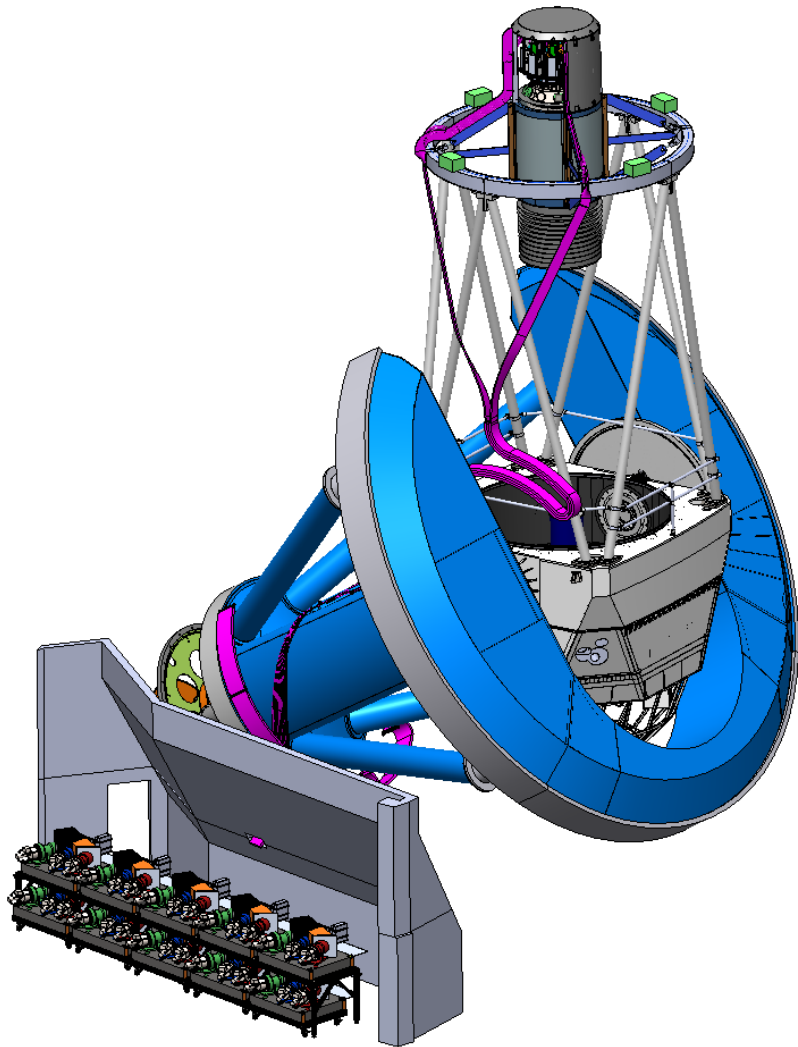


DESI status

Nathalie Palanque-Delabrouille
(CEA-Saclay)

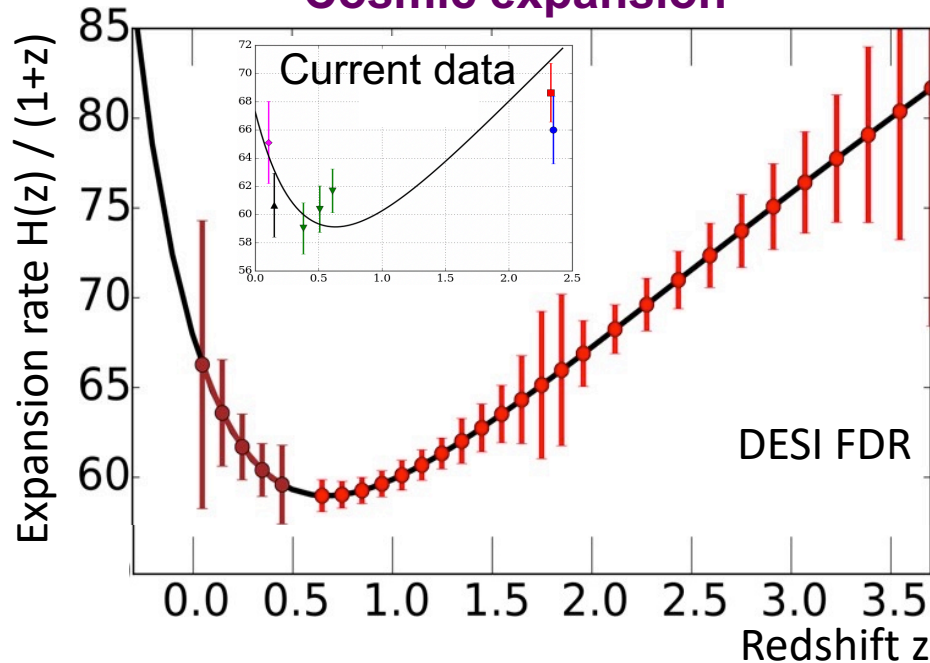
Saclay
May 6, 2019



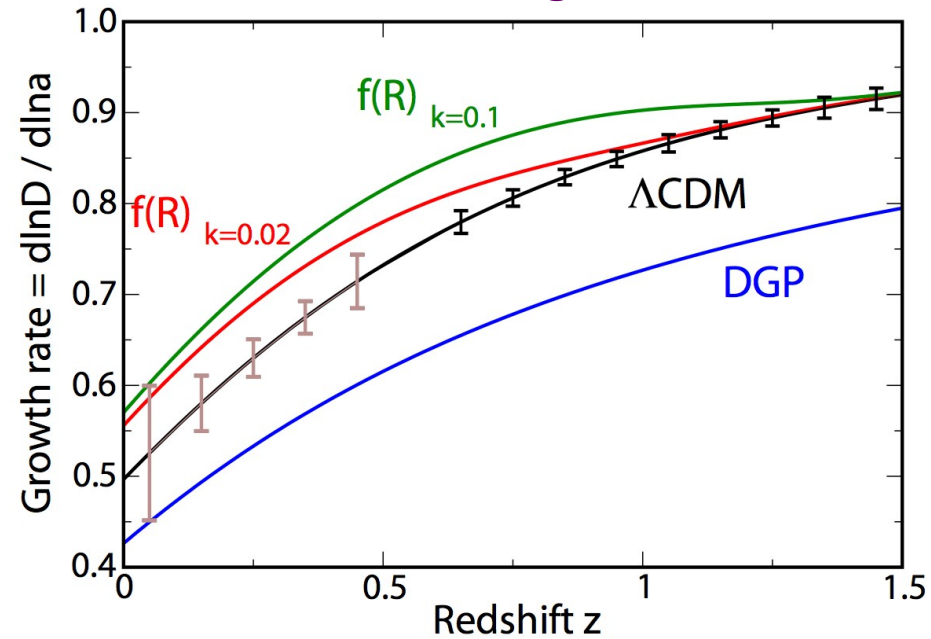
DESI science goals

- **Stage-IV DE experiment** (factor of merit x10 w.r.t. Stage II) relying upon
 - **BAO** 0.28% over $0 < z < 1.1$ on isotropic BAO scale
0.39% over $1.1 < z < 1.9$
 - **RSD** a few % for $z < 1.4$ on $f \sigma_8$
 - **M_ν** 20 meV at 1σ

