

# Technology Transfer at Jefferson Lab

## Overview

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 Jefferson Lab



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science



# Overview of Jefferson Lab

- An FFRDC created to build and operate the **Continuous Electron Beam Accelerator Facility (CEBAF)**, world-unique user facility for **Nuclear Physics**
- **Conducts basic nuclear physics research:** to gain a deeper understanding of the structure of matter
  - Through advances in fundamental research in nuclear physics
  - Through advances in accelerator science and technology
- Facilities include 12 GeV SRF-based electron beam particle accelerator, 4 experimental halls and FEL\*
- In operation since 1995
- **Managed for DOE by Jefferson Science Associates, LLC (JSA)**



## Jefferson Lab by the numbers:

- ~725 employees
- FY2016 Costs: \$184.1M
- FY2017 Costs: \$162.1M
- 169 acre site
- 72 buildings/trailers; 880k SF
- 1,530 Active Users
- 26 Joint faculty
- 600+ PhDs granted to-date (200 in progress)

# JLab Examples: Measuring Impact & “Telling the Story”

## Impact

- Tell the numbers:
  - Inventions
  - Commercialization / TT Agreements
- Tell the reach:
  - FEL
  - Start-ups
  - Large and small business

## The Story

- Rally the stakeholder: inventors, licensees, SB, BB, public
- Social media
- Workshops
- Open houses

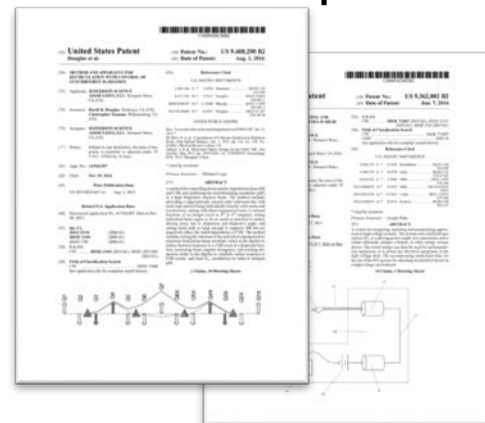
# Technology Transfer & Commercialization

JLab has generated to-date:

- 53 CRADAs
- 34 SPPs (work for others)
- 435 Invention Disclosures
- 151 Patents
- 24 (14) Licenses
  - to 14 (9) companies
- 58 SBIR/STTR support letters (FY2016)
- Entrepreneurial Leave (3)

Industries that have licensed JLab Technology:

- Nuclear medicine imaging (small and large businesses)
- High vacuum technology
- Gas technology
- Specialty technologies for research
- Safety industry
- Academic publisher



# Large Scale Cryogenics



NASA Johnson Space Center's Space Environment Simulation Lab Chamber A. Photo: NASA.

Jefferson Lab's cryogenics group helped NASA scientists design and commission a cryogenics plant to cool the Webb telescope's components to *temperatures its instruments will experience in space*, to within 30 degrees Fahrenheit of absolute zero. Gannett cycle a licensed patent

- **tripled the capacity** of the refrigeration system.
- cut the **liquid nitrogen consumption in half**
- helium refrigerator system now **maintains peak efficiency**
- **46%** energy savings

Gannett cycle technology was also employed to save money and increase efficiency at DOE national labs, resulting in savings of:

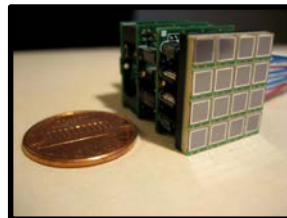
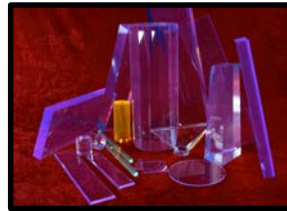
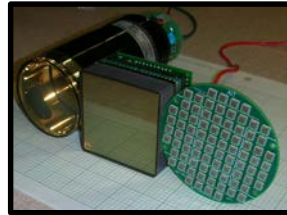
- \$1000 a day at Jefferson Lab
- \$50,000/week at RHIC at Brookhaven

# Detector Spin-Off Advances Patient Care

Nuclear physics detector technology developed to explore the structure of matter at Jefferson Lab leads to new and advanced tools for better patient care.

