



QA/QC During the Construction of a Modular Neutrino Detector, NOVA

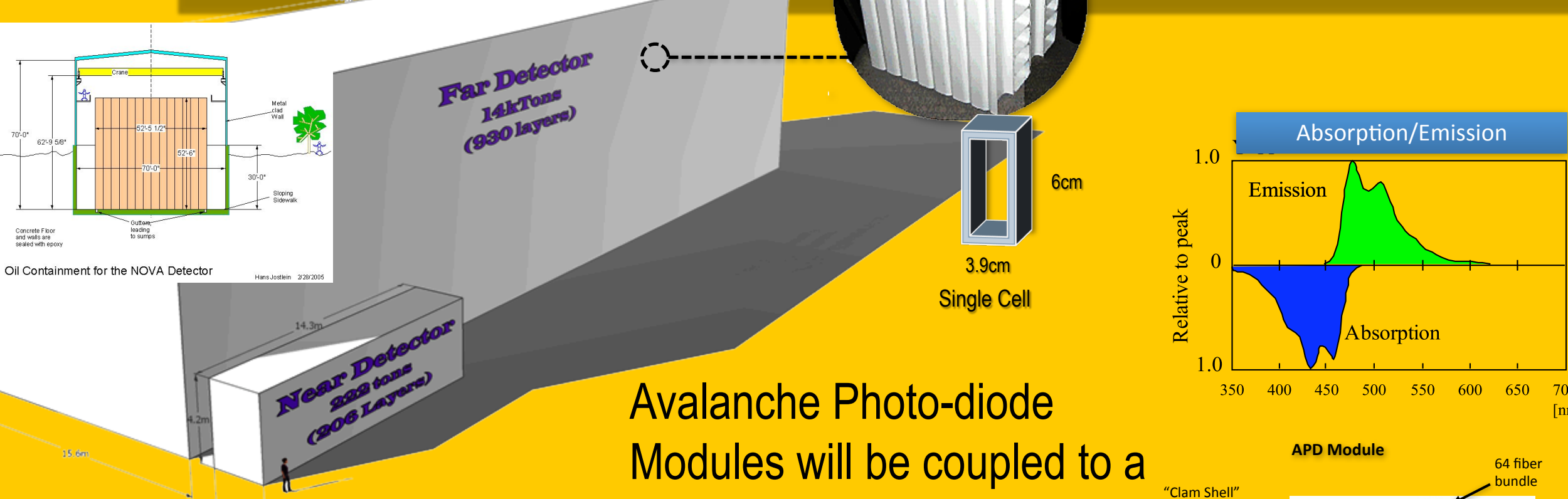
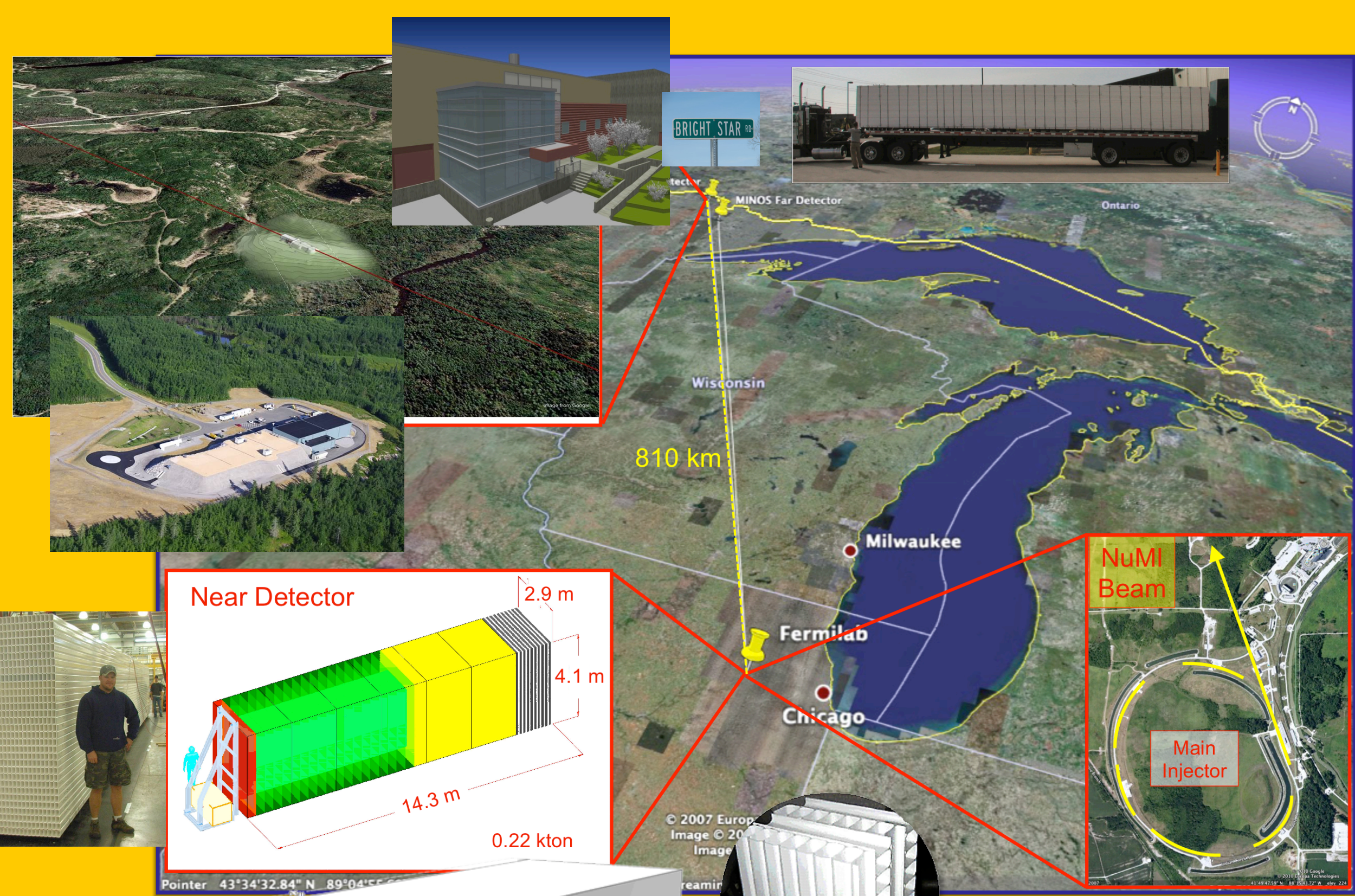


