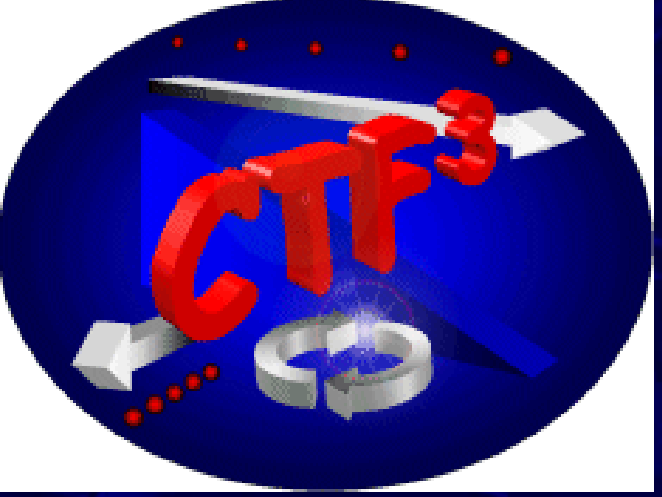
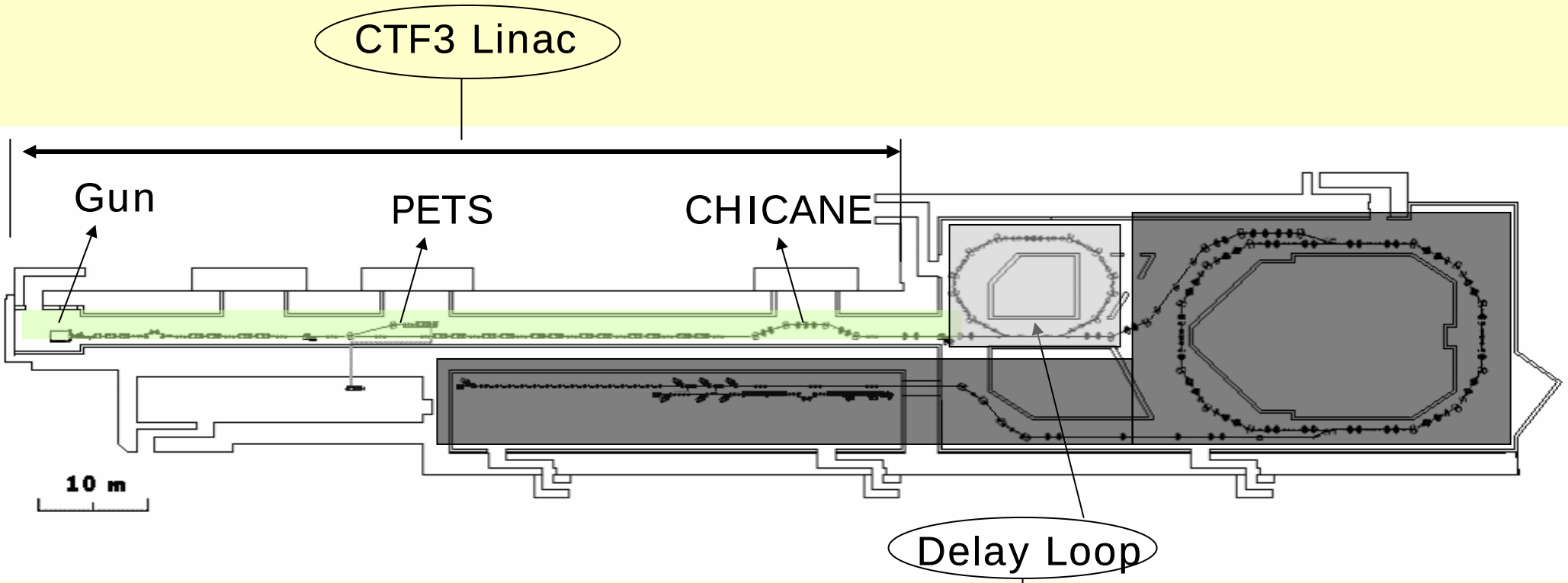


