Used Fuel Disposition Campaign

Integrating Discrete Fracture Networks with Performance Assessment

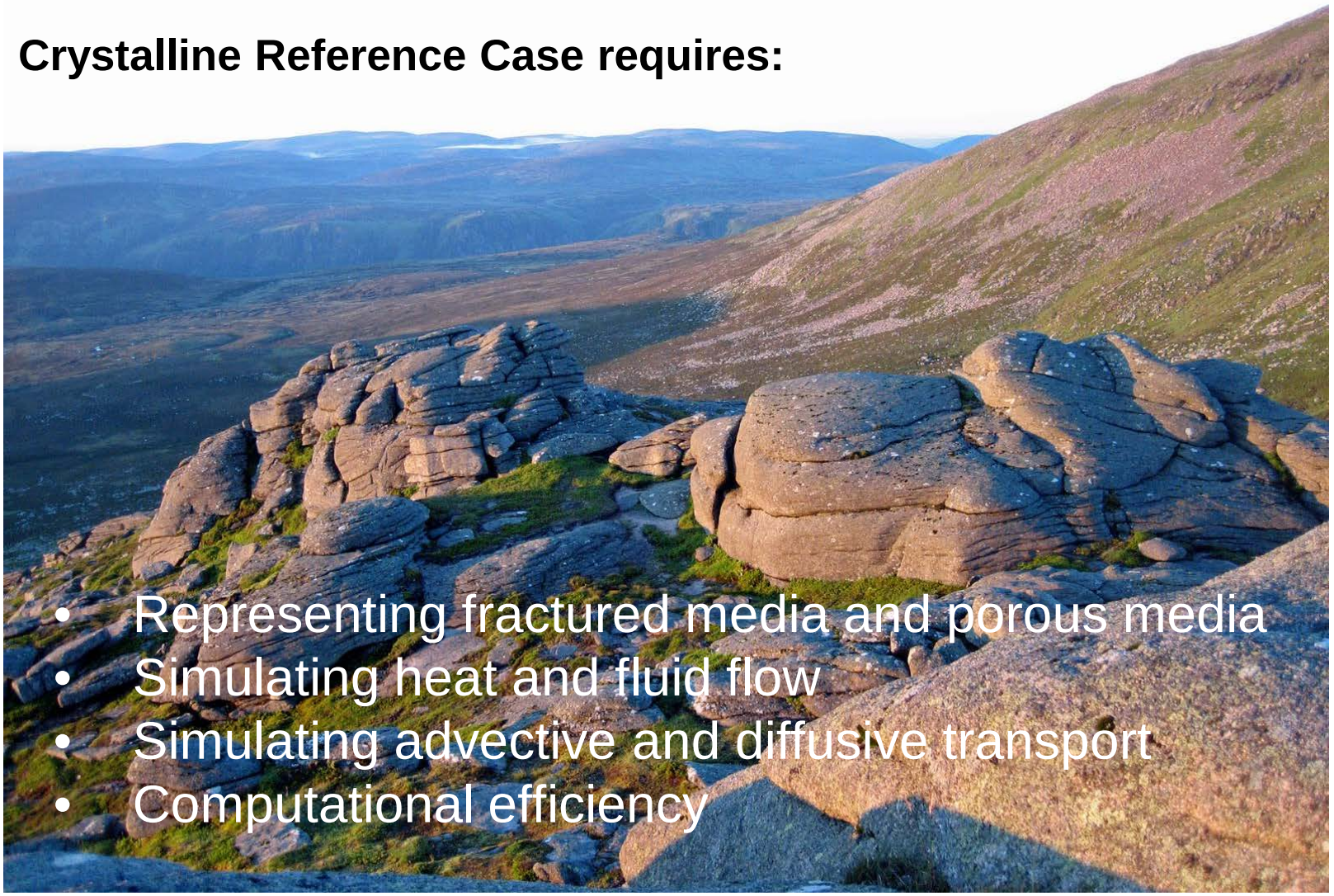
Emily Stein, Kris Kuhlman
Sandia National Laboratories
Nataliia Makedonska, Satish Karra, Jeffrey Hyman
Los Alamos National Laboratory

