

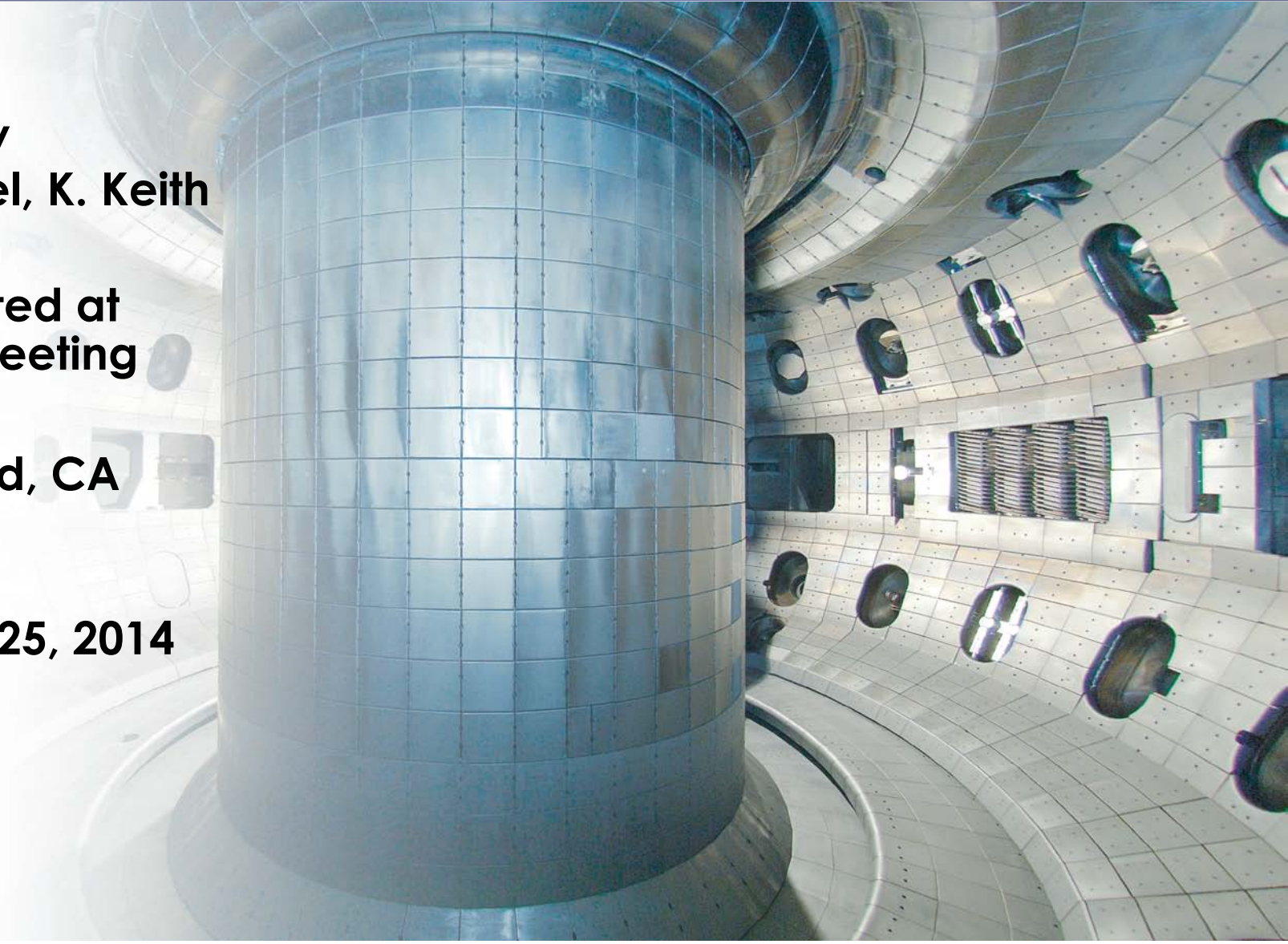
Site Report for ESCC: The DIII-D National Fusion Facility

by
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Presented at
ESCC Meeting

