



*... for a brighter future*

# *Instrumentation and Stimulus Funds*

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*APS UO Steering Committee Meeting*

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U.S. Department  
of Energy

UChicago ►  
Argonne<sub>LLC</sub>



A U.S. Department of Energy laboratory  
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QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

*Daniel Jacob Radcliffe*  
*Born: July 23, 1989*

# Background

- Response to DOE request for ARRA funds\*
    - Front end and insertion devices upgrade \$3,600K
    - Detectors and new effort \$2,000K (First installment)  
\$2,300K (Second)
- Total: \$7,900K**

\*Stringent reporting and milestone requirements

# 1. Front End and Insertion Devices Upgrade

- **Canted Front-End and New Undulators for GSE-CARS:**

GSE CARS VC & IDs (2.9 cm and 3.6 cm periods):	\$772K
New effort	\$137K
GSE CARS canted front end:	\$572K
<b>Sub-total – GSE CARS:</b>	<b>\$1,484K</b>
  
  - **Canted Front-End and New Undulators for Sector 34-ID:**

Sector 34 VC & IDs (one additional undulator A):	\$222K
Sector 34 canted front end:	\$575K
<b>Sub-total – Sector 34:</b>	<b>\$797K</b>
  
  - **Canted Front-End and New Undulators for HP-CAT**

HP-CAT VC & IDs:	\$772K
HP-CAT canted front end:	\$572K
<b>Sub-total – HP-CAT:</b>	<b>\$1,347K</b>
- TOTAL** **\$3,628K**

# *Front End and Insertion Devices Installation*

- **Schedule being developed**
- **The earliest FE installation to begin in September 2010**
  - Takes ~ 1 year to procure components
- **Completion expected in 2011**
  - Assuming one FE installation per shutdown

## 2. Detector Pool: Quick Glance

- **GE a-Silicon Flat Panel (1) (>100%)**
- **PerkinElmer a-Si Flat Panel (1) (>100%)**
- **Pilatus 100K Pixel Array Detector (2) (>100%)**
- **SII 4-element Vortex SDD (2) (>100%)**
- **Mar165 CCD (3) (>100%)**
- ~~SII Vortex Single element SDD (4) (75%)~~
- Mar 345 Image Plate (2) (75%)
- Photometrics CoolSnap & Zeiss Optics (2) (75%)
- APS-in-house Avalanche Photodiodes (APDs) (4)
- High Speed Sarnoff CCD & Ziess Optics (1)
- Ketek Silicon Drift Diode (6)
- Single & multi - element Germanium (3)
- Fuji BAS-2500 Image Plate Scanner (1)
- Bruker 6500 CCD Detector (1)
- Others: Cyberstar NaI & YAP, Xradia Resolution pattern, calibrated PIN diode, etc.
- ~300 requests per year from entire APS community
- *The Detector Pool is grateful to DND-CAT, GSE-CARS, Bio-CAT, Bio-CARS, and HP-CAT for letting them borrow various detectors (mar165, mar345, Pilatus, and 4-element SDDs)*



