



Experience of an E-Beam Facility with USDA-APHIS Certification

National Center for Electron Beam Research

An IAEA Collaborating Centre for Electron Beam Technology

Suresh D. Pillai – *Director*

Mickey Speakmon – *Facility Manager*

Outline of the Presentation

- Texas A&M University and eBeam Center
- R&D and commercial food irradiation experience (prior to USDA-APHIS Certification)
- APHIS certification and current status
- Our perspective



Texas A&M University



- **6th Largest US University**
(~ 60,000 students)

- **# 1 Agricultural & Life Sciences research expenditures among US universities**

- **More than 240 Masters and Ph.D programs**

- **More than 120 undergraduate programs**



Exploiting eBeam Technologies for Cleaning, Healing, Feeding, and Shaping this World and Beyond...

History



May 2002



Exploiting eBeam Technologies for Cleaning, Healing, Feeding, and Shaping this World and Beyond...



FACILITY HIGHLIGHTS



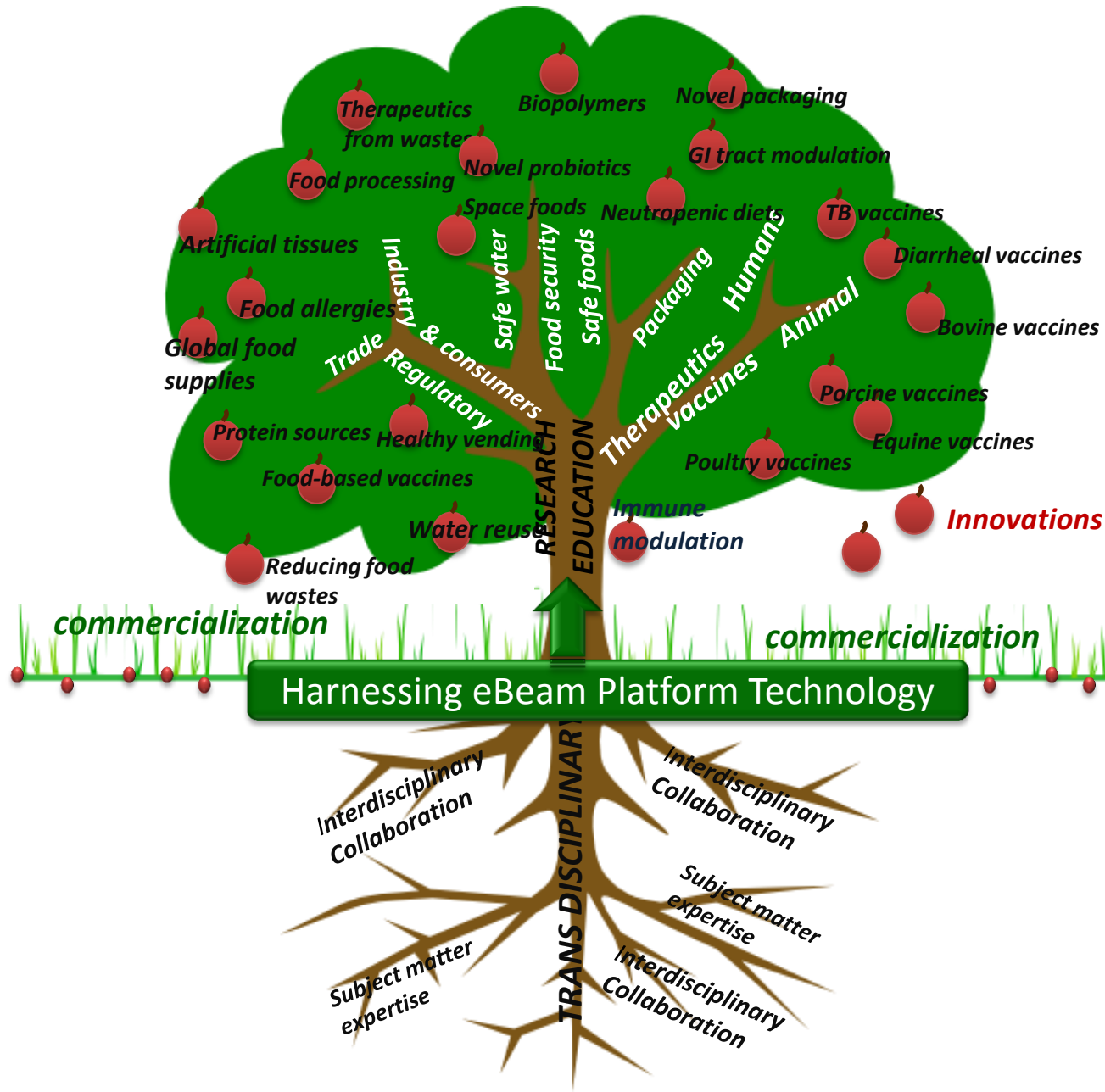
- 16,000 sq. feet
- Dual modality facility
 - eBeam
 - X-ray
- 2 vertically mounted 10 MeV, 15 kW eBeam linear accelerators
- Single horizontally mounted 5 MeV, 18 kW X-ray linear accelerator





