

Joe Carrow, Mechanical Engineer

System Design

•

Simulation

•

Injection Molding

•

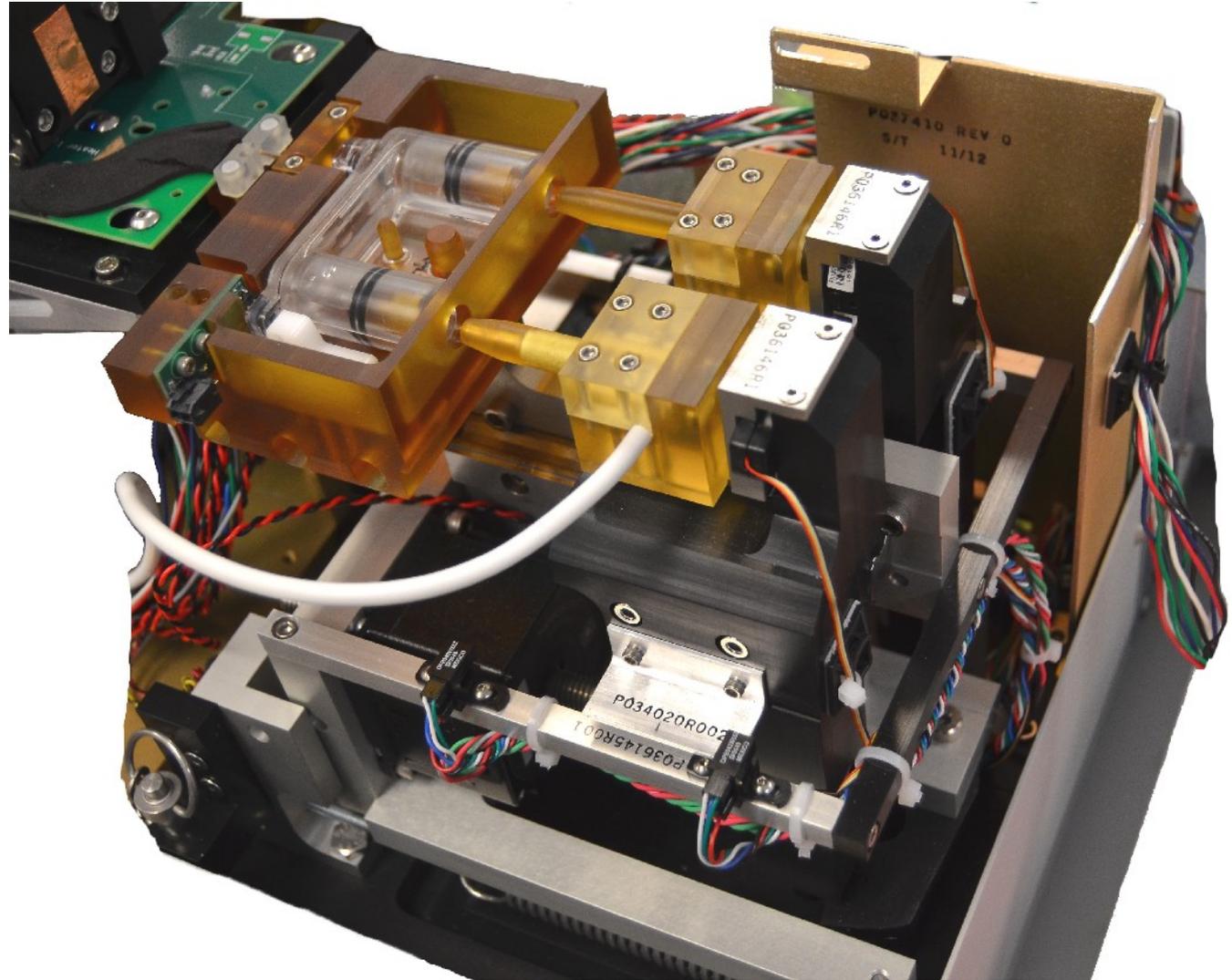
Human Factors

•

Tooling

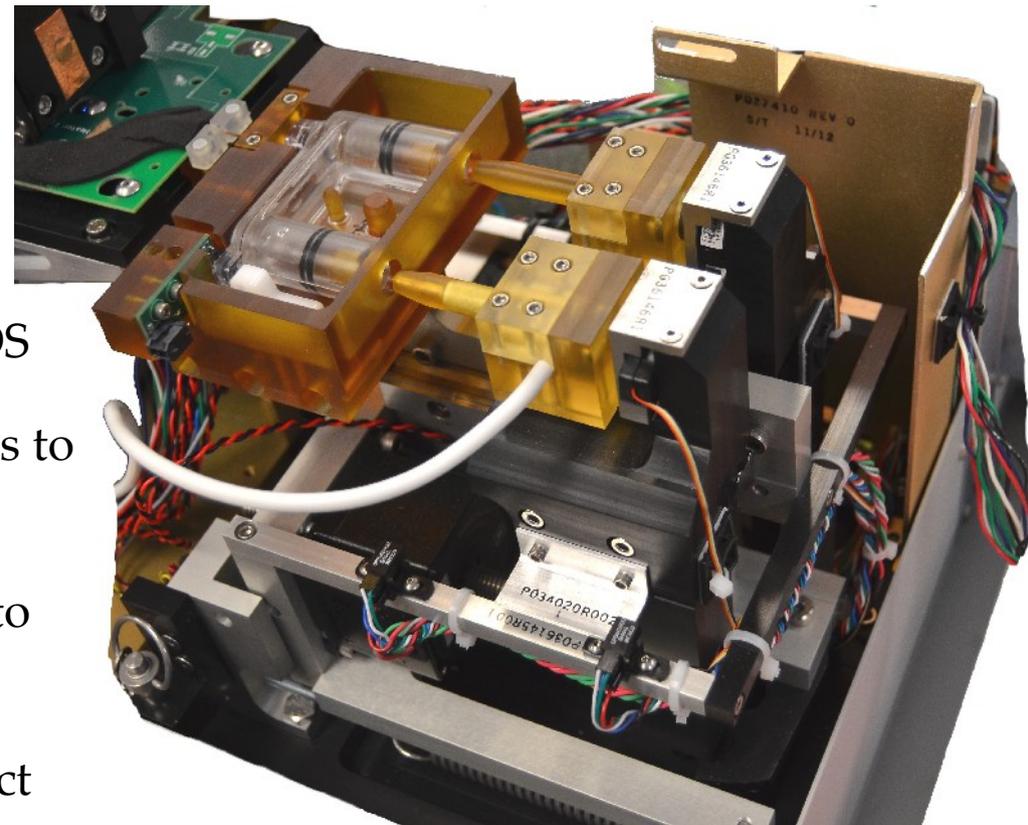
•

Fabrication

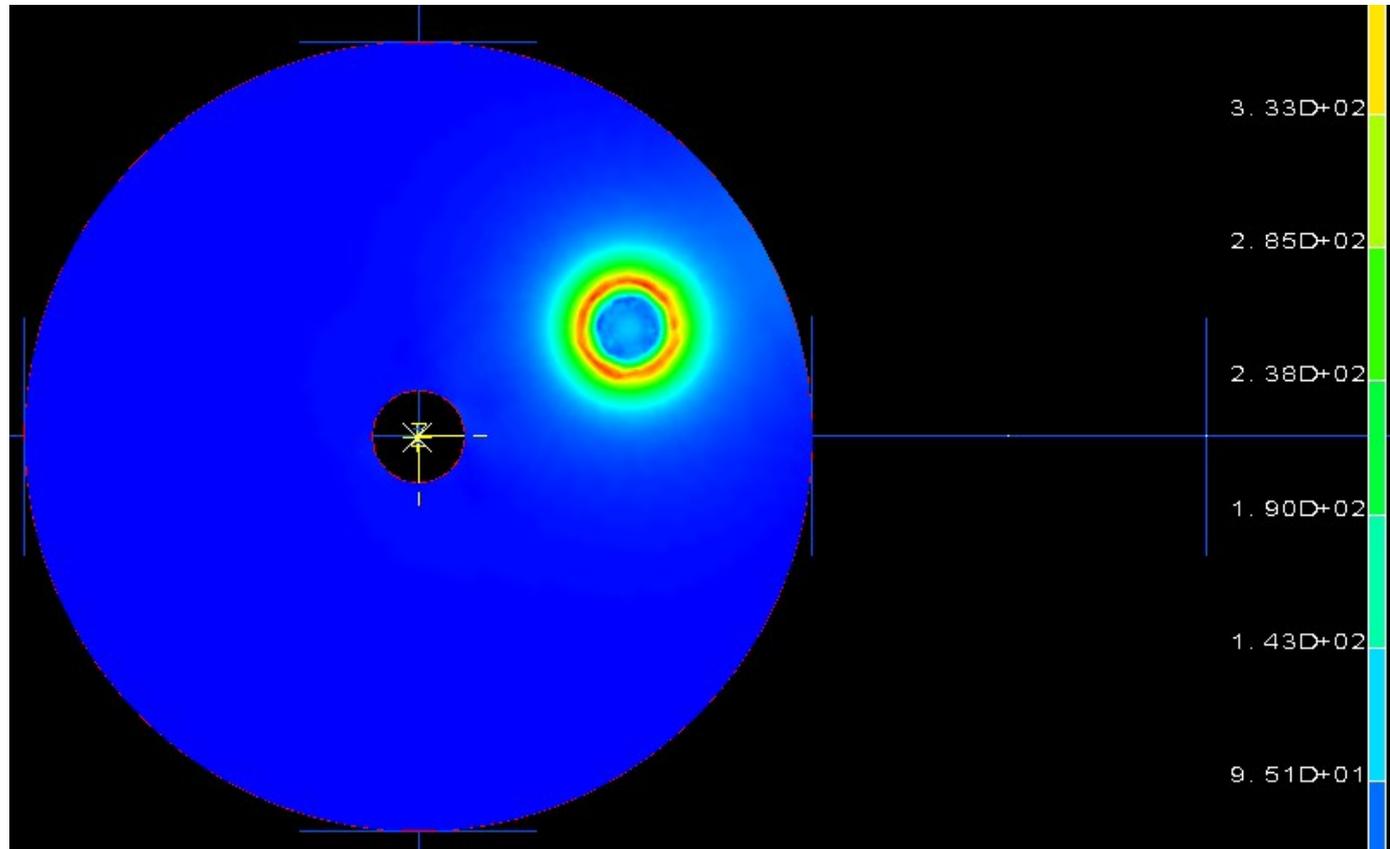


Capillary Electrophoresis Separations Gel Handling for Automated Human DNA Identification Device

- Worked with scientists to define performance requirements of system
- Coordinated with sales and marketing, and industrial designers to define physical envelope of disposable cartridge and handling mechanism
- Fabricated proofs of concept to test physical processes and human factors concerns
- Designed plastic injection molded assembly
- Simulated all stressed components in COSMOS
- Worked with electrical and firmware engineers to achieve full automation
- Carried out accelerated life and overload test to failure.
- Documented system and handed off to contract manufacturer, ahead of schedule and under budget



