

Lessons Learned from Large Programs with Keck

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The DEEP2 & DEEP3 Galaxy Redshift Surveys

THE DEEP2 GALAXY REDSHIFT SURVEY: DESIGN, OBSERVATIONS, DATA REDUCTION, AND REDSHIFTS*

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For more details see...

DEEP2: Newman, Cooper et al. (2013, ApJS, 208, 5)

DEEP3: Cooper et al. (2011, 2012, 2016?)

The DEEP2 & DEEP3 Galaxy Redshift Surveys

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[unrealistically small for TMT]

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The DEEP2 & DEEP3 Galaxy Redshift Surveys

DEEP2

2002 - 2007
~90 nights
4 fields ($\sim 3 \text{ deg}^2$)
~400 slitmasks
~50,000 targets

DEEP3

2008 - 2010
~30 nights
1 field (EGS, $\sim 0.25 \text{ deg}^2$)
~120 slitmasks
~7500 targets

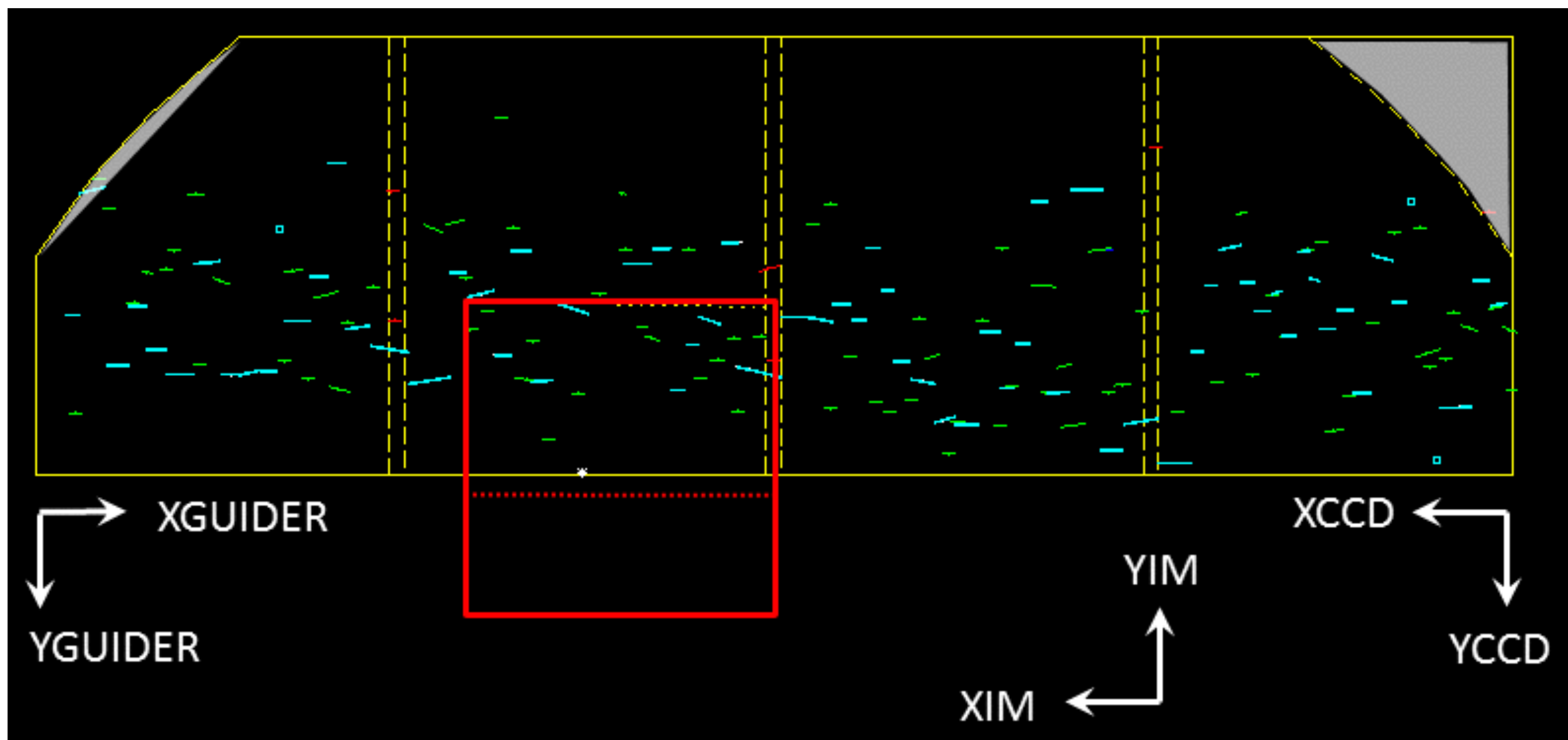
For more details see...

