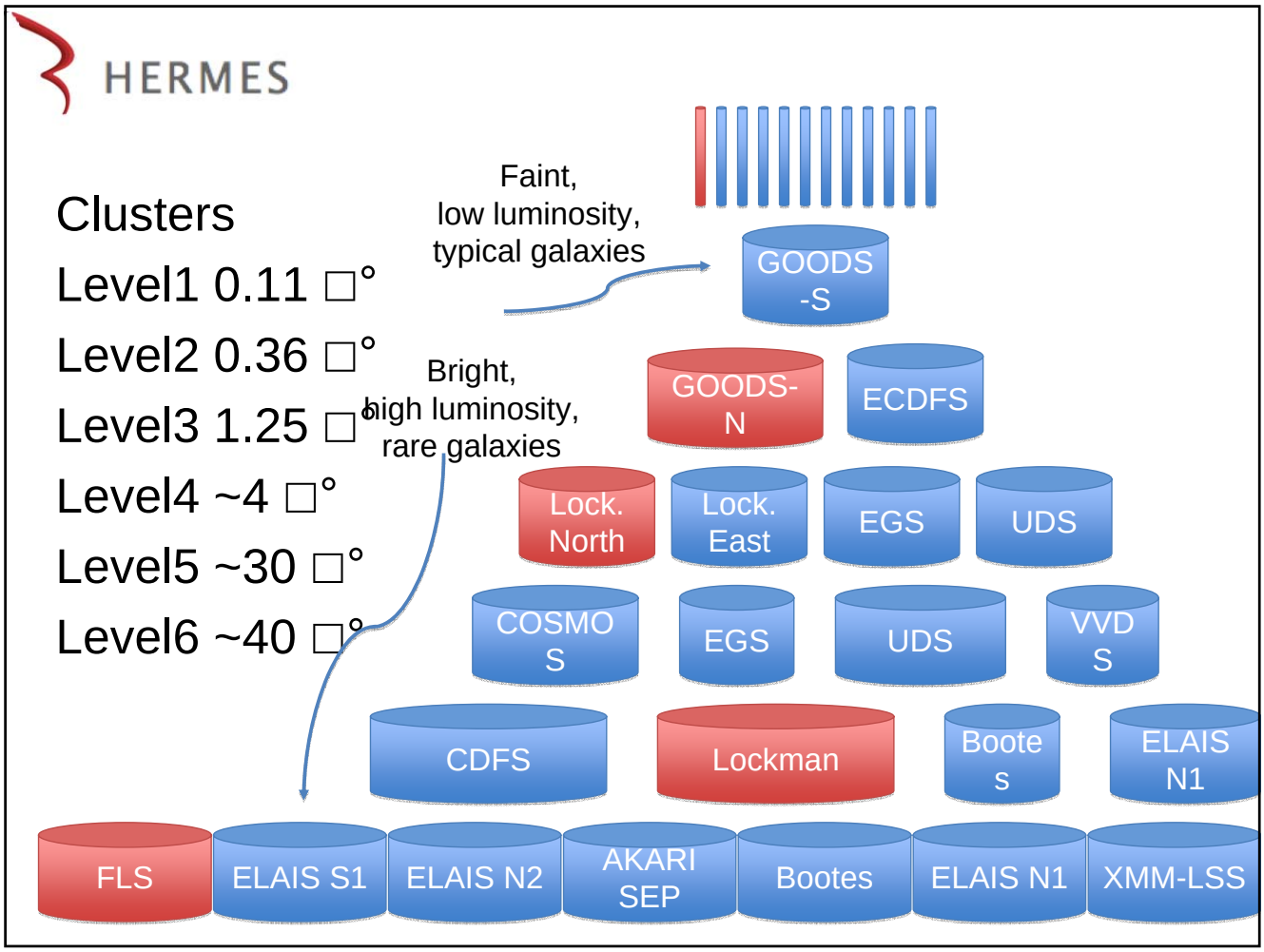
SFR per unit volume

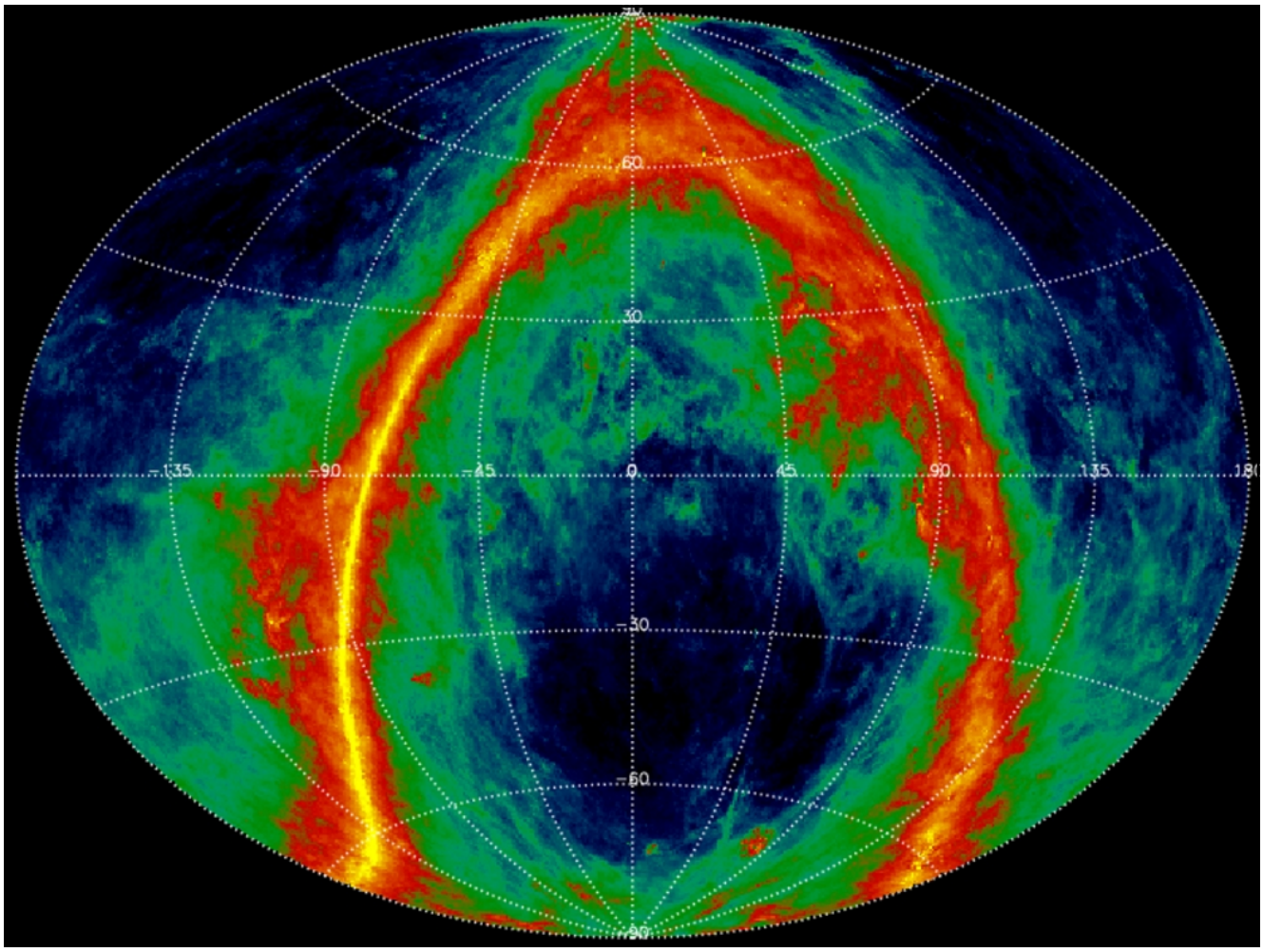


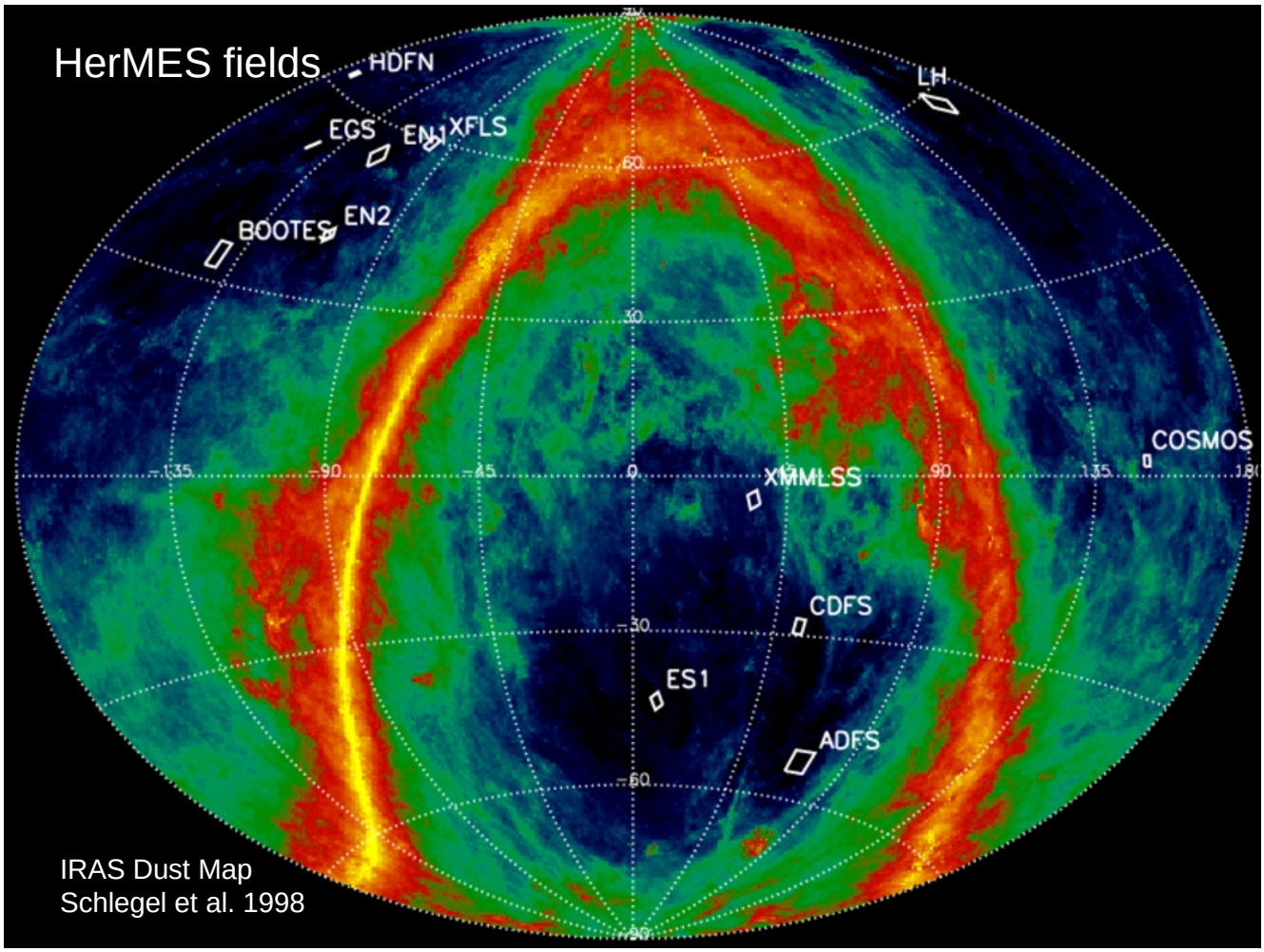
Pascale et al. 2009



Millennium simulation


HERMES
Clusters
Level1 0.11 □°
Level2 0.36 □°
Level3 1.25 □°
Level4 ~4 □°
Level5 ~30 □°
Level6 ~40 □°
Faint,
low luminosity,
typical galaxies
Bright,
high luminosity,
rare galaxies
GOODS-S
GOODS-N
ECDFS
Lock. North
Lock. East
EGS
UDS
COSMOS
EGS
UDS
VVDS
CDFS
Lockman
Bootes
ELAIS N1
FLS
ELAIS S1
ELAIS N2
AKARI SEP
Bootes
ELAIS N1
XMM-LSS


