Nike KrF Facility Tour

HAPL Meeting
31 October 2007

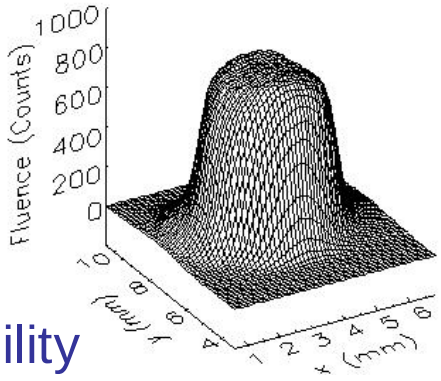
- NRL program became interested in KrF in mid 1980's
- KrF program begun in 1987
- Nike competed in 1995
- Up to 5 kJ obtained from main amplifier (~60% more with modern diode)
- About 600 shots per year for target experiments with ~ 1.5-3 kJ on target
- Complements Electra as half-full scale scale KrF reactor beamline

KrF lasers for inertial fusion energy

PHYSICS

Outstanding uniformity:

reduces seed for hydro instabilities



Shortest wavelength (248 nm)

higher absorption, rocket efficiency

minimizes risk from laser plasma instability

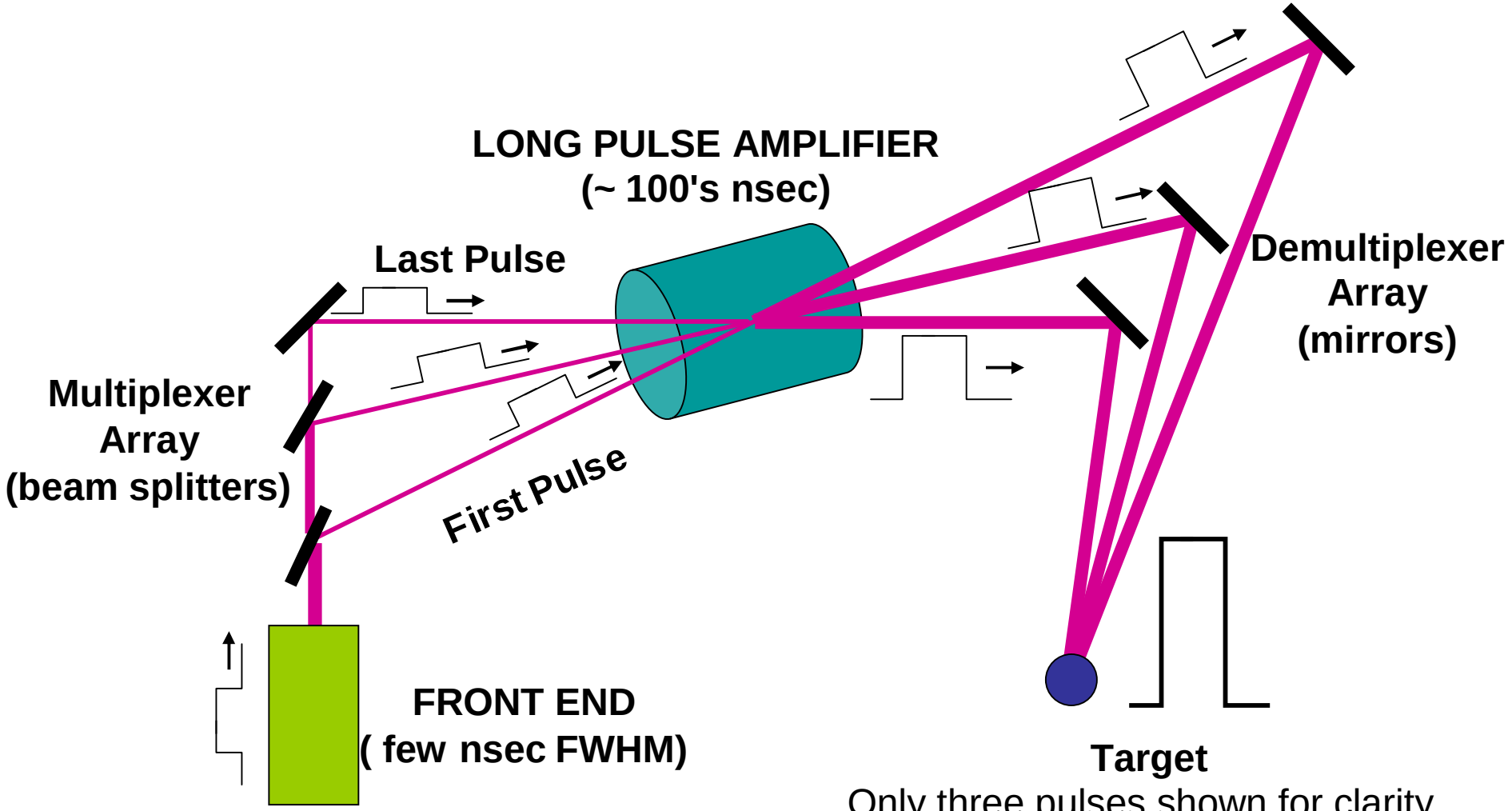
Straight-forward "zooming“

increases absorption & pellet gain

NRL ICF physics program is focused on target designs that benefit with KrF

- Conventional direct drive
- Shock ignited direct drive (may reduce laser energy and increase gain)
- Impact Fast Ignition

We match the electron-beam-pumped amplifier time scale to few ns target time scale via angular multiplexing