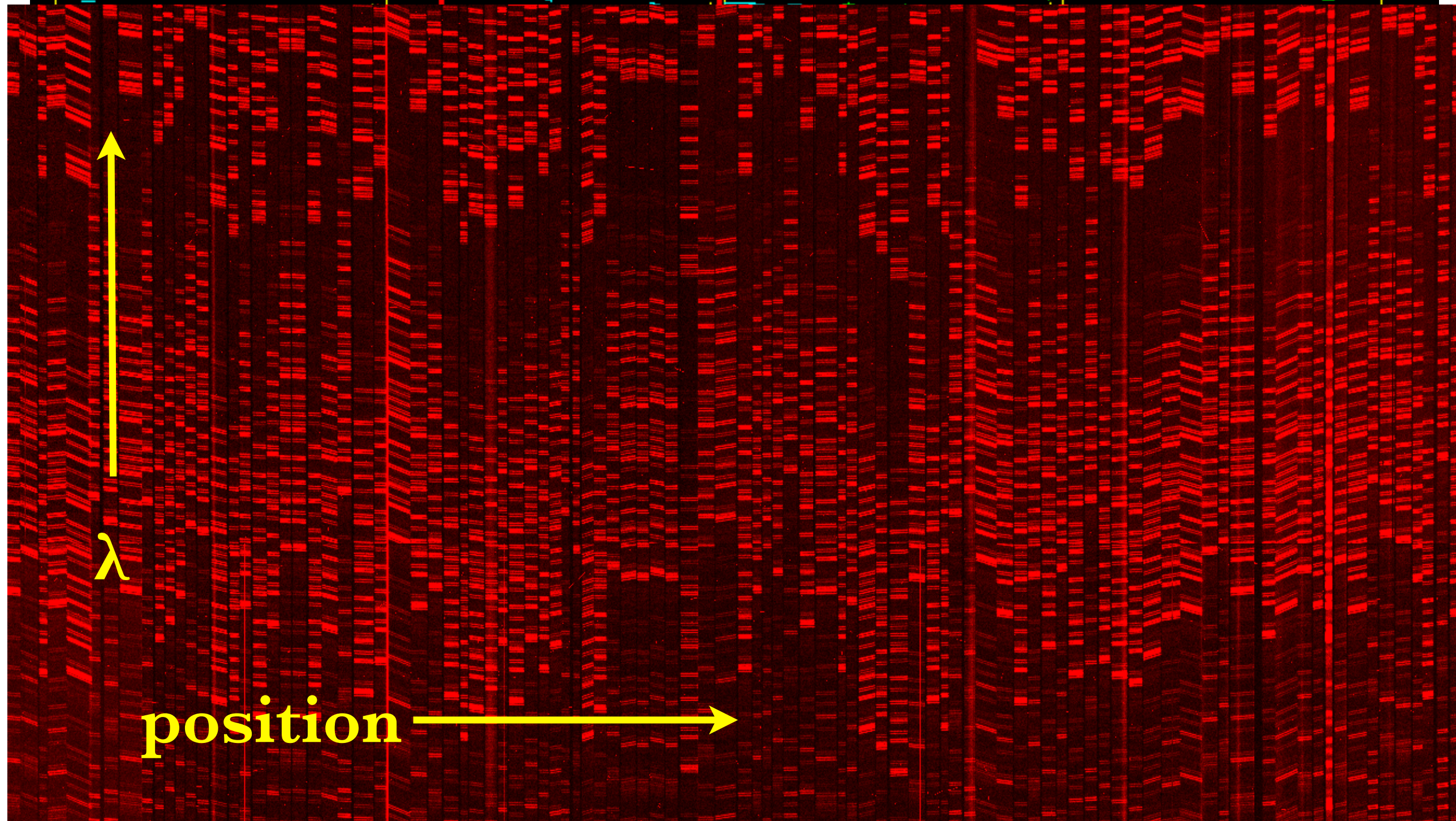
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DEIMOS: Deep Extragalactic Imaging Multi-Object Spectrograph







