

# Gantry setup at FNAL

**Caleb Fangmeier**

University of Nebraska - Lincoln

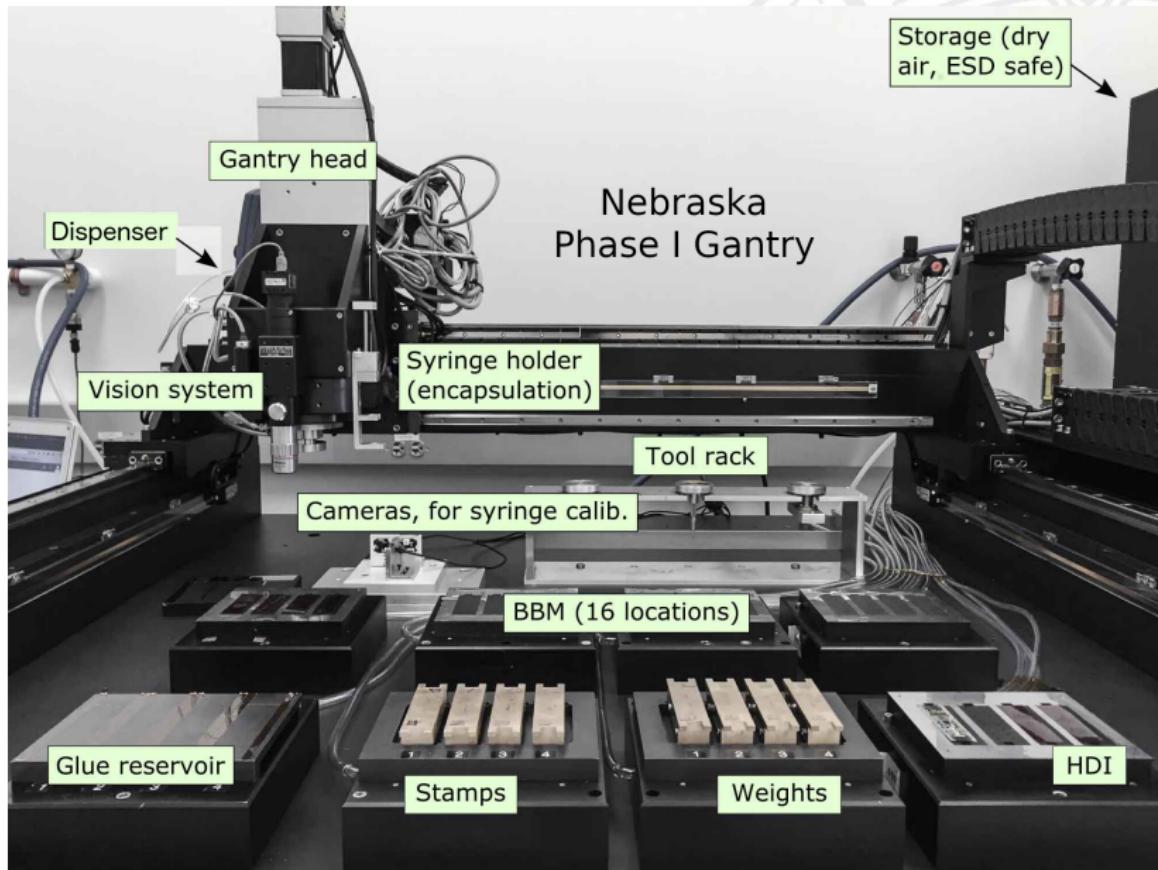
ETL Metting — Dec 9, 2019



## INTRODUCTION

- ▶ Aerotech 3+1 axis gantries were used successfully in Phase I FPIX at Nebraska and Purdue
- ▶ Nebraska, Purdue, and CUA will be using such gantries again for Phase II TFPX
- ▶ Such gantries will be used for ETL module assembly
- ▶ ETL assembly sites:
  - ▶ Nebraska - Gantry ordered, expected delivery roughly May
  - ▶ SiDet @ FNAL - Existing gantry recommissioned

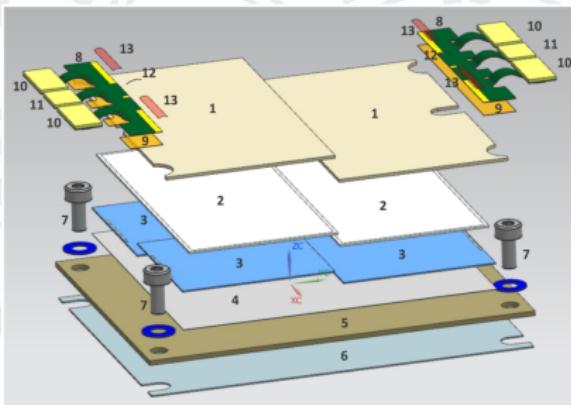
# GANTRY SYSTEM OVERVIEW



## ETL MODULE ASSEMBLY STEPS

1. Operator places baseplates and sensor assembly onto chucks
2. Vision system is used to do position fine-tuning (few micron level)
3. Gantry grabs a stamp, dips it in glue, and applies the glue to the baseplate
4. Gantry picks a sensor assembly and places it on the baseplate
5. Gantry grabs weight and places it on sensor assembly
6. Repeat 3-5 for other modules
7. Allow glue to cure (at least partially) before removing modules from gantry table