60
30
-135
-90
-45
0
45
90
135
-30
-60


HerMES fields
HDFN
EGS
EN1
XFLS
BOOTES
EN2
LH
COSMOS
XMMLSS
CDFS
ES1
ADFS
IRAS Dust Map
Schlegel et al. 1998

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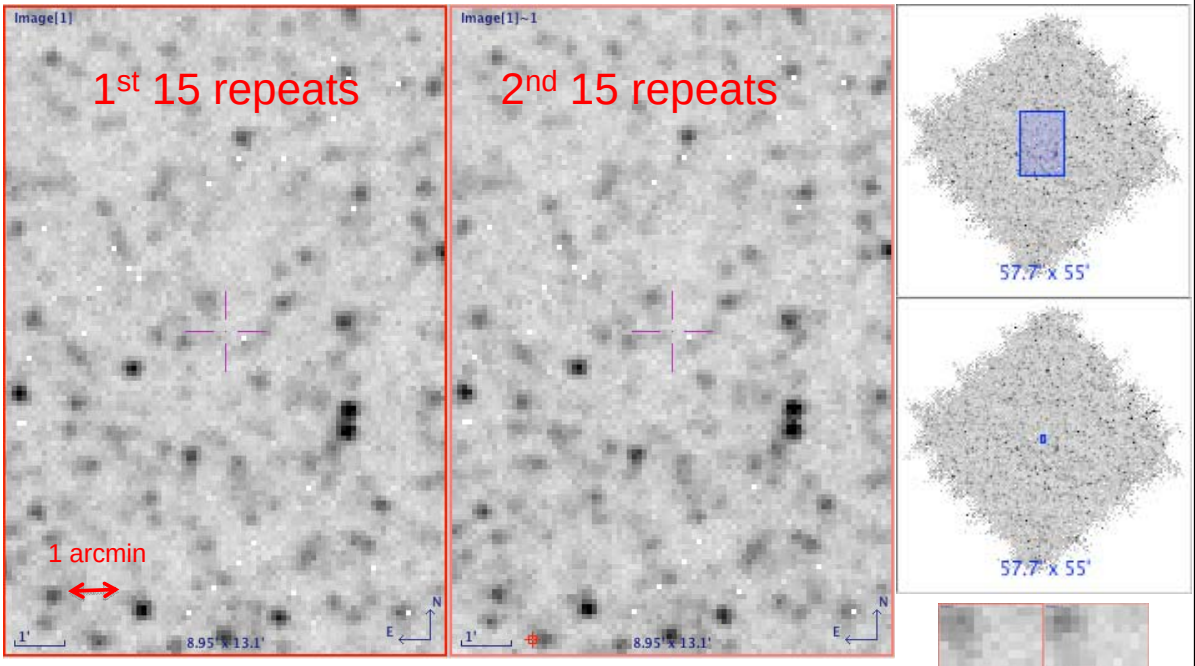
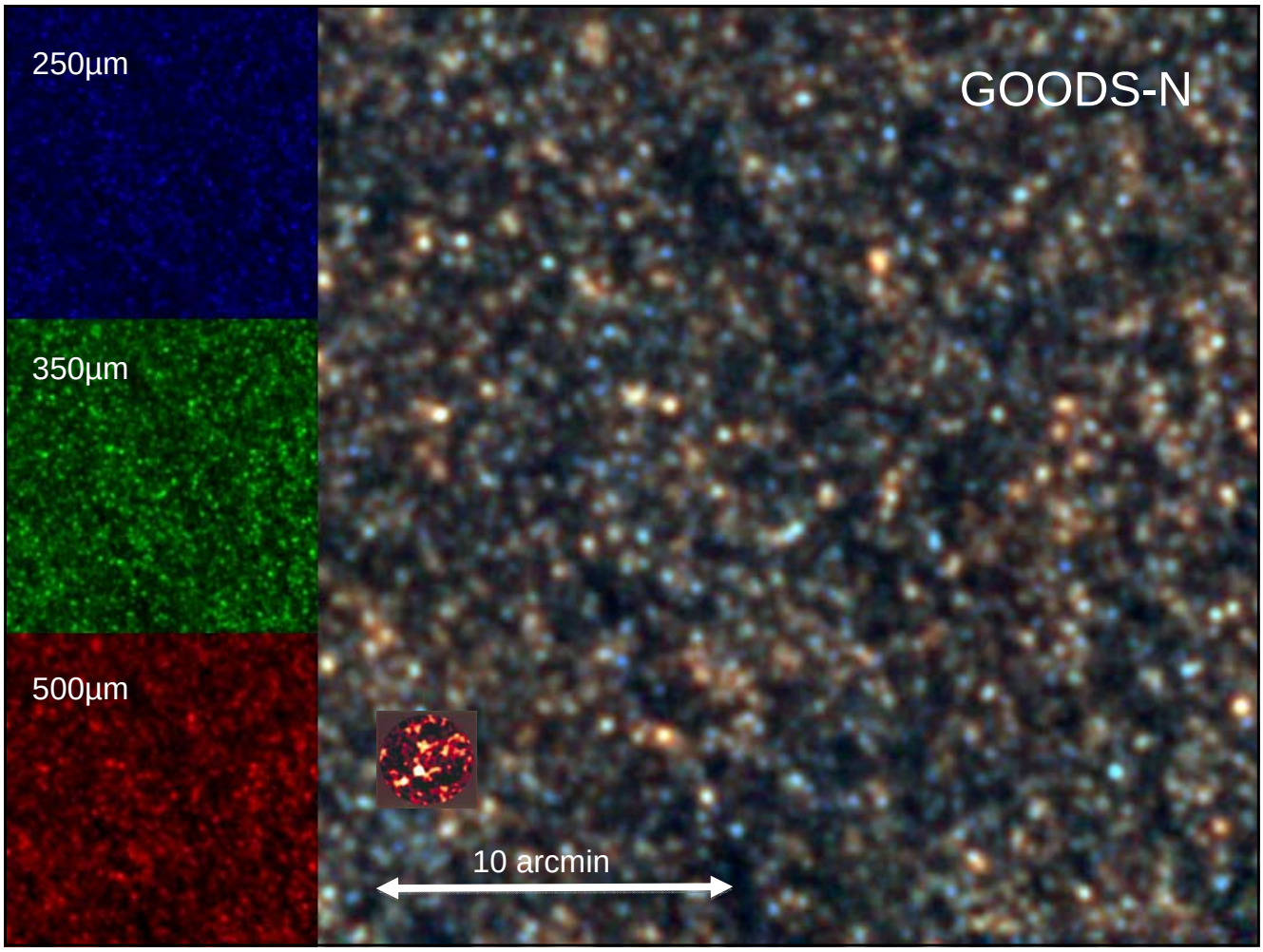
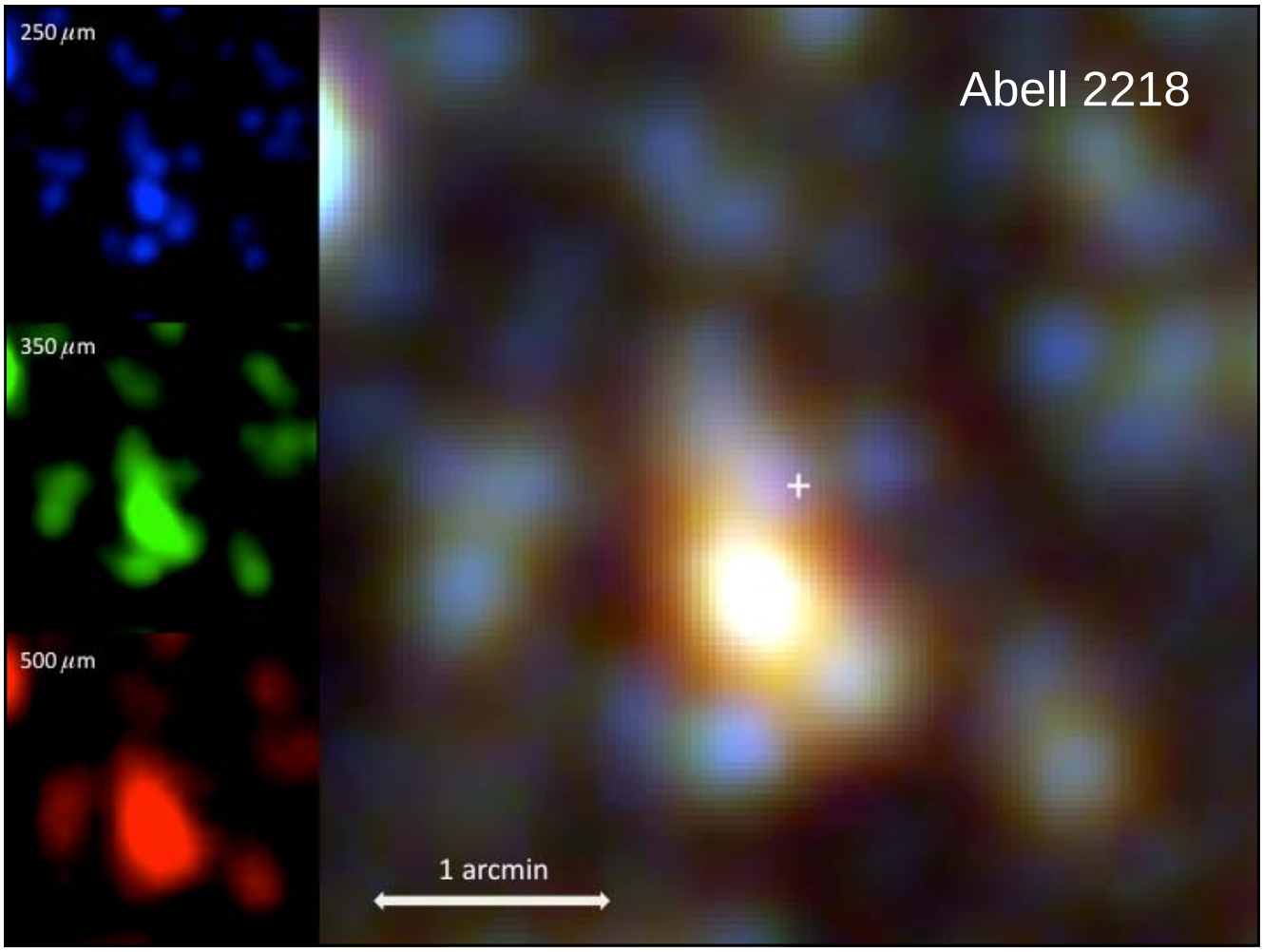
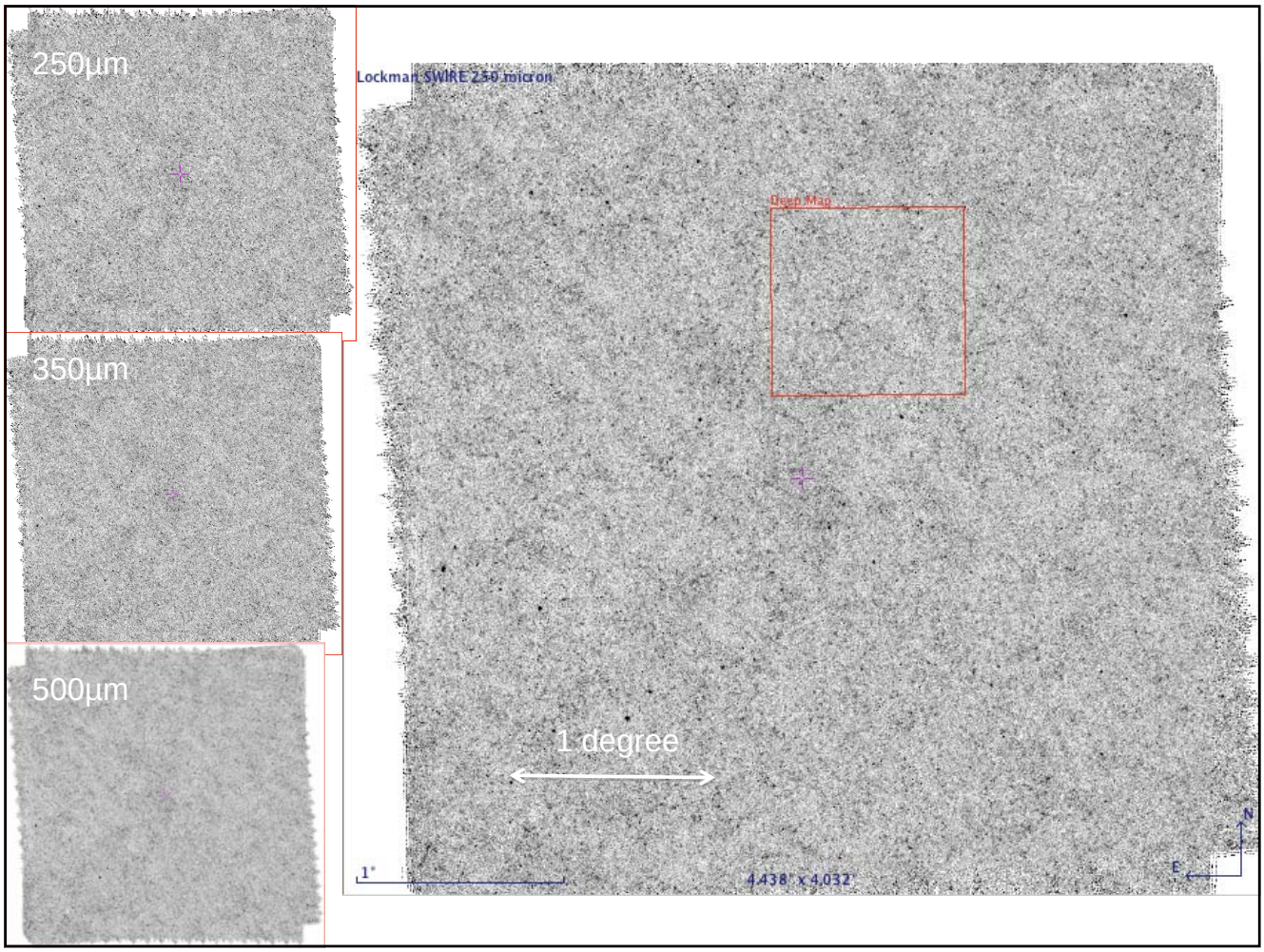
Data Quality

