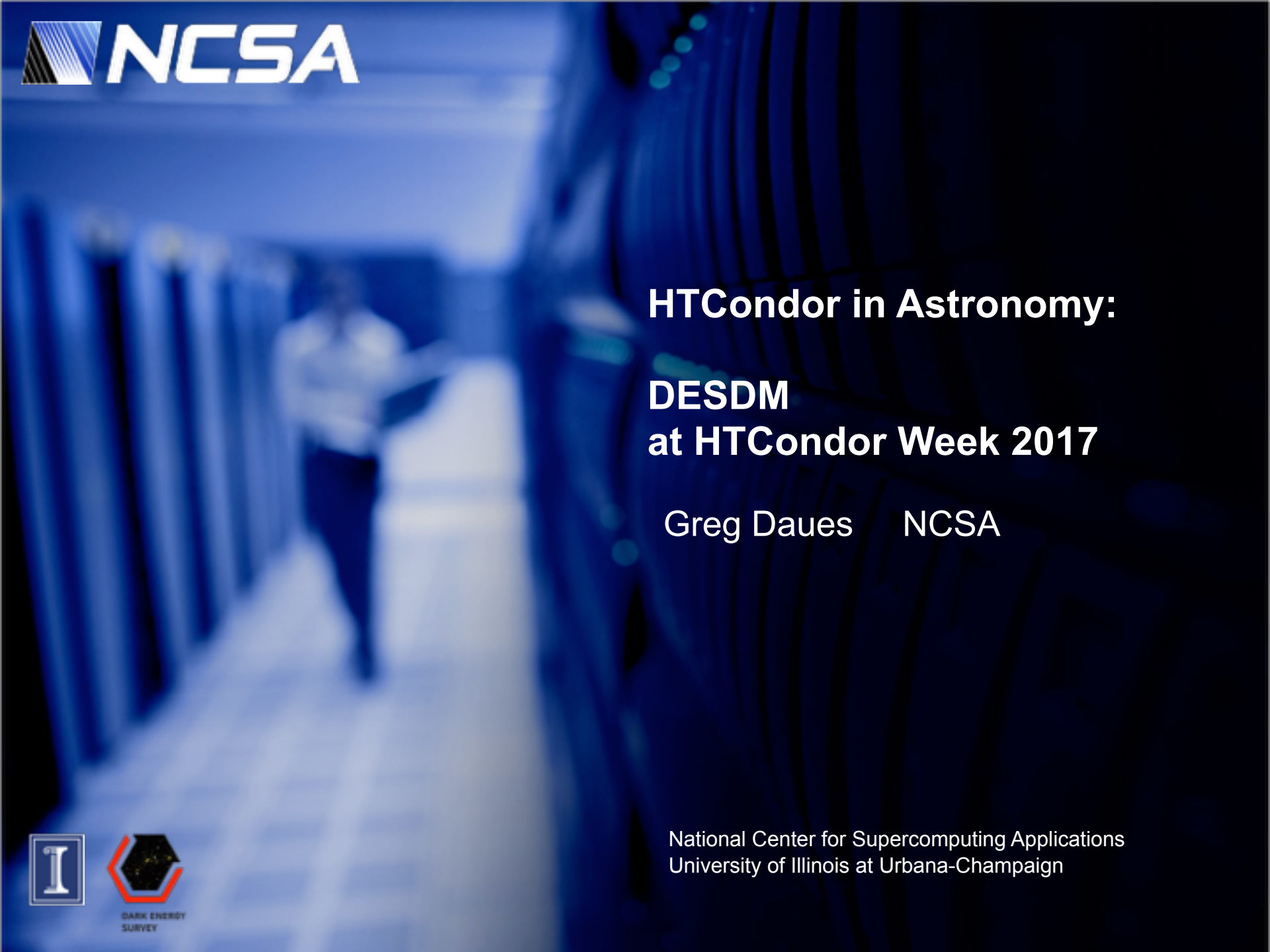


HTCondor in Astronomy:

DESDM at HTCondor Week 2017

Greg Daues NCSA

National Center for Supercomputing Applications
University of Illinois at Urbana-Champaign

The Dark Energy Survey (DES) Data Management (DESDM) @ NCSA

DECam 570 MegaPix

CTIO Blanco/4m

The Dark Energy Survey

New 3 deg^2 FOV, 570 Megapixel camera on the Blanco 4m

Survey 2013-2018 (525 nights)

Premiere facility instrument for astronomy community

Two multiband imaging surveys:

5000 deg^2 *grizY* to 24th mag

30 deg^2 time-domain *griz* (SNe)