2016 UFDC Annual Working Group Meeting
GDSA Integration Session, June 8, 2016
Las Vegas, NV

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND2016-5225P

Motivation

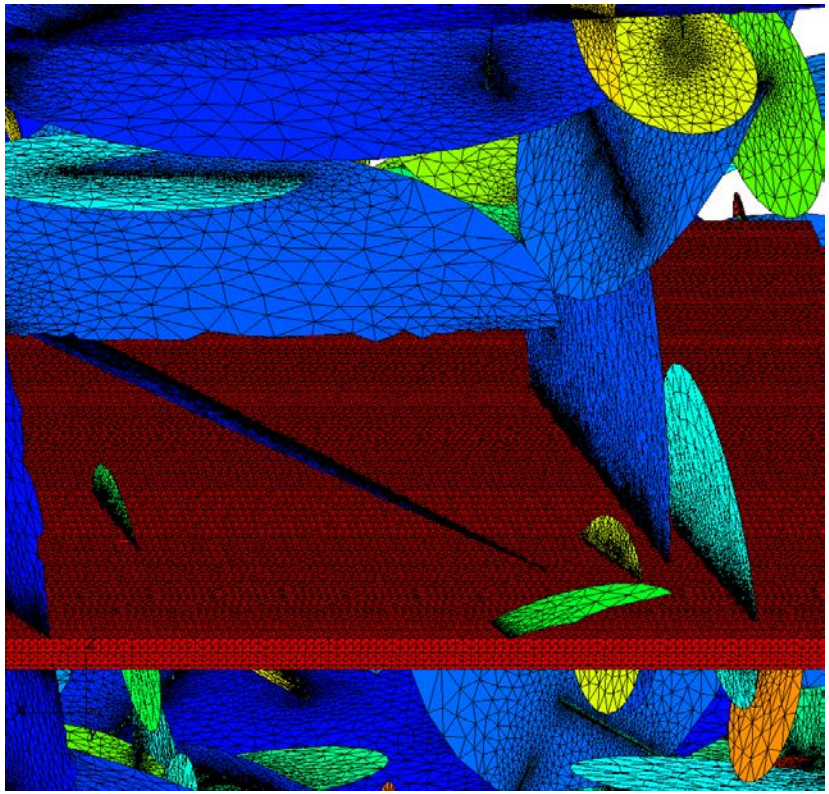
- **Crystalline Reference Case requires:**



- Representing fractured media and porous media
- Simulating heat and fluid flow
- Simulating advective and diffusive transport
- Computational efficiency