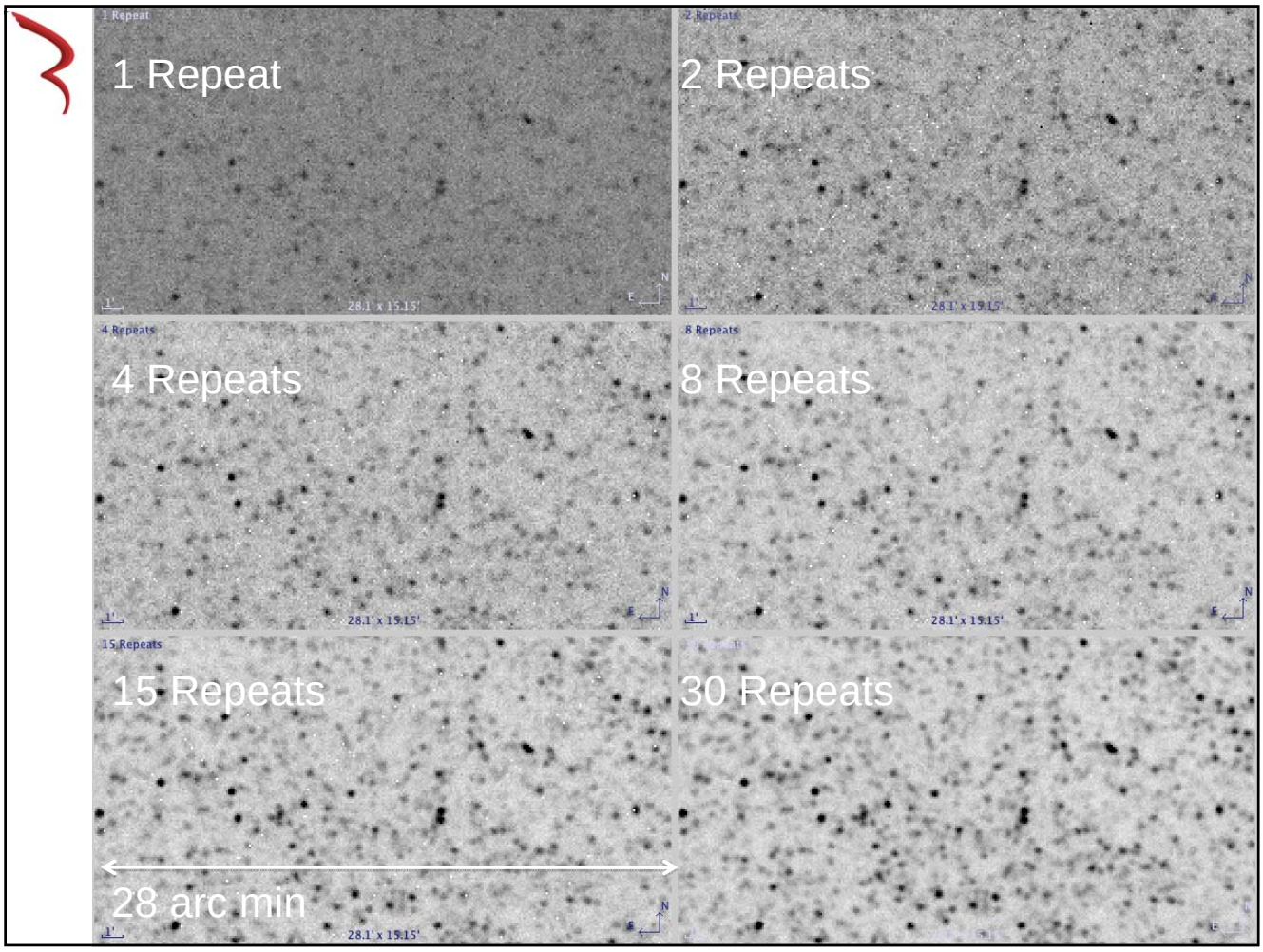


Everything you see is


250µm
350µm
500µm
GOODS-N
10 arcmin


250 μm
350 μm
500 μm
Abell 2218
1 arcmin


250µm
350µm
500µm
Lockman SWIRE 250 micron
Deep Map
1 degree
1°
4.438° x 4.032°
N
E


1 Repeat
1 Repeat
2 Repeats
2 Repeats
4 Repeats
4 Repeats
8 Repeats
8 Repeats
15 Repeats
15 Repeats
30 Repeats
28 arc min
28.1' x 19.15'

SPIRE Confusion Limit

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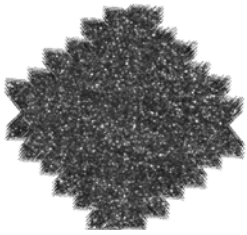
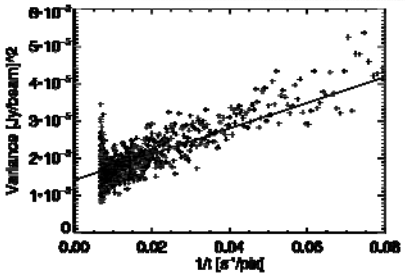
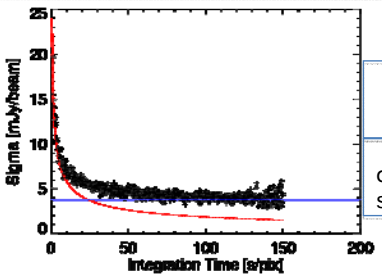
Map fluctuations in the limit of no instrument noise.

250 µm



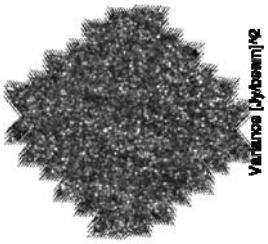


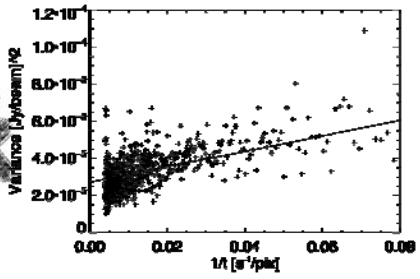


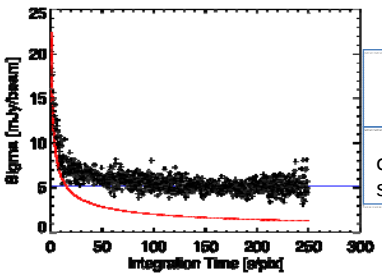
σ_{conf} = 4 mJy/beam

σ_{inst} = 20 (mJy/beam) $s^{0.5}$

350 µm



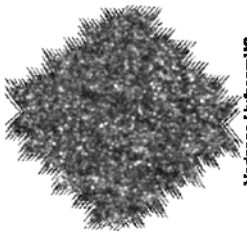


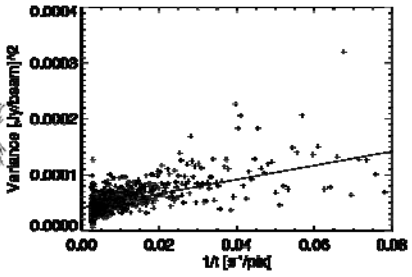


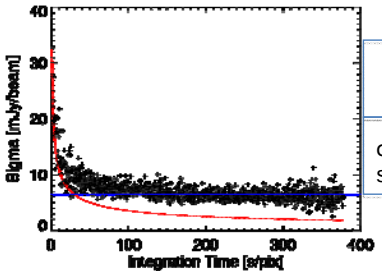
σ_{conf} = 5 mJy/beam

σ_{inst} = 19 (mJy/beam) $s^{0.5}$

500 µm







σ_{conf} = 6 mJy/beam

σ_{inst} = 36 (mJy/beam) $s^{0.5}$

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Science Demonstration Obs.

