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Idaho
National
Engineering
Laboratory

MOCUP: MCNP-ORIGEN2 Coupling Utility Programs

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Overview

- Goals and purpose
- Program flow
- Program capabilities
- Applications to test reactors
- Future of MOCUP

What is MOCUP?

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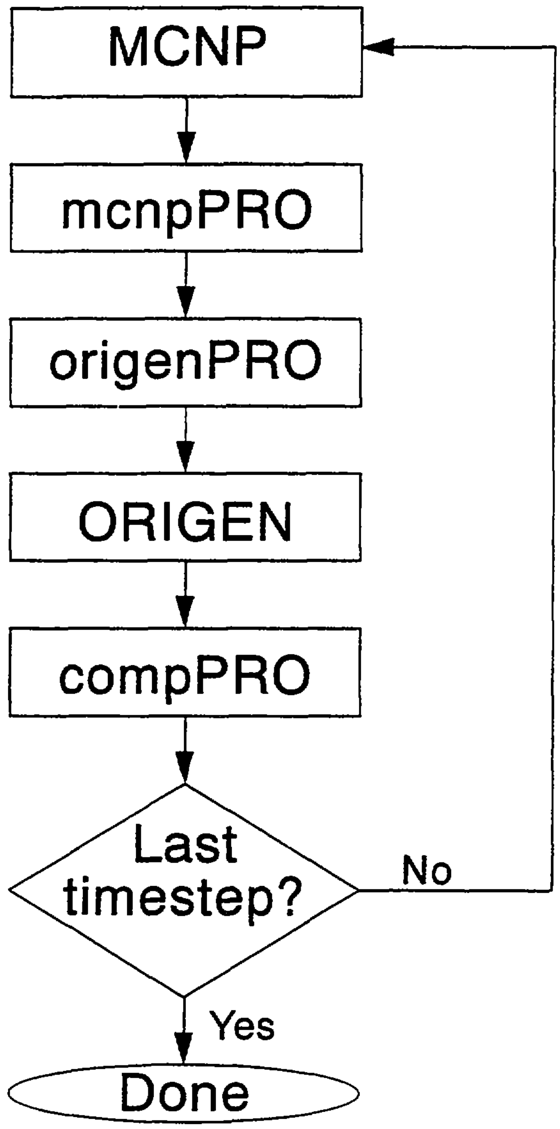
- System of interface codes wrapped around MCNP Monte Carlo transport code and ORIGEN2.1 depletion and isotopics code
- GUI for user interface w/codes
- Performs depletion in complex, non-lattice geometries for research and test reactors

Goals and Purpose

- Provide capability for depletion using Monte Carlo fluxes
  - Complex geometries (i.e., test reactors)
  - Target depletion
  - Isotope production
- Minimal extra user input
- Maximum flexibility
- Ease of use (GUI)
- Easy expansion of code
- Completely external to MCNP and ORIGEN

MOCUP Program Flow



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MOCUP Capabilities

- Fuel depletion
  - Arbitrary geometry
  - Arbitrary number of regions
  - Arbitrary number of nuclides tracked
  - Constant flux or power across timestep

- Target depletion
  - Independent nuclide tracking
  - Arbitrary number of target locations and compositions
  - Constant flux across timestep

- Structural material transmutation

- Control depletion

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User Supplied Data

- MCNP input with special comments
- ORIGEN2 skeletal input files and execution script
- Normalization factors for flux tallies
- Table of nuclide identifier equivalence (master)
- Computer environment variable settings (for GUI)