The DEEP2 DEIMOS Data Reduction Pipeline

(spec2d, Cooper et al. 2012)

Fully-automated IDL-based pipeline produces rectified, wavelength-calibrated, and sky-subtracted 2-d and 1-d spectra.

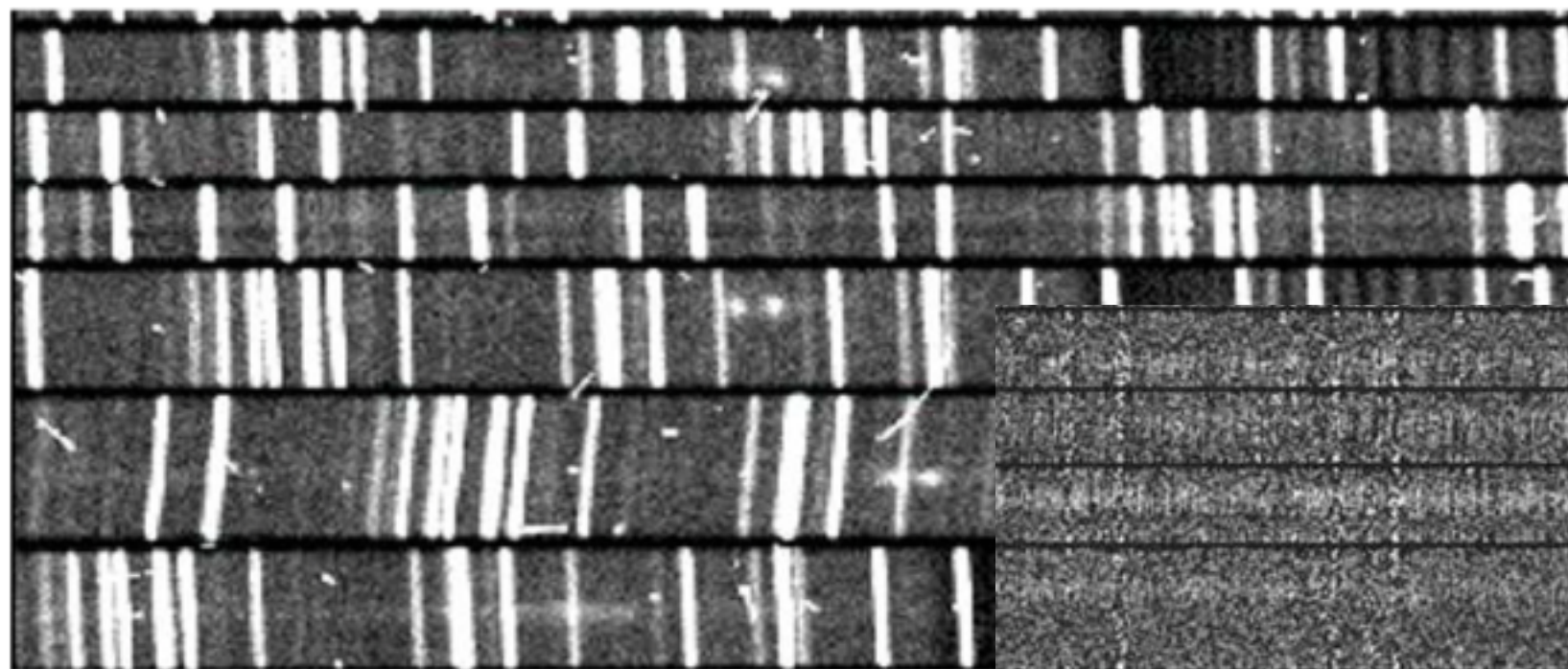


**small portion of raw
DEIMOS frame**

The DEEP2 DEIMOS Data Reduction Pipeline

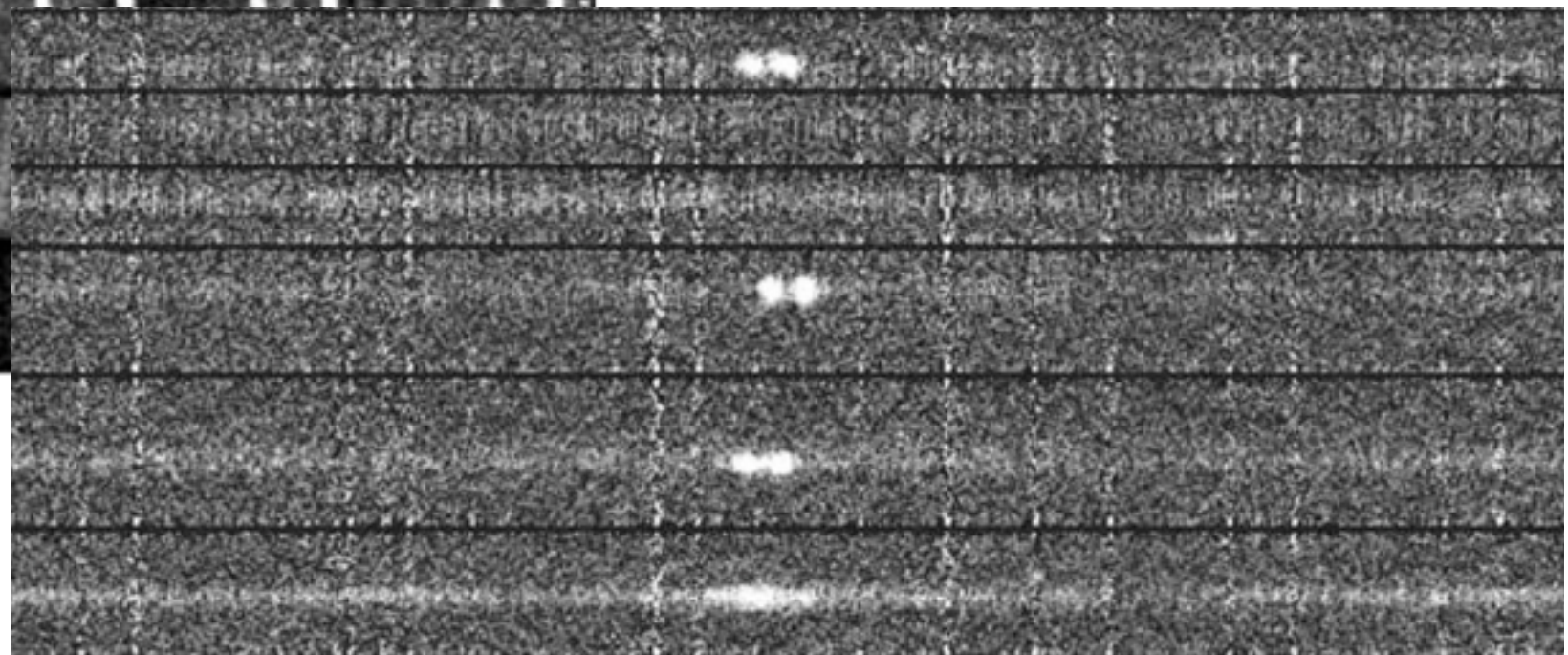
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**small portion of raw
DEIMOS frame**

reduced 2-d spectra



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Weaknesses:

- not a general reduction tool
(e.g. no dithering, poor for long-slit, etc.)

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Strengths:

- facilitated >500 publications (as of ~2012),
including subsequent surveys (SPLASH, TKRS).
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—> public pipeline would perhaps not exist without proprietary period.

