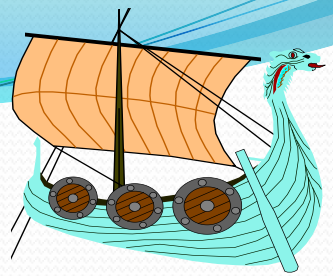
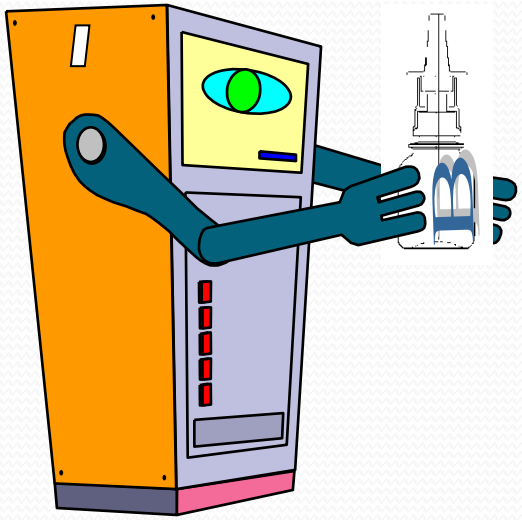


An Odyssey into Automation

From commercial systems to custom designed systems



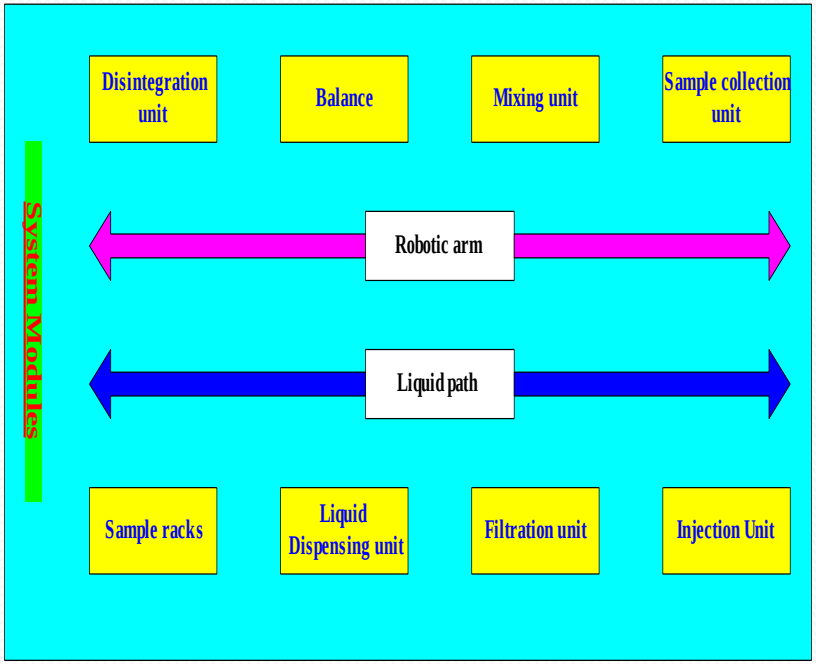
Herman Lam, Ph.D.

Benefits of Lab Automation

- Increase productivity
  - Improve utilization of staffs and instruments
  - Less preparations, better flexibility
  - Around the clock operation
- Improve quality of results
  - Better precision and better accuracy
  - Error reduction
  - Easy method transfer
- Safety
  - Minimize exposure to hazardous environment
  - Reduce the amount of solvent used

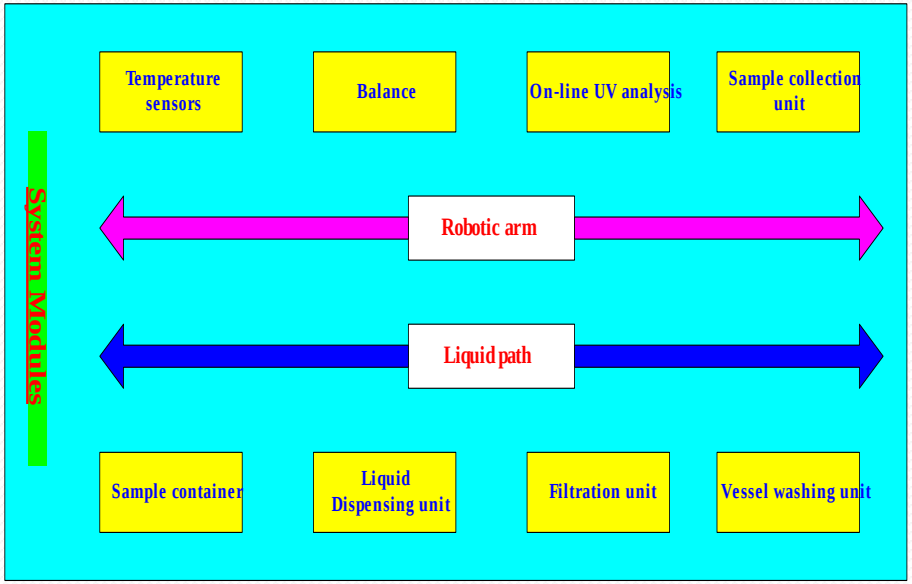
Automated Workstations

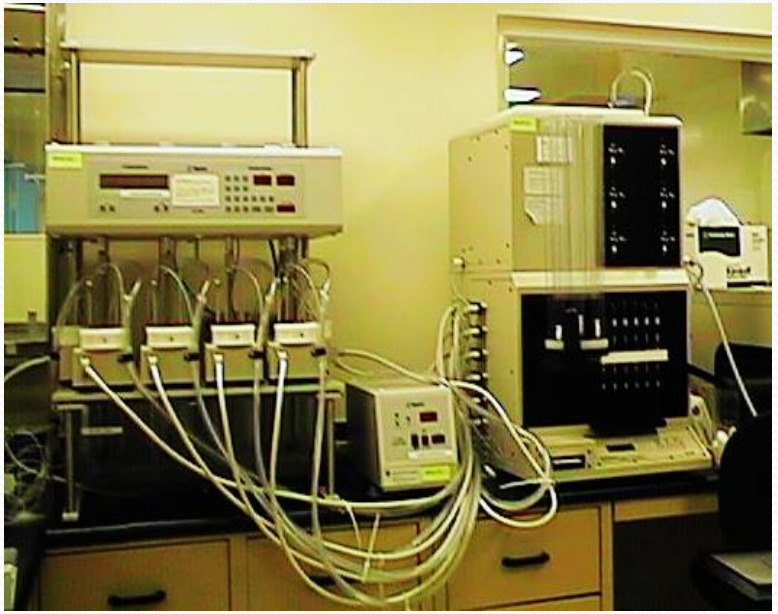
Schematic overview of a tablet processing workstation



