Nuclear Engineering
THE UNIVERSITY OF UTAH

Introducing the University of Utah Nuclear Engineering Facilities:

Operational Protocols, Training Practices, Outreach Activities and Research

Dr. Tatjana Jevremovic

EnergySolutions Presidential Endowed Chair Professor in Nuclear Engineering

Director, University of Utah Nuclear Engineering Program

Ryan Schow*, Jessica Engler*, Greg Moffitt*, Steven Burnham

Reactor Supervisors, Lab Planner & Analyst

TRTR, September 26, 2013

OUTLINE

- A third of all workers at the 102 currently operating U.S. plants could retire in the next five years[1]
- Majority of operating Nuclear Power Plants were constructed in the 1970's
- Average person earning their PhD in Nuclear Engineering wasn't alive when the last plant began construction!
- At the Universities – we hardly see the training in nuclear safety in nuclear engineering labs, and at the existing research reactor facilities

NRC Safety Culture Traits

- Training
- Education
- Research
- Outreach

With examples on:

- Lab/Reactor Daily Practices
- Knowledge Transfer (Management)
- Workforce development

[1]2011 - Elizabeth McAndrew-Benavides, Manager of Industry Infrastructure, NEI

UNEP Mission & Vision

http://www.nuclear.utah.edu/

- **MINOR in Nuclear Engineering**
- **New Graduate Program**
- Advantages:
  - HANDS-ON experience: facilities
  - New modernized program in meeting the expectations of the 21st century nuclear industry
  - Cutting-edge research for all students

Provisioning the next generation staff

with high quality hands-on education & training for aspiring nuclear engineers, scientists and policy-makers

UNEP interdisciplinary curriculum of national interest targeting the competency gaps in nuclear engineering education and training:

Bridging nuclear engineering and other disciplines at the U into nuclear engineering integrated studies with hands-on experiential learning

Introducing a discipline-specific training emphasizing the nuclear safety culture, human performance and knowledge management

Adjusting the Development of Nuclear Education to New Technical and Social Realities – UNEP

2009: Facility cleanup/renovation & new SRO training

2010: New education curricula & new lab protocols establishing safety culture elements/ Started the process of relicensing TRIGA

2011: Relicensed TRIGA for the next 20 years

PM Geoff Wertz

2012: Operation under DevonWay CAP system

2013: Renovation/ New staff/ "Measuring" our framework of nuclear safety improvement; innovations; training and education ; nuclear knowledge management framework; workforce development

Adjusting the Development of Nuclear Education to New Technical and Social Realities – UNEP

Blue Wing

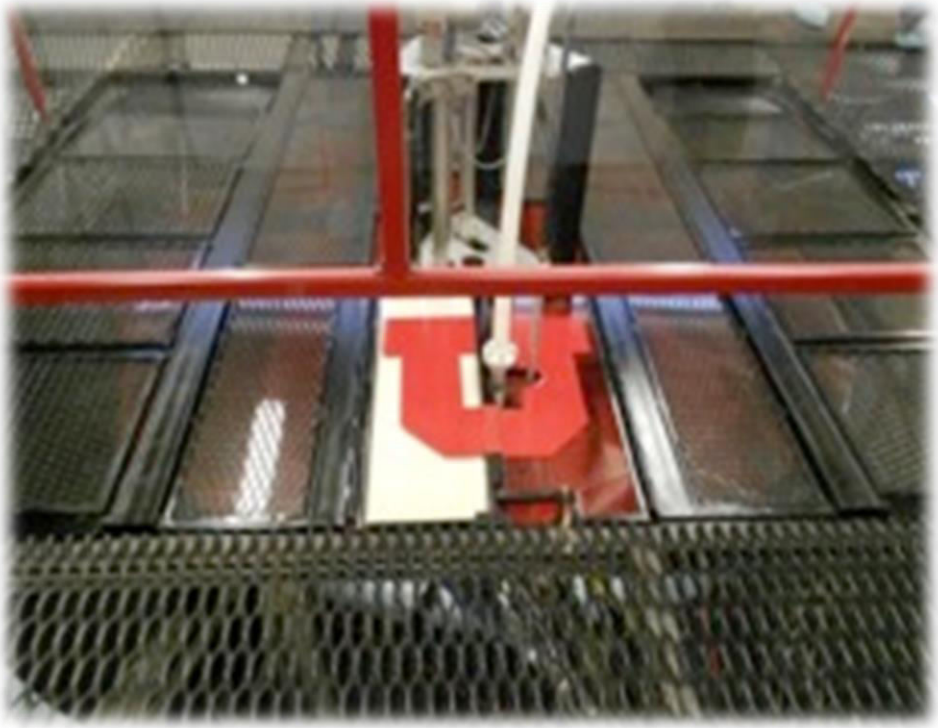
White Wing

Safety Culture
&
Nuclear Discipline

100 kW TRIGA
& Nuclear Museum (AGN)

9 radiation counting stations
Microscopy Lab
Source room
BNCT room
Nuclear Forensics Lab

Adjusting the Development of Nuclear Education to New Technical and Social Realities – UNEP

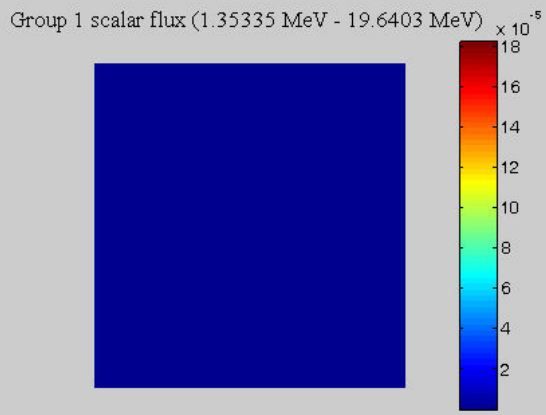


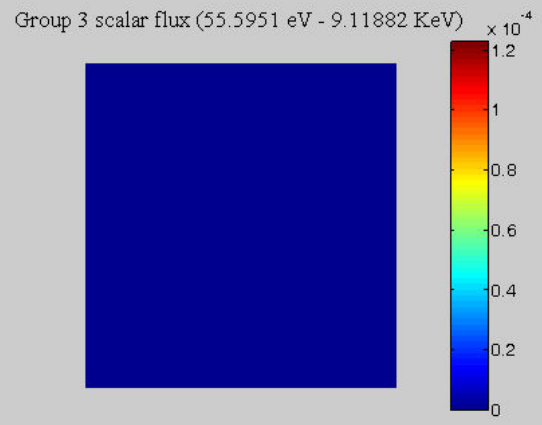
Blue Wing

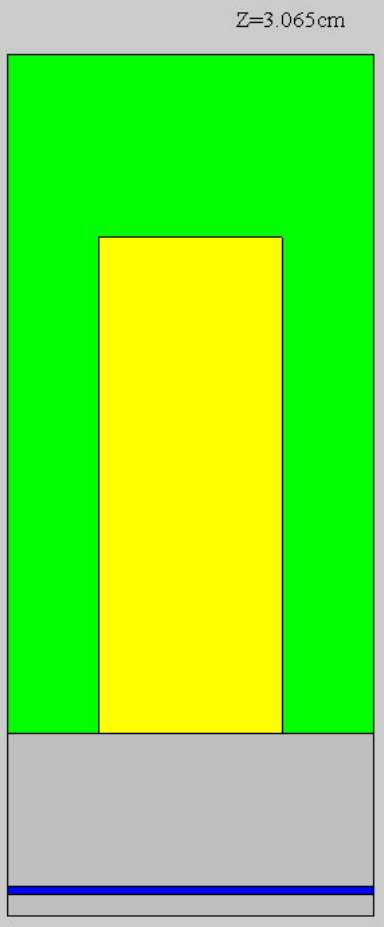
2011:

