

VACUUM, POWER AND INFRASTRUCTURE



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AGENDA

- VACUUM TECHNOLOGY
- POWER
- INFRAESTRUCTURE

VACUUM SYSTEM

- In smaller regions the large pressure region, which today covers more than 16 orders of magnitude, is divided into:

Rough vacuum (RV)	1,000 to 1mbar
Medium Vacuum (MV)	1 to 10^{-3} mbar
High Vacuum (HV)	10^{-3} to 10^{-7} mbar
Ultra-high vacuum (UHV)	10^{-7} mbar and below

VACUUM

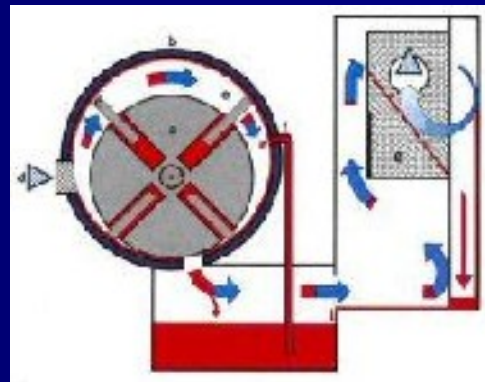
- There are in vacuum technology essentially three types of flows:
 - ✦ **Viscous flow** which prevails almost exclusively in a rough vacuum.
 - ✦ **Molecular flow** is dominant in high and ultra-high vacuum.
 - ✦ **Knudsen flow** at which there is a transition from viscous flow to molecular flow. It predominates above all in the medium vacuum region.

VACUUM PUMPS

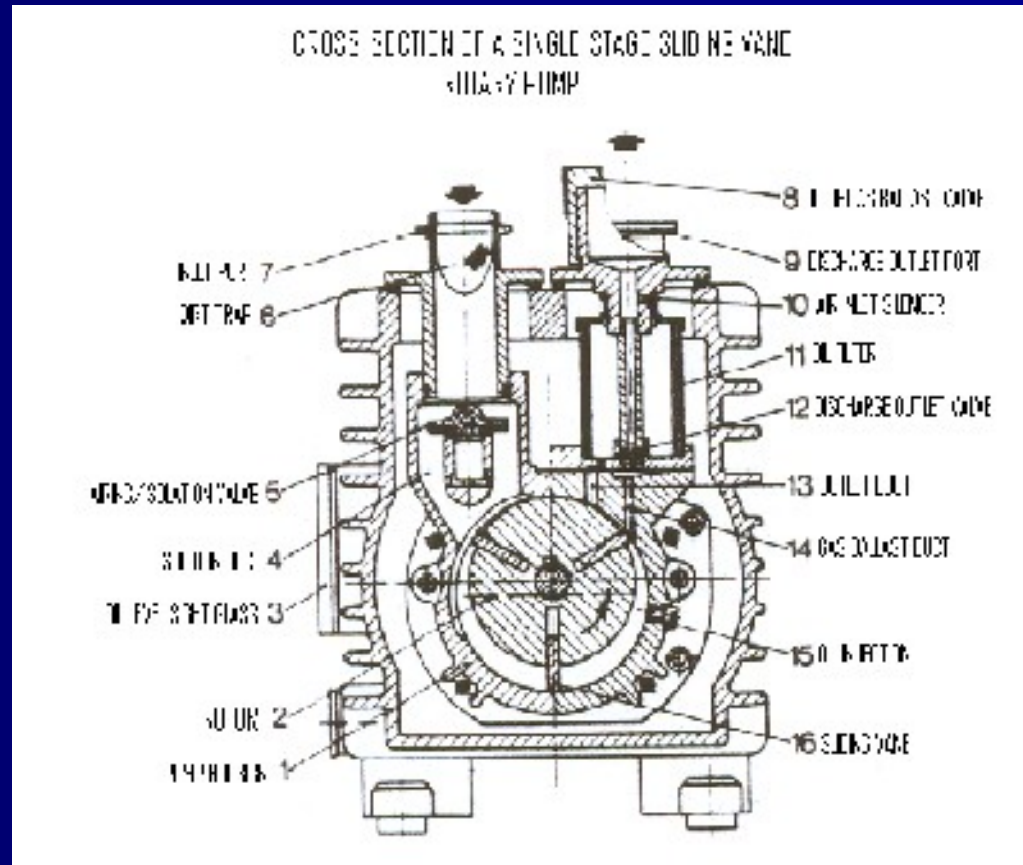
- Fundamentally distinction can be made between two groups of vacuum pumps:
 - ✦ Those which remove the gas particles from the pumped volume and convey them to the atmosphere in one or more stages of compression.
 - ✦ Vacuum pumps which condense or in some other manner bind the particles to be removed at a solid wall which is often a part of the boundary of the volume being pumped.