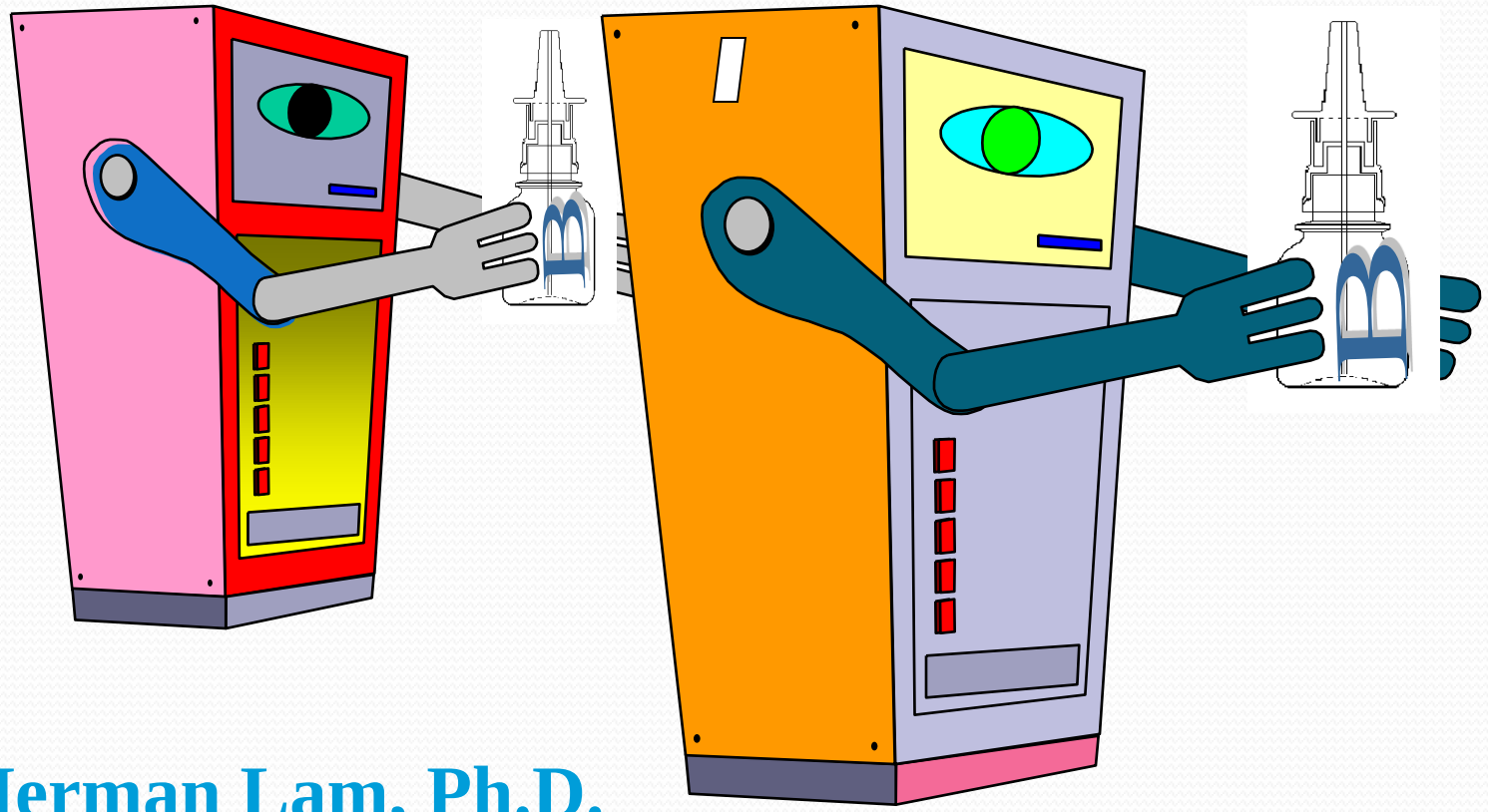
Automated Workstations

Schematic overview of a dissolution processing workstation





Nasal Spray Automation



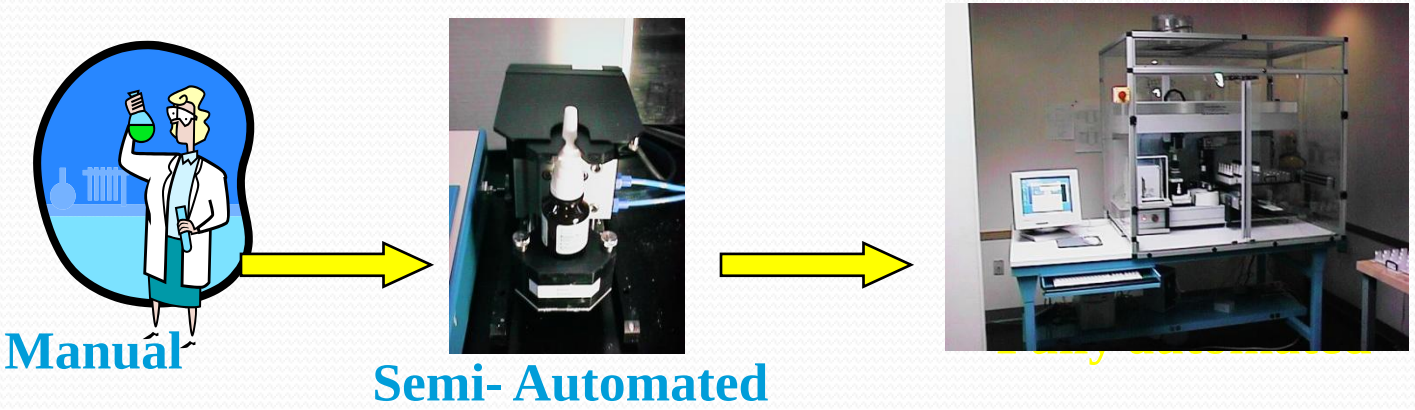
Herman Lam, Ph.D.

