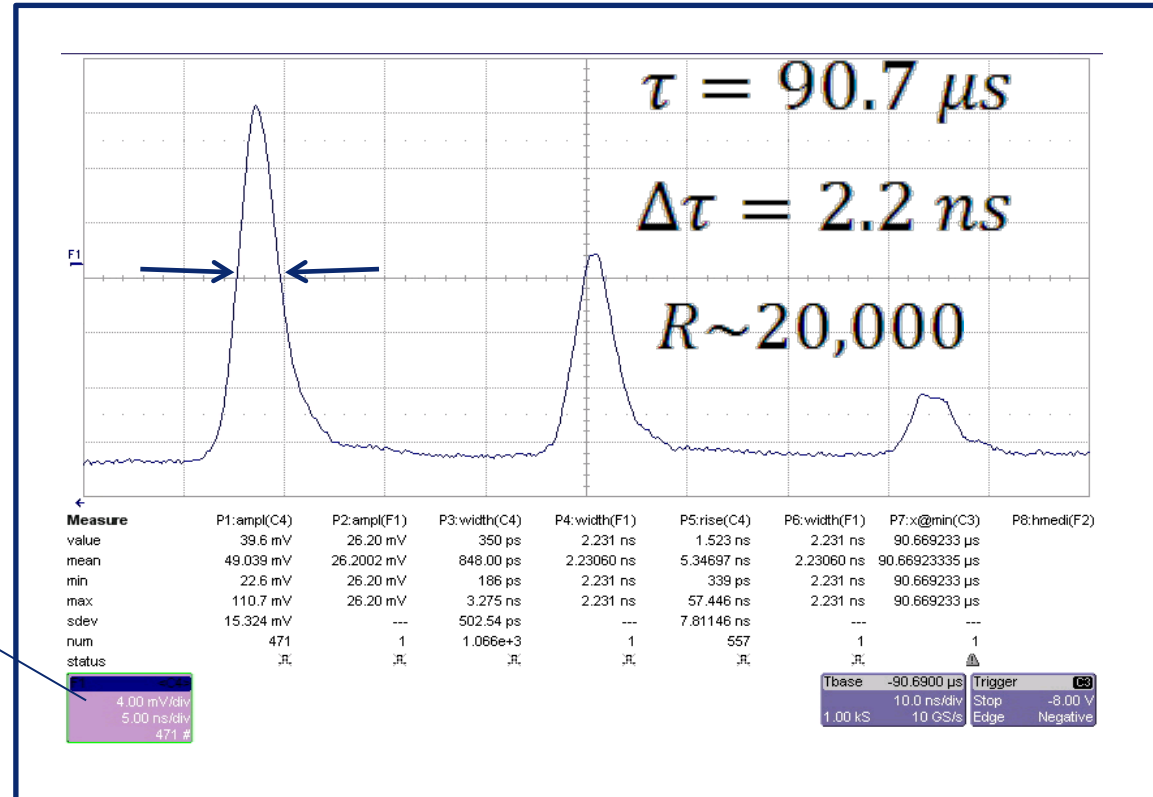
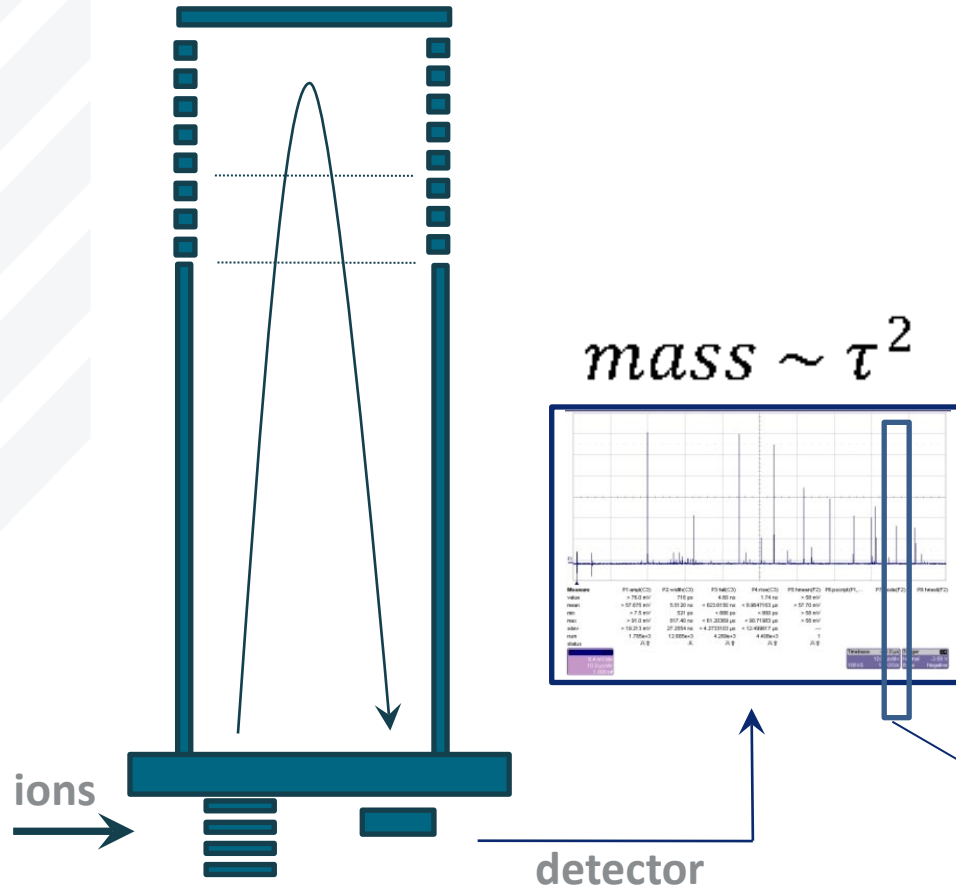




