TREAT Transient Shaping

N.E. Woolstenhulme
208-526-1412, Nicolas.Woolstenhulme@inl.gov

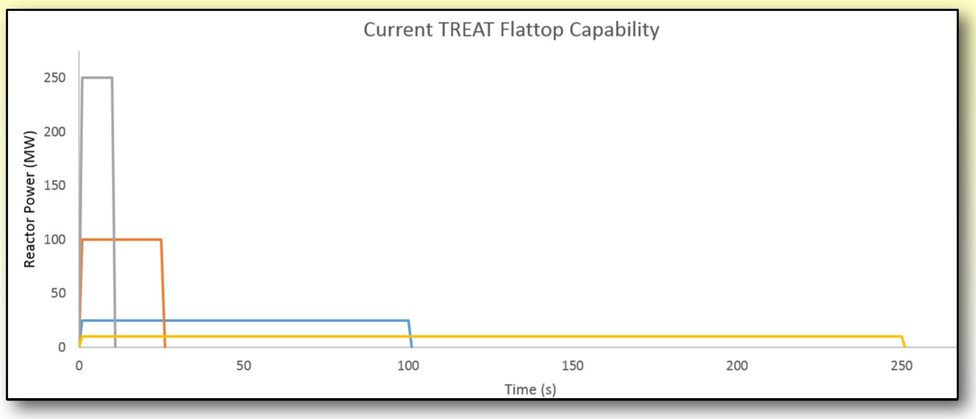
Overview

-The Transient Reactor Test facility (TREAT) can provide flexible power vs. time responses
-Predominately-graphite air-cooled core is self protecting (negative temperature feedback)
-Nimble control rod drive and reactor control systems shape transients
-Current transient limit 2500 MJ core energy release
-Feedback with experiment instrumentation possible

Steady State and Flattop Transients

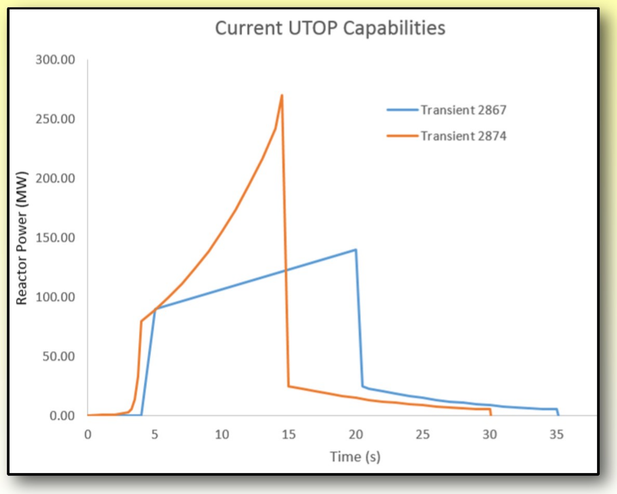
-120 kW steady state core power
1) Specimen power coupling measurements
2) Isotope build-in (e.g. ^{131}I) for follow-on tests
3) Neutron radiography

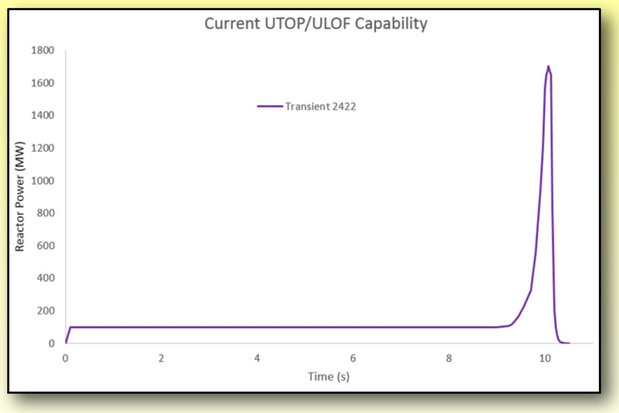
-"Flattops" >120 kW are considered transients
1) Virtually any power level, time limited by 2500 MJ
2) Heat balance and nuclear instrument calibrations
3) Fission heating during TH transients (LOFA)
4) Can precede ramps, pulses, SCRAM decay, etc.



Transient Overpower

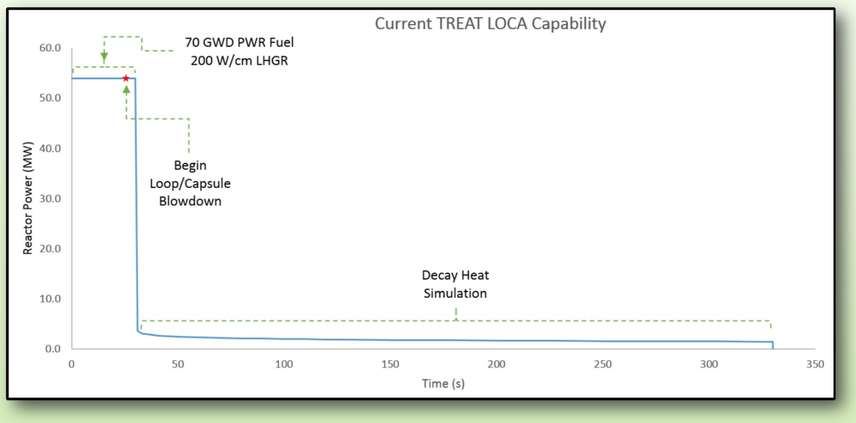
-TREAT has extensive historic with transient over power simulation
-Tuned to achieve desired fuel temperature and/or power history
-Ramp, pulse, shutdown, etc. can be triggered by experiment instruments





