The Future of Food Irradiation Technology

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INTRODUCTION

- Phytosanitary irradiation is one of the fastest growing applications for irradiation technology
- Growth due to increased consumer demand for imported produce and the desire of countries to increase commercial trade
- Requirements are very different from other radiation applications

What do we as irradiation equipment suppliers need to do to ensure that we are able to provide reliable and available capacity to meet the growing demand for this application?

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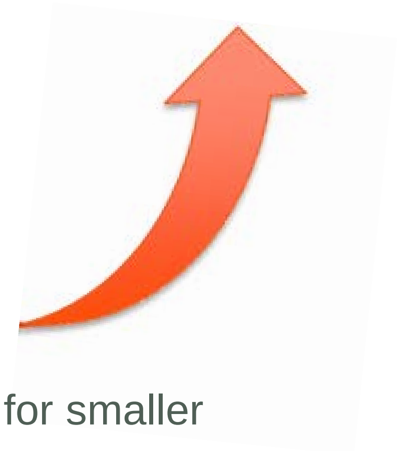
THE PRESENT

TECHNOLOGY TODAY

PHYTOSANITARY TECHNOLOGY TODAY



- How would you describe the Phytosanitary Irradiation market?
    - Exciting, growing, enabling, commercial, economical, novice
- Most processing in multipurpose gamma sites, some electron beam for smaller packages
- Competes with inexpensive technologies
    - Environmentally unfriendly such as Methyl Bromide
    - Potentially harmful to produce such as hot or cold treatments

GAP TO COMMERCIAL SUCCESS

- Availability of processing facilities
  - Competing for irradiation time with higher value medical devices or other products
  - Infrastructure of sites that can handle phytosanitary products (turn around time, cold storage, dose levels, etc.)
- Ease of meeting dose specifications
  - Delivering dose between 400 Gy to 1 kGy can be a challenge at high densities
- Experience in validating phytosanitary processes
  - APHIS often required to be on site

TECHNILOGICAL CHALLENGES

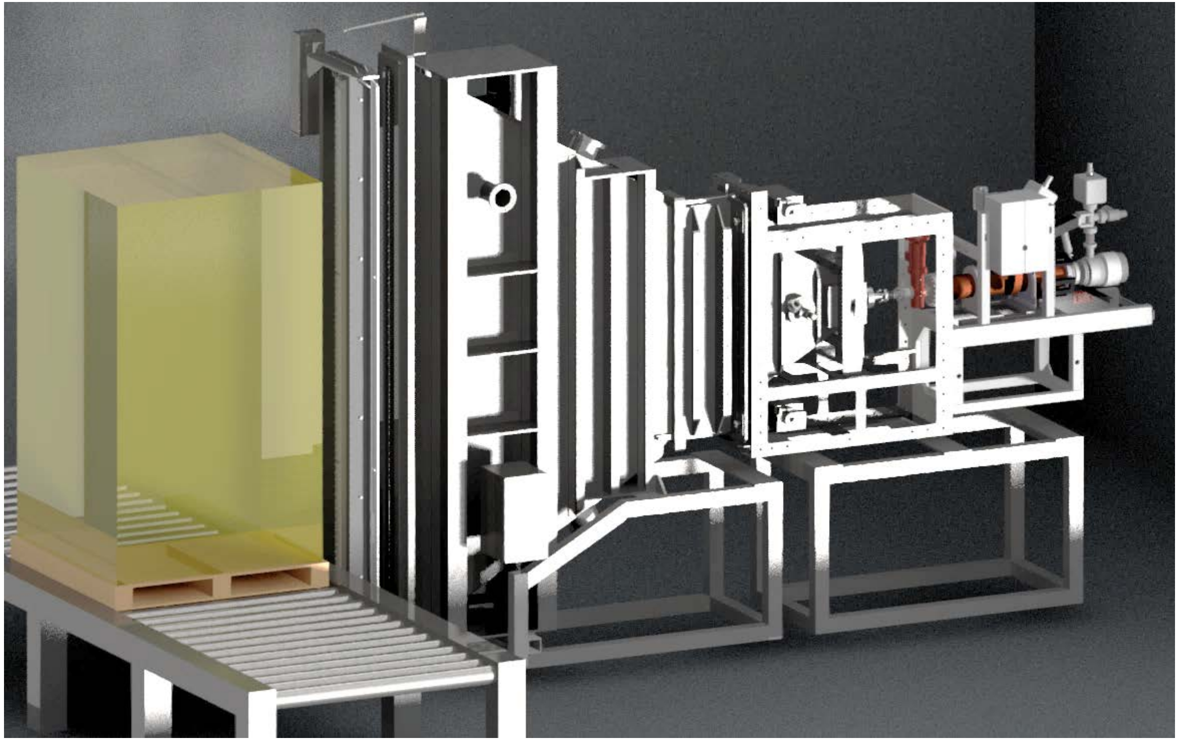
- Capacity of irradiators needs to be flexible to match the pattern of harvesting
- Poor utility infrastructure in some countries wishing to irradiate at point of export
- Larger processing volumes required to make investment in technology make sense economically
- Ability to demonstrate competency in dose mapping and process delivery

