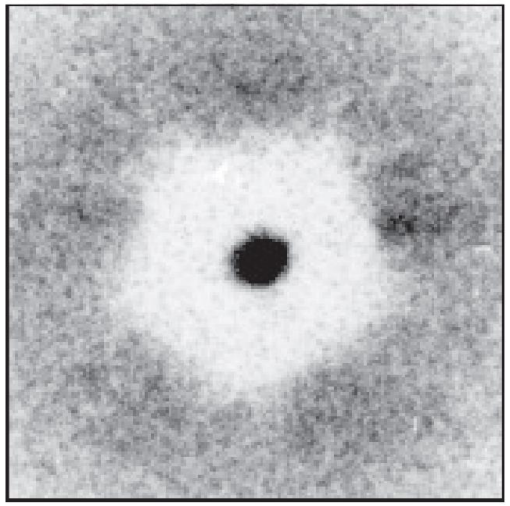
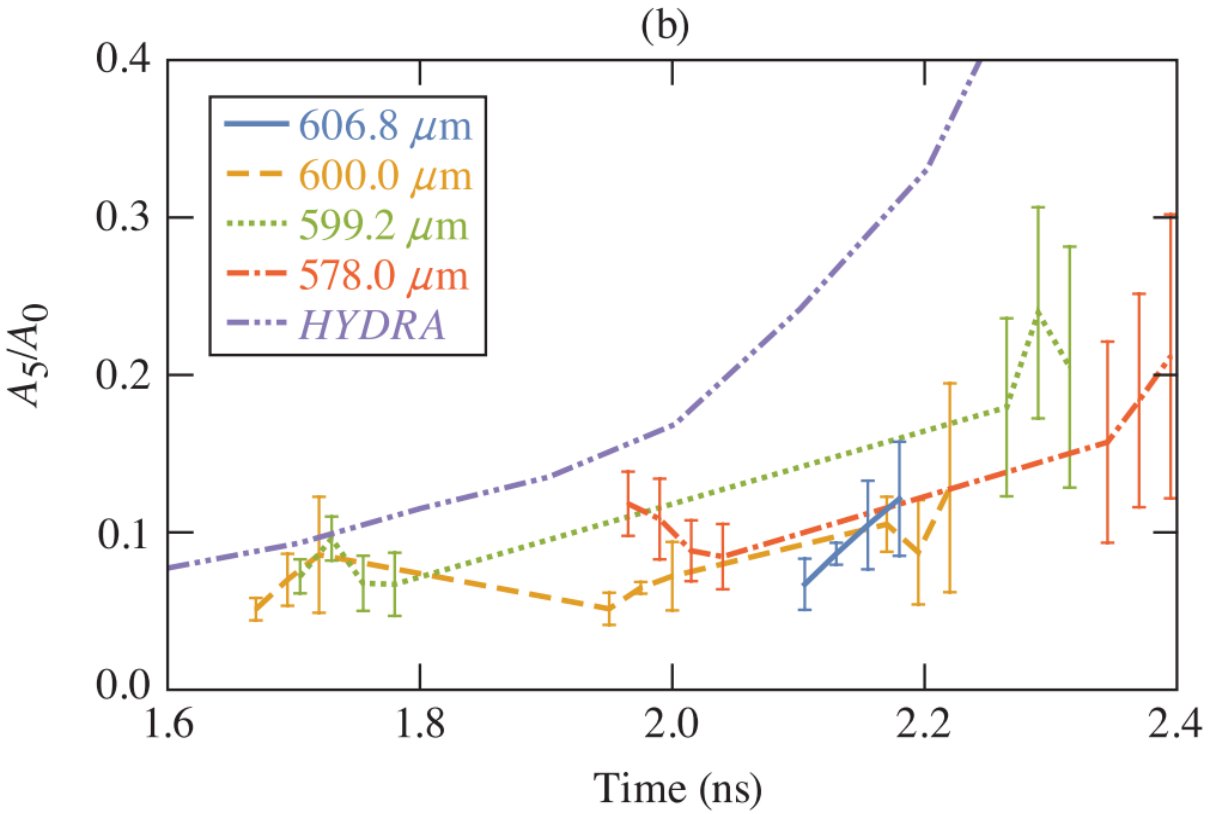
Achieving an axial uniform cylindrical implosion on OMEGA