Rationale for Nasal Spray Automation

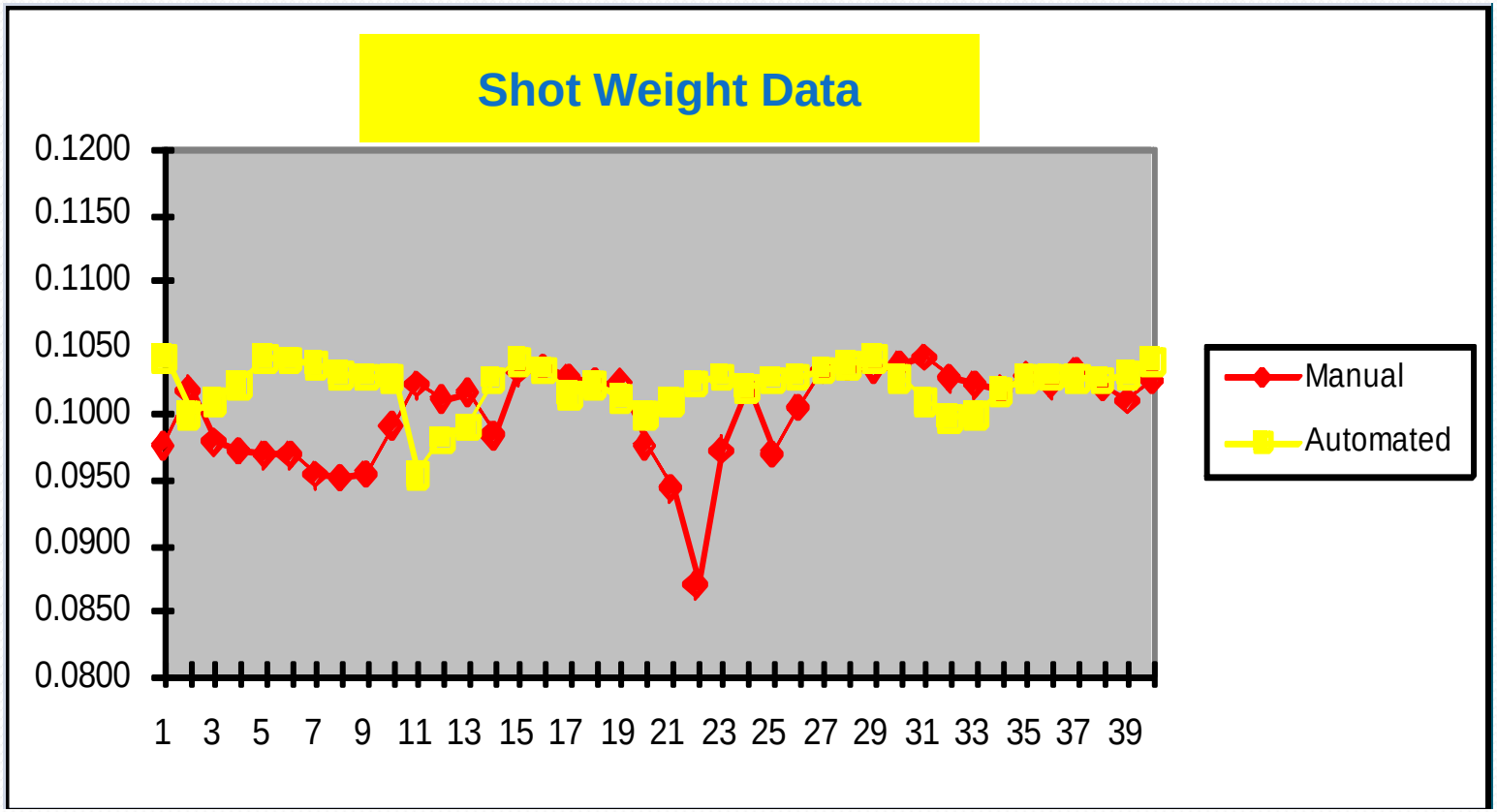
- Increase operational efficiency
  - Manual testing: 4 analysts
  - Fully automated testing: 1 analyst
- Increase actuation consistency
  - Reduce chance of batch rejection
- Prevent repetitive strain injury
  - Employee safety
  - Potential costly compensation
  - Company image
- Regulatory Requirements

Choosing Automation Solutions

- Tactical Solution: Semi-automated (firing only)
  - Consistency of firing ⇒ Improves precision
  - Mechanized ⇒ Eliminates Repetitive Strain Injury
- Strategic Solution: Fully Automated Testing
  - Consistency of sample preparation ⇒ Improves precision
  - “24 hour” operation ⇒ Increased throughput



Automated Actuation Improves Precision



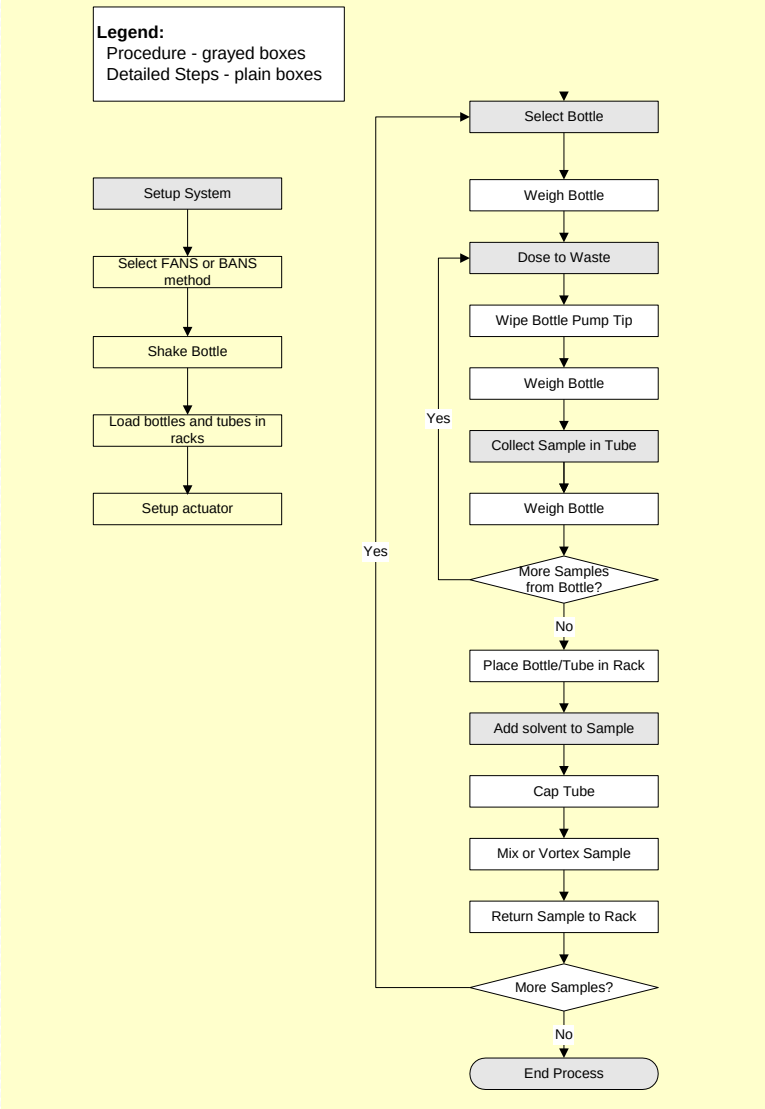
Capability of the Nasal Spray Automated Dose Delivery System