VACUUM PUMP

- A positive displacement pumps is understood to be a mechanical vacuum pump which transports the gas with the aid of pistons, rotors, vanes, valves and other devices, compresses it and expels it. There are so called oil-sealed and dry rotary pump.



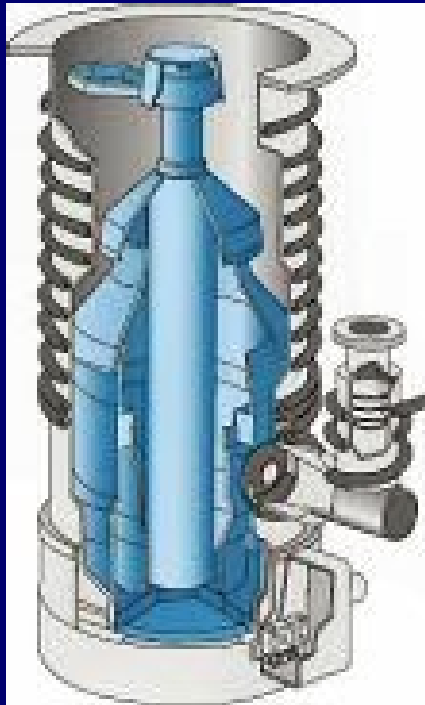
VANE ROTARY PUMP



DIFUSION PUMP

- These consist basically of a pump body with cooled wall and a three or four stage nozzle system.
- The oil serving as pump fluid is in the boiler and is vaporized from here by electrical heating.
- The pump fluid vapor streams through the chimneys and emerges with supersonic speed from the ring-shaped nozzles.
- The so formed jet widens thereafter like an umbrella, reaches the wall where condensation of the pump fluid takes place.
- The liquid condensate flows as a thin film along the wall downwards and returns finally into the boiler.

DIFUSION PUMP



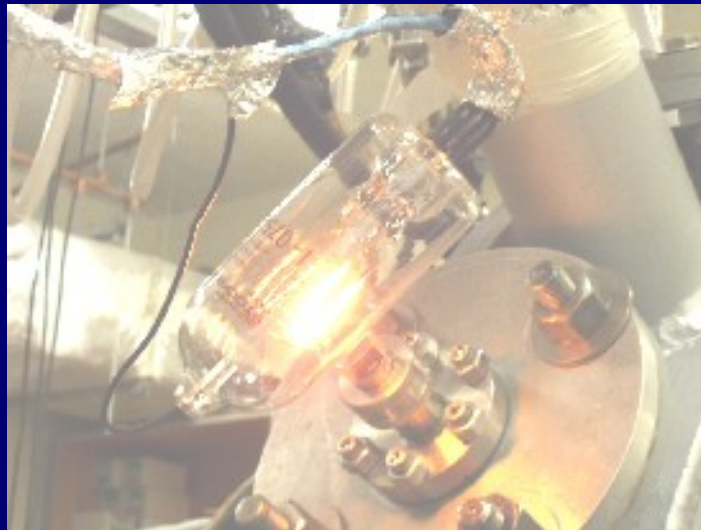
TRANSITION TO TURN ON THE DIFFUSION PUMP

In order to have the diffusion pump on, pre-vacuum must be done to the vessel, so as to the diffusion pump.



VACUUM GAUGES

- ***Ionization vacuum gauges*** measure, like all electrical vacuum gauges, the pressure in terms of the number density of molecules.



IONIZATION VACUUM GAUGE

- In order to extend the lifetime of the ion gauge tubes, scientists looked for a material which would provide a non-burnout filament. They discovered that iridium was a good alternative.

