4MOST – 4m Multi-Object Spectroscopic Telescope

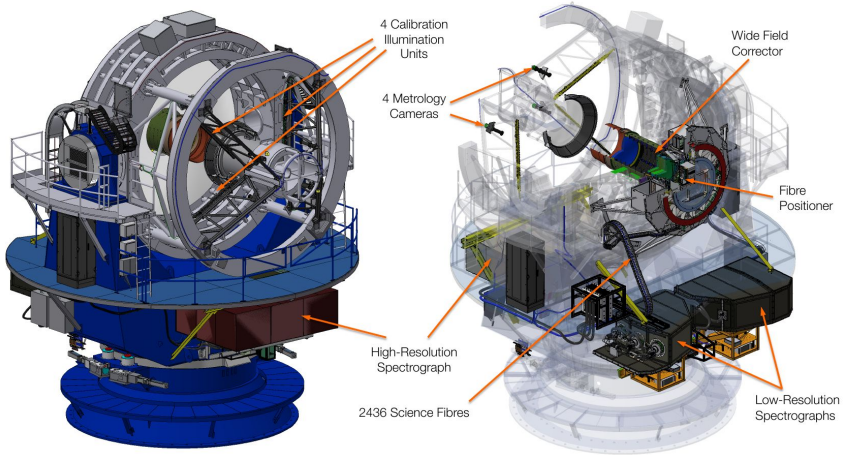
Cosmology Redshift Survey: Bright Galaxies and Luminous Red Galaxies Target Selection

Swiss Cosmology Days, Zürich - 06/06/2025 - Aurélien Verdier - EPFL

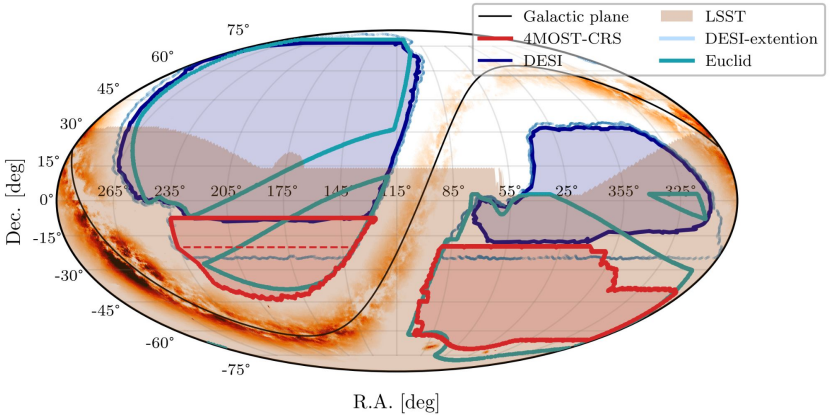
www.4MOST.eu

Plan of the Presentation

4MOST Overview



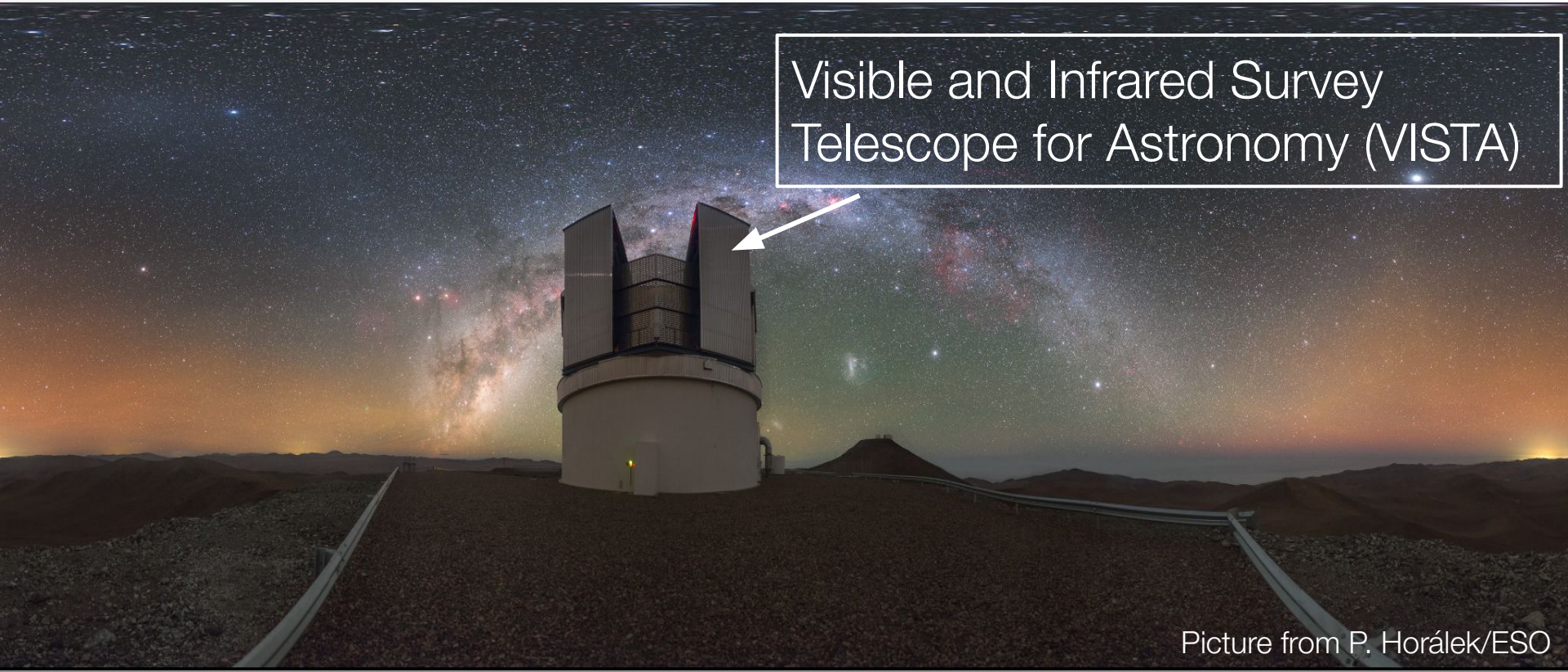
Cosmology Redshift Survey



4MOST Site

Picture from P. Horálek/ESO

4MOST Site



Picture from P. Horálek/ESO

4MOST Site

Visible and Infrared Survey Telescope for Astronomy (VISTA)

