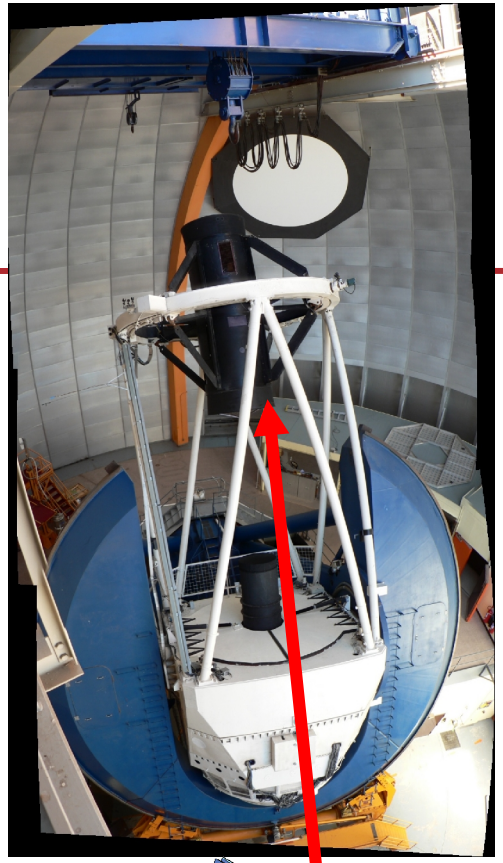
Dark Energy Survey (DES)



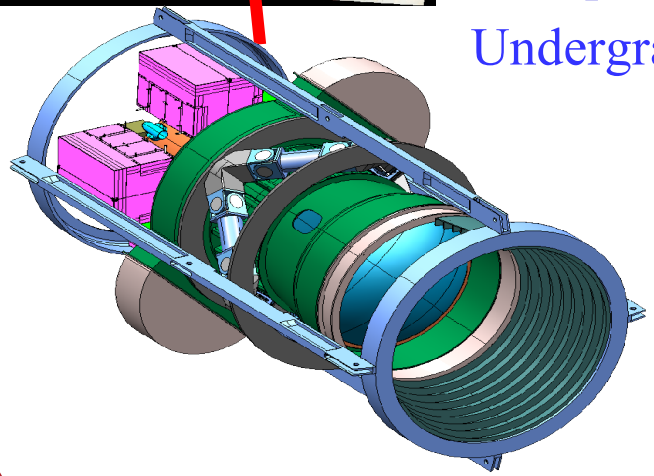
DES is providing a new 520Mpixel CCD camera (DECam) for an existing 4m telescope in Chile in exchange for 525 survey nights over 5 year period.

DES group at Argonne:

Joe Bernstein, Steve Kuhlmann, Hal Spinka, & Rich Talaga, plus engineers Vic Guarino & Allen Zhao

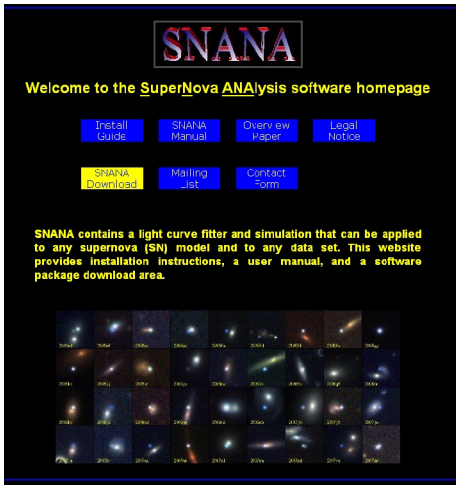
New post-doc Nov. Long-term visitor J. Cunningham (LUC).

Undergrad students Tara Hufford(LUC) and Ian Crane(UIUC).



Supernovae Cosmology Science

- Post-doc Joe Bernstein's main focus.
- Working closely with Rick Kessler(UC), Josh Frieman(FNAL/UC), John Marriner(FNAL).
- Co-developers of SNANA, most sophisticated simulation/analysis package for supernovae.
- Because of our SNANA expertise, able to join SDSS and LSST SN groups. Other than our group, only 3 scientists world-wide in SDSS+DES+LSST SN groups.
- SN field moving into new era, higher statistics but smaller fraction of full spectra for redshift and typing:
  (30% SDSS, 10% DES, <<1% LSST)
- SDSS data and DES Strategy Paper leading the way…



Web page by Joe Bernstein

Supernovae Science (also SDSS full-sample cosmology)

DES Strategy Paper (draft)

Supernovae Simulations and Strategies:
Application to the Dark Energy Survey
(Draft: 09/17/2009)

J. P. Bernstein[1], R. Kessler[2,3], S. Kuhlmann[1], R. Reis[4],
D. A. Finley[4], J. A. Frieman[2,3,4], A. G. Kim[5], J. Marriner[4], P. Mukherjee[6],
R. C. Nichol[7], P. Nugent[5], D. R. Parkinson[6], M. Sako[8], H. Spinka[1]. . .