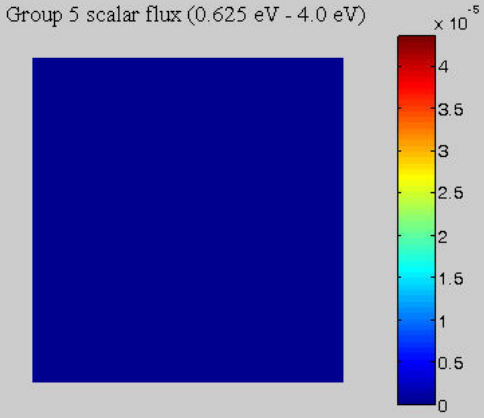
- Relicensed in October
  (simulations and modeling performed by ourselves)
- Pool grating in December

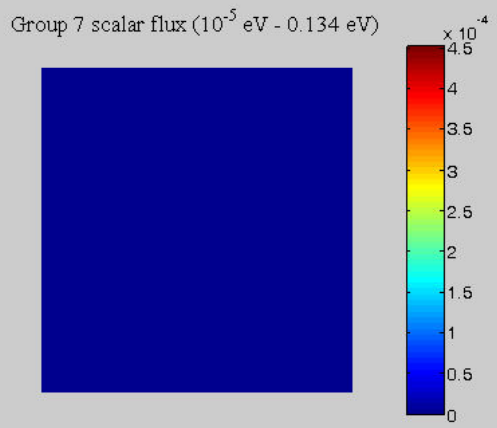
UNEP Research: REACTOR MODELING











AGENT Model of our TRIGA

After the NRC Safety Culture Traits

2012: Operation under DevonWay CAP system

- Continuous learning and continuous improvement
- Safety thinking
- Raising concerns
- Problem identification & resolution
- Personal accountability
- Education underlying the reasons for safety culture

+

- Sample science and library
- SRO training
- NAA, BNCT,…. protocols

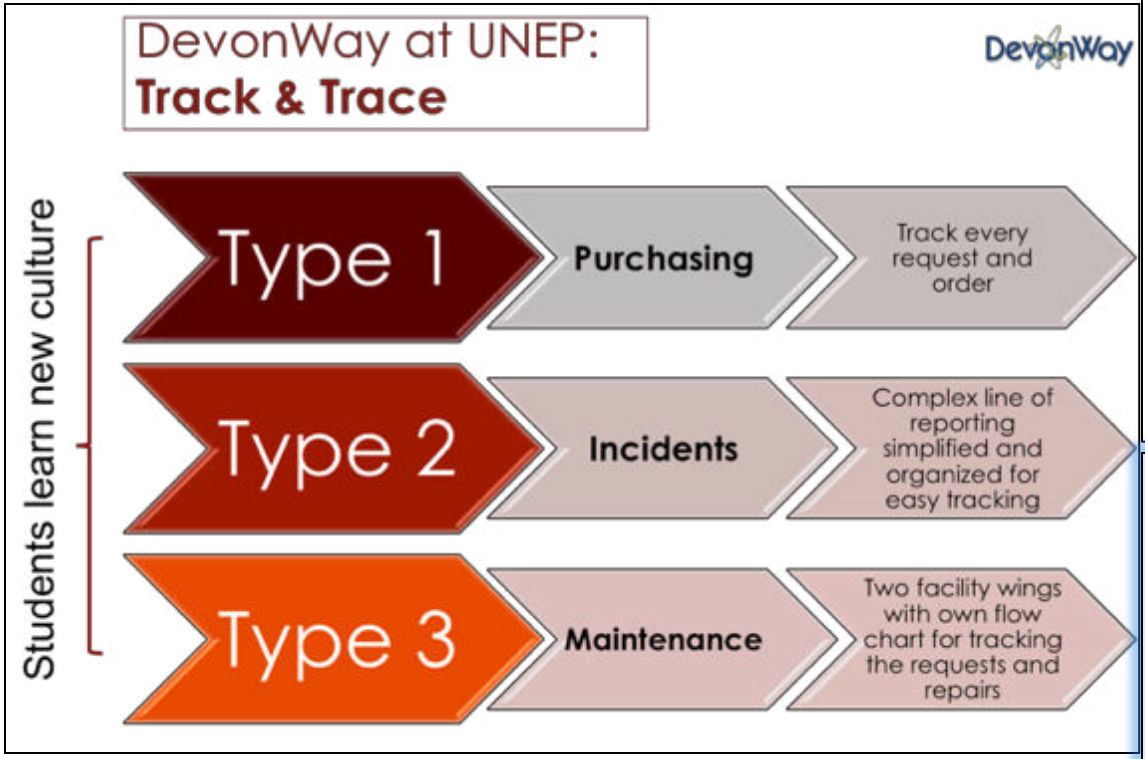
Measuring" our framework of nuclear safety and continuous improvement; innovations; training and education ; nuclear knowledge management framework;
Toward workforce development

After the NRC Safety Culture Traits

GLOVES

SHOES COVER

New realities in Scientific, Technological and Social Life of Society became reflected in the content and tools of Nuclear Education at UNEP



Track&Trace adopted to our facility

Developing new modules

Use:

- Training, education
- Reactor operation, purchasing and
- Facility maintenance

- Providing students with the training at the level of NPP operation regulation and safety level
- Providing new teaching on nuclear power engineering safety, security, line of reporting, and tracing of the events
- Creating NEW paradigm at the University settings with research reactors and nuclear facilities to trace and track every action
- Migrating CFR 50.59 and other NRC forms into digital *world*

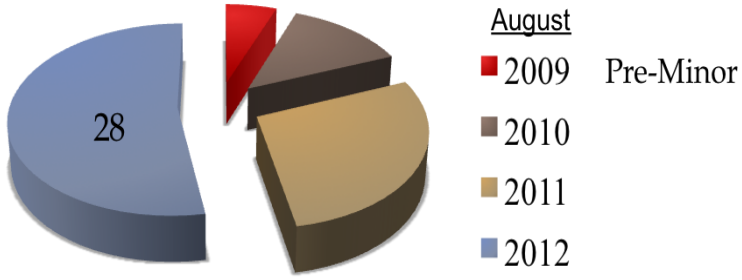
UNEP Safety Values and Actions	UNEP Training on How to Address the Problem in Labs, How to Identify and Develop a Proper Resolution	Personal Accountability
We are now teaching nuclear safety culture as a part of regular lab classes & all graduate students are required to be trained in CAP using DevonWay	We train the students to identify issues impacting personal and team safety in the lab settings, with the hope to develop new set of skills – knowing how to evaluate, define, where and to whom to report and when to immediately correct We created environment for continuous improvement and learning of new safety practices and needs as applied to UNEP	We train and require that all students working in the labs at UNEP, practice the safety procedures and take personal responsibility for the overall safety We created environment where students are couched how to raise safety concerns

With so many tours (high-school students close to 80% of total visitors), we are developing instructional web-based (cell-phone based!) nuclear safety culture communication tools → Facebook or similar….

UNEP Students

Nuclear Forensics Graduate Track as of 2012!

Number of Minor Students



In 2013: 35 minor students

National Level Comparison for 2012: Our success!

Program	Number of faculty	Number of graduate students
UNEP	2 (3)	29
Penn State	11	50
Ohio State	7	35
Illinois Urbana	11	70

17 MS
12 PhD

Top 15 ranked programs in the USA

As of December 2012: 6 MS and 1 PhD graduated!

Spring 2013: 3 new MS students admitted

August 2013: 35 graduate students and 2 faculty!