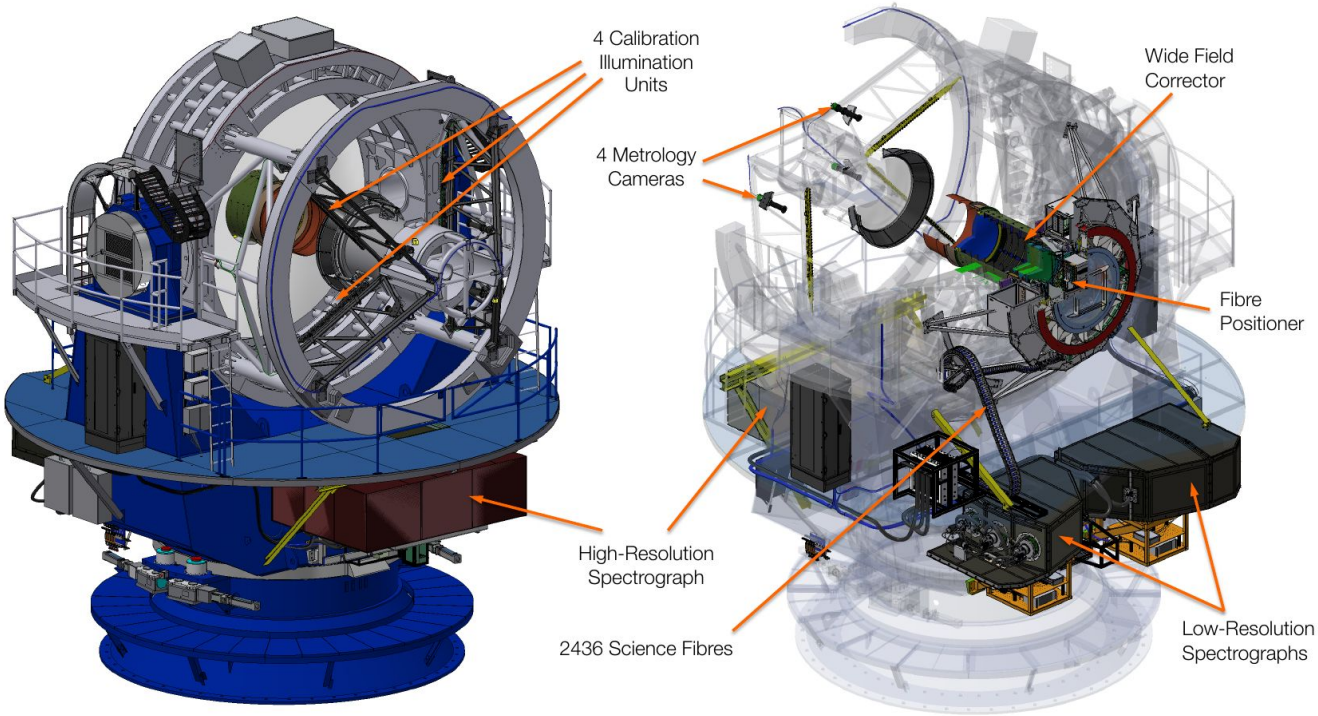
Picture from P. Horálek/ESO

4MOST Site

Visible and Infrared Survey Telescope for Astronomy (VISTA)

Picture from P. Horálek/ESO

4MOST Facility



5-years
Starts in 2026

Fibers
2436

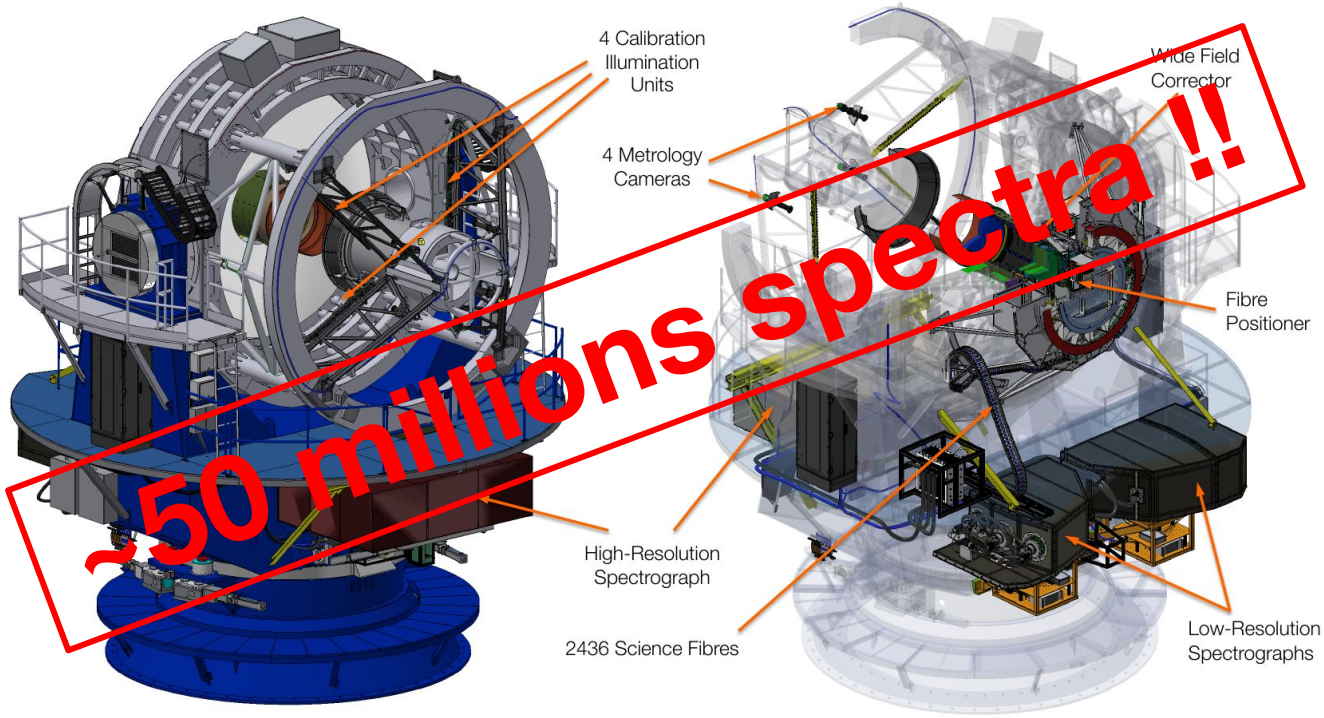
FoV
4.2 deg^2
Hexagonal

Mirror
4m
(VISTA)

Spectro
Low-res & High-res

Channels
Blue, Green and Red

4MOST Facility



5-years
Starts in 2026

Fibers
2436

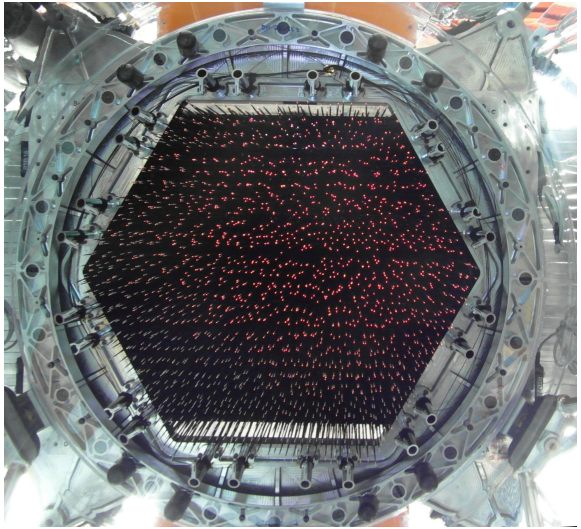
FoV
4.2 deg^2
Hexagonal

Mirror
4m
(VISTA)