THE FUTURE

TECHNOLOGY ENABLING APPLICATIONS

REDEFINING STATE OF THE ART

- Dedicated phytosanitary facilities
- Growth of X-ray as a proven radiation technology
- Capacity when needed
- Ability to run off of generator backup power



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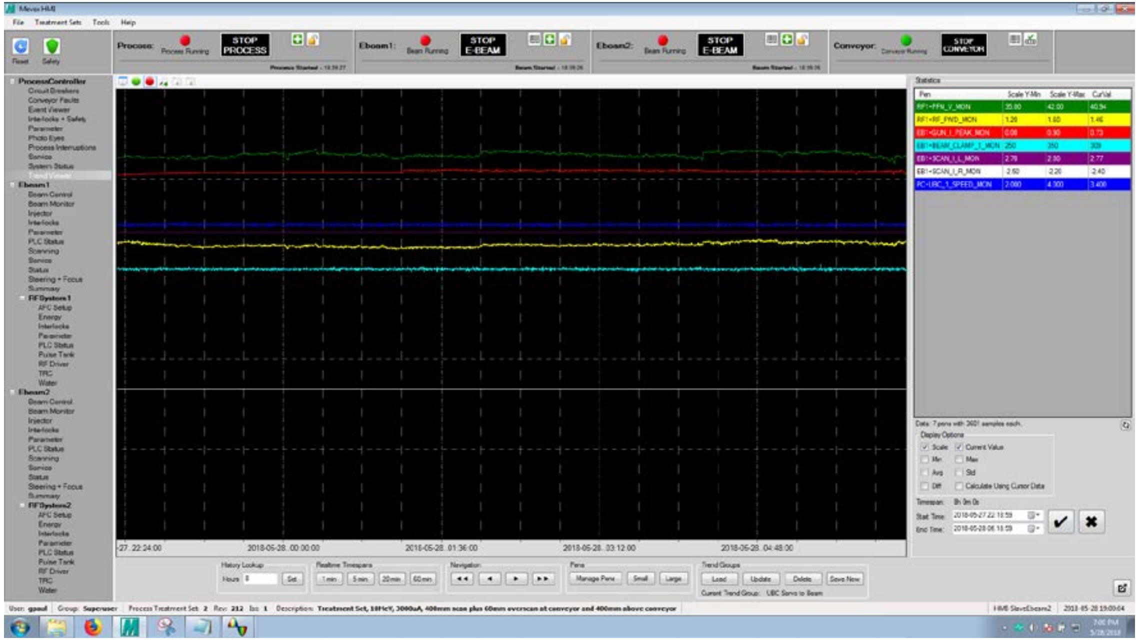
USING NEWER TECHNOLOGY TO OUR ADVANTAGE

- Online/remote monitoring of irradiator activity performance
- Technology once thought Novel is now becoming mainstream
- Modelling as part of PQ and monitoring