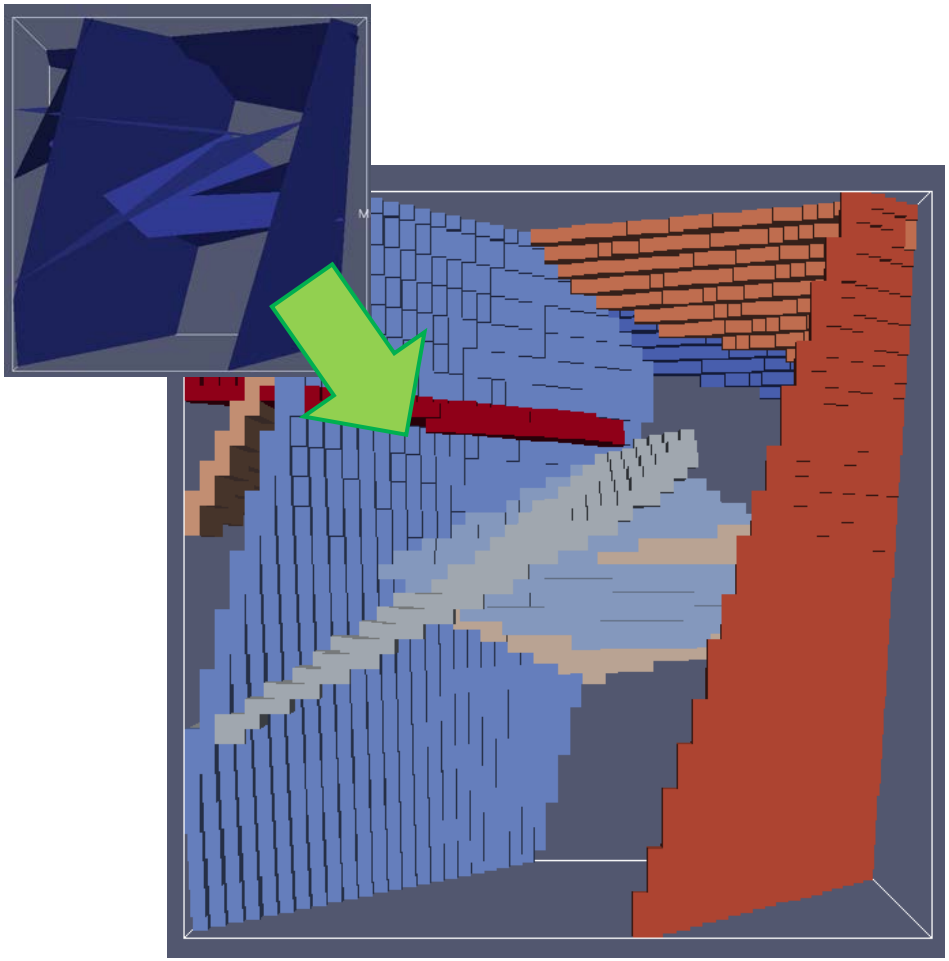
Used Fuel Disposition Options

- Couple Discrete Fracture Network with Continuous Porous Medium



OR

- Map *DFN* to *CPM*

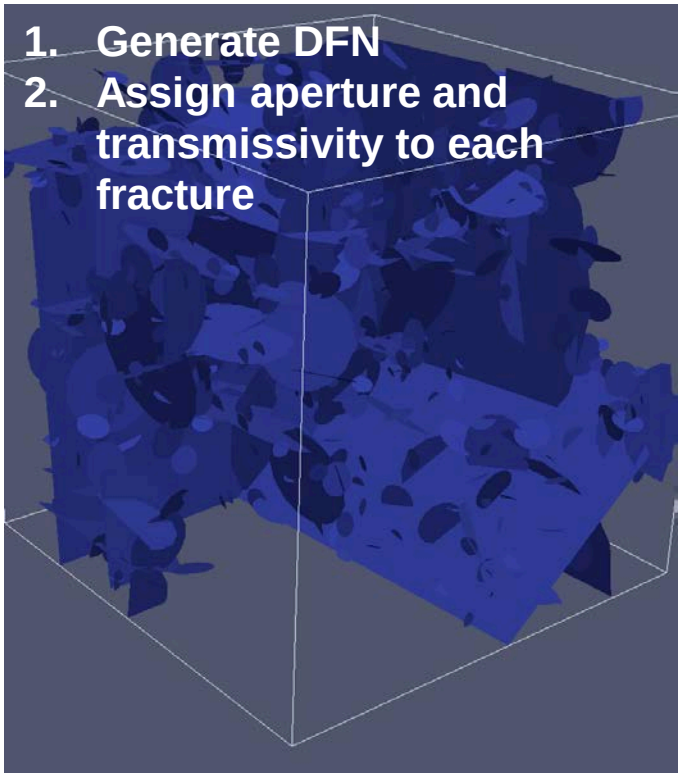


Method

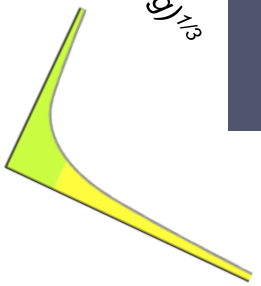
Los Alamos NATIONAL LABORATORY EST. 1943