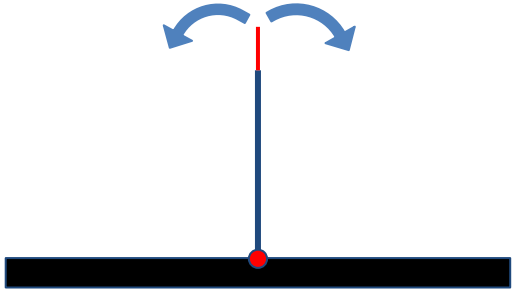
Spectro
Low-res &
High-res

Channels
Blue,
Green and
Red

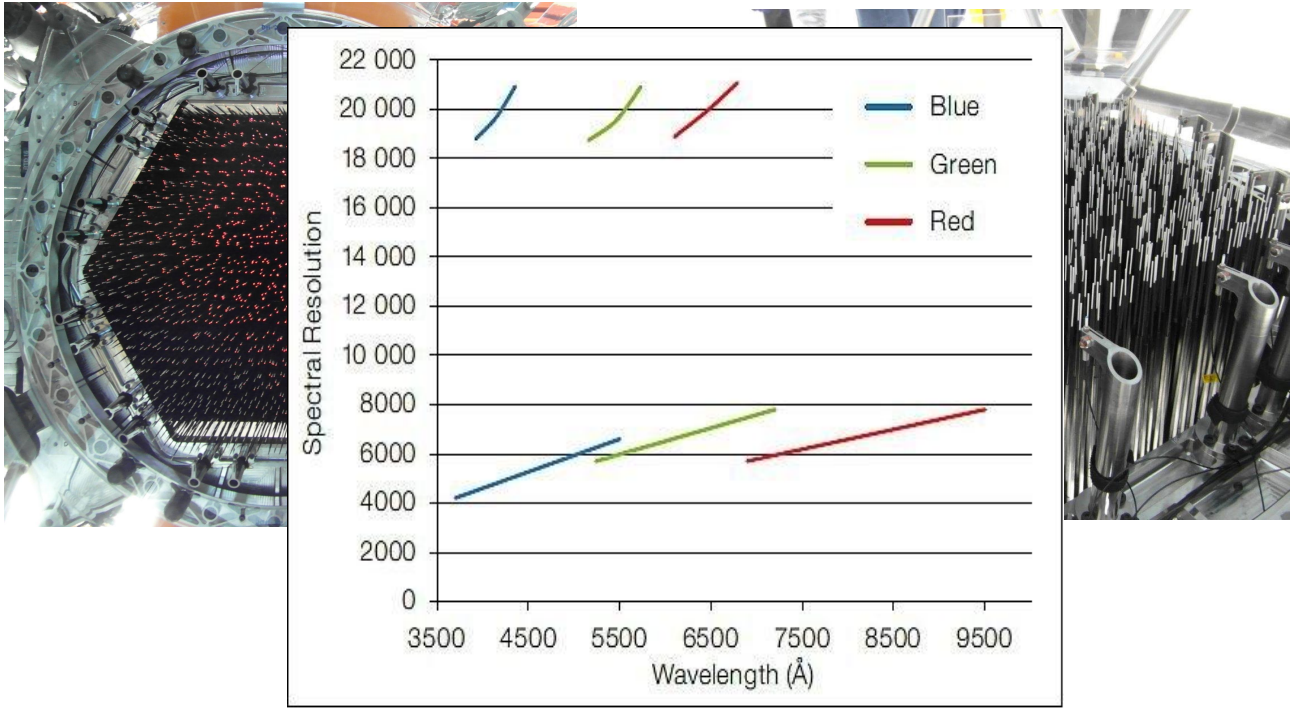
4MOST Fibre System



Reconfiguration time
< 2min



4MOST Fibre System



Reconfiguration time
< 2min

1624 Low-Res. Spectro.
R ~ 4'000 - 8'000

Wavelength Coverage
370-950 nm

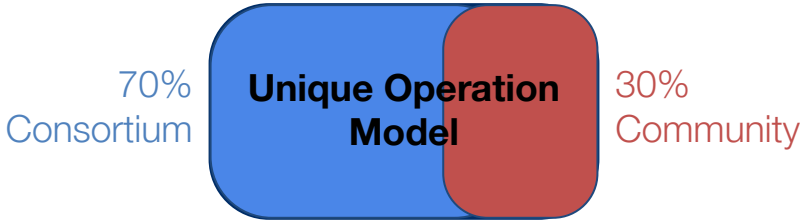
812 High-Res. Spectro.
R ~ 18'500 - 21'000

