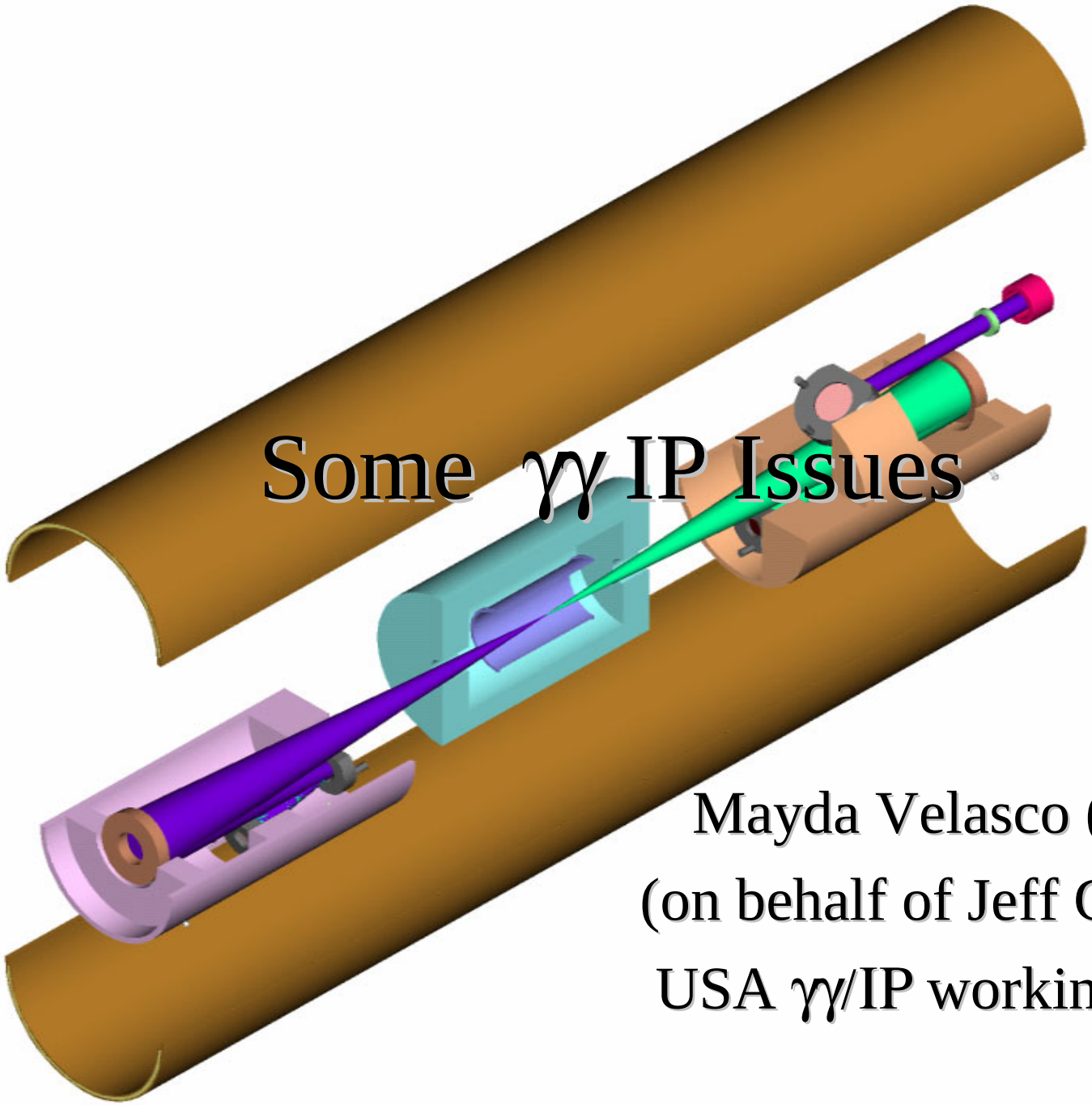
# Some $\gamma\gamma$ IP Issues



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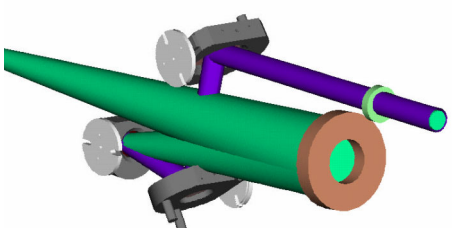
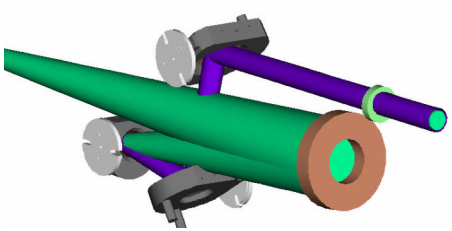
(on behalf of Jeff Gronberg,
USA $\gamma\gamma$/IP working group)



