Welcome!

Commissioning and Science Validation

Tuesday, 12 August 2020 @ 12:00-13:00 PDT

Chairs: Keith Bechtol and Chuck Claver

Rubin Observatory

Session Webpage:
link

Rubin2020_PCW Slack Channel:
#day2-tue-slot3a-commissioning

Friendly Reminders

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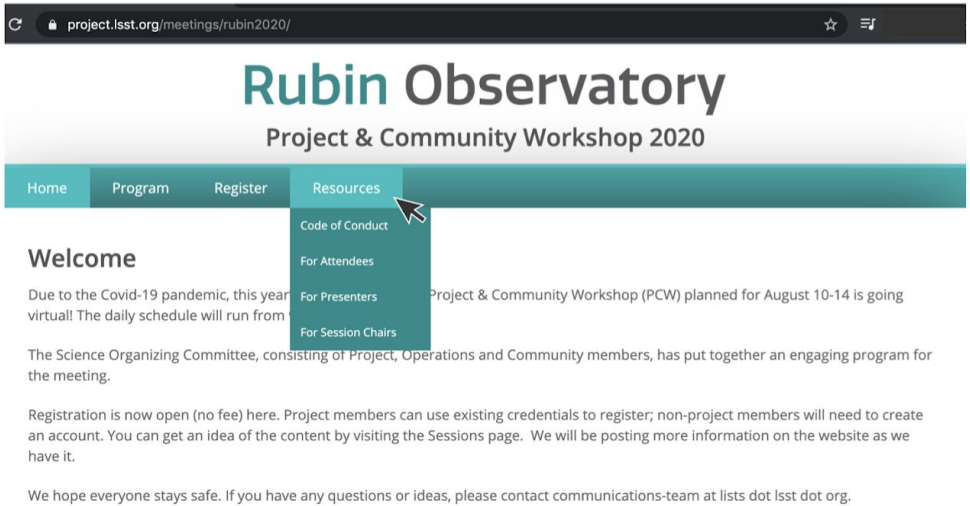
You agreed to abide by the Code of Conduct at registration - it can be found here on the website



Rubin adheres to the principles of Kindness, Trust, Respect, Diversity and Inclusion in order to provide a learning environment that produces rigor and excellence.

Any discriminatory behavior against colleagues on any basis, such as gender, gender identity, race, ethnic background, national origin, religion, political affiliation, age, marital status, sexual orientation, disabilities or any other reason will not be tolerated.

If I witness any form of bullying, harassment or aggression I will follow the reporting instructions in the Code of Conduct.

Reminders

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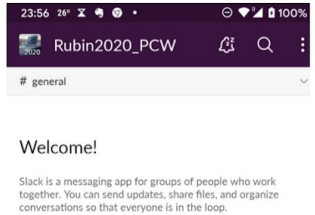
All talks at this workshop will be recorded.

If you do not wish to be recorded, you are welcome to keep your camera off.

Videos are posted the next working day.

Each session will be posted on YouTube and embedded on the session's page.



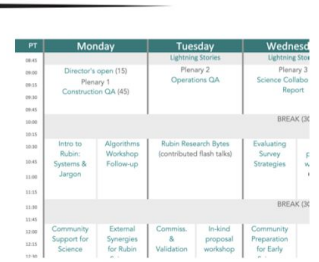
Ask questions through the Slack channel or the Zoom chat.

Give Slack questions a thumbs-up.

Questions with more thumbs up may get priority if time runs short.

Show your appreciation.

Feel free to applaud at any time but especially at the end - Slack has a clap emoji.



You can access the presentation material on the session page.

