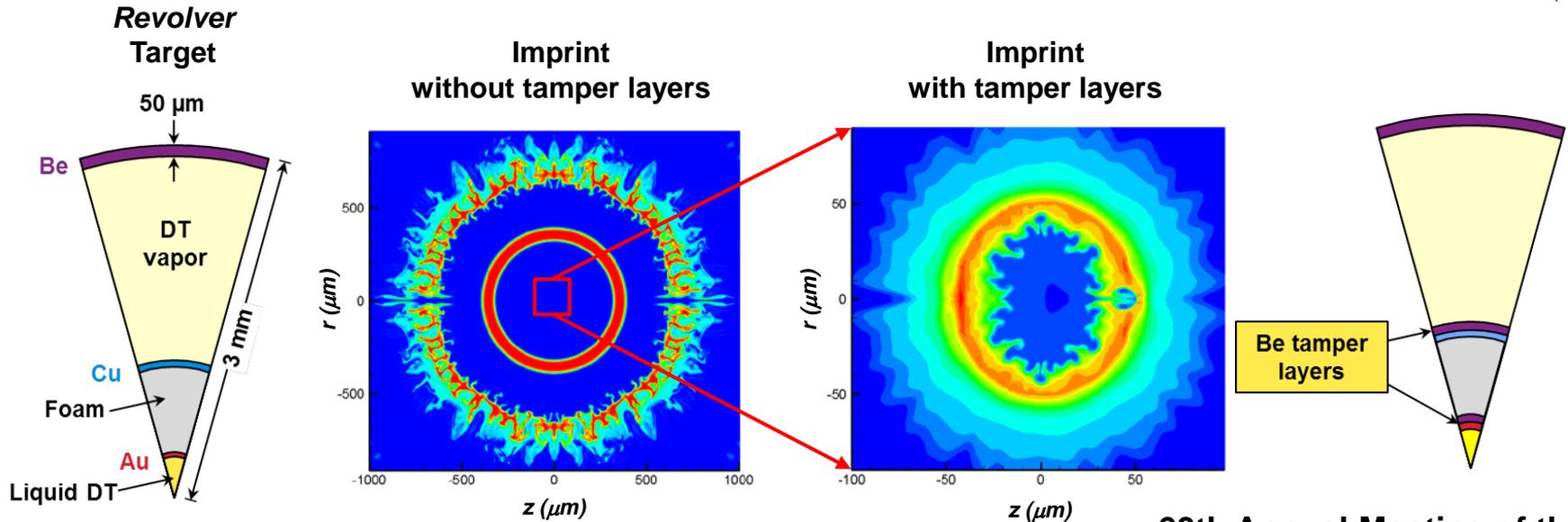


# Numerical Investigation of Laser Imprint Mitigation in Revolver Ignition Designs



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# The use of beryllium tamper layers in *Revolver* capsules significantly reduces the development of imprint perturbations at stagnation



- **Laser-imprint seeding of high-mode perturbations in *Revolver* ablators leads to in-flight failure of the copper driver.**
- **Application of a beryllium tamper layer in double-shell designs\* has been shown to mitigate the growth of high-mode perturbations.**
- **A single tamper layer on the copper driver plate does stabilize its growth, but is not sufficient in protecting the bare gold pusher from short-scale perturbations.**

\*E. Loomis, “*Using Double Shell Targets for High-Yield Experiments at the NIF,*” LA-UR-17-21662, (2017).