DECam on the Blanco 4m at Cerro Tololo Inter-American Observatory (CTIO)

DESDM Workflow

- Production as Independent HTCondor DAGMan Workflows
- Process in Real Time ("Nightly") and Yearly Reprocessing
  - Automated Submissions for Nightly
    - Single Epoch Processing ("firstcut") :
      Individual by-Exposure Workflows launched as data arrives
    - Supernovae Processing:
      Set of Exposures in a filter, launched after set arrives
  - Reprocessing produces "finalcut" and Coadd Images
- Tight integration with central Oracle database at NCSA
  - DAG generation uses Queries of central DB
  - Running HTCondor jobs also connect to the central DB
- HTCondor has provided uniform interface to a heterogeneous set of compute resources

DESDM Computing Platforms: Nightly

- NCSA Private Sector Program System: “iForge”
  - Utilized Globus gatekeeper [“Condor-G”]
- NERSC [standby]
  - HTCondor running in containers
- FermiGrid / General Purpose Grid
  - Utilized Globus gatekeeper [“Condor-G”] for several years
  - 2016: HTCondor CE
  - Open Science Grid certificates / proxies
  - DES Virtual Organization
  - JobRouter to DES Nodes
- Illinois Campus Cluster
  - DESDM provisions ~ 30 nodes
  - Traditional HTCondor Pool
  - Partitionable Slots
  - Machine ClassAds for Processing Type

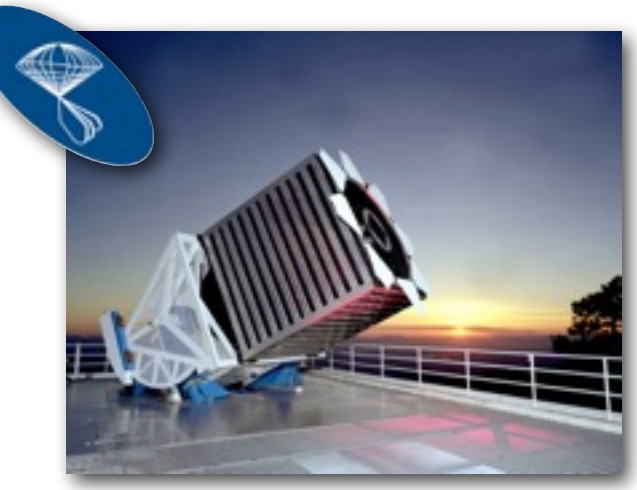
DESDM Computing Platforms: Yearly

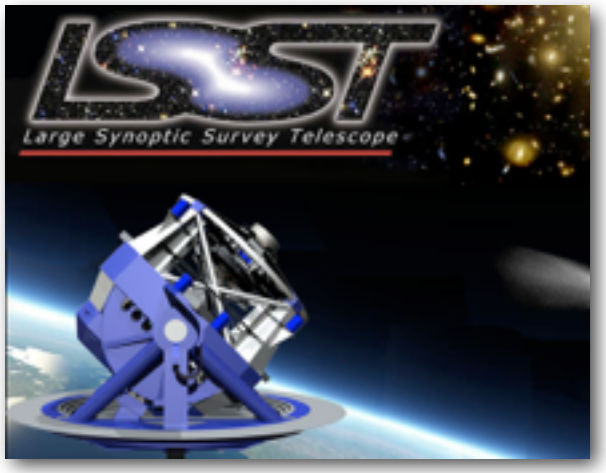
- Blue Waters Computing System at NCSA NPCF
  - Innovation and Exploration Allocation
  - HTCondor Glide-ins submitted by Operations team through PBS
  - Devel & Testing of RSIP solution for outgoing connections
    - started with LSST DM activity in 2013 :
      Scaling Test to 10000 cores
    - Stress tested with oversubscribed HTCondor Glide-ins
  - HTCondor Connection Broker : firewalls
  - Application Manager: Cluster Compatibility Mode
    - “ccmrun” command a specialized “aprun”
    - Improved core utilization for serial jobs
  - Backfill / Utilization of idle nodes
  - Extended Processing for Y4 :
    - Coadd Image Generation
    - Weak Lensing Shear Measurements

DES and LSST in Context:

Past, Current and Future Large Optical Surveys

SDSS I-II	DES	LSST
[Stage I/II]	[Stage III]	[Stage IV]
2000-08	2013-18	2022-32
2.5-meter mirror	4-meter	8.4 -meter
O(10^8) Galaxies	O(10^8) Galaxies	O(10^9) Galaxies
10k sq. deg.	5k sq. deg.	20k sq. deg.
200 Gb/Night	500 Gb/Night	15 Tb/Night





DES Footprint (After Y3)