HYDRA Simulation

Experiment





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62nd Annual APS DPP Meeting
Virtual (COVID-19)
November 9-13 2020

Summary

Azimuthal uniformity was achieved by distributing the beam centers evenly in angular space and measured with self-emission x-ray radiography

- Cylinders of different shell thicknesses and outer diameters imploded with the standard beam pointing, demonstrating a mode 5 perturbation is present and does not depend on target parameters

- Despite a mode 5 perturbation in the hard cylinder illumination profile persisting in the adjusted pointing, no perturbation was observed using the adjusted pointing

- HYDRA simulations show a higher degree of mode 5 and a higher degree of uniformity for the two pointing cases without the need to include CBET

A 2.2% mode 5 perturbation in the hard cylinder illumination profile has no observed mode 5 in x-ray self emission images

Motivation

Cylindrical geometry drive uniformity studies provide a basis of relating hard surface illumination profiles to shell uniformity in flight

- Highlights pointing limitations for the OMEGA laser system
- Highlights discrepancies between code prediction of implosion uniformity and experiments
- Establishes a minimum perturbation amplitude to observe drive uniformities of a shell in flight

Collaborators

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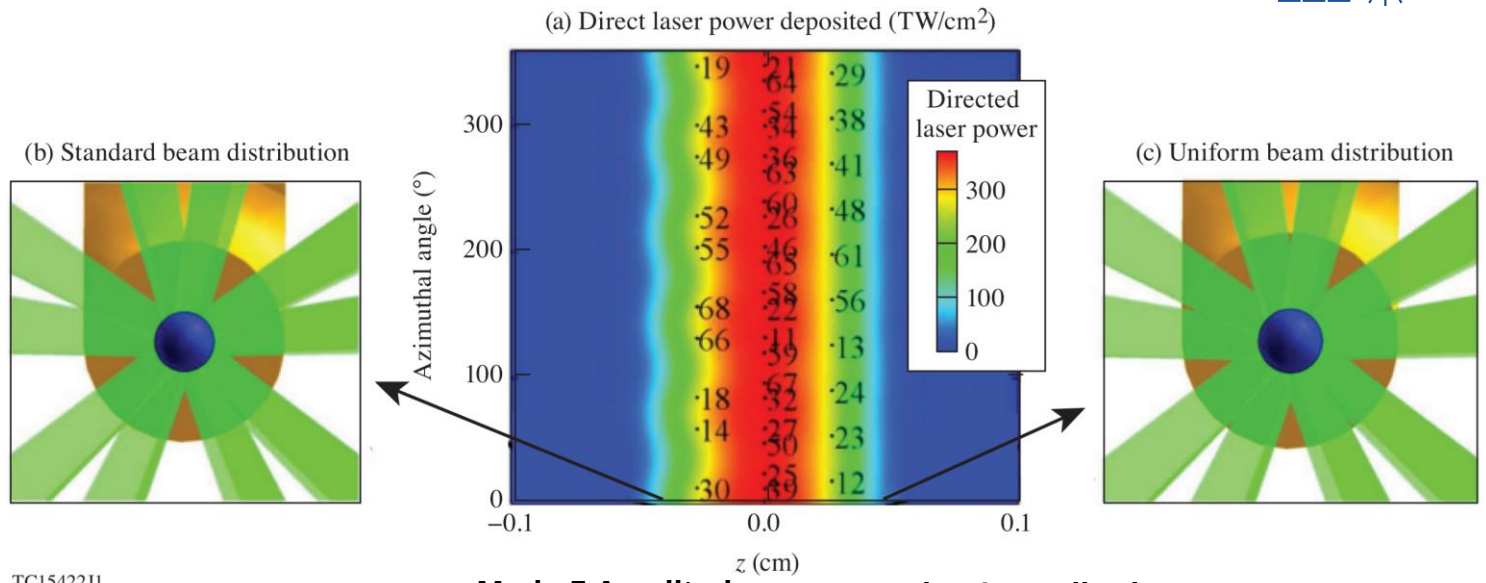
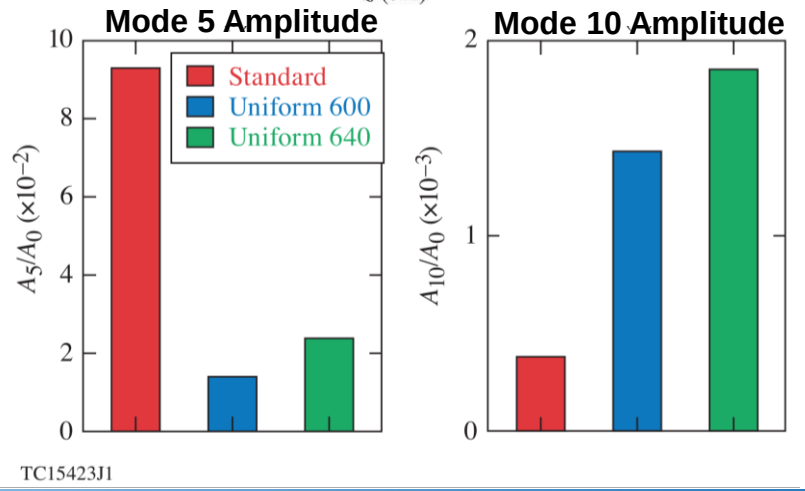
Hard cylinder illumination profiles show a mode 5 perturbation from the standard pointing geometry of the OMEGA laser