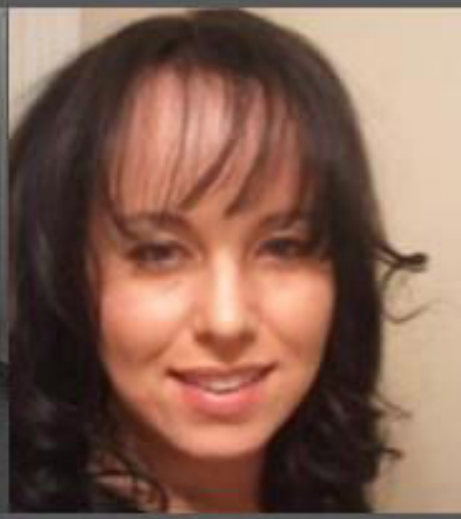
Graduating 5 MS this fall!

UNEP Staff

Steve Burnham
Lab Planner and Analyst
MS student

Greg Moffitt
Reactor Supervisor
MS student

Ryan Schow
Reactor Supervisors in training
PhD student



Jessica Engler
Reactor Supervisors in training
MS student

UNEP Remodeling

UNEP Remodeling

EXAMPLE #1: 10CFR50.59

- Formalized the implementation of 10 CFR 50.59
- Created a Manual and an Administrative Procedure
  - Procedure is supplemented with 3 “Job-Aids”
    - 1: Screening
      - Determine if a full evaluation is required
    - 2: Evaluations
      - If a change affects safety and Evaluation is done and goes to the Safety Committee
    - 3: Designates Those Approved by UNEP Director to Implement 10CFR50.59

EXAMPLE #1: 10CFR50.59

Screening Job Aid

Formatting
Based on similar industry forms

NOTE
This Job Aid is to be prepared and reviewed only by those individuals designated as 10 CFR 50.59 Screener/ Evaluators, by the UNEP Director, in writing, via UNEP JOB-AID 004.
AND
At least one of those individuals (preparer or reviewer) must be a licensed SRO, with an active NRC license, at the UNEP UUTR Facility

1. APPLICABILITY

The scope of this job aid applies to implementation of certain activities that affect the following:

- Permanent and temporary design changes.
- Changes to UNEP procedures that are outlined, summarized, or completely described in the UNEP Forms.
- Tests or experiments not described in the UUTR SAR Technical Specifications.
- Proposed compensatory actions to address degraded or non-conforming conditions.

2. ACTIVITY DESCRIPTION

Summary of Activity (Title):

Detailed Description of Activity (what is being changed and why):

3. SAFETY DETERMINATION

CAUTION: IF the answer to the following question is yes, **THEN; Do not continue with this JOB-AID. STOP**, identify and report the concern to the UNEP Director, **STOP**.

1. Does the proposed activity have the potential to adversely affect nuclear safety or safe UUTR facility operations?

YES ( ) NO ( )

EXAMPLE #1: 10CFR50.59

10 CFR 50.59 SCREENING

NOTE

This Job Aid is to be prepared and reviewed only by those individuals designated as 10 CFR 50.59 Screener/ Evaluators, by the UNEP Director, in writing, via UNEP JOB-AID 004.

AND

At least one of those individuals (preparer or reviewer) must be a licensed SRO, with an active NRC license, at the UNEP UUTR Facility

1. APPLICABILITY

The scope of this job aid applies to implementation of certain activities that affect the following:

- Permanent and temporary design changes.
- Changes to UNEP procedures that are outlined, summarized, or completely described in the UNEP Forms.
- Tests or experiments not described in the UUTR SAR Technical Specifications.
- Proposed compensatory actions to address degraded or non-conforming conditions.

2. ACTIVITY DESCRIPTION

Summary of Activity (Title):

Replacement of ultrasonic level Detector

Detailed Description of Activity (what is being changed and why):

Replacement of the Omega -LV401- ultrasonic level detector with an Omega LVU-030

3. SAFETY DETERMINATION

CAUTION: IF the answer to the following question is yes, **THEN;** Do not continue with this JOB-AID. **STOP**, identify and report the concern to the UNEP Director, **STOP**.

1. Does the proposed activity have the potential to adversely affect nuclear safety or safe UUTR facility operations?

YES ( ) NO (X)

This year NRC inspection

- Approved the protocol
- Liked the Job Aids
- Examined all our repairs due to aging

EXAMPLE #1: 10CFR50.59

4. SCREENING QUESTIONS

Instructions: Answer the following questions. Refer to the following documents, as necessary, for additional information/ clarification.

1. UNEP AP-001, "Guidelines for 10 CFR 50.59 Evaluations"
2. 10 CFR 50.59, "Changes, Tests and Experiments"
3. NRC Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," October 2000
4. NEI 96-07, Revision 1, "Guidelines for 10 CFR 50.59 Evaluations," November 2000
5. UNEP Safety Analysis Report (SAR)
6. UNEP Technical Specifications

1. Does the proposed activity involve a change to an SSC that adversely affects a design function described in the UUTR SAR?

YES ( ) NO (X)

2. Does the proposed activity involve a change to a procedure that adversely affects how UUTR SAR described SSC design functions are performed, controlled, or tested?

YES ( ) NO (X)

3. Does the proposed activity involve revising or replacing an UUTR SAR described evaluation methodology that is used in establishing the design bases or used in the safety analyses?

YES ( ) NO (X)

4. Does the proposed activity involve a test or experiment not described in the UUTR TS, where an

EXAMPLE #1: 10CFR50.59

6. Justification of Screening Question Responses

Instructions: Explain, in detail, why each "NO" answer was given in section 2 for questions 1-4. Site the references made to make the determination, including pages and section numbers where appropriate. It is **NOT** adequate to merely restate the question in the negative, specific explanations, with references are required. (Additional pages may be and attached added as necessary)

Question 1: Does the proposed activity involve a change to an SSC that adversely affects a design function described in the UUTR SAR?	
Justification of "NO" response:	NO. THEY ULTRASONIC LVL. DETECTOR IS ONLY MENTIONED AS A MONITOR FOR LVL. ONLY ONE TIME, AND NO DATA OR REQUIREMENTS, OTHER THAN MONITOR ARE LISTED.
References:	SAR 5.2 (ONLY MENTION IN SAR OF THE DETECTOR) SAR 7.1 (STATES LVL IS MONITORED) SAR 7.2.1 (MENTIONS WATER LVL ALARM, BUT THIS DOESN'T COME FROM ULTRASONIC)

Question 2: Does the proposed activity involve a change to a procedure that adversely affects how UUTR SAR described SSC design functions are performed, controlled, or tested?	
Justification of "NO" response:	NO. THIS DETECTOR FUNCTIONS WITH THE SAME OUT PUT VOLTAGE. SO THE METER WILL FUNCTION THE SAME. NO TESTING OR FUNCTIONS FOR THE DETECTOR ARE IN THE SAR
References:	SAR 5.2

Question 3: Does the proposed activity involve revising or replacing an UUTR SAR described evaluation methodology that is used in establishing the design bases or used in the safety analyses?	
Justification of "NO" response:	NO, THE DETECTOR PLAYS NO PART IN THE SAR ACCIDENT ANAYLISIS, ONLY THE BALL FLOAT. (FEEDS THE SCRAM)
References:	SAR 13.2.3 → LOSS OF COOLANT ACCIDENT

Question 4: Does the proposed activity involve a test or experiment not described in the UUTR TS, where an SSC is used or controlled in a manner that is outside the reference bounds of the design for that SSC, or is inconsistent with analyses or descriptions presented in the UUTR SAR?	
Justification of "NO" response:	NO, NO TESTS OF THE ULTRASONIC DETECTOR ARE DESCRIBED IN ANY ~~ONE~~ LOCATION IN THE UUTR SAR.
References:	

Number of Attached Pages: 0

EXAMPLE #1: 10CFR50.59

7. Approvals and Document Retention

NOTE

The completed document, with any additional pages, must be filed in the UNEP control room grey file cabinet.