Experience with the existing CTF3 vacuum system

Jan Hansen
CERN
CH-1211 Geneva 23

Wednesday 24th of November 2004



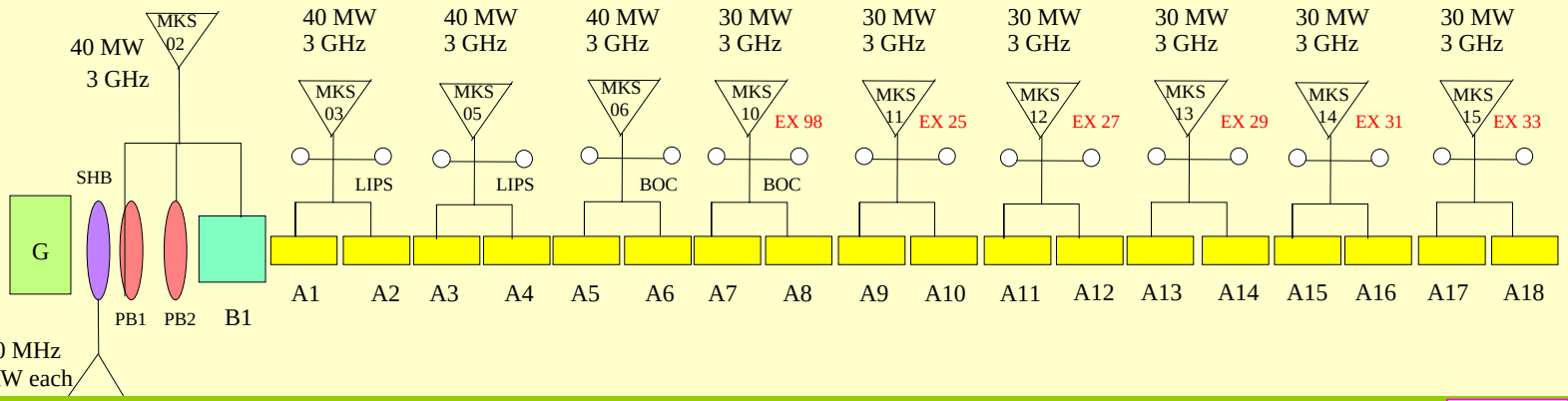
The Delay Loop will have the same type of pumps, gauges and vacuum control system as the CTF3 Linac

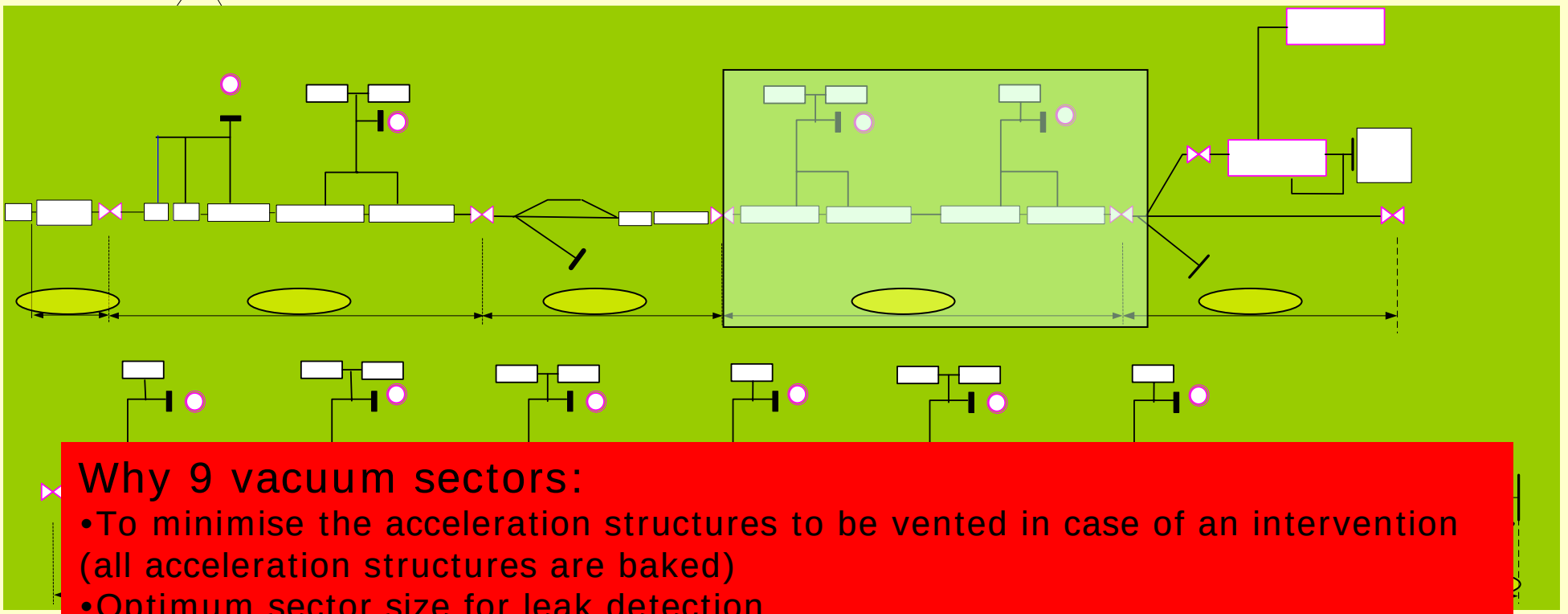
- Base-line for the CTF3 vacuum system.
- Existing setup of the CTF3 Linac.
  - Vacuum system.
  - Control and interlock system.
  - Bakeout system.
- Outgassing measurements.
  - Acceleration structures.
  - Beam diagnostic equipment.
- Static and dynamic vacuum pressure in CTF3.
  - Static pressure in Linac and CHICANE.
  - Dynamic pressure in PETS experiment.
- Summary and outlook