Cosmic expansion



Structure growth



DESI targets

Five target classes spanning redshifts $z = 0 \rightarrow 5$
~35 million redshifts over 14,000 sq. degrees

30x larger map than SDSS

2.4 million QSOs

Lya $z > 2.1$

Tracers $1.0 < z < 2.1$

17 million ELGs

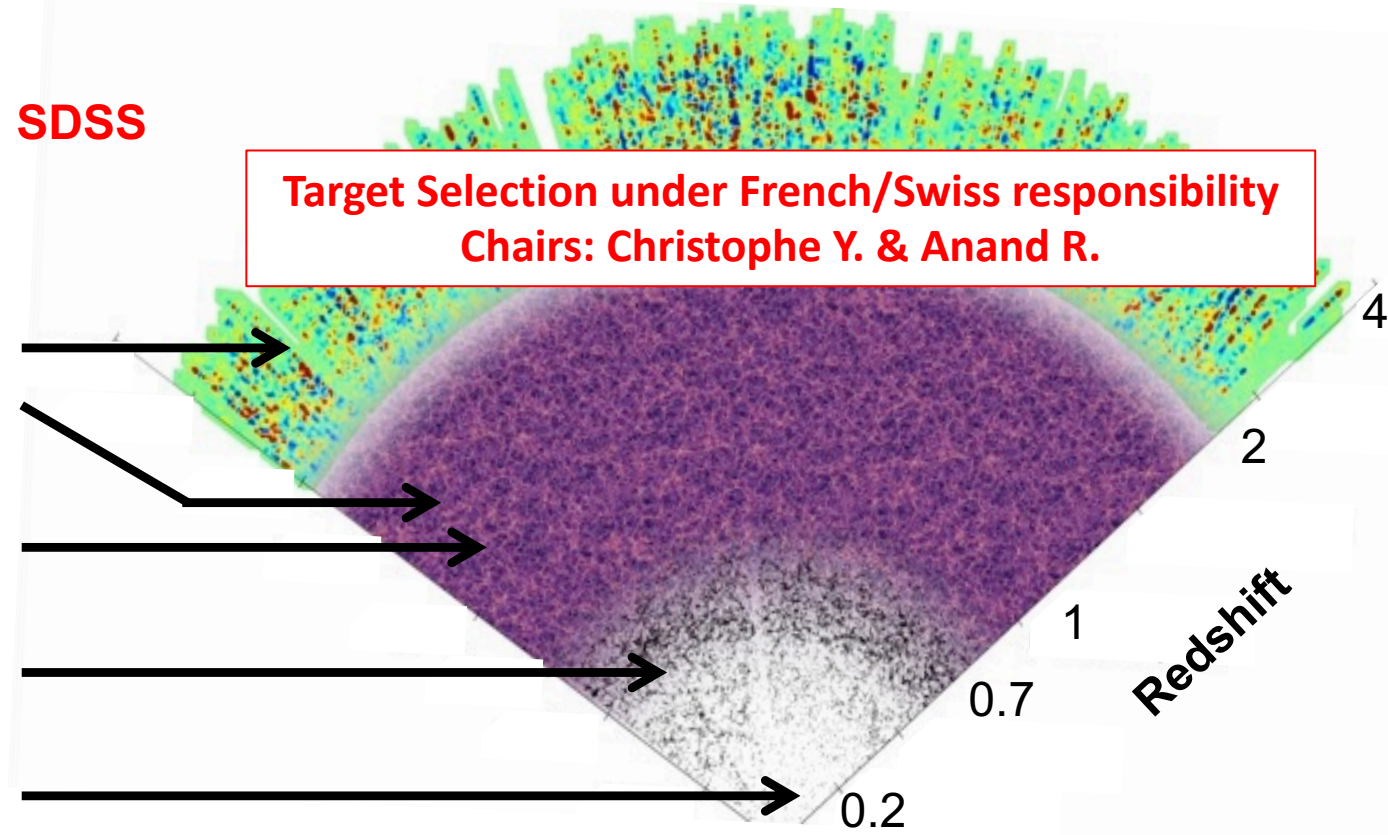
$0.6 < z < 1.6$

6 million LRGs

$0.4 < z < 1.0$

**10 million
Brightest galaxies**

$0.0 < z < 0.4$



Status on imaging

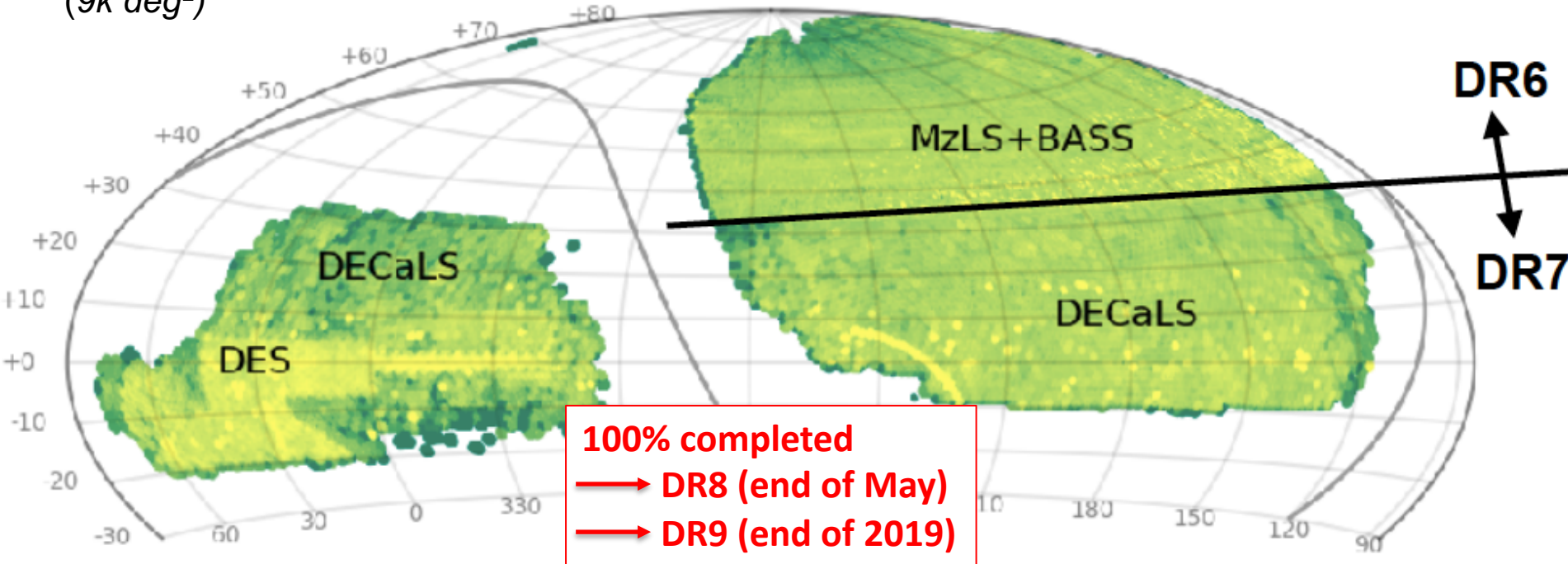
Pre-imaging over 14,000 sq. deg required for target selection