Session Logistics

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Please post questions / comments on Slack channel rather than Zoom

Moderators: Keith Bechtol and Chuck Claver

Monitoring Slack for questions: Markus Rabus

Scribes: Jeff Carlin and Kevin Reil

Minutes: google doc (editable by anyone with link)

Goals for Today

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- This parallel session is meant to be a starting point for discussion as the Project continues planning and preparations for on-sky commissioning activities
- We have invited the Science Collaborations to share snapshots of their current thinking and questions in brief presentations today
- By end of session, we hope that the Science Collaborations will have more information and resources for drafting “commissioning notes” that can be posted in the public domain and that the Project can consider when planning of on-sky observations during commissioning
    - Further discussion and iteration will likely be beneficial as we get closer to first light

We are here to listen to you!

Agenda

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- **Introduction** - Keith Bechtol and Chuck Claver (10 min)
  - Education and Public Outreach Considerations - Lauren Corlies
- **Science-driven considerations for on-sky observing**
  - Dark Energy Science Collaboration - Chris Walter (15 min)
  - Solar System Science Collaboration - Matthew Tiscareno, Meg Schwamb, Hal Levison, Marc Buie, Michael Kelley (15 min)
  - Galaxies Science Collaboration - Lee Kelvin (5 min)
  - Transients and Variable Stars Science Collaboration - Markus Rabus (5 min)
  - TVS / SMWLV - Massimo Dall'Ora (5 min)
  - Stars, Milky Way, & Local Volume Science Collaboration - Will Clarkson (5 min)

Current On-sky Observing Schedule

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Time →

Early System Integration & Test w/ComCam	Full System Integration & Test w/LSSTCam	Science Verification/Validation

3 months — **Technical I&T with ComCam**
Engineering verification: Active Optics, calibration & instrument signature removal

3 months — **Technical I&T with LSSTCam**
Engineering verification: Active Optics, calibration & instrument signature removal

- 3 months of technical I&T with ComCam
  - Required verification of system interfaces
  - System software integration & data transport to NCSA
  - Commissioning the LSSTCam refrigeration system
- 3 months of technical I&T with LSSTCam
  - Re-verification of interfaces, software and data transport
  - LSSTCam startup on the TMA – vacuum, refrigeration, utilities, SW, etc…
- 2 months of on-sky performance and science verification

2 months
- **Survey 1: Wide Area** Template Generation
- **Survey 2: Full Depth** 10-year survey in selected reference fields with external imaging and spectroscopy
- **Survey 1: Wide Area** Real time Alert Production

Current Commissioning Data Expectations

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Phases of planned on-sky data collection:

- ComCam and LSSTCam Integration and Test
  - Expect to deliver modest amounts of science-quality imaging (e.g., few hours to few nights)
- Science Verification Surveys (example “minimal” plan)
  - Single-visit Performance:
    - 6 star flats in *ugrizy* * 4 epochs = 4 nights
  - Nominal observing for scheduler testing = 3 nights
  - Challenging regions = 1 night
  - Full-Depth Survey:
    - 20-year depth in *ugrizy* overlapping at least 1 external reference field, allowing multiple dither tests (factor ~3) → ~5K visits = 8 nights
  - Wide-Area Survey:
    - 800 deg^2 in *griz* filters to 1-year equivalent depth, repeated in two phases → ~12K visits = 20 nights

Managing Expectations for Community Input

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Data content from commissioning is a “shared risk” / “best effort” situation:

- Project needs to prioritize technical and scientific verification of formal system requirements to demonstrate construction completeness in a timely fashion
- The detailed schedule for on-sky commissioning observations is TBD
- The Commissioning Team has already been planning to acquire on-sky observations that would enable science validation studies for the four main science drivers of the LSST
  - **Guidance from science community is welcome and appreciated to enhance opportunities for science validation studies based on commissioning data**
- Commissioning observations are NOT an observing proposal / TAC process
  - We cannot ensure that any particular observations will be taken during commissioning

Proposed Process to Provide Input

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To provide guidance for the on-sky observing strategy during commissioning, the Science Collaborations are encouraged to produce summary documents, “commissioning notes”, that are placed into the public domain and can be considered by the Commissioning Team.