# $e^-$ & $\gamma$ spots

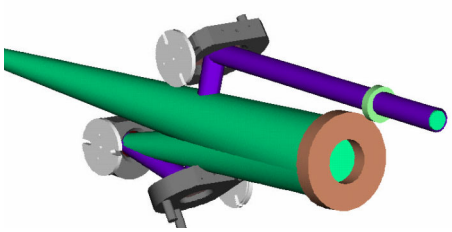
- For an NLC design with a the LLNL-laser system:
  - $e^- \approx \gamma$ spot ➔ same stability issues as $e^+e^-$
  - Beam-beam deflection needed ➔ magnet stabilization
- However, $\gamma\gamma$ can use round beams ➔ vertical stabilization can be relax by factor 10, while keeping same luminosity:
  - Therefore, this is a better operating mode, if stabilization becomes difficult.



# Laser spot

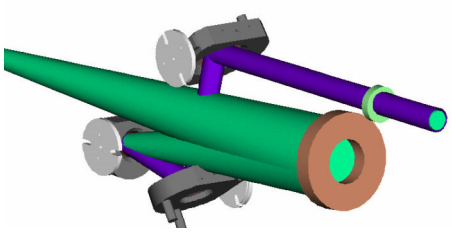
- Laser spot size ≈ 10 microns
  - Stabilization of mirrors not a problem
  - Drifts of focus location is a problem
  - Drifts of e- beam center is a problem

  ➔Might have to move the laser focus to determine e- beam center
- Feedback system keeps the e+e- colliding, is not guarantee that the IP does not wander around…
  - Question: How big this effect could be, & how well can they keep the IP fixed with respect to the mirrors?
- To do: add to simulation the effects of slow creep in the laser focus.



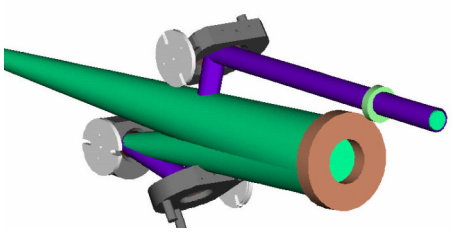
# $e^-$ vs laser pulse

- $e^-$ beam and laser pulse must arrive at center of the laser focus at the same time (synched at the ps level)
  - Done before!
  - However, the laser front end must maintain that stability…
- Path length changes in the optics path will affect changes in the arrival time of the laser pulsed ➔ must me controlled



# Mirrors

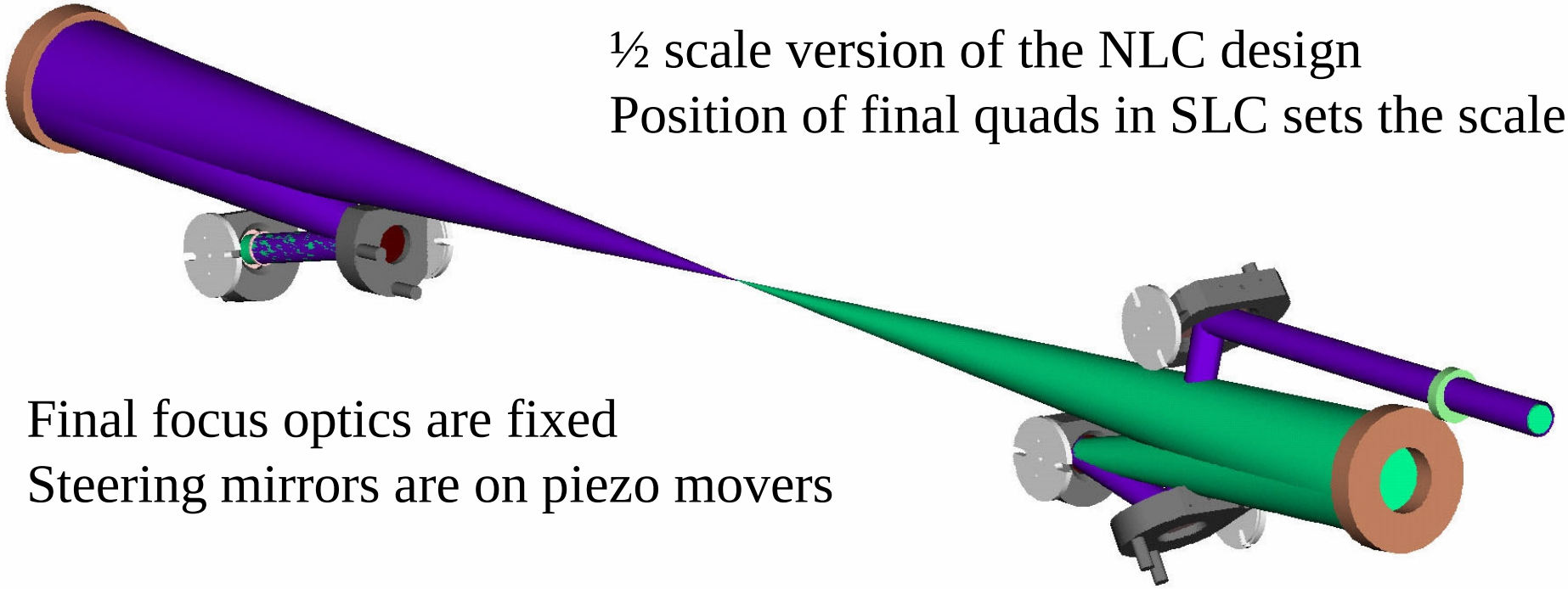
- They leak light ☹
- Cooling loops of running water will be required.
- How much cultural vibration introduce by this part of the system?
  - How big has to be to start affecting the stabilization of the magnet?
- Lifetime of mirror➔ Needs to be tested in a suitable radiation environment!!!!!