AND

This document must be retained for the lifetime of the UUTR facility

	Print Name	Signature	Date
Preparer:	Jessica Engler		8/9/11
Reviewer:	Greg Moffitt		8/9/11
Approval: *(UNEP Director)*	Tatjana Jevremovic		08/09/11
Devon Way Entry:	Jessica Engler		8/25/13
Control Room File:	Jessica Engler		8/25/13

NOTE: *Either the preparer or the reviewer must be a licensed SRO, with an active NRC license, at the UNEP UUTR Facility*

EXAMPLE #2: Sample Science and Library

Sample Accountability & Students' Training

Sample library

Sample coming into UNEP facility

Logged-into the sample-log (RED) station

Sample's faith: stored, returned, destroyed

Under development: sample "walk" inside the facility
DevonWay TRACK&TRACE

Sample prep protocols & manuals

Sample science

EXAMPLE #2: Sample Science and Library

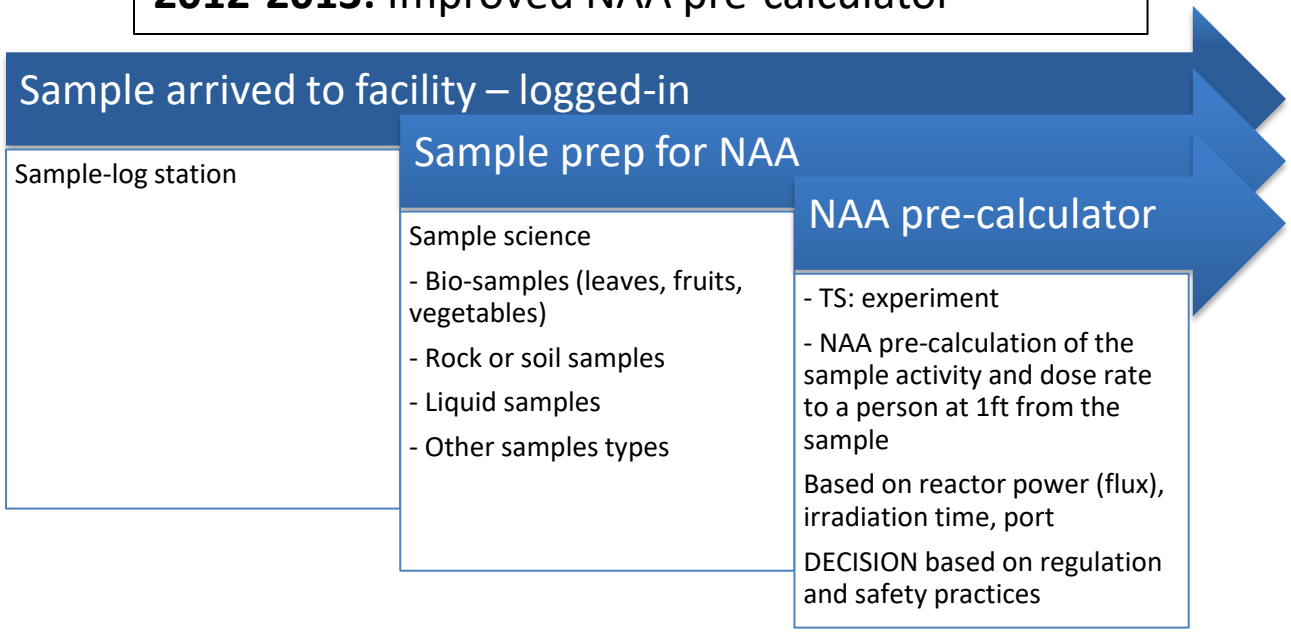
Sample physical library

EXAMPLE #3: NAA

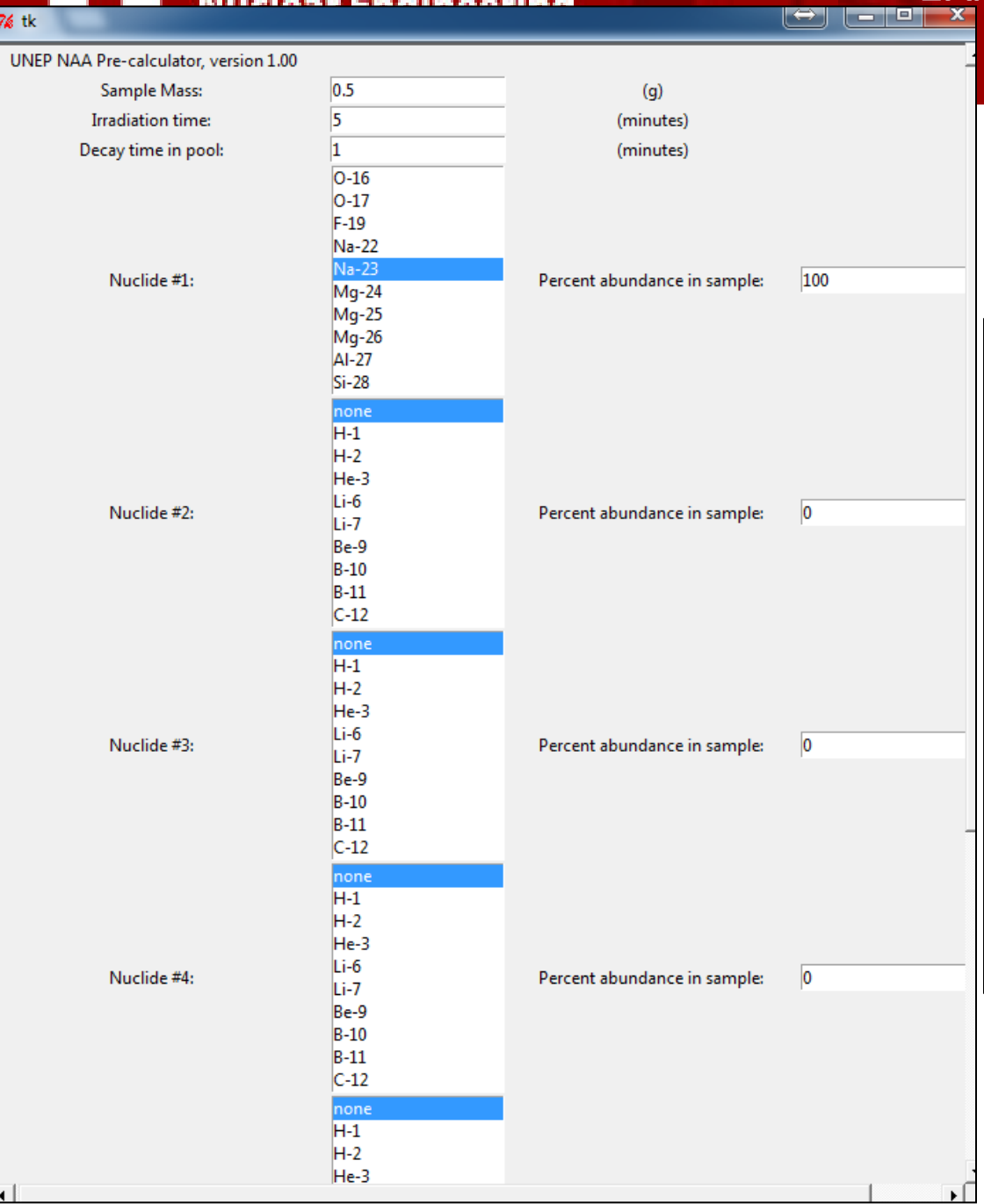
2010: NAA protocol is established, and in 2011 implemented at full scale