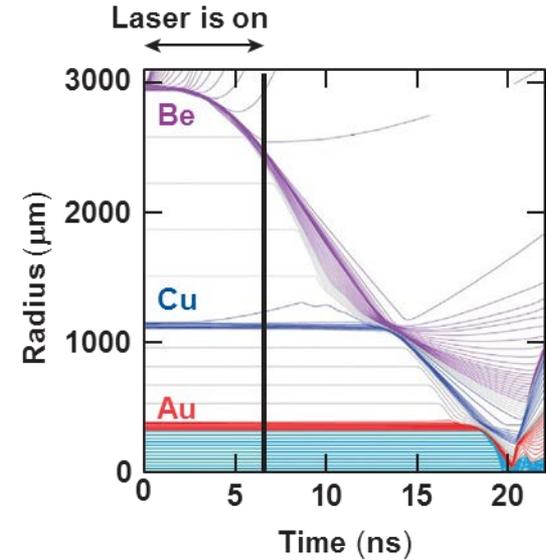
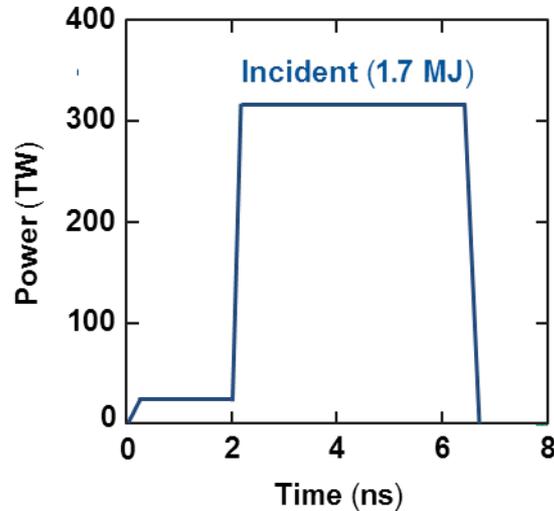
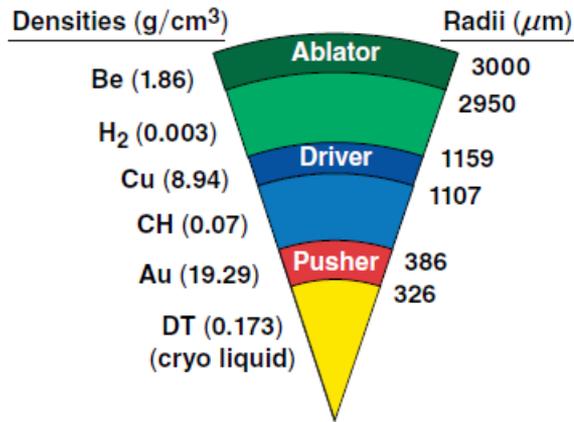
**T. J. B. Collins, J. A. Marozas, and E. M. Campbell**

**University of Rochester**

**K. Molvig and M. Schmitt**

**Los Alamos National Laboratory**

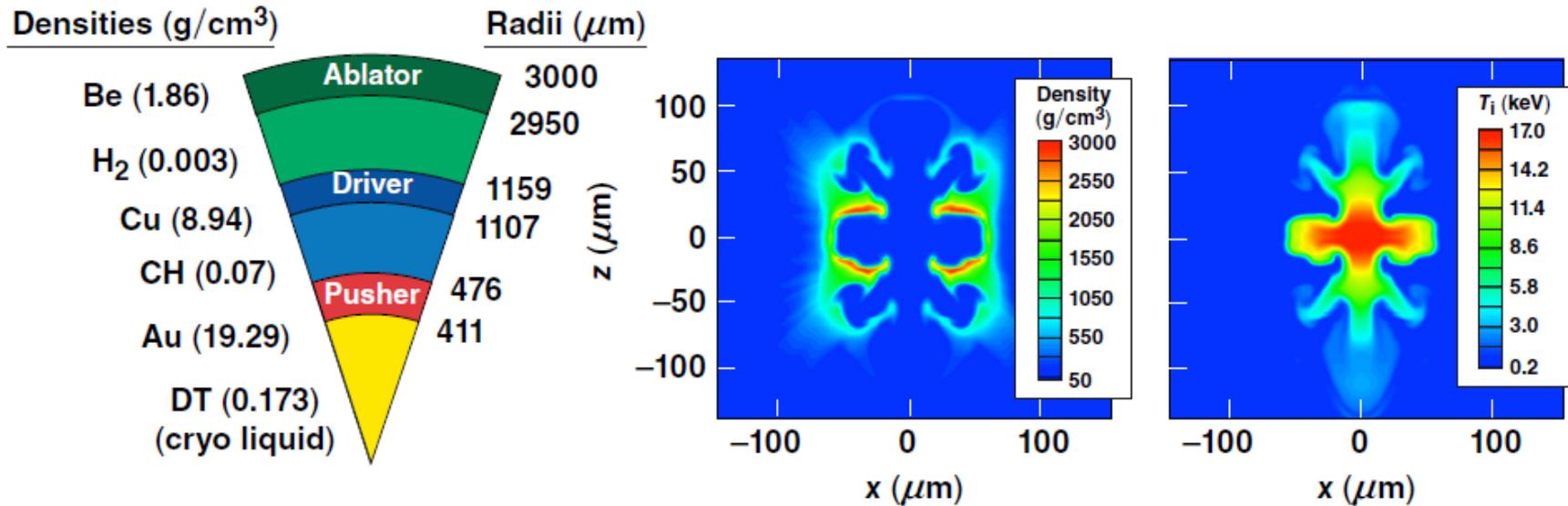
# The *Revolver* NIF design\* employs 1.7 MJ and, using symmetric illumination, returns a modest gain of ~3