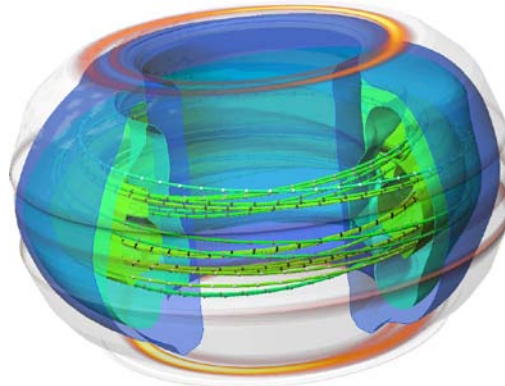
Stanford, CA

February 25, 2014

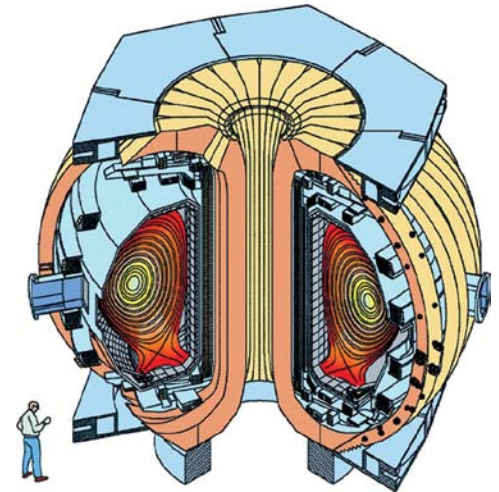


The DIII-National Fusion Facility: The Nation's Largest Magnetic Confinement Experiment

- **DOE Office of Science/Office of Fusion Energy Sciences**
 - Fundamental experimental/theoretical research in magnetic fusion
 - ~\$75M/ year budget



- **DIII-D is a DOE SC enclave within General Atomics (GA)**
 - No direct link between GA and the DIII-D network
- **Research extended through at least 2018**
- **DIII-D's network overview**
 - 10G ESnet connection
 - ~700 nodes, ~500 national and international users (1/3 GA employees)
 - 50-50 GA collaborator computers, ~300 TB of total data



DIII-D National Fusion Facility: an International Program



Active Collaborations 2008–2012

US Labs

LANL (Los Alamos, NM)
 LBNL (Berkeley, CA)
 LLNL (Livermore, CA)
 ORNL (Oak Ridge, TN)
 PPPL (Princeton, NJ)
 SNL (Sandia, NM)

Industries

ALITRON (CA)
 AWE Comm (Germany)
 Calabasas Creek (San Mateo, CA)
 CompX (Del Mar, CA)
 CPI (Palo Alto, CA)
 Digital Finetec (Ventura, CA)
 DRS (Dallas, TX)
 DTI (Bedford, MA)
 FAR-TECH, Inc. (San Diego, CA)
 GA (San Diego, CA)
 Lodestar (Boulder, CO)
 NOVA Photonics (Princeton, NJ)
 SAIC (La Jolla, CA)
 Spinner (Germany)
 Tech-X (Boulder, CO)
 Thermacore (Lancaster, PA)
 TSI Research (Solana Beach, CA)

US Universities

Auburn (Auburn, Alabama)
 Colorado School of Mines (Golden, CO)
 Columbia (New York, NY)
 Georgia Tech (Atlanta, GA)
 Lehigh (Bethlehem, PA)
 Maryland (College Park, MD)
 Mesa College (San Diego, CA)
 MIT (Cambridge, MA)
 New York U. (New York, NY)
 Palomar (San Marcos, CA)
 Purdue U. (W. Lafayette, IN)
 SDSU (San Diego, CA)
 Texas (Austin, TX)
 UCB (Berkeley, CA)
 UC Davis (Davis, CA)
 UCI (Irvine, CA)
 UCLA (Los Angeles, CA)
 UCSD (San Diego, CA)
 U. Arizona (Tucson, AZ)
 U. Colorado (Boulder, CO)
 U. New Mexico (Albuquerque, NM)
 U. Rochester (Rochester, NY)
 U. Tulsa (Tulsa, OK)
 U. Washington (Seattle, WA)
 U. Wisconsin (Madison, WI)
 West Virginia Univ. (Morgantow, WV)
 William and Mary (Williamsburg, VA)
 Yeshiva U (Morgantown, WV)