- Versatility: Five procedures will be automated using the NSADD
  - Dosage Uniformity per batch
  - Dosage Uniformity per bottle
  - Dosage Collection
  - Dosage/Shot Weight
  - Firing to waste only

Capability of the Nasal Spray Automated Dose Delivery System

- Designed to test two different nasal spray products
- 20 nasal spray bottles
- 60 dose collection containers

Process flow



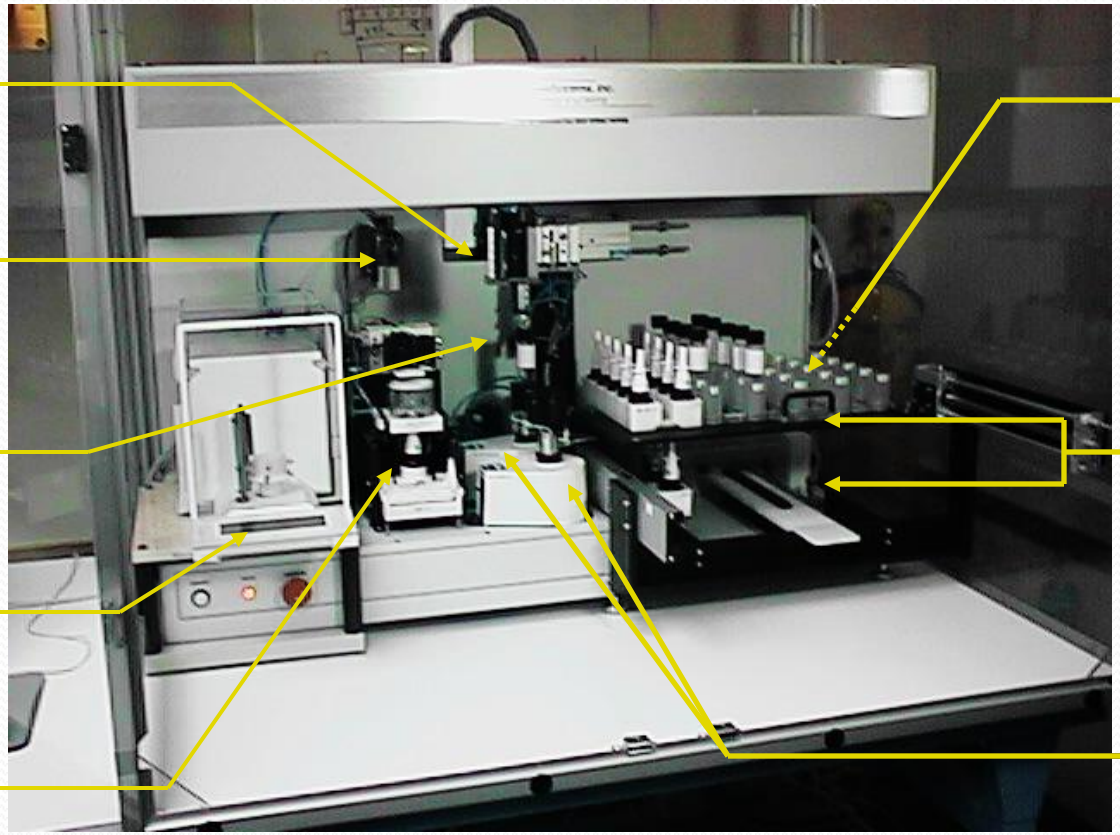
System Software

- Operation system: Windows NT
  - For security and ease of use
  - Compatibility with company's systems
- NSADD program
  - Look and feel of MS Windows
  - Run sequence and scheduling
  - SCADA is written in JAVA

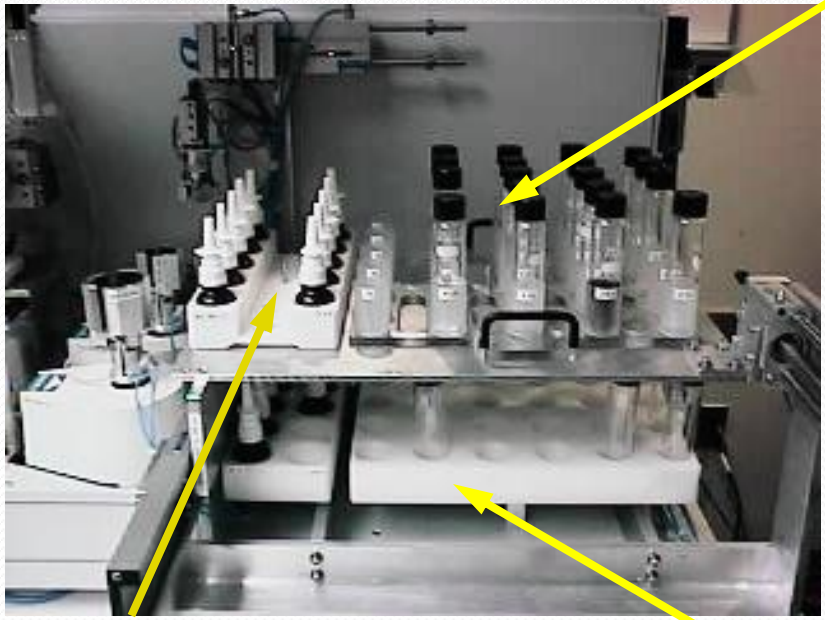
System Hardware

- Bohdan Robotic Platform
  - Gripper for nasal spray and dose container
- Task Specific Substations
  - Sample holder
  - Balance
  - Dose Collection
  - Capping
  - Vortexing/shaking
  - Liquid dispensing