<http://www.etigauges.com/images/pg4a.gif>



<http://www.etigauges.com/images/pg4b.gif>



THERMOVAC GAUGE

- The relationship between the decreasing number density of molecules with decreasing pressure is exploited, especially for pressure measurement in the medium vacuum region. The classical measuring instrument of this kind is the *Thermo conductivity vacuum gauges*.



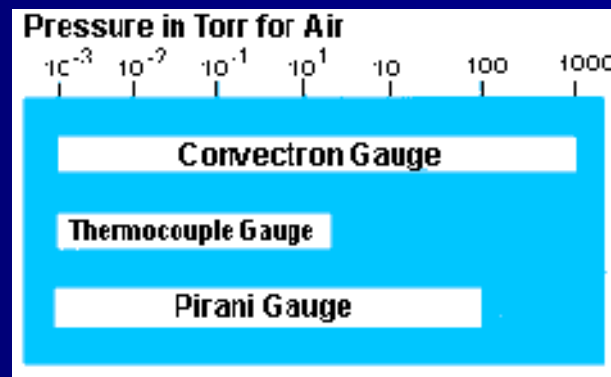
CONVECTRON GAUGES

- *Convector gauges* provide useful pressure measurement over 6 decades from 1 millitorr to 1000 Torr, or from 1×10^{-3} mbar to 1000 mbar.



Convectron gauges advantages relative to THERMOVAC gauges:

- System performance can be monitored continuously from atmosphere down without pressure blind spots.
- Purchase of additional controller and gauge tube models is not necessary if your needs change to different segments of the range.
- A much wider range can be covered with one Convectron gauge than with thermocouple gauges.
- There is no chance of error that might be caused by using the wrong gauge tube-controller combination. One gauge tube fits all controller models