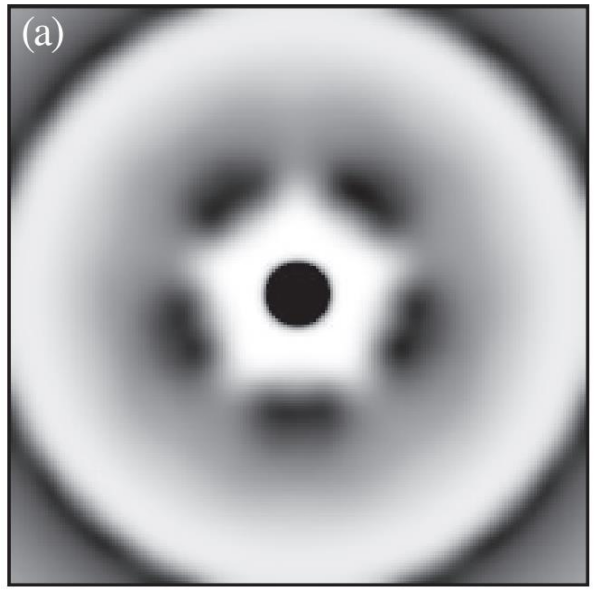
- A ring of 10 beams come in as five pairs around the cylinder creating the mode 5
- Adjusting the pointing azimuthally reduces the mode 5 but not entirely
- Mode 10 amplitude increases, but mode 5 is still an order larger

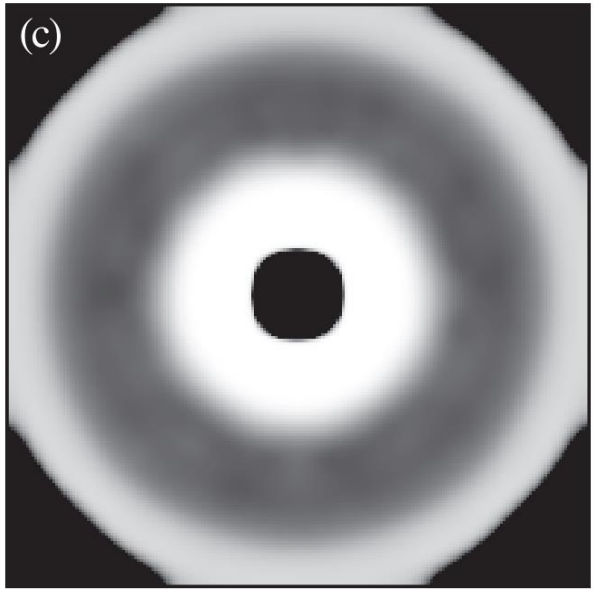




HYDRA was used to simulate pointing conditions in 3D geometry and reproduce x-ray self-emission radiographs from experiment

