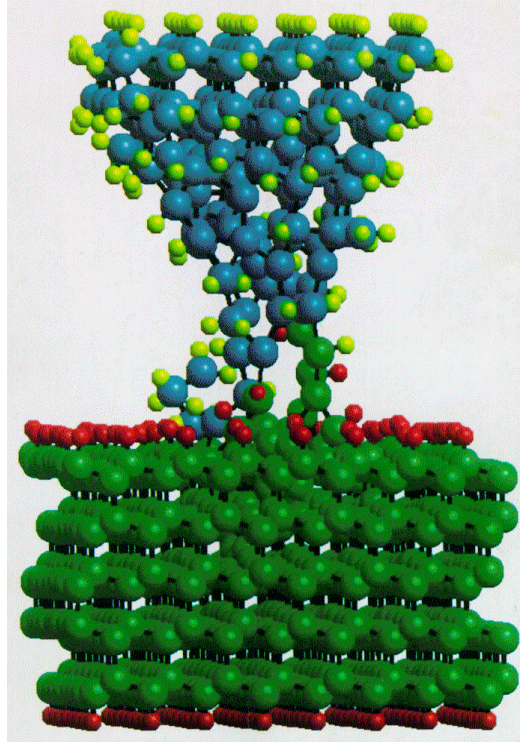
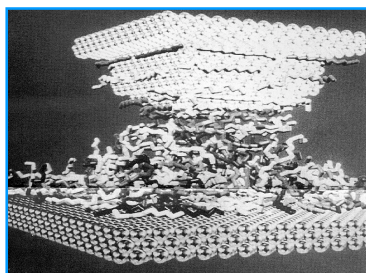


Building an Unique System: STM-AFM-FIM

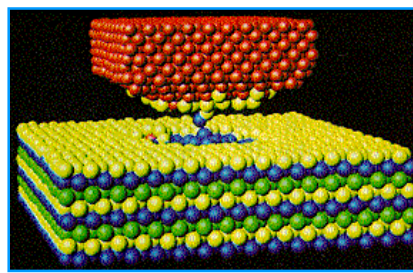
- The system allows viewing the atoms on the surface/sample (STM-AFM mode)
- The system allows viewing the atoms on the STM-AFM tip (FIM mode)
- Ideal UHV system for atomic and nano-contacts experiments



Molecular Dynamic Simulation of the Atoms Interaction During an Atomic and/or a Nano-Contact Experiment (from *Judith A. Harrison et al.* work)