PLASMA ELECTRIC ROOM



MAIN DISCONNECT SWITCH



225 KVA TRANSFORMER



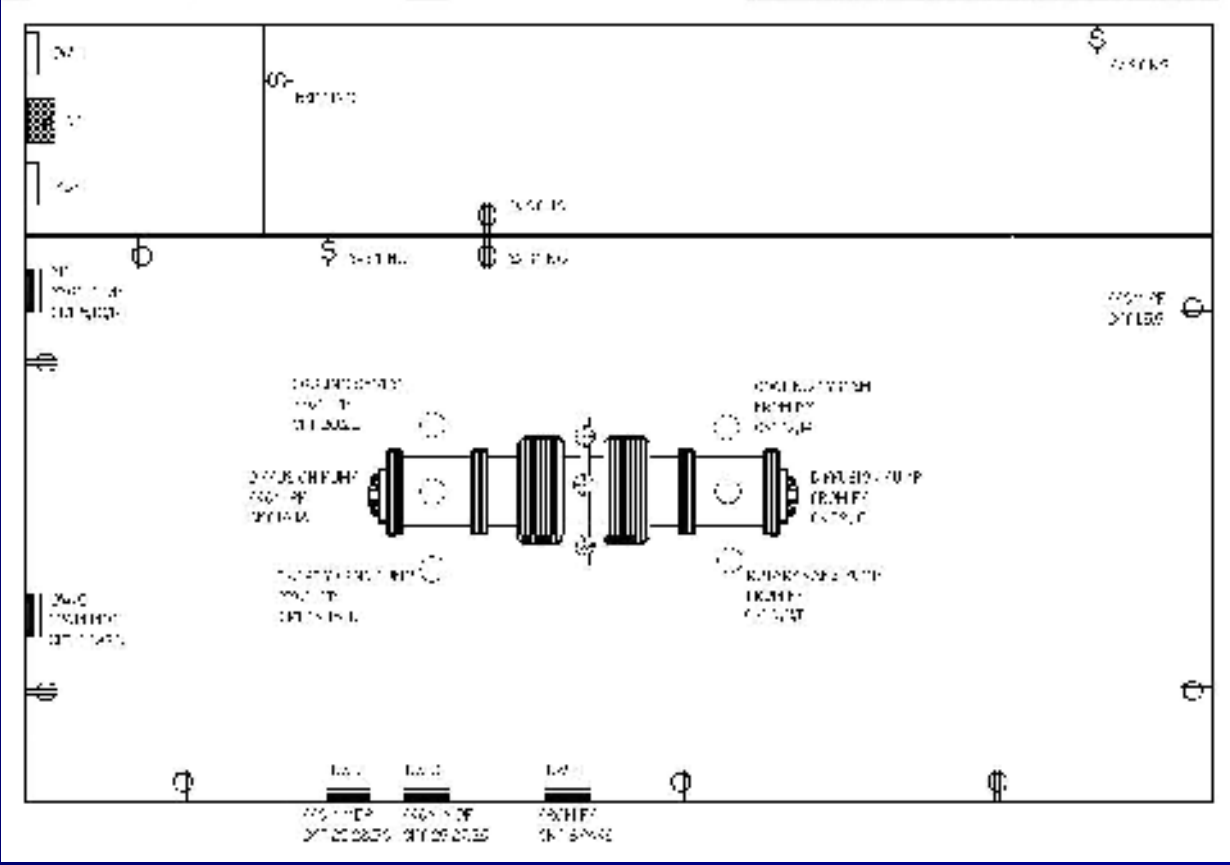
MAIN BREAKERS PANEL