2011-2012: New equipment from the NEUP grant

2012-2013: Improved NAA pre-calculator

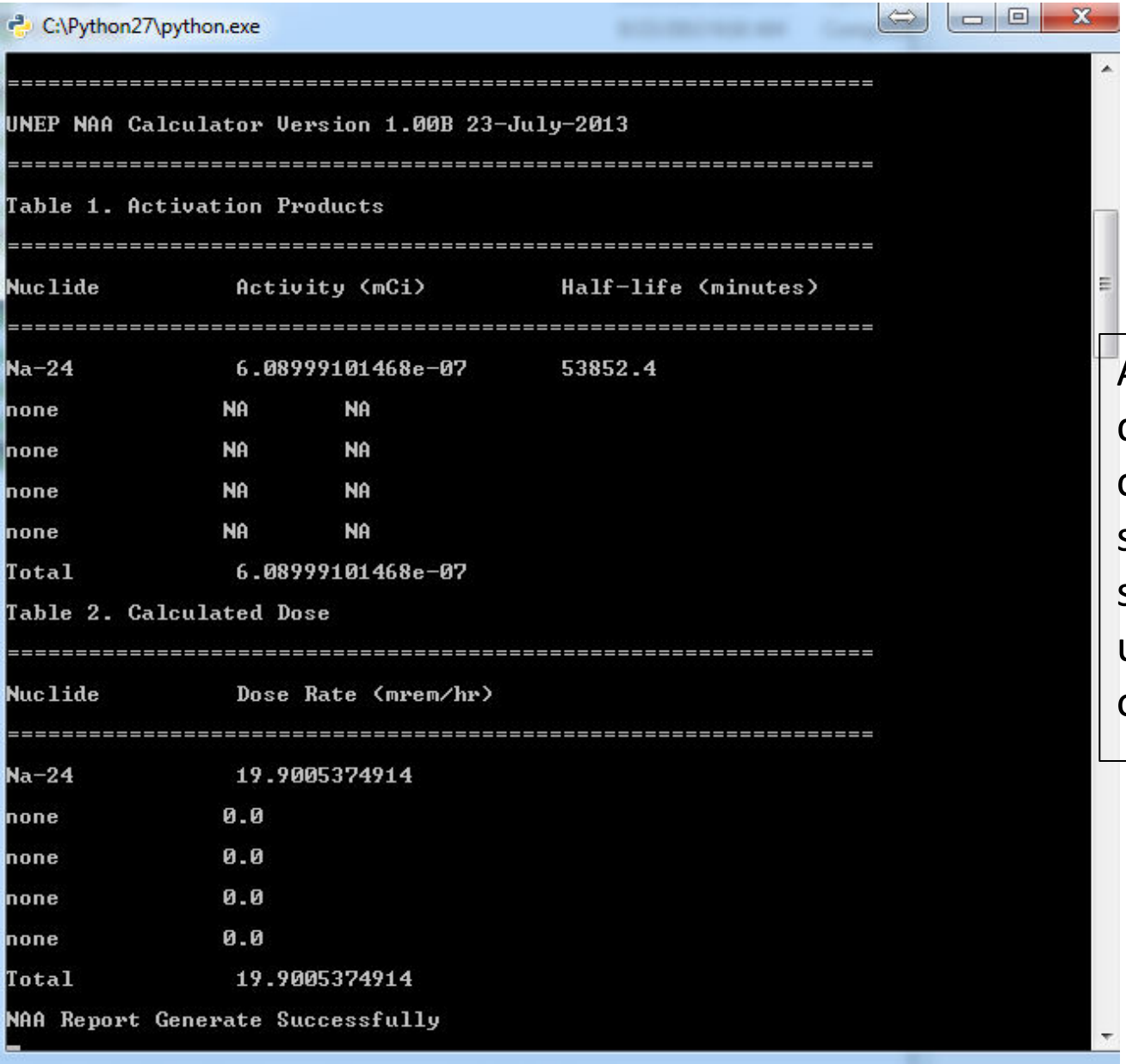


EXAMPLE #3: NAA



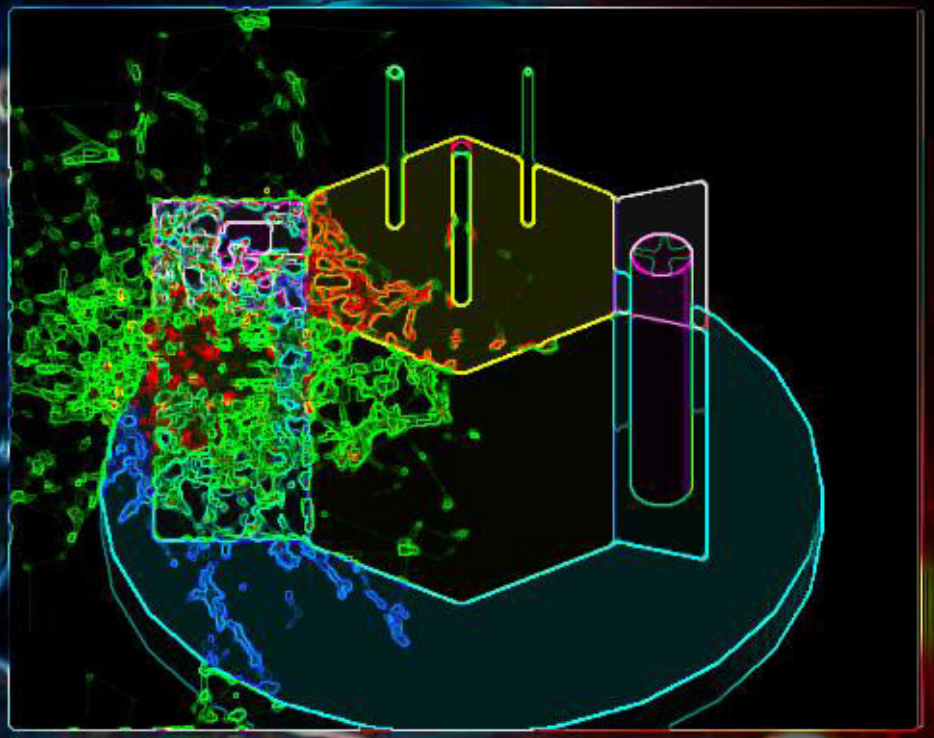
- GUI and the associated command prompt are opened simply by double clicking on GUI_NAA.py file
- Enter mass
- Enter irradiation time
- Enter decay time after removal from core
- Select up to 5 different nuclides per calculation
  - 237 Nuclides currently built into the calculator
- Enter percent abundance of each nuclide

EXAMPLE #3: NAA



Activation products and dose rate are printed to the command prompt into a separate report that is then submitted in DevonWay under reactor run operation request

Buy our nuclear art:



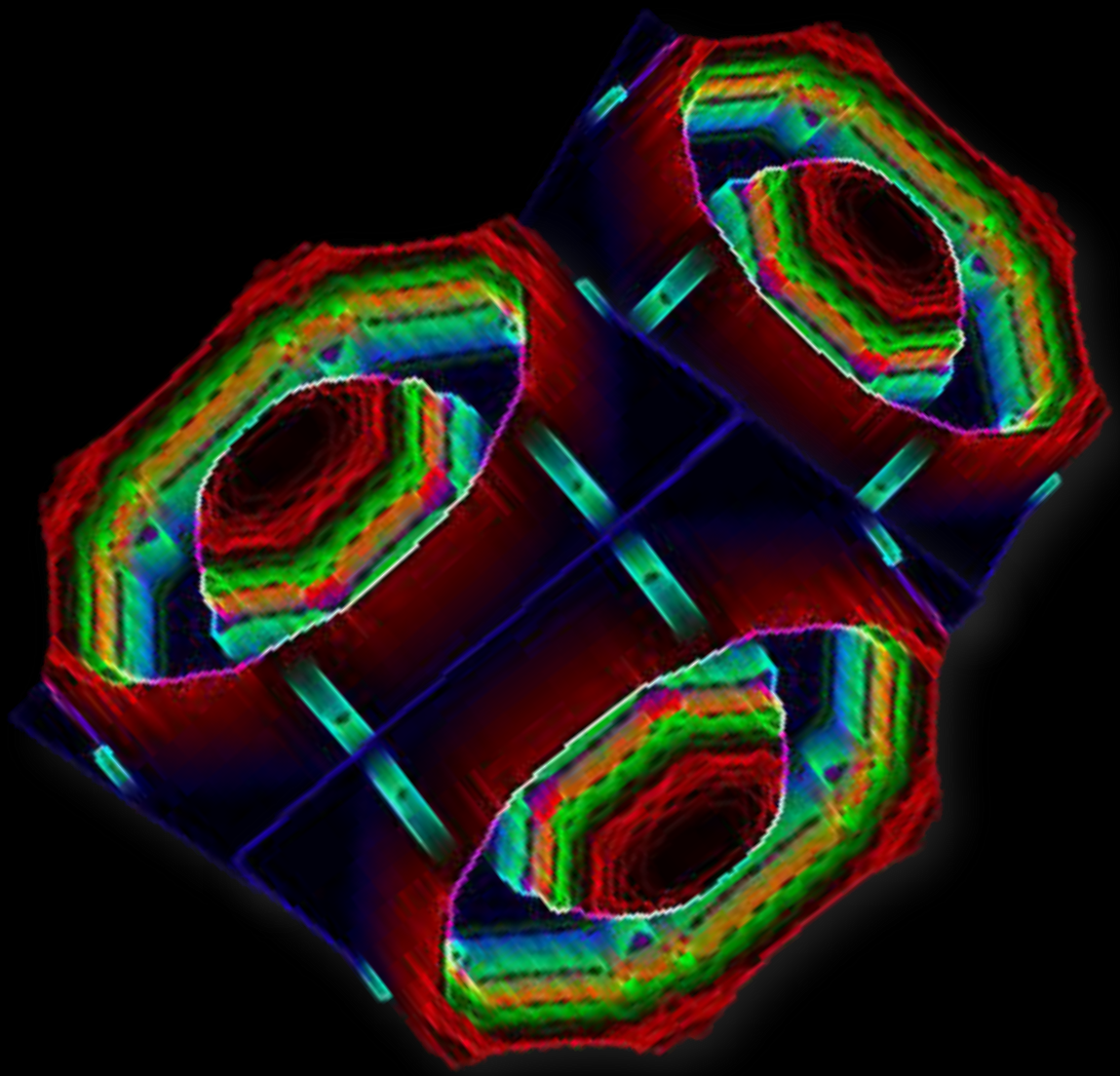
UNEP Nuclear Art

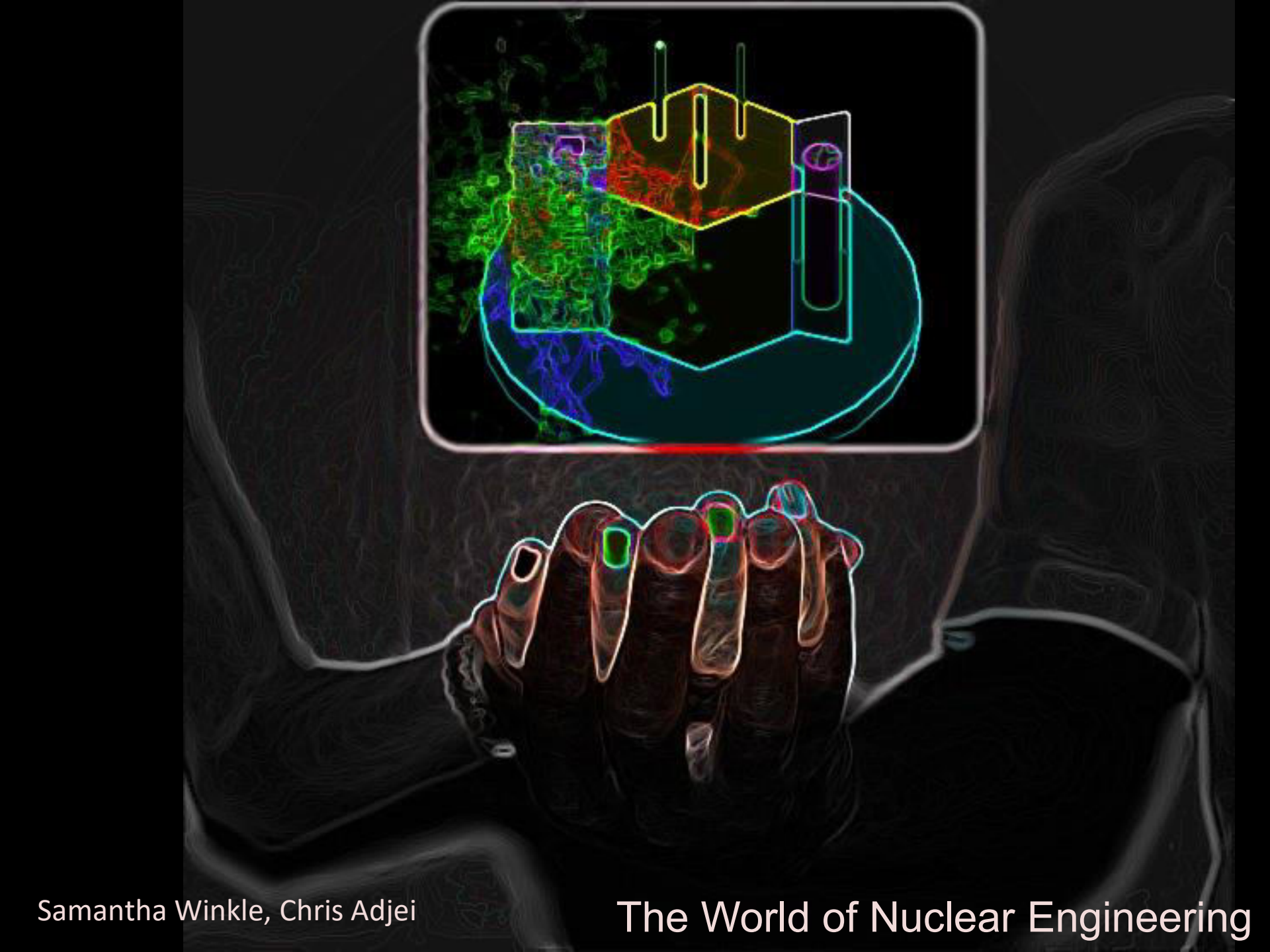
The Future of Mobile Technologies in Nuclear Engineering