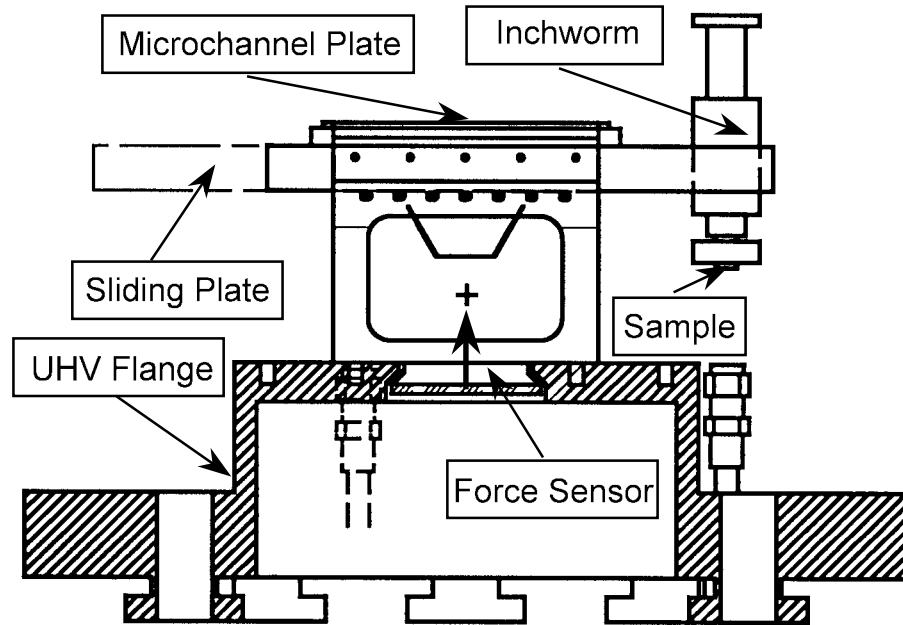


dirty conditions

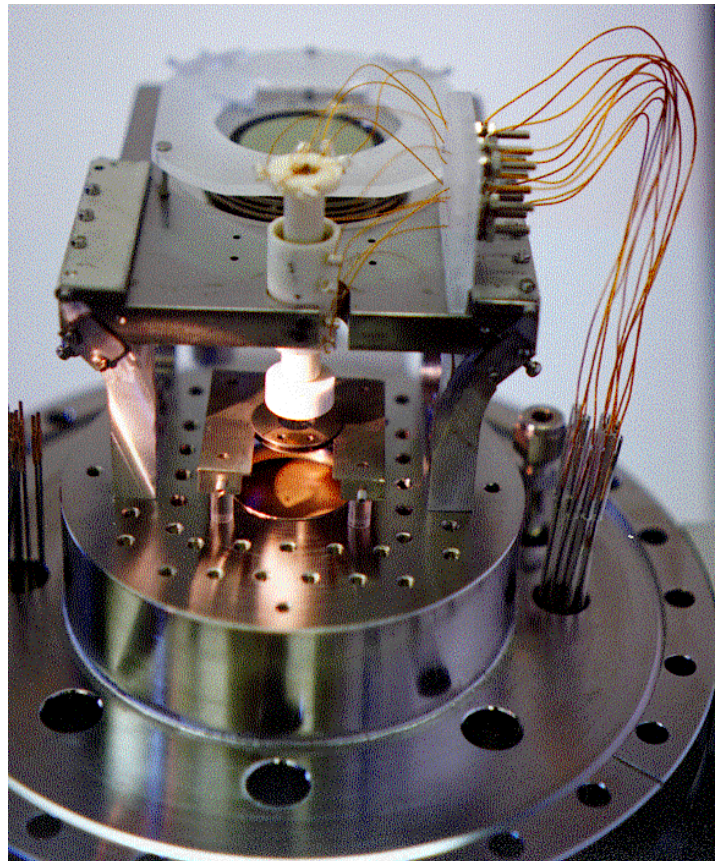


clean conditions, e.g., UHV

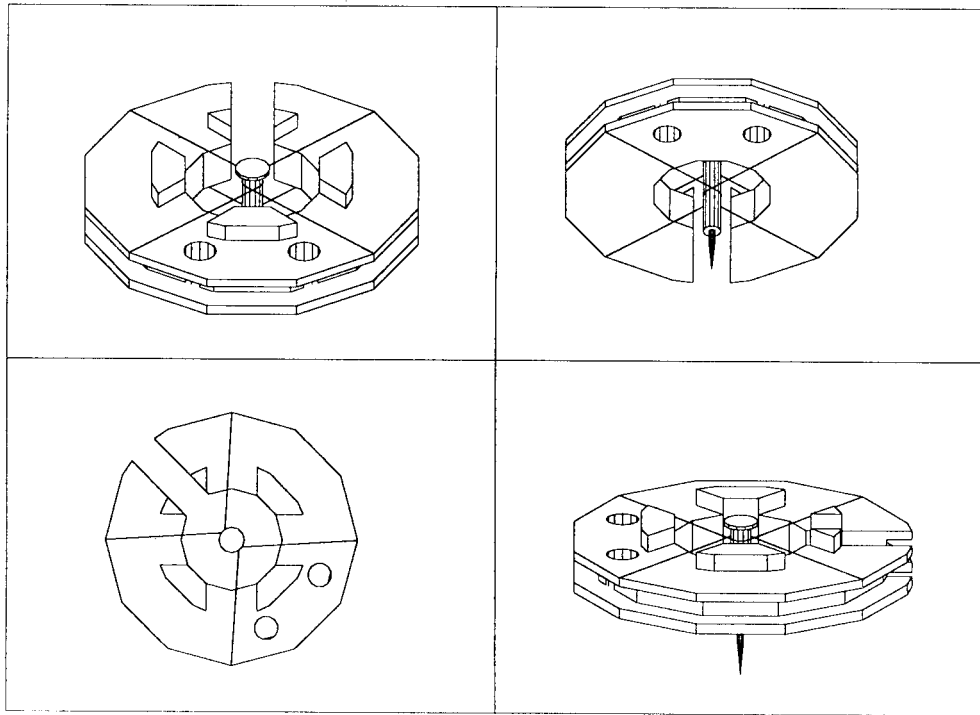
Well-Defined Contact Experiments in Controlled Environments.



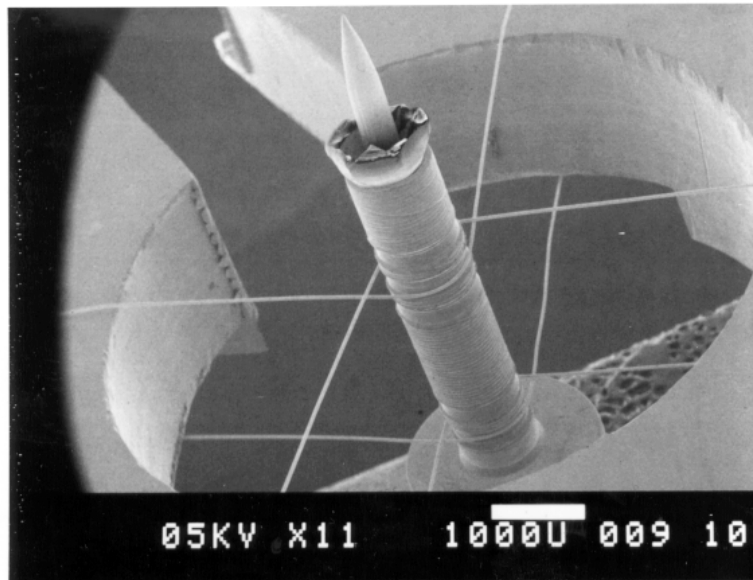
Schematic Design of the STM-AFM-FIM Head Assembly.



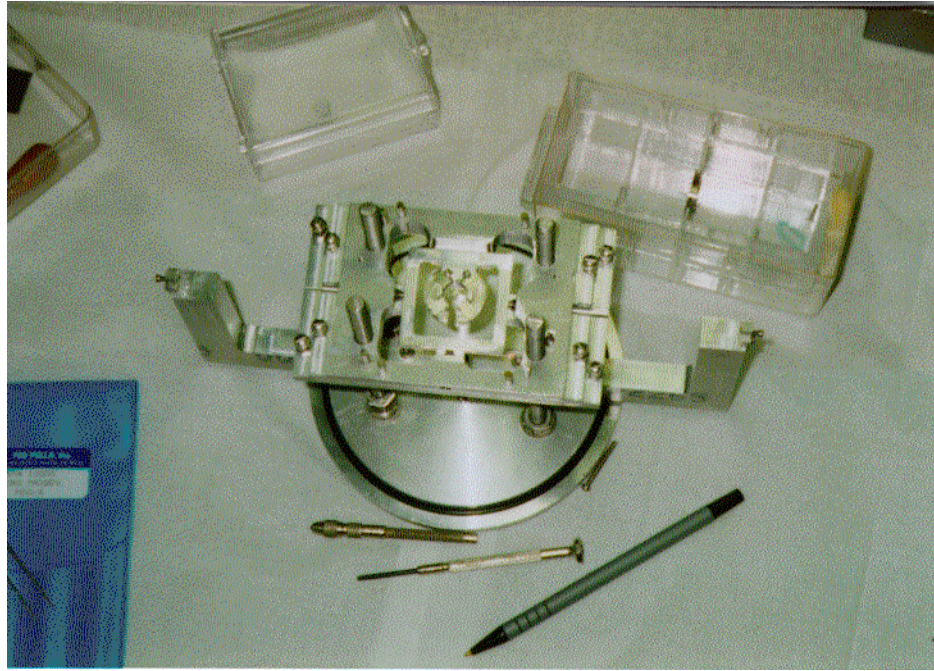
Design of the STM-AFM-FIM Head Assembly.



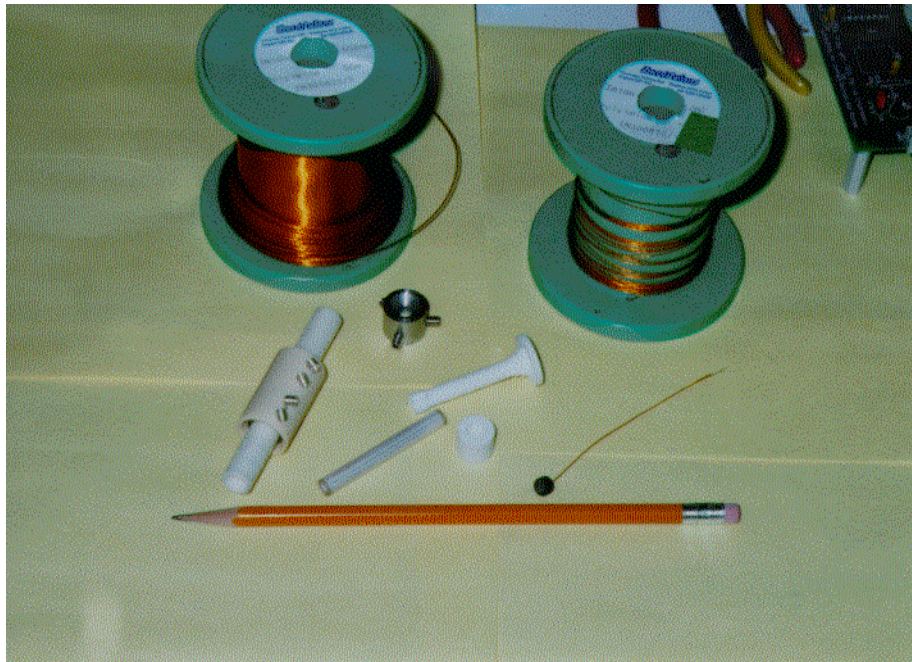
Schematic Design of the Force Sensor (also used as STM-AFM Tip)