Exploiting eBeam Technologies for Cleaning, Healing, Feeding, and Shaping this World and Beyond...

Just Beam it!



TEXAS A&M AGRILIFE RESEARCH

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tron Beam Research



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National Center for Electron Beam Research

- The USDA in 2003 designated the eBeam Center as a **National Center for Electron Beam Research**
 - *Based on the unique capabilities, broad focus, and emphasis on training*
- *The IAEA designated the eBeam Center in 2014 as an* **IAEA Collaborating Centre for Electron Beam Technologies**
- Focus on serving as an un-biased venue for academic, government, and industry scientists to carry out strategic eBeam and X-ray research, training, and commercialization activities



Prior Experience with Food Irradiation

- **50% of Time : Commercial Irradiation**
- **FDA approvals & USDA-FSIS certification**
 - Every year, ~ 1400 tons (~ 3.5 million pounds) of frozen ground beef
 - Every year ~ 100 tons (~ 200,000 lbs. of spices)
- **50% of Time : R&D Activities**



Strategic Decisions

- eBeam and X-ray technology adoption had to be accelerated
- Texas A&M University was the only institution capable of advancing eBeam and X-ray food irradiation technologies
 - Unique capabilities in a large research university setting
- Focus on promoting commercialization of eBeam and X-ray technology worldwide
 - we were going to expand commercial adoption
- Start offering Hands-on eBeam and X-ray technology workshops meant specifically to drive adoption
- Partner with leading eBeam and X-ray technology developers to help expand commercial adoption



TAMU Hands-On eBeam Workshops



- Offered continuously since 2010
- Over 100 individuals have been obtained hands-on training on eBeam technology and dosimetry

Sponsors

ASTM

Comet E-Beam

GEX

IBA

L-3 Pulse Science

Mevex

Comet E-Beam



Exploiting eBeam Technologies for Cleaning, Healing, Feeding, and Shaping this World and Beyond...



Electron Beam Pasteurization and Complementary Food Processing Technologies

Edited by Suresh D. Pillai and Shima Shayanfar

WILEY
Publishers since 1807

2016 Annual Hands-On Workshop in eBeam Technologies

April 17– April 22, 2016 | Texas A&M University, College Station, TX

To address the needs of the food, phytosanitary, agribusiness, and pharmaceutical industries, the NCEBR is organizing a week-long hands-on workshop in eBeam technologies in April 2016. This will be the sixth eBeam workshop, after the inaugural workshop in April 2010.

The National Center for Electron Beam Research (NCEBR) at Texas A&M University in College Station, Texas serves as an un-biased venue to carry out strategic electronic pasteurization and sterilization research and commercial projects using electron beam (eBeam) technologies.

The objectives of the hands-on workshop are:

- To provide attendees with an understanding of the basic *principles of ionizing irradiation*—focusing on eBeam technologies
- To provide hands-on training in *dosimetry* (alanine & radiochromic film), *dose-mapping*, and *dose penetration, distribution, and validation* with single and dual eBeam configurations.
- To provide attendees with an understanding of the *equipment and other infrastructure requirements needed* for this technology
- To provide attendees with unparalleled access to leading International commercial eBeam equipment and sub-system vendors and suppliers to accelerate commercialization
- To provide information needed to commercialize eBeam and technologies in the food industry for food security, food quality, phytosanitary treatment, and food safety
- To provide information to commercialize eBeam and technologies in the pharmaceutical and biomedical industries for sterilization applications and vaccine development
- To provide information to commercialize eBeam technologies in the environmental industry for wastewater remediation, industrial waste treatment, treatment of municipal sludges and we-



The National Center for
Electron Beam Research
Texas A&M University
400 Discovery Drive
College Station, TX 77845
Tel: (979) 458-1640

LOCATION

College Station is about a 2 hour drive from Houston/Austin and about 4 hours from Dallas. There are direct flights into College Station (CLL) by United Airlines and American Airlines.