Suggestions:

- Commissioning liaisons curate guidance from their respective collaborations
- Structure of “commissioning notes” is flexible (~2 pages will be valuable)
- Supplemental digital resources welcome
- Input posted by Nov 2020 would be considered as input to Project re-plan
  - Periodic updates after that are welcome
- Based on input received, Project and Community will iterate to refine proposals

What can be done in 1 night?

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For purpose of estimation, take a typical night to be ~8 hours. Consider an average time between visits of ~40 seconds. This corresponds to ~720 visits per night, and realistically somewhat less due to filter changes, slews, variable conditions, etc. Allowing 85% efficiency, ~600 visits per night

For comparison, the 10-year depth from SRD is

Specification: The sum of the median number of visits in each band, Nv1, across the sky area specified in Table 22, will not be smaller than Nv1 (Table 23).

Quantity	Design Spec	Minimum Spec	Stretch Goal
Nv1	825	750	1000

Quantity	u	g	r	i	z	y
Nv1 (design spec.)	56 (2.2)	80 (2.4)	184 (2.8)	184 (2.8)	160 (2.8)	160 (2.8)
Idealized Depth	26.1	27.4	27.5	26.8	26.1	24.9

What can be done in 1 night?

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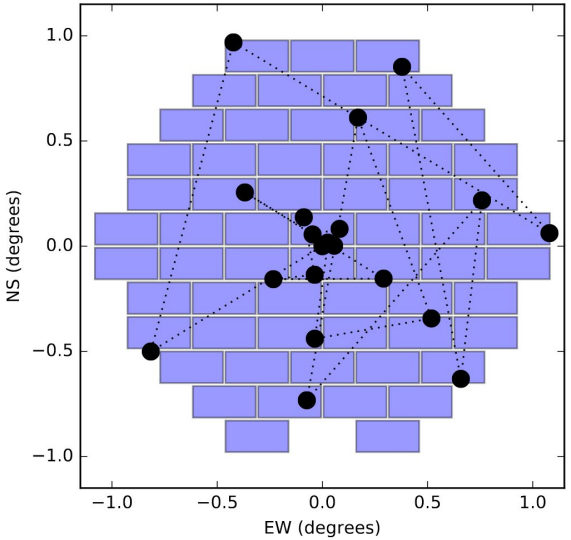
A few representative possibilities:

- An LSSTCam star flat with with 20 visits in each of 5 bands would take ~80 minutes
  - Area includes ~10^5 Gaia reference stars
- ~325 deg^2 to ~1-year WFD equivalent depth (18 visits) in a single filter
- 10-year WFD equivalent depth in 4 bands for a single pointing, spanning range of airmass



Example DECam star dither pattern
Bernstein et al. 2017
arXiv:1703.01679

Field Name	Optimal Date	Optimal Airmass	$T_{1.4}$ (hr)	$T_{2.0}$ (hr)	Dates $\sec(z) < 1.4$	Dates $\sec(z) < 2.0$
LSST DDF ELIAS S1	Oct-01	1.03	7.1	9.6	May-15 to Jan-21	Apr-25 to Feb-18
LSST DDF XMM-LSS	Oct-28	1.11	5.1	7.5	Jun-23 to Feb-04	Jun-05 to Mar-03
LSST DDF Chandra Deep Field South	Nov-14	1.00	6.7	8.1	Jun-26 to Mar-17	Jun-09 to Apr-13
LSST DDF COSMOS	Feb-21	1.18	4.2	6.9	Nov-24 to Jun-21	Oct-28 to Jul-10

Table from DESC Note

Education and Public Outreach Considerations

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EPO's main early goals involve generating excitement about the observatory and beginning to populate our products with LSST data.

No strong preference for specific objects but characteristics that would best serve our needs include:

- Color images of photogenic galaxies or nebulae to spark public interest
- Reasonably large, continuous patch of sky covered in all six filters to test EPO image coloring algorithm and creation of HiPS files for all-sky viewer
- Alert stream production from ideally the same patch of sky to populate website and adding transient objects to our products