A2218	9’ × 9’
GOODS-N	30’ × 30’
Lockman-North	35’ × 35’
FLS	2.6° × 2.3°
Lockman-SWIRE	3.6°× 3.6°

27,113 sources

Flux(250μm) >20mJy

about 7% of our final time

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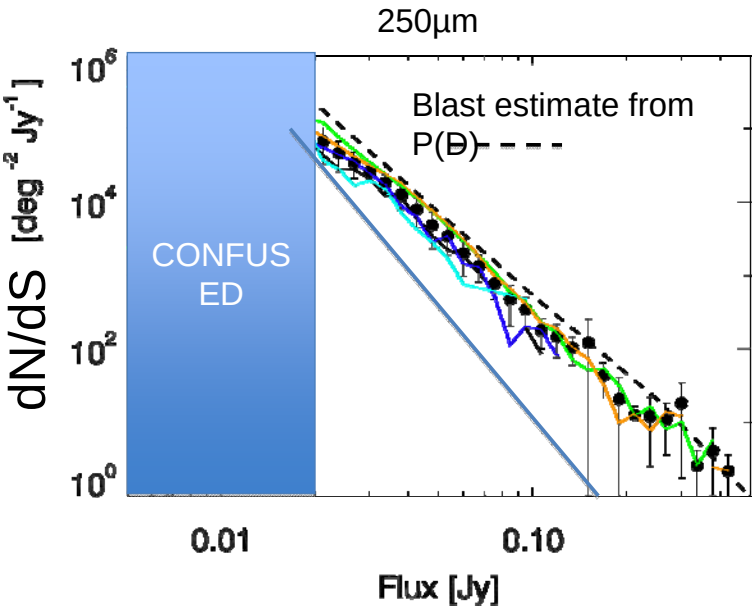
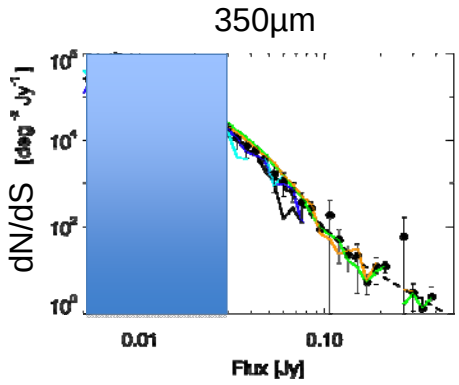
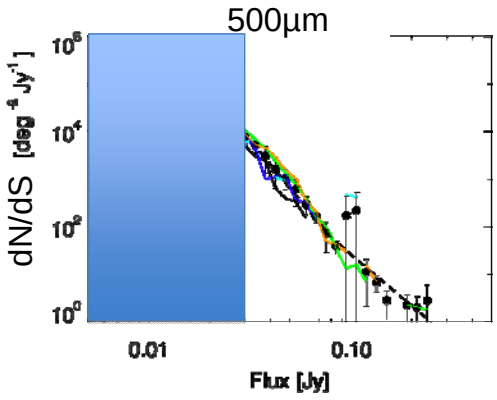
Counts from resolved sources







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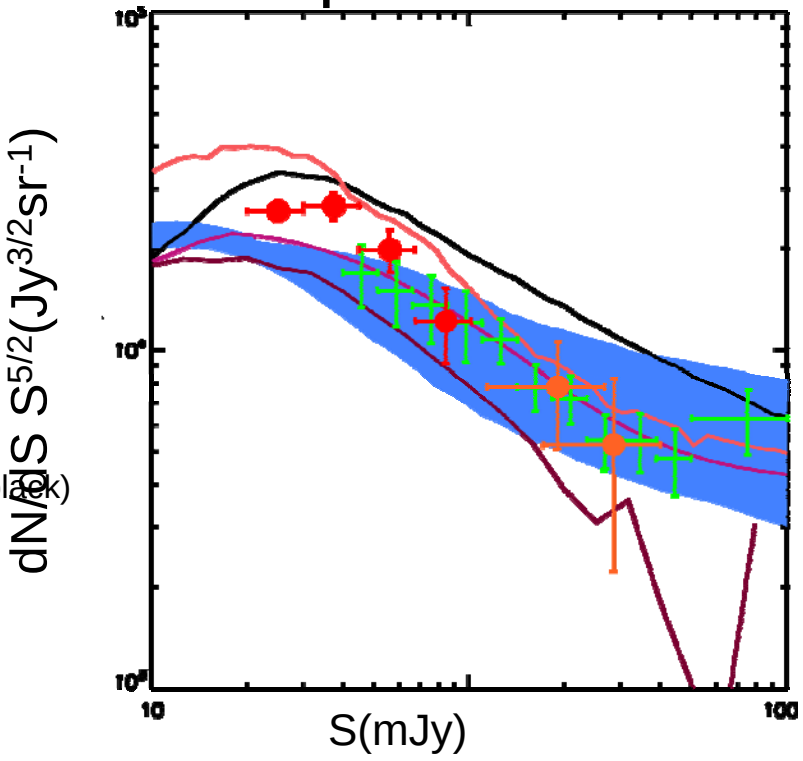
PACS Number counts 160µm

- Lockman North
- FLS
- FIDEL Bethermin et al (2009, in press, accepted)

Lagache, Dole, Puget 2004 (black)
Leborgne et al. 2009 (blue)
Valiante et al. 2009 (maroon)
Rowan-Robinson (plum)
Franceschini (Coral)



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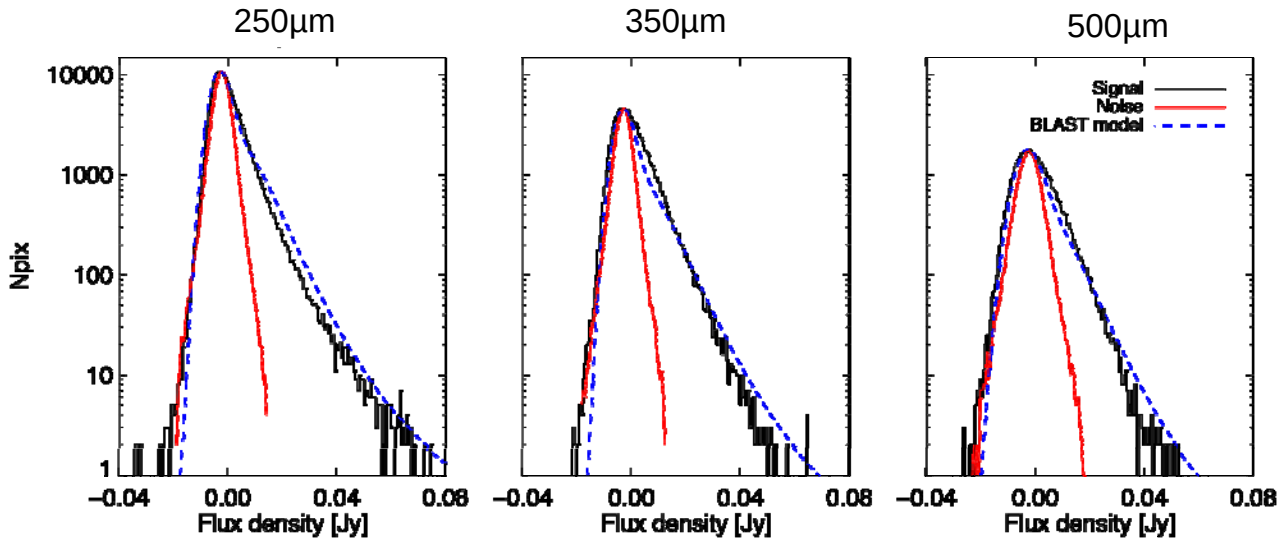
GOODS-N P(D) analysis

Signal
Instrumental Noise (jack-knife)
Model from BLAST



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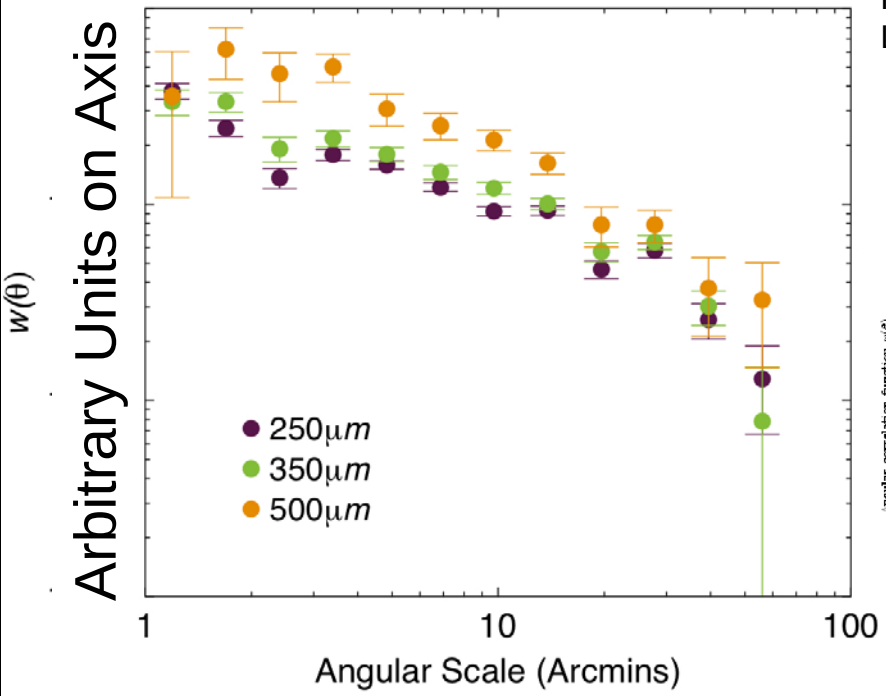
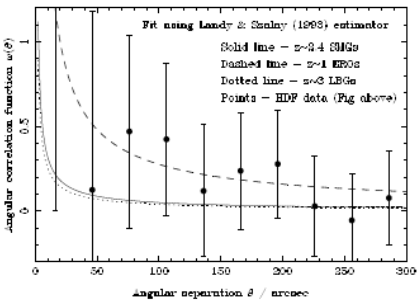
Correlation function