Blue	Green	Red
393-436 nm	516-573 nm	610-679 nm

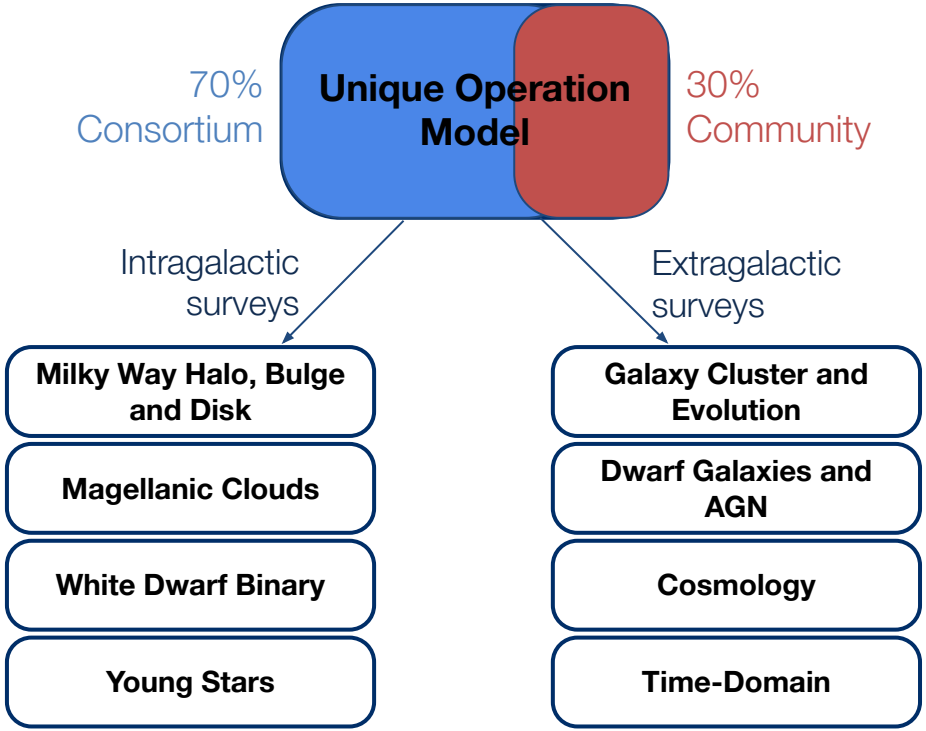
4MOST Observing strategy

Unique Operation Model

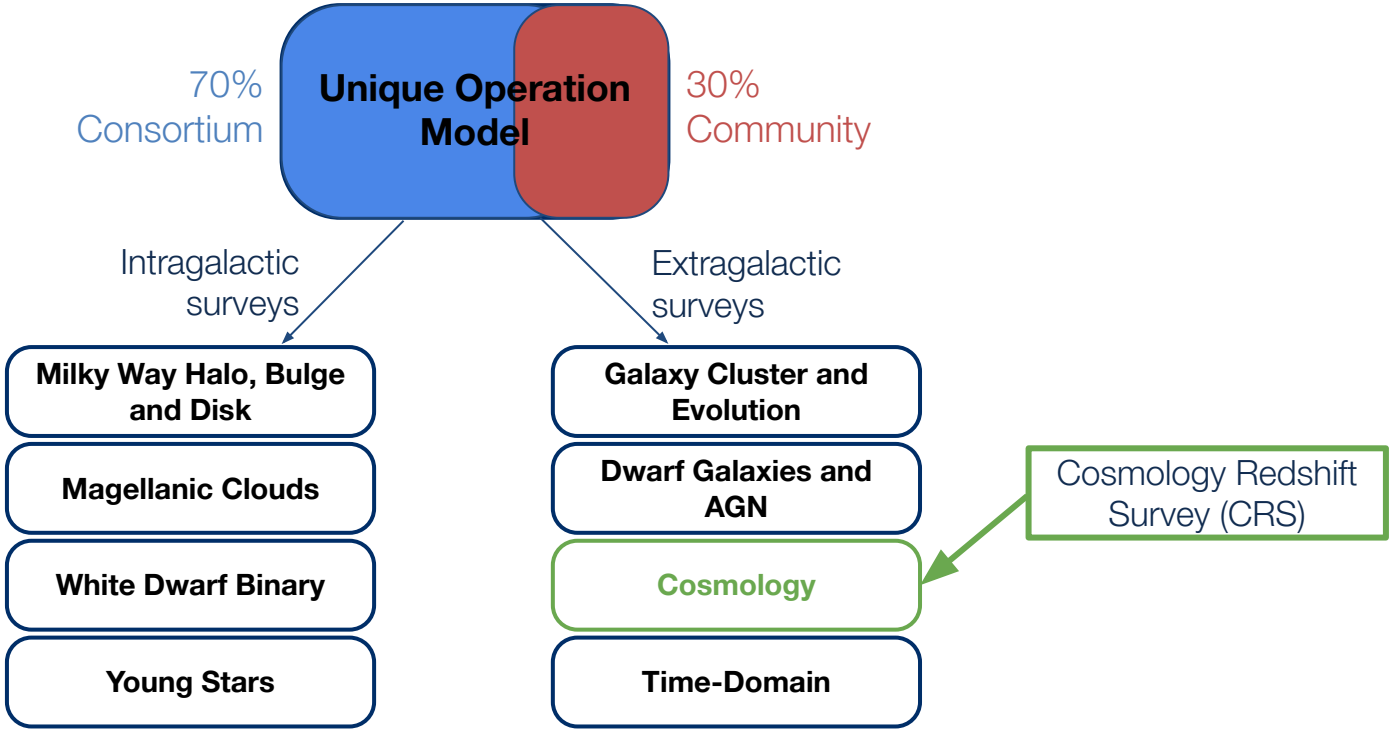
4MOST Observing strategy



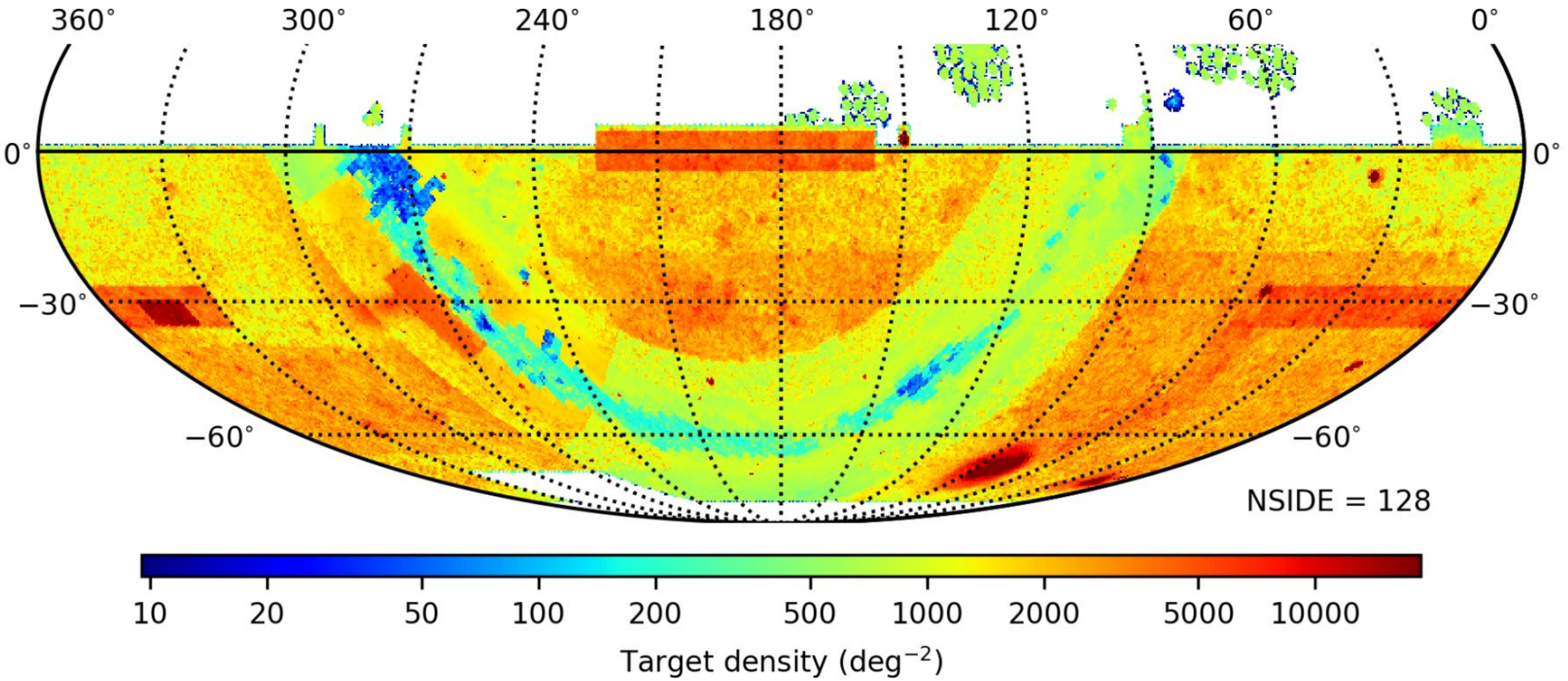
4MOST Observing strategy



4MOST Observing strategy



4MOST Sky Area and Target Density



4MOST Cosmology

Main Science Purposes

- **Weak Lensing**
- **Galaxy Clusters**
- **SNe Ia**
- **BAO & RSD**

Synergies

- **LSST / Euclid**
  Weak Lensing
- **SKA / HIRAX**
  Radio Surveys
- **SPT / ACT**
  CMB Surveys
- **eROSITA**
  Clusters