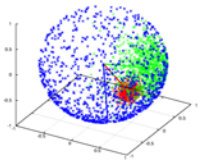
DFNWorks

1. Generate DFN
2. Assign aperture and transmissivity to each fracture



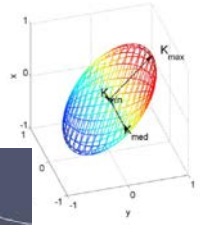
$b=(12T\mu/\rho g)^{1/3}$



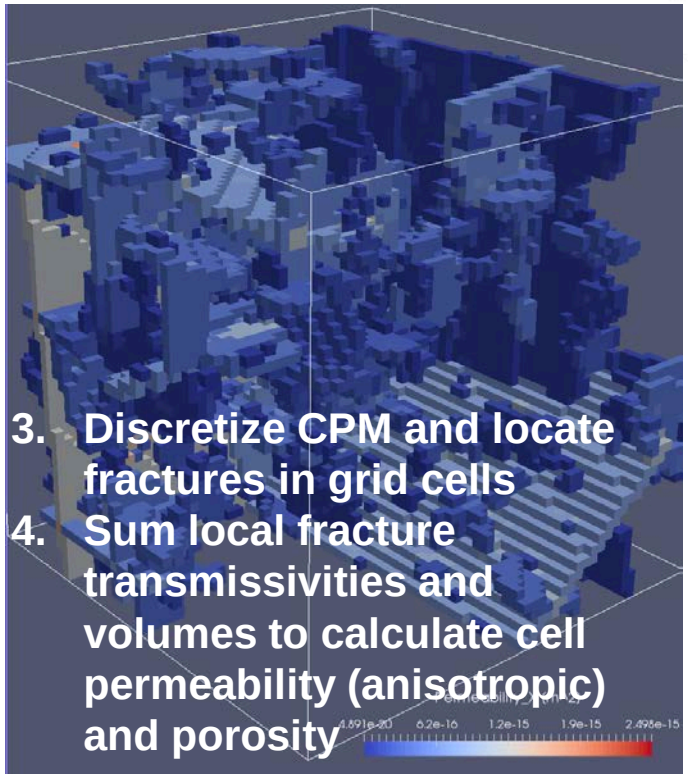


$T=\log(1.6*10^{-9}*r^{0.8})$

$k = T\rho g/\mu b$



$\phi = V_\phi/V_{cell}$



3. Discretize CPM and locate fractures in grid cells
4. Sum local fracture transmissivities and volumes to calculate cell permeability (anisotropic) and porosity