Published paper

SNANA: a Public Software Package for Supernova Analysis

kessler@kicp.uchicago.edu

Richard Kessler,[1,2] Joseph P. Bernstein,[3] David Cinabro,[5] Benjamin Dilday,[4] Saurabh Jha,[4]
Stephen Kuhlmann,[3] Gajus Miknaitis,[7,6] Masao Sako,[8] Matt Taylor,[5] Jake Vanderplas,[9]

Testing Explosion Models with SDSS data (funded!)

Proposal Number:
UChicago PI: Donald Lamb
Fermilab PI: John Marriner
Argonne PI: Stephen Kuhlmann

1. Application Cover Page

Title of Project: Confronting Supernova Explosion Models with Observations: Developing SNe Ia as Precision Tools to Probe Dark Energy

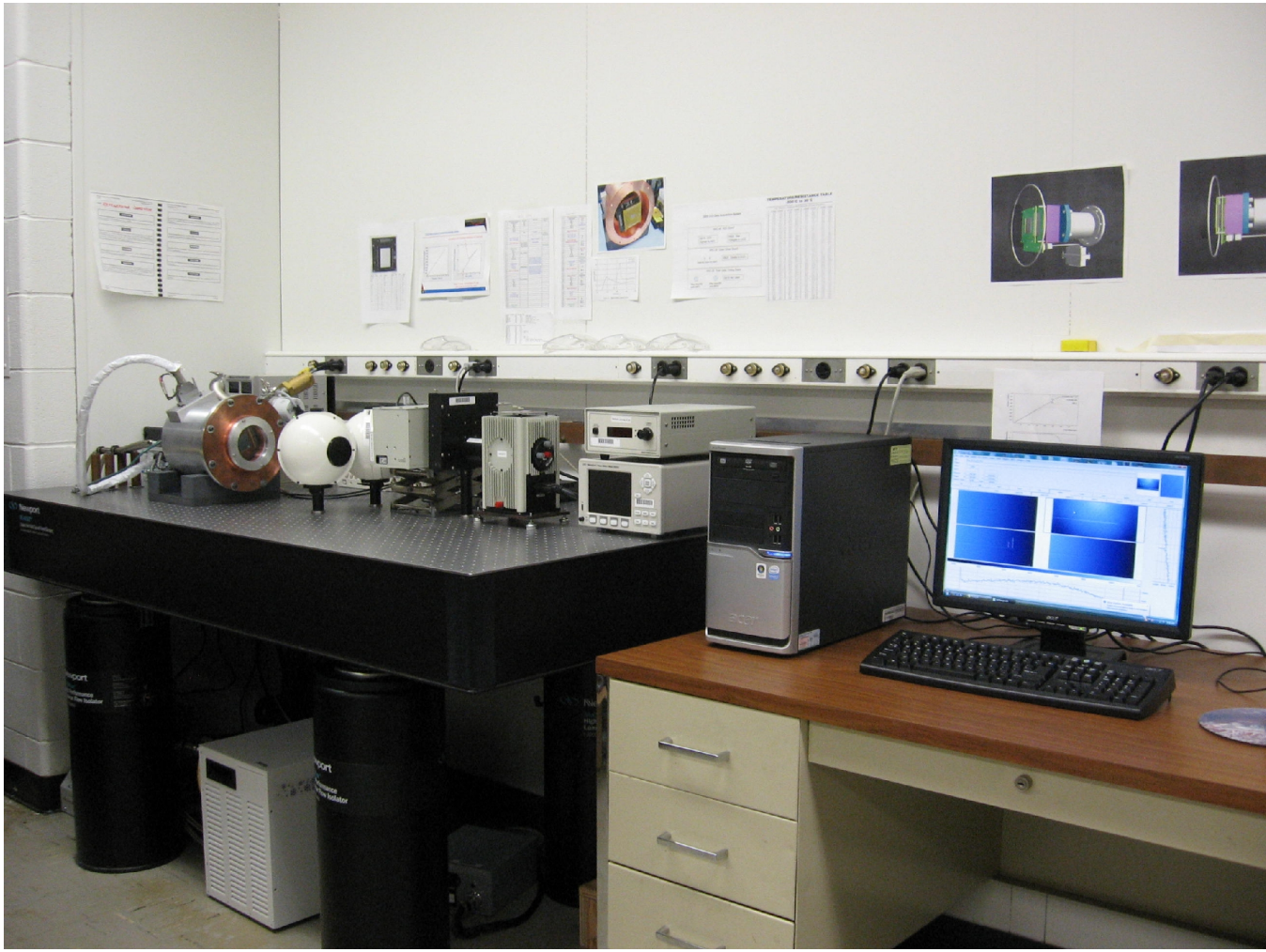
LSST (2 sections of Science Book)

Supernova Prospects with LSST based on SNANA Simulations

Joseph Bernstein, David Cinabro, Richard Kessler, Stephen Kuhlmann

DES CCD Studies at ANL

- Vacuum vessel designed in ANL/HEP and machined in Bld 366.
- FNAL busy doing production testing, we can spend extra time characterizing CCDs and studying anomalies.
- Draft paper on one type of anomaly called traps.



