# Vacuum Systems

RHIC RETREAT

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## Outline

- Vacuum failures/problems
- System Improvements
  - Upgrades
  - Shutdown Bakeout Schedule
  - Shutdown Goals, Upgrades, Repairs
- Future Upgrades

# Vacuum Trouble Reports

## ONLY 1 TROUBLE REPORT FOR THE RUN

- **TURBO ISOLATION VALVE CLOSED FROM GAUGE CONTROLLER FAILURE**
  - 1.5 Hrs, April 4

## OTHER VACUUM FAILURES/EVENTS

- **BOOSTER ION GAUGE CONTROLLER LTB-035 FAILED**
  - Gauge controllers nearing end of life – Not supported by Vendor
    - Spares controllers/parts available when tandem is replaced by EBIS
    - Difficult to upgrade since gauge heads would need to be replaced requires baking entire ring
- **YELLOW RHIC POLARIMETER NEG ISOLATION VALVE WOULD NOT OPEN AFTER MAINT.**
  - Air flow damping adjusted
- **ATR YSV1 VALVE WOULD NOT REOPEN AFTER POWER DIP**
  - PLC program modified to allow open command when valves are in mid position

**Failures this year were random and have not been repetitive and or ongoing**

**Instrumentation upgrades we have done the last few years contributed to increased reliability with NO downtime**

# SYSTEM IMPROVEMENTS/CONCERNS

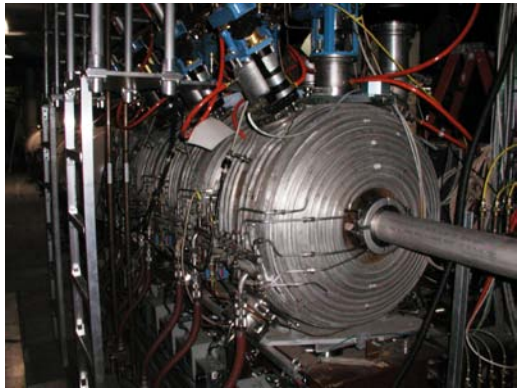
- MORE AND MORE BEAM COMPONENTS ARE BEING ADDED TO WARM BORES
- NEG PIPES ARE BEING REMOVED TO MAKE ROOM FOR BEAM COMPONENTS
- RESULT - INCREASED GAS LOAD FROM BEAM COMPONENTS WITH LESS PUMPING
- COULD LEAD TO HIGHER WARM BORE PRESSURES

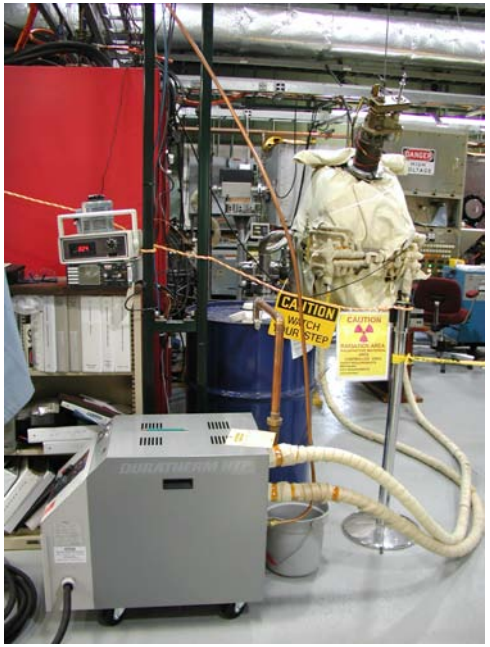
## MITIGATION FOR REMOVING NEG PIPES

- ADD PUMPING PORTS ON NEW CHAMBERS FOR NEG CARTRIDGES
- DESIGN CHAMBERS AND BEAM COMPONENTS FOR 200$^{O}$ C BAKEOUT TEMP
- CAREFUL MATERIAL SELECTION (USE CERAMICS, METALS BUT NO ORGANICS)
- MATERIALS SUCH AS PEEK, G-10, KAPTON, EPOXY, IMPREGNATED CIRCUIT BOARDS ARE NOT ACCEPTABLE AND HAVE OUTGASSING RATES SEVERAL HUNDRED TIMES HIGHER ($10^{-8}$ TORR-L/SEC-CM$^{2)}$ THAN METALS AND CERAMICS

# RHIC RF BAKEOUT

- Major upgrade since RF region was never baked before
- Bake Common and Storage Cavity sections @ 150$^{O}$ C
- Bakeout Temp limited by aluminum diamond seals
- Hot water Heating Unit used instead of conventional heating jackets saving ~$100K
- HW Unit delivered a ramp rate of 100 C/hr. Limit in ring to 50 C/hr
- HW heating unit use hot water at a supply temp of 150$^{O}$ C @ 90 PSIG to keep water from boiling
- Cavity baked with HOM, tuner and window installed using metal diamond seals.