NSADD System Configuration



Bottles and Sample Tubes

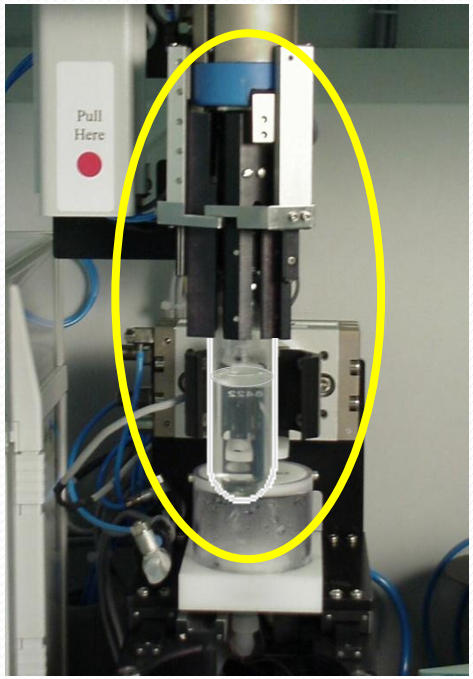


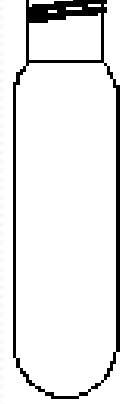
Upper Tray

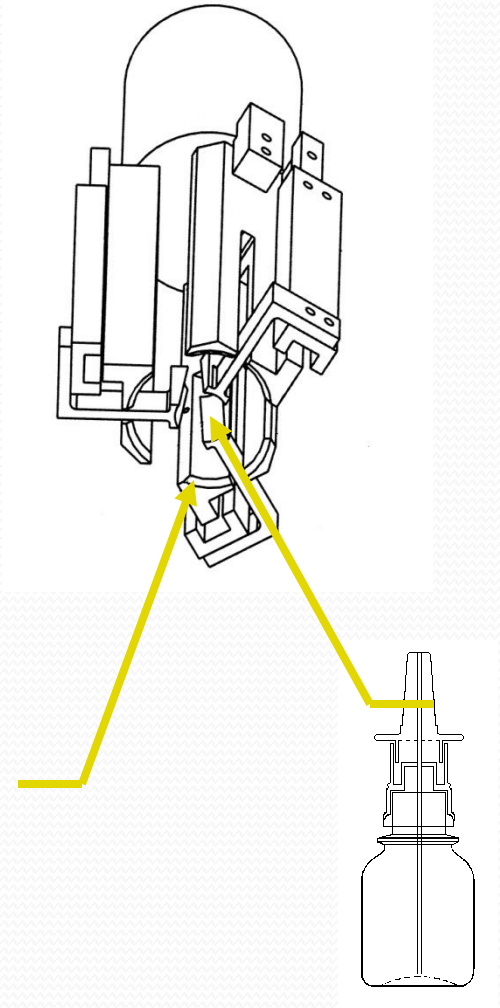
Nasal Spray Bottles

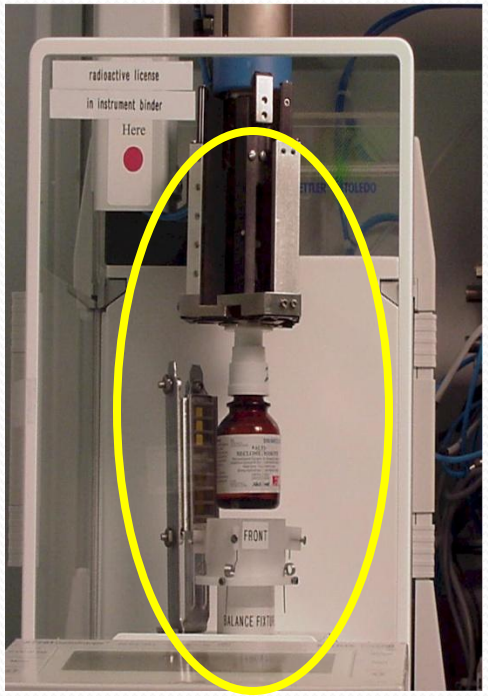
Lower Tray

Multi-Purpose Transport Gripper

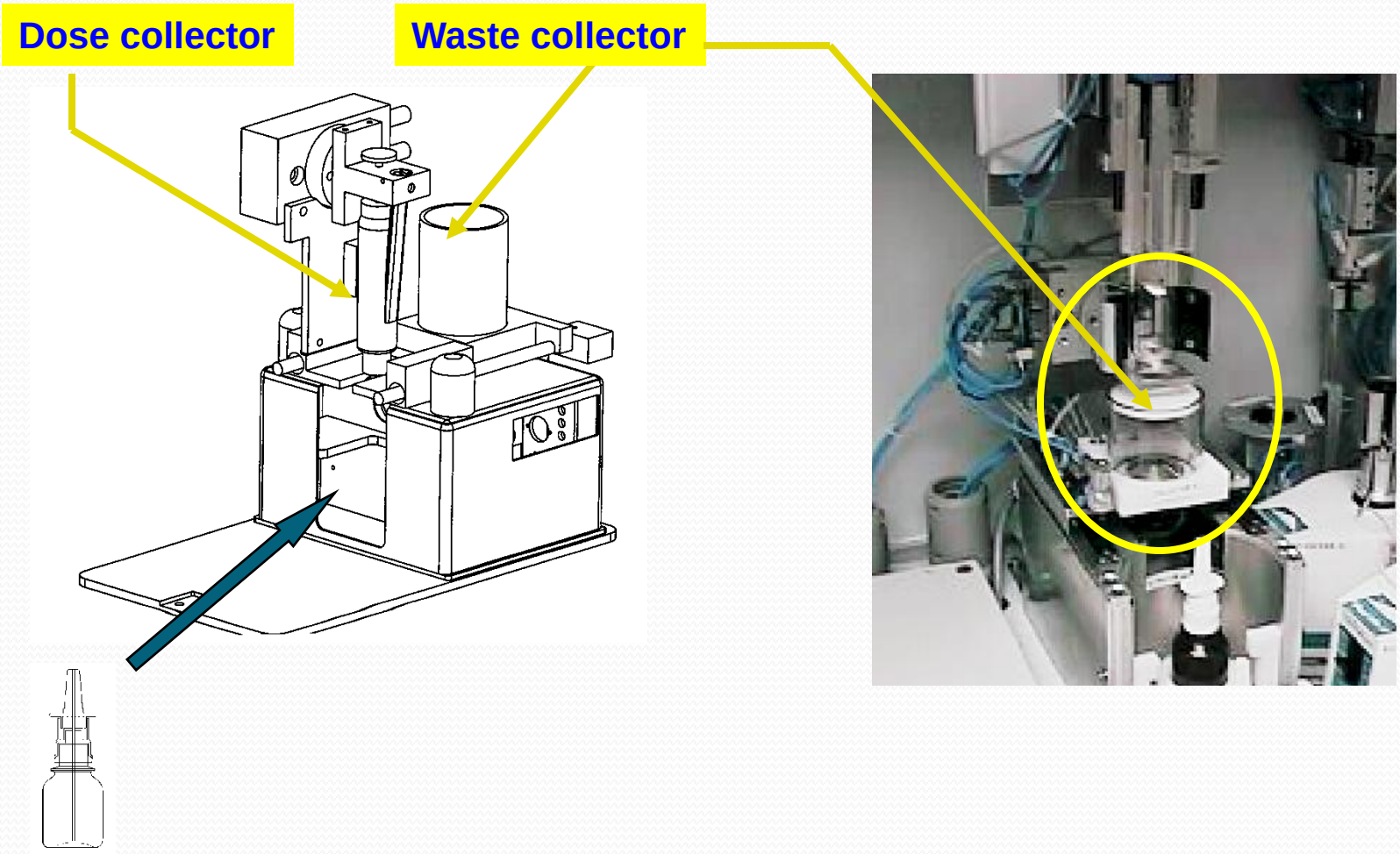