DES CCD Studies at ANL

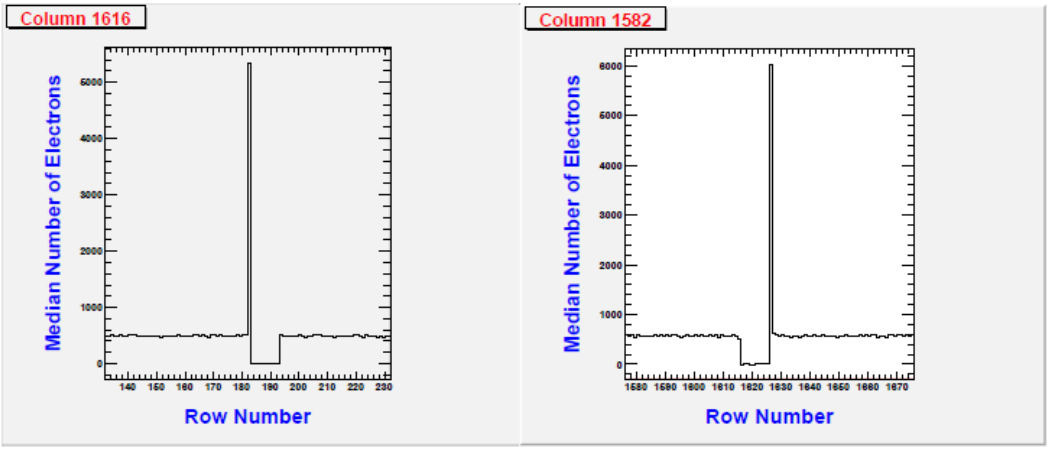
- CCD defects that trap charge can be problematic and hard to detect.
- First Hubble Space Telescope repair mission replaced camera full of traps.
- Our testing procedure and software is part of the FNAL production testing (stage 2).

Locating Traps for DES CCD's

S. Kuhlmann and H. Spinka
High Energy Physics Division
Argonne National Laboratory, Argonne, IL 60439

and

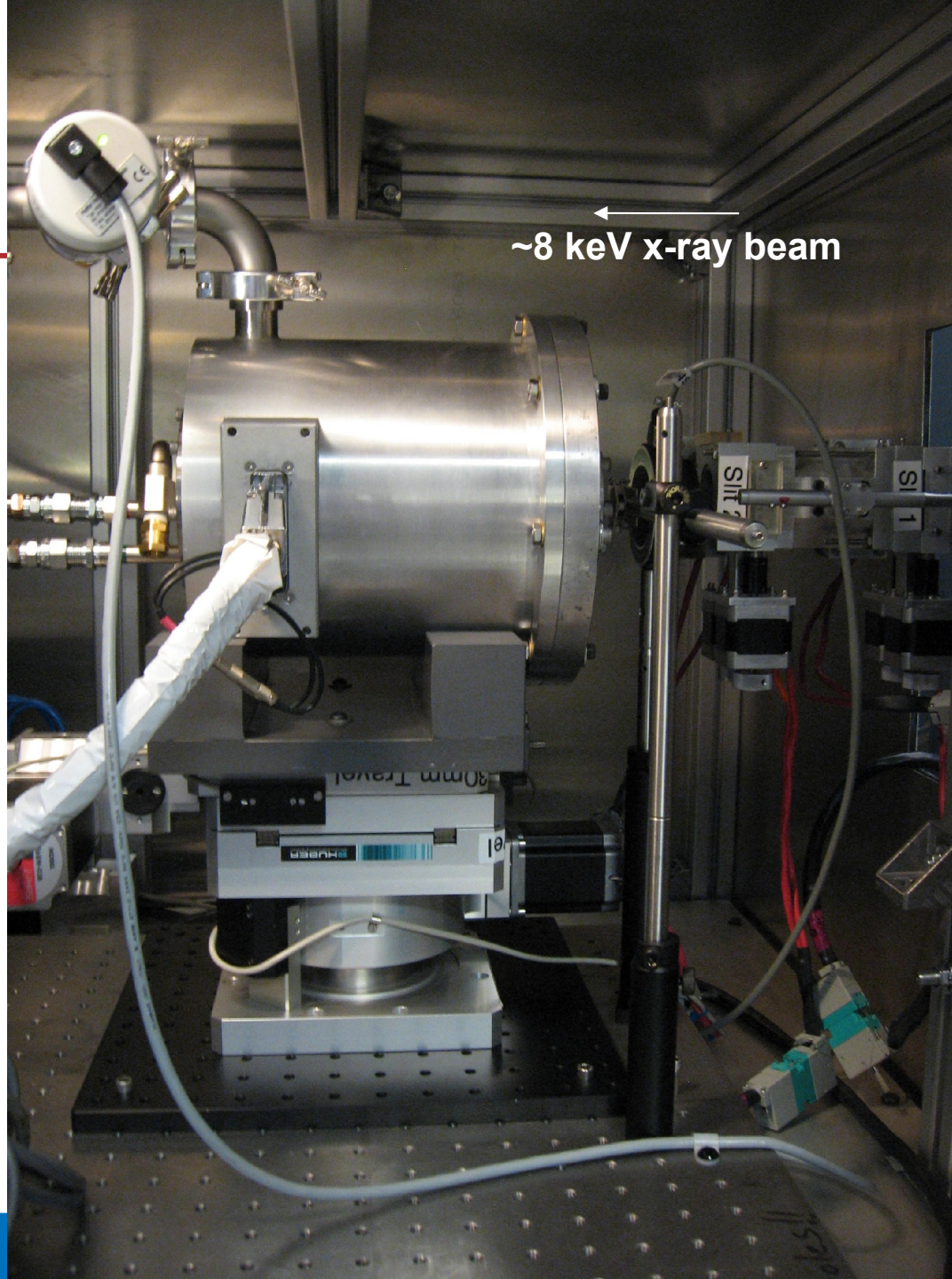
J. Estrada and D. Kubik
Fermi National Accelerator Laboratory, Batavia, IL 60510