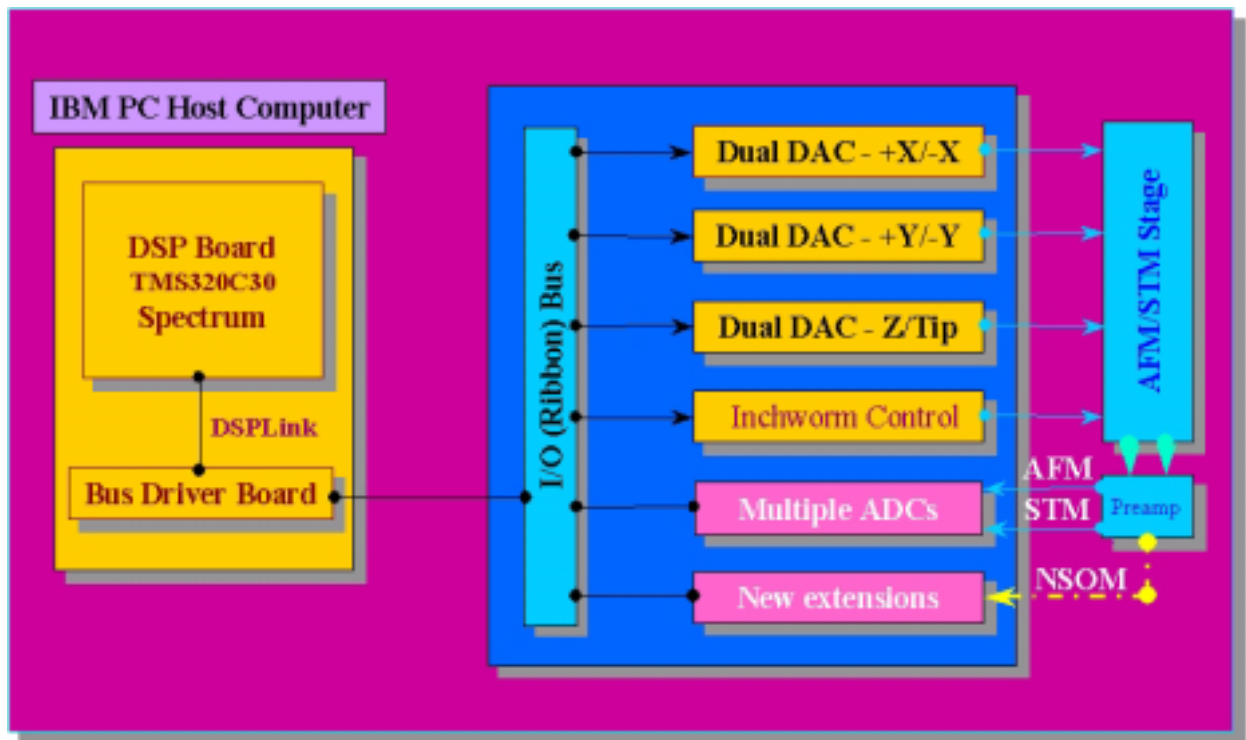
Scanning Electron Micrograph of the Force Sensor Carrying the STM-AFM Tip



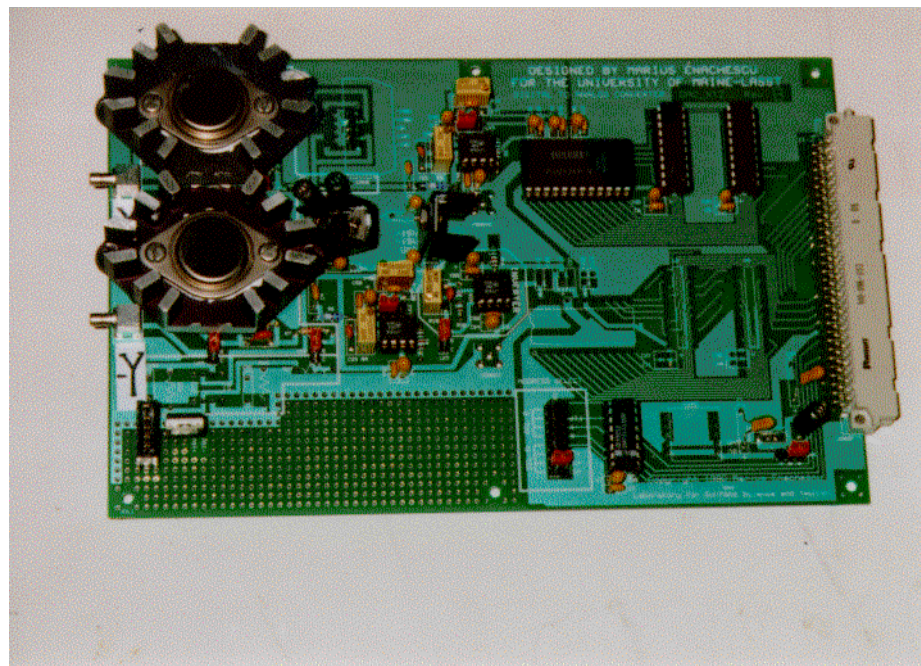
Mechanical Setup Designed and Used for Force Sensors in-House Fabrication.