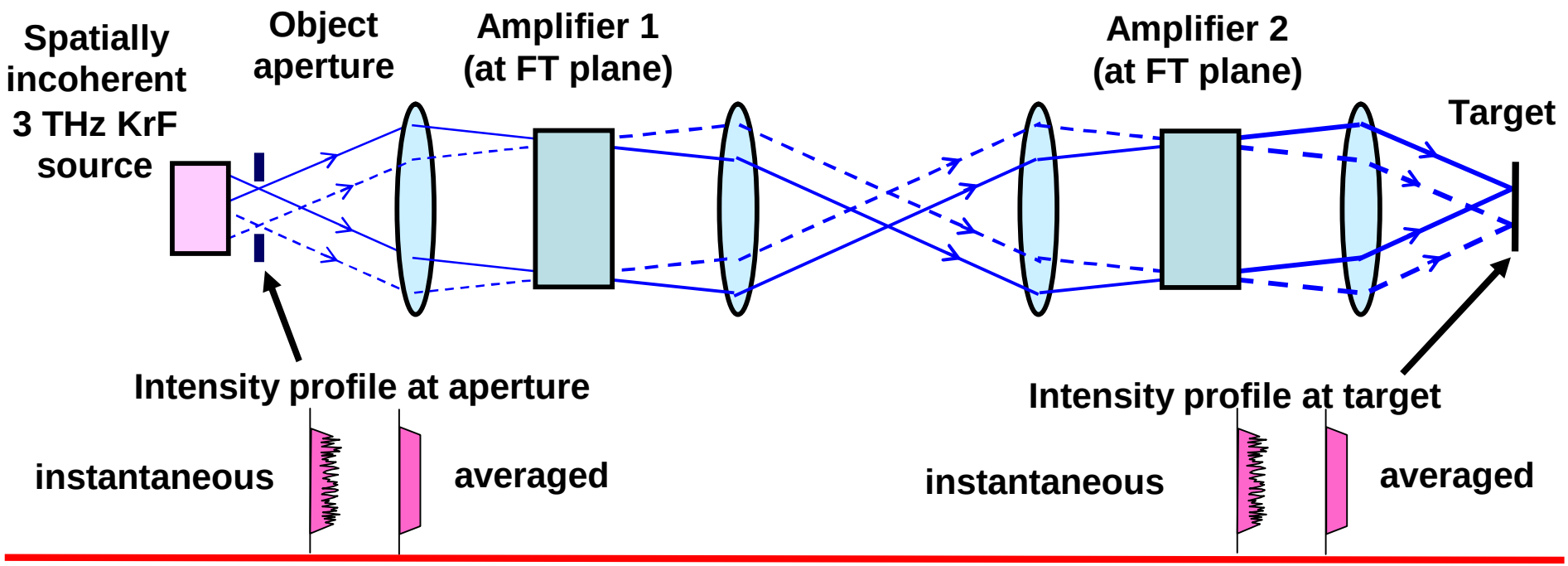


Only three pulses shown for clarity

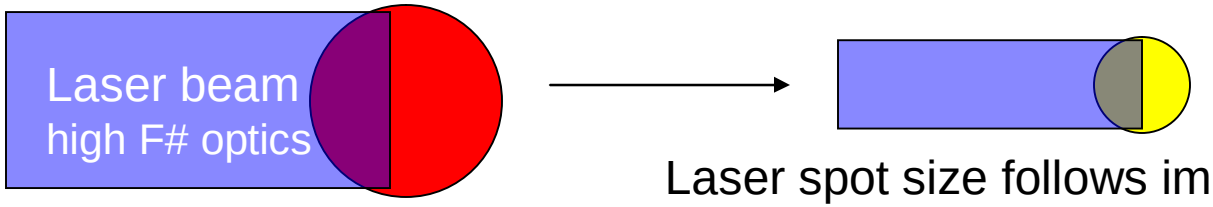
Adapted from Rosocha et al, Fusion Technology, May 1987 page 497

A KrF laser train uses Induced Spatial Incoherence (ISI) to produce very uniform target illumination

The laser profile at the aperture is imaged through the amplifiers onto the target