\*K. Molvig *et al.*, Phys. Rev. Lett. **116**, 255003 (2016).

# The latest *Revolver*-PD design\* employs a slightly larger gold pusher and 1.85 MJ, returning a modest gain of $\sim 1.1$

- Design employs custom phase plates and  $\pm 6 \text{ \AA}$  (UV) wavelength detuning

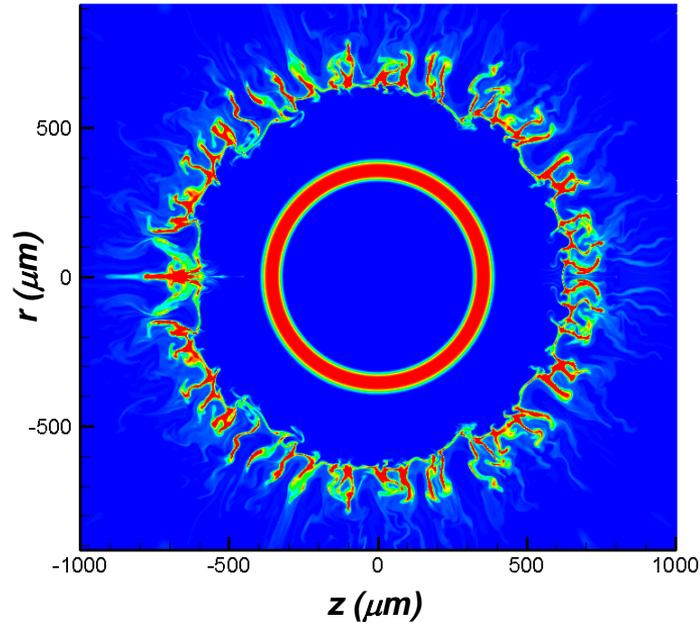


\*P. McKenty *et al.*, <http://meetings.aps.org/link/BAPS.2017.DPP.NO7.5>

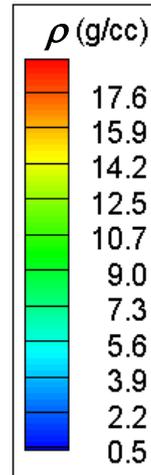
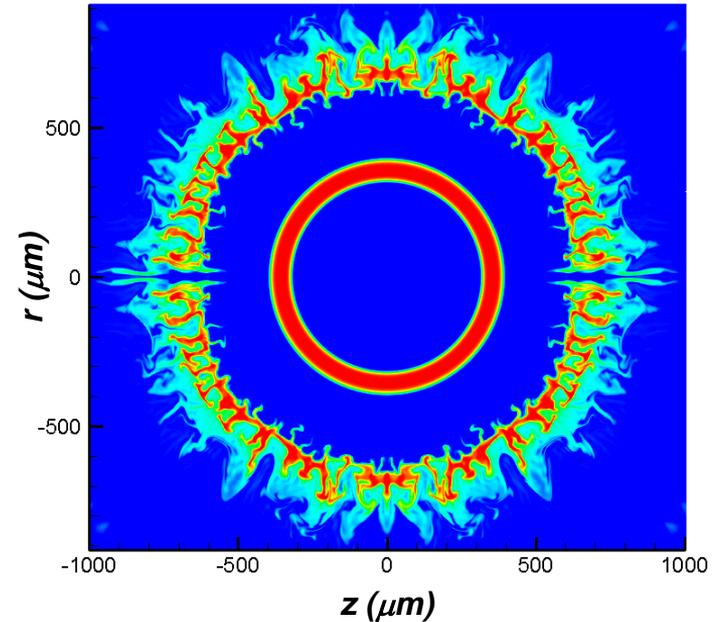
# Laser imprint represents a significant challenge to *Revolver*, seeding critical perturbation growth in the copper driver layer