Three optical surveys

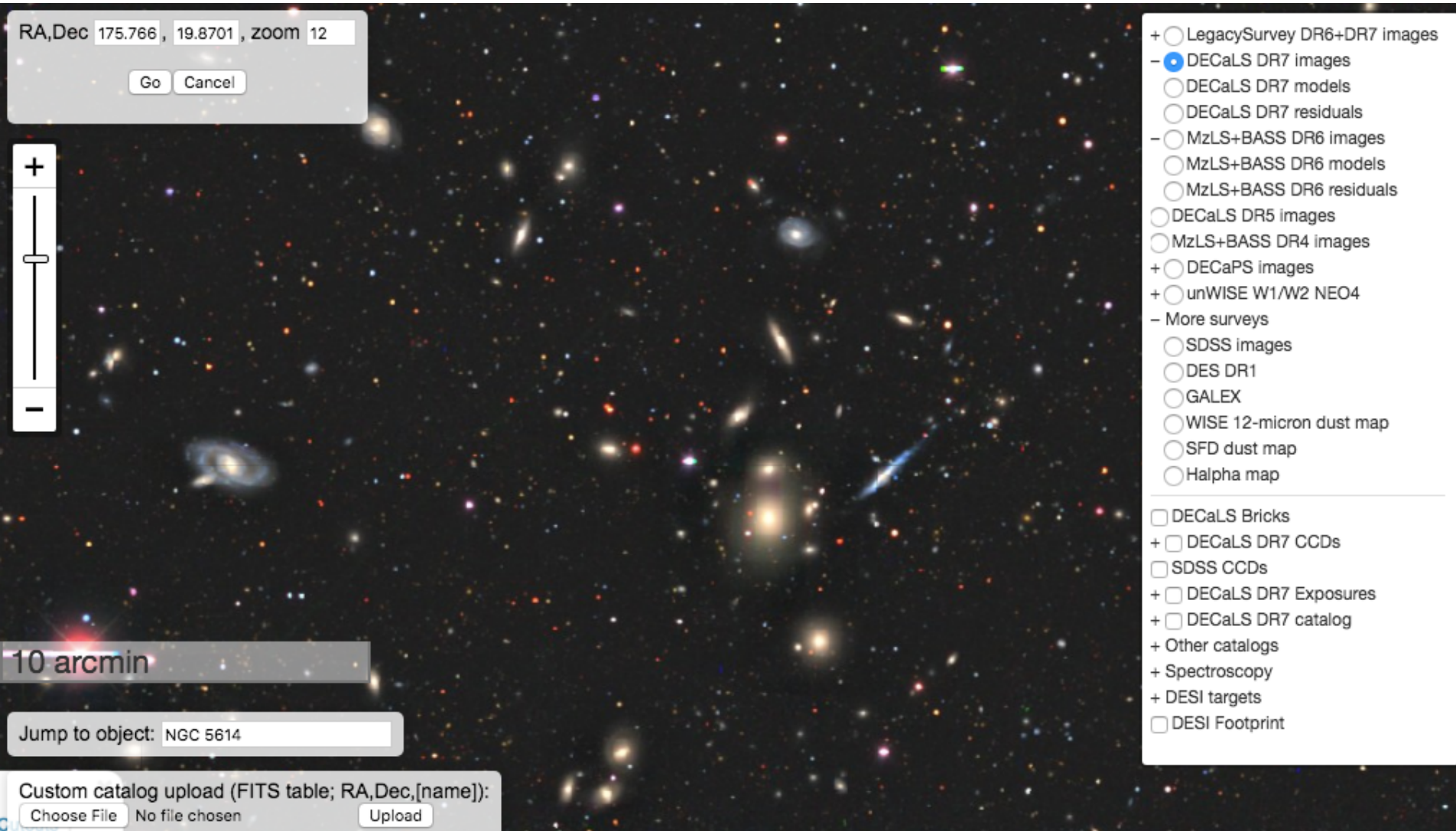
- **North** **BASS** gr
(5k deg²) **MzLS** z
- **South** **DECaLS** grz
(9k deg²)

One infrared survey

- **All Sky WISE**
(NASA satellite)
W₁ W₂



Imaging viewer at <http://legacysurvey.org/viewer>



RA,Dec 175.766 , 19.8701 , zoom 12

Go Cancel

+

-

10 arcmin

Jump to object: NGC 5614

Custom catalog upload (FITS table; RA,Dec,[name]):

Choose File No file chosen Upload

- LegacySurvey DR6+DR7 images
- DECaLS DR7 images
 - DECaLS DR7 models
 - DECaLS DR7 residuals
- MzLS+BASS DR6 images
 - MzLS+BASS DR6 models
 - MzLS+BASS DR6 residuals
- DECaLS DR5 images
- MzLS+BASS DR4 images
- + DECaPS images
- + unWISE W1/W2 NEO4
- More surveys
 - SDSS images
 - DES DR1
 - GALEX
 - WISE 12-micron dust map
 - SFD dust map
 - Halpha map
- DECaLS Bricks
- + DECaLS DR7 CCDs
- SDSS CCDs
- + DECaLS DR7 Exposures
- + DECaLS DR7 catalog
- + Other catalogs
- + Spectroscopy
- + DESI targets
- DESI Footprint