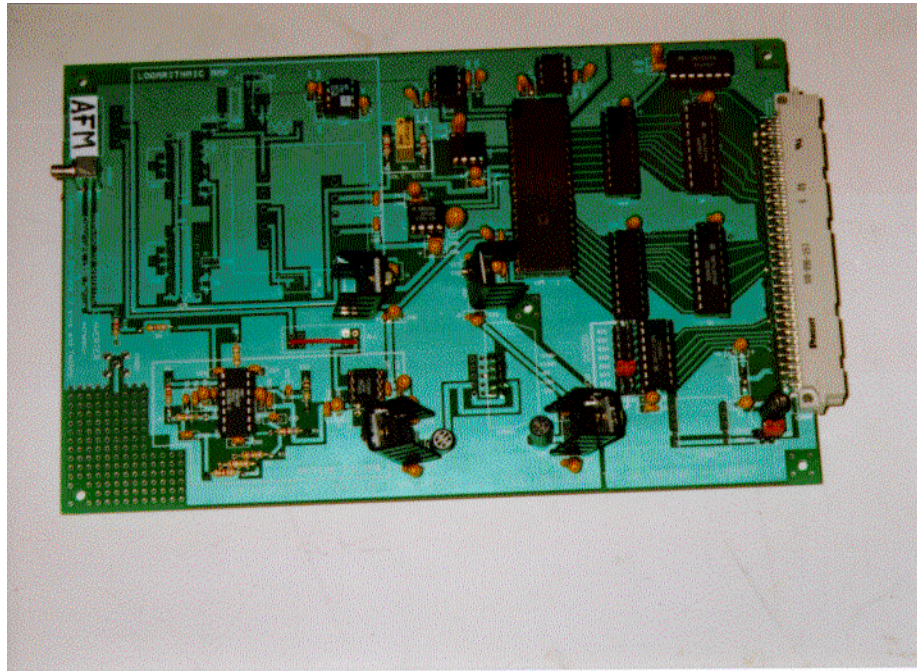
Rebuilding the Inchworm and the Piezo System Carrying the Sample.



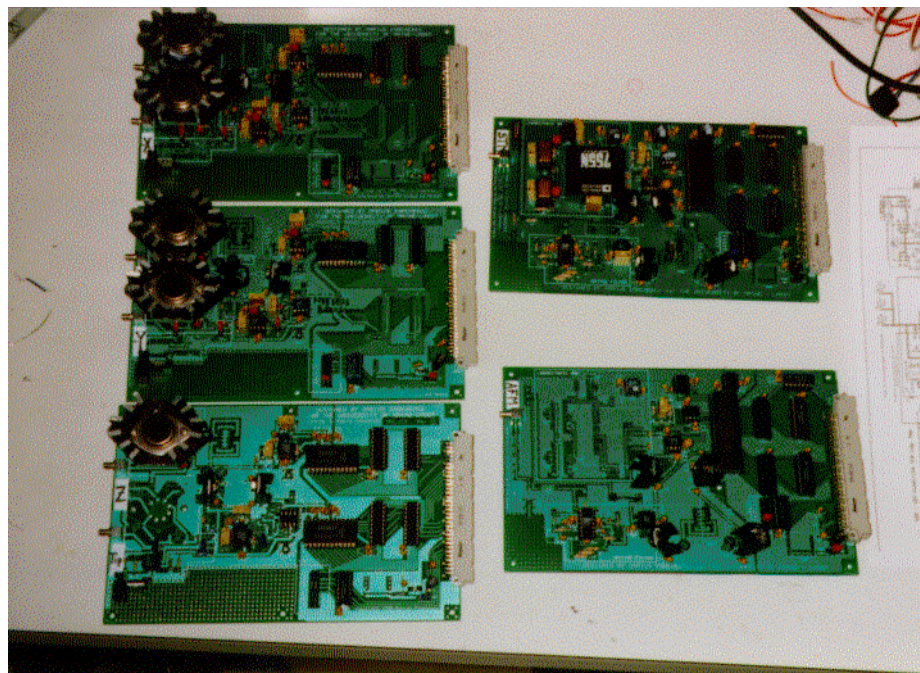
Parallel Architecture Design of the Digital Electronics Controlling the STM-AFM-FIM System.



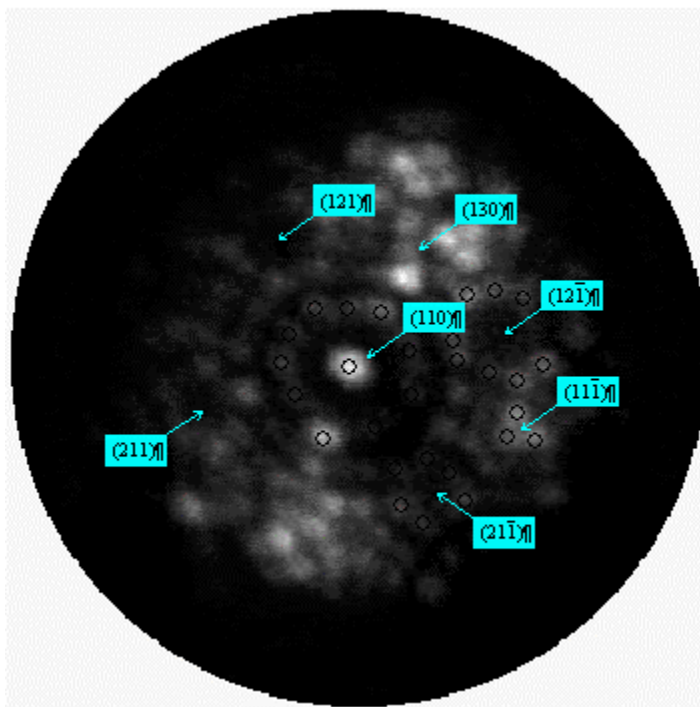
Digital-to-Analog Converter Module Designed and Built in-House.



Analog-to-Digital Converter Module Designed and Built in-House.

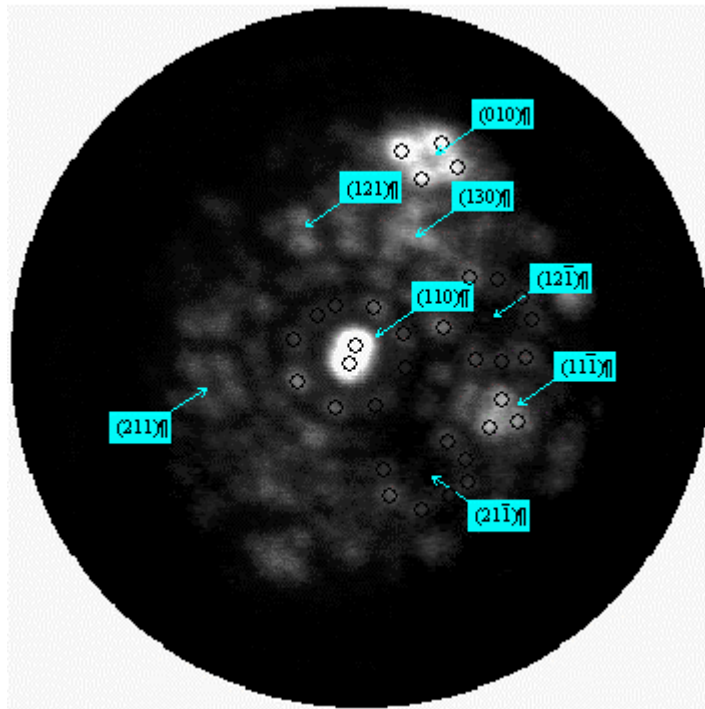


DAC, ADC, and STM-AFM Tip Bias Electronics Modules Designed and Built in-House.