CCD Tests at Advanced Photon Source test lab

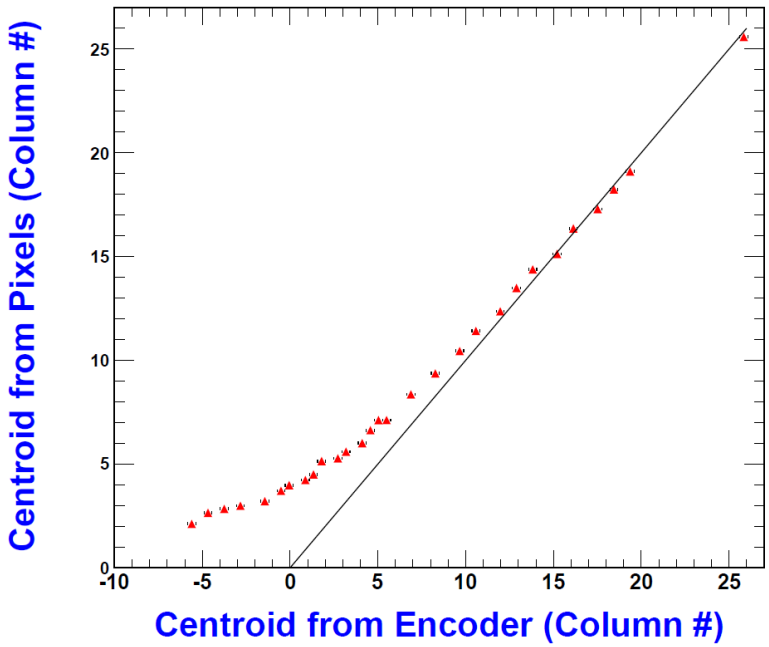
HEP portable CCD test-stand taking data with DES CCD at APS x-ray lab.

Using x-ray tube plus 5 μm tungsten pinhole, provides rare ~1-pixel beam.