4MOST Cosmology

Main Science Purposes

- **Weak Lensing**
- **Galaxy Clusters**
- **SNe Ia**
- **BAO & RSD**

Synergies

- **LSST / Euclid**
  Weak Lensing
- **SKA / HIRAX**
  Radio Surveys
- **SPT / ACT**
  CMB Surveys
- **eROSITA**
  Clusters

4MOST Cosmology Redshift Survey

Goal: Constrain Dark Energy and General Relativity by measuring cosmic expansion history and growth of structure

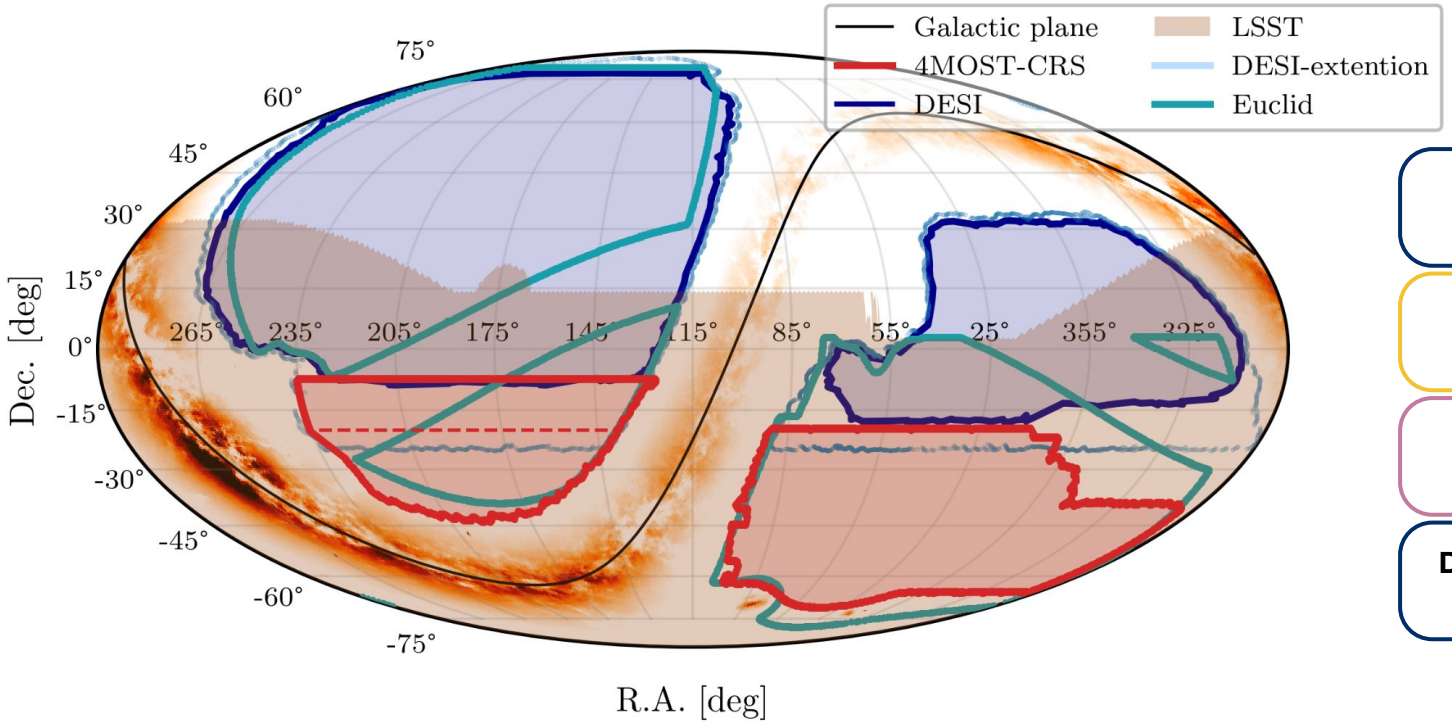
Bright Galaxies
$0.15 < z < 0.4$
~1.5 million targets

Luminous Red Galaxies
$0.4 < z < 1.0$
~2.8 million targets

Quasars + QSO Lyman α
$0.9 < z < 2.1$ / $2.2 < z < 3.5$
~1.5 million targets

We won't be competitive with DESI but complementary !!