The base-line for the CTF3 vacuum system

- Vacuum requirements for the CTF3 Linac.
  - "The vacuum level required being in the region of 10^{-7} mbar for the LINAC''. (Design Report)
- Vacuum components.
  - Use as many vacuum components from LPI, CTF2 and LEP as possible (pumps and gauges).
  - Use the existing vacuum control units and interlock system from LPI and CTF2.
- Results from outgassing measurements.
  - -Acceleration structures (fabricated at CERN and at ACCEL).
  - -Beam diagnostic equipment.

Global vacuum system layout

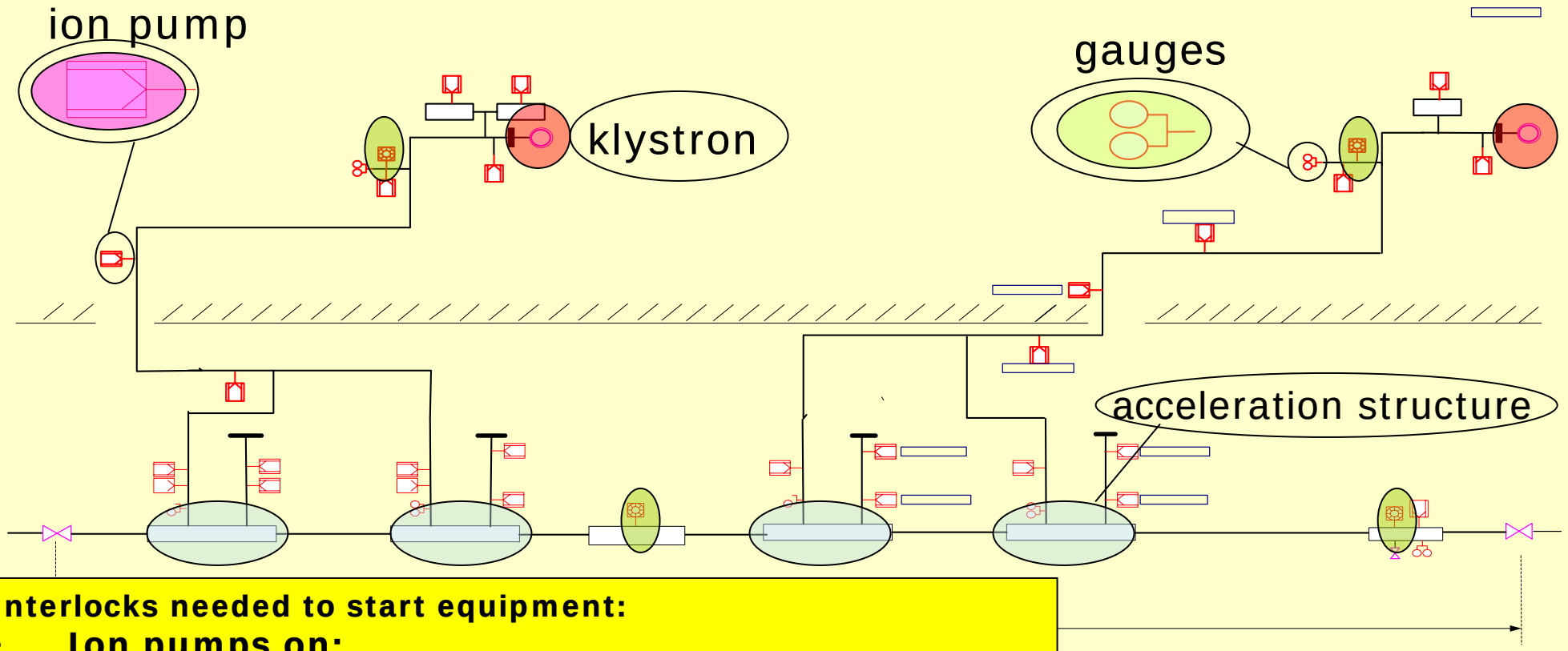




Why 9 vacuum sectors:

- To minimise the acceleration structures to be vented in case of an intervention (all acceleration structures are baked)
- Optimum sector size for leak detection.
- Limited availability of high pressure water heaters. (3 needed for each sector).

