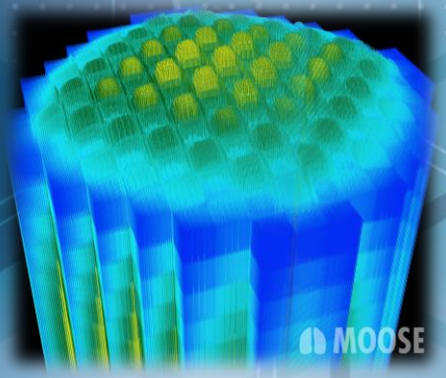
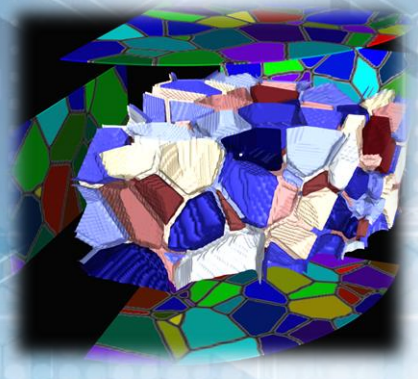




MOOSE* - Continuous Integration, In-Code Documentation and Automation for Research Software

Team: C. Permann, D. Gaston, J. Miller, A. Lindsay, R. Stogner, G. Giudicelli, L. Charlot, O. Marin, J. Hansel, P. German, R. Liu, N. Peat, V. Kyriakopoulos, C. Icenhour, L. Harbour … and growing

Presenter: Oana Marin

Computational Scientist – Numerical Analyst

SuperComputing 2022

Nov. 16, 2022

*Multiphysics Object Oriented Simulation Environment

https://mooseframework.inl.gov/

2008 - inception

2014 - open-sourced

2022 - 30+ different applications ecosystem

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy

Idaho National Laboratory

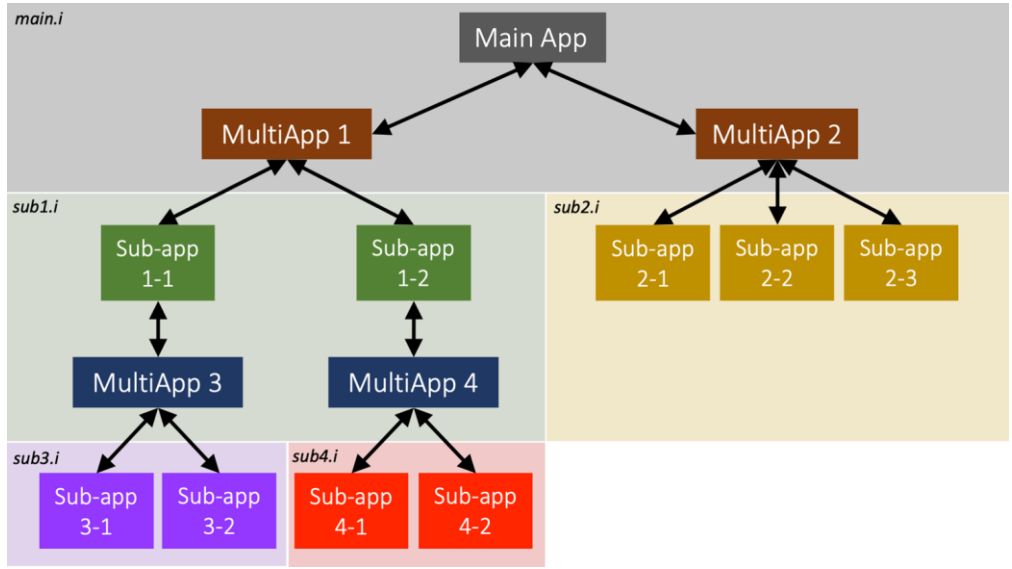
MOOSE Ecosystem - *mooseframework.inl.gov*

- ***Concept:*** object-oriented ***FEM/FV*** framework for rapid development of simulations
- ***Credo: "The user is king"*** - take the best from any DOE/University scientific tool; if it does not exist or perform then code it in MOOSE
- ***MOOSE farms out software*** capabilities to many other applications: Bison, Griffin, Cardinal etc.

MOOSE overview - *mooseframework.inl.gov*

- ***What can MOOSE do?*** Everything!* 😁
  - ✓ Any mesh element shapes/dimensions/topology
  - ✓ Adaptivity (space/time), automatic differentiation, mesh generation, parsed inputs
  - ✓ Parallelism - Everything defined per grid point
  - ✓ Flexible for multiscale applications, harder to vectorize.
  - ✓ Focus on nonlinear solvers – linear is a subclass

Couples any physics modules (***MultiApp*** transfers)



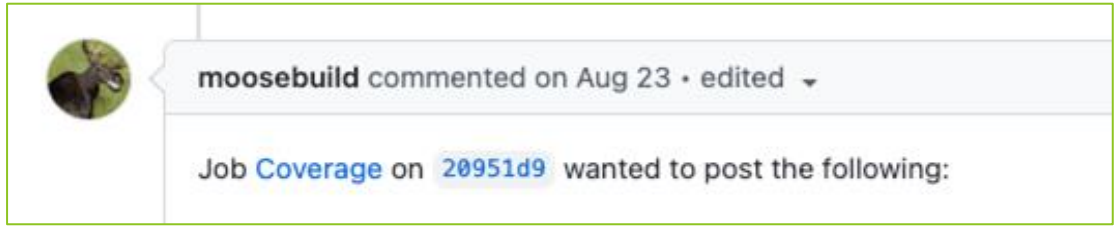
User friendly input files (YAML-like code)

```
[Postprocessors]
  [./without]
    type = ElementIntegralVariablePostprocessor
    variable = c
    execute_on = initial
  [../]
  [./with]
    type = ElementIntegralVariablePostprocessor
    variable = c
    use_displaced_mesh = true
    execute_on = initial
  [../]
[]
```

*If you don't find ***it*** or like ***it***, join us! We link to ***it***, seek funding for ***it***, or hire ***you*** to make ***it*** happen.

MOOSE design choices - *mooseframework.inl.gov*

- Meets ASME ***NQA-1*** (Nuclear Quality Assurance) requirements
- MOOSE automates developer compliance
- ***On-the-fly*** generated for each PR
  - Review feedback
  - Documentation – `moosedoc.py`
  - Testing – CIVET (*https://github.com/idaholab/civet/wiki)*



`clang-format`

- ***Conda***-based build system - `mamba install moose-tools moose-libmesh`
- ***github*** integration (submodules) – `github.com/idaholab/moose.git`
- Beyond ***MultiApp*** - Dynamic linking for graph-based coupling at any level (software tools wear many hats: library/ stand-alone application/3rd-party)

Any physics application can be written as input file, little need to alter the C++ backend.

Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.