

Virginia Nuclear Medical Isotope Development Facility

Ganapati Myneni

On behalf of Virginia ADS Consortium

**5th Thorium Energy Alliance – Future of Energy Conference
May 30th & 31st 2013, Loyola University, Chicago**

Outline

Introduction to accelerators for Thorium

Virginia Nuclear Energy Consortium

Nuclear Medical Isotope Developments

Summary

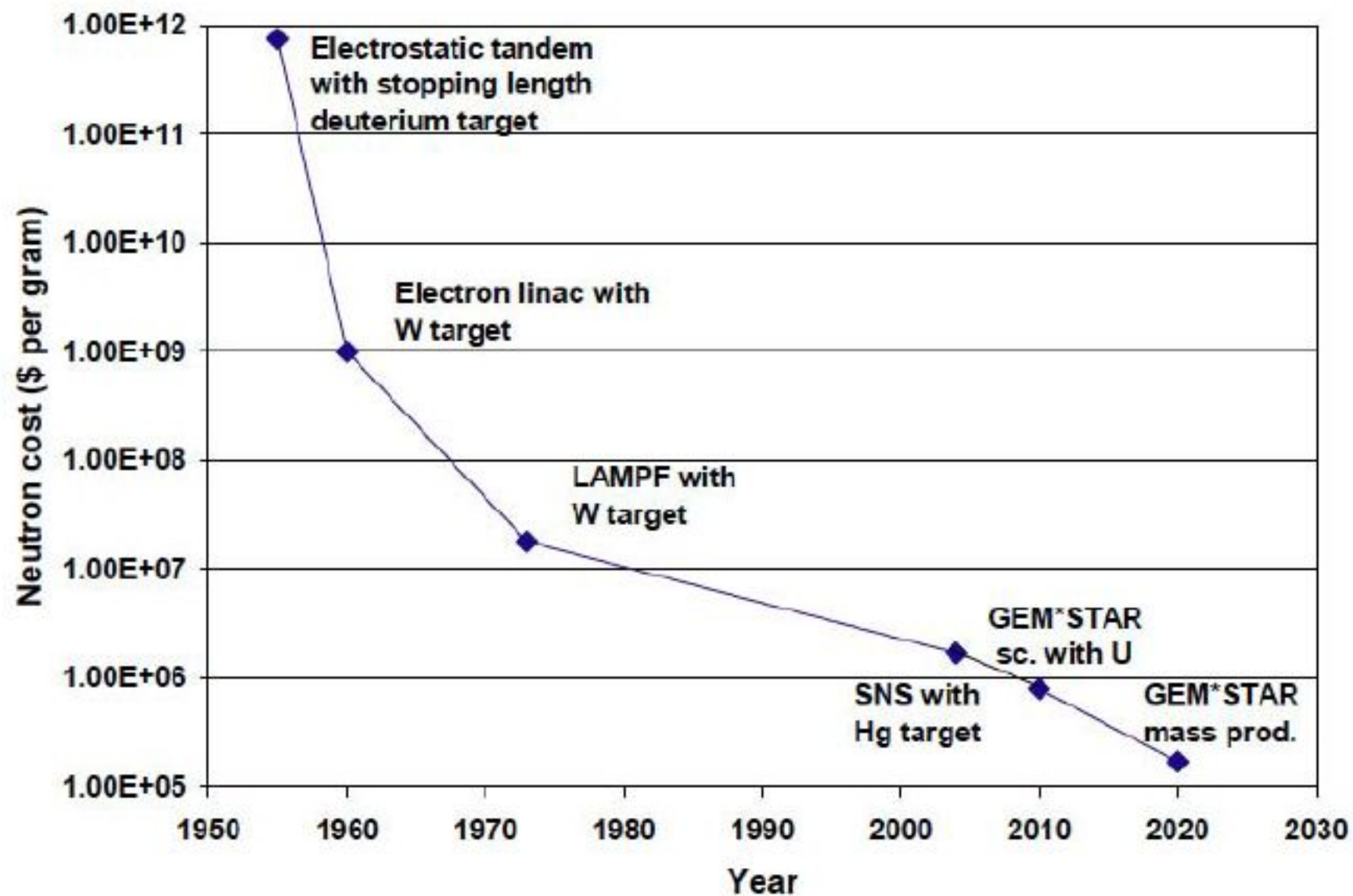