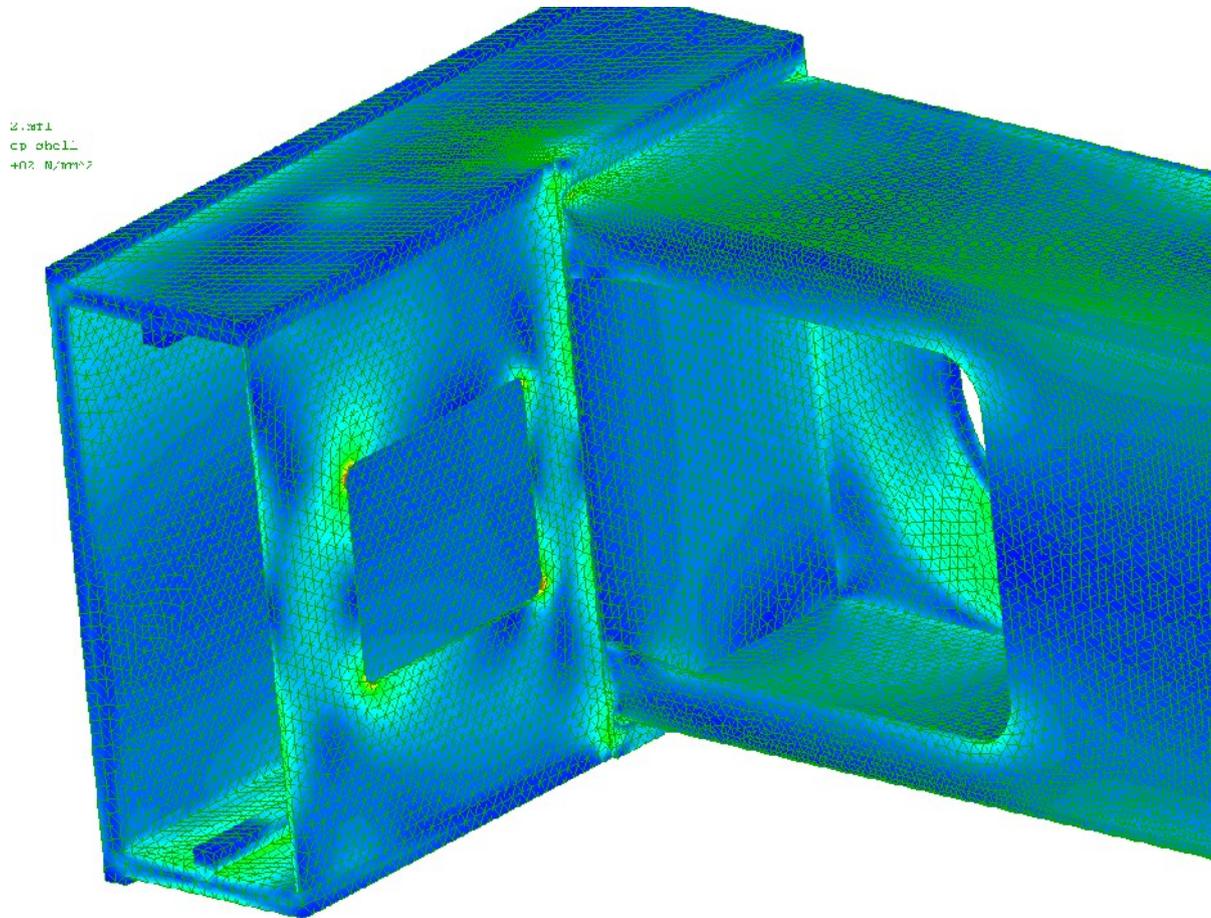
Simulation Examples



Simulation of thermal shock load in X-ray target
(Siemens Medical, I-DEAS)

While investigating a new failure mode in a legacy product, I performed a **transient thermal simulation** to model stress due to thermal shock, and **steady state thermal analysis** to determine the cooling regime. My investigation showed that the X-ray target was exceeding a critical temperature for materials compatibility. I made recommendations to prevent reaching this temperature and identified a coating to prevent damage.

Simulation Examples



Simulation of Stress and Deflection in Welded Structure
(Siemens Medical, I-DEAS)

An existing welded gantry structure for a medical linear accelerator required modification to accommodate the addition of a flat panel imaging device. I **simulated stresses** to demonstrate **factors of safety in a medical environment**, and verified simulated values using strain gauges. I also simulated deflection prior to modifications to **mitigate risk**, and identified “worst case” test points to guide test efforts.