4MOST-CRS Footprint



CRS Sky Area
~5700 deg^2

BG Density
~250 deg^{-2}

LRG Density
~400 deg^{-2}

DESI + CRS Sky Area
21'000 deg^2

4MOST-CRS Photometry

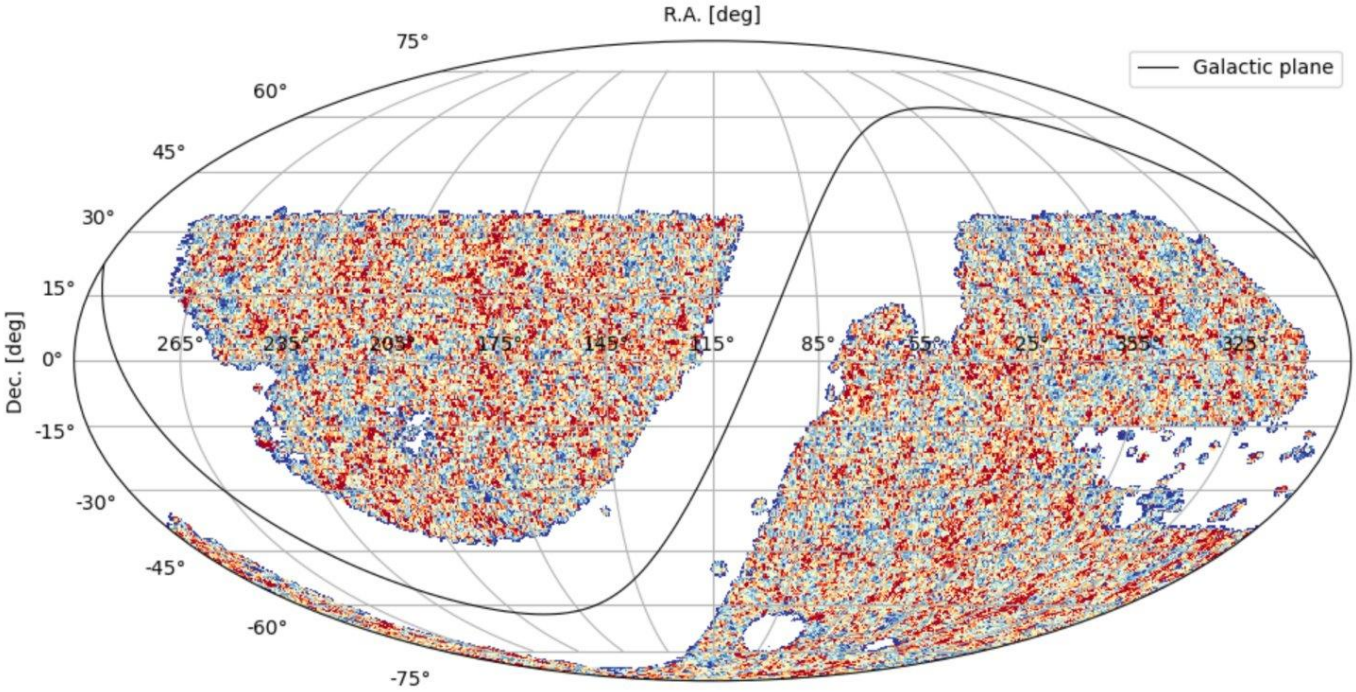
DESI Legacy Survey DR10.1

DECaLS | **DES**

Target Selection similar to DESI for BG and LRG

Take advantage of DESI TS Performance

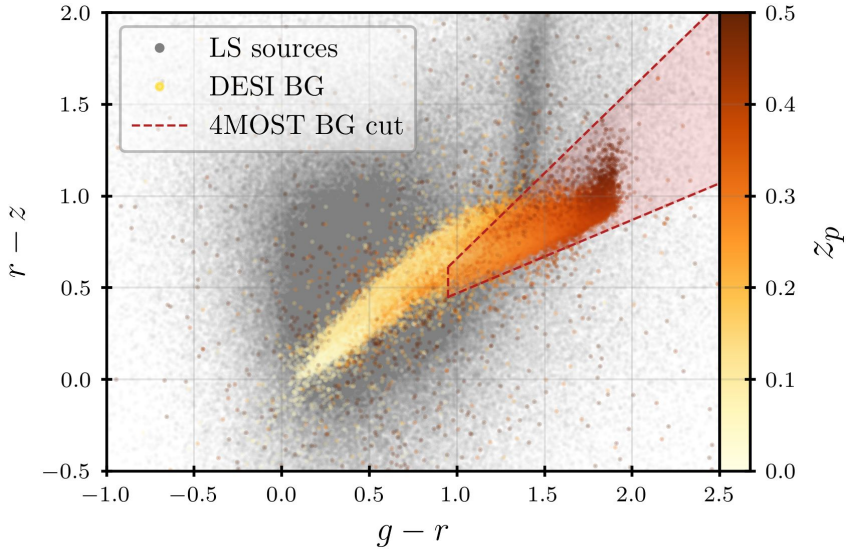
Be complementary to DESI



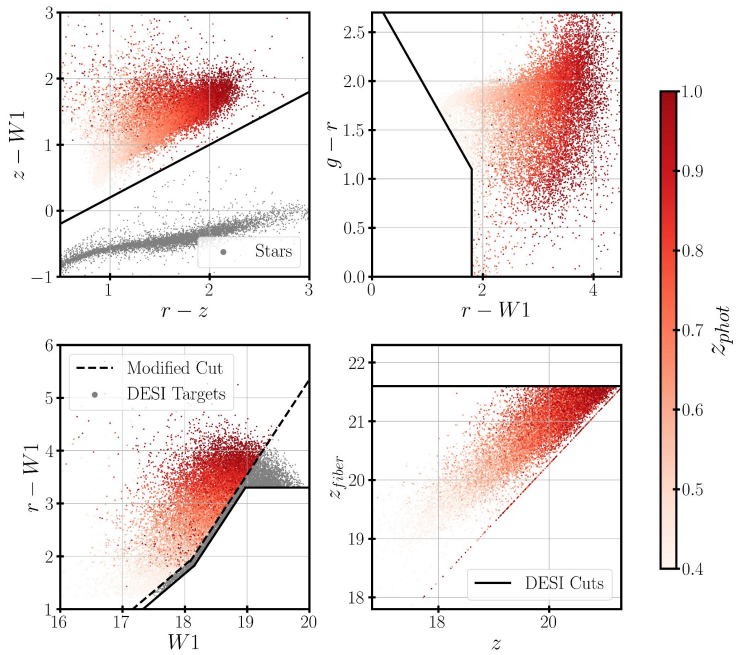
4MOST-CRS Target Selection

Bright Galaxies

R magnitude cut > 19.25 (19.5 in DESI)