Brief Early History of ADS



- ❖ 1950 – U. E. O. Lawrence, High power accelerators for producing fissile materials
- ❖ 1952 – W. B. Lewis, proposed use of thorium with intense neutron generator
- ❖ 1992 – V. Bowman, Energy generation with ATW
- ❖ 1993 – C. Rubbia, Energy amplifier

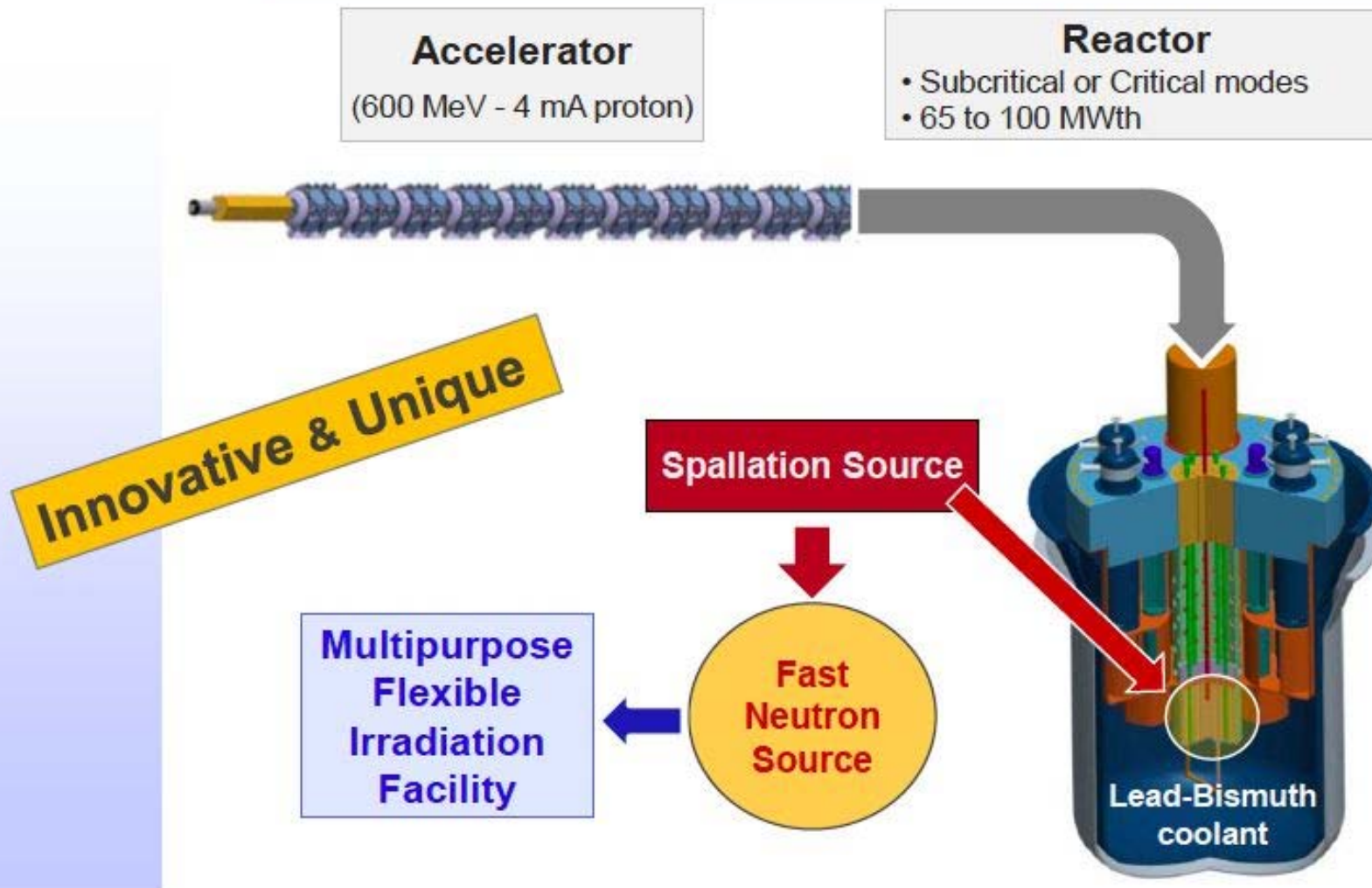
Thorium – non proliferation, no melt down, safe and least NRC involvement