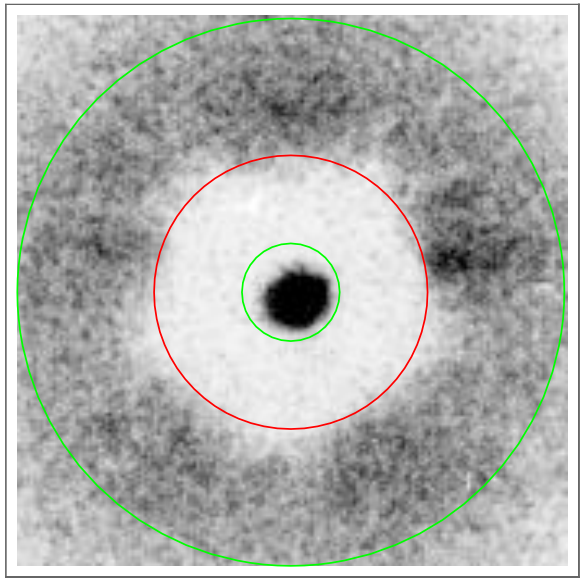
- 3D ray tracing calculates the trajectory and absorption of laser light
- Self-emission x-ray images produced using Yorick interpreted language, convolved with an instrument PSF, using identical filtration to the framing cameras used in experiments
- HYDRA images are analyzed in the same way as experimental images (next slide)