- Simulations examine 60-beam symmetric beam geometry

No laser smoothing

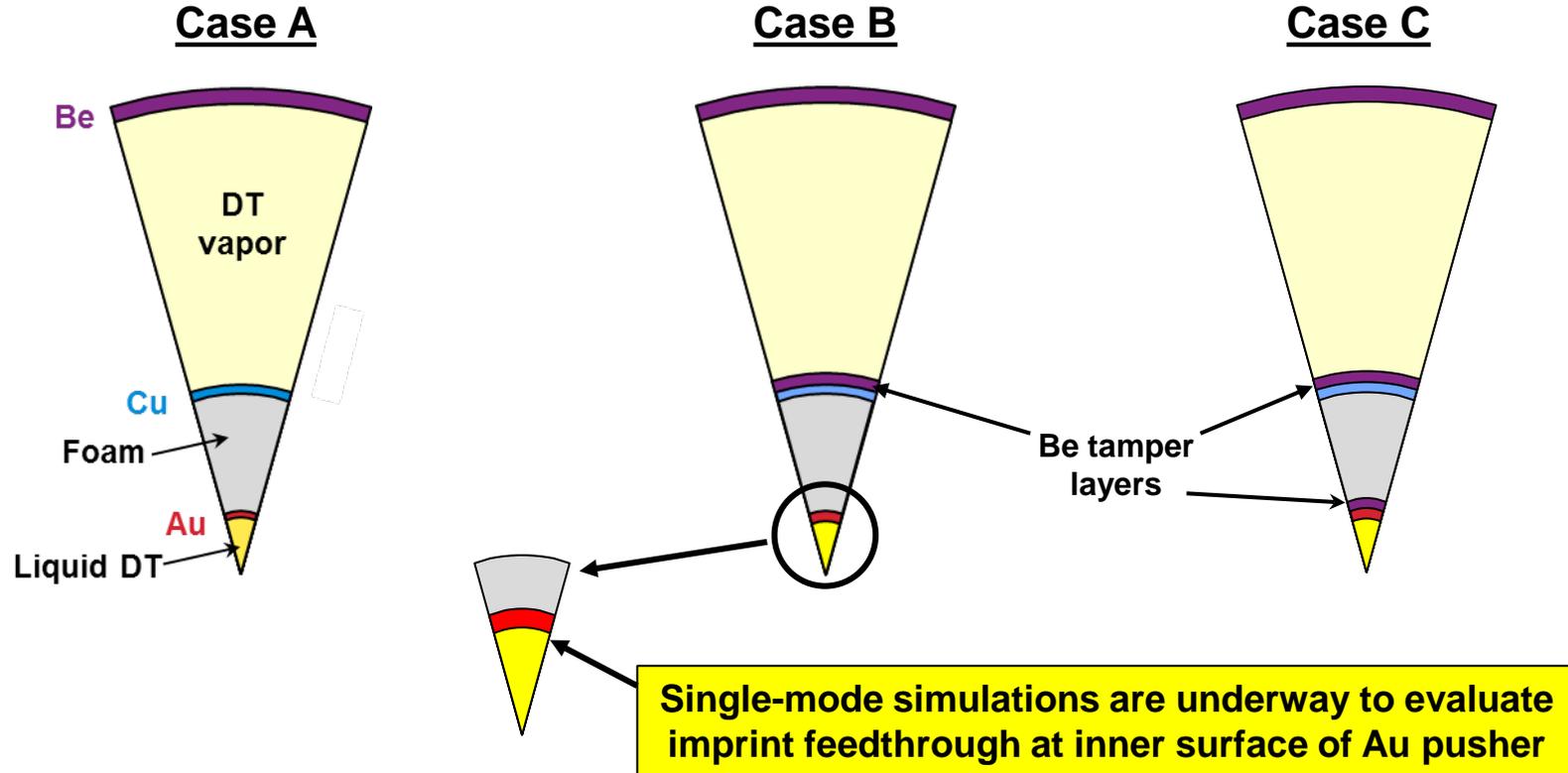


2-D SSD smoothing





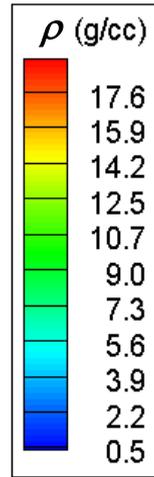
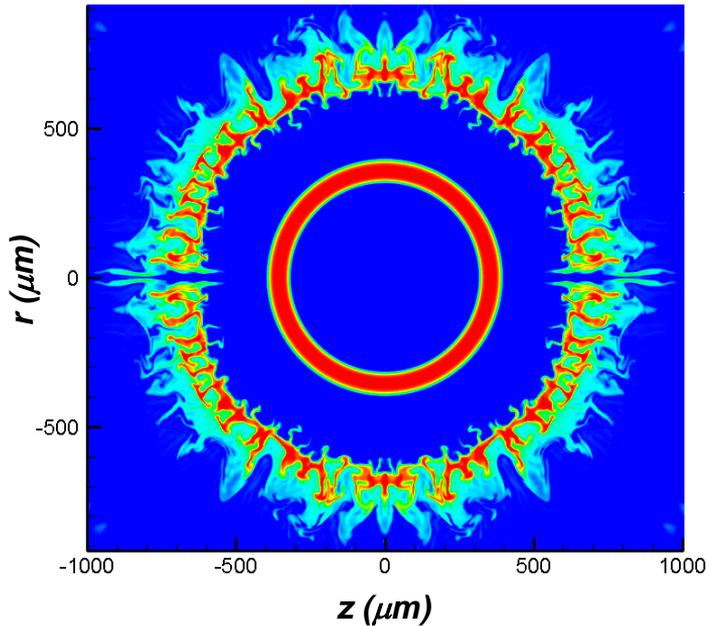
# Beryllium tamper layers are being studied