Charlie Bowman's Neutron Cost Estimates



World's 1st ADS Project

MYRRHA - Accelerator Driven System



Virginia Governors Bill

- Recently Virginia General Assembly legislated Governors Bill and established Virginia Nuclear Energy Authority and paved a way for the creation of a non profit Virginia Nuclear Energy Consortium (VNEC)

Effective July 2013

The VNEC consortium will foster strategic partnerships to expand the nuclear energy business sector in Virginia.

Jobs in the nuclear energy industry are high paying jobs that require strong STEM-H education, and unique training and skills.

Nuclear energy is an important source of safe, reliable base load electricity. Nuclear power is a zero emissions energy resource.

Virginia is one of only 2 or 3 states that is home to a large number and broad variety of businesses and institutions involved in nuclear energy related activities.

From Dominion Virginia Power, that operates four nuclear reactors to generate 42% of the electricity its customers use, to Newport News Shipbuilding, the key provider of reactor plants to the nation's nuclear Navy, to Babcock and Wilcox, the world's leading developer of Small Modular Nuclear Reactors and including our colleges and universities and companies that provide equipment, processes and workforce to the nuclear energy industry across the country and around the world, there exists in Virginia a tremendous potential for business partnerships, workforce expansion, research and development, and attraction of new nuclear-energy related businesses and activity

The goals of the VNEC

- To bring all of Virginia's nuclear industry players together around a single table to identify opportunities and develop strategies for supporting and expanding the nuclear industry in Virginia, across the country and around the globe.
- To maximize the return on Virginia's investment in nuclear energy higher education and research initiatives by facilitating partnerships and collaborative programs between and among Virginia higher education and the private sector for nuclear energy related research.
- To assist and support successful applications for federal grants.
- To allow the Commonwealth to leverage the nuclear energy expertise and resources it has available to attract nuclear energy projects, provide training and education programs, facilitate business, education and research partnerships, and meet the needs of this unique and valuable sector of Virginia's economy.
- The VNEC will be governed by a Board of Directors to include higher education, Virginia's nuclear industry and not-for profits that promote nuclear energy. It will be accountable to an Authority that will establish a strategic plan for the Consortium consistent with state and federal policy, make policy recommendations when necessary and coordinate with appropriate state and federal agencies regarding the work of the Consortium.

Stake holders of VNEC

	AREVA
	Babcock & Wilcox
	Bechtel
	Center for Advanced Engineering & Research
	College of William and Mary
	Dominion Virginia Power
	George Mason University
	Huntington Ingalls (Newport News Shipbuilding)
	International Symposium on Hydrogen In Matter (ISOHIM)
	James Madison University
	Thomas Jefferson National Accelerator Facility
	Liberty University
	Longwood University
	Mitsubishi Nuclear Energy Systems (MNES)
	Nuclear Energy Institute (NEI)
	Old Dominion University
	Sweet Briar College
	University of Virginia
	URENCO
	American Nuclear Society and its Virginia affiliate
	VCCS
	Virginia Commonwealth University
	Virginia Military Institute
	Virginia Tech