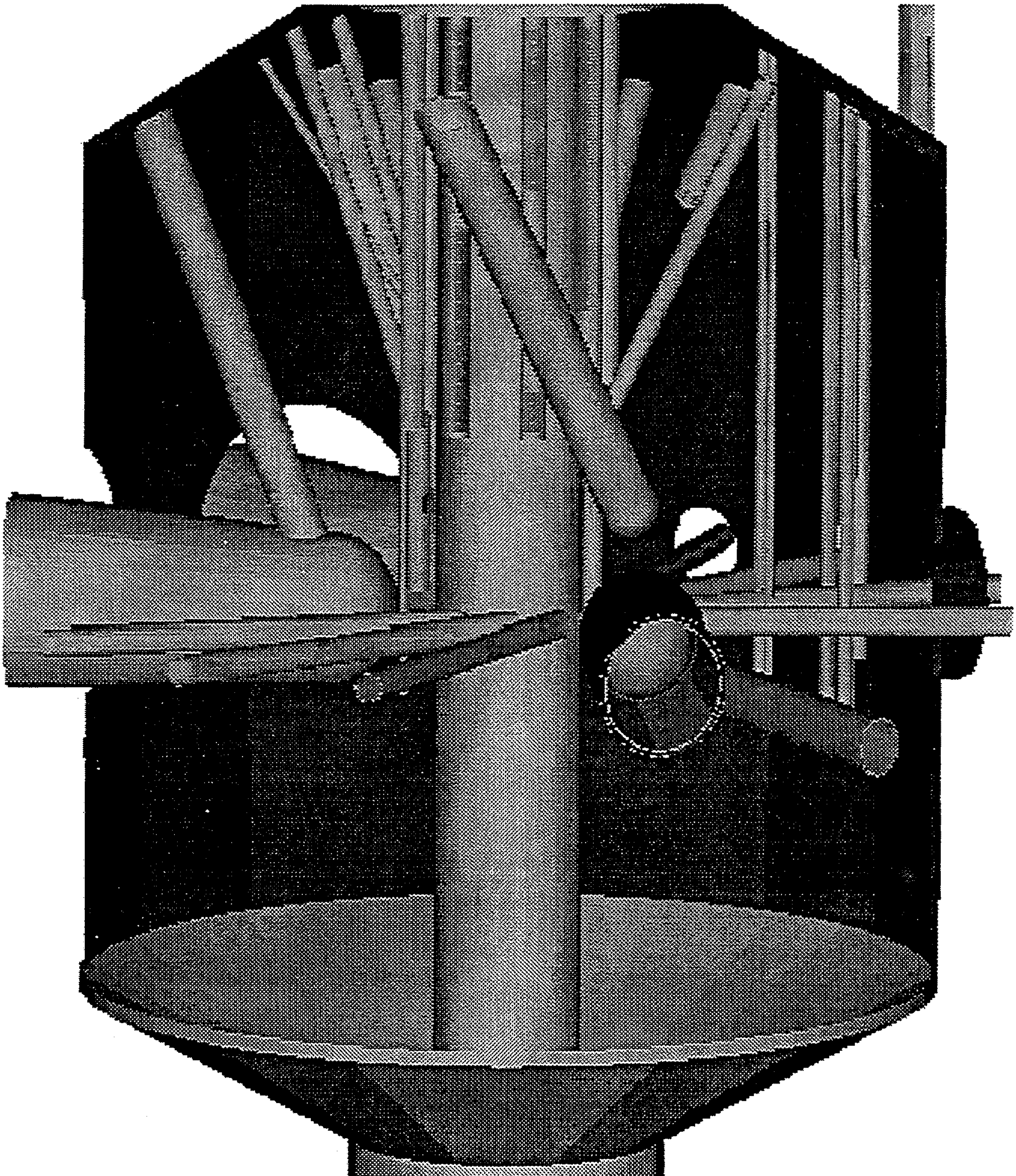
Applications of MOCUP (so far . . .)