# TruFlite™ Microchannel Plate

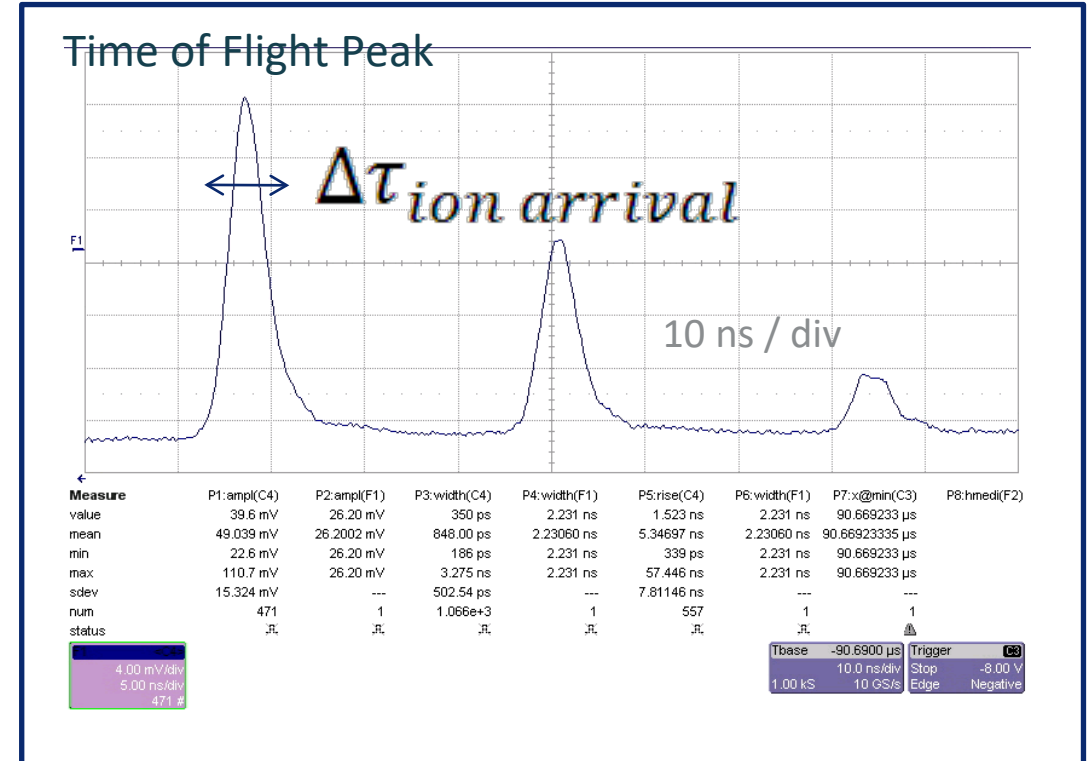
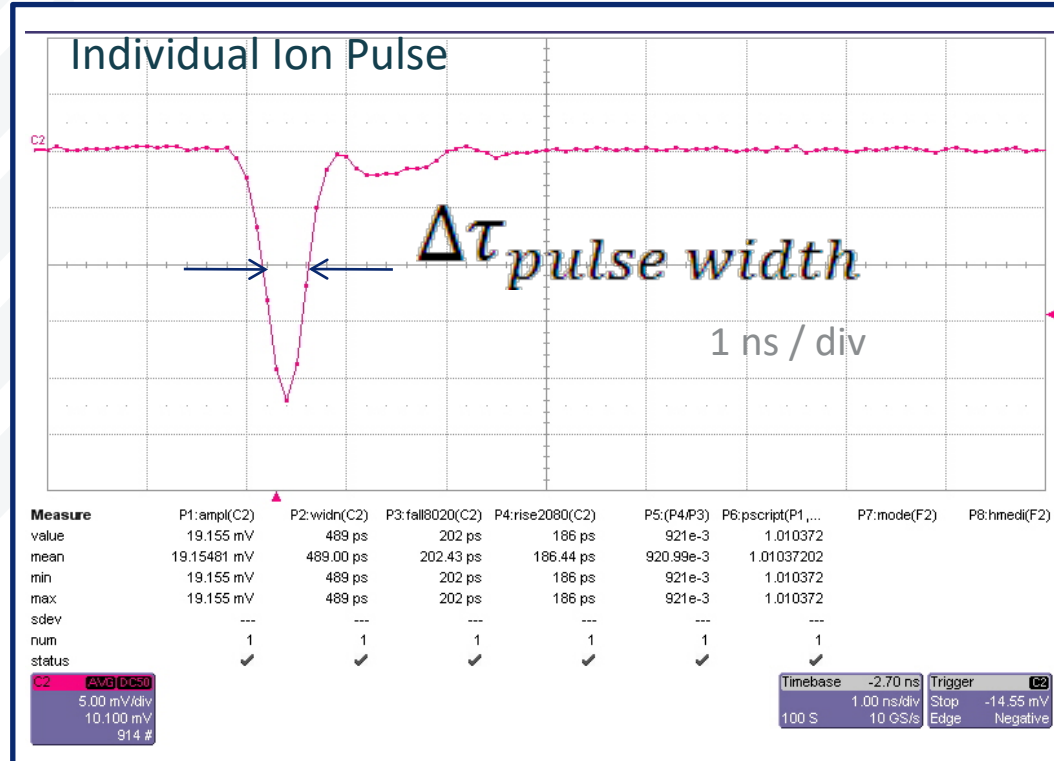
# Time of Flight (TOF) Mass Resolution

$$R = \frac{m}{\Delta m} = \frac{\tau}{2 \Delta \tau}$$



➤ Any travel-time difference for ions of the same mass in a TOF system reduces the mass resolution

# Detector Time Jitter



$$\Delta\tau_{detector}^2 = \Delta\tau_{pulse\ width}^2 + \Delta\tau_{ion\ arrival}^2$$

- Ion arrival jitter is partially due to the TOF instrument
- We are separating out the jitter that is due to the detector