Attaching of cover plate follows similar steps

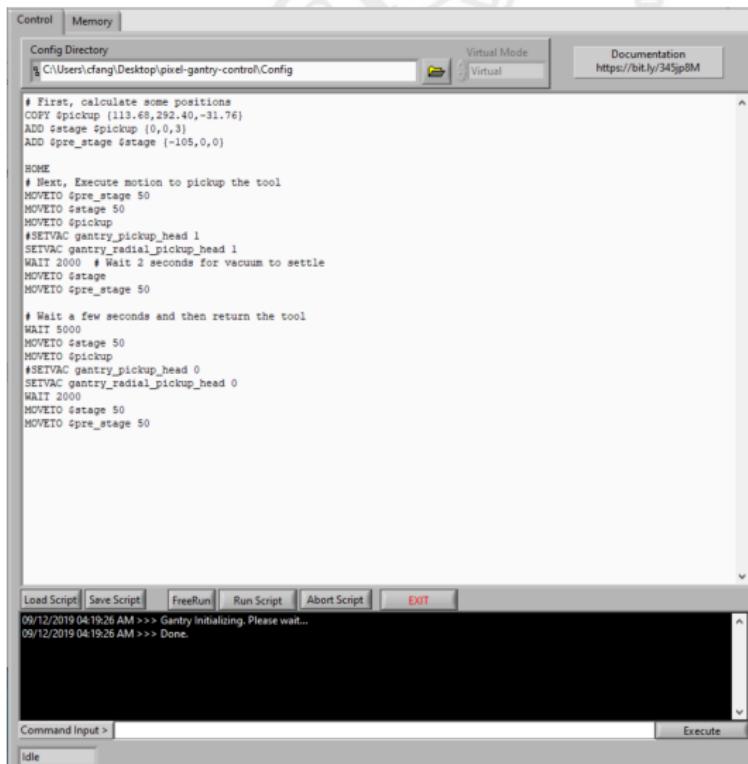


## SOFTWARE AUTOMATION

- ▶ During Phase I production, control software was developed to automate the process of gluing and encapsulation.
- ▶ Written observing LabVIEW best practices. Split between “applications” and an underlying library.
- ▶ Library includes
  - ▶ Access to all hardware (Gantry, vacuum, cameras...)
  - ▶ Fiducial pattern recognition
  - ▶ Calculation of part location from fiducials
  - ▶ Atomic motion operations (Pickup a tool, Move to chuck X, etc)
- ▶ Existing applications include:
  - ▶ (Legacy) Gluing Application
  - ▶ (Legacy) Potting Application
  - ▶ gScript Application

# gSCRIPT APPLICATION

- ▶ Implements simple text-based command language called gScript
- ▶ Developed in Spring 2019 as a replacement for Purdue's legacy scripting tool
- ▶ Enables quick prototyping of gantry procedures
- ▶ Example script (right) retrieves a tool from the tool rack and replaces it
- ▶ **Script in action!**
- ▶ All gantry software, including the gScript interpreter, can be found [here](#).



The screenshot shows the gScript application interface. At the top, there are tabs for 'Control' and 'Memory', with 'Control' being the active tab. Below the tabs is a 'Config Directory' field containing the path 'C:\Users\cfang\Desktop\pixel-gantry-control\Config'. To the right of the field are buttons for 'Virtual Mode' (with 'Virtual' selected) and 'Documentation' (with the URL 'https://bit.ly/345jp8M').