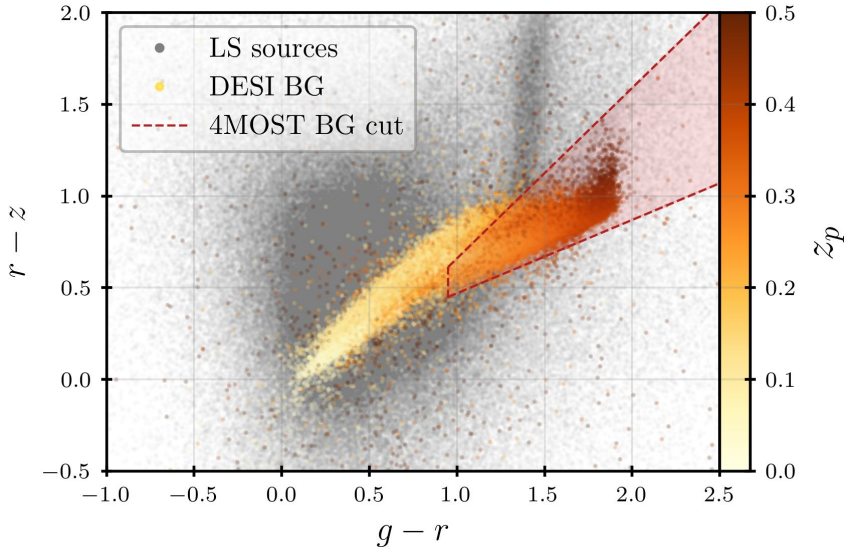
Luminous Red Galaxies



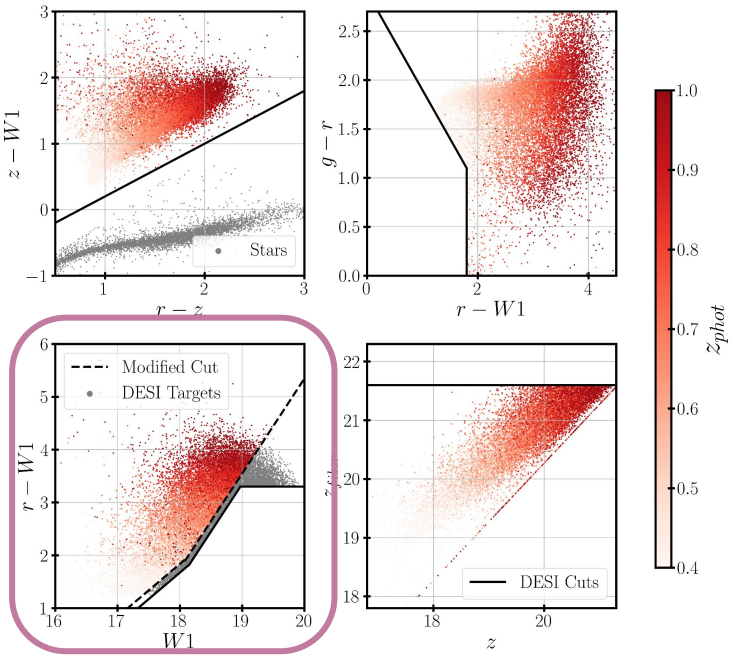
4MOST-CRS Target Selection

Bright Galaxies

R magnitude cut > 19.25 (19.5 in DESI)



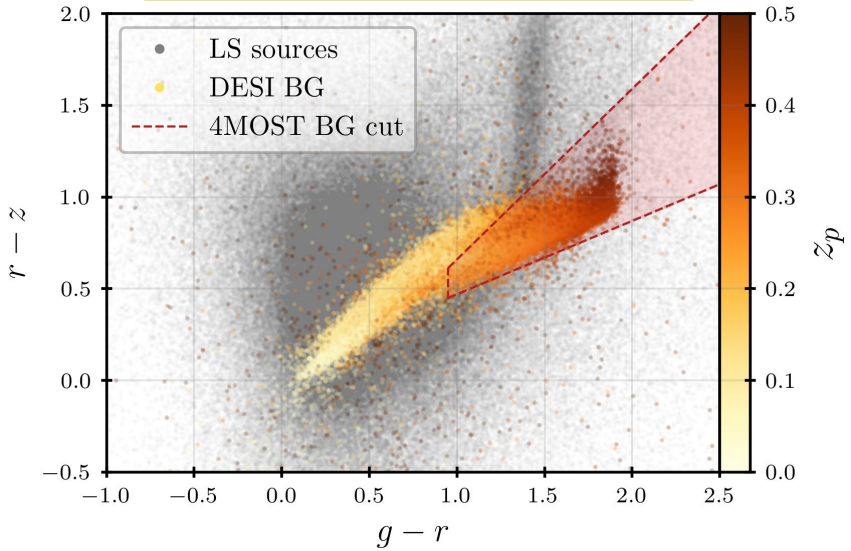
Luminous Red Galaxies



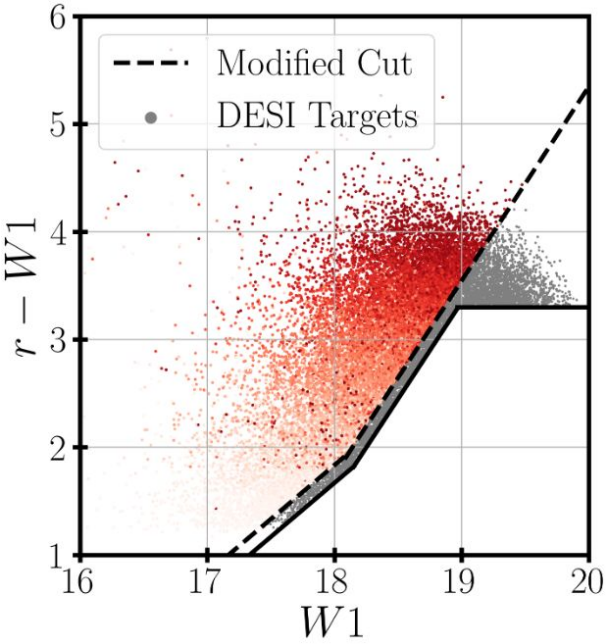
4MOST-CRS Target Selection

Bright Galaxies

R magnitude cut > 19.25 (19.5 in DESI)