Dark Energy Spectroscopic Instrument

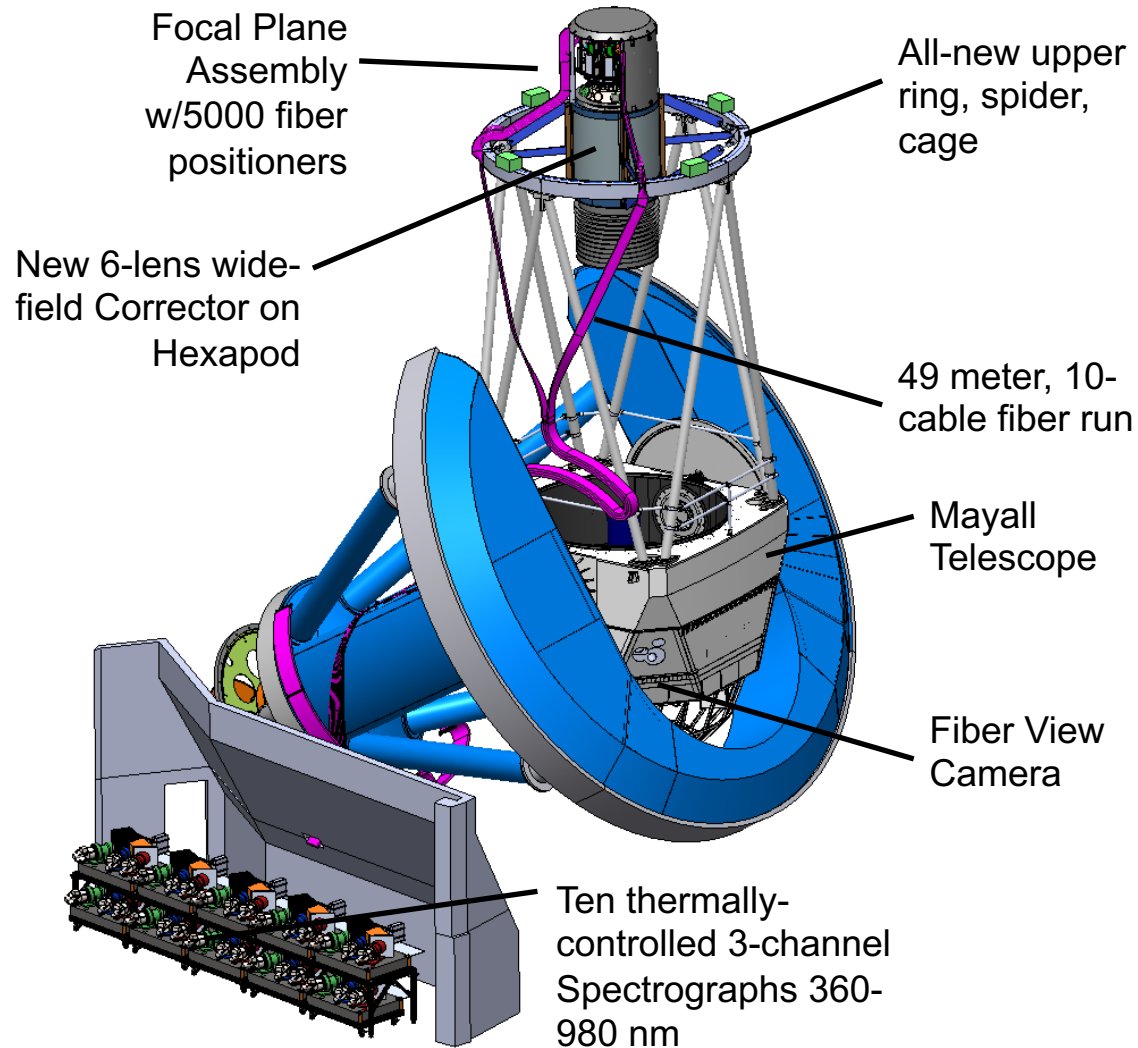
U.S. Department of Energy Office of Science
Lawrence Berkeley National Laboratory

N. Palanque-Delabrouille

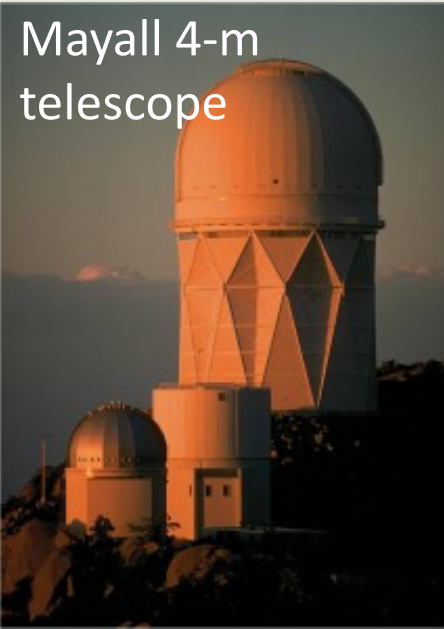
eBOSS/DESI-France days

DESI instrument overview

- Fiber-fed multi-object spectrograph
- 5000 robotically positioned optical fibers on focal plane
- Ten 3-channel spectrographs (B,R,near-IR)
- 8 deg² FOV



DESI installation at Kitt-peak (Arizona) has begun



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Removal of old cage & ring (1.3)



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New cage & ring delivered (1.3)



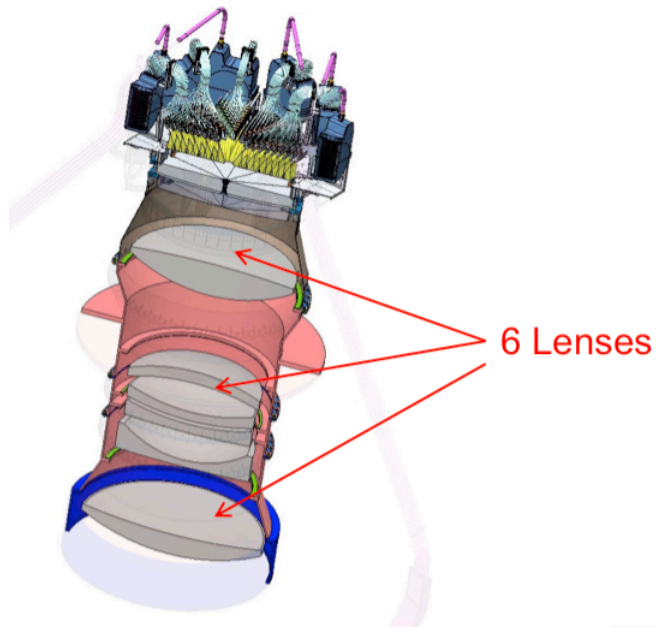
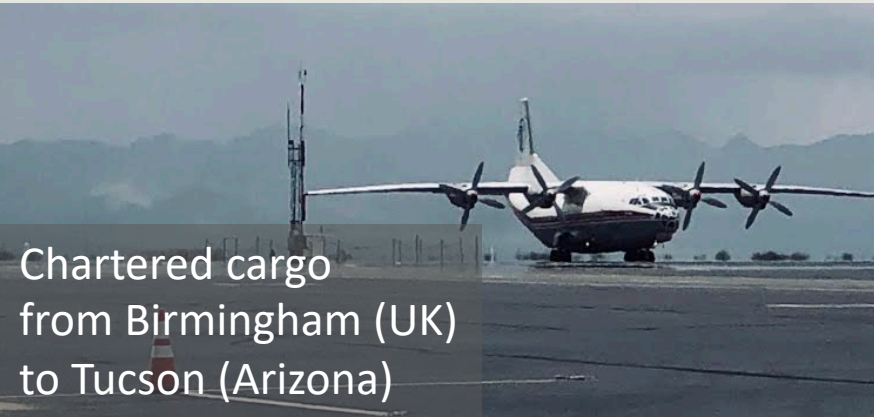
Corrector mechanical support system complete