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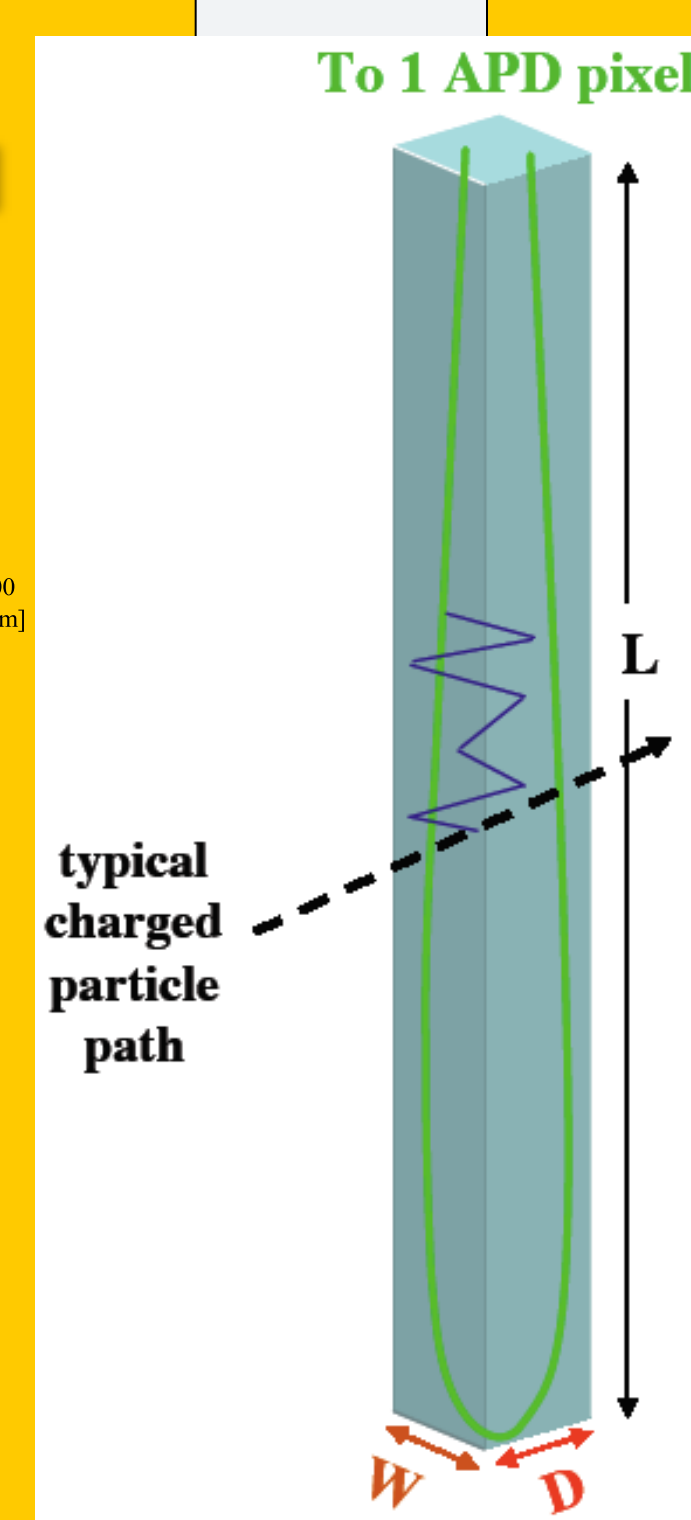