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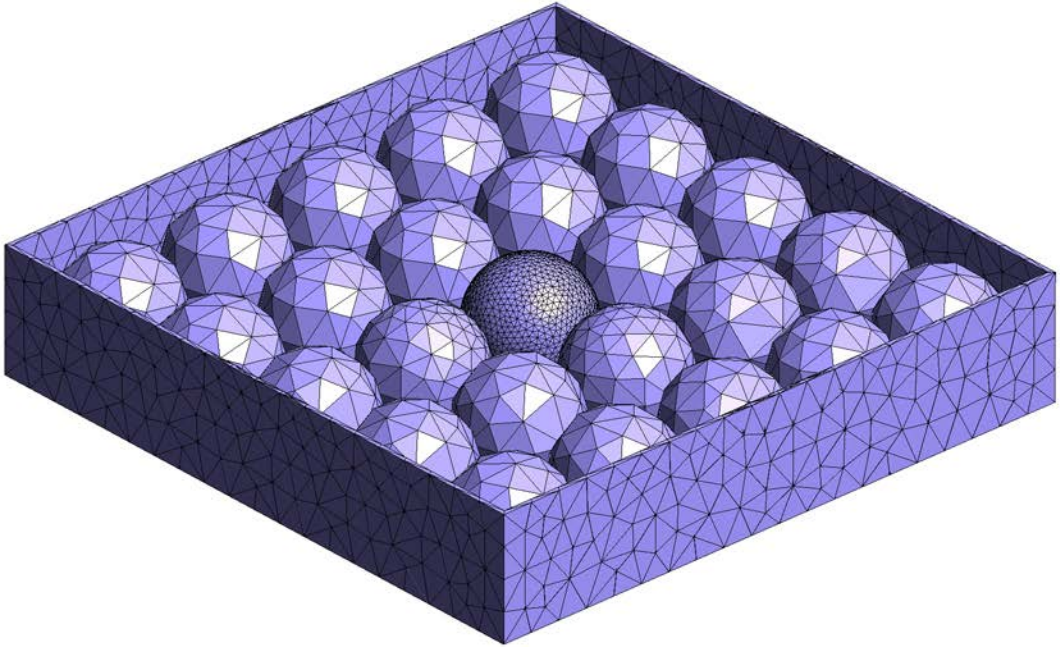
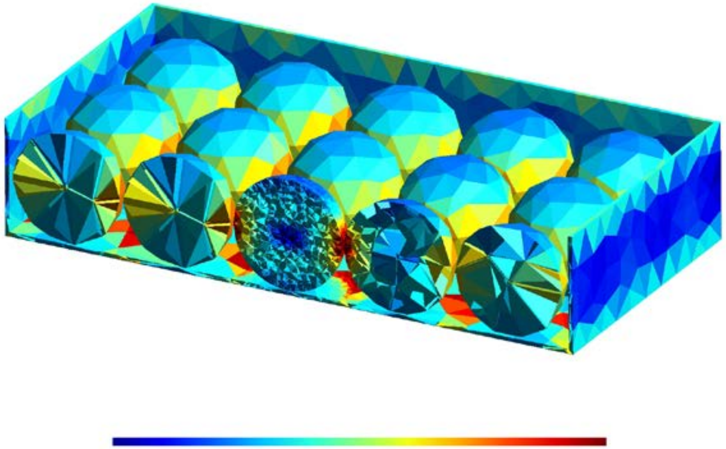
CASE STUDY – ORANGE MODEL

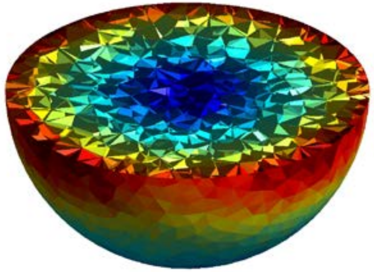
SETTING UP THE MODEL

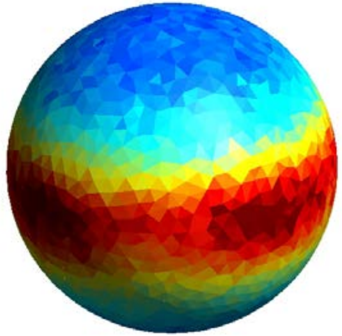


- Different levels of detail can be assigned to different regions of model depending on information required