Europe

Aalto U. (Helsinki, Finland)
 CEA (Cadarache, France)
 CFN-IST (Lisbon, Portugal)
 Chalmers U. (Göteborg, Sweden)
 CIEMAT (Madrid, Spain)
 Consorzio RFX (Padua, Italy)
 CRPP (Lausanne, Switzerland)
 EFDA (Brussels, Belgium)
 F4E (Barcelona, Spain)
 FOM (Utrecht, The Netherlands)
 Frascati (Frascati, Lazio, Italy)
 FZ-Jülich (Jülich, Germany)
 Heinrich-Heine U (Dusseldorf, Germany)
 Helsinki U. (Helsinki, Finland)
 IFP-CNdR (Milan, Italy)
 IPP (Greifswald, Germany)
 IPP AS CR (Prague, Czechslovakia)
 IST (Lisbon, Portugal)
 ITER (Cadarache, France)
 JET-EFDA (Culham, England)
 Kharkov IPT (Ukraine)
 Max Planck (Garching, Germany)
 U. Dusseldorf (Dusseldorf, Germany)
 UKAEA (Culham, United Kingdom)
 U. Naples (Naples, Italy)
 U. Rome (Italy)
 U. Strathclyde (Glasgow, Scotland)
 U. York (York, England)

Japan

Kyoto U. (Kyoto)
 JAEA (Naka, Ibaraki-ken)
 NIFS (Toki, Gifu-ken)
 Tsukuba U. (Tsukuba)

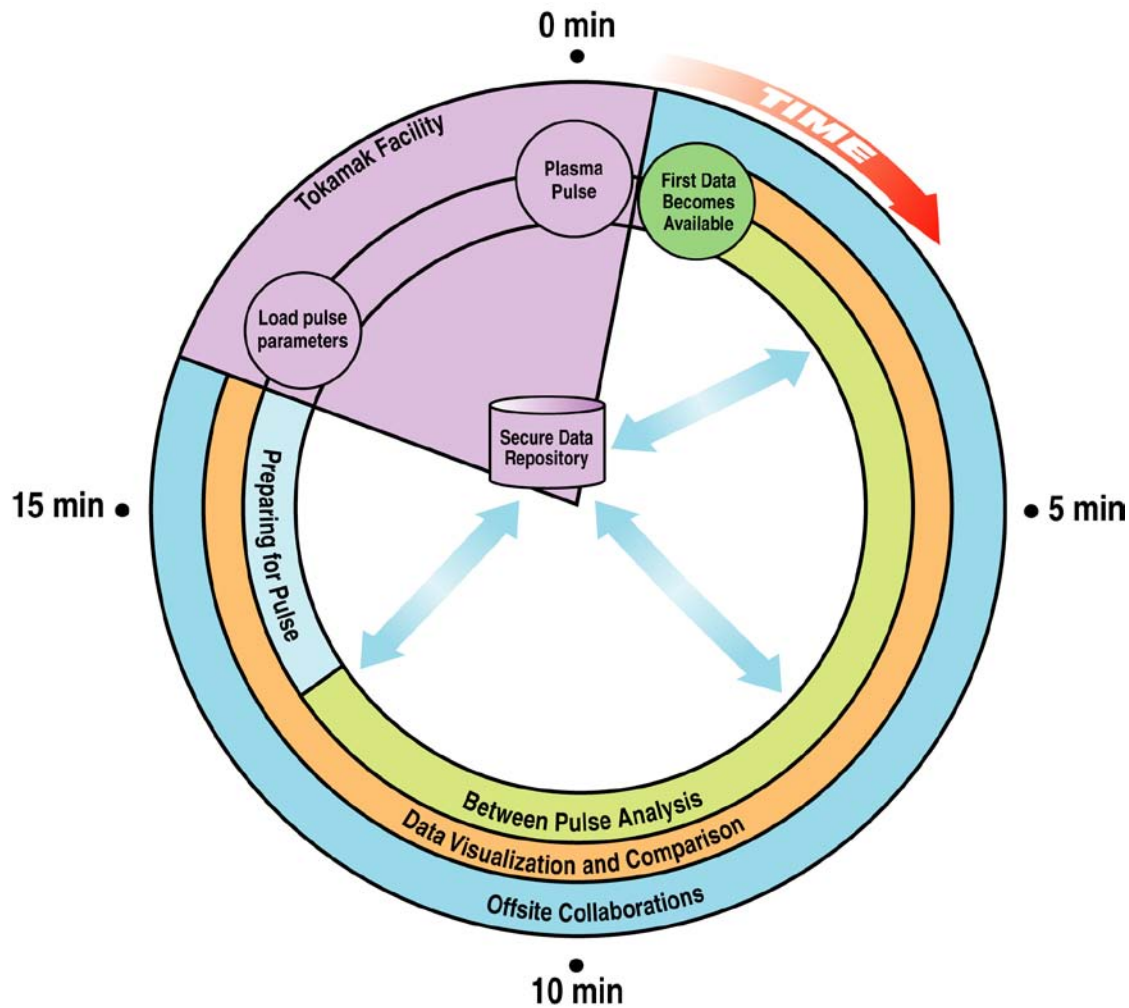
Russia

Efremov Institute (St. Petersburg)
 Ioffe (St. Petersburg)
 Keldysh (Udmurtia, Moscow)
 Kurchatov Institute (Moscow)
 Moscow State (Moscow)
 St. Petersburg State Poly (St. Petersburg)
 TRINITY (Troitsk)
 Inst. of Applied Physics (Nizhny Novgorod)