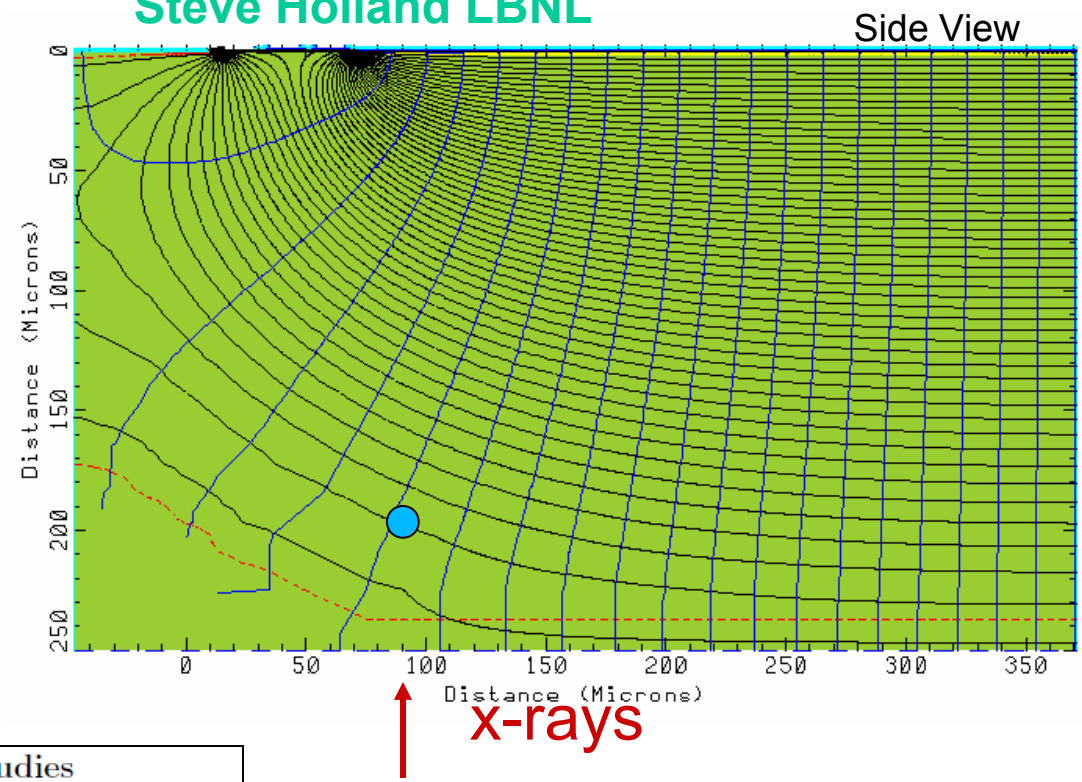


CCD Studies with x-rays

Scan of CCD edge with <1 pixel x-ray beam at Advanced Photon Source (never done before)



Motivated by our data, simulation of electric fields of DES CCD Edge by Steve Holland LBNL



CCD X-Ray Beam Studies

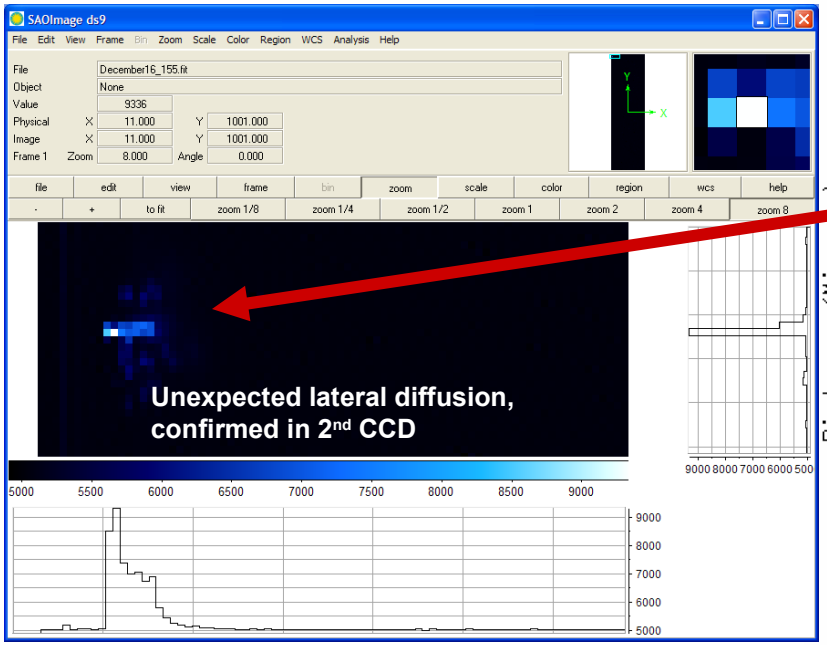
S. Kuhlmann[1], H. Spinka[1], J. P. Bernstein[1], K. A. Beyer[1], J. Estrada[2], L. M. Gades[1], A. Miceli[1], R. A. Spence[1], R.Talaga[1]

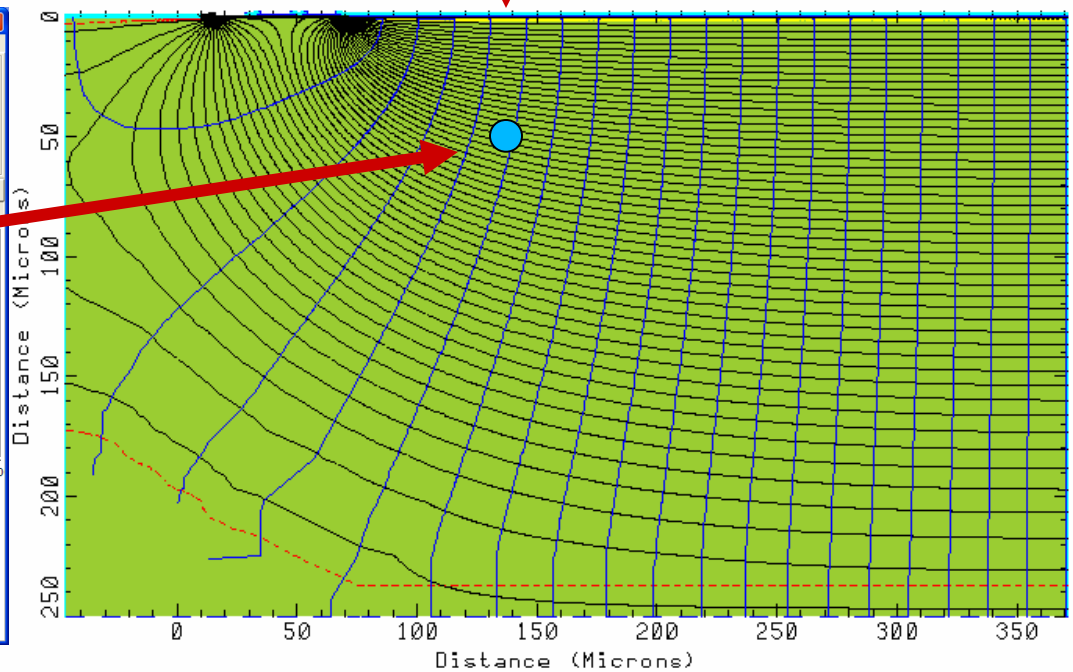
(Four authors from APS)