Vacuum layout for sector C30



Interlocks needed to start equipment:

- **Ion pumps on:**

Gauge pressure $<5\times10^{-5}$ mbar (only needed to start the ion pumps).

- **Sector valves open:**

Ion pump pressure $<1\times10^{-5}$ mbar (ion pump current equiv. pressure).
Access doors are closed.

- **Gun on:**

Sector valves open (interlock).

CK.VPI05-3

lips

CTF3 vacuum control system

Vacuum control system designed by:
Jean-Pierre Bertuzzi (AT/VAC/IN)

Vacuum control racks

Gauge controls

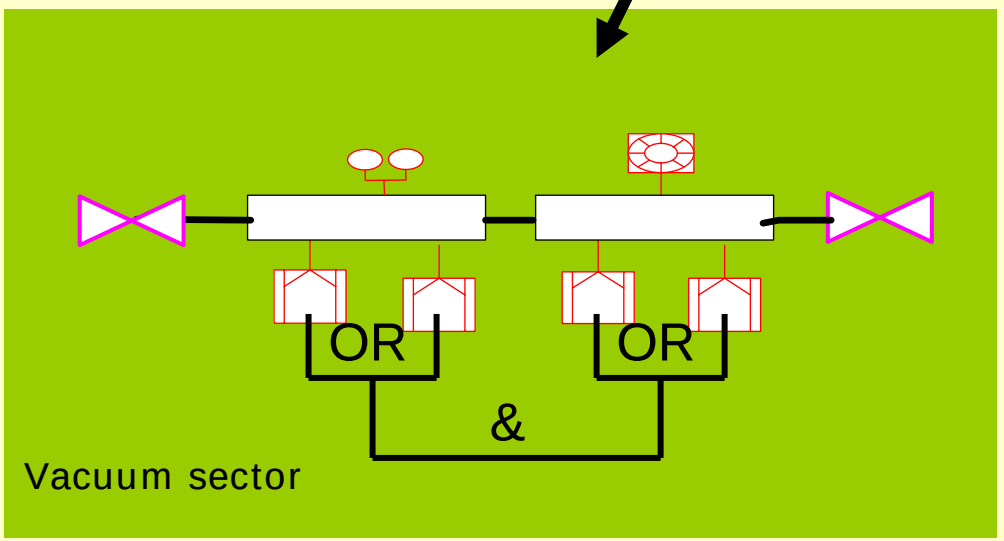
Interlock

Ion pump controls

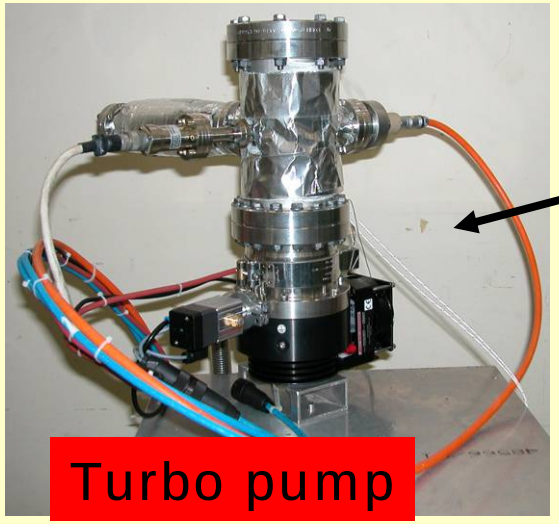