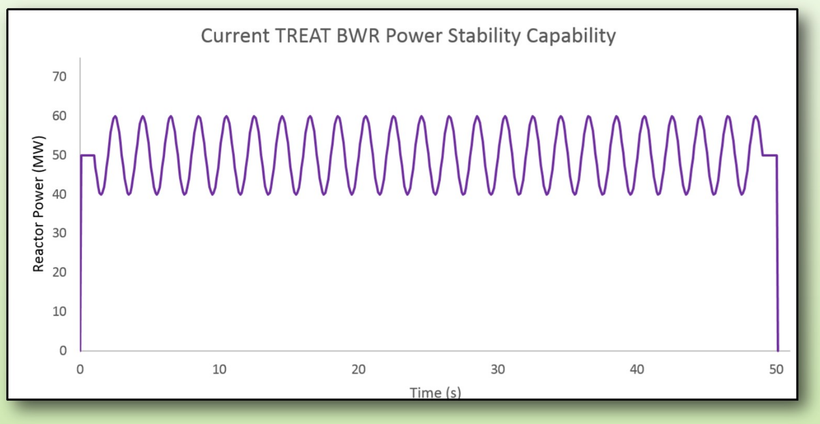
LOCA

-Fission heat provides internal heat generation to simulate decay during LOCA



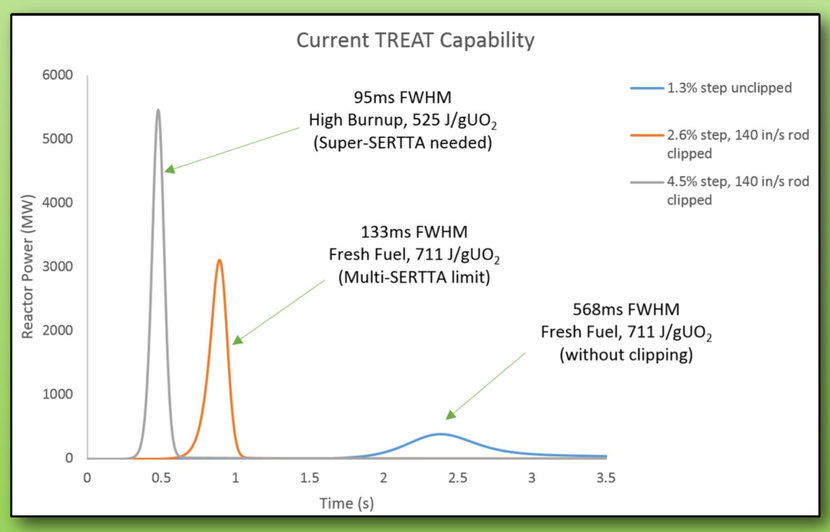
BWR Stability

-Transient rod oscillations to simulate BWR void power instability



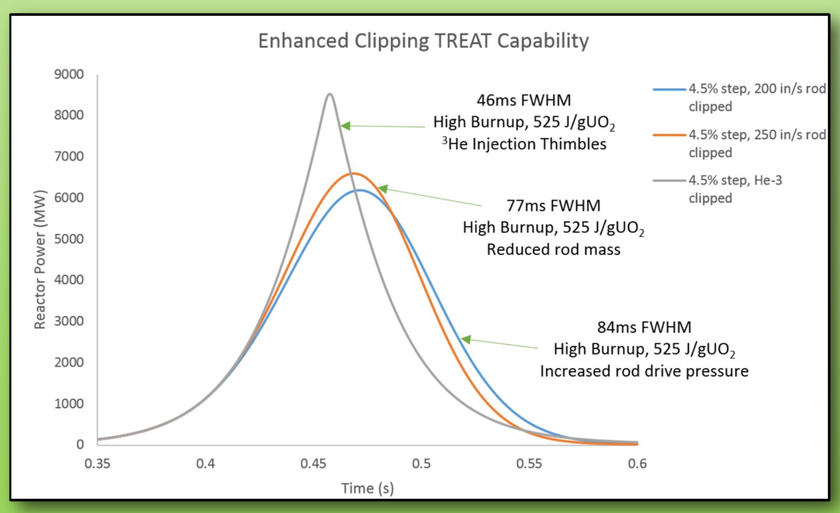
Pulsed Operations (e.g. RIA)

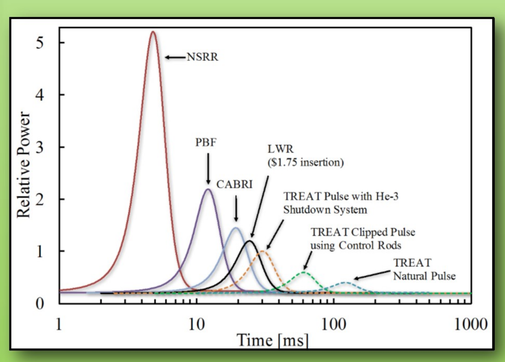
-Step insertion 4.5% Δk/k → 2500 MJ released in ~0.5 sec
1) Big dose for short-lived isotope effect studies
2) Facility's current energy limit
-Step can follow flattop for HFP RIA simulation
-Transient rod "clipping" → narrower pulses
1) Higher capacity vehicles needed for <100ms FWHM



Enhanced Pulsed Operations (HZP RIA)

-Enhanced clipping viable for narrower pulses
1) Better simulation of PWR HZP RIA event
2) Drives high burnup PWR fuel to reg. limits in 46ms FWHM
-Active project currently addressing enhanced clipping design





Capability complemented by partner facilities

Image courtesy of N. Brown