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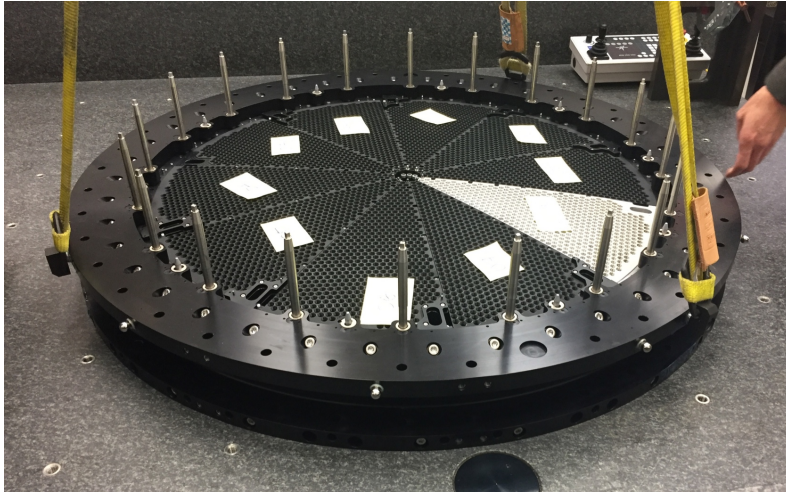
New corrector for 8 deg² FOV in place (1.2)



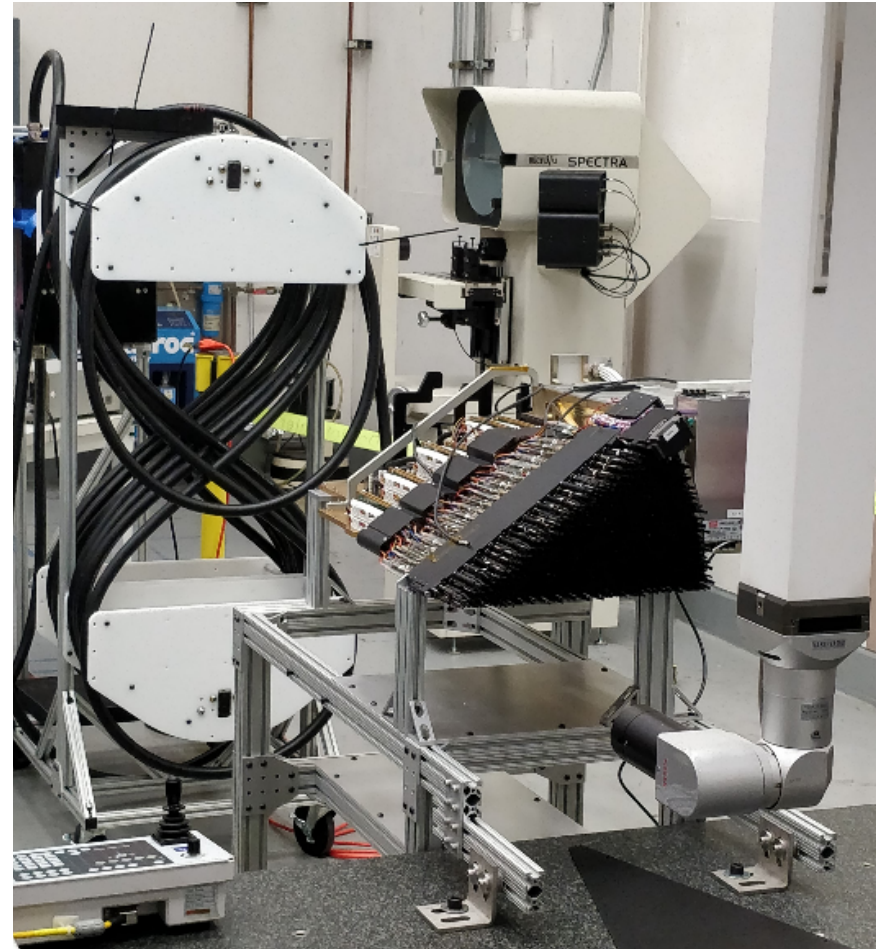
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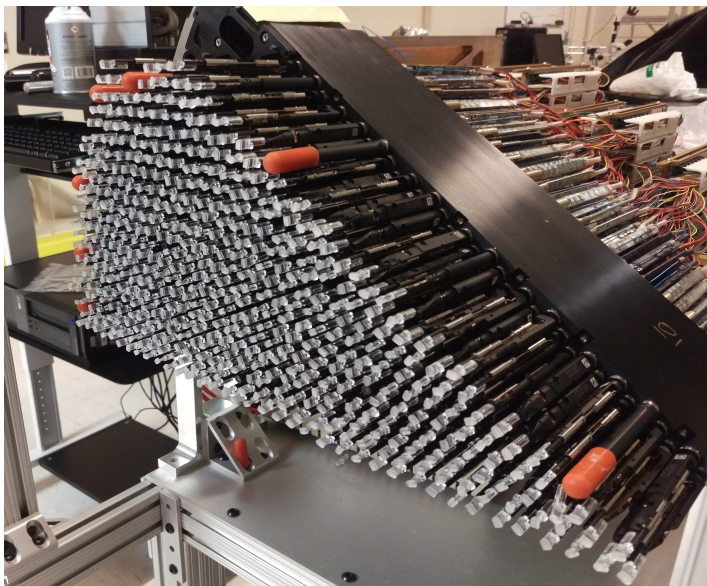
Focal plane assembly (1.4) & fiber system (1.5)