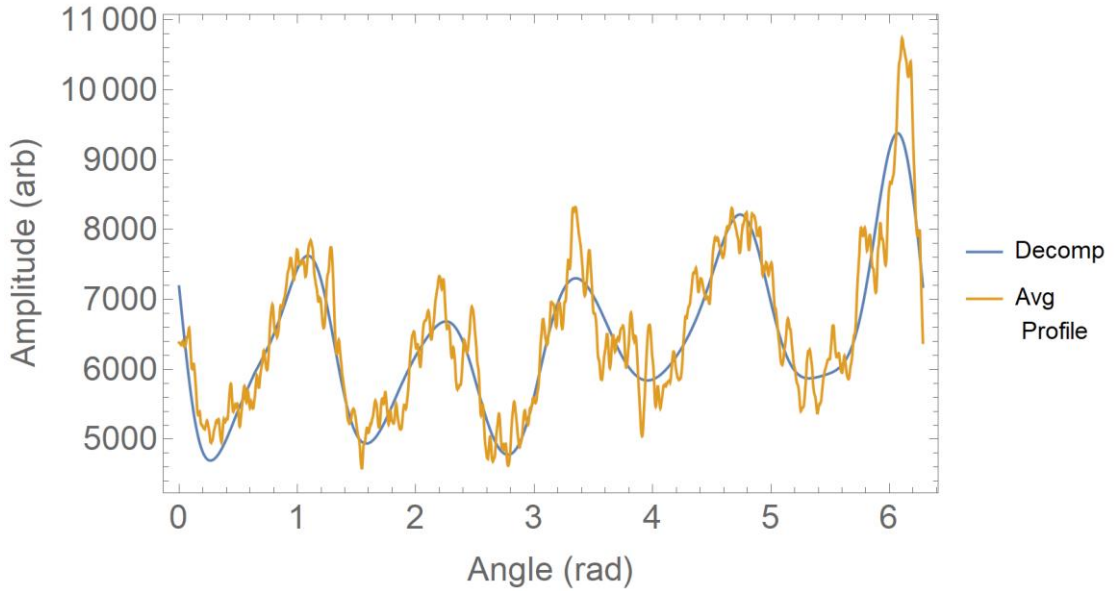




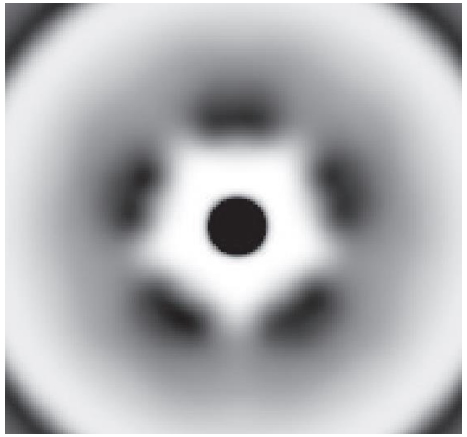
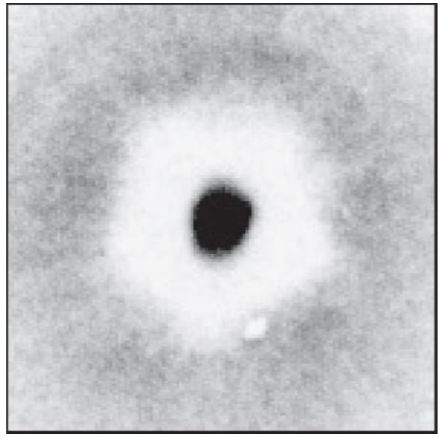
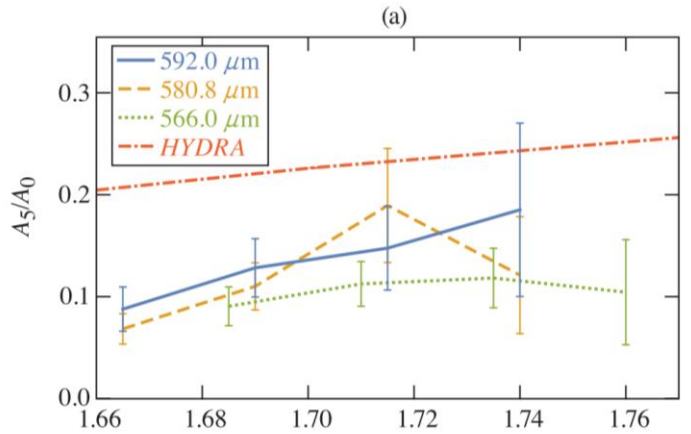
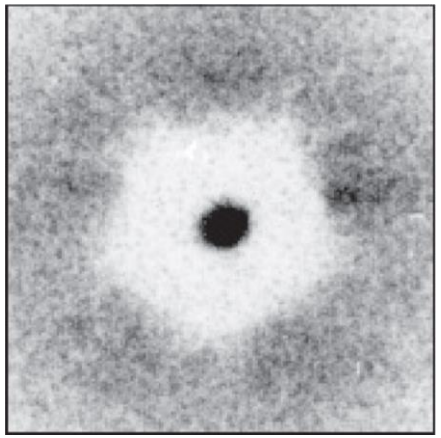
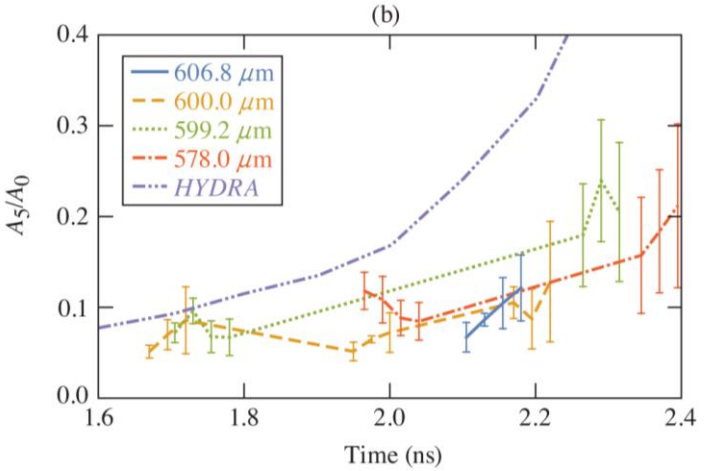
X-ray self-emission azimuthal profiles are radially averaged and decomposed into cylindrical harmonics

- The inner surface of the x-ray emission is fitted with a (red) circle that maximizes radius, but the pixel value average within the circle must stay within 5% of the image background value (ignores core emission)
- The extent of the radial average is 1.8 times the radius of the inner red circle (outer green circle)
- The radially averaged profile is fit with cylindrical modes 1-10 with error bars