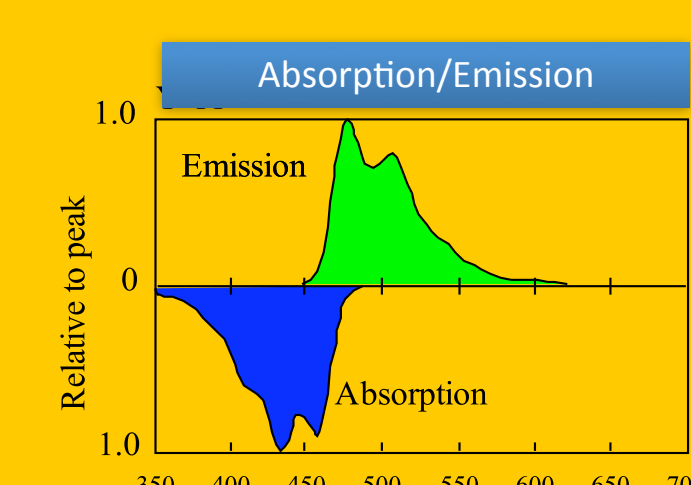
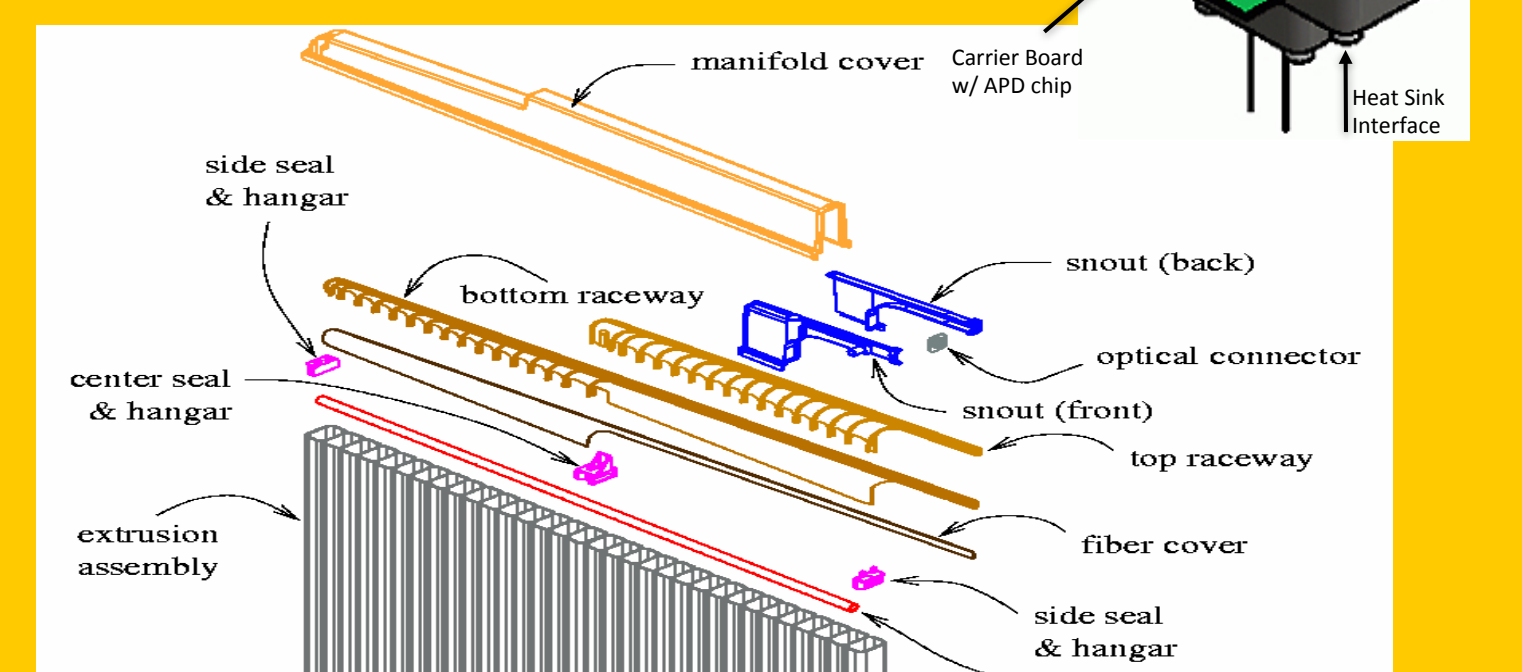
NOVA Detector at Ash River