CCD studies with x-rays (surprise!)

Different CCD, now front-illuminated…

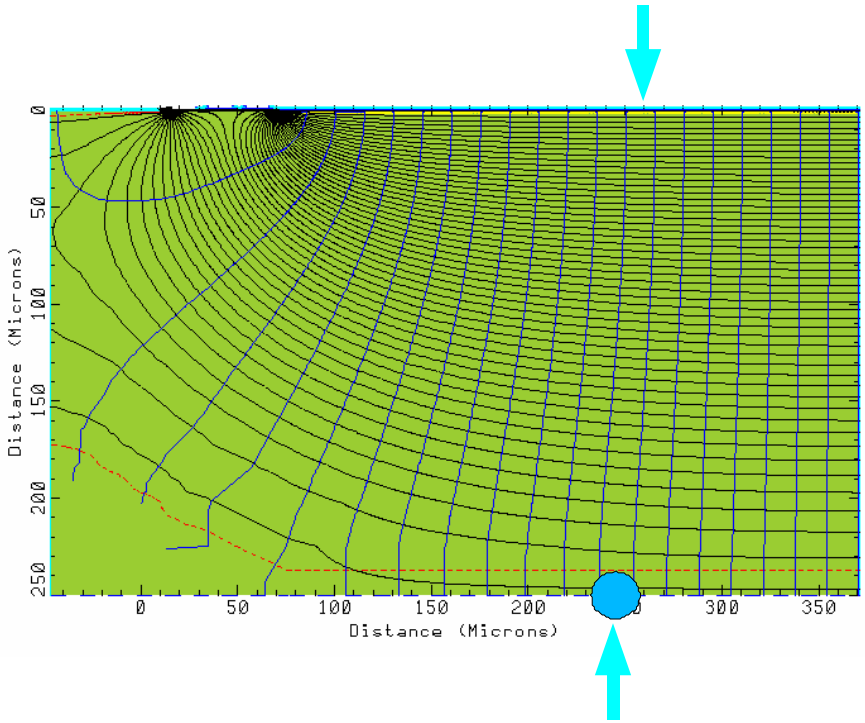
x-rays into front-illuminated CCD

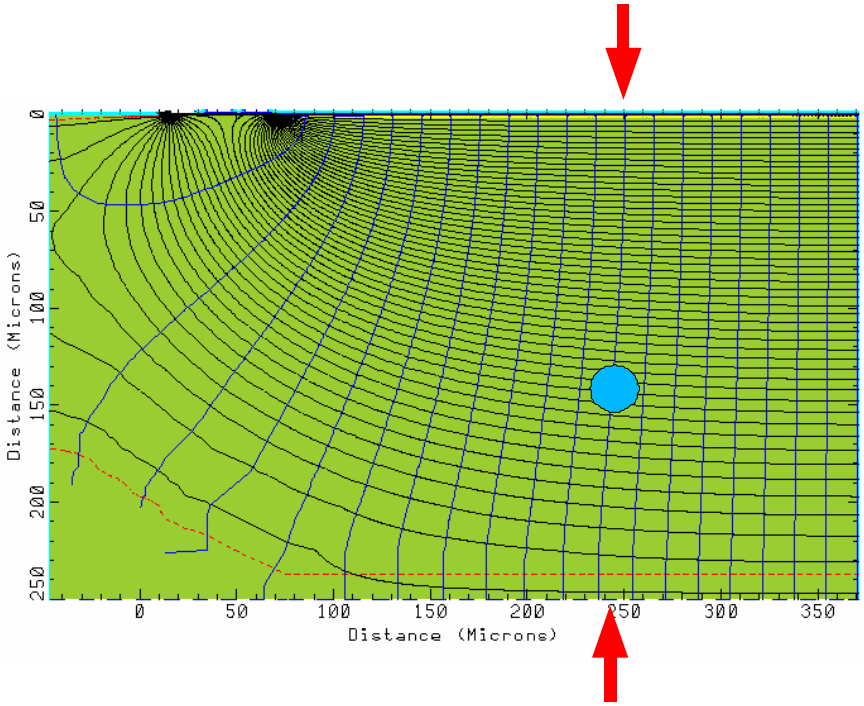




Working with Steve Holland/LBNL on possible model improvements, and with FNAL on impact on science.