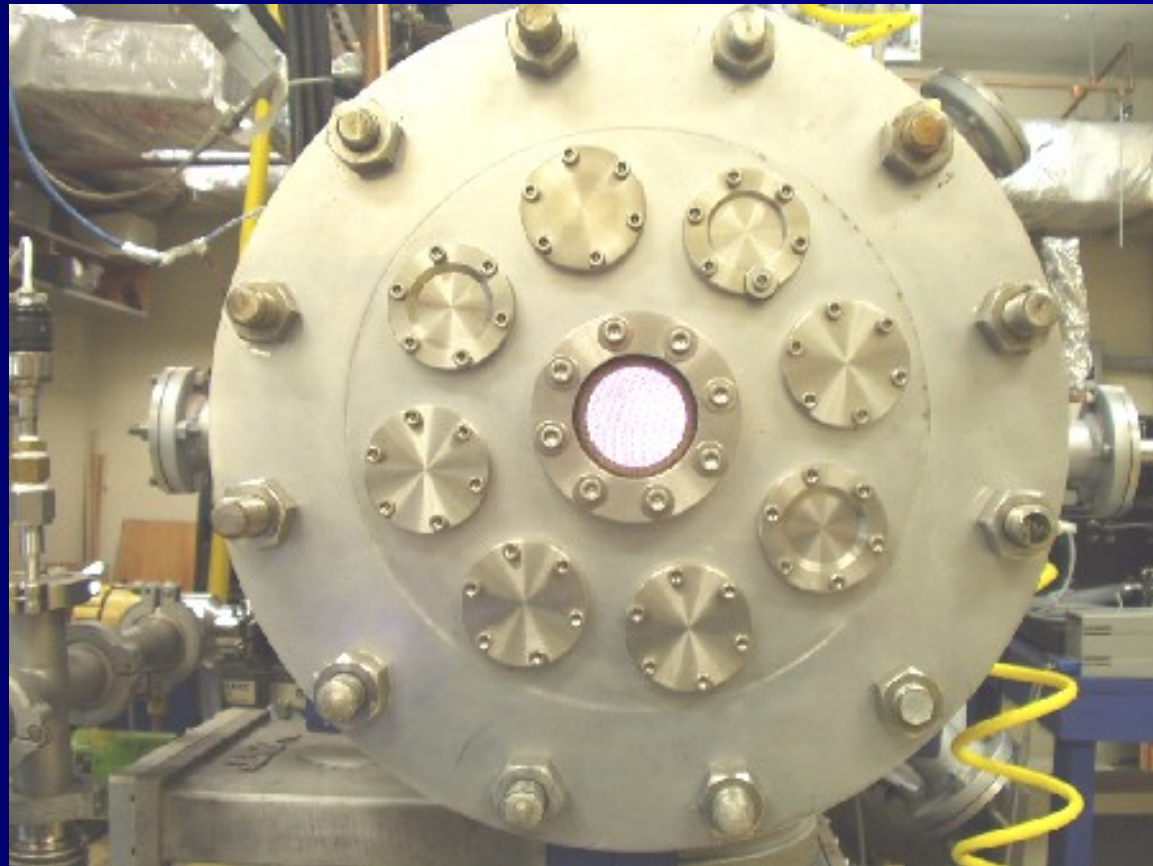
SAFETY SWITCHES FOR HELMOLTZ COILS



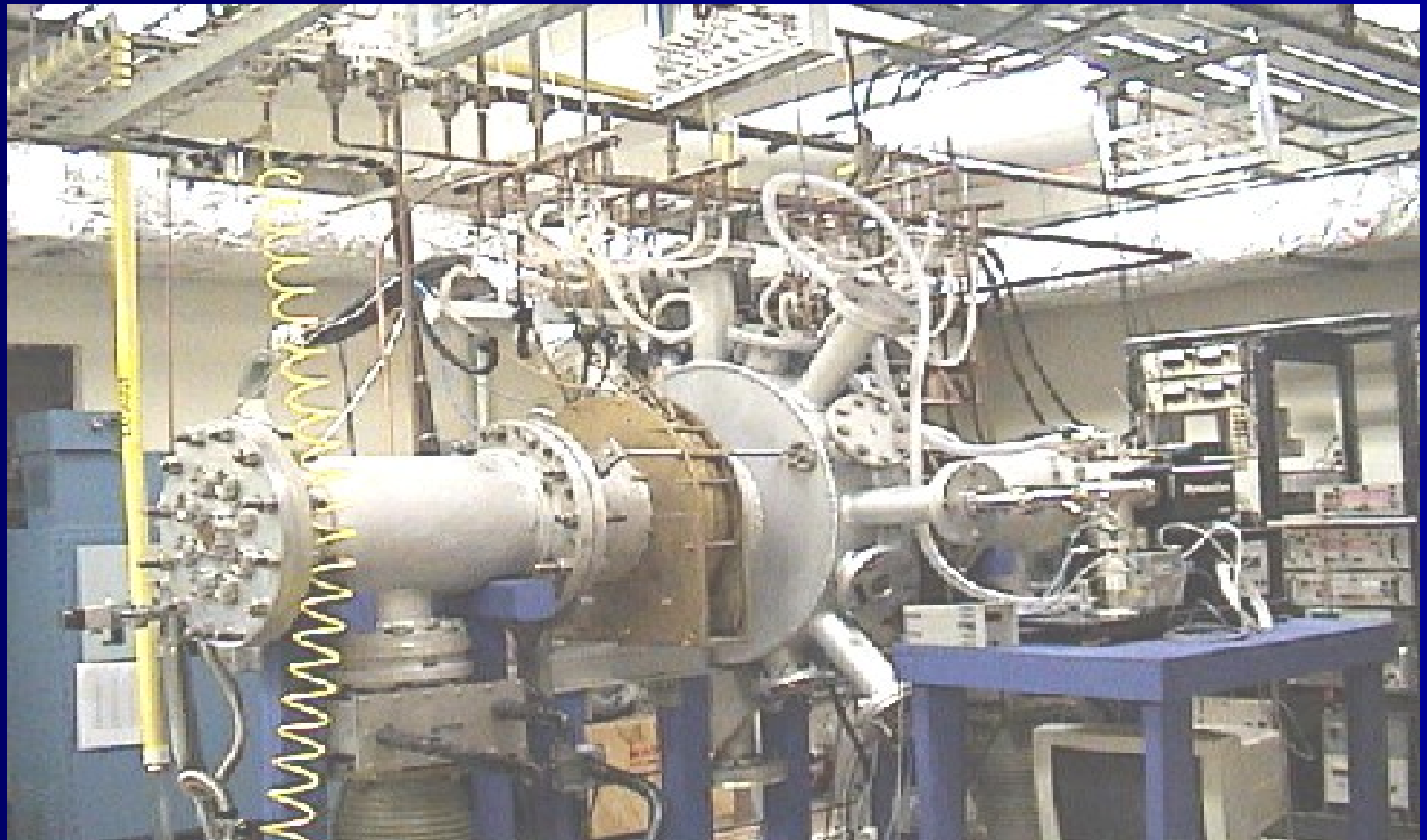
ELECTRIC SYSTEM FLOOR PLANT AND INFRASTRUCTURE



