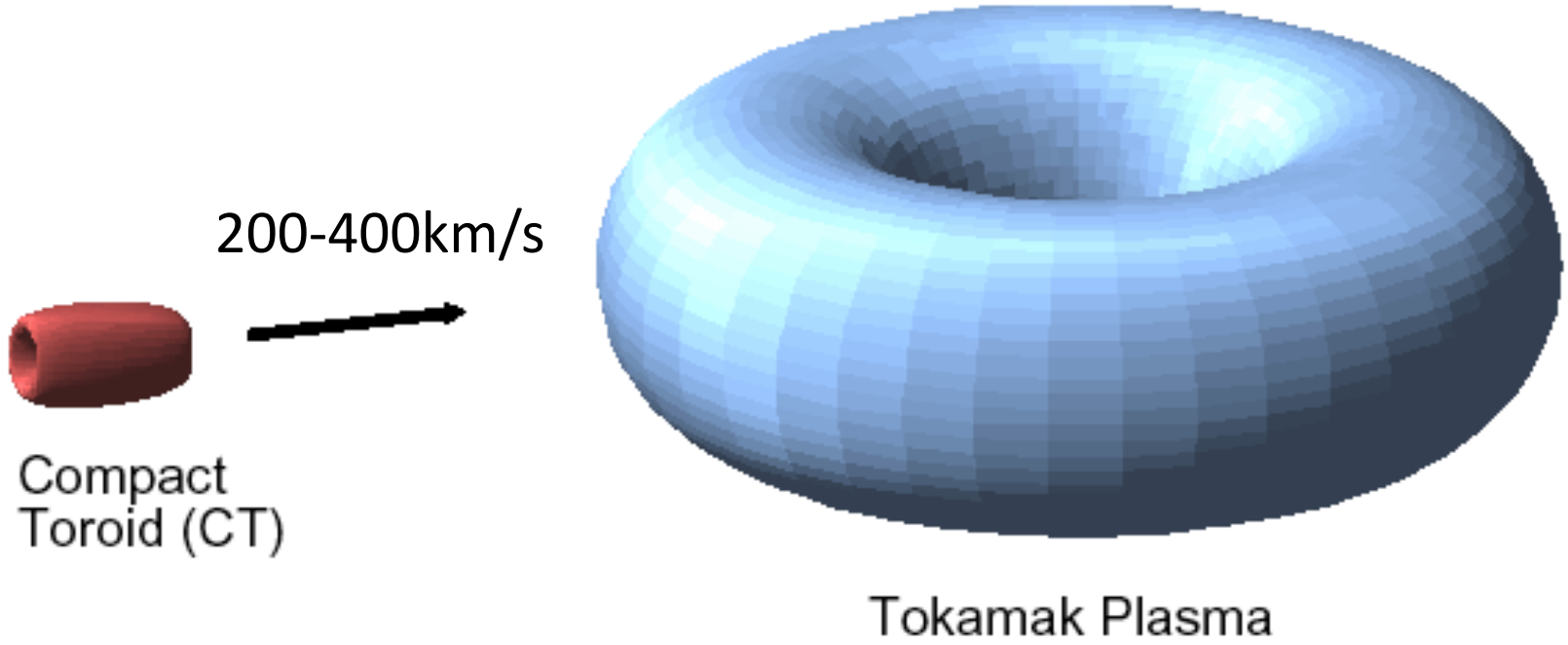
Advanced fueling system for density profile control

In a CT injection system a CT is accelerated to high velocity and injected into the target plasma to achieve deep fueling



CT Penetration time: few μs

CT Dissociation time: < 100 μs

Density Equilibration time: 250 - 1000 μs

Variable Penetration depth: edge to beyond the core

"Steady-state AT & ST scenarios rely on optimized density and pressure profiles to maximize the bootstrap current fraction. Under this mode of operation, the fueling system must deposit small amounts of fuel where it is needed and as often as needed, so as to compensate for fuel losses, but not to adversely alter the established density and pressure profiles"

- A CT injector has the potential to deposit fuel in a ***controlled*** manner at any point in the machine
- In a burning plasma device with only RF for current drive, a flexible fueling system may be the only internal profile control tool
  - Inject momentum for plasma beta and stability
  - Precise density profile control to optimize bootstrap current and to maintain optimized fusion burn conditions
  - Study core transport (He ash removal studies, ELM control)