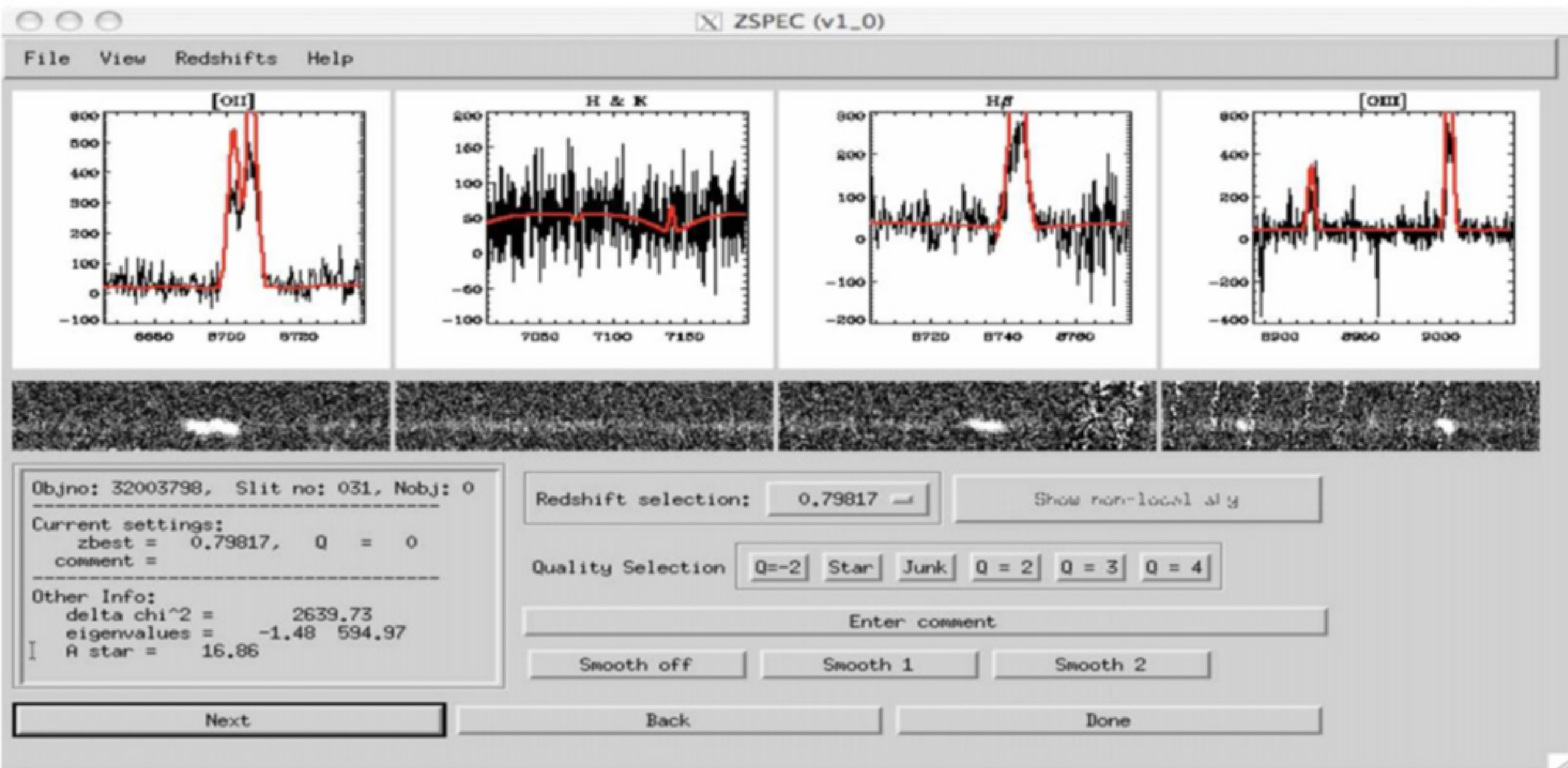
The DEEP2 Redshift Pipeline

(spec1d)

Fully-automated IDL-based pipeline measures line-of-sight velocities via comparison to a set of stellar, AGN, and galaxy templates.

