

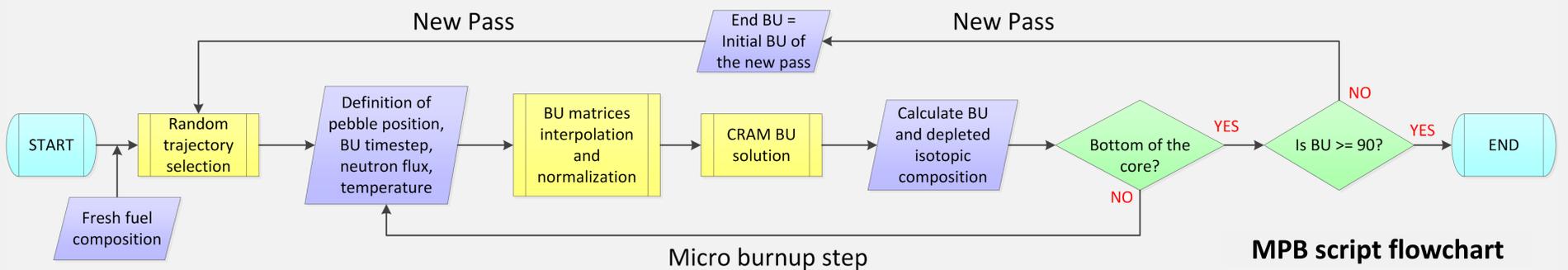
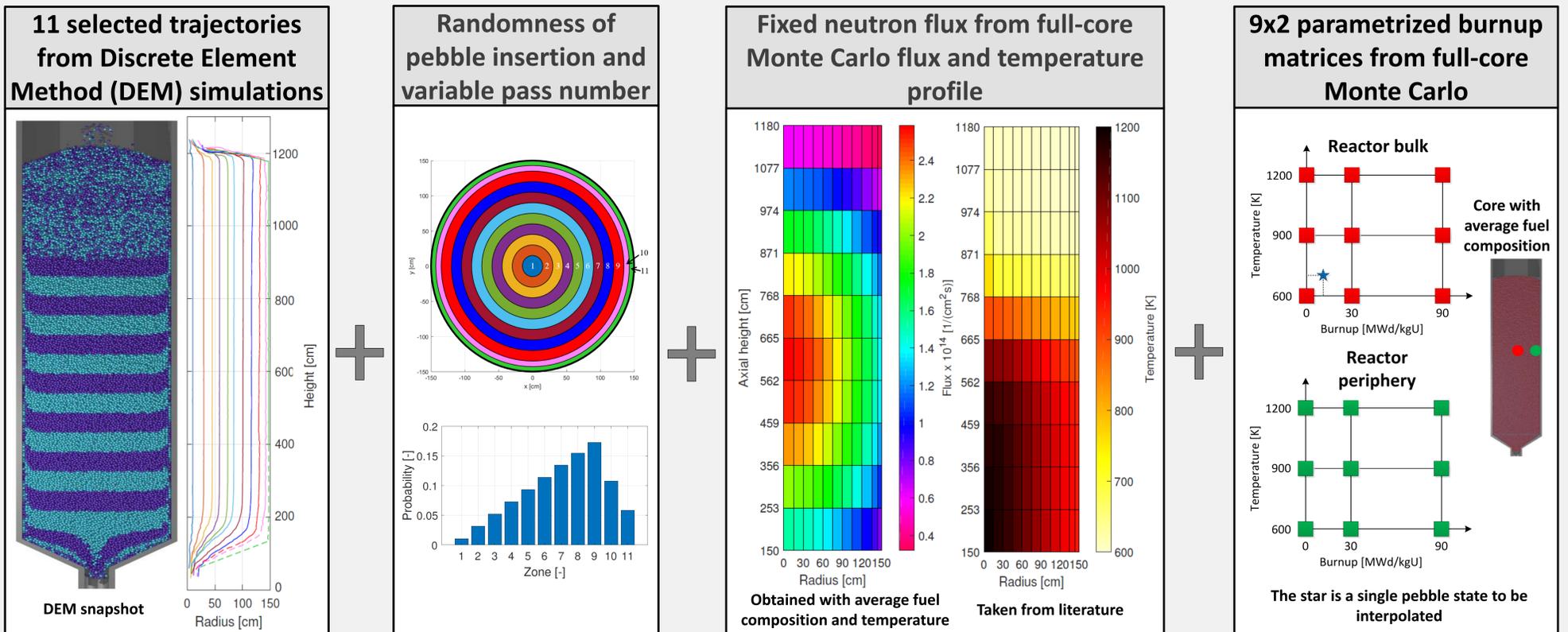
# STATISTICAL BURNUP DISTRIBUTION OF MOVING PEBBLES IN HTR-PM REACTOR