to control imprint seeding and feedthrough at the copper and gold shells in *Revolver*



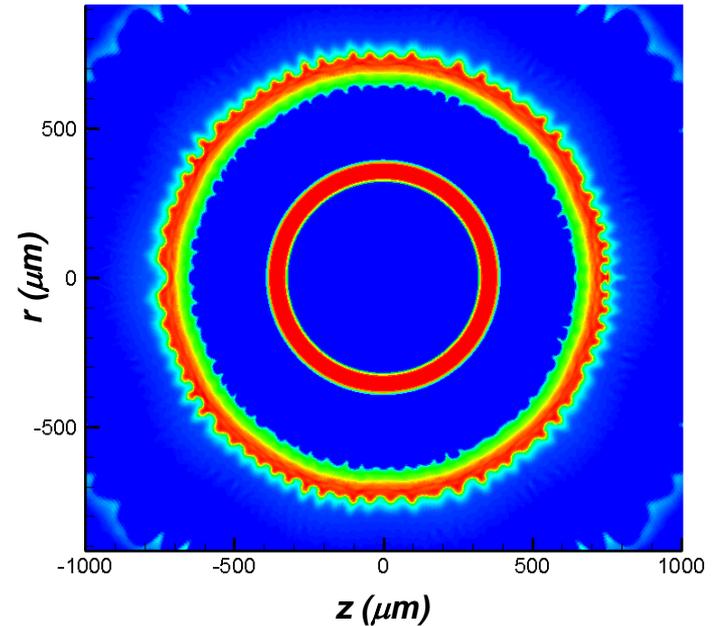
# Application of a beryllium tamper layer onto the copper driver shell leads to a dramatic reduction of the in-flight perturbations