Varun Vijay

Hermilo Hernandez

Reactor Mirror

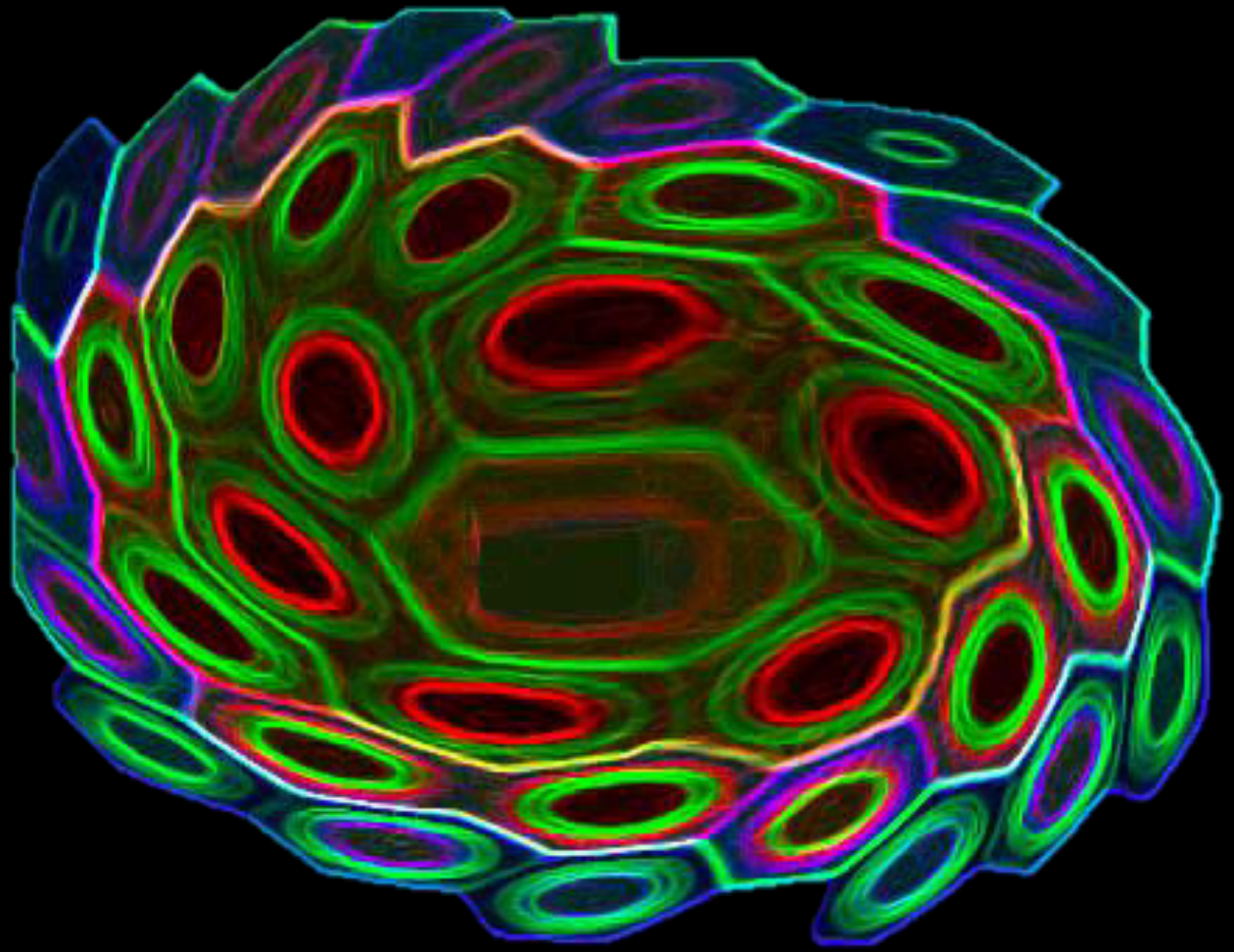




Samantha Winkle, Chris Adjei

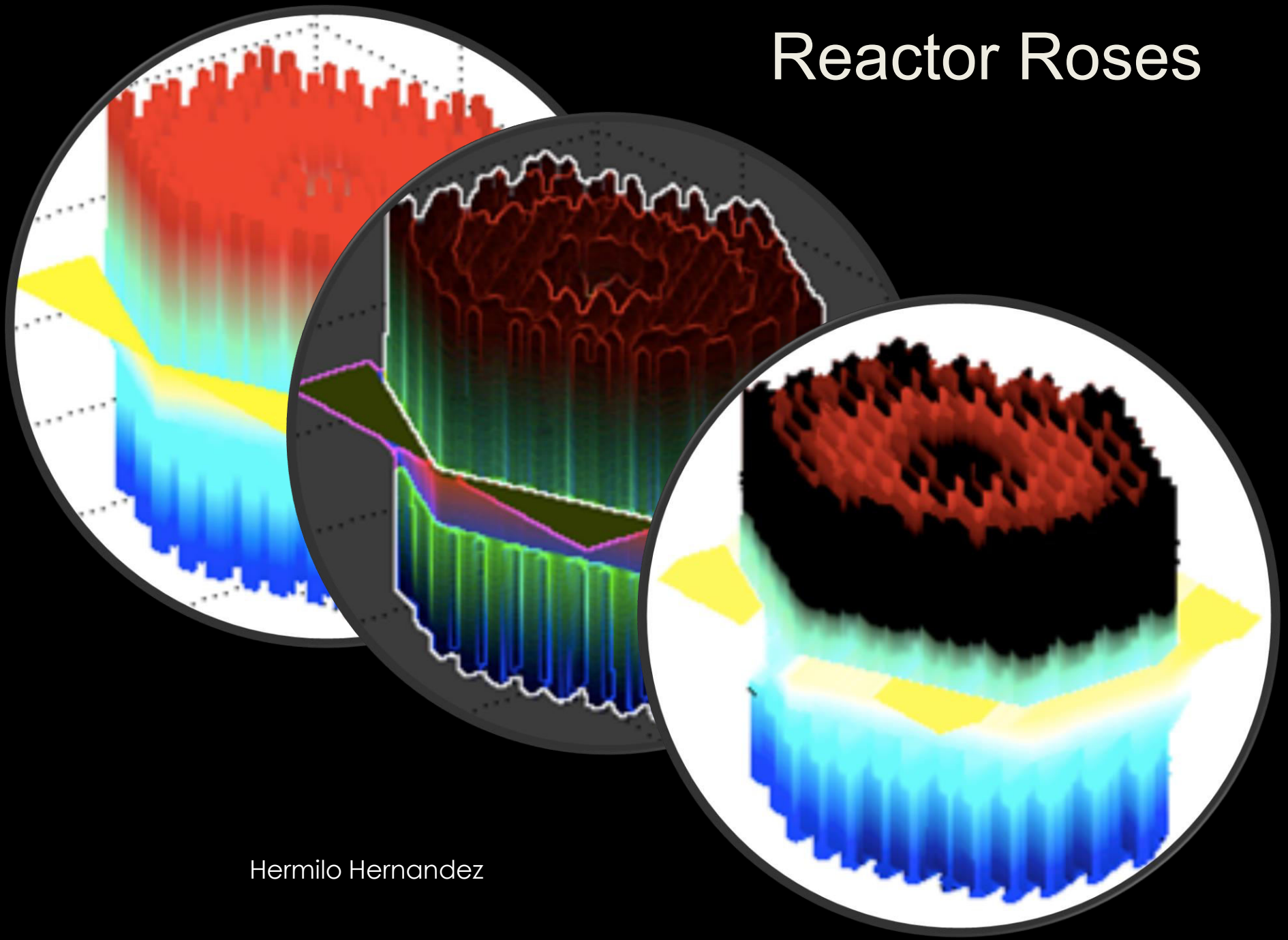
The World of Nuclear Engineering

Spiral of Life?