Virginia ADS Consortium Institutions

- The consortium includes members from outside Virginia, and even outside the USA
 - Casting Analysis Corp.
 - Homi Bhabha National Institute, India
 - International Symposium On Hydrogen In Matter (ISOHIM)
 - Jefferson Lab
 - Muons, Inc.
 - Longwood University
 - Oak Ridge National Laboratory
 - Old Dominion University
 - South Dakota School of Mines and Technology
 - University of Virginia
 - Virginia Commonwealth University
 - Virginia Tech

ADS&ThU International Workshops

1st Internatinal ADS&ThU Workshop

- <http://www.phys.vt.edu/~kimballton/gem-star/workshop/index.shtml>

2nd International ADS&ThU Workshop

- <http://www.ivsnet.org/ADS/ADS2011/>

- 3rd International ADS&ThU - TEA Workshop
 - 2014 in Richmond Virginia

Virginia Nuclear Medical Isotope Development Facility

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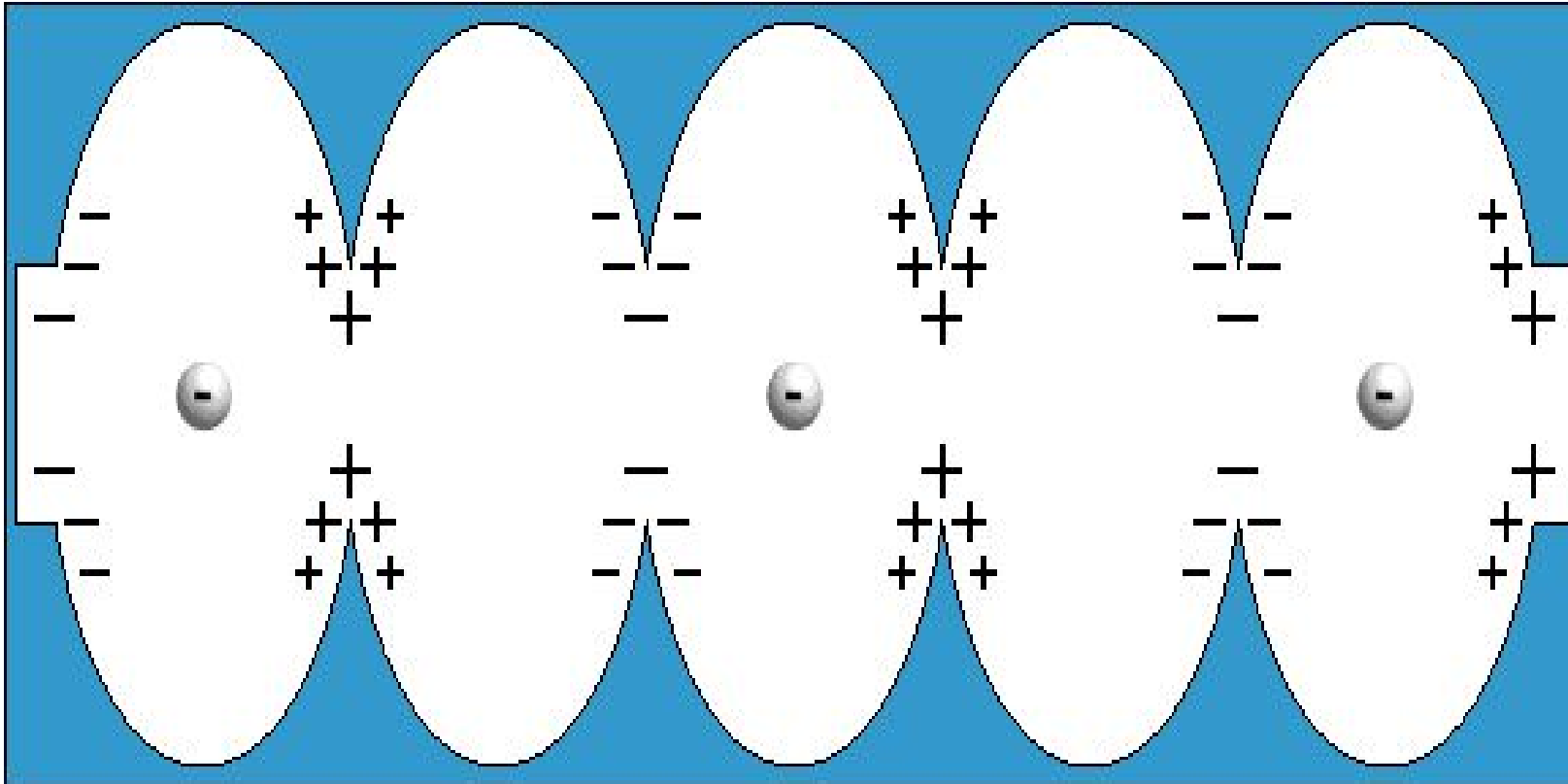
² Jefferson Laboratory, Newport News, VA, USA