**t = 16 ns**

**Case A – No tamper layers**

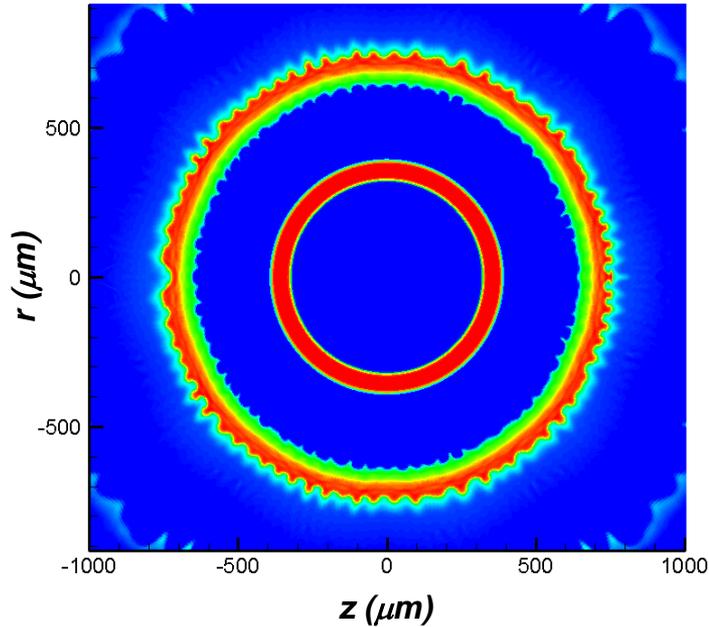


**Case B – Cu layer tamper**

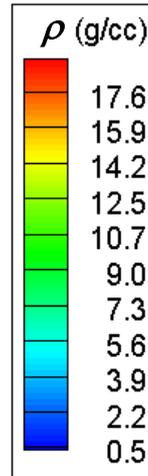
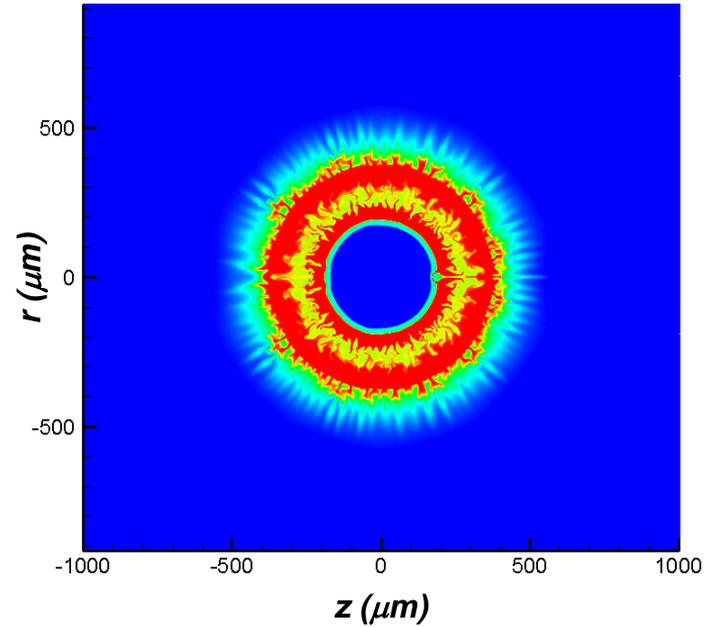