Other International

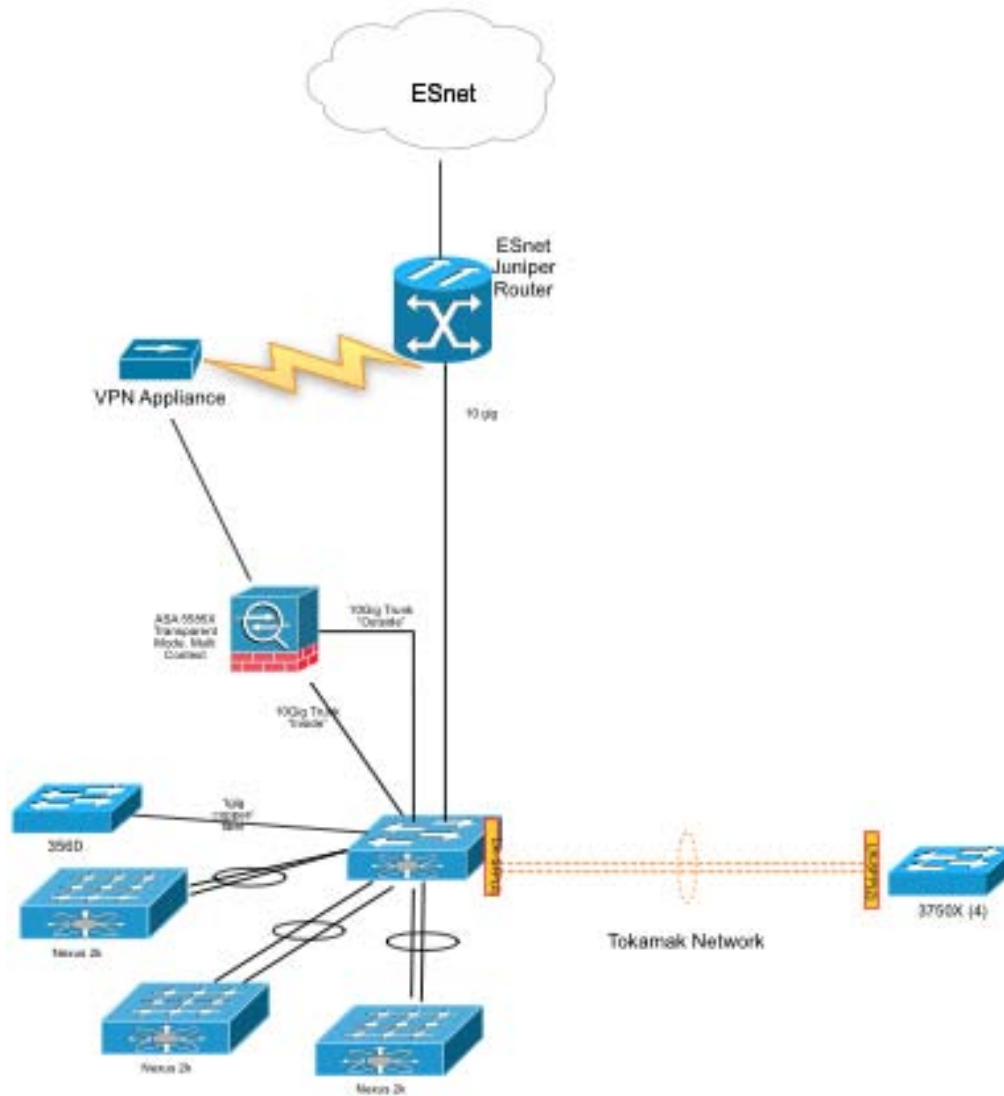
Australia National U. (Canberra, AU)
 ASIPP (Hefei, China)
 IPR (Gandhinager, India)
 NFRI (Daejeon, S. Korea)
 Pohang U. (S. Korea)
 Seoul Nat. U. (S. Korea)
 SWIP (Chengdu, China)
 U. Toronto (Toronto, Canada)