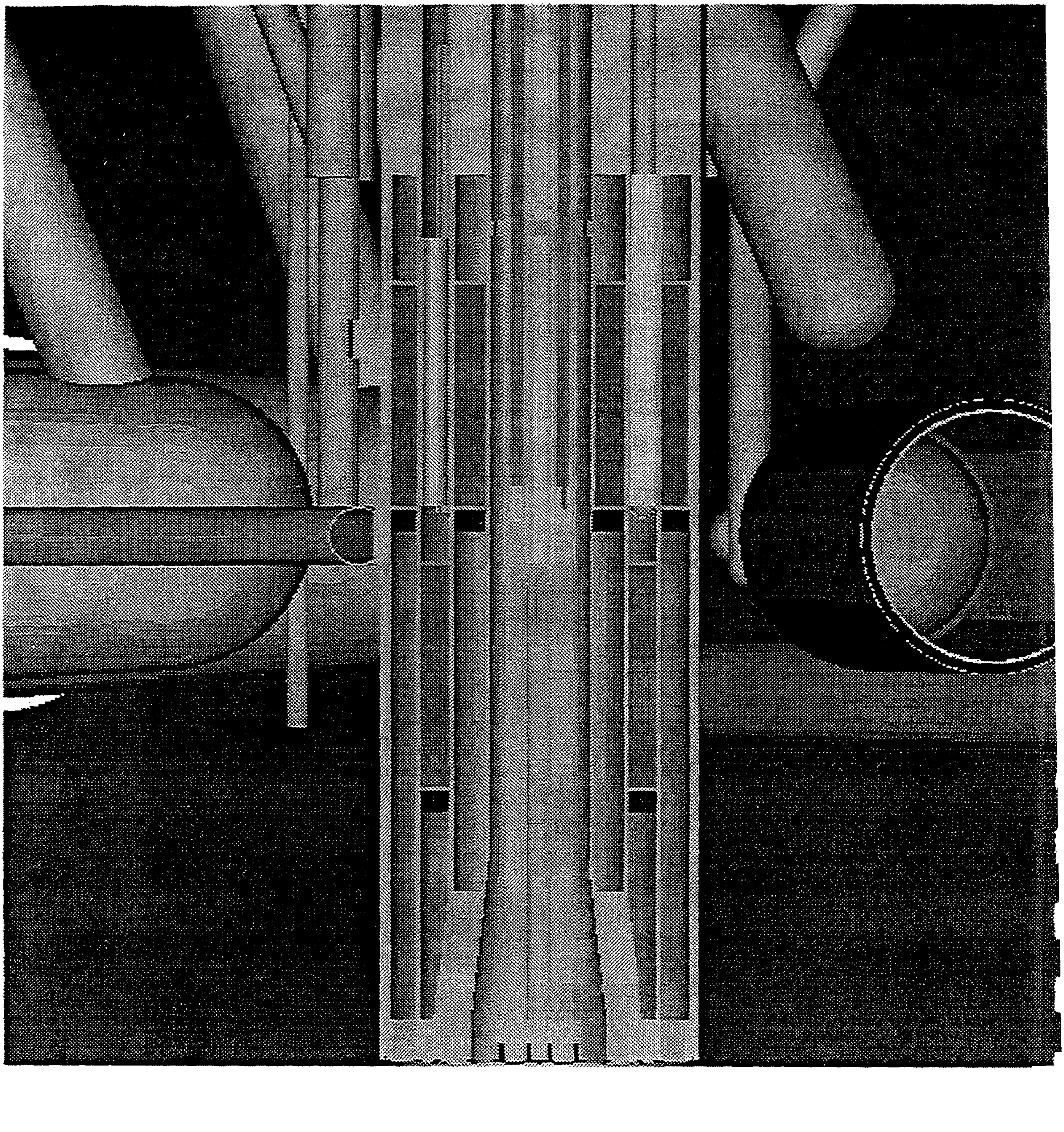
- INEL
  - Advanced Neutron Source Reactor
  - Advanced Test Reactor
  - Pu disposition reactor analysis