A 15 kTon detector is being built at Ash River, MN to record particle interactions from neutrinos generated in a 700kW beam located 810 km away at Fermilab, in Chicago, IL. Assembly of this massive PVC detector is tracked via an enterprise level software system (Java EE) designed to ensure high quality construction. Each of the dozen client stations are located throughout the detector hall to track one of inventory, testing, assembly, filling, and outfitting tasks using a bar code scanner system coupled to a central database. The business logic resides in its own tier where it ensures procedures are correct and restricts failed processes. Remote monitoring and reporting is provided via a web-interface. A crew of forty will work in either of two ten hour daily shifts, four days per week through 2014 when the installation of the NOVA Far Detector is scheduled for completion. In this poster the QA/QC is described. Reference: <http://www.umn.edu/~demuth/nova/>



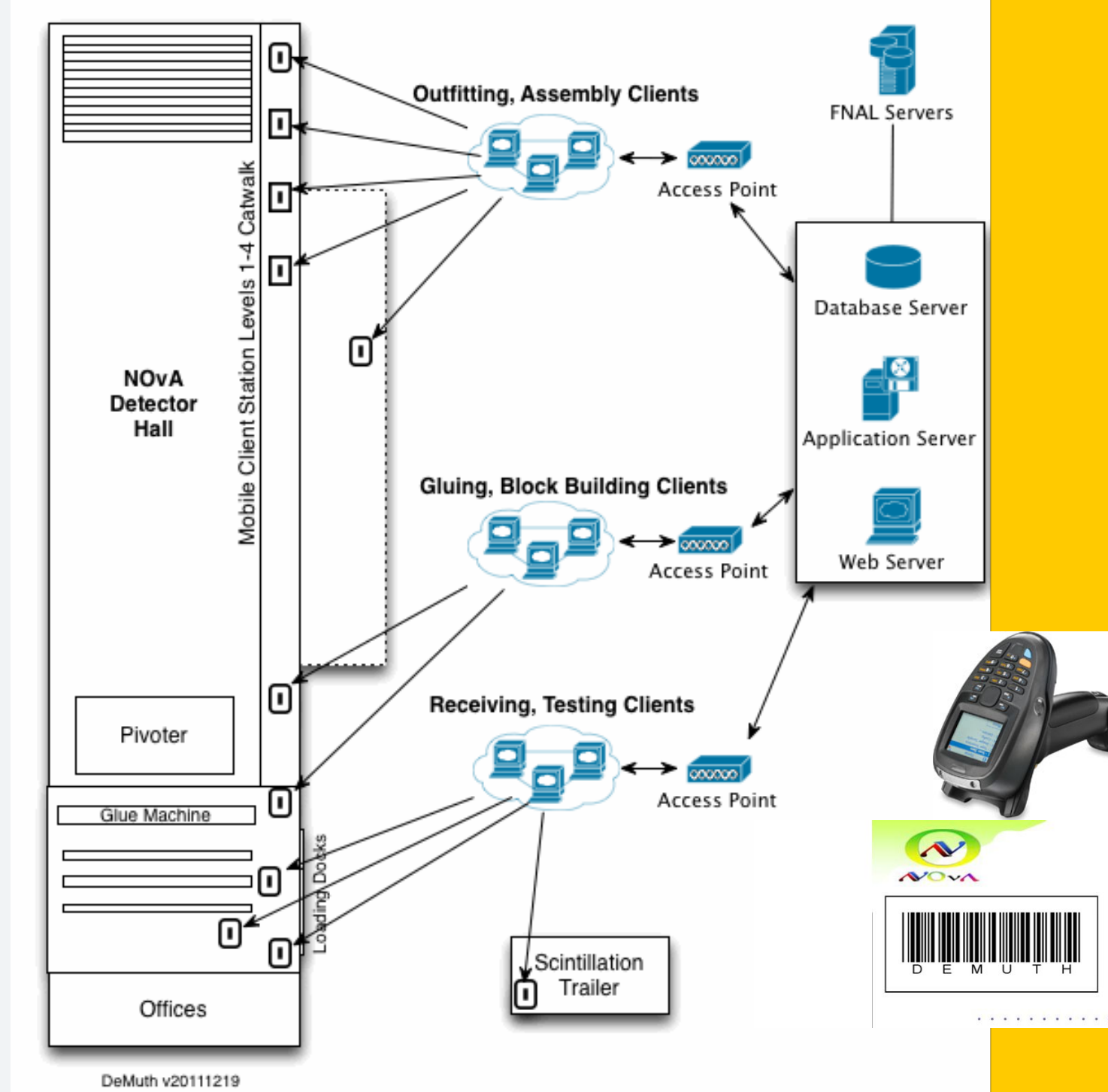
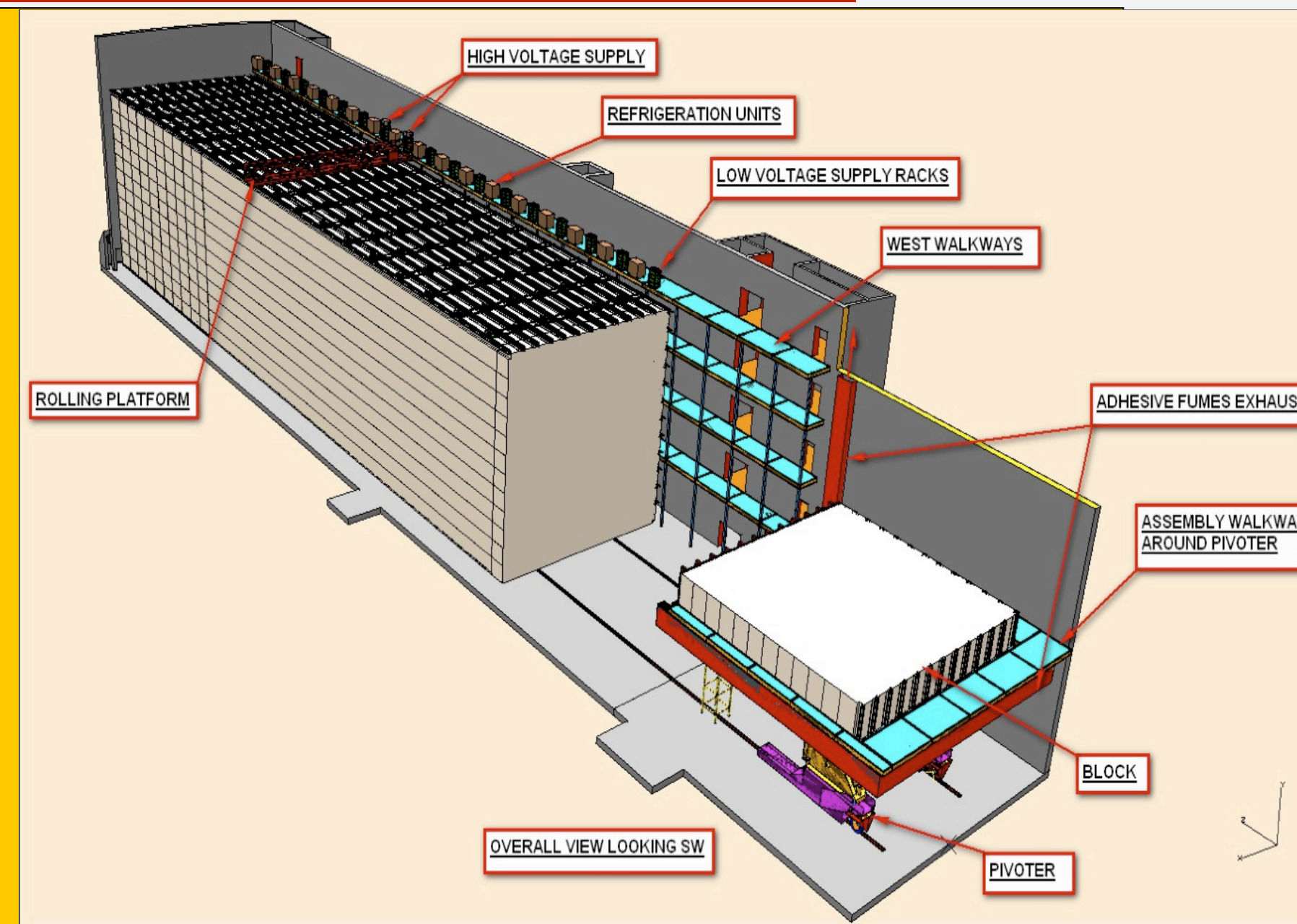
The detector is constructed from 11,520 modules (30, 384 module, 200 ton blocks), each extruded from a high reflectivity PVC, strung with 0.7 mm fibers, then filled with scintillator. Once complete, the detector will hold 14,000 km of fiber and 3 million gallons of liquid scintillator.