## Tools for nuclear physics research:

*photomultiplier tubes, silicon photo multipliers, scintillator and detector electronics*

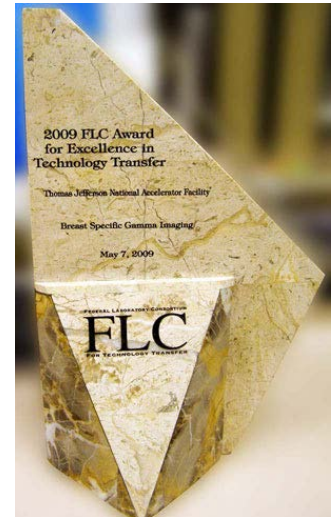


## Tools for better patient care:

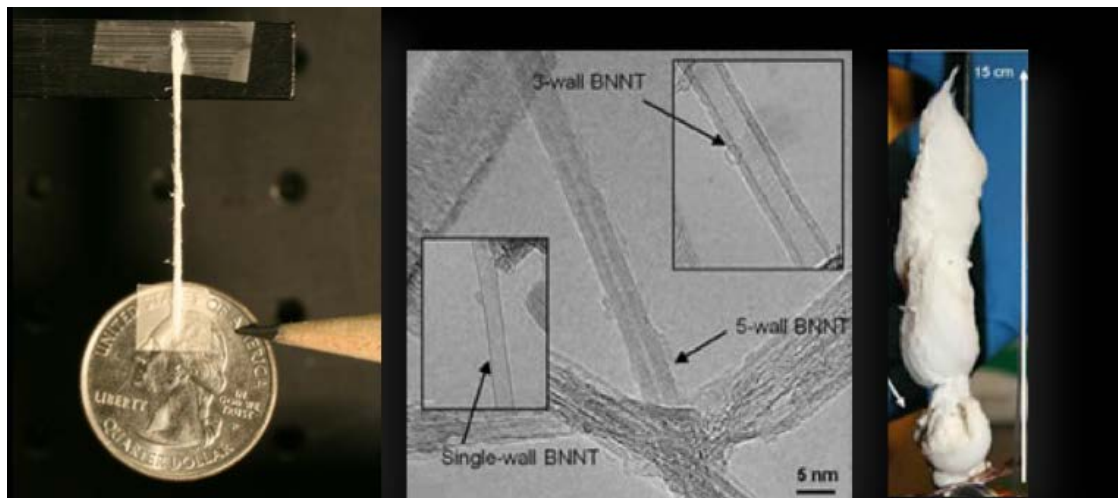
*Compact gamma camera for breast cancer detection*

## Dilon 6800 Gamma Camera

Dilon Technologies, Inc.  
Newport News, Virginia  
~30 employees, ~200 cameras world wide



# FEL Spin-off: Boron Nitride Nanotubes (BNNT)



Raw BNNT Yarn

Blowup of BNNT



**BNNT is lightweight, very strong, electrically insulating, thermally conductive, likely not cytotoxic**

- Maintains strength to  $> 900^{\circ}\text{C}$  vs. carbon at  $400^{\circ}\text{C}$
- Fibril; few defects, NO metal catalyst impurities vs. carbon (not fibril)
- Possible applications: biomedical - scaffolding for living tissue; chemical - aircraft, aerospace, jet engine parts, fire retardant cabling, electrical insulation, athletic equipment and more.
- BNNT Intellectual Property (IP) developed from research conducted at JLab with NASA Langley Research Center (LaRC) and National Institute of Aerospace (NIA).
- Adopted DOE-approved JLab Entrepreneurial Leave Program for JSA/JLab employees to advance technology to commercialization.
- BNNT, LLC factory producing BNNT now in Newport News, Virginia. [www.bnnt.com](http://www.bnnt.com)
- CRADA with JLab

# Thank You!

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*"Beside the comfort of knowledge, every science is auxiliary to every other."*

*Thomas Jefferson*

*August 26, 1786*