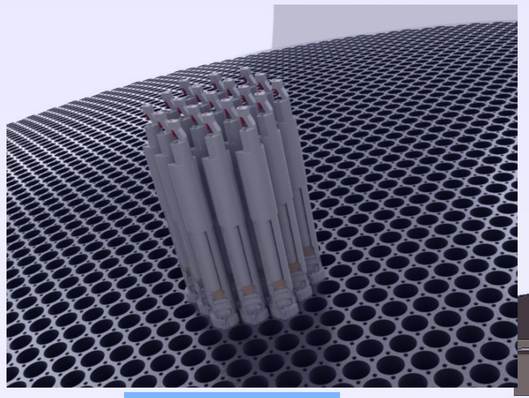
BigBOSS

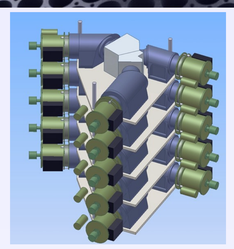
Guider, Focus and Alignment System

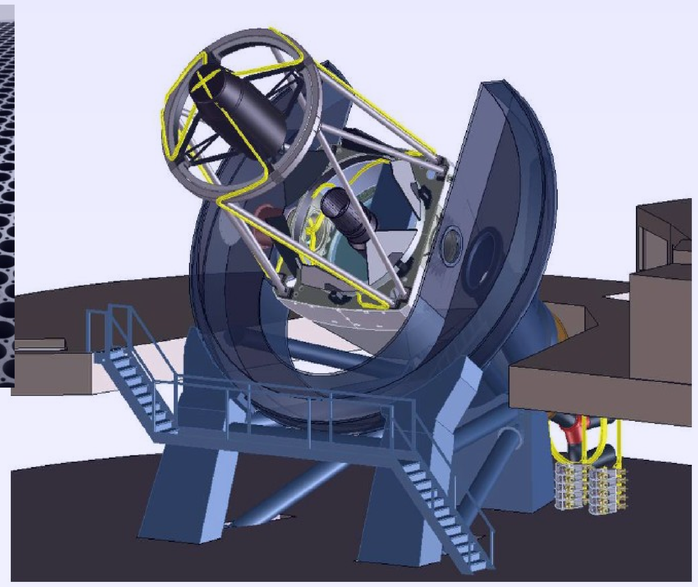
Kevin Reil for the BigBOSS Collaboration
reil@slac.stanford.edu

BigBOSS

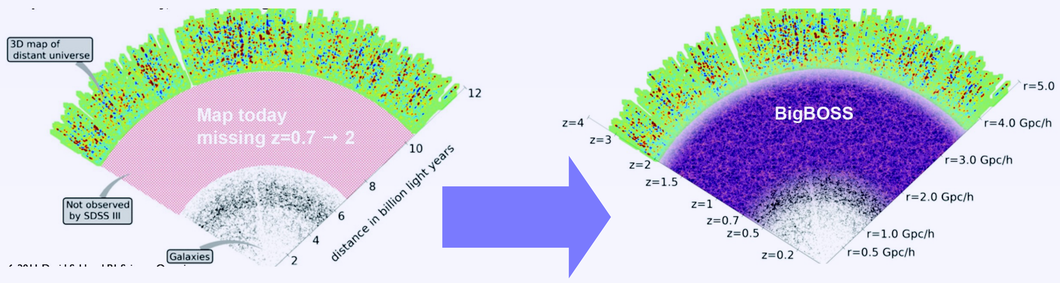
BigBOSS is a proposed 5000 fiber multi-object spectrometer designed for installation on the Mayall 4m telescope.







The scientific mission is to measure measure BAO and redshift space distortions in the distribution of galaxies and hydrogen gas spanning redshifts from $0.2 < z < 3.5$.