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## INTRODUCTION

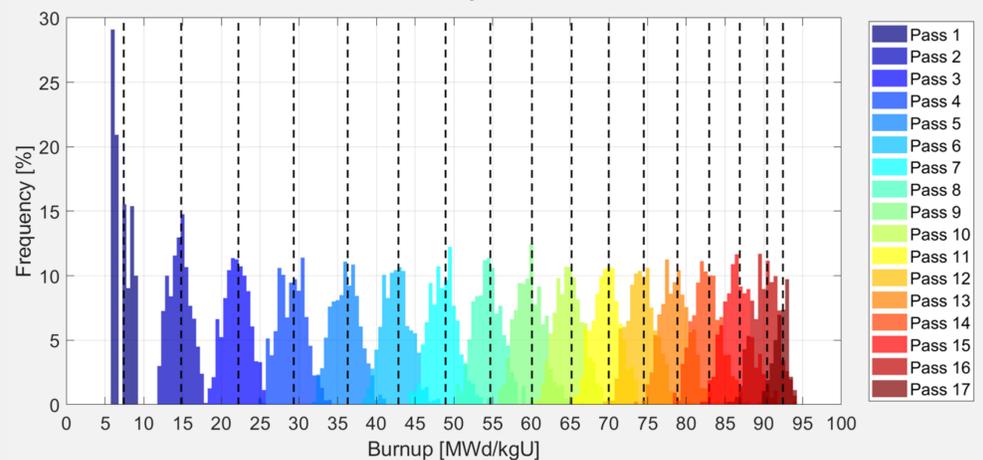
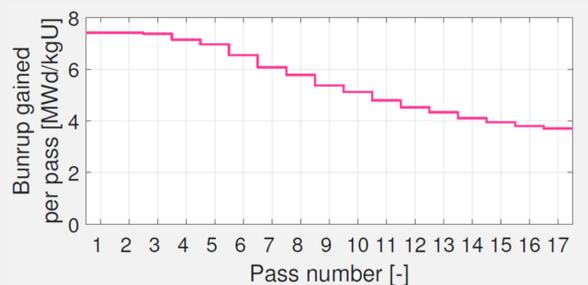
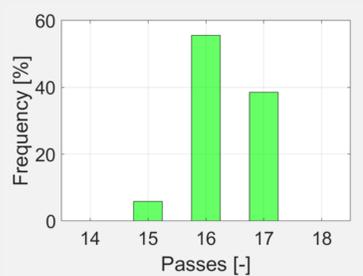
- HTR-PM: Commercial pebble-bed High Temperature Reactor (HTR) demonstration plant under construction in China since 2012.
- Composed by two 250 MWth modules, both graphite-moderated, helium-cooled and with a thermal spectrum.
- 420000 spherical fuel elements flowing in the core and being recirculated up to 16 times.
- Single pebble burnup evolution influenced by the surrounding → Cross sections (XS) generation at core-level.
- **GOAL: Loosely couple exact pebble movement with fuel burnup using parametrized full-core XS generated with Monte Carlo code → MPB script: simulation of 3000 single pebble histories to enable statistic evaluations on the HTR-PM burnup process.**

## LOOSE COUPLING OF PEBBLE MOVEMENT AND FUEL BURNUP: MPB SCRIPT



## STATISTICAL RESULTS WITH MPB SCRIPT FOR 3000 SINGLE PEBBLE HISTORIES

- Statistical burnup distribution for each pass through the HTR-PM core.
- Pebbles discharged between 15 and 17 passes, with 90 MWd/kgU as limit burnup.
- Decreasing average burnup gained per pass → miss-handling of recirculated fuel elements is unlikely to exceed the maximum allowed burnup of 100 MWd/kgU.
- Self-compensating effect due to high number of passes: the core compensates burnup under- or over-runs in the successive passes.



## CONCLUSIONS

- The loose coupling of the exact pebble movement with the fuel burnup has been successfully achieved.
- The fuel cycle and the multi-pass fuel loading scheme of the HTR-PM are well-designed and feasible.