2nd Science Impact, Position Shifting Near Edge is Wavelength Dependent



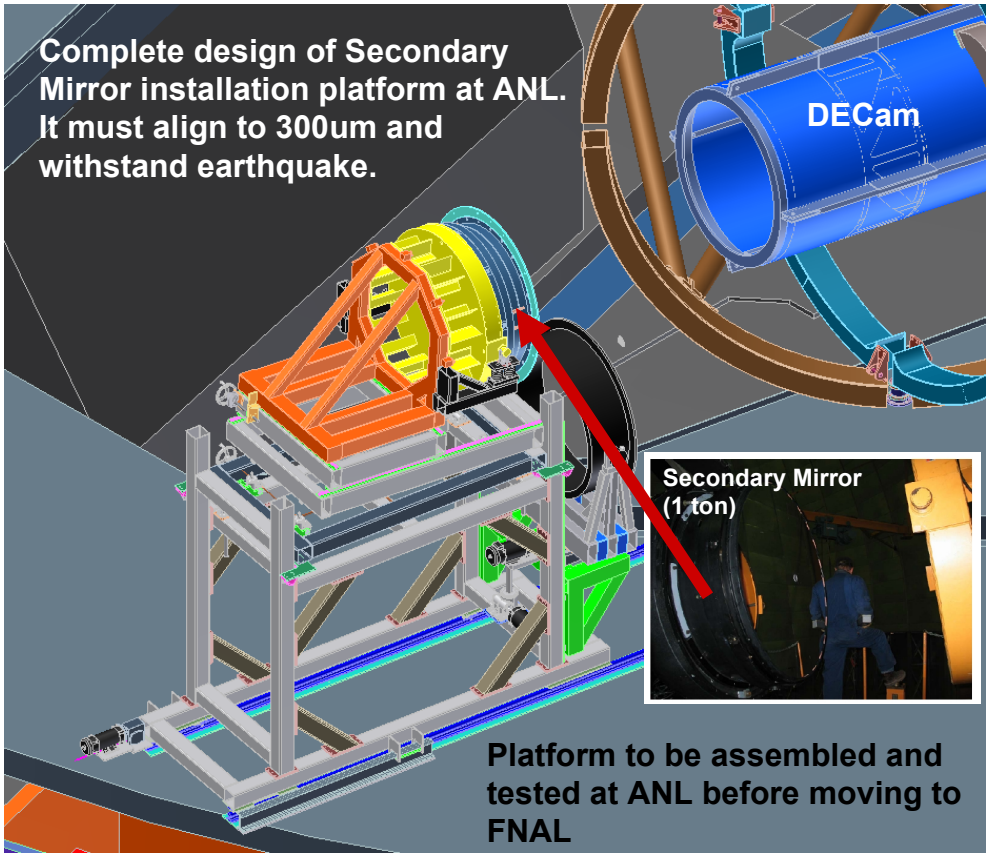


Blue light in pixel 11 interacts near surface, reported in pixel 12.

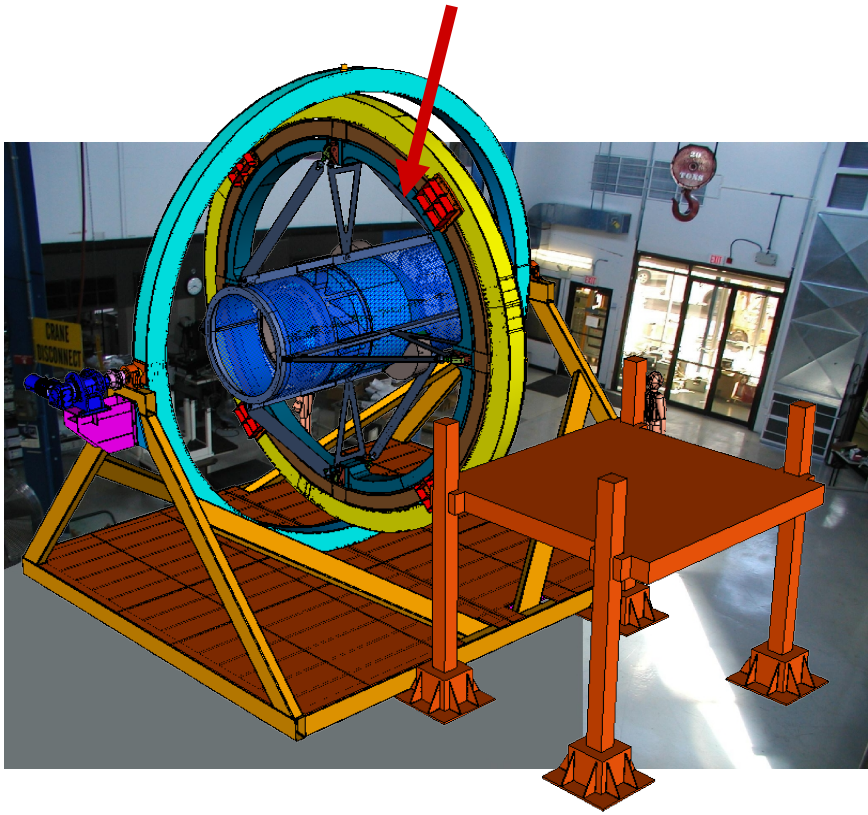
Red light in pixel 11 interacts past surface, reported on pixel 11/12 boundary.