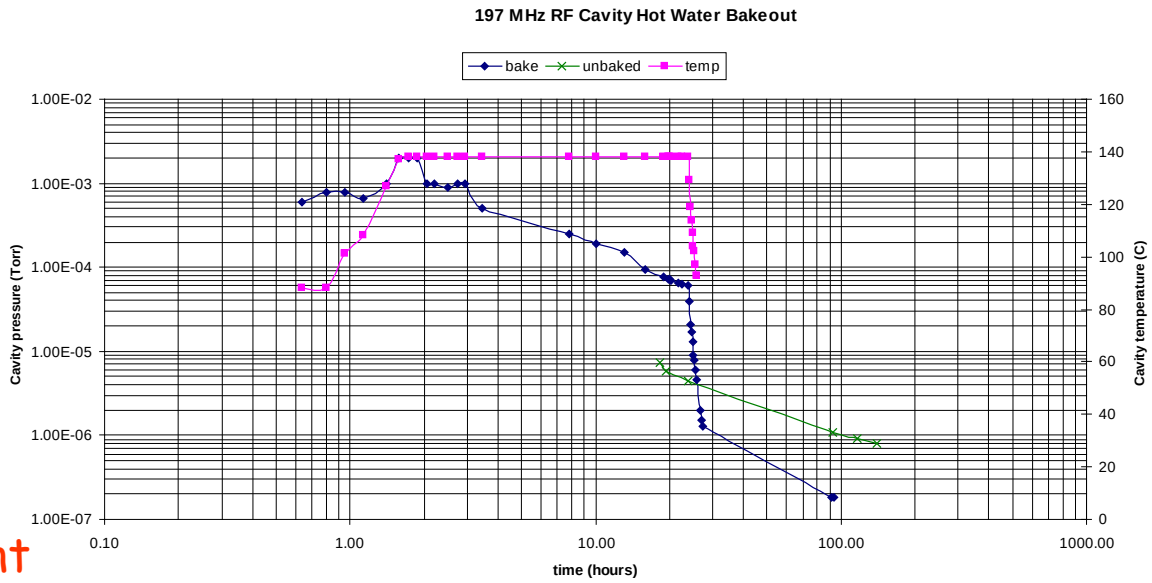




# RHIC RF BAKEOUT

## SUMMARY

- Hot water unit reached design temp and ramp rate
- Aluminum diamond seals remained leak tight at 150 C
- Will allow full exploitation of ion pump TSP pumping as well as NEG pipe pumping when combined with conventional bakeout of entire region
- Expect significant improvement in pressure (1-2 decades)
- Installing Cryopumps in Storage cavity sections for faster pumpdown after bleadup for repairs




Plot of pressure baked and un-baked

- Ultimate pressure is limited by the pump conductance and base pressure

# Shutdown Bakeout Schedule

## WHAT'S IT TAKE TO DO A BAKEOUT?

AFTER NEW COMPONENTS ARE INSTALLED (2 WEEKS FOR INSTALLATION)

- 3-4 TECHS
- 2 WEEKS OF BLANKET AND TC INSTALLATION PLUS WIRING FOR SECTION NEVER BAKED (RF)
- 1 WEEK OF BAKEOUT WIRING FOR AREAS THAT HAVE BEEN BAKED BUT HAVE NEW COMPONENTS
- 1 WEEK TO SETUP PUMPS, BAKEOUT CART, BAKE FOR 3 DAYS AND REMOVE EQUIPMENT

## 18 BAKEOUTS FOR THIS SHUTDOWN

- RHIC RF Y&B Storage Cavities and Common Cavity
- RHIC 12:00 area (from accidental venting of the Gas Jet)
- RHIC Y&B Polarimeters
  Small pressure improvement with last years upgrade
  Still needs to be made bakeable to get to 11 range
- RHIC IPM's YO1, BI1, BO2 and YI2
  (Upgraded to bake at 200° C with new ceramic boards)
- RHIC Stoichastic Cooling upgrades and rearranging
  YI2 Pick Up, BO3 pick up, YI11 Long. Kicker, BI12 Transverse Kicker
- RHIC GAS JET
- EBIS BUNCHER INSTALLATION IN BOOSTER RING

# SYSTEM UPGRADES/REPAIRS

- AGS ION PUMPS

  SHOWING THEIR AGE ~ 20 YEARS OLD

  INSTALLING REBUILT PUMPS IN SECTORS K, J AND E

- AGS TURBO UPGRADE

  EXISTING PUMPS INSTALLED IN 1983 – PUMPS ARE OBSOLETE

  INSTALLING 3 DIFFERENT PUMPS THIS SHUTDOWN FOR EVALUATION

  WILL INSTALL NEW PUMPS NEXT SHUTDOWN

- BOOSTER ION PUMP POWER SUPPLY UPGRADE (shutdown 08)

  REPLACED 'HOMEMADE' IPPS WITH OFF THE SHELF SUPPLIES

  FINISHED LAST SHUTDOWN- NO FAILURES TO DATE ON THIS RUN

- REMOTE CONTROL AND MONITORING OF BAKEOUTS IN TUNNEL

  NEEDS SOME FEATURES SUCH AS REMOTE RESET

- MAKE SPARE STRAIGHT SECTIONS FOR AGS IN ANTICIPATION OF THE GOLD RUN

# Goals, Upgrades & repairs for Shutdown 2009

- Bake RF Common and Storage Cavity Sections
- Evaluate new turbos for AGS
- Fine tune remote monitoring and control of bakeouts
- Change and rebuild ion pumps in AGS
- Complete 18 bakeouts in RHIC
- EBIS vacuum system installation

# Future plans and upgrades

- Replace PHENIX beampipe with NEG coated Pipe Next Shutdown
- Replace STAR beampipe with NEG coated Pipe 2011
- Implement bakeout for RHIC Polarimeters