³ South Dakota School of Mines and Technology, Rapid City, SD, USA

The US FDA approved the use of the radioisotope ^{67}Cu , for cancer treatment and imaging trials in humans, about 25 years ago. However, despite its attractive decay and imaging properties, ^{67}Cu is not yet available in sufficient quantities from spallation reactions using high energy cyclotrons. In order to accelerate its clinical use in therapeutic and imaging applications, an alternative approach to its production is needed. Superconducting 50 MeV electron linacs are expected to remedy this situation very effectively. Virginia Commonwealth University Schools of Medicine (including Center for Molecular Imaging), and Engineering, Jefferson Lab and South Dakota School of Mines and Technology have come together under the recently established Virginia Nuclear Energy Consortium umbrella to jointly develop the Virginia Nuclear Medical Isotope Development Facility (VNMIDF). The partner institutions are planning to develop new approaches to provide a “step change” in the production of copper radioisotopes, in particular ^{67}Cu for multi-modality biomedical imaging and multi-therapeutic applications. The strategy is extensible and amenable to the production of other radioisotopes spanning a variety of applications including scientific, medical and industrial uses. The VNMIDF will not only aid in the development of critically needed medical radioisotopes but will also provide huge opportunities in materials research, including theranostic (therapeutic and diagnostic) nanoparticles and complementary research in novel approaches in non-invasive image guided technologies in surgical, radiation, drug therapeutics and training of future generation of scientists and engineers.