Luminous Red Galaxies



4MOST-CRS Redshift Density

DESI Densities

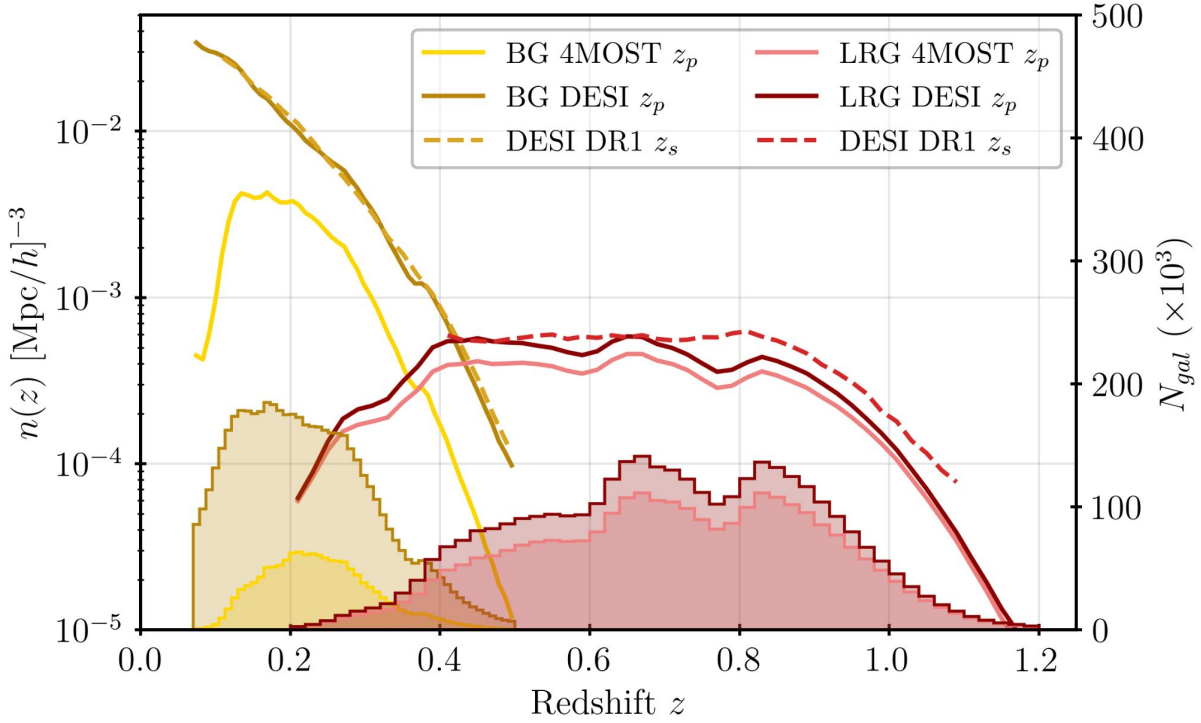
BG Density
~860 deg^{-2}

LRG Density
~600 deg^{-2}

4MOST-CRS Densities

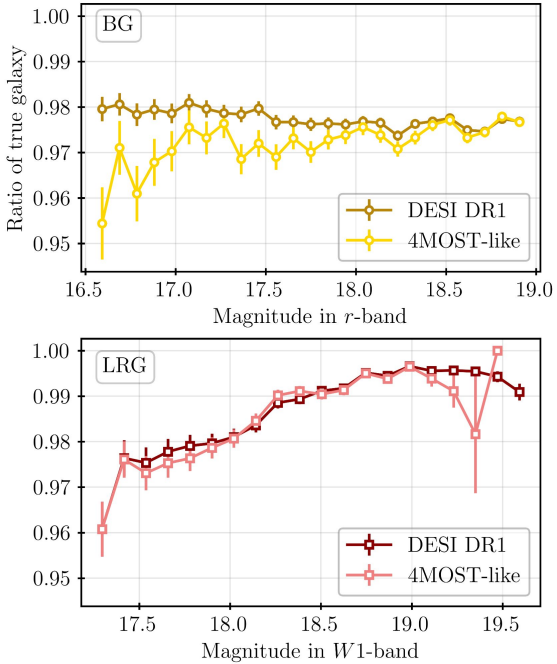
BG Density
~250 deg^{-2}

LRG Density
~400 deg^{-2}

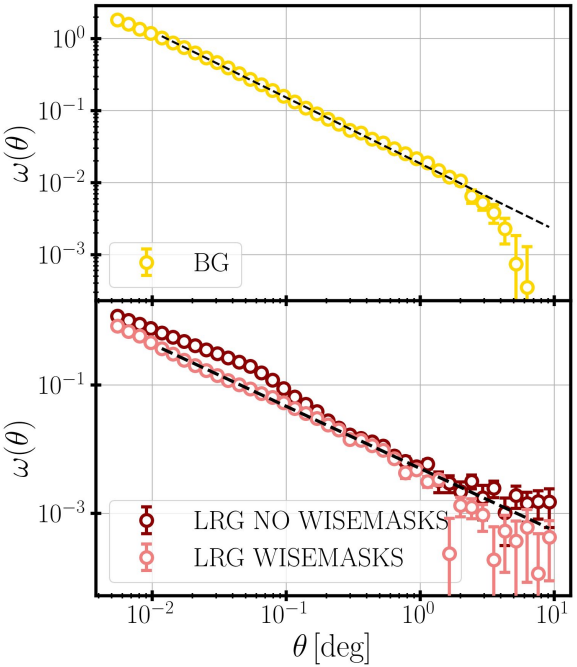


4MOST-CRS Quality Check

Purity



Angular Clustering



4MOST-CRS Forecasts

Fisher Forecasts taking into account:

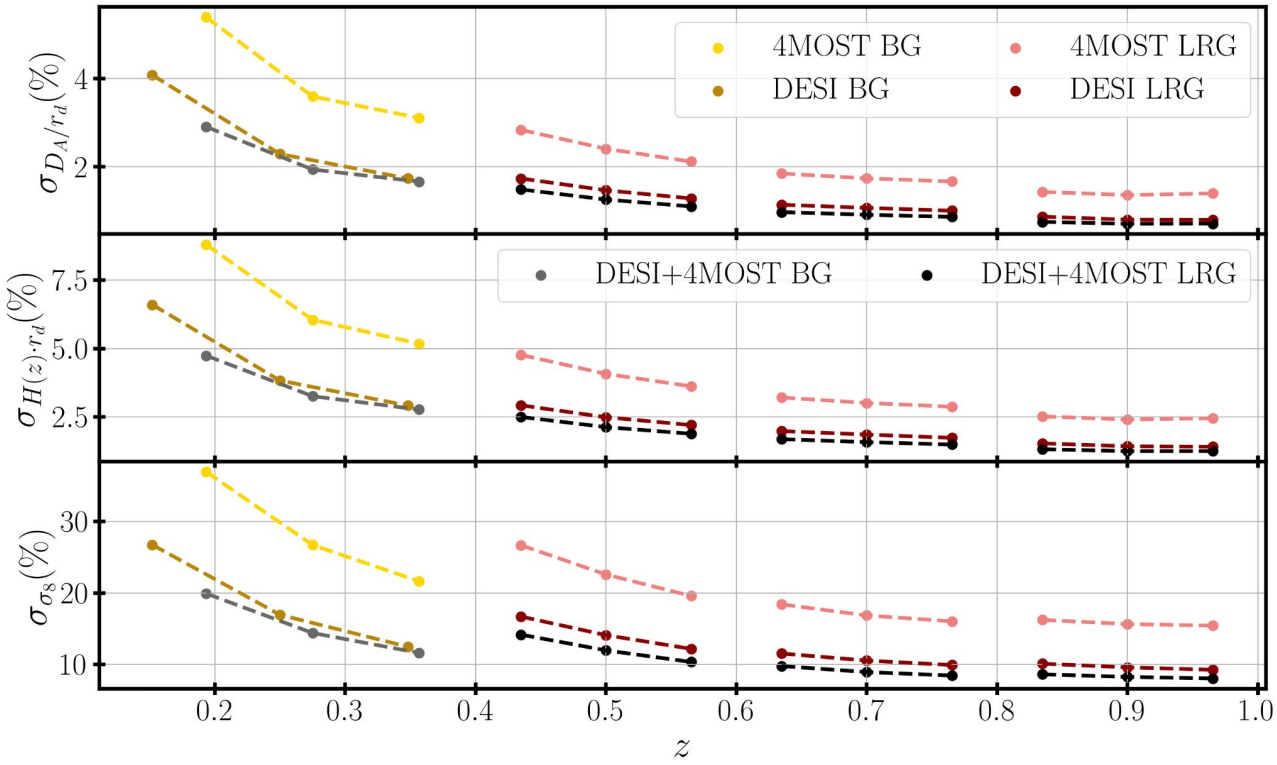
5-years 4MOST completeness simulation

BG ~87%

LRG ~67%

DESI downsampled to CRS densities

4MOST will improve constraints in redshift bins $0.4 < z < 0.8$ by at least 16%



Thank You


EPFL
AIP
NOVA
CRAL
AAO
WARWICK
US
UNIVERSITY OF SUSSEX
UNIVERSITY OF HULL
UCL
IN2P3
GEPI
UPPSALA UNIVERSITET
LUND UNIVERSITY
University of Portsmouth
Queen's University Belfast
ZAH
MPE
UNIVERSITY OF CAMBRIDGE
Durham University
rijksuniversiteit groningen
ESO
University of Southampton
Lancaster University
THE UNIVERSITY OF WESTERN AUSTRALIA
MOST