Mechanical Engineering for DES

(~6 FTE Eng./Design/Tech project funds thru March 2010, more to come… (HEP+NE))



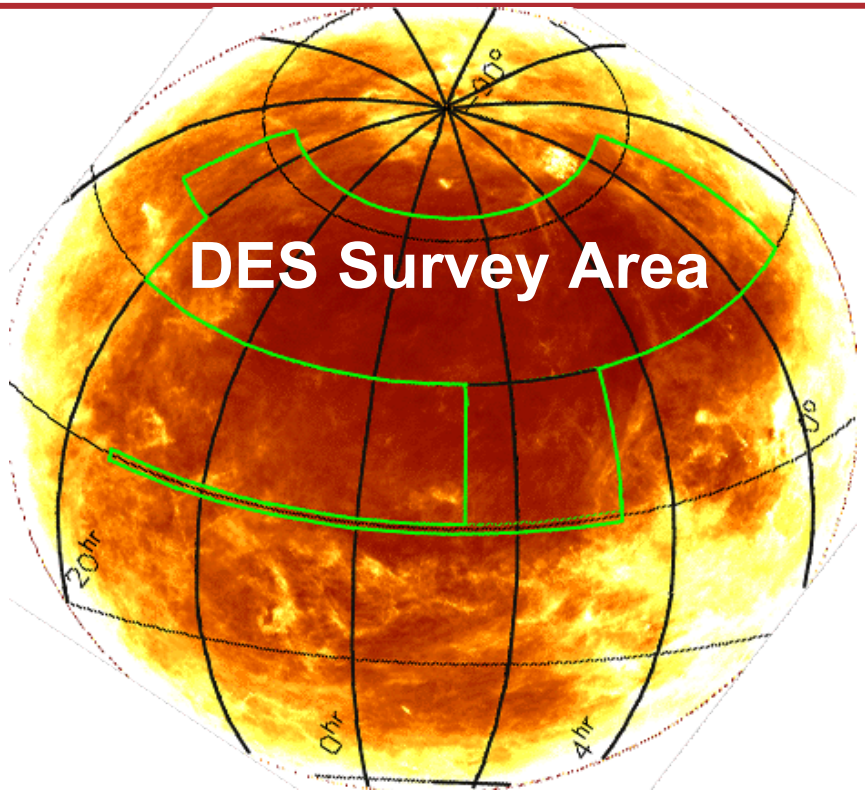
Design and procurement of 2 inner rings and struts of telescope simulator.

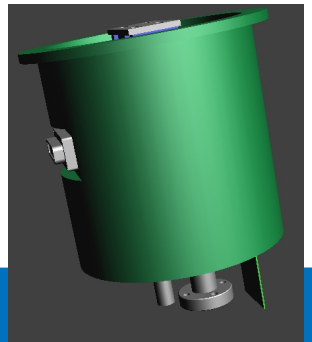


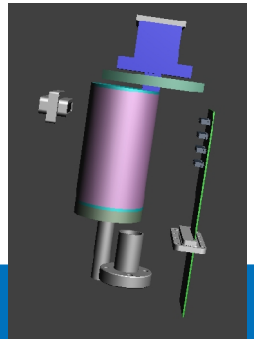
L3 Managers for Camera Controls, Secondary Mirror, Simulator rings, Electronics Cooling

DES Calibrations with Small Telescope(s)

- DES has 1700 hexagonal fields in southern sky, less than 50 fields have "standard" stars for calibration.
- Requires ~10% of telescope time to move to fields to calibrate. (~$1M!)
- Idea is put 4-6 DES CCDs on a small telescope and create a catalog of standard stars for DES use.
- Ability to reach 2% calibration goal 1-2 years faster.
- ANL/HEP completed initial conceptual design of vacuum vessel, with 2009 LDRD.
- Concrete proposal just now being finished at FNAL.







The End