Resolved Sources in Lockman-SW field

With sources
17,000 in PSW
10,000 in PMW
2,600 in PLW



Previously sub-mm clustering with SCUBA ~73 sources

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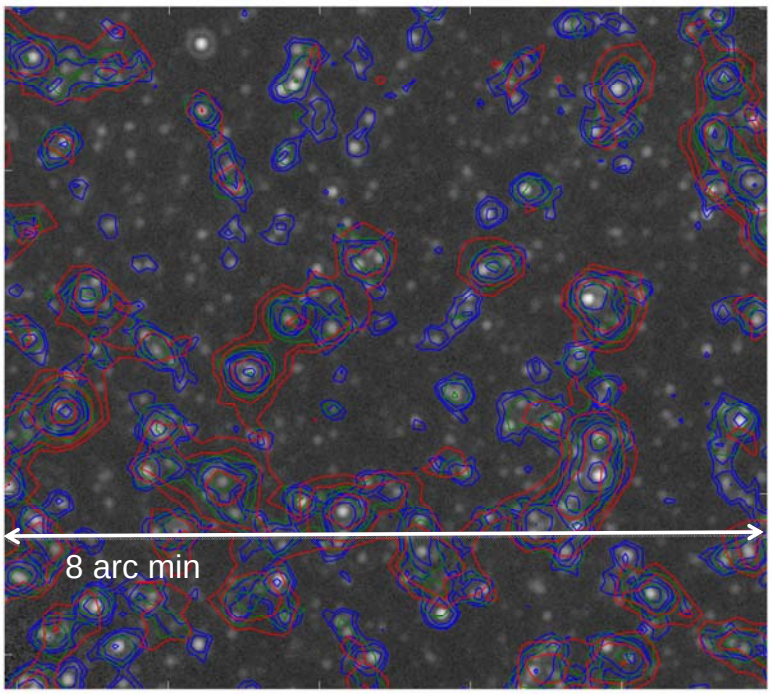
Correspondence with 24 µm

24µm grey-scale
250µm in blue
350µm in green
500µm in red



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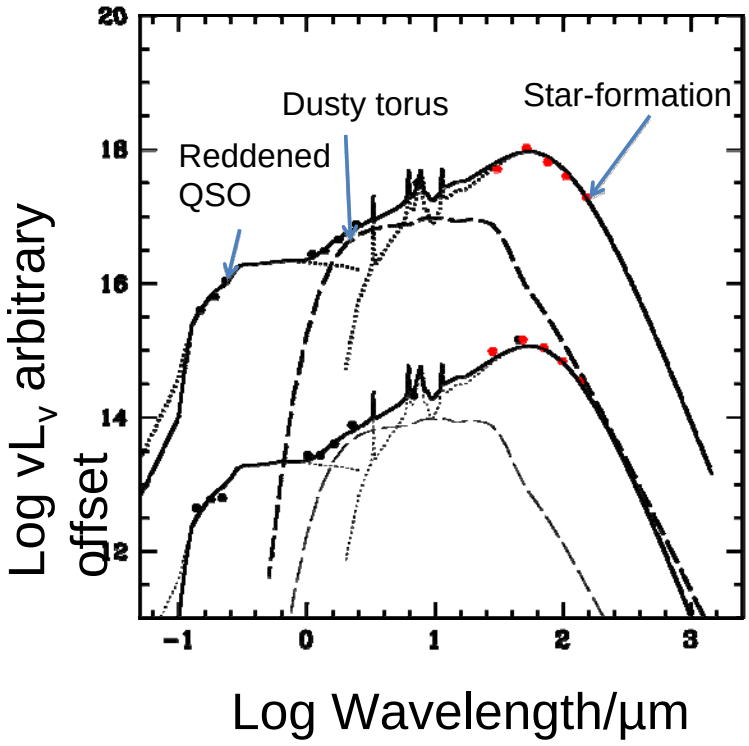
Hyperluminous galaxies



SFRs
>3000-4000$M_\odot yr^{-1}$

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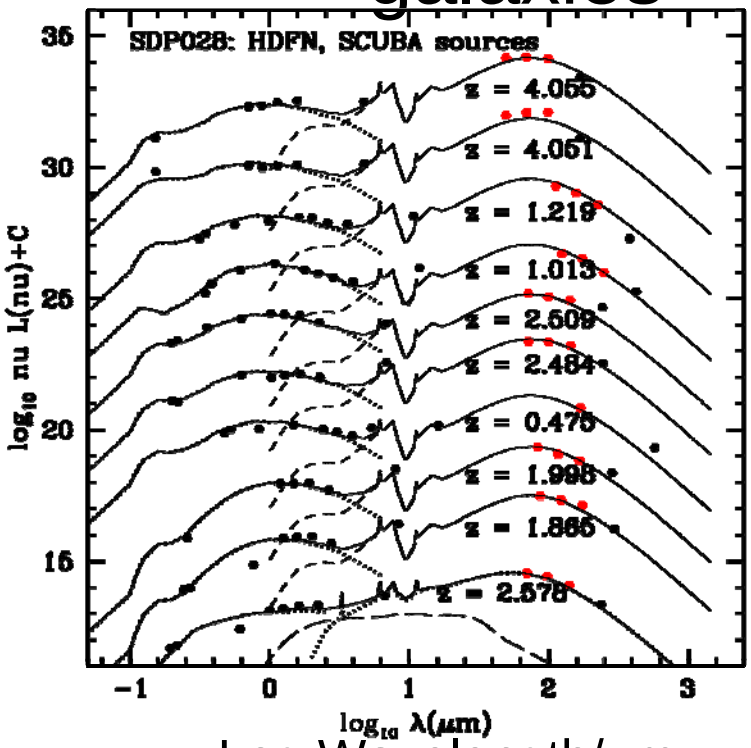
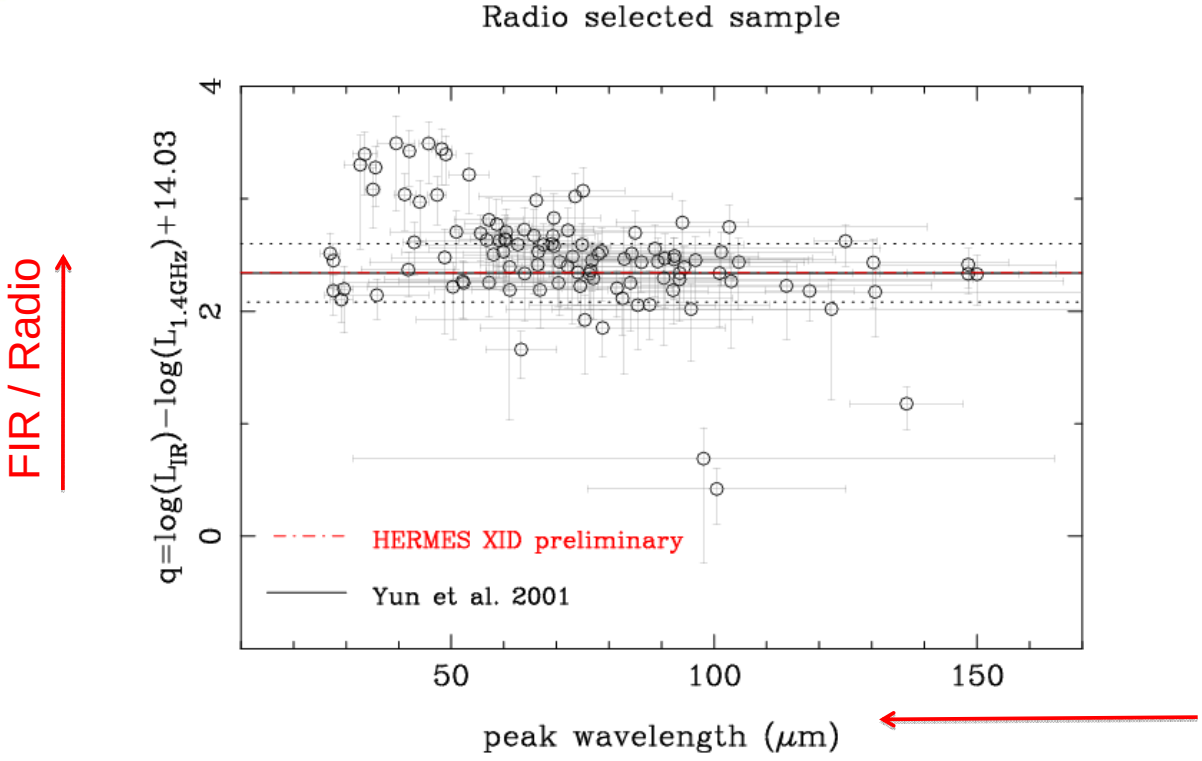
SPIRE & SCUBA galaxies