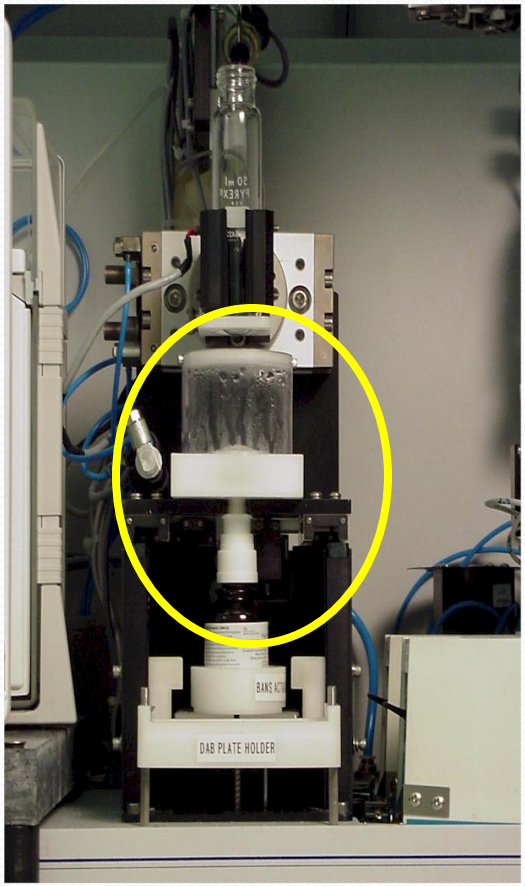




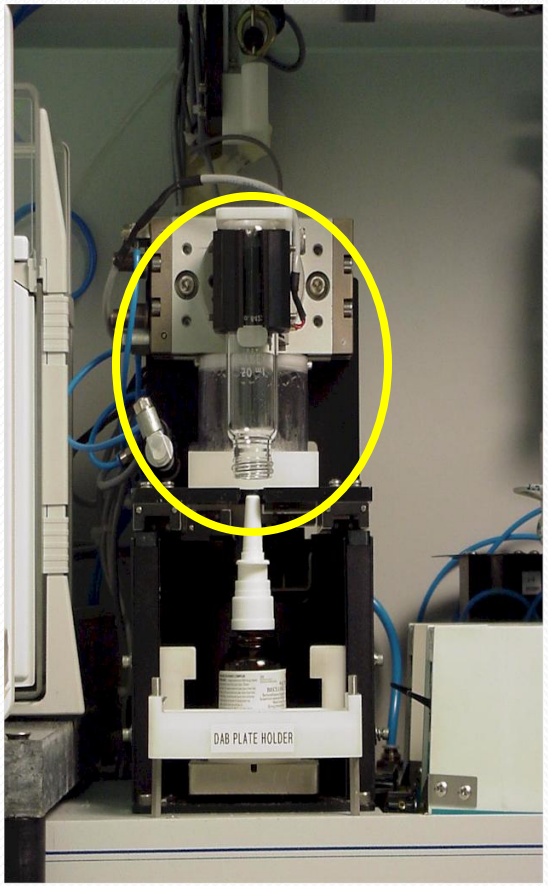
Dose/Waste Collection Station



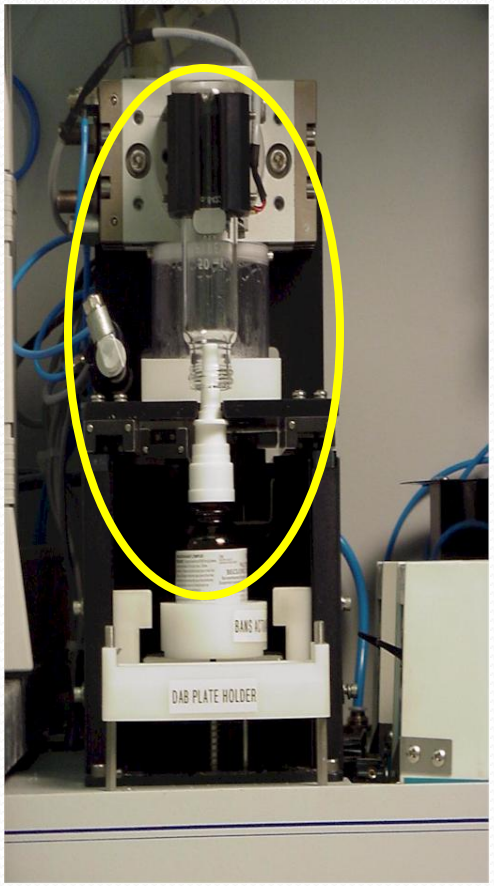
Dose Actuation/Collection



Actuation to waste



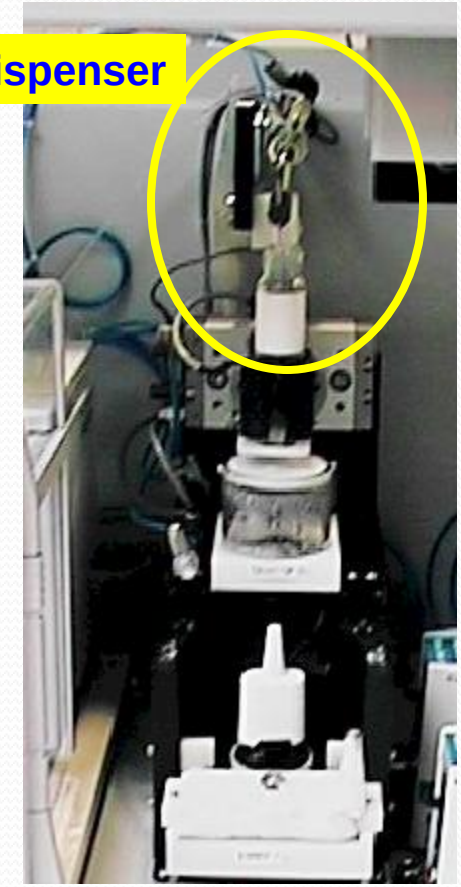
Tube inversion



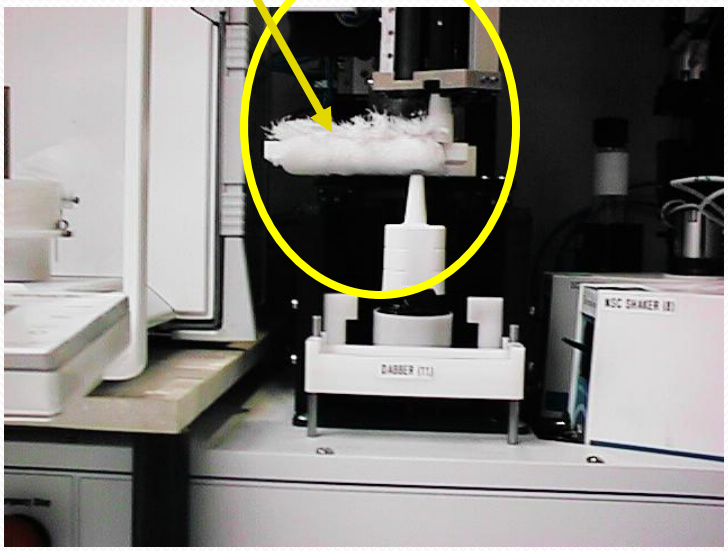
Collect doses

Solvent Dispensing and Dabbing Stations