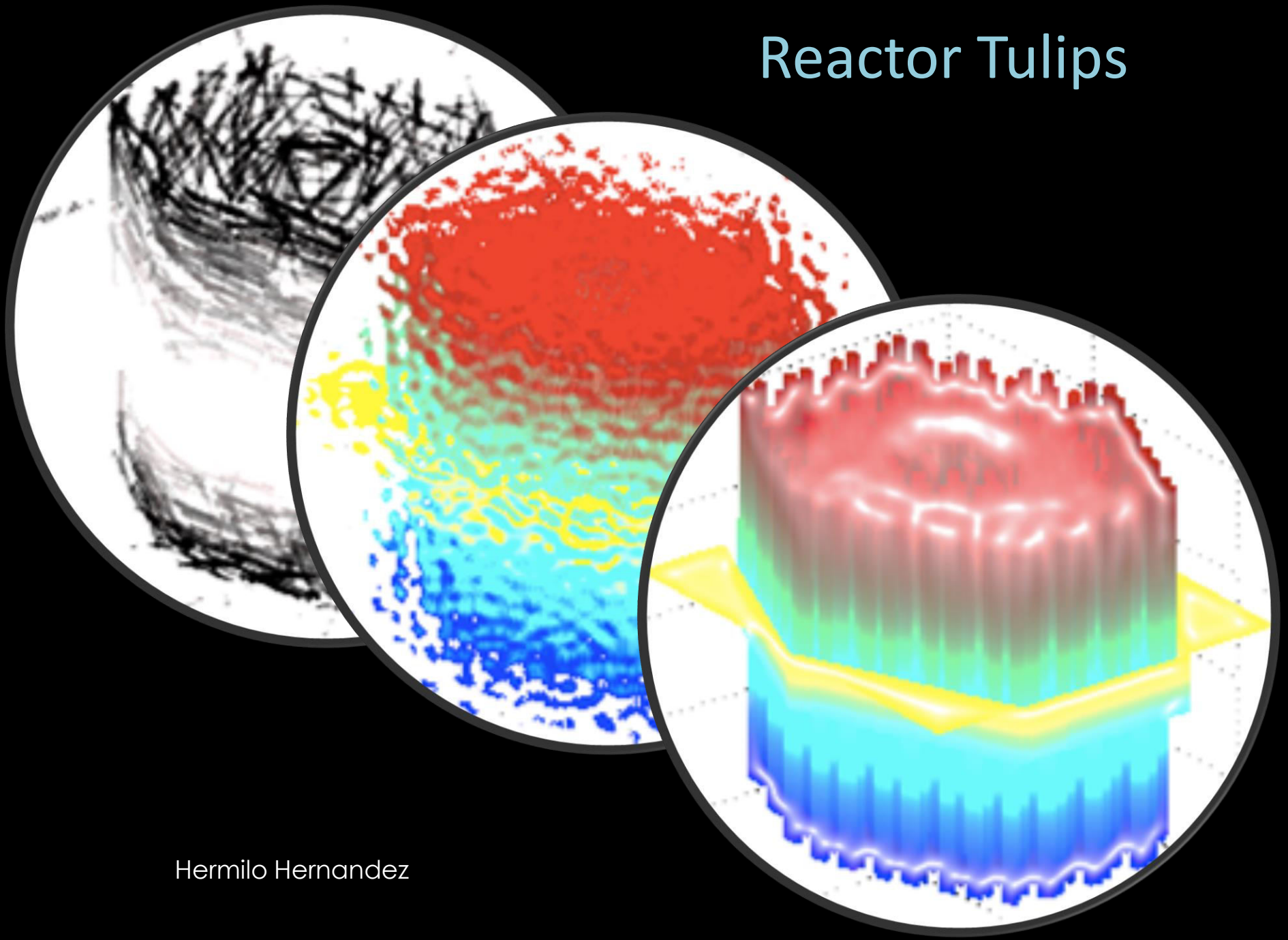
Victor Bautista

Reactor Roses



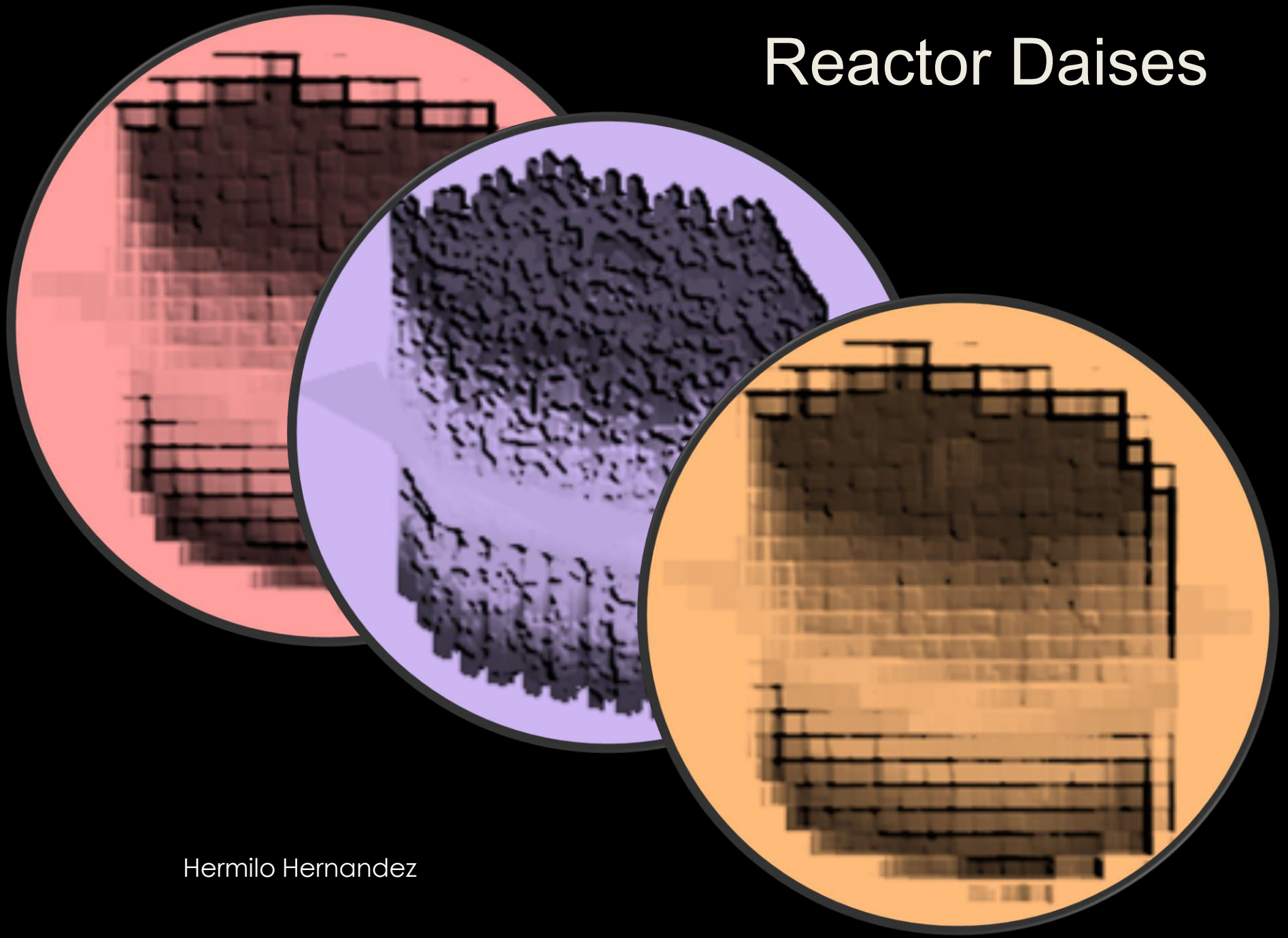
Hermilo Hernandez

Reactor Tulips



Hermilo Hernandez

Reactor Daises



Hermilo Hernandez

THANK YOU!