and spliced to cables



All 10 petals
equipped
with fiber
positioners



4 fully tested

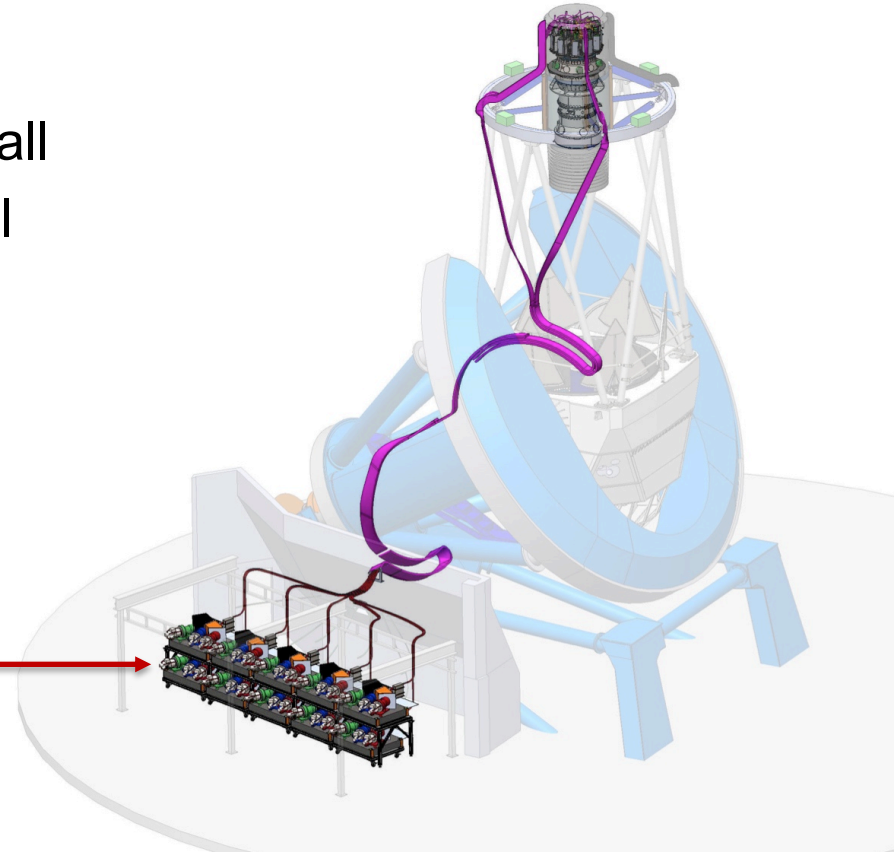
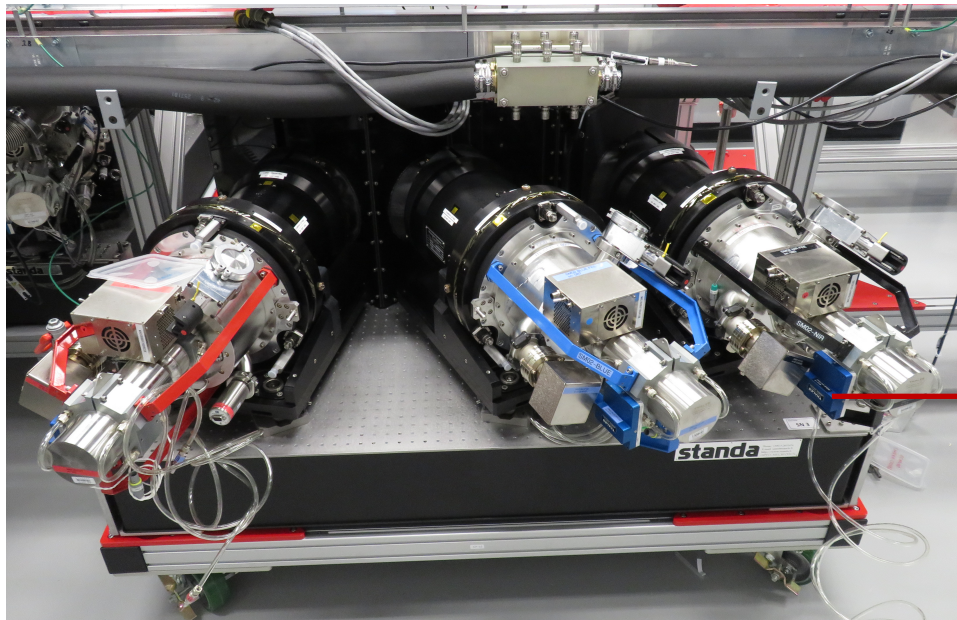


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Spectrographs (1.6)

- **Major French contribution:**
CEA, CPPM, LAM-OHP, LPNHE + Winlight optics vendor
- Spectrographs: 8/10 built, 4 are at Mayall
- Cryostat sets: 8/10 built, 2 are at Mayall



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Spectrographs (1.6)

First of ten spectrographs delivered to Kitt Peak



Rolling in a spectrograph set



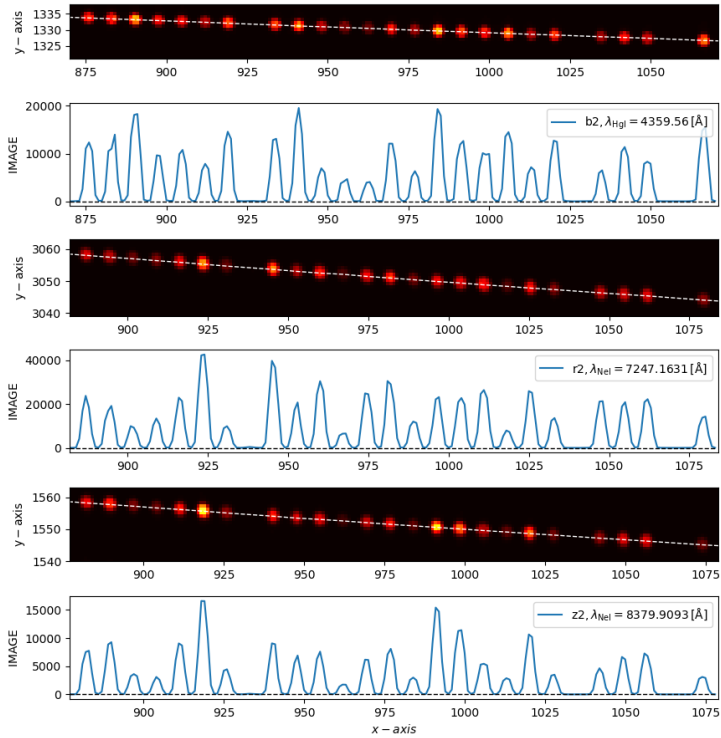
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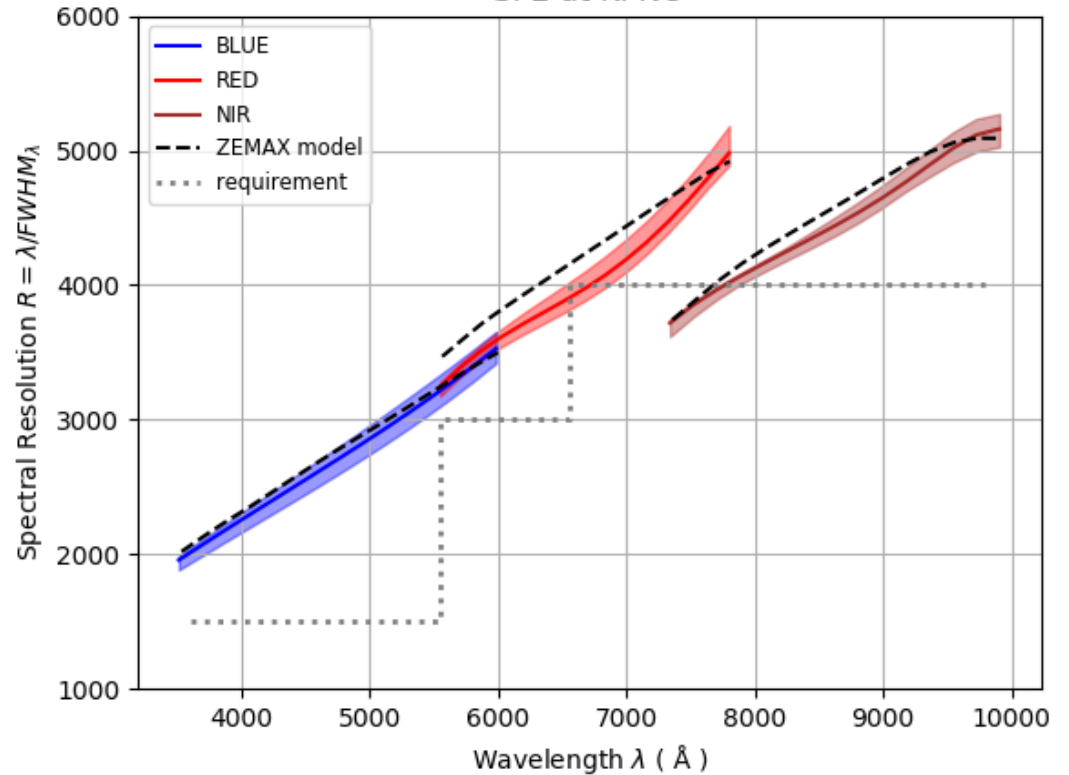
Spectrographs (1.6)