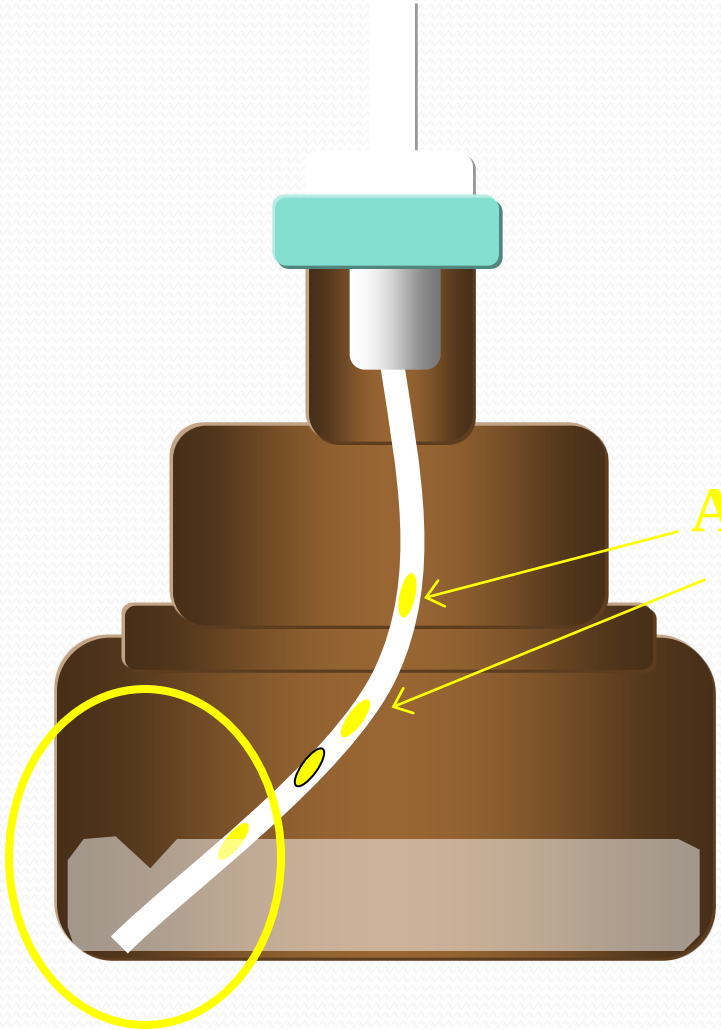
Solvent Dispenser



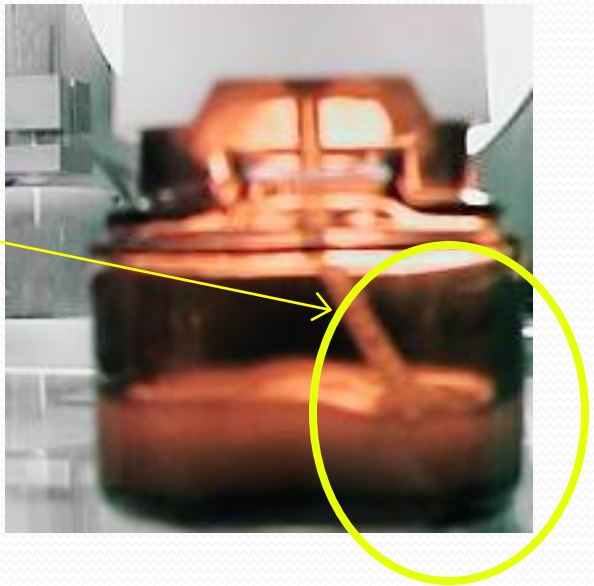
Absorbing Material



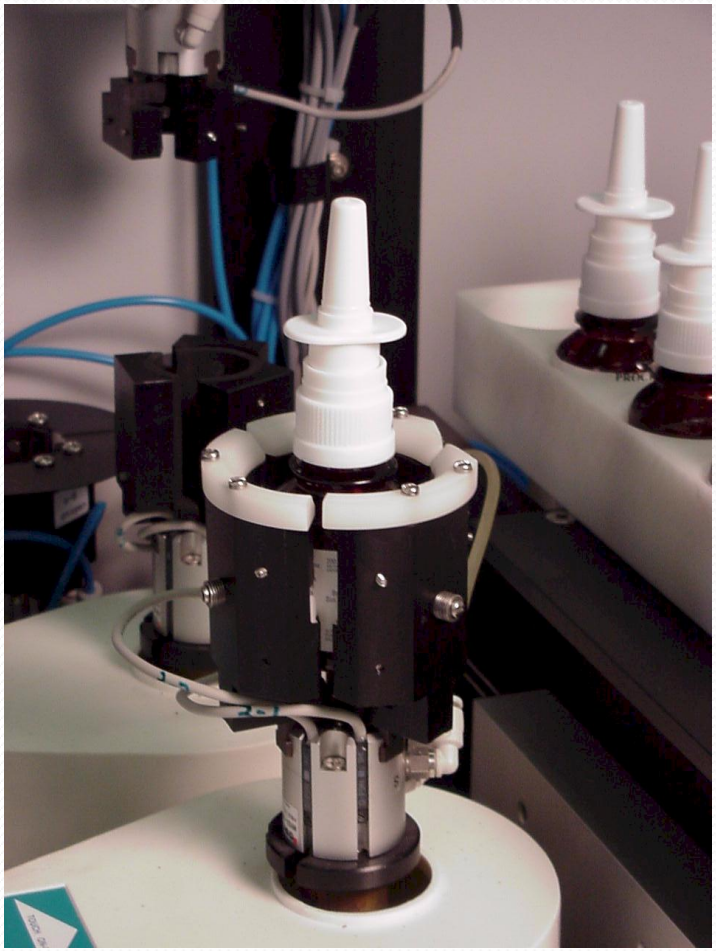
Spray at the End of Bottle



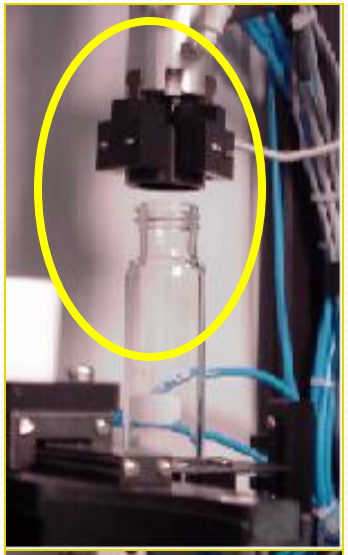
Air Bubbles



Bottle Shaking and Capping Stations

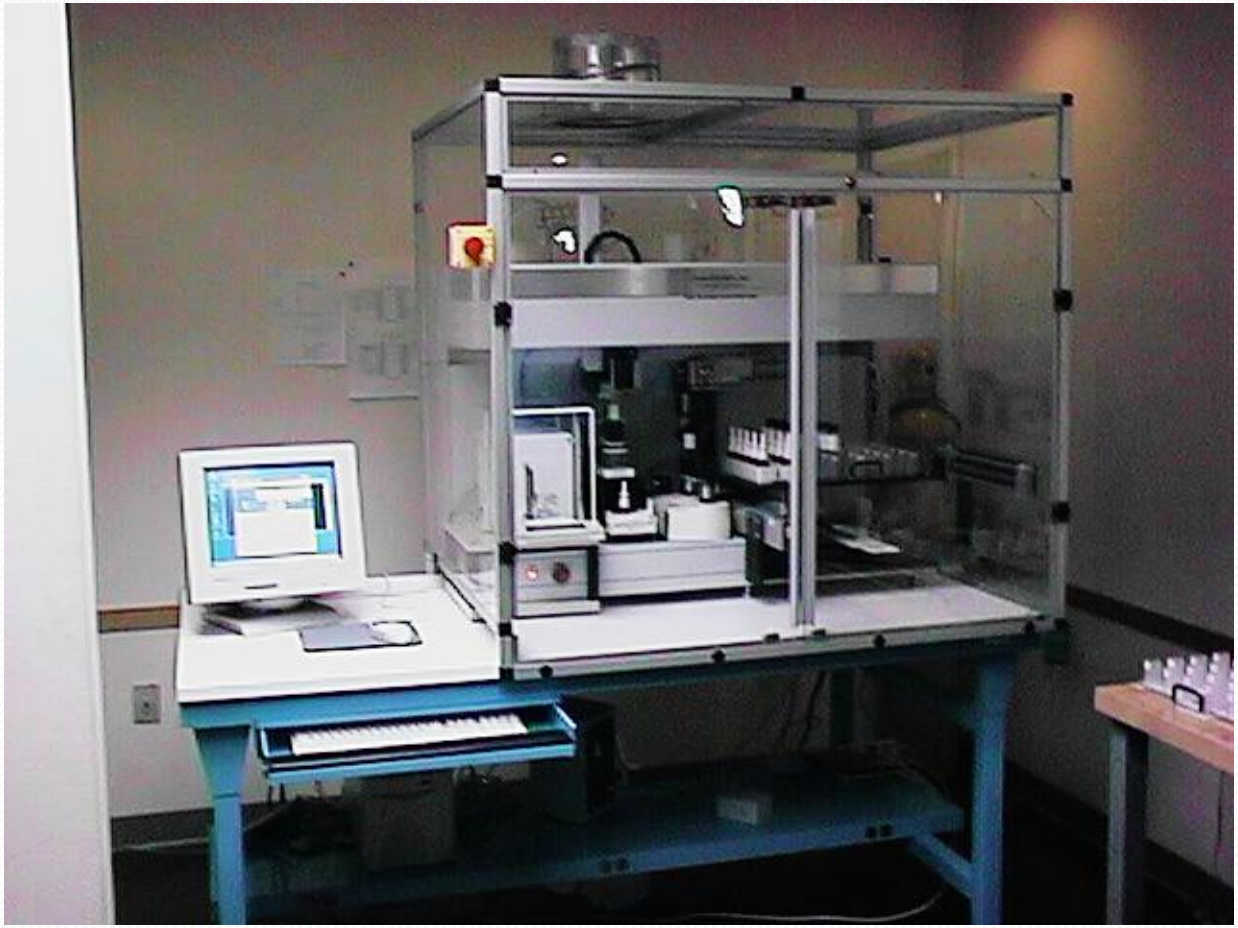