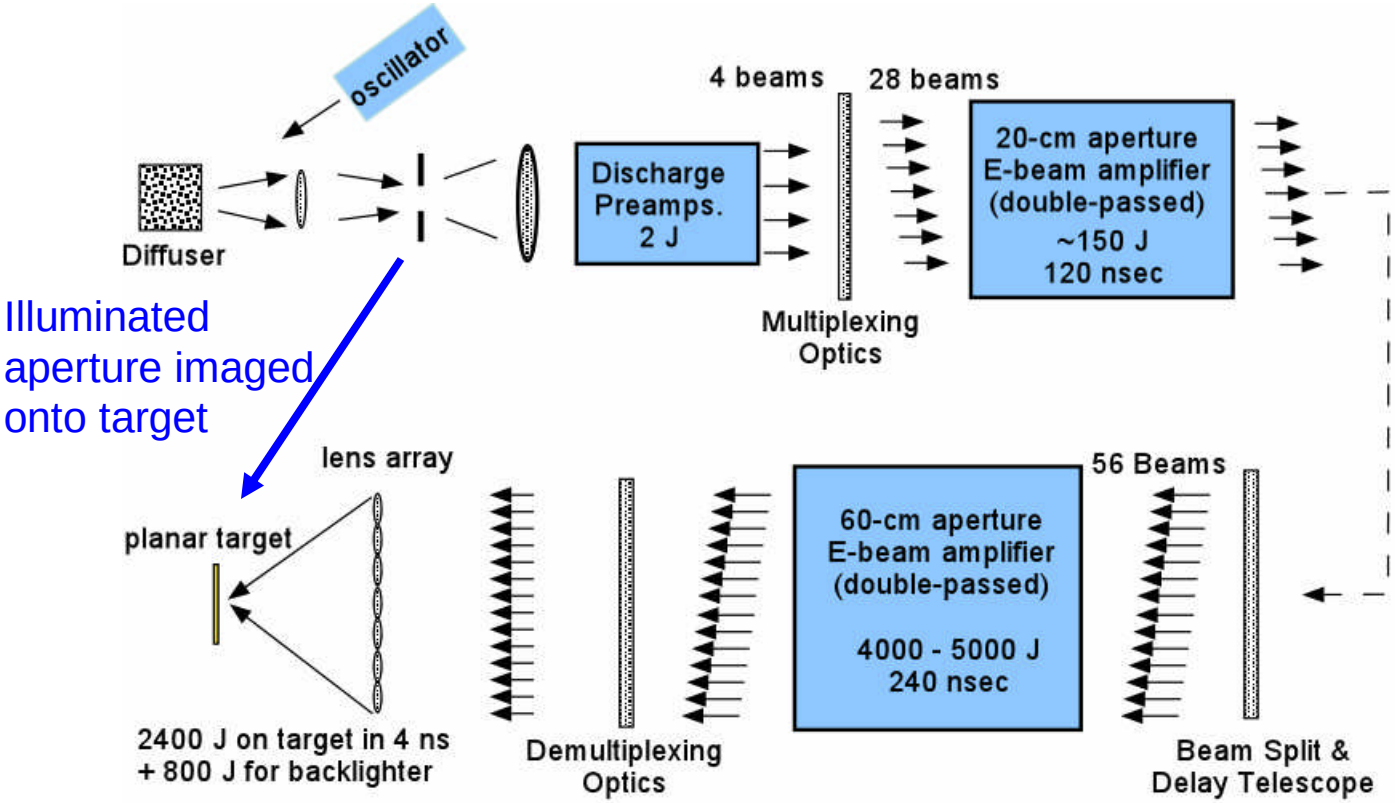


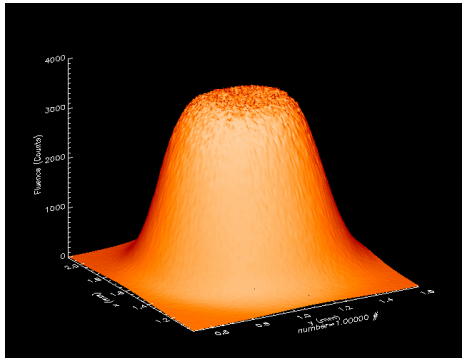
One can easily achieve **focal zooming** by passing different temporal portions of the pulse through different apertures