Log νL_ν arbitary offset



Log Wavelength/μm

Testing radio/IR correlation



radio selected sample (Biggs & Ivison 2006) in HDFN

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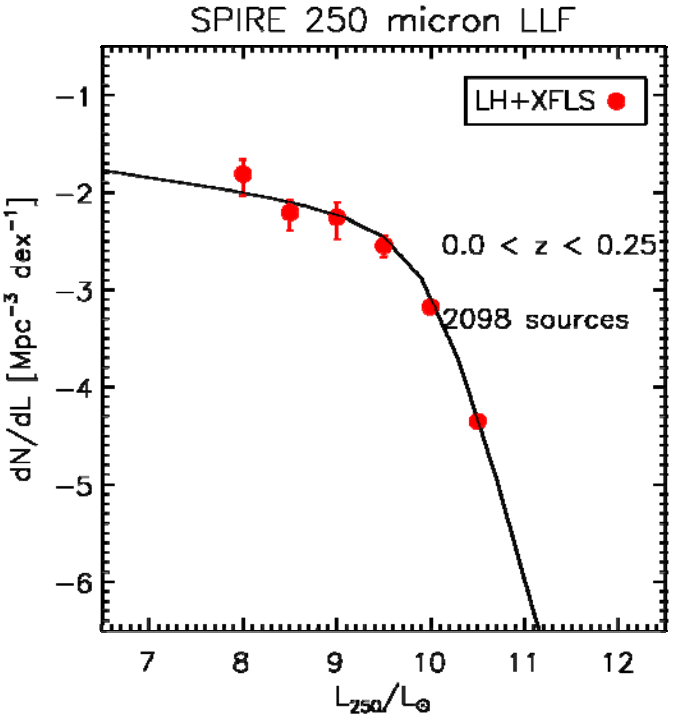
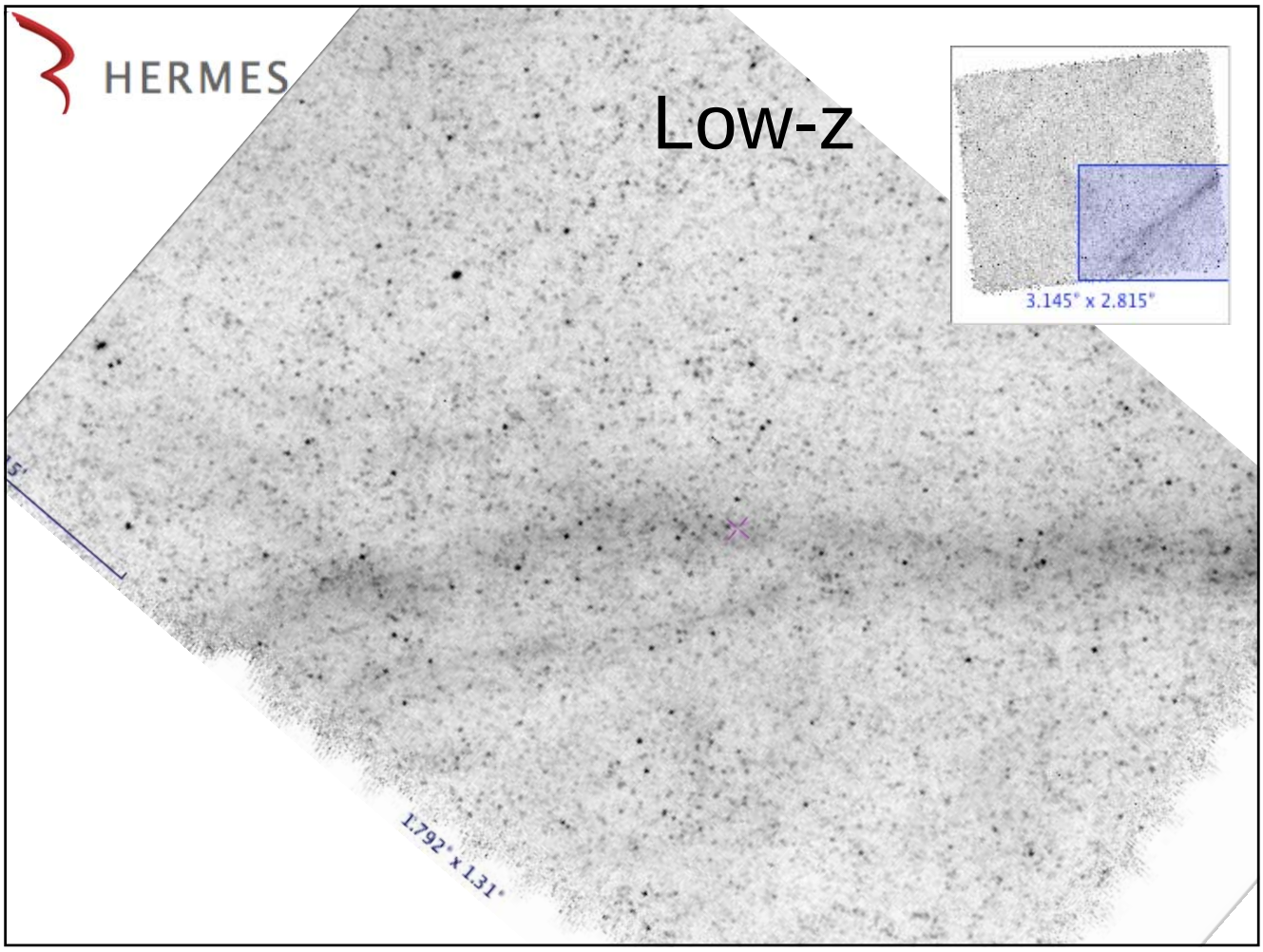
250μm Luminosity Function

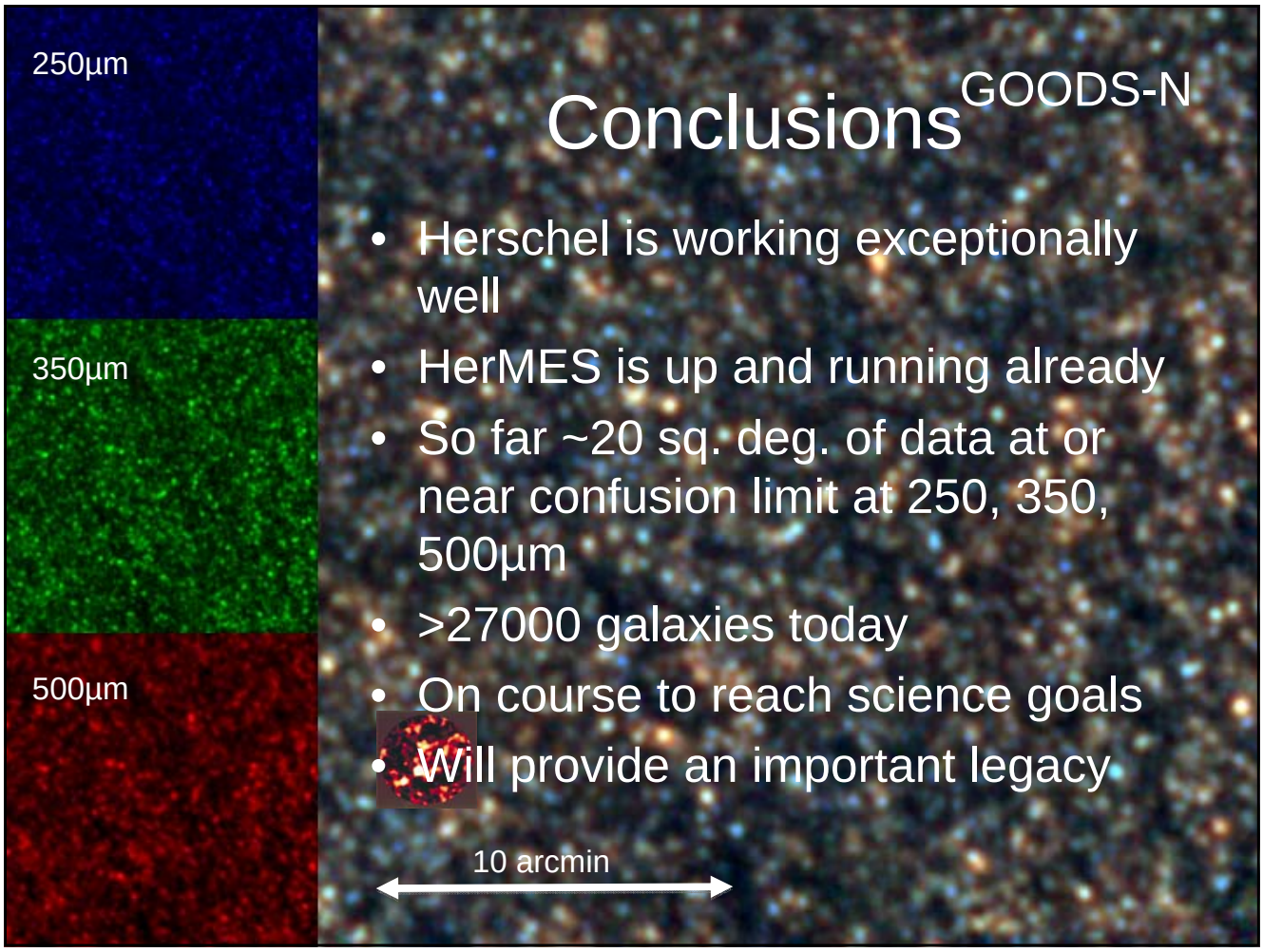



HERMES
Low-z
3.145° x 2.815°
1.792° x 1.31°

HERMES

Draft Schedule

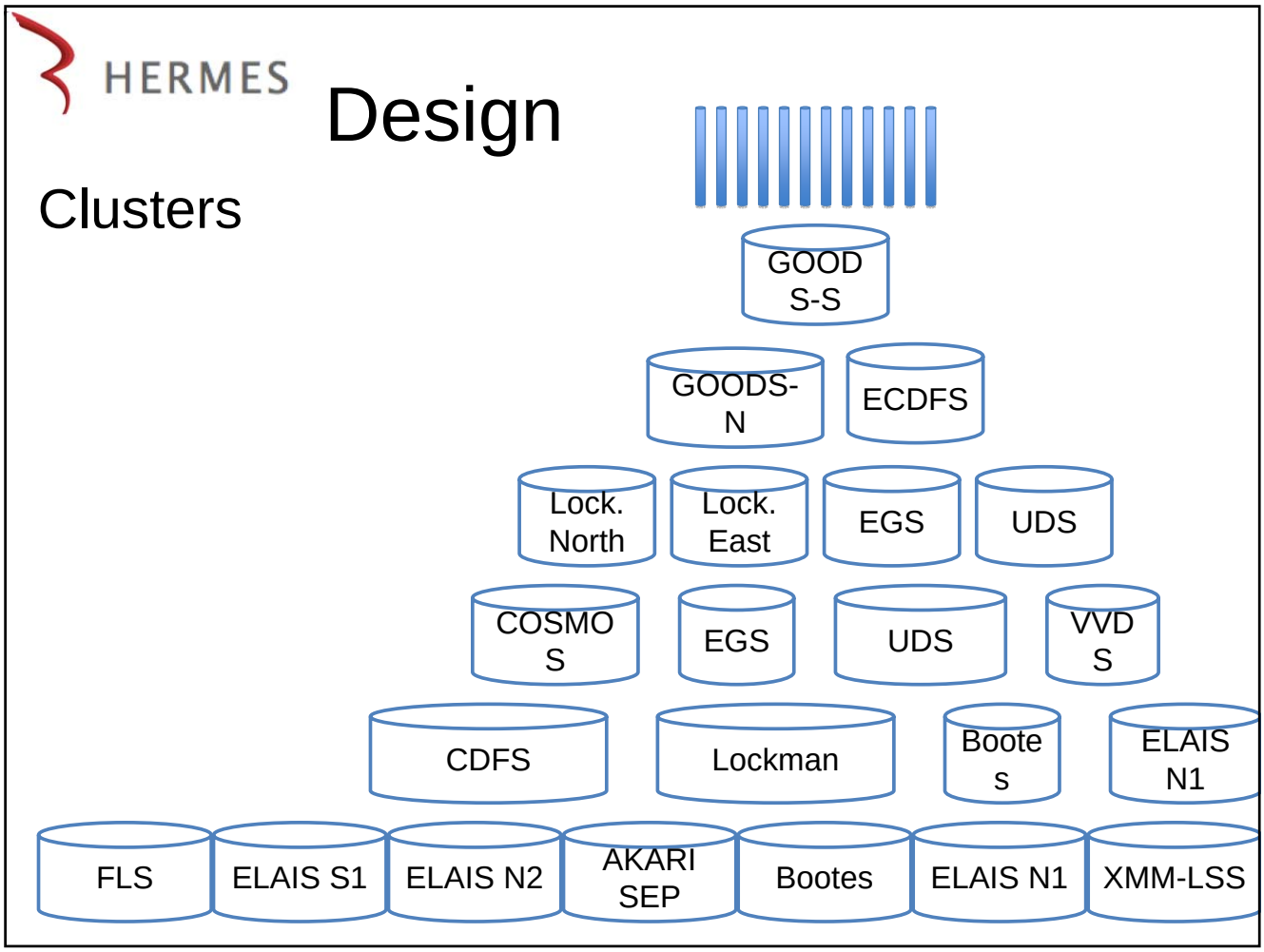
- Launch 14th May 2009
- Dec 2009 ESA First Science workshop
- May 2010 ESA SDP Conference
- ~July 2010 A&A issue EDR
- Nov. 2010 (ROS+12) DR1
- Nov. 2012 (End of Mission) DR2


250µm
350µm
500µm
GOODS-N
Conclusions
• Herschel is working exceptionally well
• HerMES is up and running already
• So far ~20 sq. deg. of data at or near confusion limit at 250, 350, 500µm
• >27000 galaxies today
• On course to reach science goals
• Will provide an important legacy
10 arcmin