Uncapped Tube



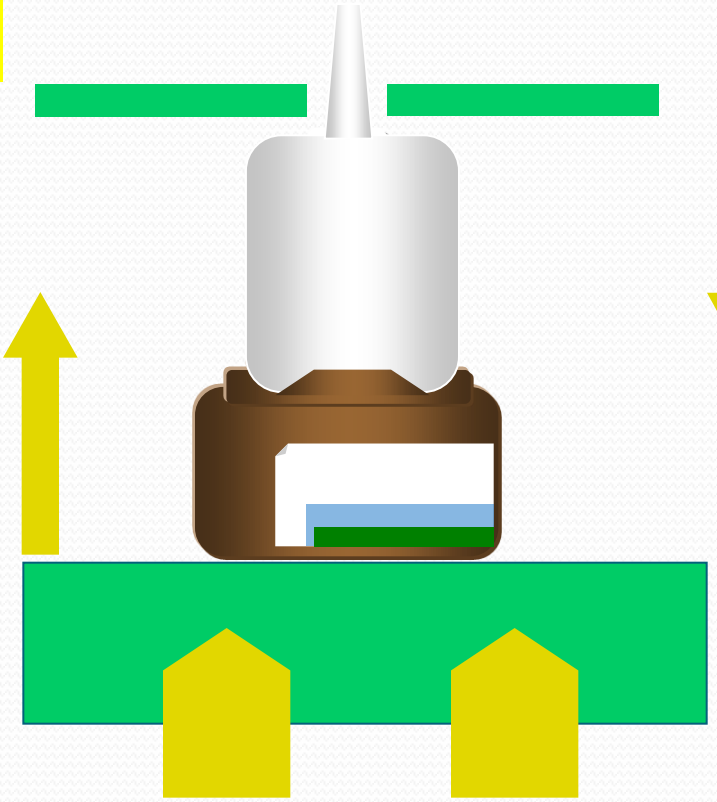
Capped Tube

Full system



Actuation Parameters

Hold Time:
Actuation time duration, 0.5 sec 3



Release Time:
Time to relax pump, 0.2 sec 4

Time To apply Force:
Time to compress pump, 0.2 sec 2

Spray Delay:
Time between actuations, 5 sec 5

1 **Actuation Force:**
Amount of force exerted
4.5 kg