GE a-Si Flat Panel

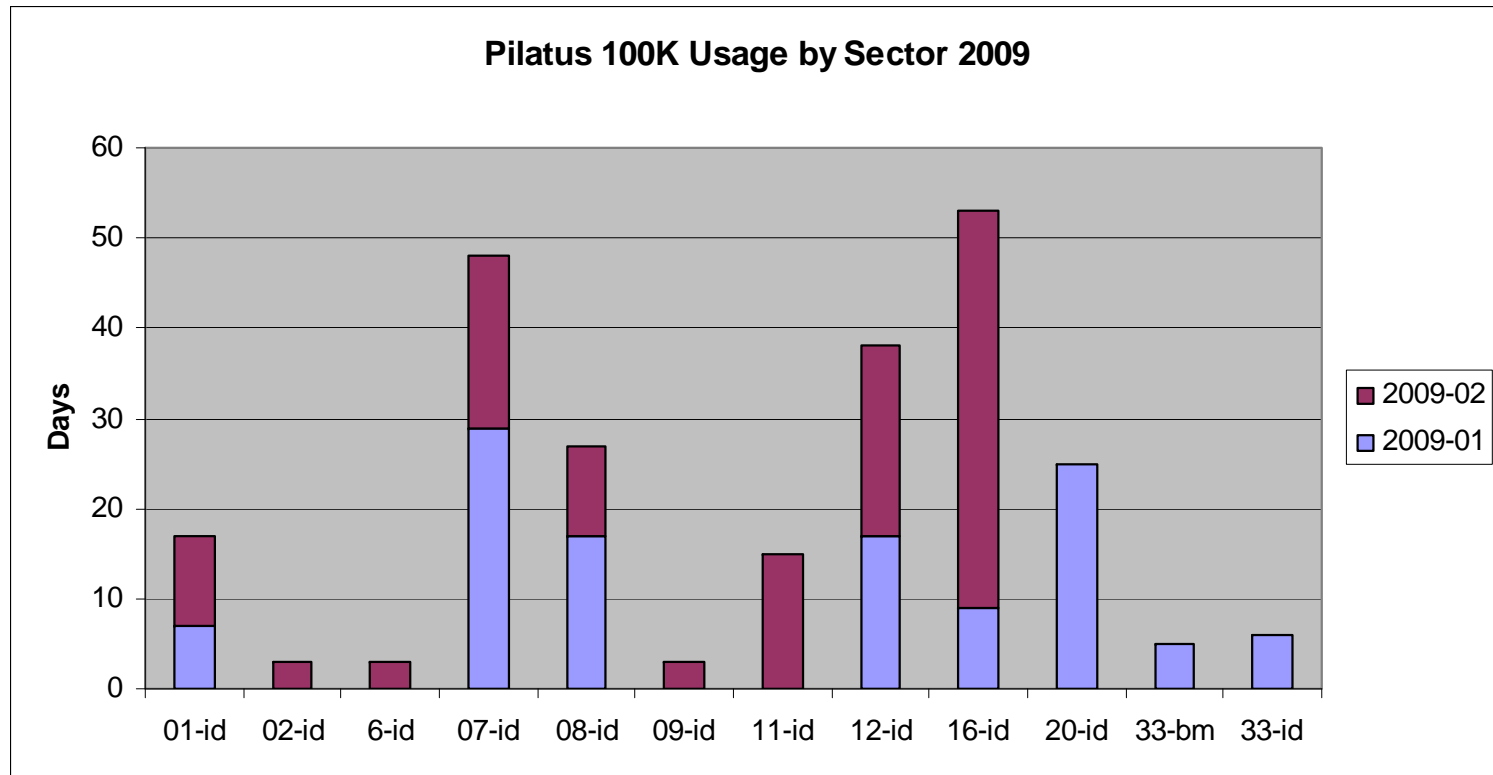


Pilatus 100K



4-element Vortex SDD

# Pilatus 100K in Highest Demand



243 days of usage for runs 2009-01 and 2009-02 combined

# Other Considerations

## First Installment - \$2,000K

- Maximum scientific impact
- Consistent with the APS Renewal direction

List of Detectors:

- **Pilatus 100K**
- **SII 4-element Vortex detectors (2)**
- **Pilatus 2M**
- **Pilatus 1M**
- **New hire for detector software support**

# *More Detectors and Support*

**Second Installment - \$2,300K (not received yet)**

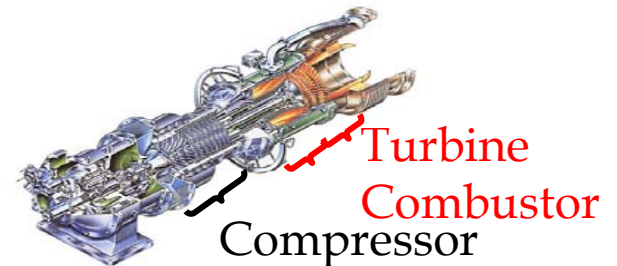
- **Additional Pilatus 100K (2)**
- **Additional SII 4-element Vortex detectors (3)**
- **Large area (Perkin-Elmer) detectors (5\*)**
- **CCD detector (Shimatzu) for ultrafast imaging**
- **Fast CCD for nanoscale dynamics (LBL-APS collaboration)\***
- **Array of CZT detectors (Amptek/Hamamatsu)\***
- **Additional hire for detector support**

# Summary

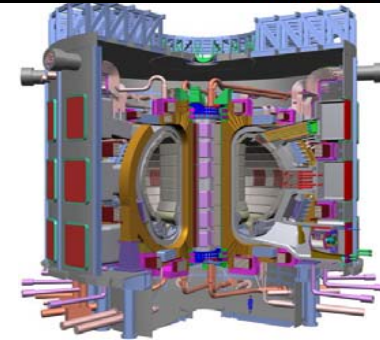
- **ARRA funds (\$3.6M) for upgrade of three canted front ends received**
  - GSE-CARS, 34-ID and HP-CAT
  - Installation schedule in development
  - Target for completion: 2011
- **First installment of ARRA funds (\$2.0M) for detectors and support received**
  - Five detectors selected
  - New hire PD for detector software support ready to be posted
- **Waiting for the second installment of ARRA funds (\$2.3M)**
  - Reviewing the list of detectors
  - New hire PD for detector support in preparation