HERMES

Design

Clusters



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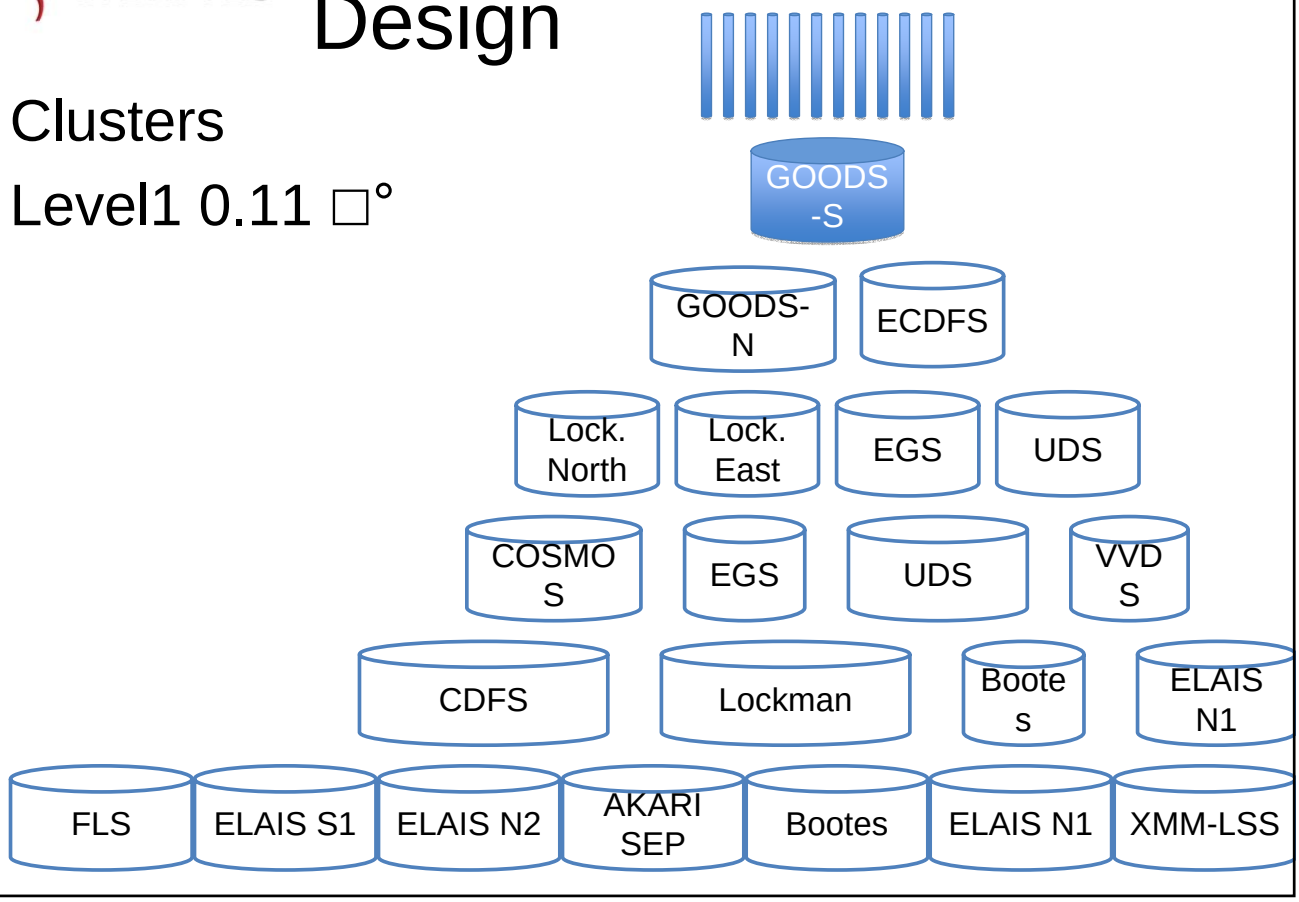
Design

Clusters

Level1 0.11 □°



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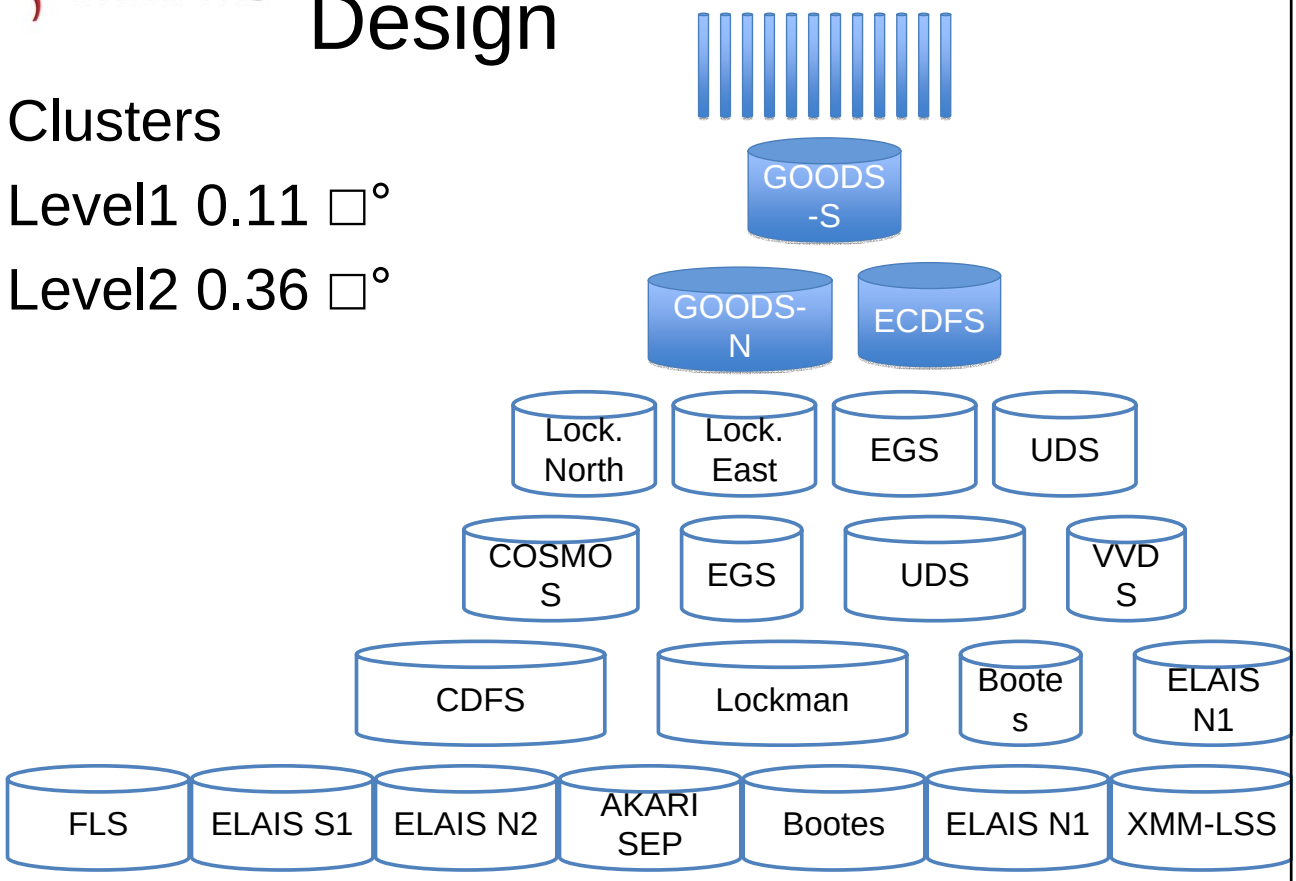
Design

Clusters

Level1 0.11 □°

Level2 0.36 □°



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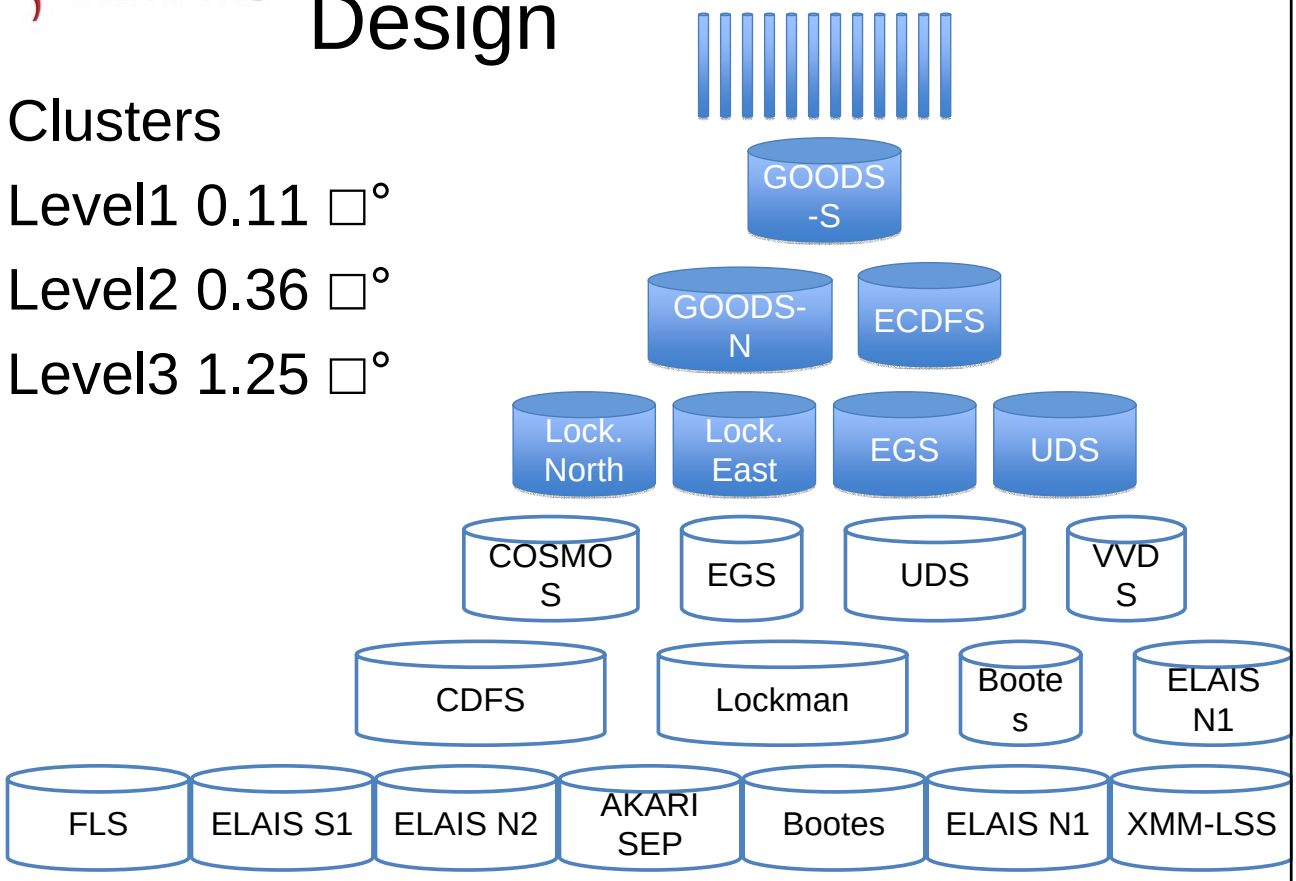
Design