# Photon Collider Testbed Hardware

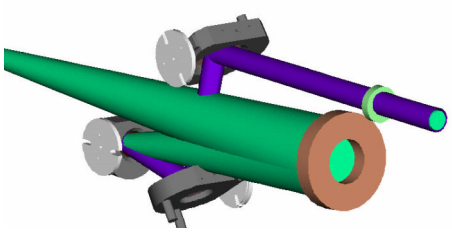
## Optical Assembly

½ scale version of the NLC design
Position of final quads in SLC sets the scale



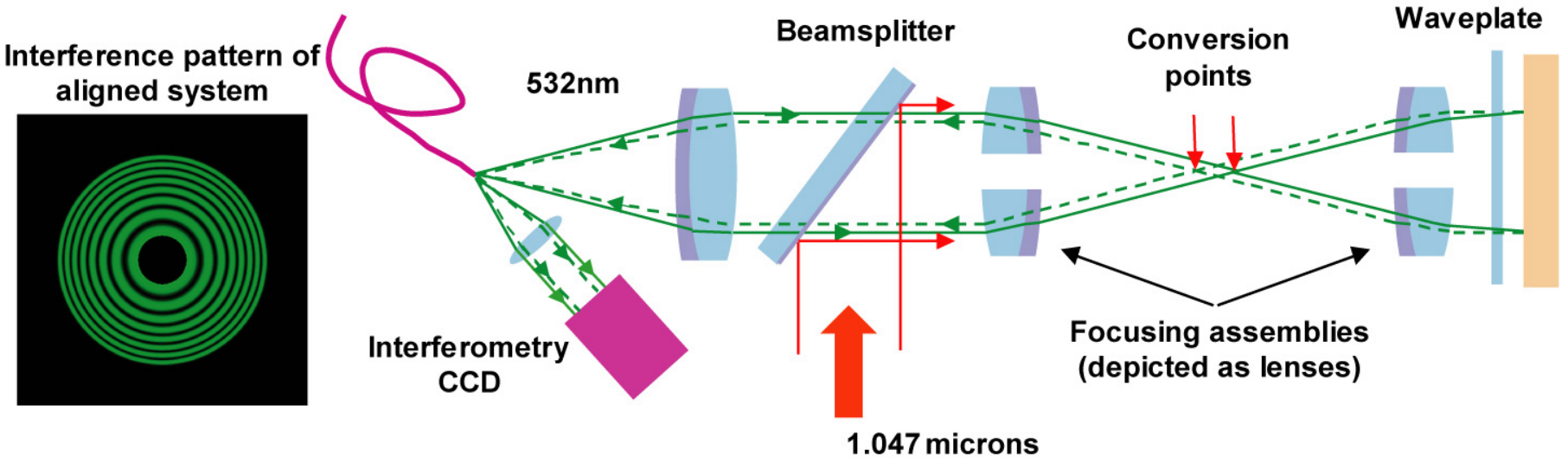
Final focus optics are fixed
Steering mirrors are on piezo movers

- Unknown factor: Optics damage
  - IP cannot often be opened up to fix the optics
    - Radiation damage to the coating
    - Laser power damage to the mirror