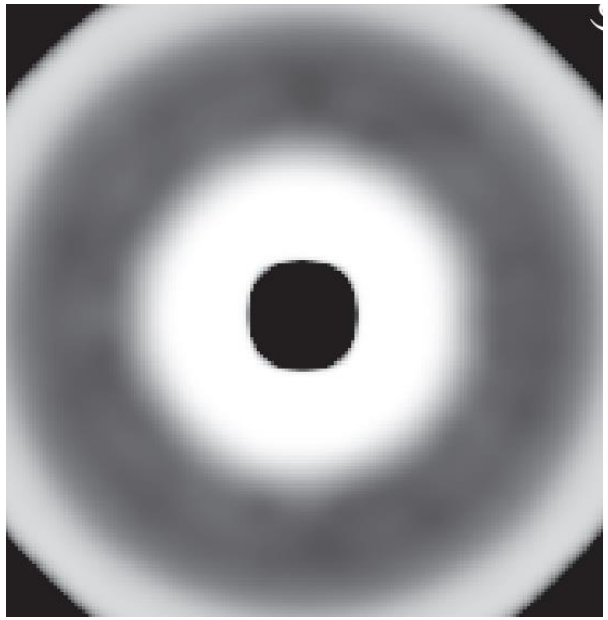
A mode 5 perturbation grows in the standard pointing case regardless of shell thickness or outer diameter

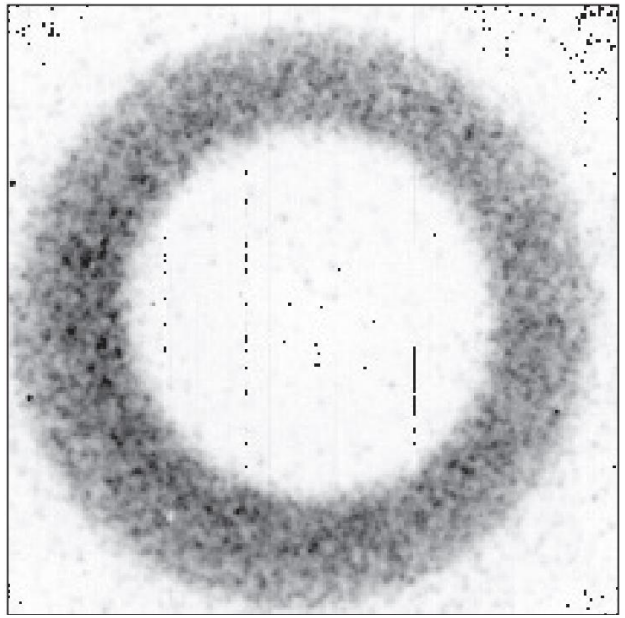
	Hydra Simulations	Experiments	Mode Analysis
20 μm shells			
30 μm shells			

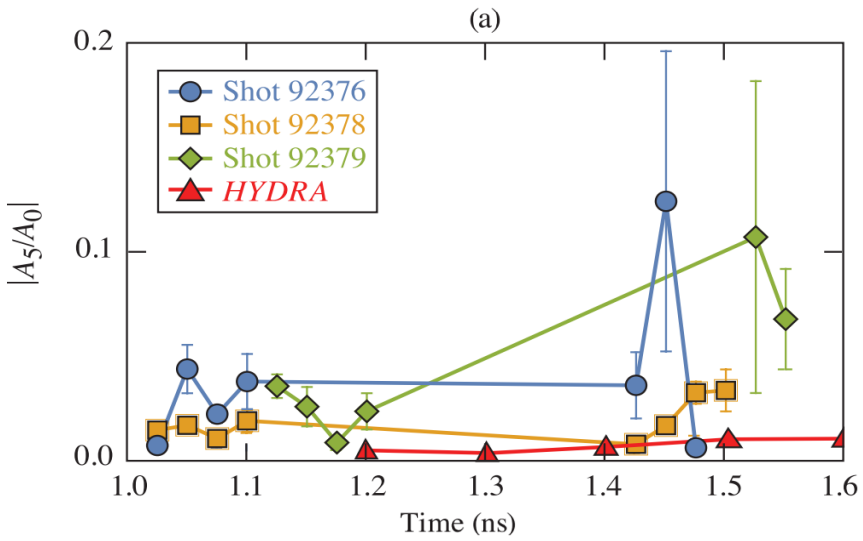
The uniform pointing shows reduced mode 5 and no mode 10 growth over time for 30 um shells

Hydra Simulations | **Experiments** | **Mode Analysis**

30 μm shells







Future work

- **Perform CBET calculations to assess the role of CBET and uniformity**
- **Determine the main source of discrepancy between simulation and experiments**
- **Compare other code results (FLASH, TriForce, etc.)**

Summary/Conclusions

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