REGISTRATION

Early registration fee is US \$2500 until Mar 9th, 2016. Late registration is US \$ 2600 after Mar 9th, 2016. **Registration fee covers EVERYTHING** (\$ nights hotel accommodation, welcome reception, an eBook Manual, hard-copy manual, lunches, dinners, refreshments, workshop materials, course completion certificates, and daily transportation from local hotels).

Payment via credit card, wire-transfer, or check can be made at

Registration details will be announced soon

ACCOMMODATIONS

Hotel reservations will be made at the Homewood Suites by Hilton in College Station, Texas. We will provide free transportation between the hotel and the workshop venues. Additional details will be available soon.

Please send emails requesting workshop information to Prof. Suresh D. Pillai (s-pillai@tamu.edu)

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APHIS Certification

- Initial interest was for Guavas from Mexico
- Partnered with Mevex, Inc.,
 - Develop a certifiable process (linac operating parameters) to achieve the 400 Gy – 1000 Gy dose limits
- Worked closely with USDA-APHIS for documenting and demonstrating process and SOP of the facility



APHIS Certification



Fig. 3: Guava Single Stack within prototype package



Fruits with 3 dosimeters each on top, bottom and within

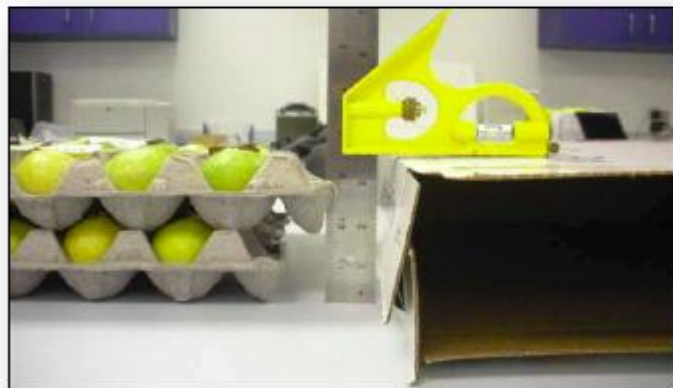


Fig. 4: Guava Double Stack beside prototype package



Single stacked guava prototype package

Double stacked guava prototype package

Fig. 7: Prototype single and double stacked guava packages on E-beam processing conveyor belt.

Table 1: Dose distribution within the single stack

Dosimeter Number	Position within stack	Position Within Fruit	Measured Dose (Gy)
# 1	Middle	Top	880
# 2	Middle	Bottom	920
#3	Middle	Middle	800
#4	Edge	Top	620
#5	Edge	Bottom	640
#6	Edge	Middle	920

$$DUR (D_{max}/D_{min}) = 1.48$$



Table 2: Dose distribution within the double stack

Stack	Dosimeter Number	Position Within Stack	Position Within Fruit	Measured Dose (Gy)
Top	#7	Middle	Top	810
Top	#8	Middle	Bottom	540
Top	#9	Middle	Middle	660
Top	#10	Edge	Top	560
Top	#11	Edge	Bottom	500
Top	#12	Edge	Middle	940
Bottom	#13	Middle	Top	590
Bottom	#14	Middle	Bottom	500
Bottom	#15	Middle	Middle	670
Bottom	#16	Edge	Top	460
Bottom	#17	Edge	Bottom	500
Bottom	#18	Edge	Middle	530

$$DUR (D_{max}/D_{min}) = 2.04$$

USDA-APHIS Certification Process



United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

Plant Protection
and Quarantine

Certificate of Approval

For: Irradiation
Type of Facility

This treatment facility and associated equipment have been examined and found acceptable for use in the treatment of articles regulated under the provisions of quarantines and regulations administered by Plant Protection and Quarantine.

National Center for Electron Beam Research Suresh D. Pillai
Name of Facility Operator

400 Discovery Place, College Station TX 77845
Location

Conditions of Approval:

1. The facility must operate under the conditions in the compliance agreement.
2. The facility can conduct port of entry, export, and domestic phytosanitary irradiation treatments.
3. Treatments must follow approved process configurations.
4. See compliance agreement for conditions under which recertification is required.