# Reducing Detector Time Jitter

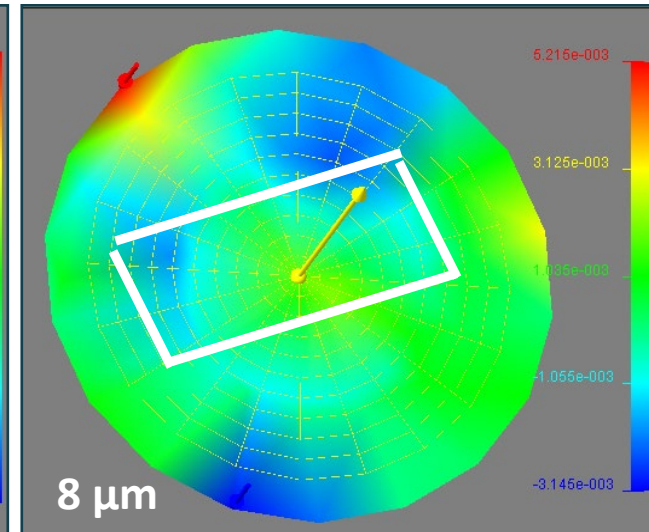
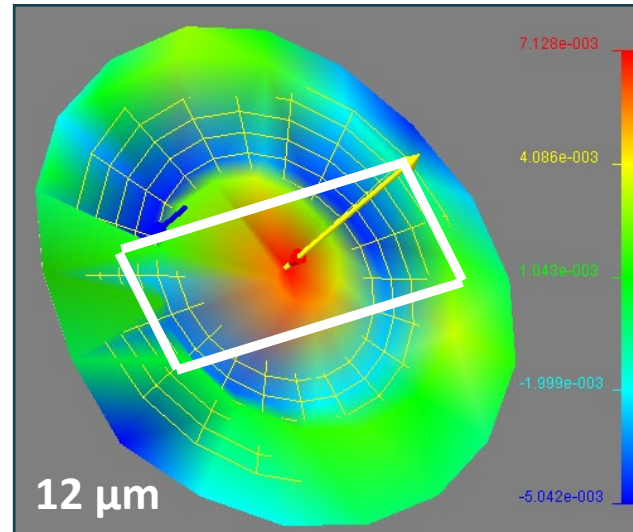
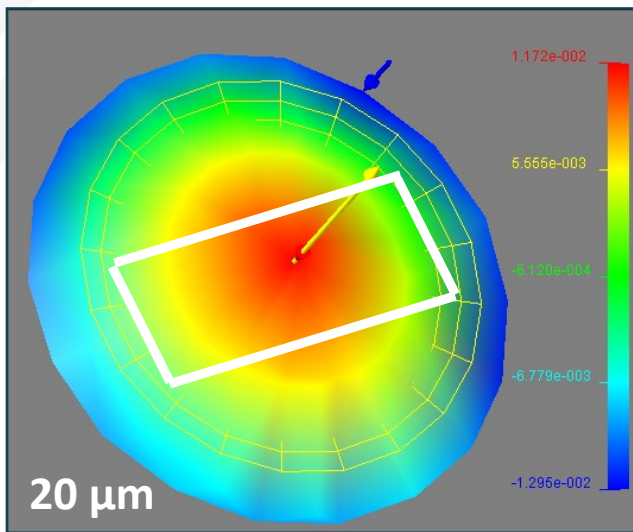
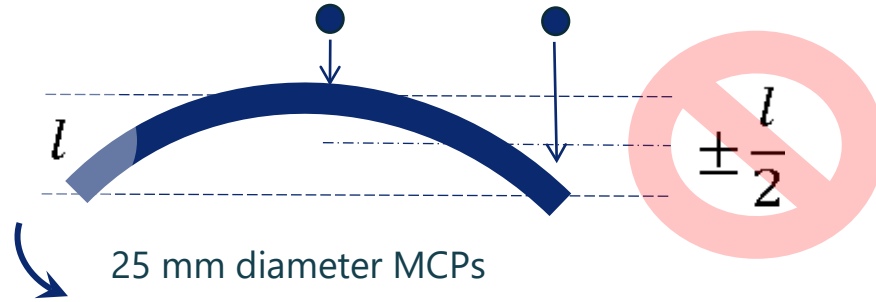
## ➤ Pulse Width

- ◆ Fast internal transit times
- ◆ Ideally, all the electrons resulting from the ion impact should reach the anode at the same time