DOUBLE SIDED 5 MeV E-BEAM EXAMPLE

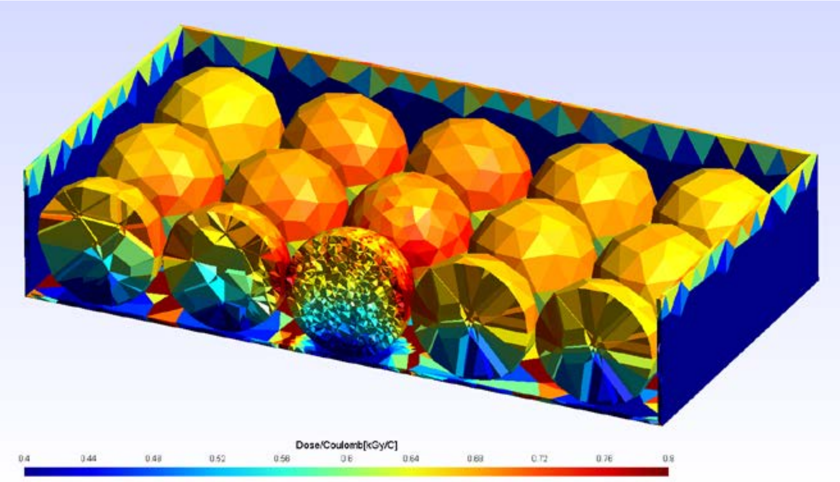


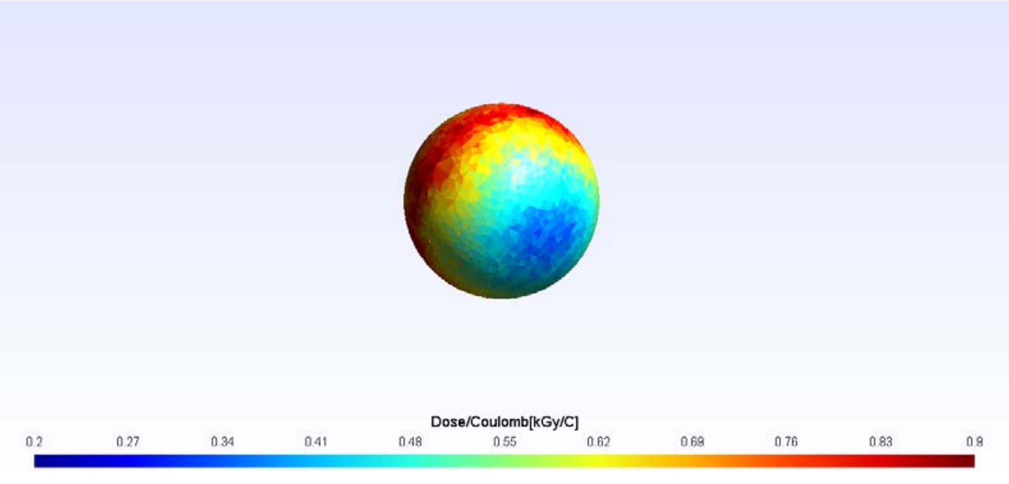




- Colours show dose gradient through the box of oranges
- Individual oranges may also be examined

SINGLE SIDED 10 MeV EXAMPLE





- By varying the energy and packaging configurations, we can optimize dose delivery for a particular type of produce
- Predict max min locations for ease of dose mapping