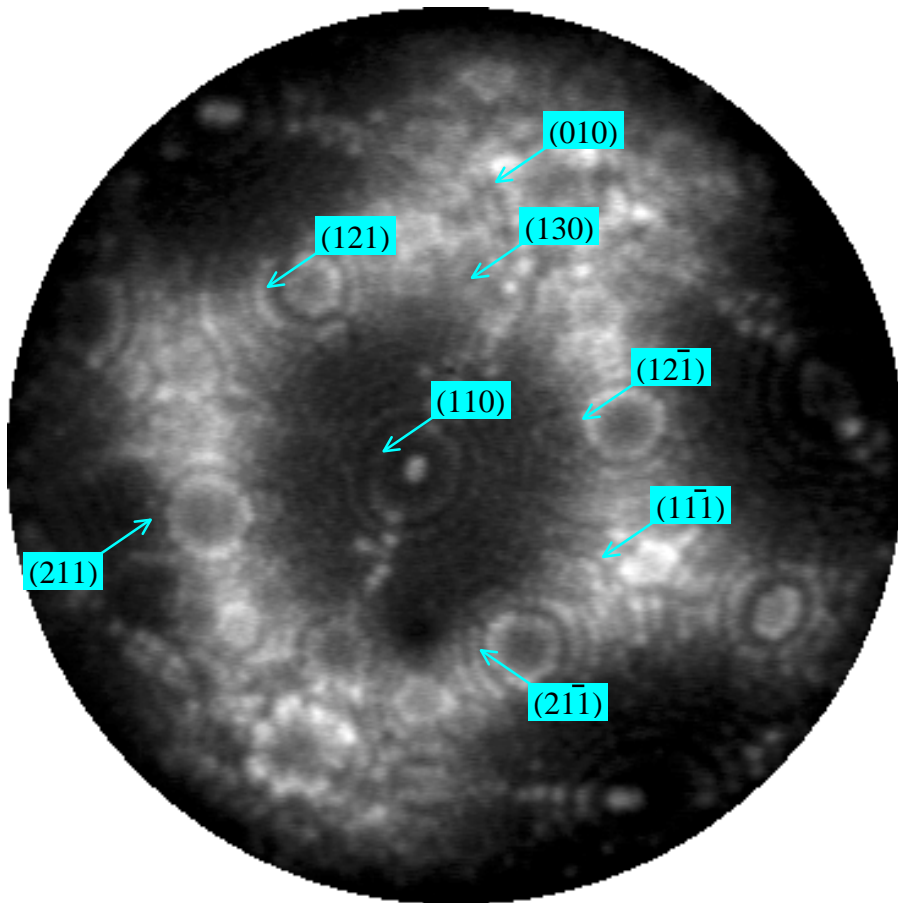
FIM Micrograph of the STM-AFM Tungsten Tip Showing a Radius of Curvature of 7.2nm with One Atom at its Proximity

- Base pressure = 1.3×10^{-10} Torr; He pressure = 1.0×10^{-3} Torr.
- Single channel plate; front: -5.76 kV, back: -4.76 kV and phosphorus screen: -1.76 kV.
- One atom at the center of the (110) plane.
- The local radius of curvature of the (110) plane is 72 Å.
- Atomic locations at the (110), (111), (121) and $\bar{2}11$ plane are labeled by circles.



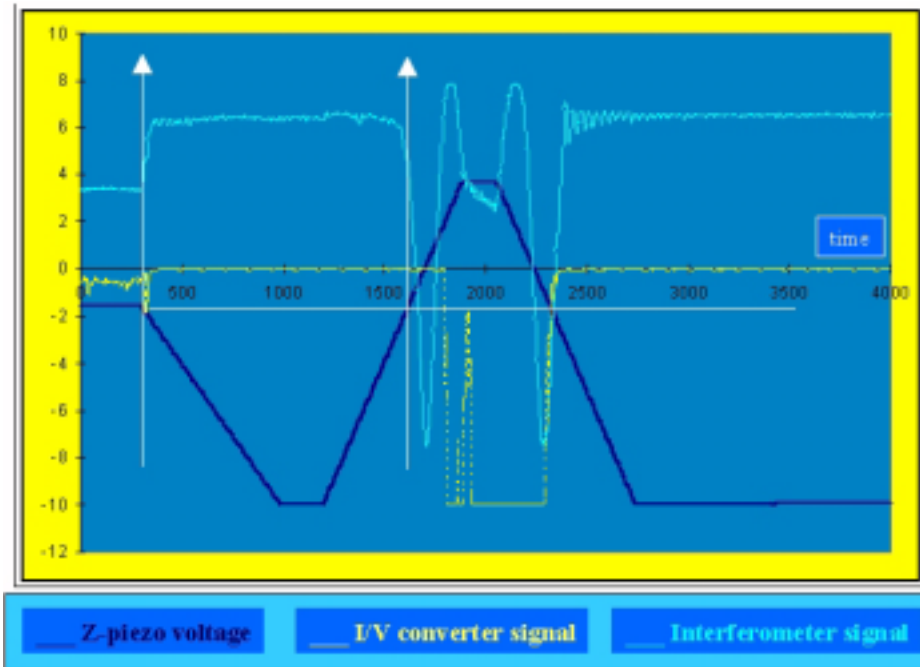
FIM Micrograph of the STM-AFM Tungsten Tip Showing a Radius of Curvature of 14.0nm with Two Atoms at its Proximity

- Base pressure = 2.0×10^{-10} Torr; He pressure = 1.0×10^{-3} Torr.
- Single channel plate; front: -9.63 kV, back: -8.63 kV and phosphorus screen: -5.63 kV.
- The local radius of curvature of the (110) plane is 140 Å.