## ➤ Ion Arrival

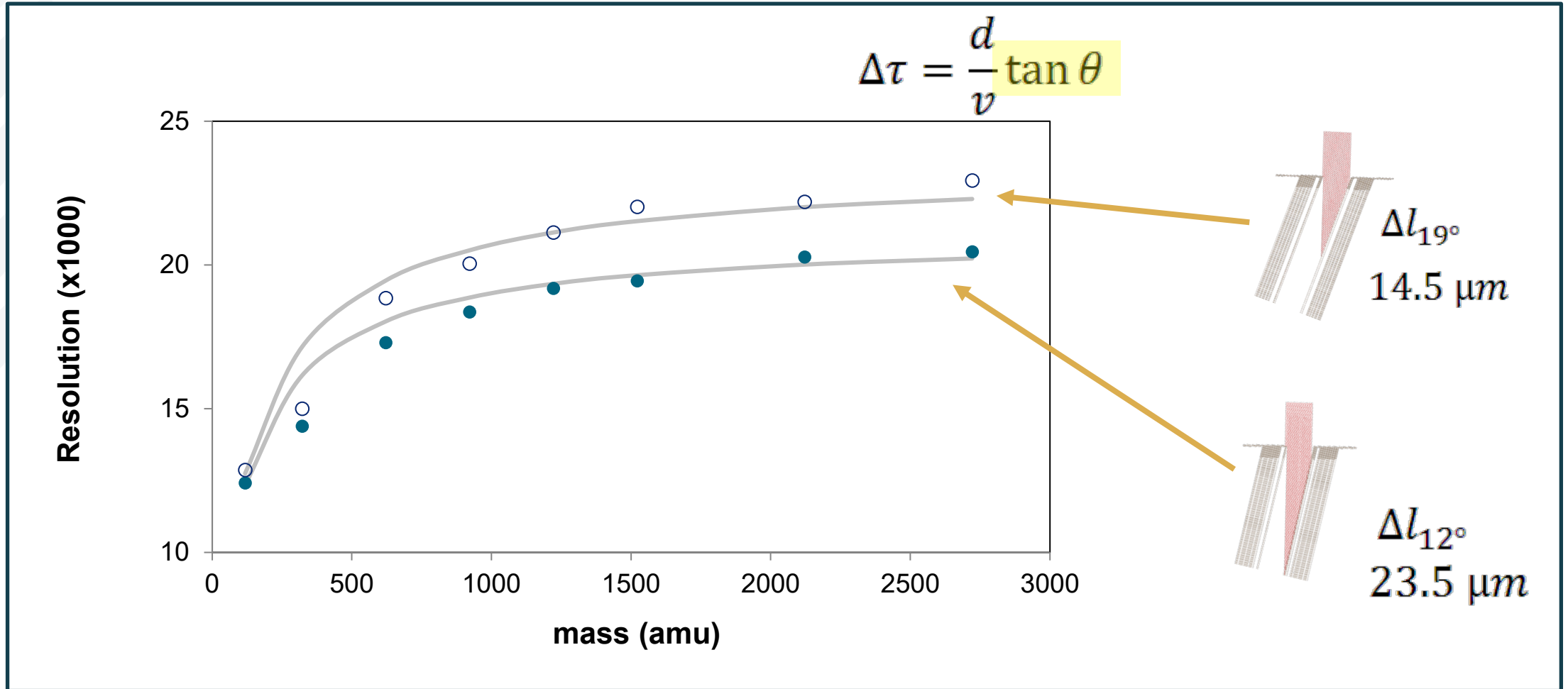
- ◆ The electromagnetic environment created by the detector should not disturb the motion of the approaching ions. (No electric or magnetic fields in front of the detector).
- ◆ **The detector surface should be planar and parallel to the arriving ion packet.**

# Global Flatness



- Reporting maximum absolute focal plane deviation
- Values reported as "±" need to be double for comparison