AccAppl'13 abstract Belgium Aug 5-8, 2013

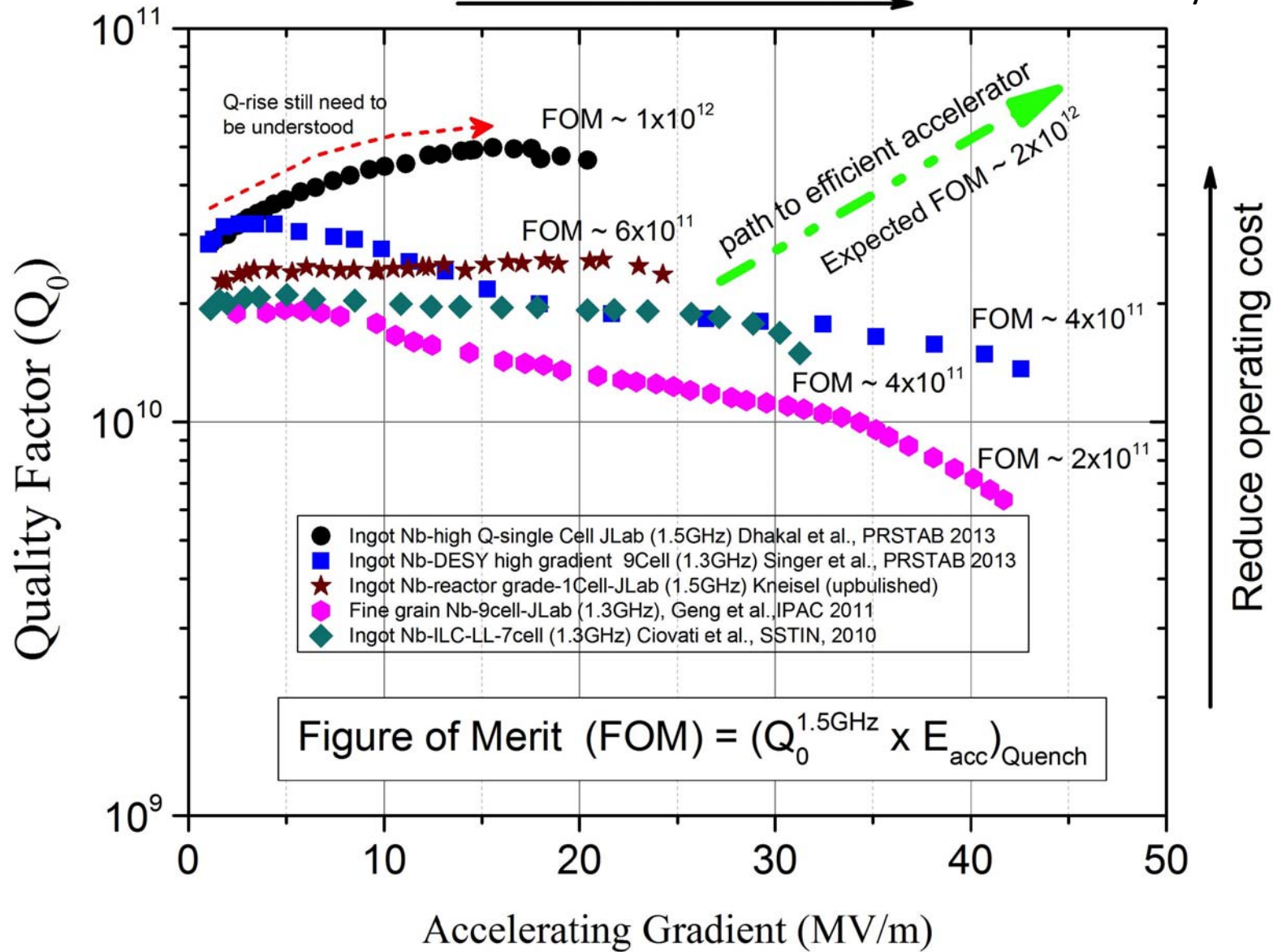
Workings of an accelerator



For continuous wave operation the resonant cavity material needs to be made out of superconducting niobium since the surface resistance is a million times smaller there by reducing the wall losses (please refer to my earlier TEA conference presentations)

Lower construction cost →

G. Myneni



50 MeV Linac CW SRF Technology

May 23, 2013

Summray

- **Virginia General Assembly establishes Virginia Nuclear Energy Consortium (VNEC) to promote nuclear energy R&D**
- **Virginia ADS Consortium is planning a nuclear medical isotope development facility based on 50 MeV CW SRF electron linac technology under VNEC umbrella**

International Symposium On Hydrogen In Matter (ISOHIM) Publications

Hydrogen in Materials and Vacuum Systems AIP CP 671

<http://www.virtualjournals.org/dbt/dbt.jsp?KEY=APCPCS&Volume=671&Issue=1>

Hydrogen in Matter AIP CP 837

<http://www.virtualjournals.org/dbt/dbt.jsp?KEY=APCPCS&Volume=837&Issue=1>

Single Crystal Large Grain Niobium AIP CP 927

<http://www.virtualjournals.org/dbt/dbt.jsp?KEY=APCPCS&Volume=927&Issue=1>

Superconducting Science and Technology of Ingot Niobium AIP CP 1352

<http://scitation.aip.org/dbt/dbt.jsp?KEY=APCPCS&Volume=1352&Issue=1>