# High Energy Scattering - Technical and Scientific Scope

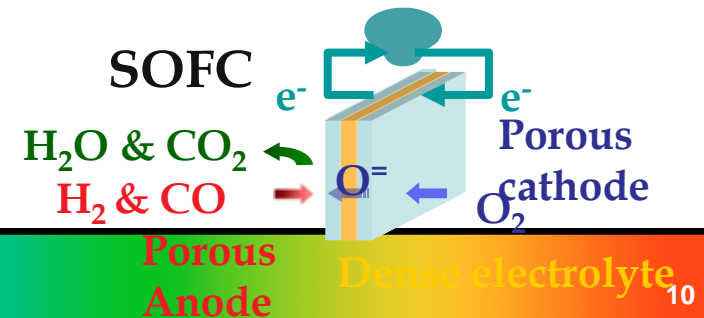
- Critical infrastructure – fundamental mesoscale properties of ‘common’ materials (steels, cements) including fatigue, corrosion and fracture.
- Energy efficiency: (1) advanced lightweight materials, (2) tribology, (3) high-temperature systems (e.g. turbine blades).
- Advanced nuclear energy systems (fission/fusion)
  - Microstructural evolution and phase stability in fuels, claddings and waste forms
  - Critical component integrity (e.g. welds)
  - Advanced alloy development (e.g. ODS-steels, SiC/SiC composites)
- Energy conversion – electrode/electrolyte interfaces in fuel-cells, batteries



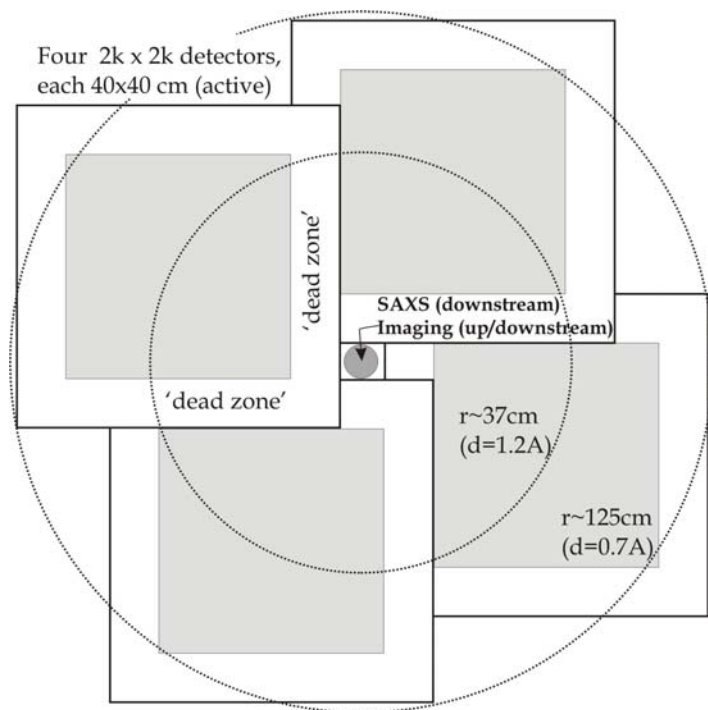
Solar Turbines CENTAUR 50



ITER



# Large Area Detectors for High Energy Scattering



## Operational modes at 1-ID

- Quad-paneled array for SAXS/WAXS
- 1 near-field, 2-3 far-field for HEDM
- 1-2 for powder/crystallography
  - fixed setup mounts, interchange detectors

## Technical gains

- Increase radial resolution to  $\sim 10^{-4}$
- Enable simultaneous SAXS/WAXS/(imaging)
- Scattering tomography
- Improved temporal resolution (up to 4) using offsets
- Improved signal/noise (fluorescence, 'hot' samples)

## Scientific gains

- Fundamental dislocation dynamics studies (HEDM)
- Nano-particle synthesis (SAXS/WAXS)
- Damage evolution under mechanical/thermo-mechanical deformation (SAXS/WAXS/HEDM)
  - Advanced nuclear energy systems (*'hot' samples*)
  - Biomechanics (*temporal studies*)
  - Energy conversion devices - batteries and fuel cells
  - Tribology/coatings