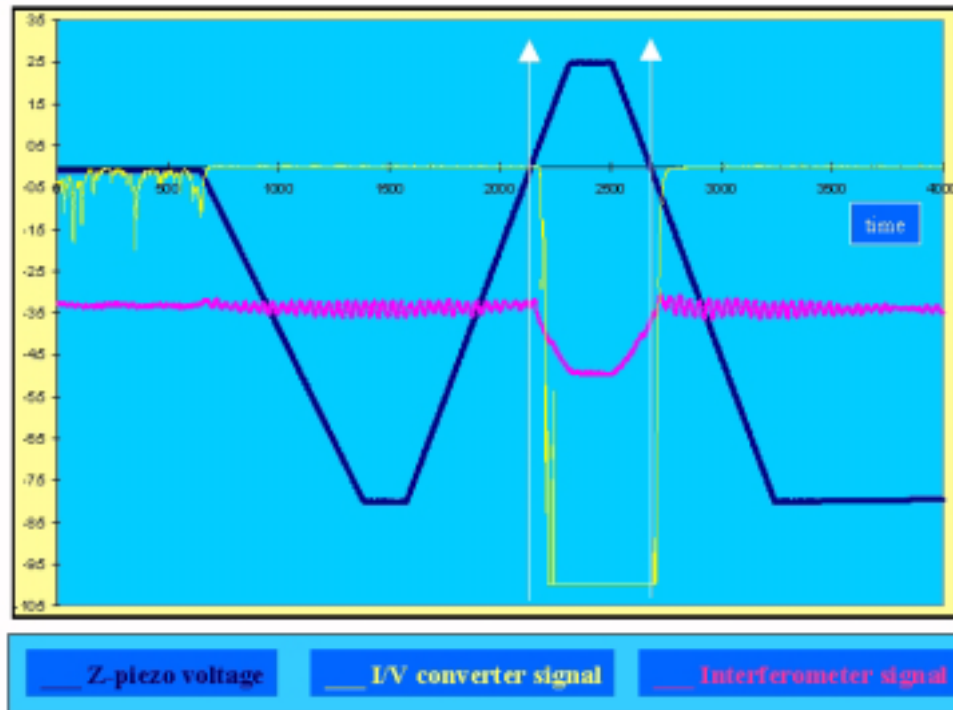


FIM Micrograph of the STM-AFM Tungsten Tip Showing a Radius of Curvature of 12.4nm with Two Atoms at its Proximity

- Base pressure = 2.6×10^{-10} Torr; He pressure = 1.0×10^{-3} Torr.
- Single channel plate; front: -12.20 kV, back: -11.20 kV and phosphorus screen: -8.20 kV.
- The local radius of curvature of the (110) plane is 224 \AA .



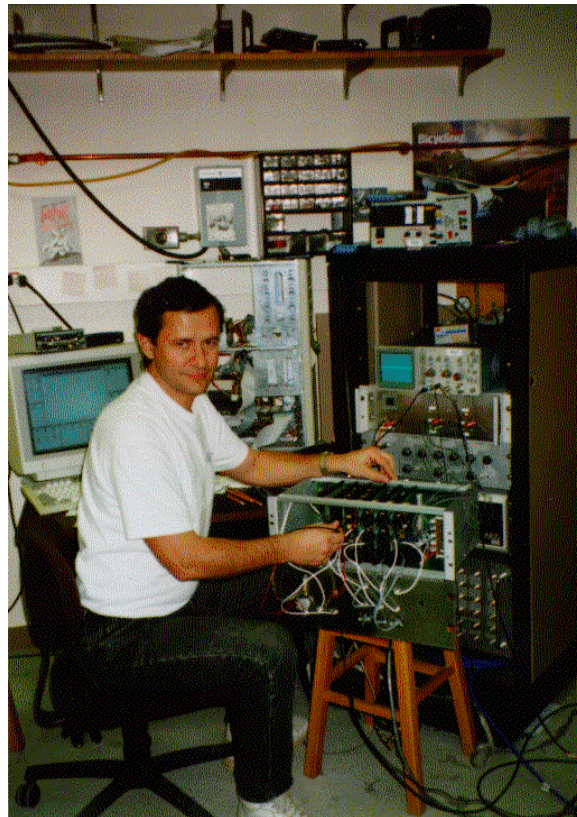
STM-AFM-FIM System Output During a Nanoindentation Experiment into a Stainless Steel Sample.



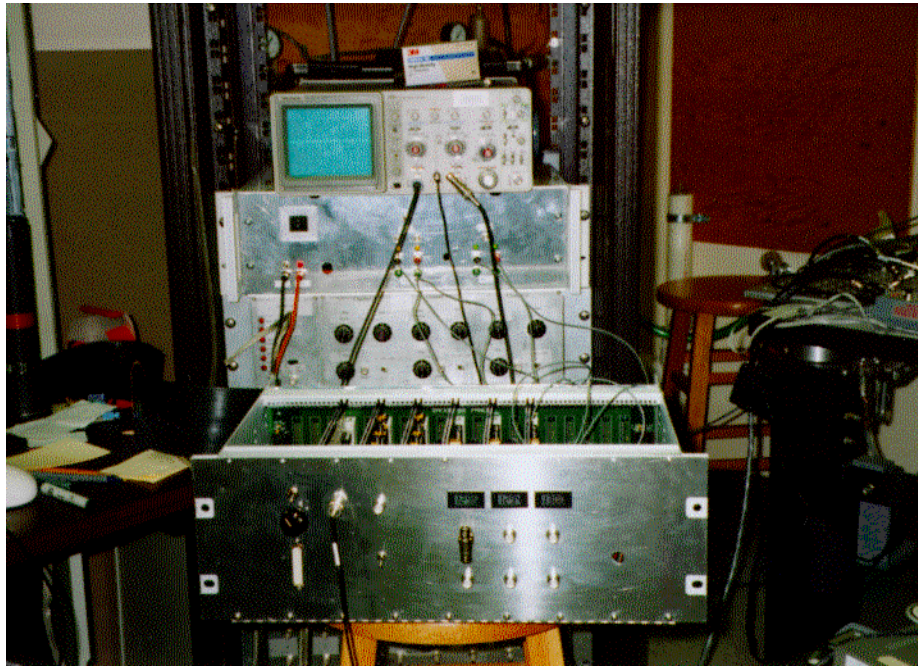
STM-AFM-FIM System Output During a Nanoindentation Experiment into a Gold Sample.