Clusters

Level1 0.11 □°

Level2 0.36 □°

Level3 1.25 □°



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Design

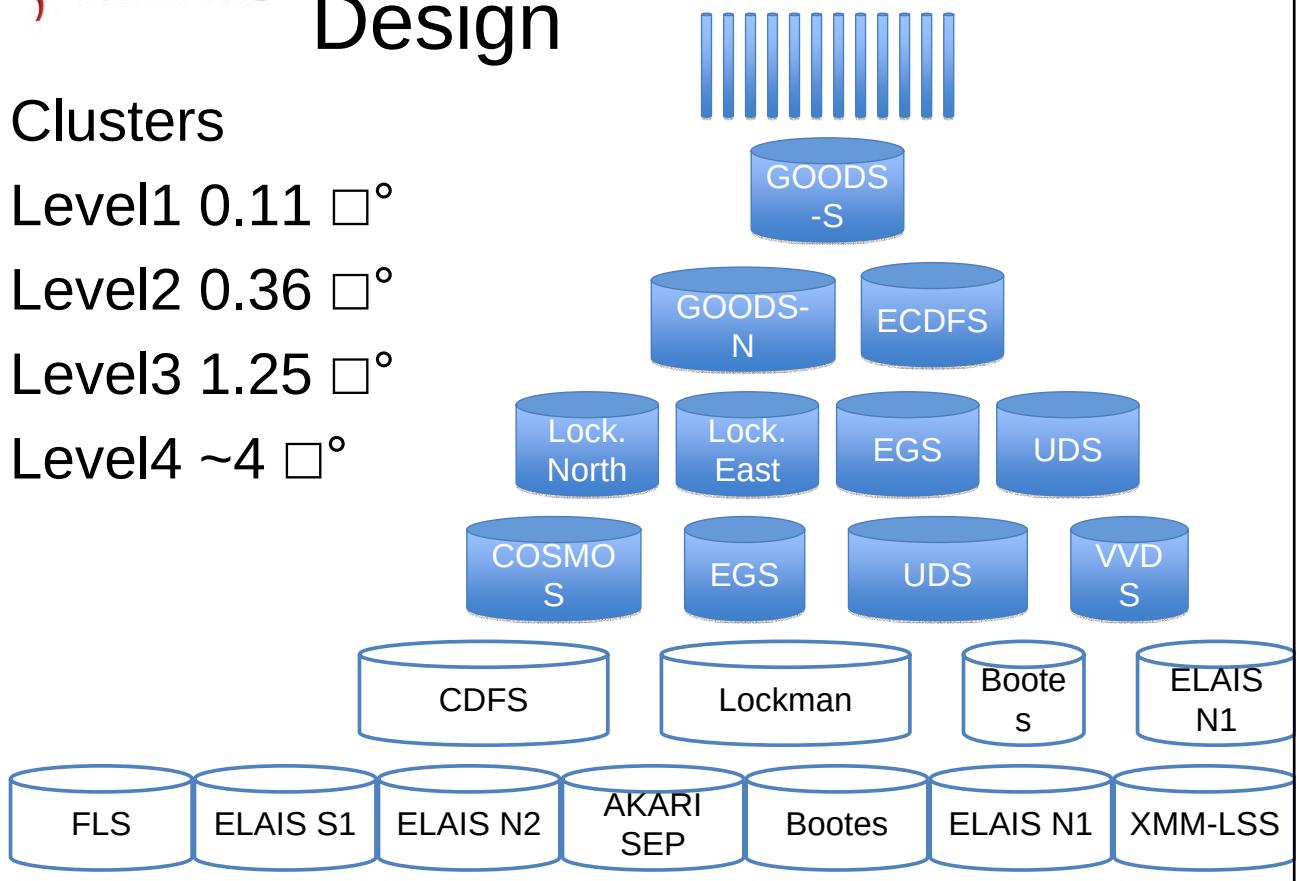
Clusters

Level1 0.11 □°

Level2 0.36 □°

Level3 1.25 □°

Level4 ~4 □°



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Design

Clusters

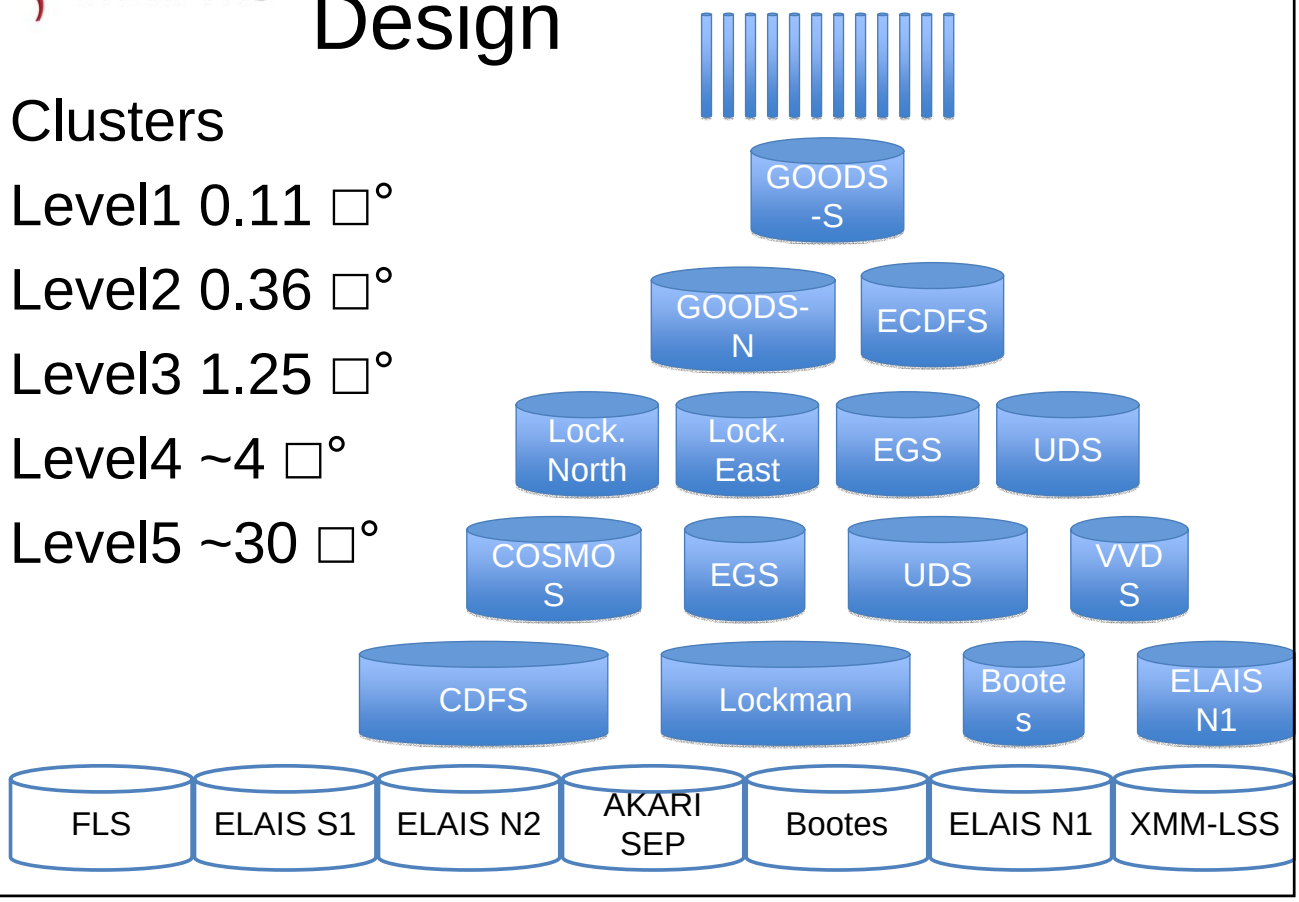
Level1 0.11 □°

Level2 0.36 □°

Level3 1.25 □°

Level4 ~4 □°

Level5 ~30 □°



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Design

Clusters

Level1 0.11 □°

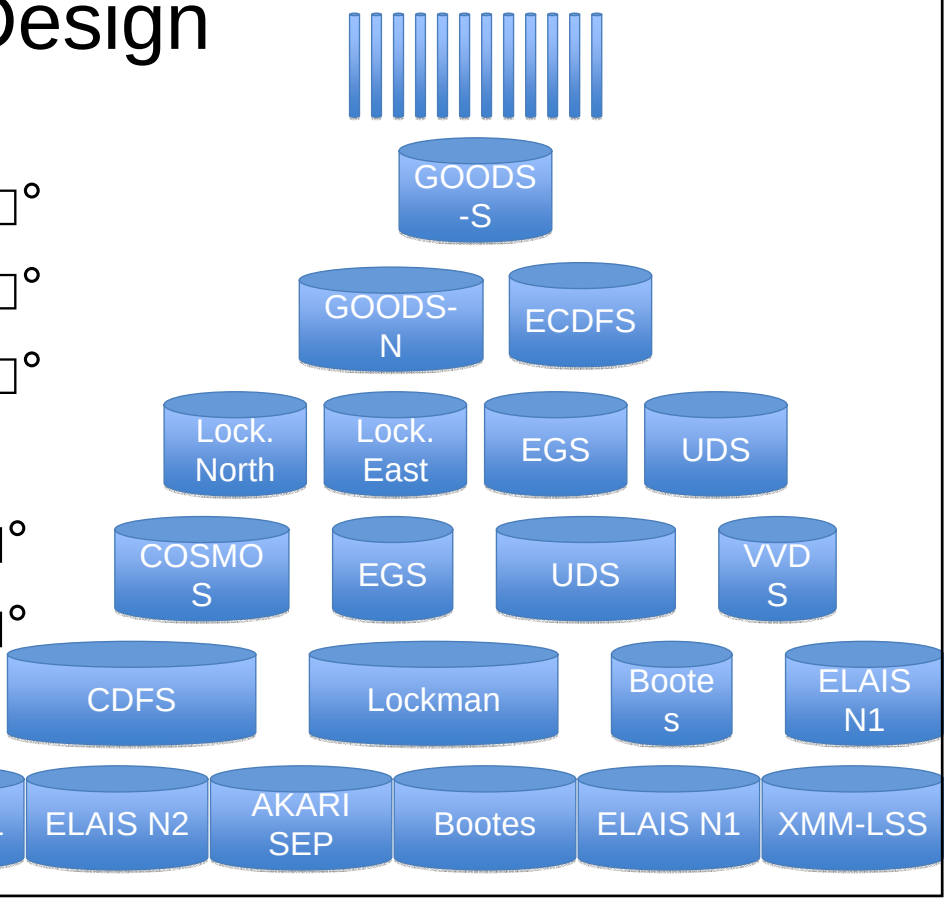
Level2 0.36 □°

Level3 1.25 □°

Level4 ~4 □°

Level5 ~30 □°

Level6 ~40 □°



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SDP

Clusters

Level1 0.11 □°

Level2 0.36 □°

Level3 1.25 □°

Level4 ~4 □°

Level5 ~30 □°

Level6 ~40 □°

Faint, low luminosity, typical galaxies