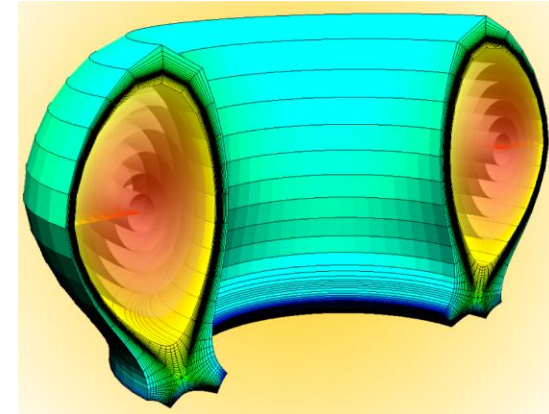


A Brief Introduction to

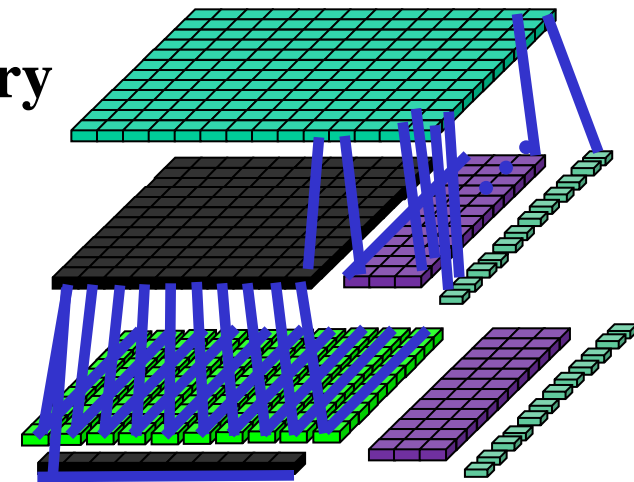


Tom Epperly

1 December 2010

Lawrence Livermore National Laboratory

LLNL-PRES-463151



<https://www.facetsproject.org/>



FACETS – A multi-institutional team



**Cary (Lead-PI),
Carlsson, Hakim, Kruger,
Miah, Pletzer, Shasharina,
Vadlamani, Durant,
Alexander, Green**



**Cohen, Epperly,
Rognien, Lodestro
(edge physics, language
interoperability)**



**McInnes, Zhang, Balay,
Farley, McCourt (solvers)**



**Cobb (modeling, user
interaction)**



**Estep, Tavener, Sheehan
(sensitivity research)**



**Malony, Spear, Shende
(performance analysis)**



**Groebner, Candy
(experiments, GYRO)**



**McCune, Indireskumar,
Hammett (core sources &
algorithms)**



**Pankin (core modeling,
SBIR subcontract)**



Pigarov (wall)

Lehigh University

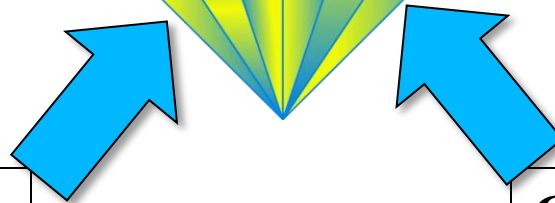
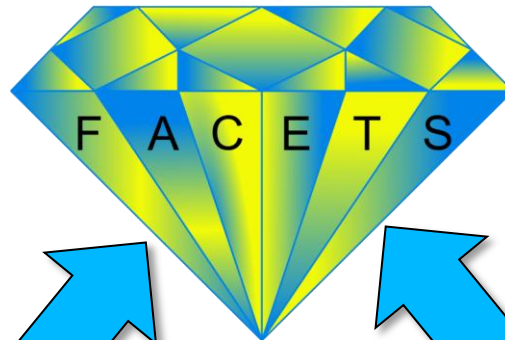
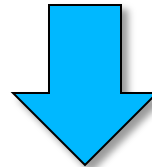


FACETS – A multi-disciplinary team



Physics:

Candy, Carlsson, Cary, Cohen, Groebner, Hammett, Hakim, Indireskumar, Kruger, Lodestro, McCune, Miah, Pankin, Pigarov, Pletzer, Rognlien, Vadlamani



Applied Math:

Balay, Estep, Farley, McCourt, McInnes, Tavener, Sheehan, Zhang

Computer Science:

Alexander, Cobb, Durant, Epperly, Green, Malony, Shasharina, Shende, Spear



FACETS especially thanks its collaborators

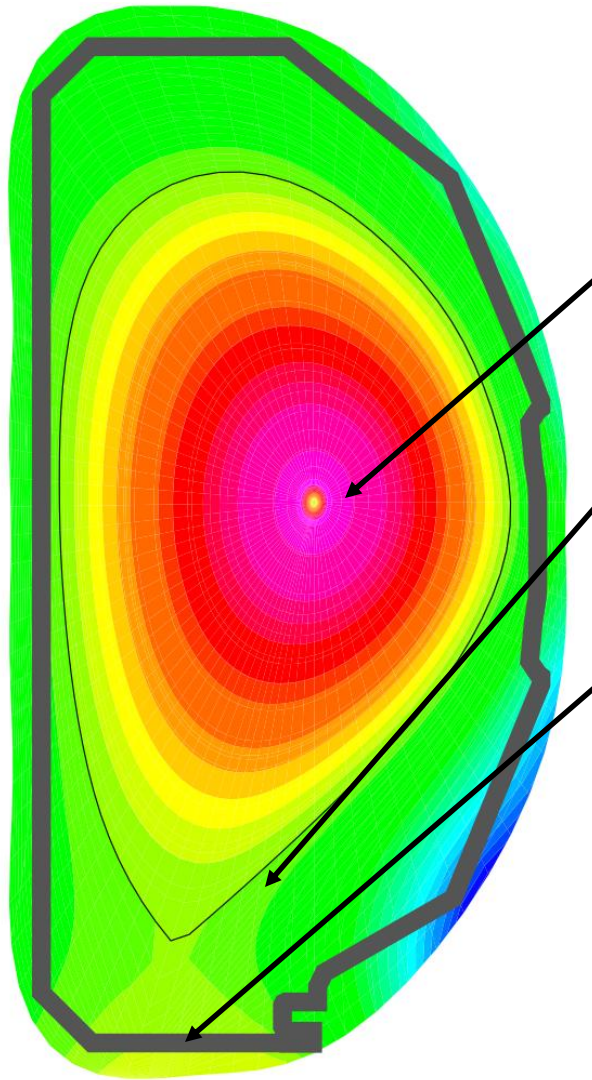


- **SWIM collaboration has led to component improvements that have been exchanged**
- **CPES: Beginning collaboration with ADIOS**
- **PETSc/TOPS collaboration has led to algorithmic improvements**
- **VACET collaboration critical to developing visualization**

- **Important input from other unfunded collaborators**
 - ◆ **Rich Groebner**
 - ◆ **Alexei Pankin**



FACETS goal: tight coupling framework for core-edge-wall



Hot central plasma: nearly completely ionized, magnetic lines lie on flux surfaces, 3D turbulence embedded in **1D** transport

Cooler edge plasma: atomic physics important, magnetic lines terminate on material surfaces, 3D turbulence embedded in **2D** transport

Material walls, embedded hydrogenic species, recycling

- **Coupling on short time scales**
- **Implicit coupling**
- **Inter-processor with MPI and in-memory communication**

FACETS project history



- Funding began January 2007
- Multiple papers on design and architecture
- Validation papers published last year
- Core-edge coupling papers in preparation
- Now finishing fourth year
- FACETS now in beta and available to all
- Fully open source -- all components, all framework infrastructure
- FACETS-1.0 out by year end



Physics/Framework Components



- **FACETS Parallel Framework**
- **Core (in-house core model)**
- **Uedge**
- **Nubeam**
- **Plasma State**
- **WaIIPSI**



External Libraries/Tools



- Autotools (autoconf & automake)
- Babel 1.5.0 (language interoperability)
- FFTW (Fourier transforms)
- HDF5 (persistence)
- Matplotlib (simple visualizations)
- NetCDF (persistence)
- NumPy (Uedge interactive)
- PETSc (numerical algorithms)
- SciPy (Uedge interactive)
- Tables
- VisIt (visualization)

Collaboration Tools



- **Subversion for file sharing and provenance**
- **Bilder – meta-build tool**
- **WebEx – routine web-based telecon with shared applications**
- **Trac Wiki**
- **Web-based dashboard for build status**
- **Mailing lists**



Contact Information



- **John Cary, Lead PI**
cary@txcorp.com
- **Tom Epperly, LLNL CS Lead**
epperly2@llnl.gov
- <https://www.facetsproject.org/>





Extra slides