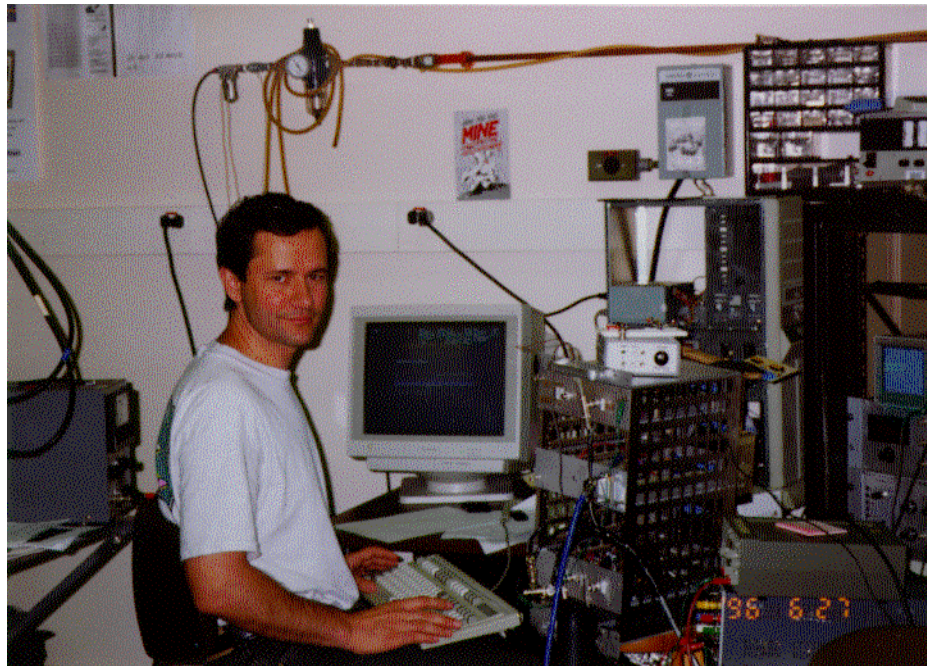
Working on the STM-AFM-FIM System Head.



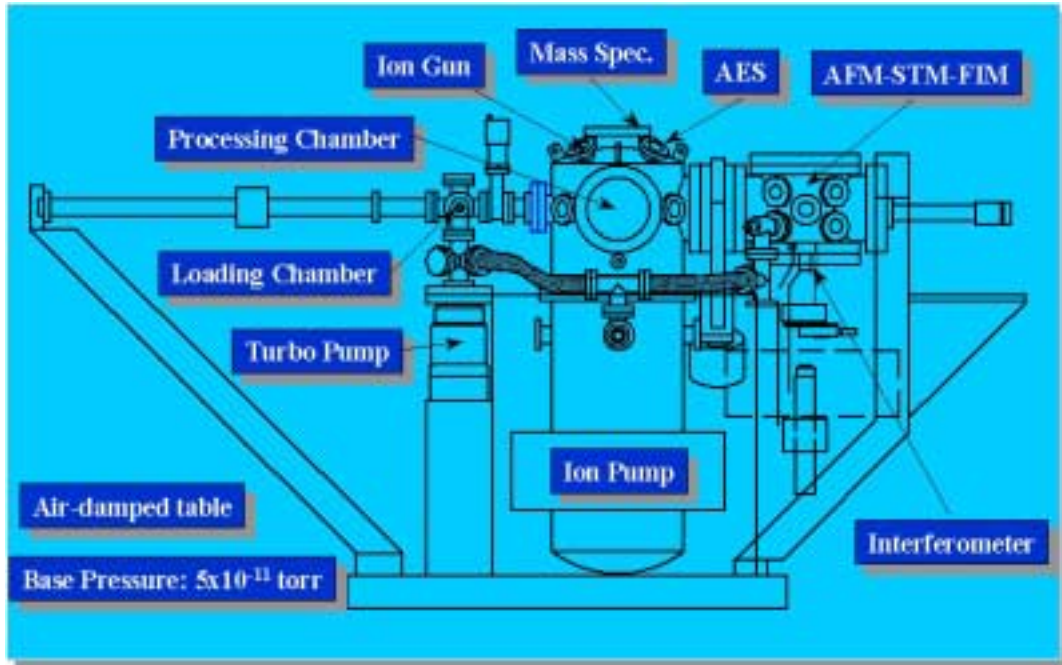
Putting the Digital Electronics Together.



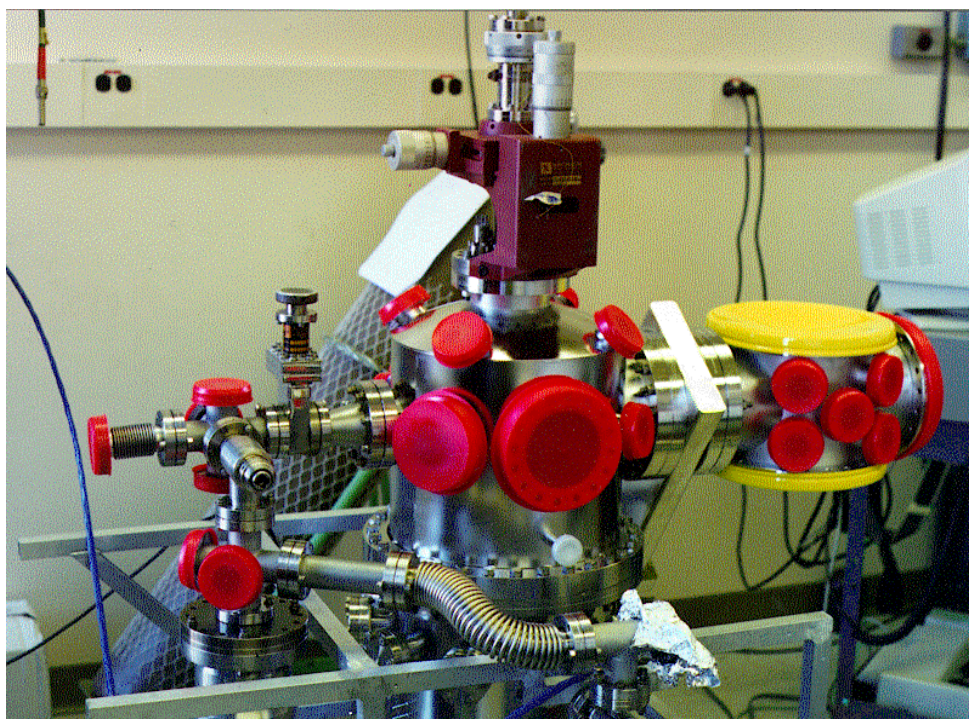
Main Modules of the Digital Electronics Controlling the STM-AFM-FIM System.



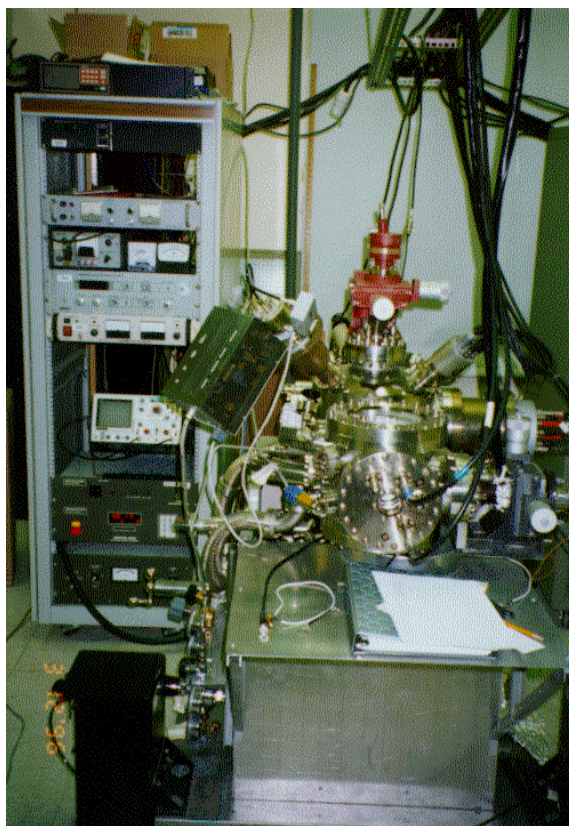
Testing/Debugging the Digital Electronics Controlling the STM-AFM-FIM System.