Ion current related to the pressure

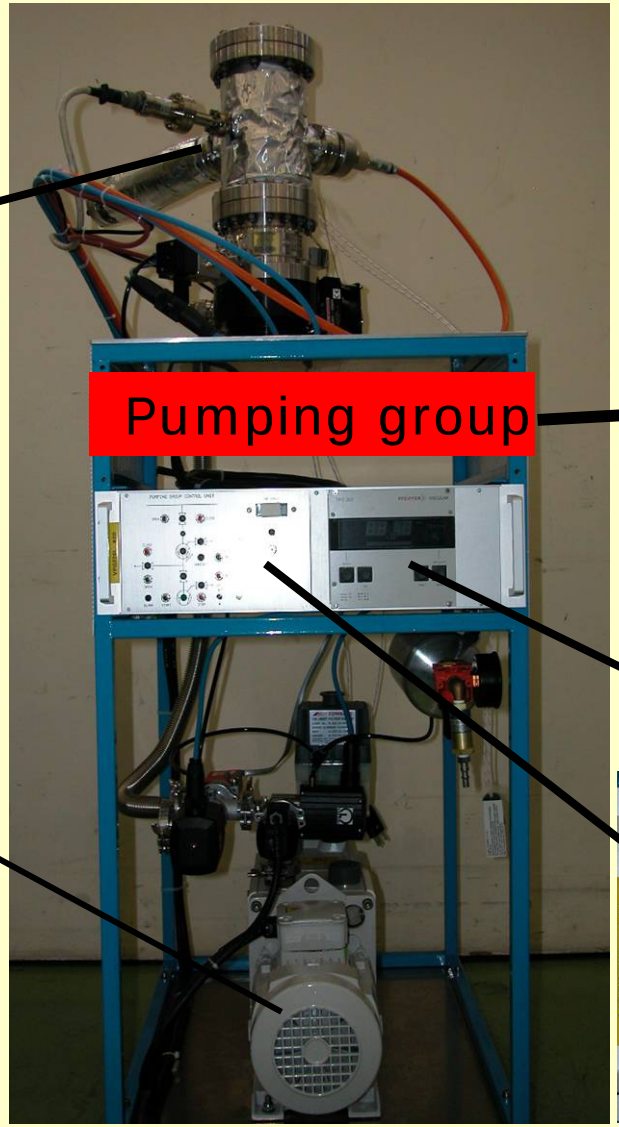
Interlock

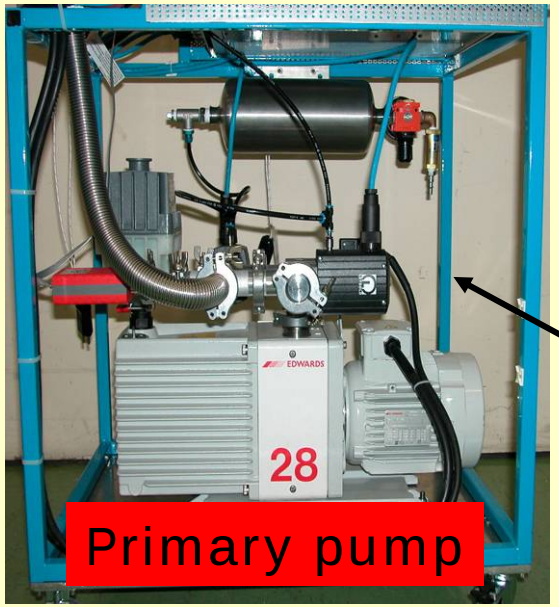
Sector valve controls

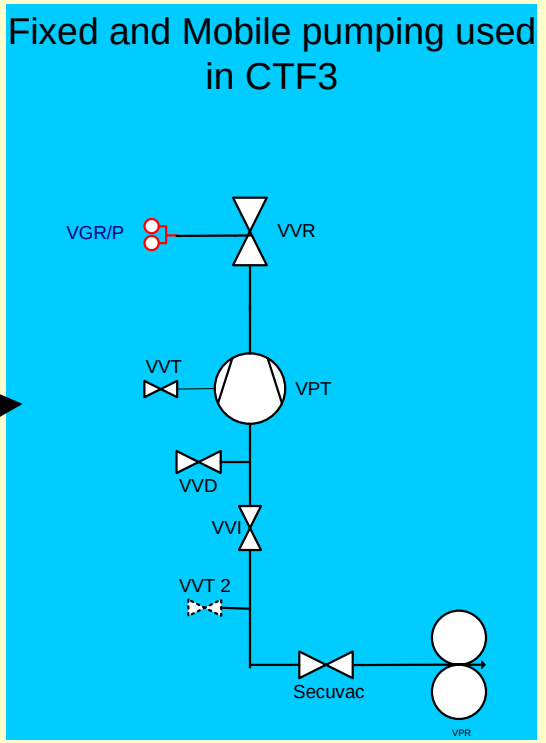


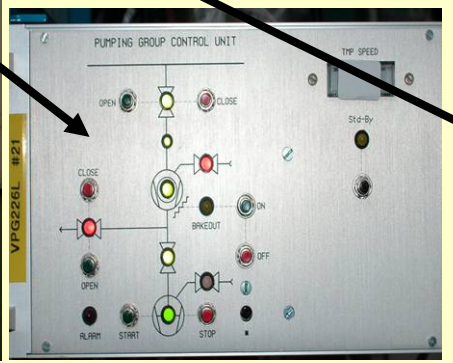
Standard CERN pumping group



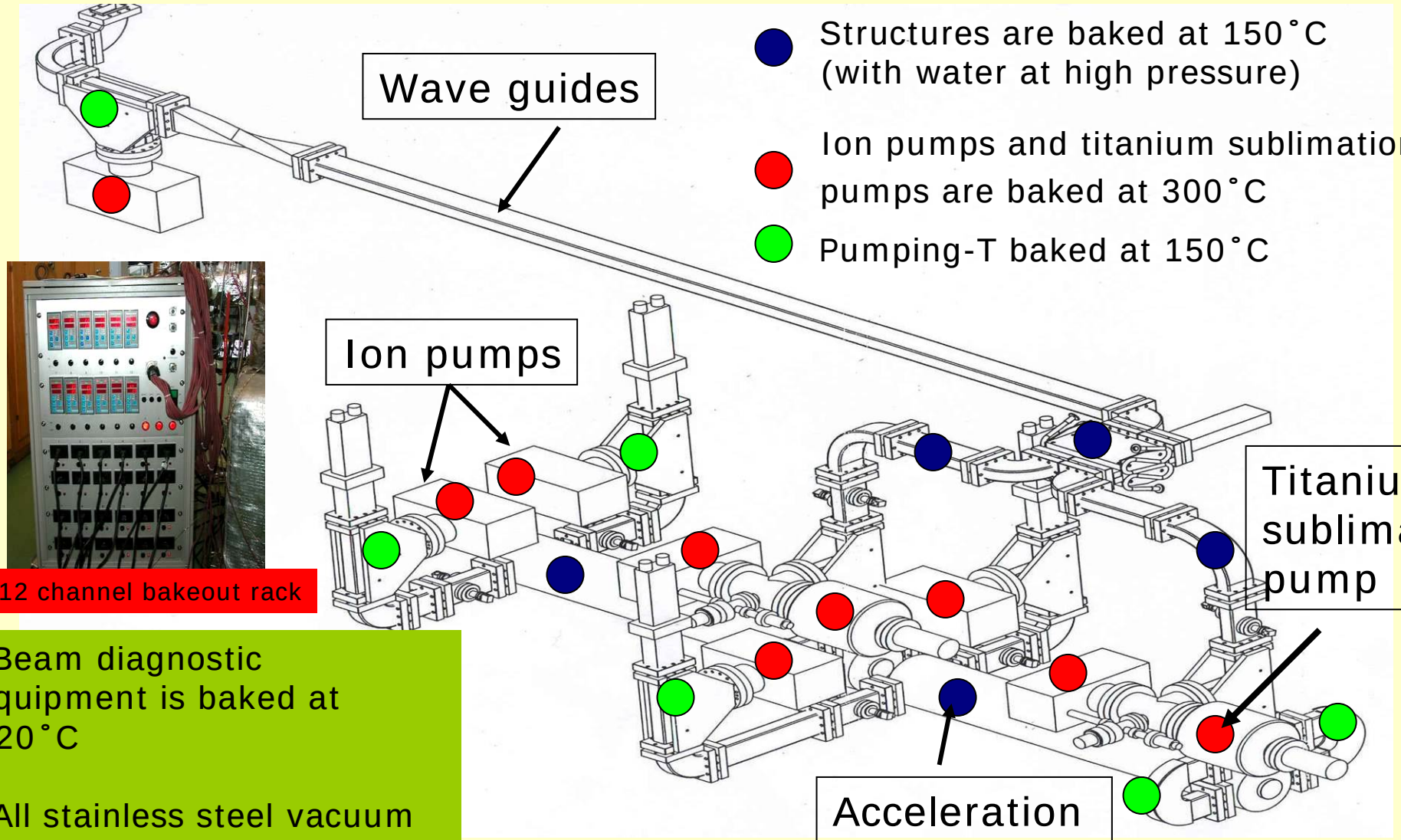