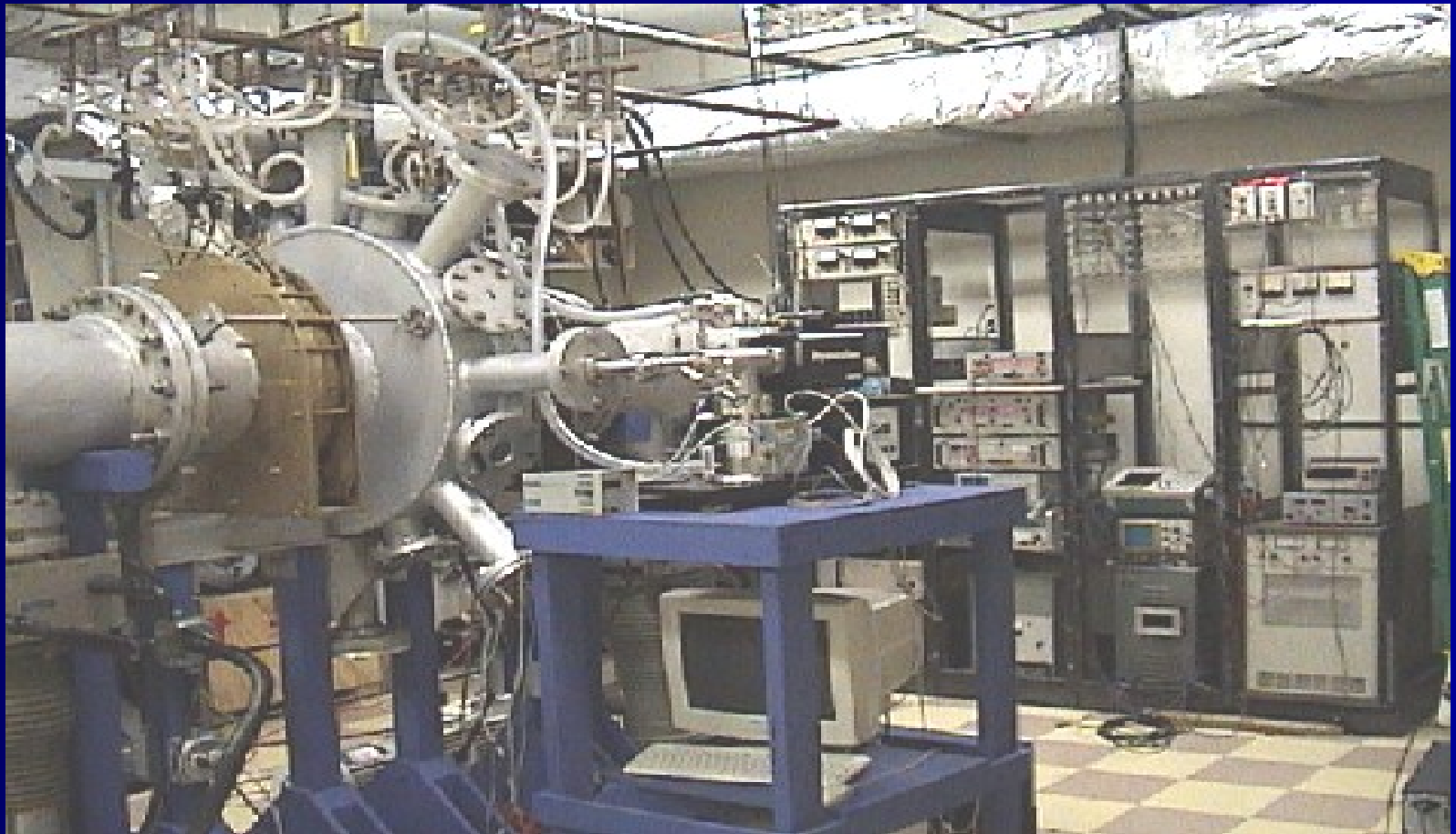
MAIN PLATE OF THE PLASMA MACHINE



PLASMA MACHINE



PLASMA MACHINE CONT.



QUESTION?