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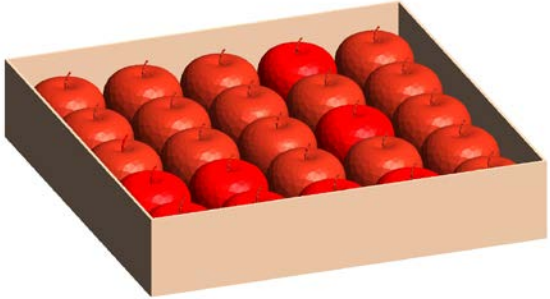
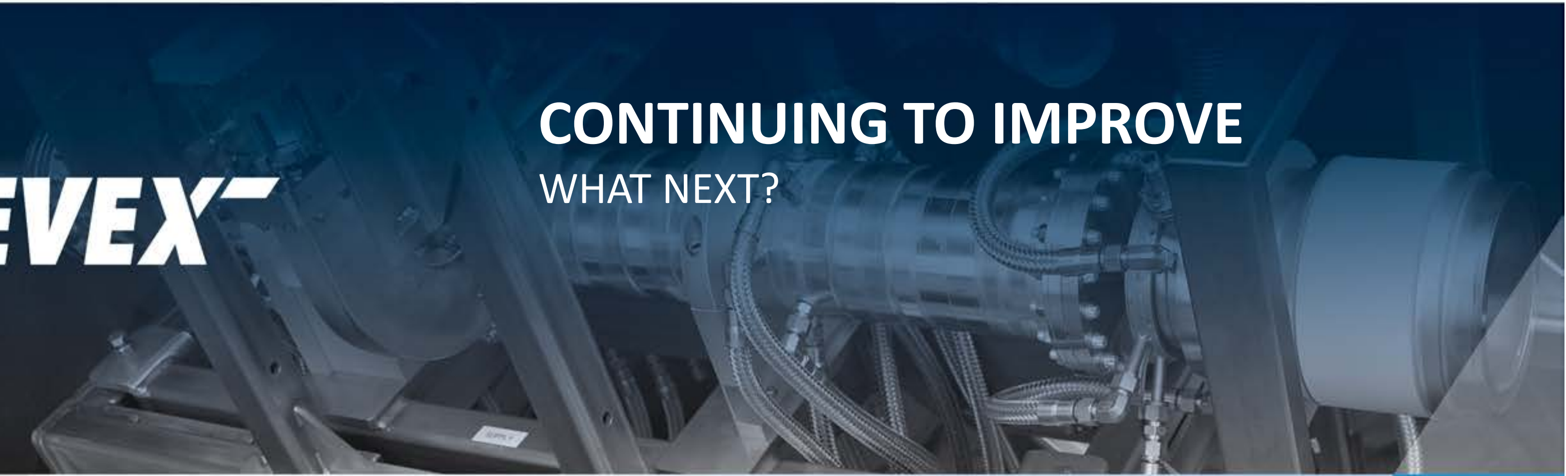
OTHER MODELS ARE POSSIBLE

- Other fruits
- Pallet stacking configurations
- Confidence improved with greater detail



CONTINUING TO IMPROVE

WHAT NEXT?



CURRENT STATUS AND FUTURE DIRECTION

Factor	Present methodology	Future prospect
Irradiation facility	Multipurpose, often gamma	Dedicated sites, any radiation modality in any geographic location
Dose mapping	Replicate dose maps, estimate or try to measure machine variability	Use modelling to direct or replace dose mapping studies, rely on machine parameter trending to actively measure machine variability
Meeting dose specification	Challenging processing windows to maintain max dose less than 1kGy	X-ray at 5 MeV up to 7.5 MeV can achieve better dose uniformity, modelling can help design product configurations to work in other modalities
APHIS supervision	Often required on site to witness and sign off on processing	Greater certainty in process output and models could be used to certify more sites to operate without APHIS on site.
Driver for Irradiation over other methods	Only regulatory option, improved food quality, better for the environment	Better cost, easier to validate

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SUMMARY

- As volume of phytosanitary irradiation increases, economics will improve
- Machine source technologies can be used to build capacity
- Modern tools like modelling and remote diagnostics can improve confidence in process delivery
- Improved global trade will help more countries export their valuable product and more consumers get the produce they want.

THANK YOU

Questions?