- MIT
  - Pu disposition reactor analysis

Advanced Neutron Source Reactor

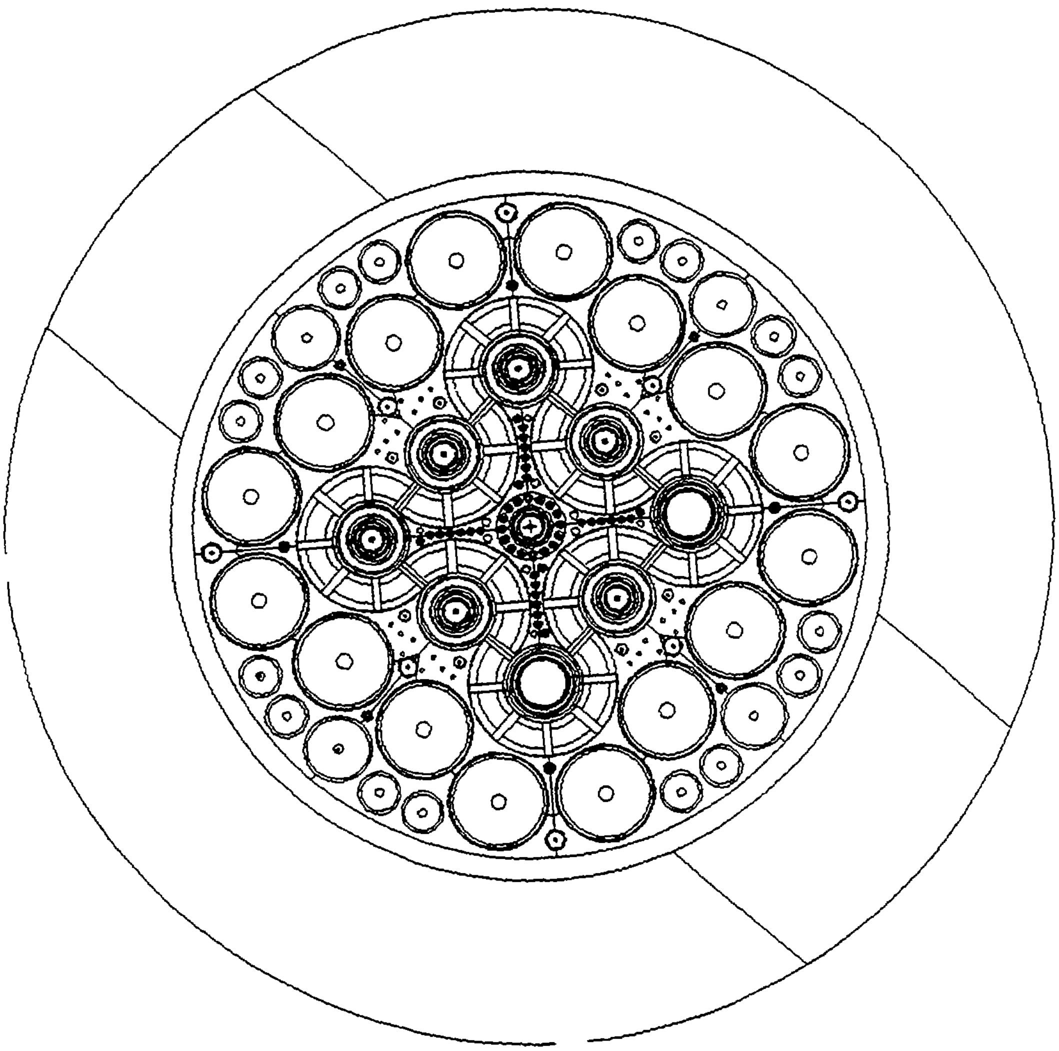
- Full complexity model
- Up to 210 fuel zones
- Up to 42 boron zones
- 50 fission products tracked
- Actinides from U-234 to Pu-242 tracked
- Up to 6 depletion steps





Advanced Test Reactor

- Full complexity model
- Some fuel plates explicitly modeled
- 40 fuel assemblies
- Boron zones
- 50 fission products tracked
- Actinides up to Pu-242 tracked
- Calculations for
  - Pu-238 production with Pu-236 contamination
  - Gd filter depletion in fusion materials test vehicle
  - Isotope production (I, Co, etc.)



Pu Disposition Studies (continued)

- MIT work
  - Student MS thesis
  - Peripheral regions of PWR
  - Very high burnups (to 100 MWd/kg)
  - Variety of burnable absorbers
  - Variety of fertile isotopes
  - Variety of lattice parameters
    - + F/M ratio
    - + Pins per assembly (17 x 17 to 10 x 10)

Pu Disposition Studies

- Work at both INEL and MIT

- INEL work
  - Weapons-grade Pu disposition
  - Non-fertile fuel types
  - LWR-type lattices
  - Variety of burnable absorbers
  - Very high burnups

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Conclusions

- MOCUP is an excellent tool for non-lattice reactor analysis
- Unique capability
- Available for "beta testing" now
- General distribution by late '95

Future of MOCUP

- Final stages of development
- Available for distribution - late FY '95
- User manual in editing
- User-defined modifications accepted
- INEL copyright pending