Laser spot size follows imploding pellet

Nike laser Chain

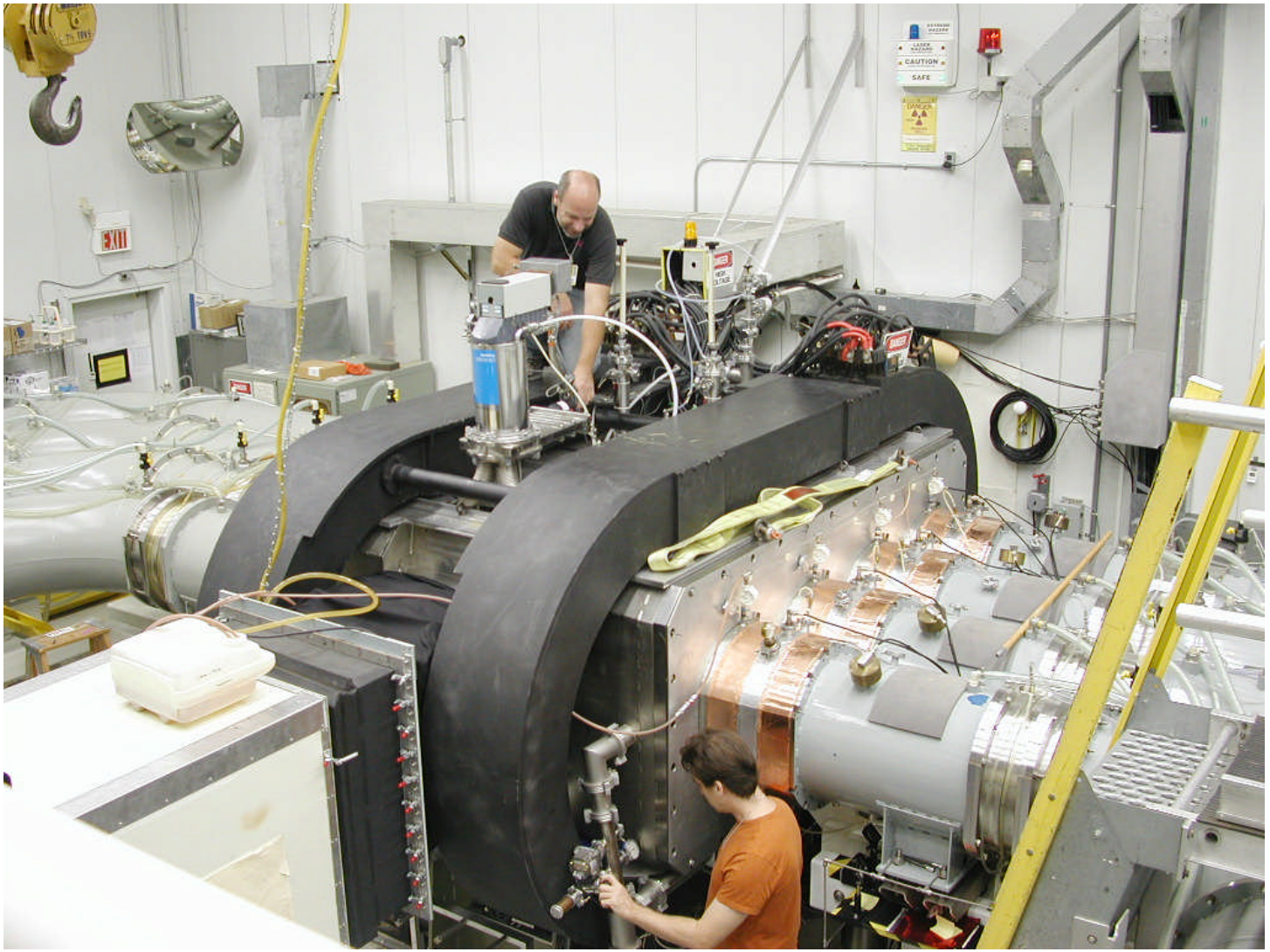




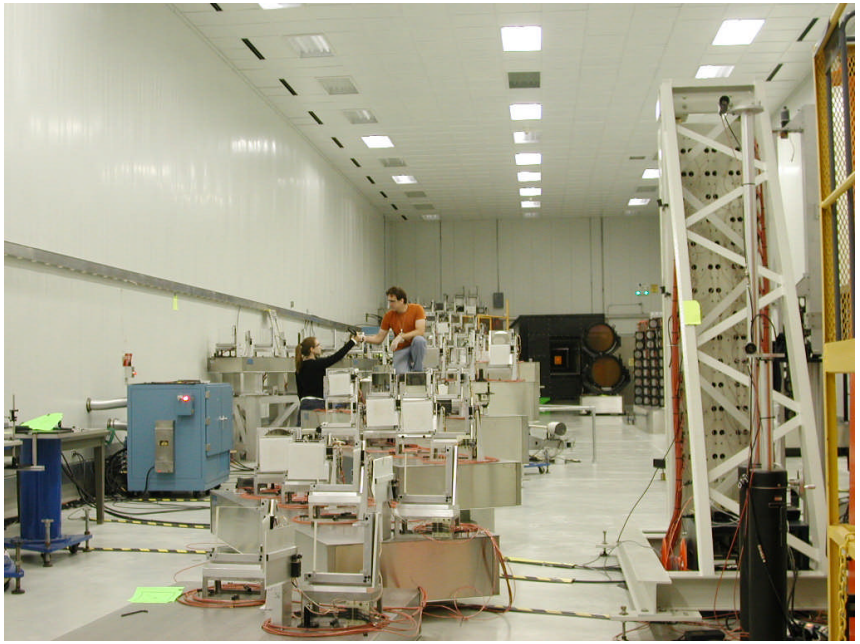
Laser profile in target chamber

Nike laser provides highly uniform target illumination (best by far in the business)