Avalanche Photo-diode Modules will be coupled to a 64 fiber bundle to record the bi-products of neutrino interactions.

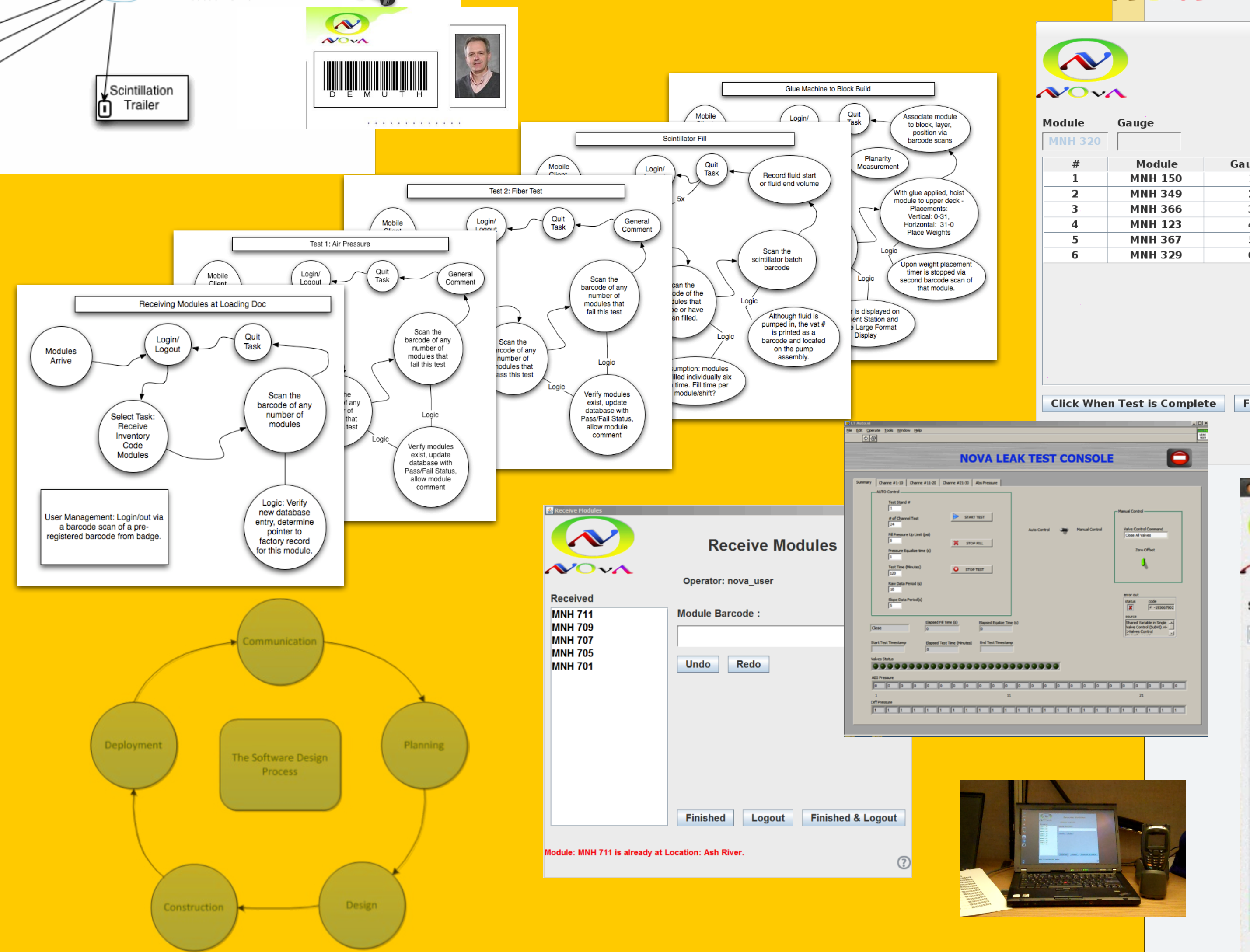


Ensuring Quality of Construction

Twelve Client Stations are used at various locations to: 1) receive modules & inventory, 2) pressure test and 3) fiber-test modules, 4) glue and placement in detector "Block", then 5) move into location, and 6) re-test pressure, 7) fill with scintillator fluid, 8) outfit with electronics, then finally 10) coordinate with the control room at Fermilab the initial connections and testing of each detector element.