November 12, 2013
Date Approved

Laura A. Jeffers
Certifying Official

none
Expiration Date

Pest Exclusion Specialist
Title



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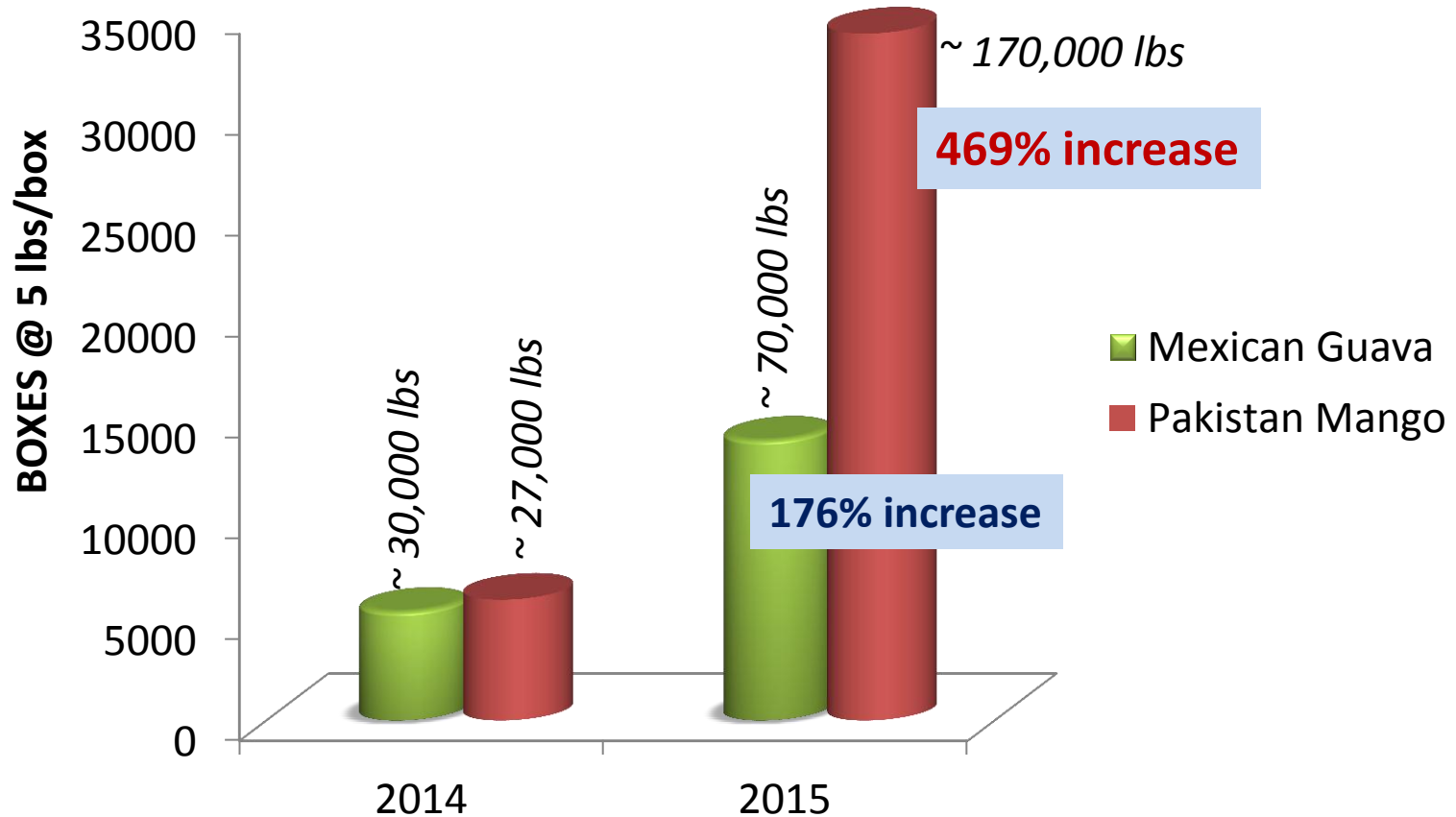




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2014-2015 Produce Volumes



From an Operations Perspective....

- Guaranteed volumes vs Actual Received Volumes
- Product Packaging and Configuration
- Time of Product Arrival
- Transportation (temperature) conditions
- Coordination with APHIS inspectors
 - Non-approved product configurations
 - 48 hour notice of shipment challenges
- Regulatory paperwork



ebeam.tamu.edu

Mark your Calendars!!!!

2016 Hands-On eBeam Workshop

April 17th – 22nd , 2016
Texas A&M University