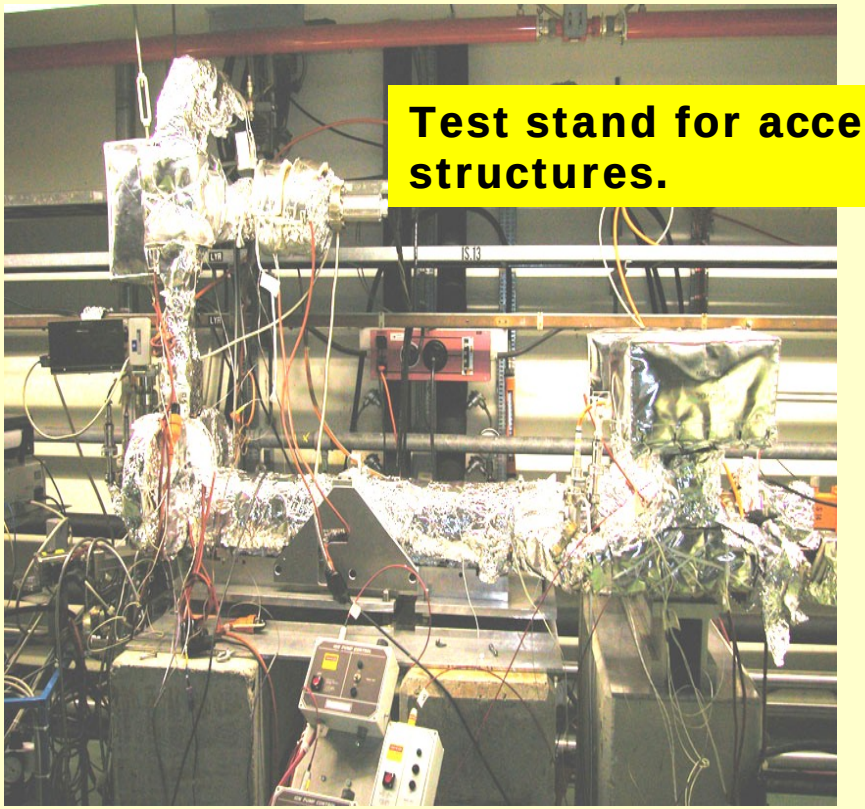
Bakeout of sector C30



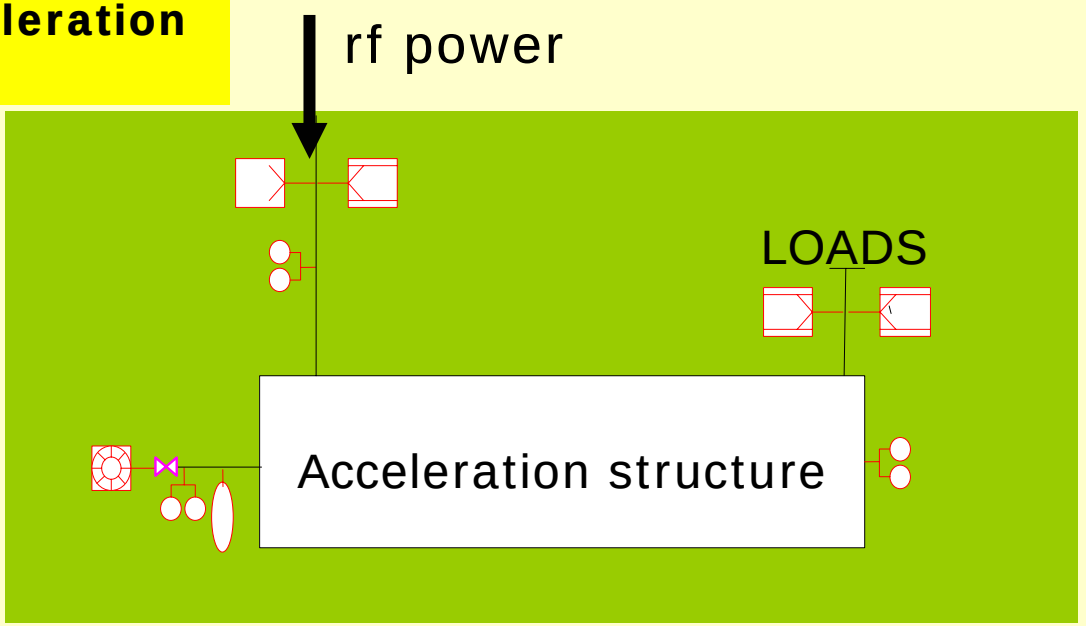
12 channel bakeout rack

- Beam diagnostic equipment is baked at 120˚C
- All stainless steel vacuum chambers are baked at 150˚C

Test of acceleration structures



Test stand for acceleration structures.