Spectroscopic resolution achieves requirements

SP2



SP2 at KPNO



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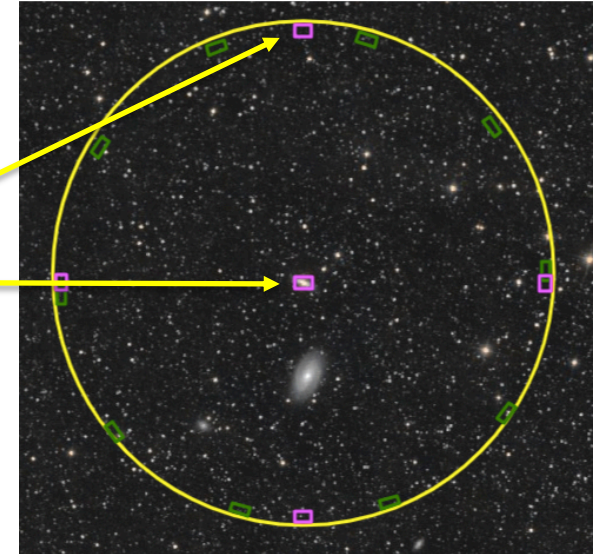
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Commissioning Instrument in place

Commissioning Instrument on corrector



4 off-axis cameras
1 on-axis camera
22 illuminated fiducials



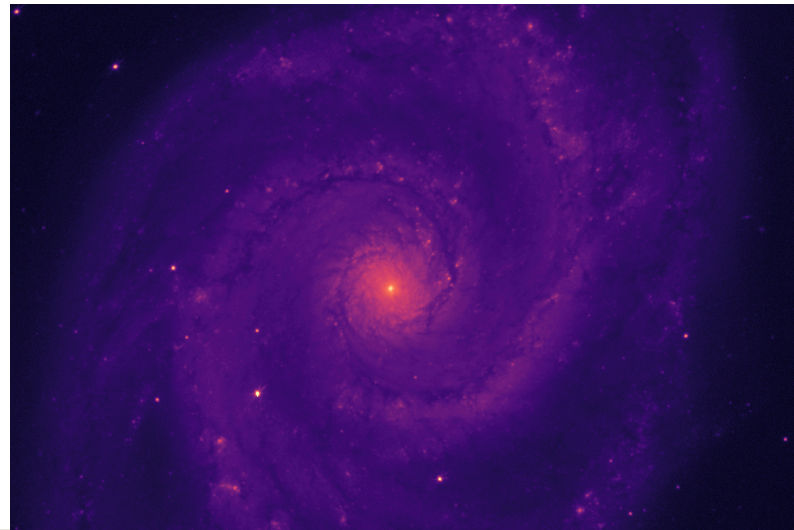
Corrector looks good

→ delivering sub-arcsec images simultaneously across FOV

Retiring significant risk!

Issue: 9mm shift in M1 focal length

→ 2-week delay to re-position corrector



First
Image!
Apr. 1st, 2019



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DESI milestones

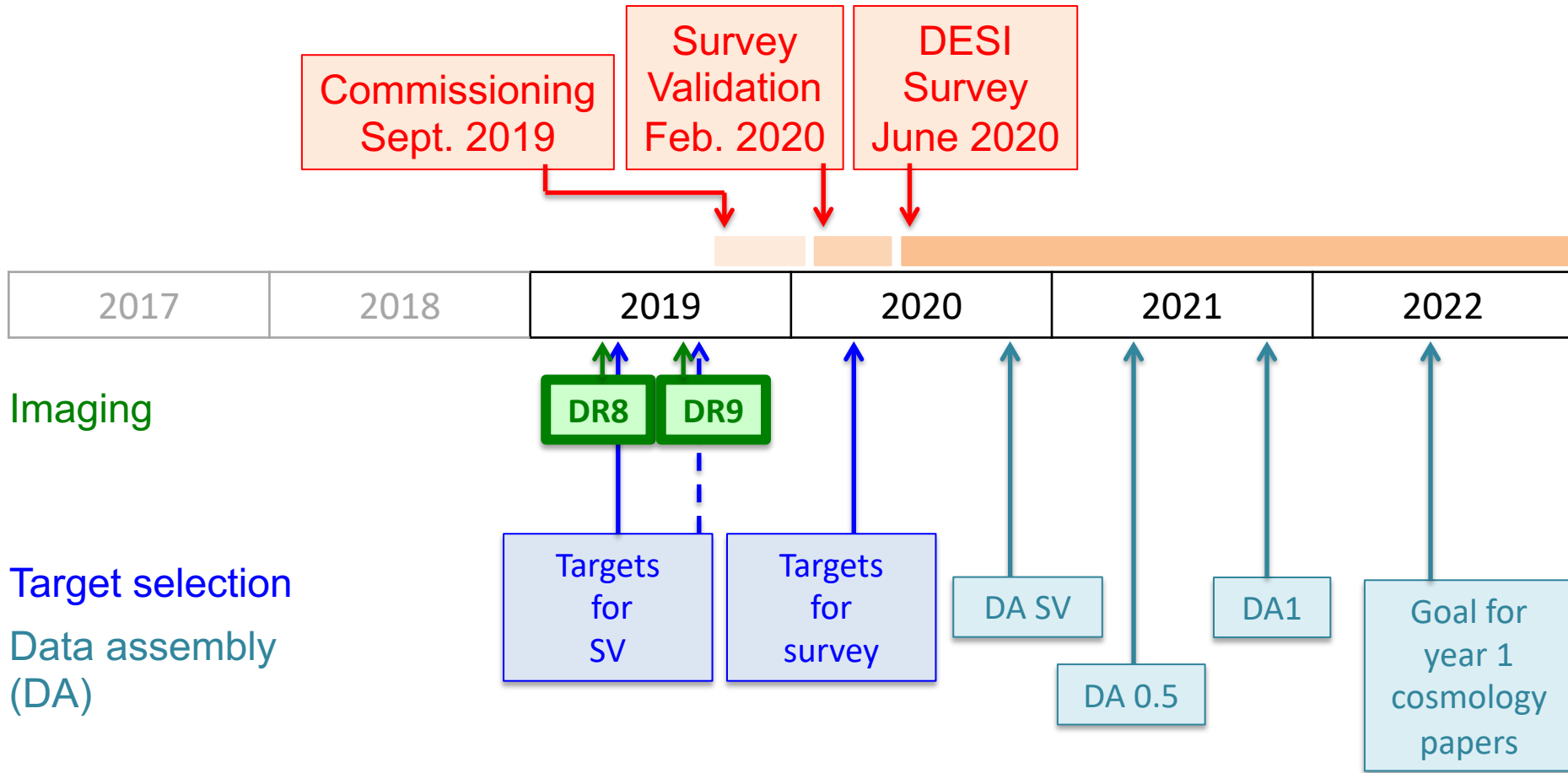
Milestones	Date	
End of Imaging Surveys	March 2019	Pre-Operations
Commissioning Instrument Run	April 2019	
Start of Commissioning	September 2019	
End of Commissioning	January 2020	
Survey Validation Survey Begins	February 2020	Operations
Science Survey Begins	June 2020	
Science Survey End	June 2025	
Final Survey Data Assembly	March 2026	