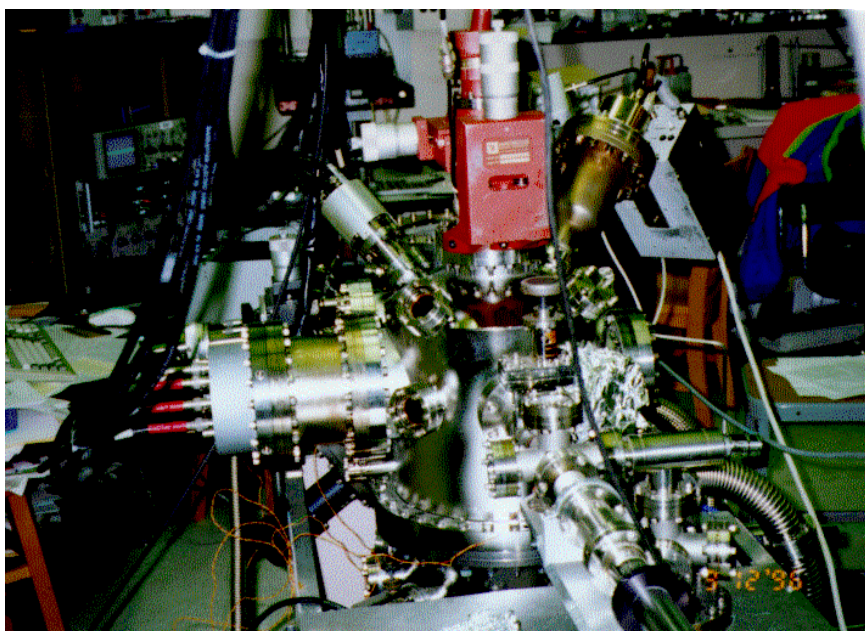
UHV STM-AFM-FIM System Overview.



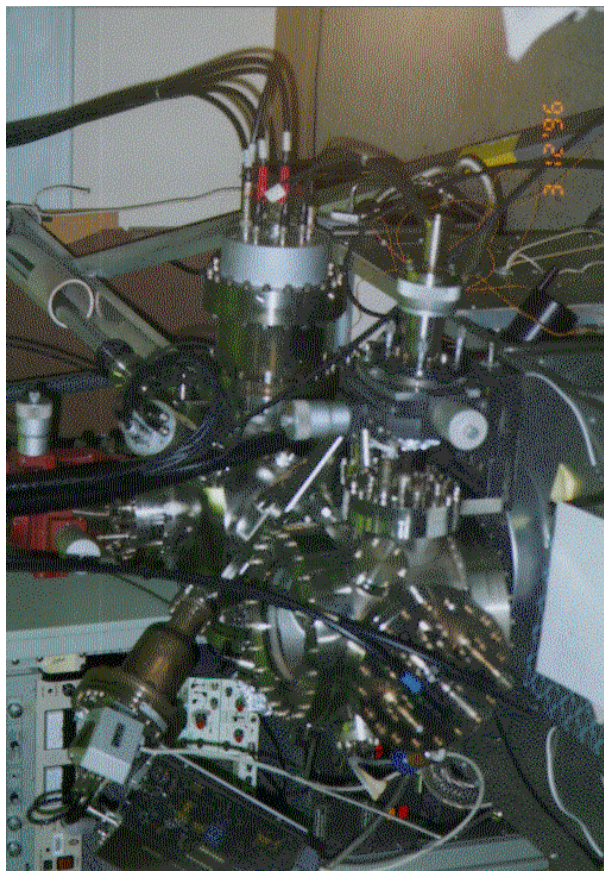
Putting Together the UHV STM-AFM-FIM System.



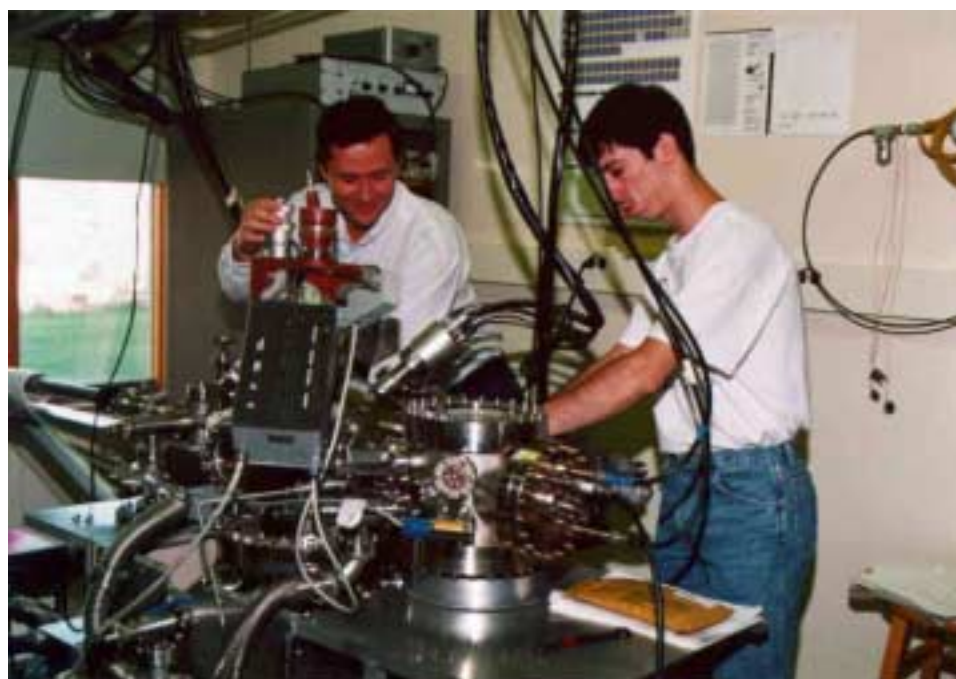
Front View of the UHV STM-AFM-FIM System.



Back View of the UHV STM-AFM-FIM System.



Side View of the UHV STM-AFM-FIM System.



Steve and Myself Working on the UHV STM-AFM-FIM System.