Acknowledgments

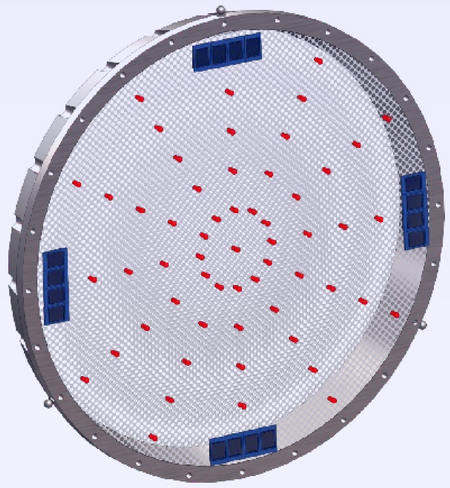
BigBOSS is supported by the Director, Office of Science, High Energy Physics, of the U.S. Department of Energy, under contract number DE-AC03-76SF00098.

The author is an associate member of the Kavli Institute for Particle Astrophysics and Cosmology, located at the SLAC National Accelerator Laboratory

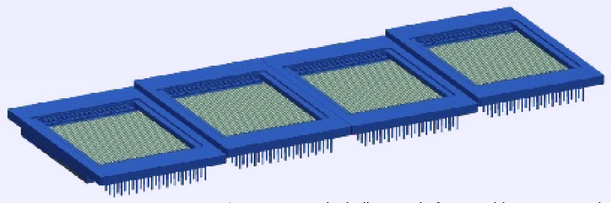
Guider, Focus and Alignment System

The guider, focus and alignment system is tasked with:

- Acquire telescope pointing after each slew
- Guide the telescope to the correct pointing at the micron level
- Provide guide signals from stars to the telescope control system
-
- Determine optical wavefront errors
- Provide focus and alignment updates for the hexapod between exposures



The BigBOSS focal plane



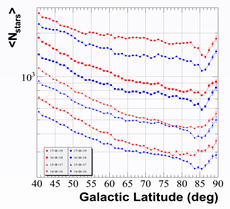
4 sensor array including two in focus guide sensors and one intra-focal and one extra-focal.sensor.

- Sensor groups are located symmetrically about the focal plane
- Each sensor group contains:
  1) 2 “in focus” sensors
  2) 1 “above focus” sensor
  3) 1 “below focus” sensor
- The in focus sensors
  - Using stars, acquire the new field after each telescope slew
  - Guide the telescope to the correct pointing
  - Provide guide signals at the Hz level to the telescope control system during exposures

System Design Considerations

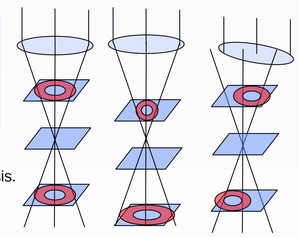
The BigBOSS instrument will be located at prime focus and several design considerations for this system have been made:

- Total sensor area so that acquisition and guiding requirements are always met.
- Ambient temperature operation (requires inverted mode sensor).
- 1 Hz guide updates from star centroids (fast readout/region of interest)
- Shutter free design (frame transfer)
- Low power electronics (heat load)



Stellar Densities

Device	Pixel Size micron	Dark Current e-/s/pixel	Area Cm^2	Summary
TH7899M	14	2.5	8.2	Low
TH7899M	14	204	8.2	Noise
KAF16070E	9	30	5.2	Small
KAF1001E	24	1071	6.0	Noise
KAF8300E	9	30	5.4	OK
KAF1301E	18	239	5.8	Small
KAF16803E	9	50	13.6	Big
KAF16803M	9	3	13.6	Big
CCD30-11	28	1000	1.8	Noise small
CCD30-11OD	20	8000	1.8	Noise small
CCD30-11OE	28	503	1.8	Small
KAF3200E	7	20	1.5	Small
CCD42-40	14	501	7.6	Noise
CCD42-40LJV	14	2000	6.2	Noise
KAF4320	24	536	24.2	Noise-Big
CCD47-10	13	274	1.5	Small
CCD77-00	12	703	0.4	Small
ICX694	5	?	0.3	Small
CCD250-00	15	20	9.4	OK
KAF10751L	30	744	5.0	Small
ICX285AL	6	?	0.6	Small
CCD3041	15	209	9.4	Noise
KAI-04022	7	1000	2.3	Noise-small
KAI-04050	6	150	1.2	Small
KAF-8300	5	199	2.4	Small
KAF-09000	12	80	13.4	Big
KAF-09000	12	30	13.4	Big

Sensor selection

“Out of focus” star image for wave front analysis.