Experimental Fusion Science is and will continue to be a Very Demanding Real-Time Activity



Collaborative Control Room: More informed decision result in better experiments

DIII-D's Utilizes a Standard Production 10Gb Backbone Network



- **Cisco based**

- Nexus 5548P
- Nexus2K
- ASA5585X

- **3 Class C networks**

- 255 nodes each

- **2 CIDR blocks**

- 1020 nodes each

- **ESnet Collaboration Services**

- H.323 & ReadyTalk

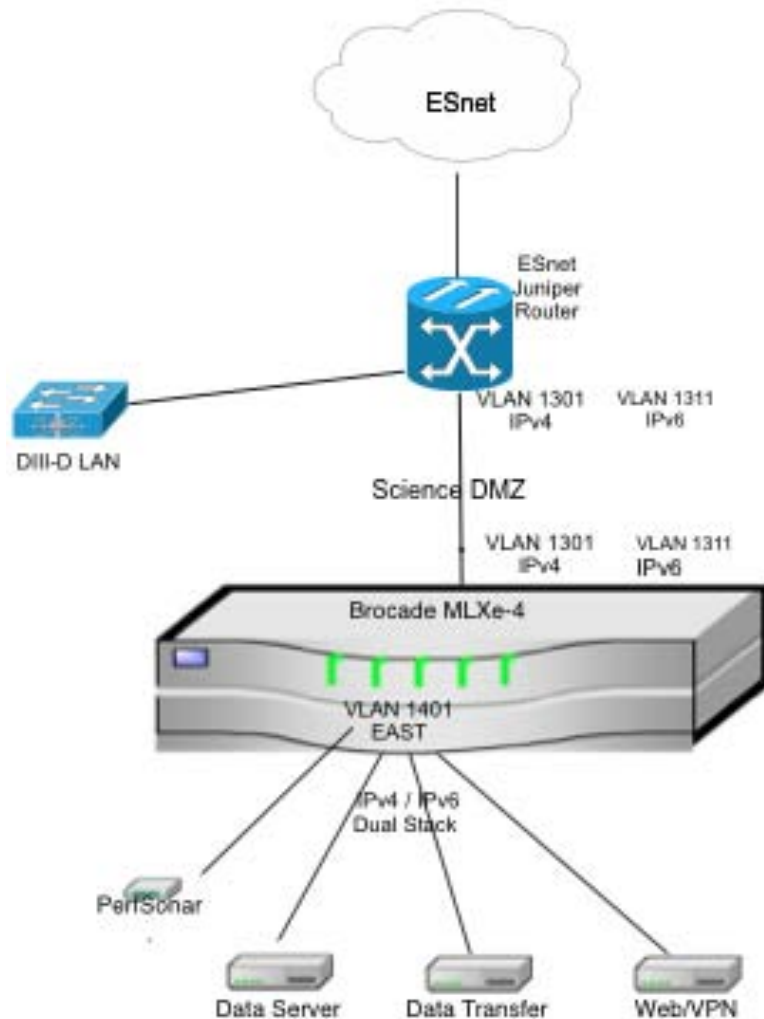
DIII-D LAN

EAST Tokamak Research is a Major Collaboration Between Chinese and US Scientists

- **EAST (Experimental Advanced Superconducting Tokamak)**
 - Institute Plasma Science, Hefei, China
 - Superconducting long-pulse (~1000s) tokamak



ESnet's "Science DMZ" Deployment to Assist DIII-D's International Collaborations with other Tokamaks



- **Targeting first our China/EAST collaboration**
 - Production usage summer 2014
- **IPV6 tested with existing Cisco 3750 switch**
 - 85% of 622 Mb/s WAN network
 - Commercial UDP application
- **New router to be purchased**
 - Looking at Brocade MLXe-4
- **Examining UDT/UDR as production solution**
 - Start with commercial software

Looking Ahead

- **Production usage of science DMZ summer 2014**
 - Real world network throughput numbers
- **Track development of open source WAN data transfer tools**
 - Possible transition away from commercial solution
- **Examine expanding the usage beyond our China colleagues**
 - KSTAR tokamak in Korea is a prime example
 - Pave the way to ITER
- **Seek to collaborate with other Science DMZ deployments**
 - Share experiences and learn from real-world usage