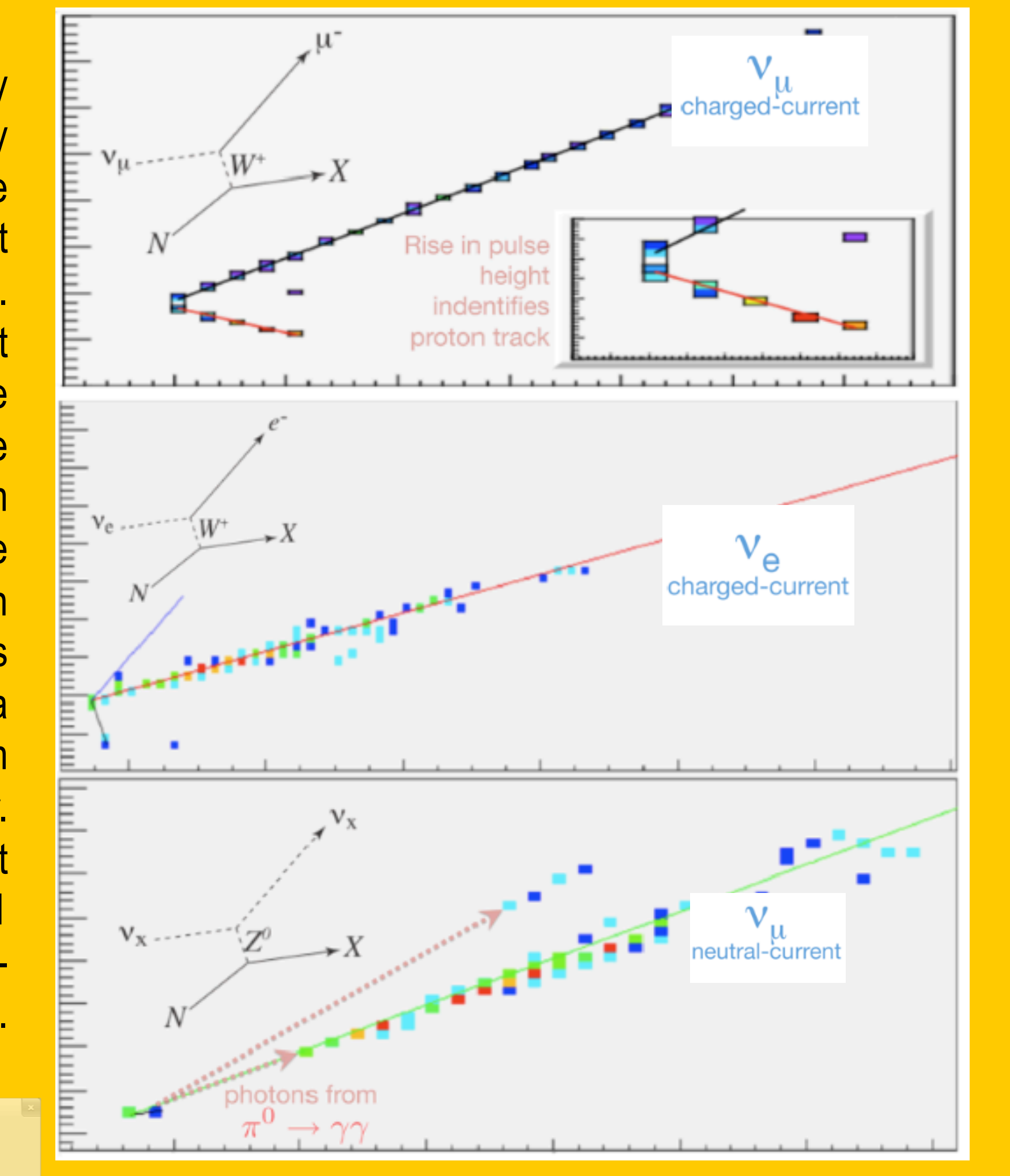
For example, after a truckload of modules are received at Ash River, the 24-module stack is tested for pressure leaks using a multi-channel rig built at Argonne National Laboratory. A barcode system is used to associate module serial numbers with the corresponding gauge of the pressure tester. Upon completion of the four hour test, data is exchanged between systems and recorded to a PostgreSQL database..



All processes recorded via barcode scanner, design must be highly reliable and robust to failure and following a sanctioned software design process.

Higher Quality Measurements

Neutrino Interacting Inside the NOVA Detector (Simulation)



A neutrino is a rarely interacting elementary subatomic particle that are found to be abundant throughout the Universe. This figure shows event topologies from an intense beam of muon-type neutrinos originating from Fermilab as recorded in the NOVA experiment. Each colored square represents the light collected by a single 4 cm x 6 cm x 15 m cell of liquid scintillator. Color indicates the amount of light recorded from 1 (purple) to 6 (red) track-equivalents.



Gluing modules prior to placement requires the module be first "certified" to verify all previous process steps were completed.



What pleases us most about this project is that software engineering students at an undergraduate-only institution are the key designers to this QA/QC system.

Acknowledgements

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For more information: <http://www-nova.fnal.gov>