Injection Molding Examples



Microfluidic Manifolds (*IntegenX, Inc, Solidworks*)

I used **3D rapid prototyping** to generate a proof of concept model to demonstrate bubble behavior and mating for two pieces in the **IntegenX RapidHIT200** human DNA identification device. **Prototype injection molding** allowed me to quickly refine the manifolds to reduce post-processing for assembly. The final product enabled blind mating of pneumatic and microfluidic connections by a minimally trained technician.

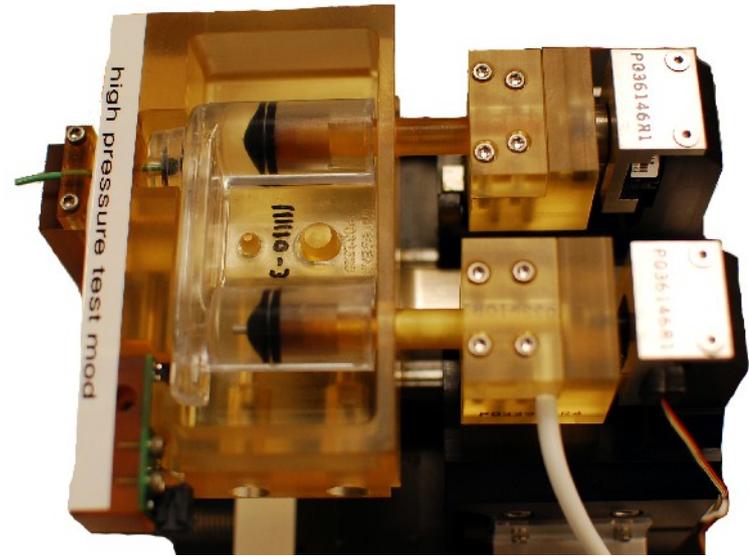
Human Factors Examples



Lever Powered Wheelchair

(Daedalus Wings, Inc, Solidworks)

In designing the control scheme for a lever powered wheelchair, I performed **market research** to identify the disabilities most likely to be represented in the target market, and identified muscle groups most likely to be retained for safety critical control motions.



Consumable CE Gel Cartridge

(IntegenX, Inc, Solidworks)

I designed the IntegenX RapidHIT200 capillary electrophoresis gel cartridge to have an obvious “correct” orientation, protecting the high voltage and high pressure connections from improper loading. **“So easy a toddler could figure it out”** is feedback from the project's industrial design firm.

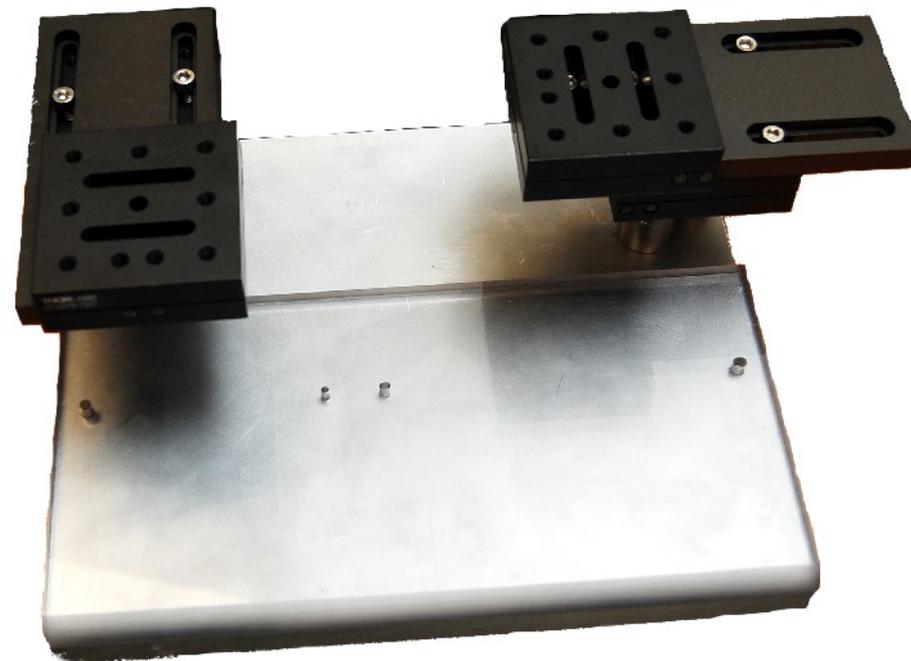
Tooling Examples



Vacuum Fixture for Microfluidic Chips

(IntegenX, Solidworks/Visualmill)