60-cm aperture amplifier



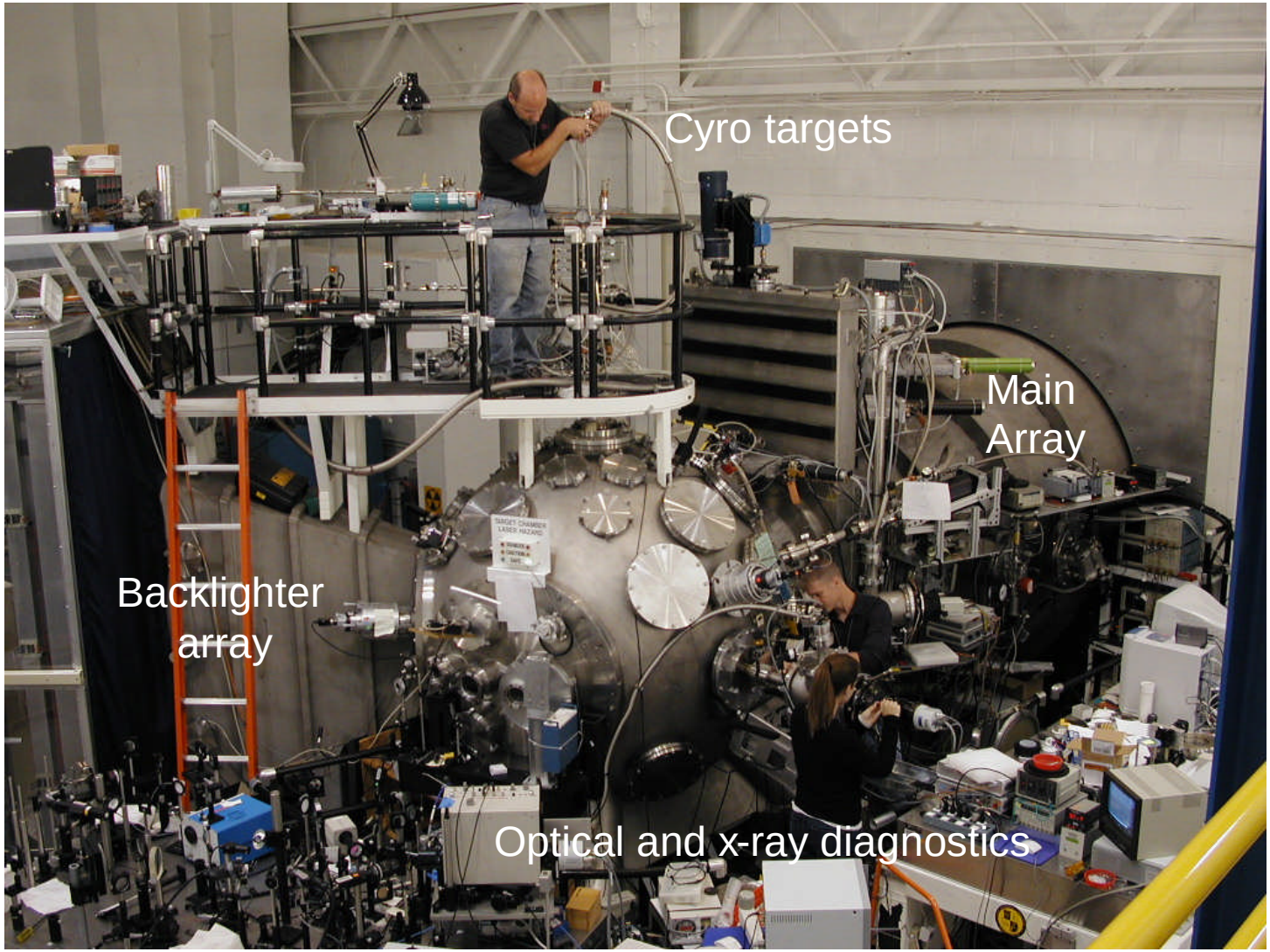
Nike “propagation” Bay



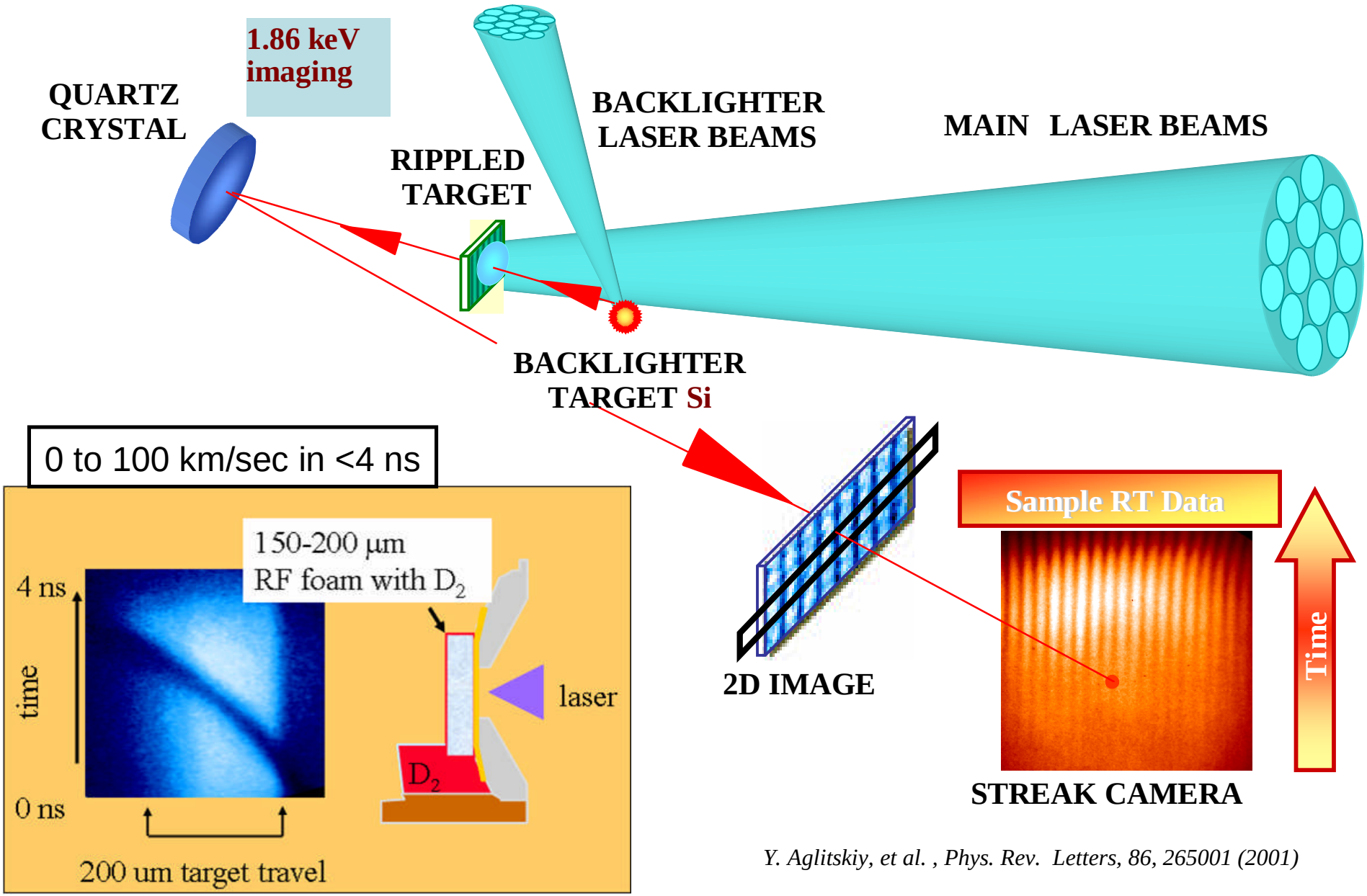
Optics for angularly multiplexed beams

Final turning mirrors and target chamber optics

Nike target chamber

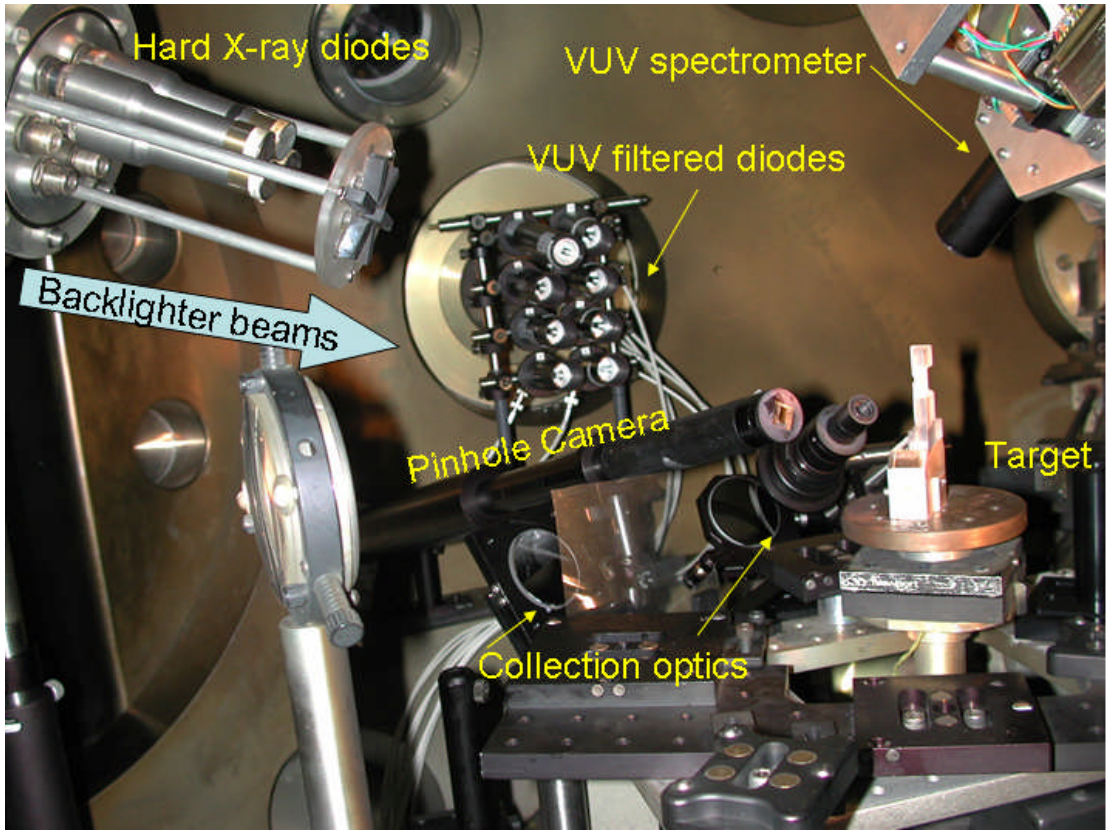