mapDFN

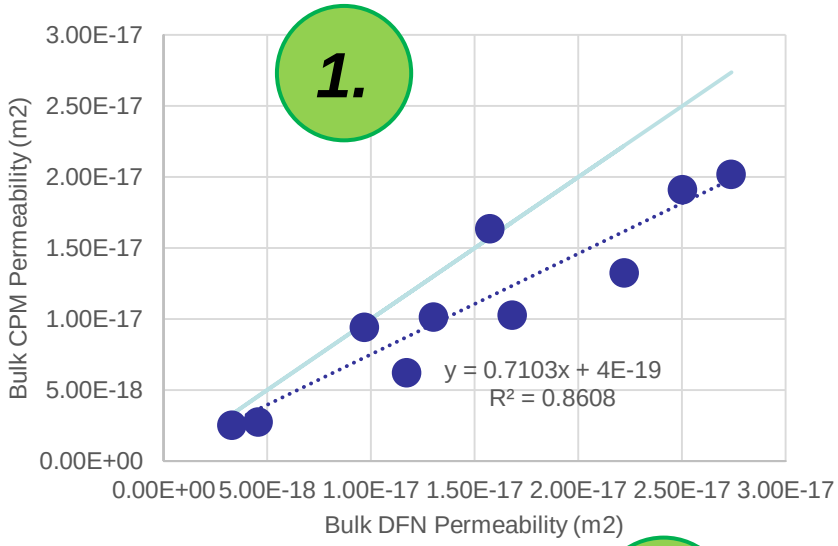
Sandia National Laboratories

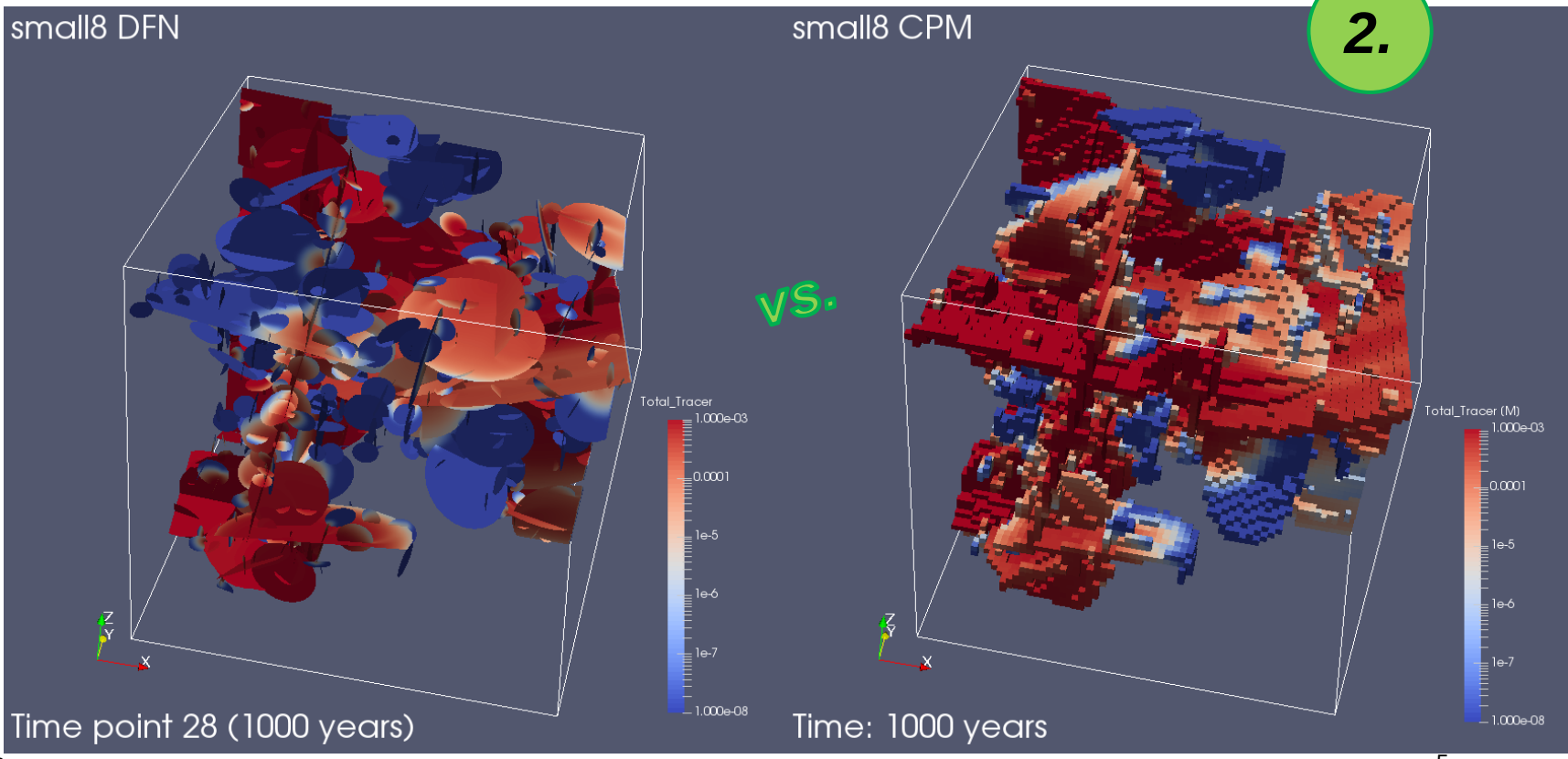
Used Fuel Disposition

Compare:

	DFN	CPM
Number of cells	~1.7 million	287,496
Time to 1 My	103 minutes	1.9 minutes
Path length	the standard	longer
Connectivity	the standard	greater

3.





Success!

- **DFN mapped to CPM:**