The DEEP2 Redshift Pipeline (spec1d)

...plus a GUI-based tool (zspec) for inspecting and interactively refitting redshifts.



The DEEP2 & DEEP3 Data Releases

DEEP2: DR1 (2004), DR2 (2007), DR3 (2007), DR4 (2012)

DEEP3: DR1 (summer of 2015?)

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DEEP3: DR1 (summer of 2015?)



DEEP2 Data Release 1



The fourth data release (DR4) for the DEEP2 galaxy redshift survey is now available, including the previously released data from DR1, DR2, and DR3. Documentation and download instructions for DR4 are available [here](#).

The [DEEP2](#) project is a redshift survey of 50,000 distant galaxies utilizing the [DEIMOS](#) spectrograph on the [Keck II](#) telescope. Data release 1 (DR1) is the first public data release for the survey and includes redshift and imaging catalogs in addition to 1-d and 2-d spectra for more than 7,500 objects. Data release 1 spans 70 DEIMOS slitmasks observed during the 2002 DEEP2 observing season (data collected August 2002 - October 2002). The slitmasks included in this release cover portions of three of the four [DEEP2 fields](#) as shown in this [sky coverage map](#).

The [DR1 Data Products Page](#) provides details regarding the contents of data release 1 and links to all public data products available for download. Please refer to the [credits page](#) for a list of our sources of funding, participating institutions, and how to acknowledge the use of DEEP2 data in publications.

DEEP2 Galaxy Redshift Survey

Data Release 4

DR4 Home

Description of Observations

[Slitmask Summary Table](#)

[Slitmask Design Parameters](#)

[Sky Coverage & Completeness](#)

Redshift Catalog

[Description of Tags](#)

[Quality Codes](#)

Spectra

[Spectra Primer](#)

Photometric Catalogs

[Photo Primer](#)

[Extended Catalogs](#)

Derived Data Products

[Group Catalog](#)

Acknowledgment

The recently-completed [DEEP2 Galaxy Redshift Survey](#) provides the most detailed census of the Universe at $z \sim 1$ to date. The survey targeted $\sim 50,000$ distant galaxies in the redshift range $0 < z < 1.4$, utilizing the [DEIMOS](#) spectroscopic on the [Keck II](#) telescope. Data Release (DR4) constitutes the fourth public data release for the survey and includes redshift and imaging catalogs in addition to sky-subtracted one- and two-dimensional spectra spanning all four survey fields. For more details regarding the survey and these data products, follow the links at the left.

A complete description is provided in [Newman et al. \(2013\)](#).

Any questions regarding DEEP2 or this data release should be directed to [Michael Cooper](#) (cooper-at-uci.edu) and [Jeff Newman](#) (janewman-at-pitt.edu).

DEEP2 Galaxy Redshift Survey

Data Release 4

DEEP2 & DEEP3 data releases include reduced 2-d & 1-d spectra, photometric catalogs, slitmask design parameters, completeness maps, and some derived data products.

Spectra
Photometric Catalogs
Photo Primer
Extended Catalogs
Derived Data Products
Group Catalog
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DEEP2 Galaxy Redshift Survey

Data Release 4

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Perhaps limited need for more sophisticated (e.g. SQL) databases for likely TMT surveys?
— caveat: linking to other datasets (e.g. JWST, WFIRST, LSST).

DEEP2 & DEEP3 Scientific Production

DEEP2 publications (as of 2012):