We use Nike is to study laser-accelerated planar targets

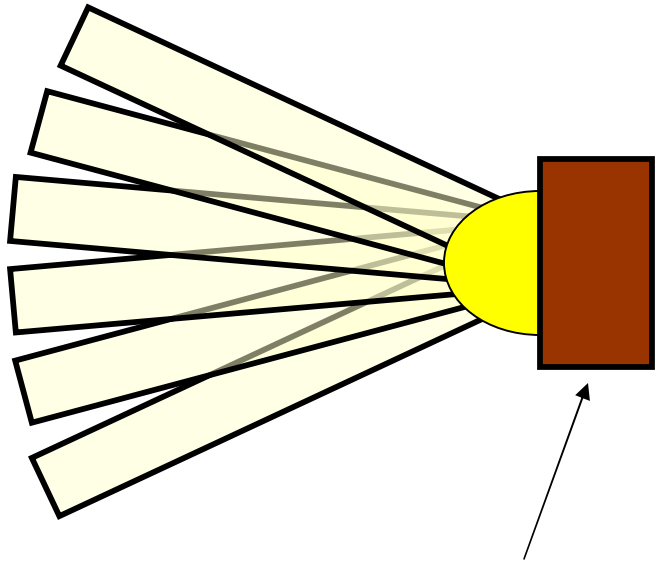


Y. Aglitskiy, et al. , Phys. Rev. Letters, 86, 265001 (2001)

Initial Nike laser-plasma experiments show no evidence for parametric instability @ 2-3x10^{15} W/cm^2



12 overlapped 300 ps Nike "backlighter" beams



Cryo D_2 and plastic foam targets

Two Tour Groups:

A-M with Victor Serlin + Y. Chan + Jim Weaver
(start with target area)

N-Z with David Kehne + Max Karasik + S. Obenschain
(start with laser)

NRL should be providing bus service (1/4 mile walk)