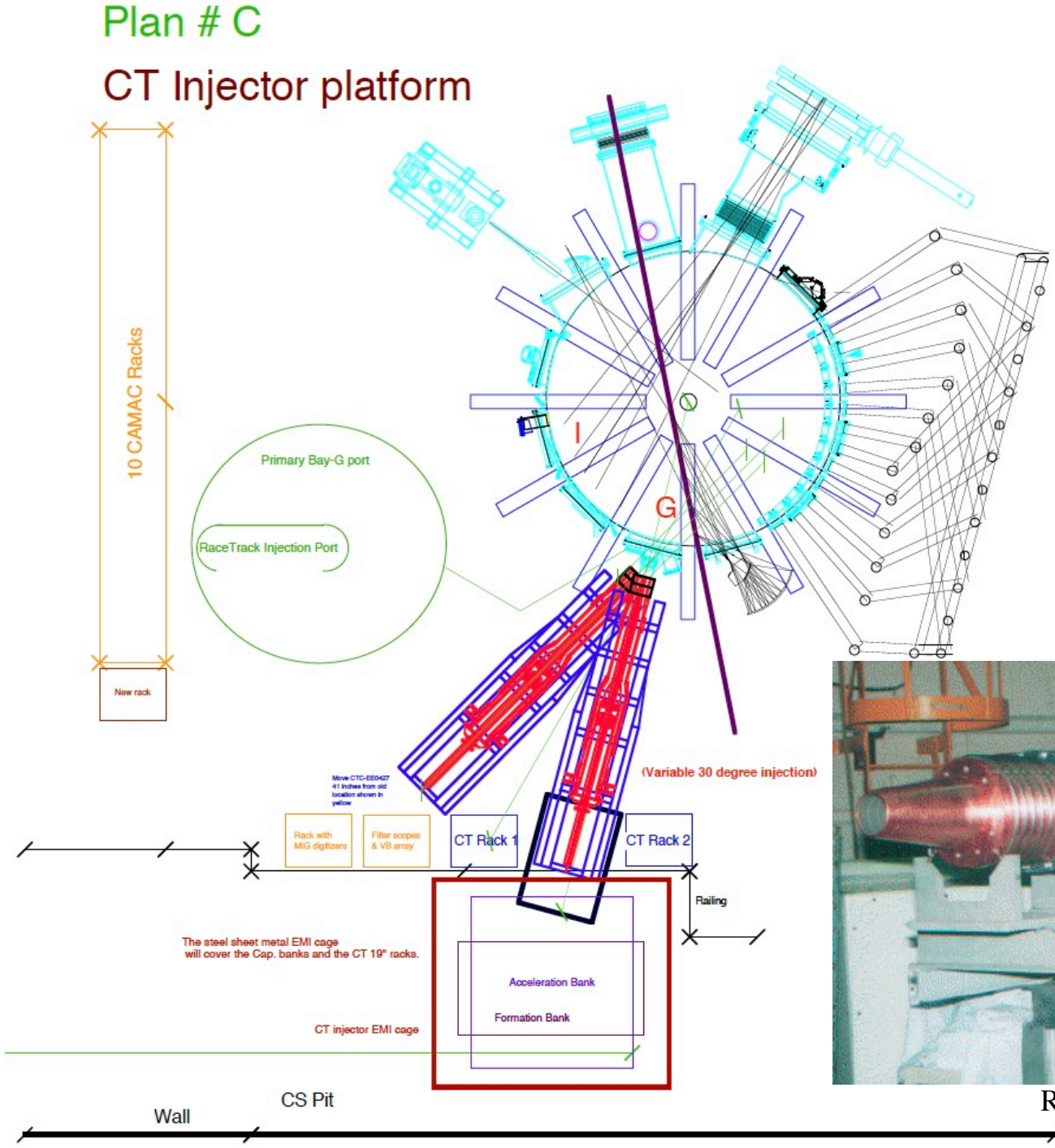
Recent publications

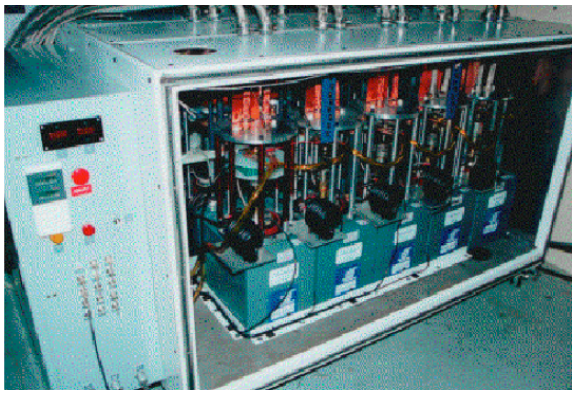
R. Raman, Advanced fueling system for use as a burn control tool in a burning plasma device, Fus. Sci. and Techn., Vol **50**, 84 (2006*) – describes density profile control*

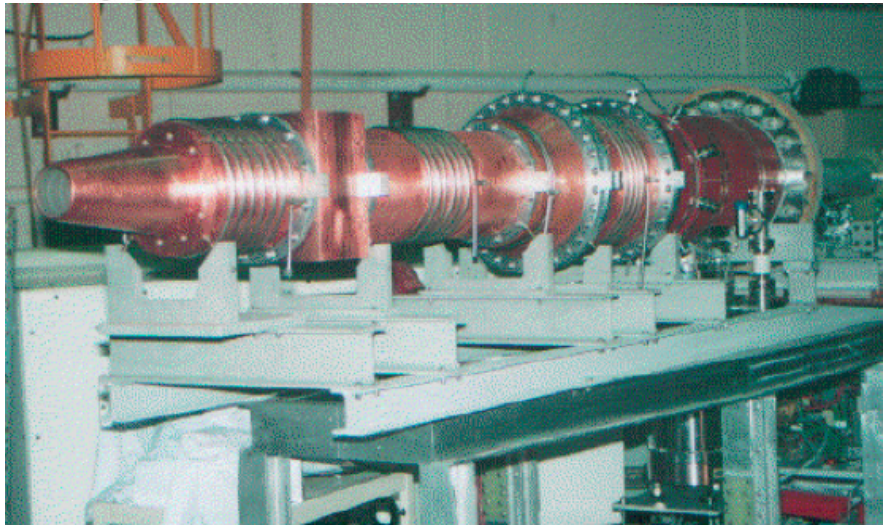
R. Raman, Advanced Fueling System for Steady-State Operation of a Fusion Reactor, Fus. Sci. and Techn., **54**, 71 (2008) *- describes improved usage of tritium*

R. Raman, Advanced Fuelling System for ITER, Fusion Engineering and Design, **83**, 1368 (2008) *– system looks attractive for ITER, should be easier in a ST reactor*

Layout in NSTX-U Test Cell







R. Raman, T.R. Jarboe, et al., – CT for NSTX-U -02072012