from survey team ~ 50+ papers

from community ~ 100+ papers

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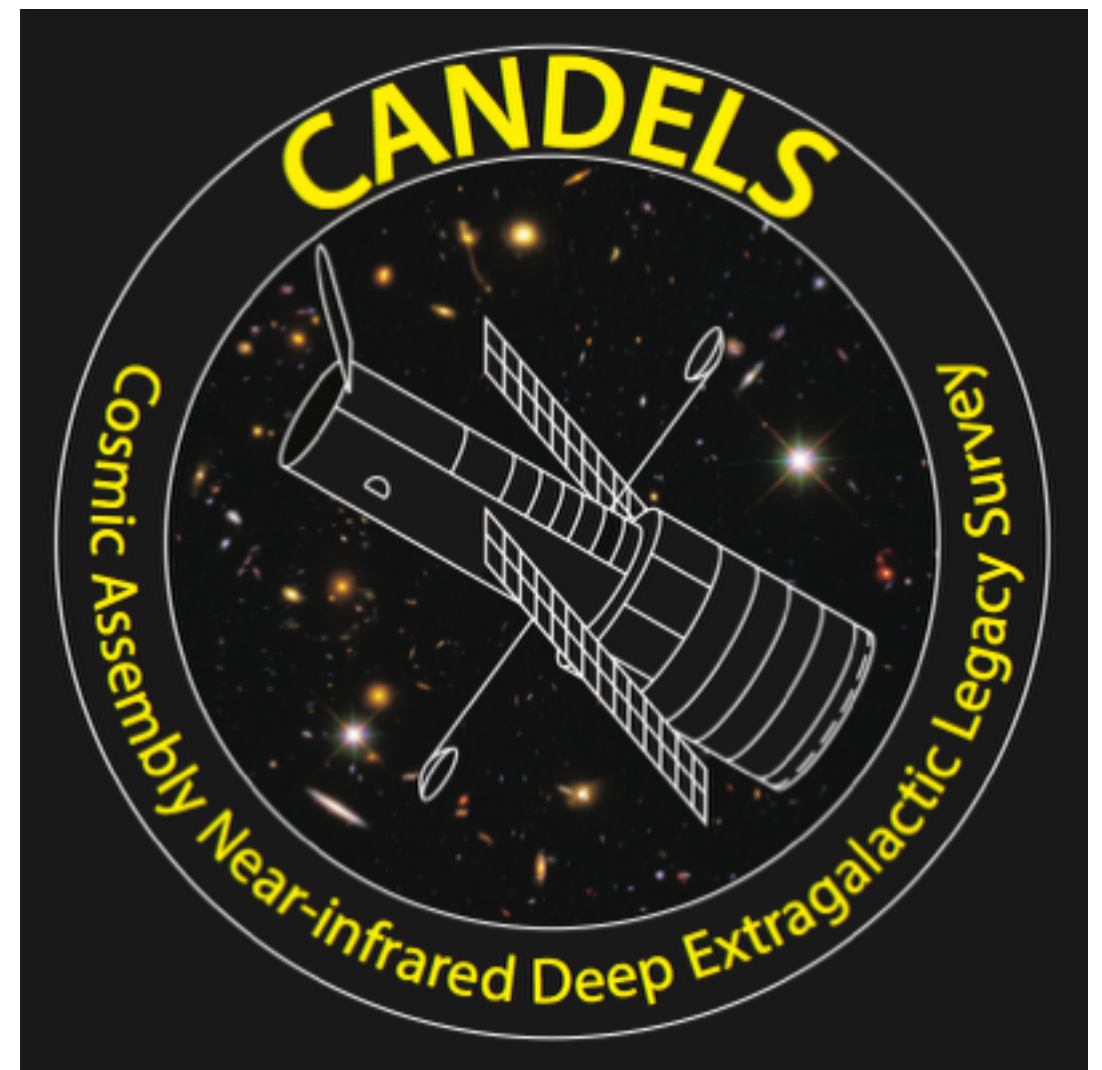
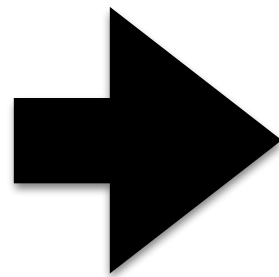
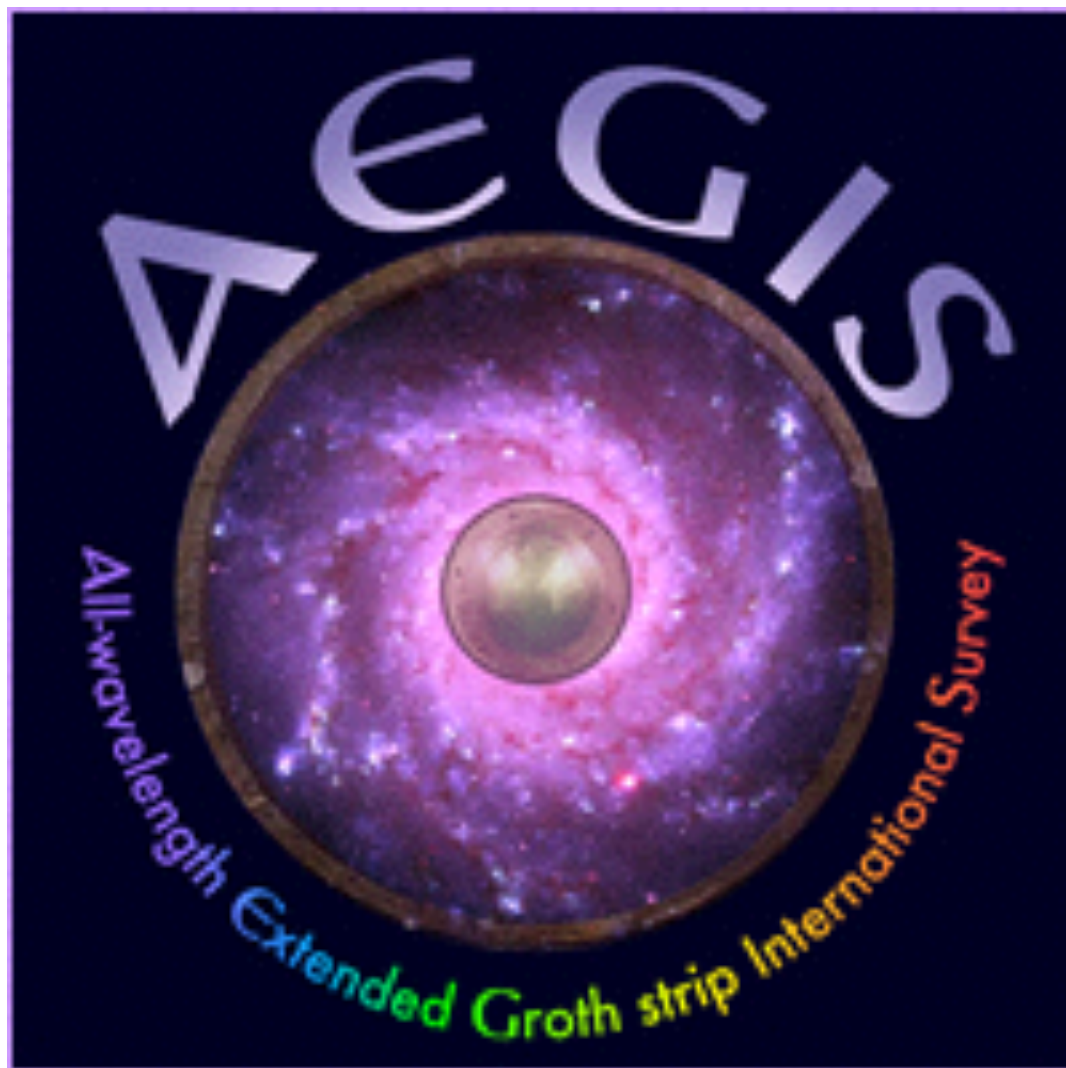
DEEP3 publications (as of today):

from survey team = 2 papers

from community ~ 40+ papers

Having a sizable and committed survey team is critical.
It may be the largest factor in the success of the survey.

TMT surveys as a seed for
larger, more international collaborations



(along with GOODS, UDS, etc.)

Final Thoughts

- The success of a large program depends directly on the quality of the instrument employed (and vice versa?).
[Is there potential benefit to having large surveys be some of the first programs using TMT?]
- Leaving the construction of data pipelines to survey teams is less than ideal — though close involvement of a survey team is very helpful.
- Success of a large program is largely driven by the size and effectiveness of the active team.