← Now

DOE funded \$70M for 6.5 yrs as of April 2019



Data coming soon!



Imaging

Target selection

Data assembly (DA)

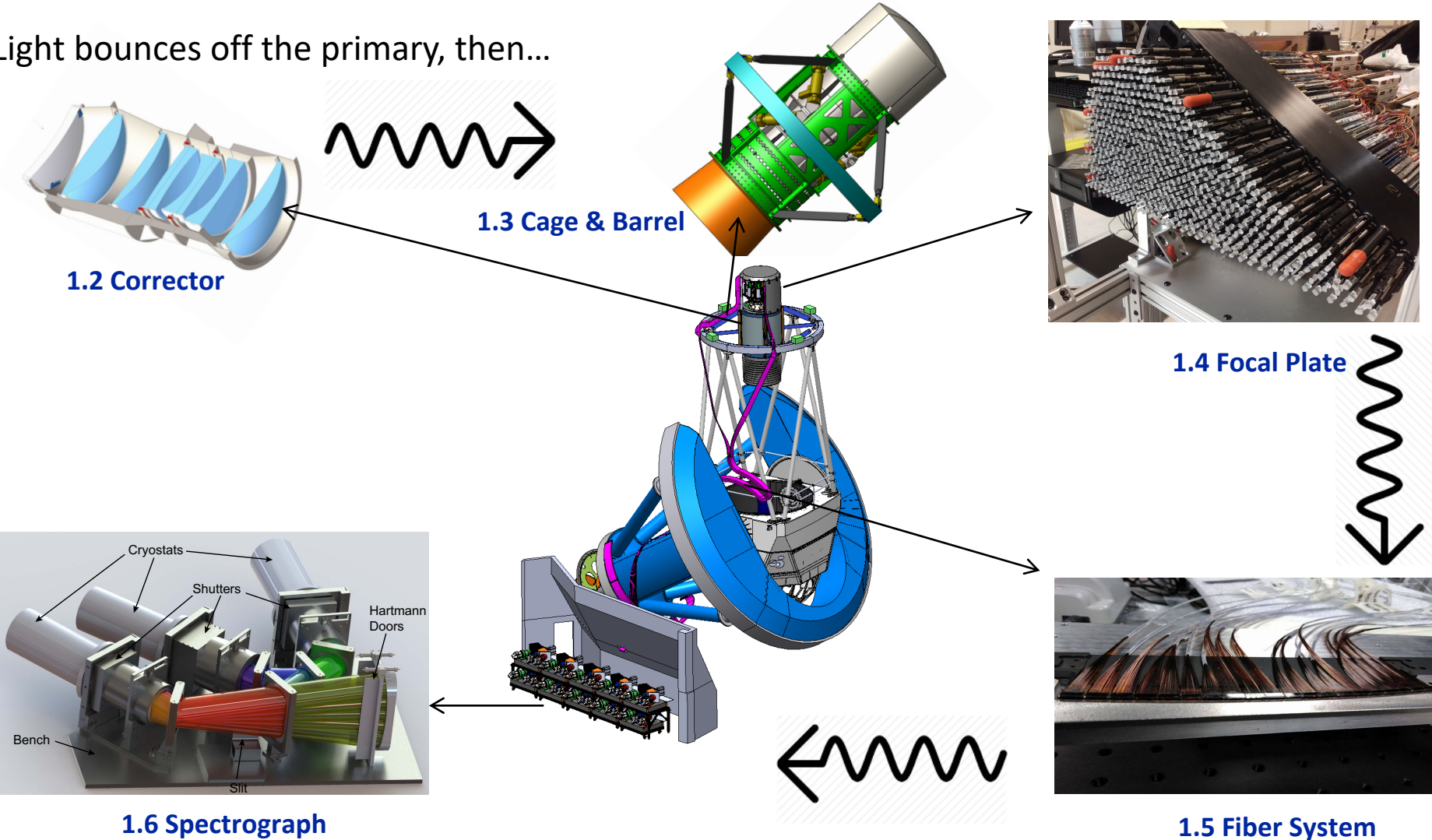
Conclusions

- DESI is a large collaboration,
 - Over 600 members
 - From 74 institutions among which 46 non-US
- DESI installation is progressing really well! First data soon
 - Survey validation in Feb 2020
 - Survey science in June 2020
 - **Plan the observing shifts (proportionally to number of participants)!**
- Significant French contribution
 - In charge of construction & integration of full end of photon path: spectrographs, cryostats, CCD integration & alignment, calibration
 - In charge of target selection since the beginning
 - In charge of Survey Validation
 - Strong implication in Ly- α science (mocks, P1D, hydro simulations)
 - Should get involved on other topics too: galaxy clustering, f_{NL} ...



Hardware Elements: following the path of a photon

Light bounces off the primary, then...



1.2 Corrector

1.3 Cage & Barrel

1.4 Focal Plate

1.5 Fiber System

1.6 Spectrograph

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