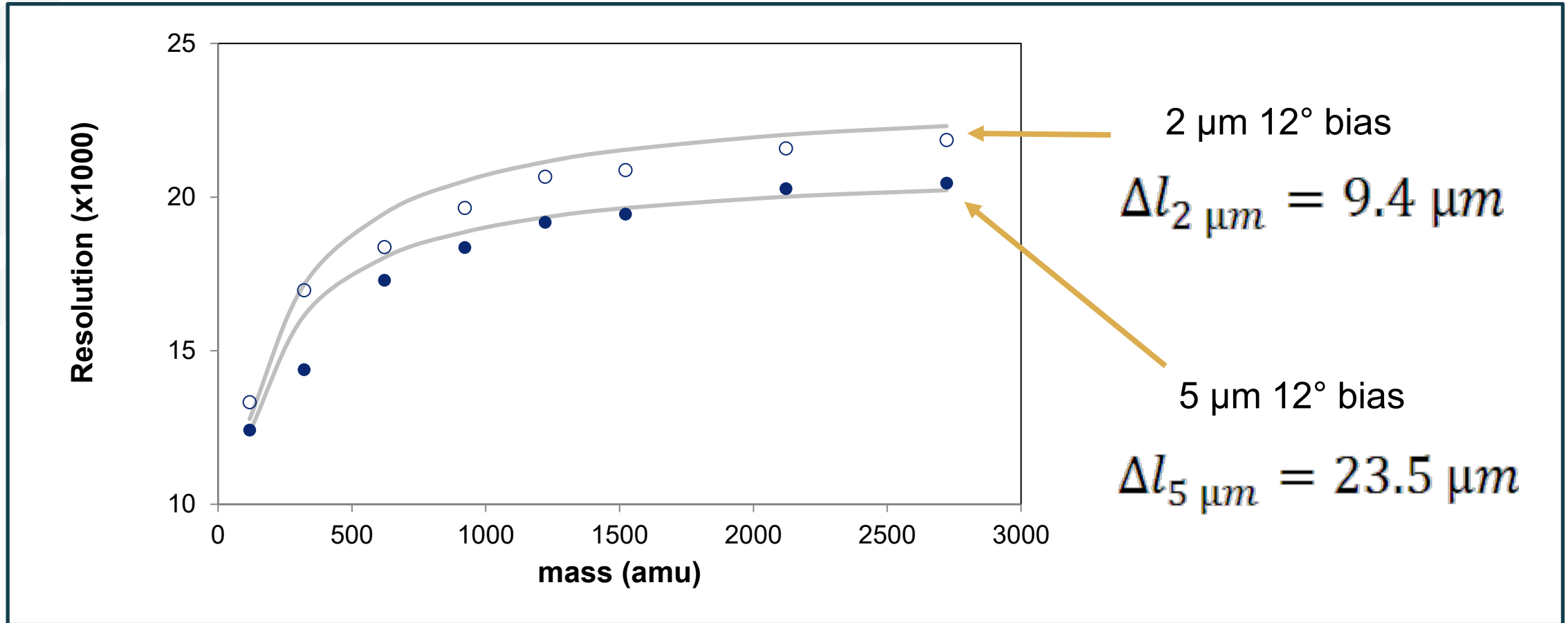
# Increase Bias Angle



➤ Bias angle change improved resolution ~10% at high mass

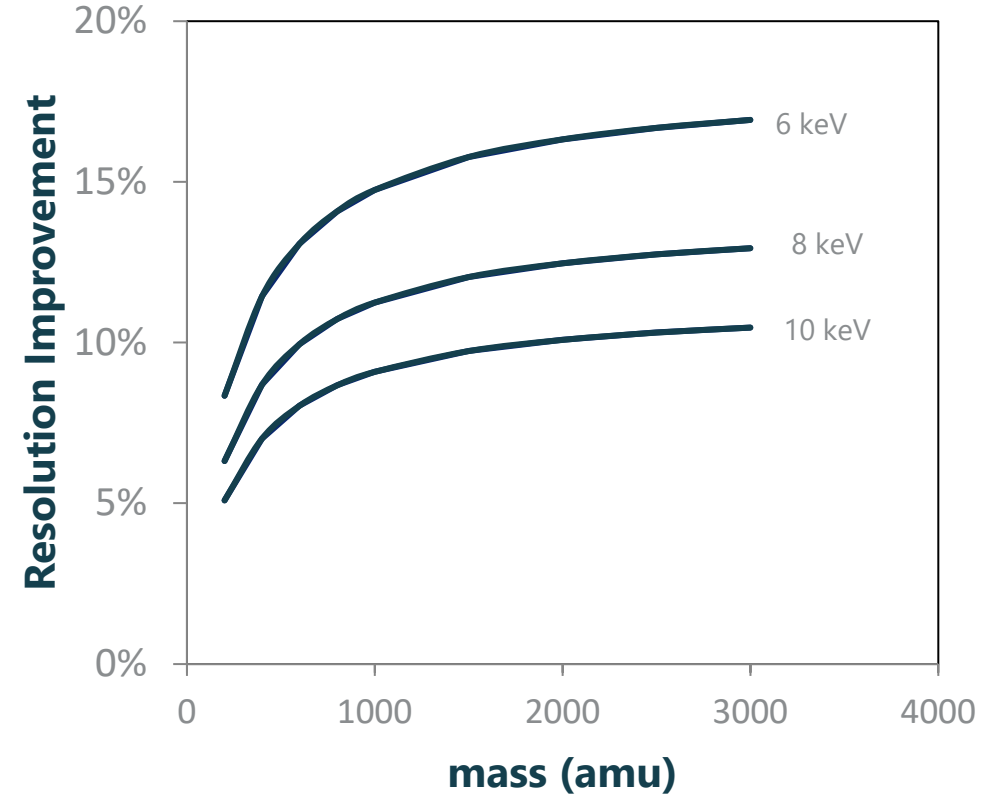
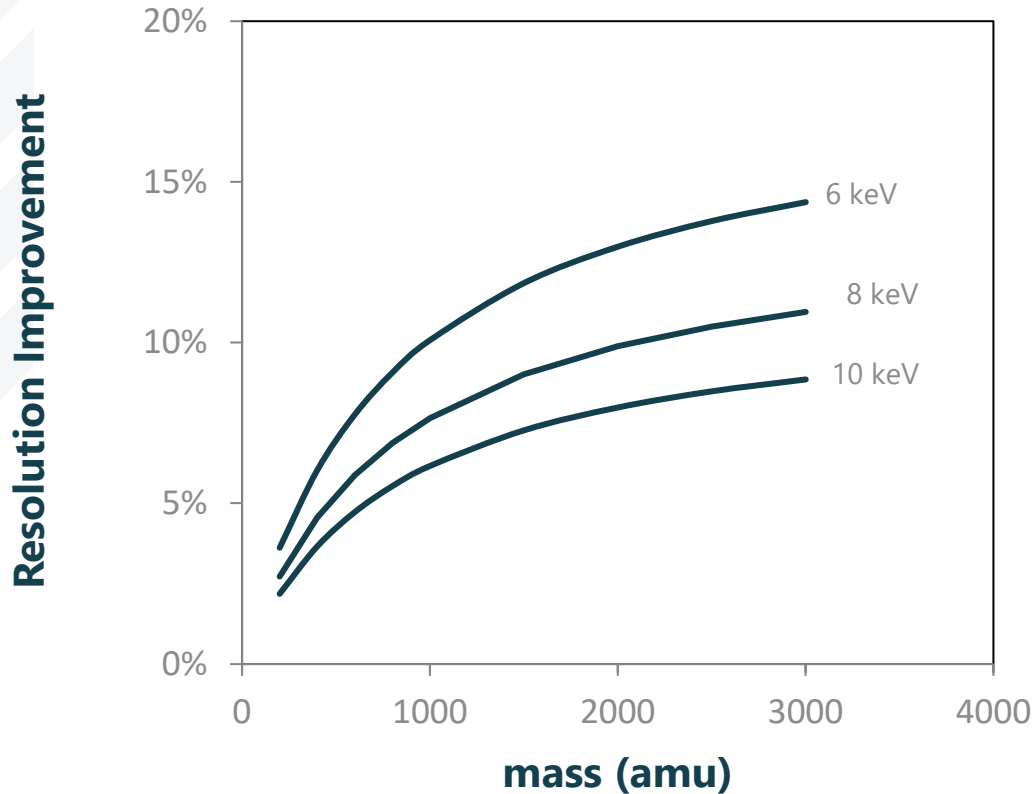
# Reduced Pore Size

$$\Delta\tau = \frac{d}{v} \tan \theta$$



➤ 2 μm pore improves resolution ~ 10% at high mass

# Ion Arrival: Limit of Resolution Improvement



- Showing the expected improvement in resolution if time spread due to the entrance geometry could be eliminated.



# Conclusions

- With no changes to the instrument, TOF mass resolution can be improved by:
  - ◆ Controlling MCP global flatness
  - ◆ Increasing MCP bias angle
  - ◆ Reducing MCP pore size
- MountingPad MCP global flatness can be controlled in hardware to under 10  $\mu\text{m}$  for a 25 mm diameter active area
  - ◆ Control of hardware and assembly are critical
- 25 mm diameter 2  $\mu\text{m}$  pore 19 bias angle MCPs reduce the pore penetration depth from 23.5 to 5.4  $\mu\text{m}$
- The use of TruFlite™ MCPs can improve resolution by 15% over standard configuration.

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