# The in-flight perturbations due to a tamped copper driver still imprint critical growth onto the bare gold pusher

Case B -  $t = 16\text{ns}$



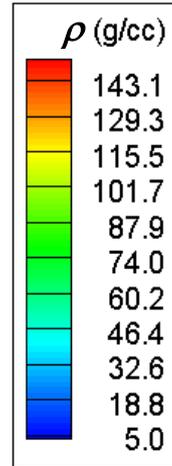
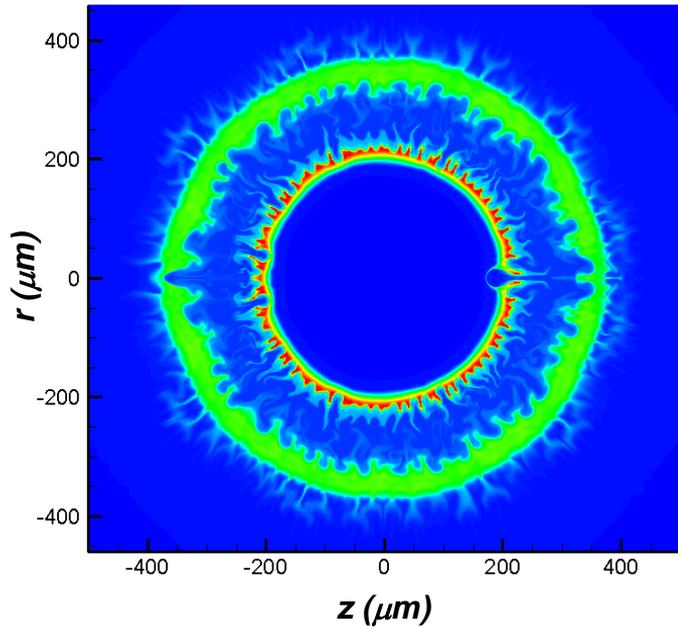
Case B -  $t = 19\text{ns}$



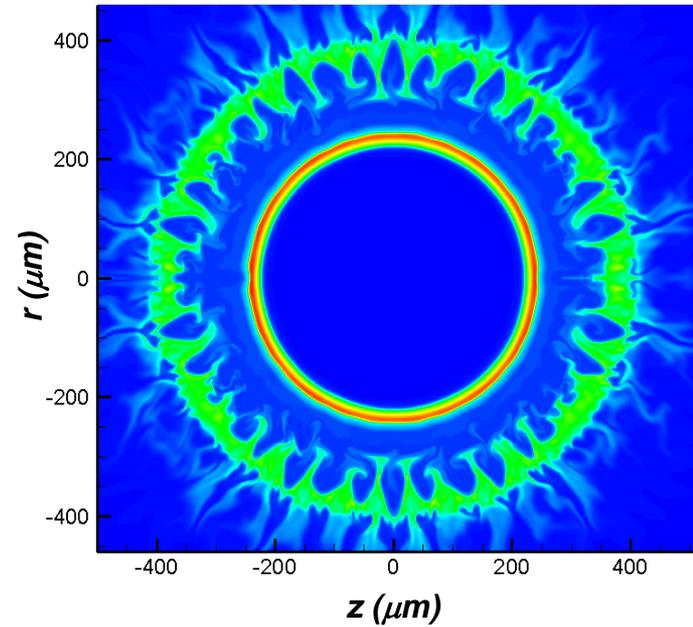
# The addition of a beryllium tamper onto the outside of the gold pusher significantly reduces the development of high-order modes