This fixture allowed technicians to actuate pneumatic valves on a microfluidic chip during microscopic inspection, enabling new inspection and testing techniques. While creating this tool I operated the **Haas CNC Mini Mill** to create the mold for casting the sealing layer.



Microscopic Inspection Work Area

(IntegenX, Inc, Solidworks)

As IntegenX began producing a larger number of microfluidic chips in house, microfabrication department needed a way to rapidly reposition chips and digital microscopes. Using kinematic mounts and interchangeable locating jigs I was able to eliminate an hour per day of prep work in the clean room.

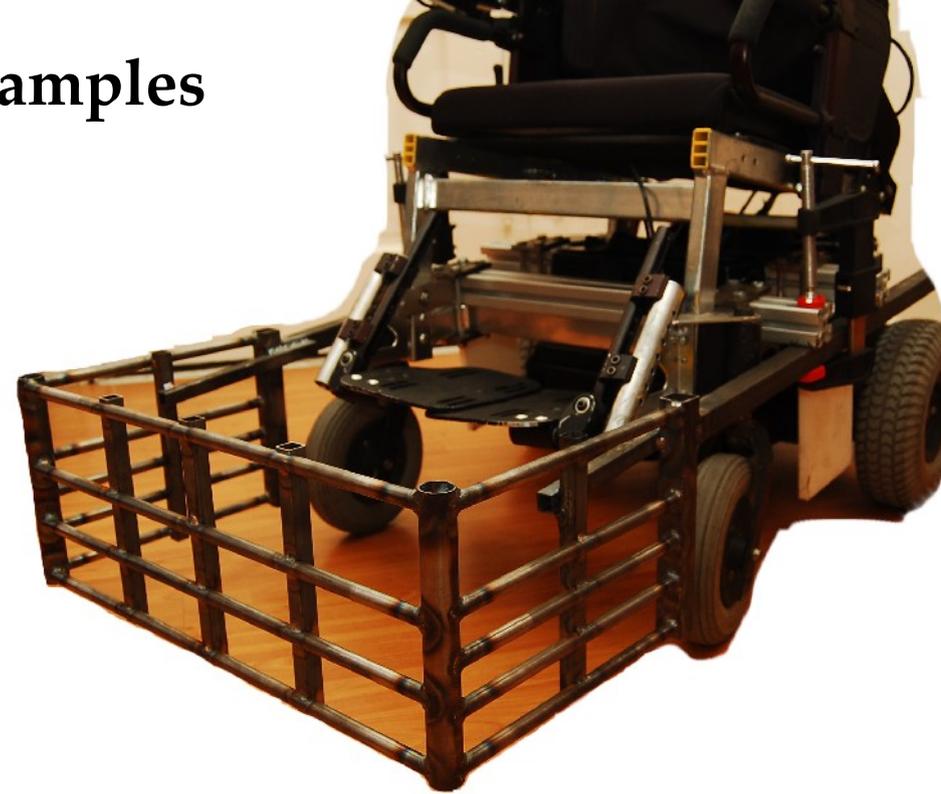
Fabrication Examples



Injection Mold for Microfluidic Chip

(IntegenX, Solidworks/Visualmill)

I created tool paths and **Haas CNC Mini Mill** to create this injection mold for a microfluidic chip, accurately producing 100 micron channels and pneumatic valve seats.



Power Soccer Foot Guard

(Personal, Solidworks)

I designed this foot guard for a starter on the US National Power Soccer team. This design exceeded the stiffness of commercially available products while reducing the system's rotational inertia. I performed all metal fabrication on the guard used by this player while winning the World Cup.