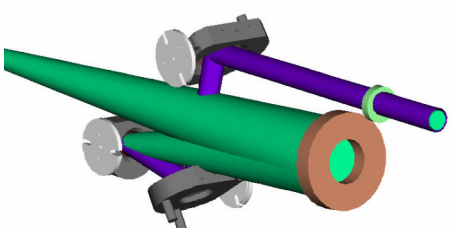


# Photon Collider Testbed Hardware

## Alignment System

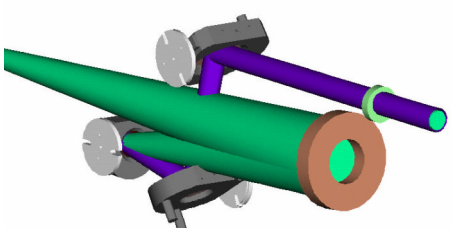



- Similar systems in use
  - ½ Scale prototype of optics / alignment system is currently under construction
  - Operation in end of FY02
  - Demonstration of alignment tolerance



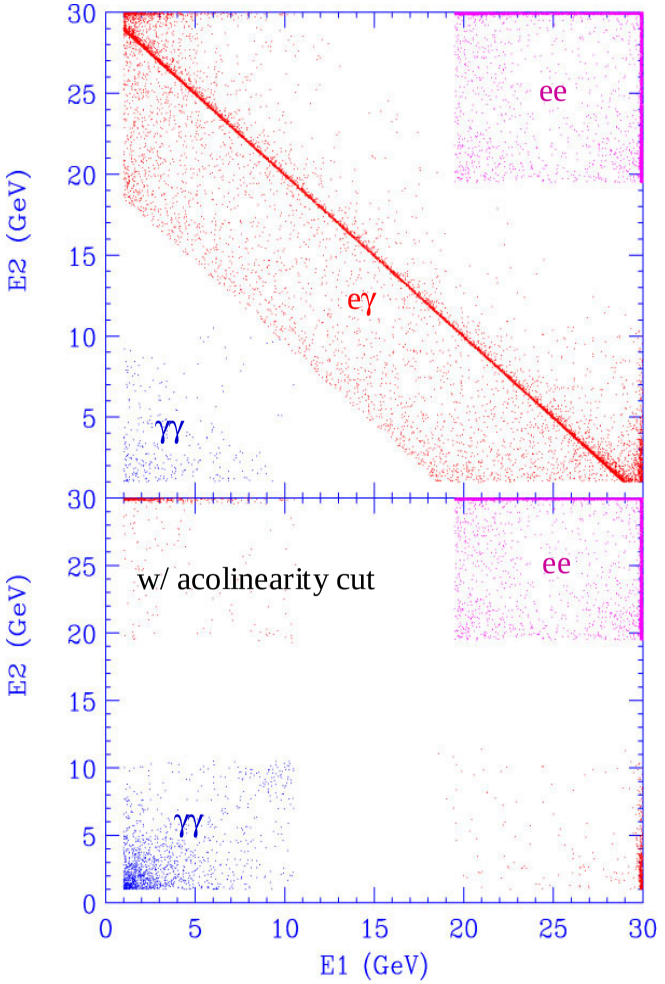
# Monitor of $\gamma\gamma$ luminosity

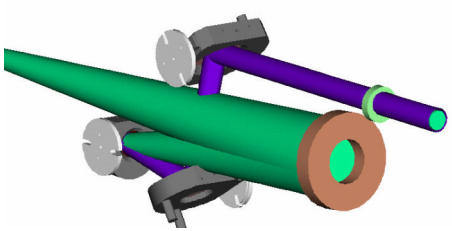
- $2 \longrightarrow 2$ processes might be the most reliable a quick way of checking luminosity, $\gamma\gamma$, $e\gamma$, $ee$
- Studies on $\gamma\gamma \longrightarrow 4\mu$, does not look as promising as originally thought, but at energies well above the $\gamma\gamma \longrightarrow WW$ will be good in regions well above threshold (assuming the Higgs not close by to cause any interference ☺ )
- Is it realistic to measure the bunch charge before the IP and before the beam dump? If so, then we can test that any drop in luminosity is due to changes in the e to $\gamma$ conversion efficiency



# Example of Kinematic separation of γγ, eγ, ee at SLD/SLC

- The three possible scatters can be separated solely with their kinematic information
  - Identify two hit events in the calorimeter
  - No tracking require





# Conclusion

- Plenty of issues are still to be though of and tested. At the moment, I think the most important are:
  - Impact of the cultural noise introduce by the water cooling of the mirrors
  - Radiation damage of the optical system