The main area displays a text-based script:

```
# First, calculate some positions
COPY $pickup [113.68,292.40,-31.76]
ADD $stage $pickup [0,0,3]
ADD $pre_stage $stage [-105,0,0]

HOME
# Next, Execute motion to pickup the tool
MOVEIO $pre_stage 50
MOVEIO $stage 50
MOVEIO $pickup
#SETVAC_gantry_pickup_head 1
SETVAC_gantry_radial_pickup_head 1
WAIT 2000 # Wait 2 seconds for vacuum to settle
MOVEIO $stage
MOVEIO $pre_stage 50

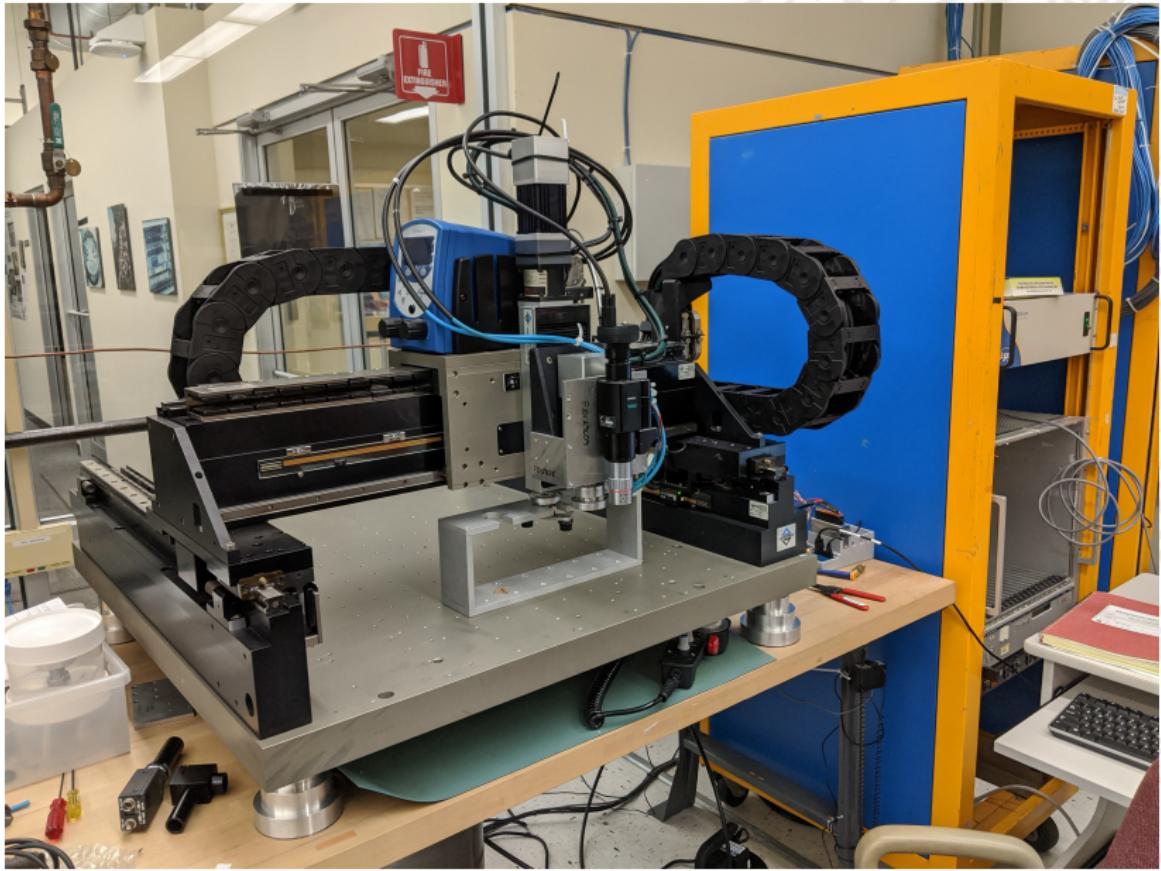
# Wait a few seconds and then return the tool
WAIT 5000
MOVEIO $stage 50
MOVEIO $pickup
#SETVAC_gantry_pickup_head 0
SETVAC_gantry_radial_pickup_head 0
WAIT 2000
MOVEIO $stage 50
MOVEIO $pre_stage 50
```

At the bottom of the script window are buttons for 'Load Script', 'Save Script', 'FreeRun', 'Run Script', 'Abort Script', and 'EXIT'. The 'Run Script' button is highlighted in red. Below the buttons is a text area showing log messages:

```
09/12/2019 04:19:26 AM >>> Gantry Initializing. Please wait...
09/12/2019 04:19:26 AM >>> Done.
```

At the very bottom is a 'Command Input' field with the word 'Idle' and an 'Execute' button.

# STATUS AT FNAL



## STATUS AT FNAL

- ▶ Hardware closely approximating Phase I gantry setup installed including:
  - ▶ Gantry hand controller
  - ▶ Gantry-head camera with associated optics
  - ▶ Vacuum pump, manifold, and controller
  - ▶ Legacy fixtures (ok for now, will require adjustments at some point)
- ▶ Software deployed on FNAL Computer and operator given basic training on its use
- ▶ Custom fixtures for ETL modules under development
- ▶ Next step is to demonstrate successful pick-n-place using dummy parts