$t = 19 \text{ ns}$

Case B – Cu layer tamper

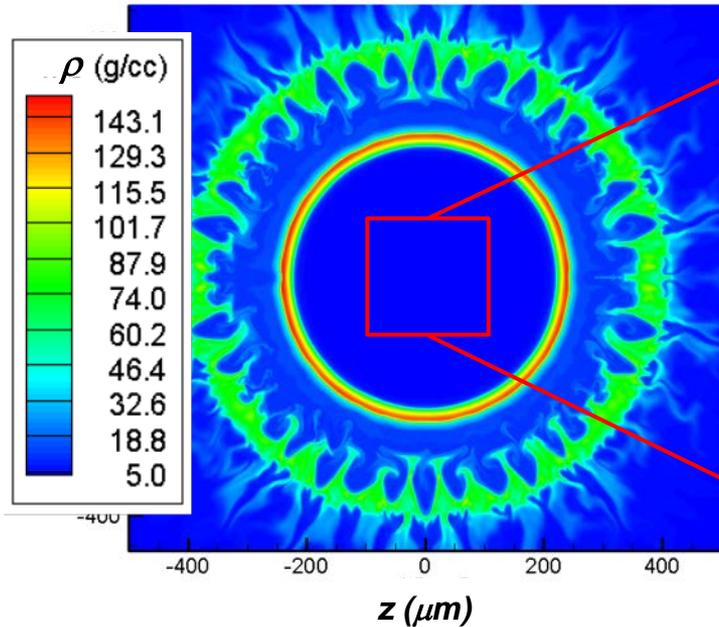


Case C – Dual tampers

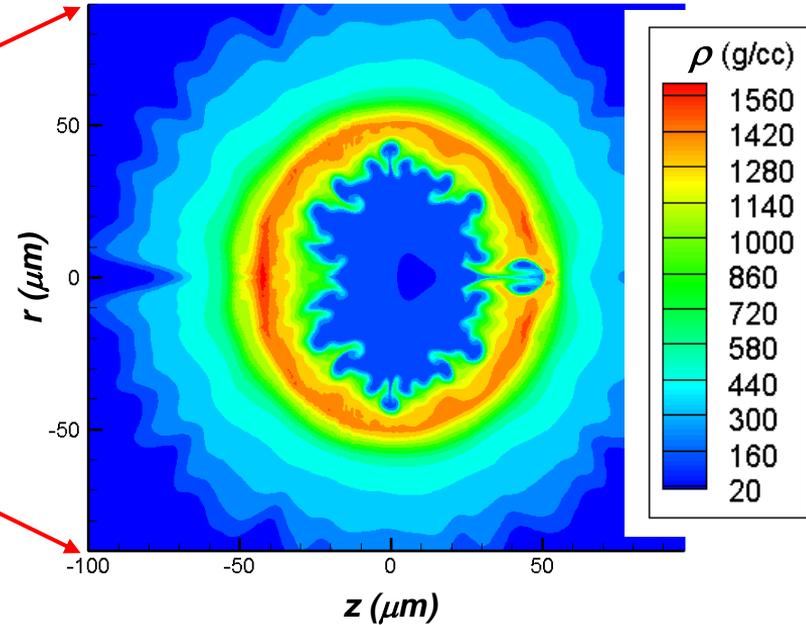


# The current dual-tamper *Revol/ver* design fails to ignite, but stagnation is dominated by mid modes ( $\ell \sim 20$ to $30$ ), not by imprint modes

Case C –  $t = 19$  ns



Case C –  $t = 20.75$  ns



# The use of beryllium tamper layers in *Revolver* capsules significantly reduces the development of imprint perturbations at stagnation



- Laser-imprint seeding of high-mode perturbations in *Revolver* ablators leads to in-flight failure of the copper driver.
- Application of a beryllium tamper layer in double-shell designs\* has been shown to mitigate the growth of high-mode perturbations.
- A single tamper layer on the copper driver plate does stabilize its growth, but is not sufficient in protecting the bare gold pusher from short-scale perturbations.

**Tamper layers will now be studied on the *Revolver*-PD ignition design**

\*E. Loomis, “Using Double Shell Targets for High-Yield Experiments at the NIF,” LA-UR-17-21662, (2017).