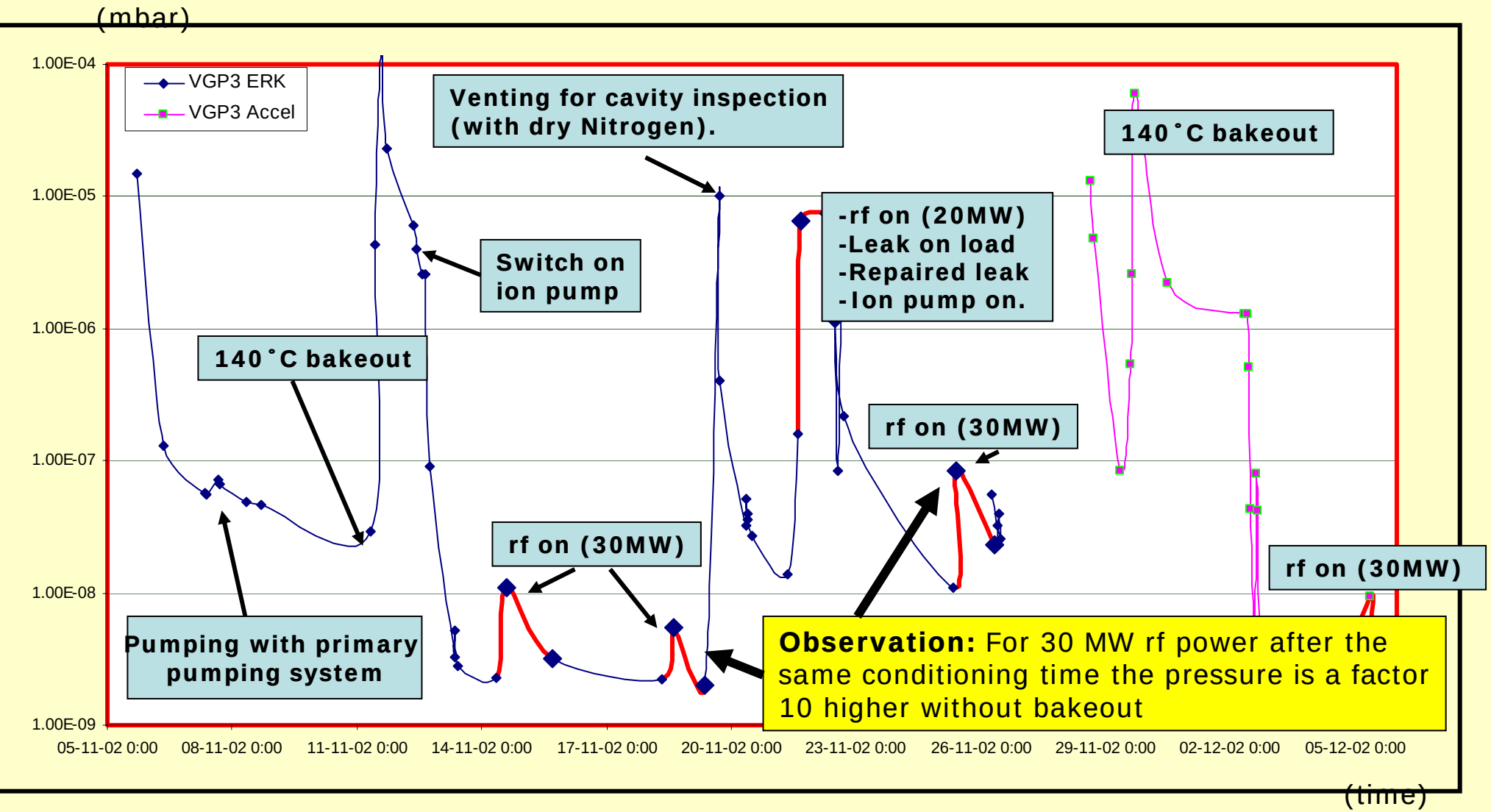


-The pump configuration is the same as used on acceleration structures previously installed in CTF2.

-Bakeout temperatures
Structures : 140˚C
Pumps : 300˚C

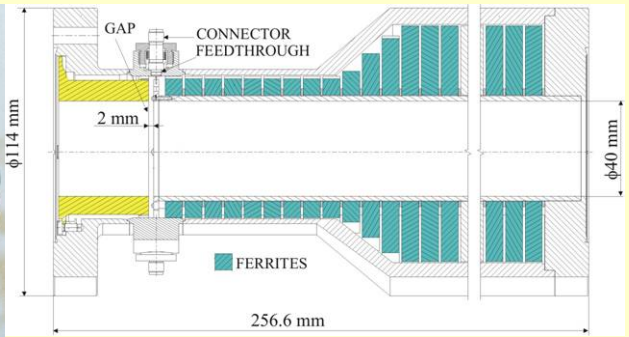
Limit pressure after bakeout
VGP1: 3.2×10^{-10} mbar
VGP2: 1.8×10^{-9} mbar
VGP3: 2.0×10^{-9} mbar

Result of acceleration structure rf power tests



Beam diagnostic equipment

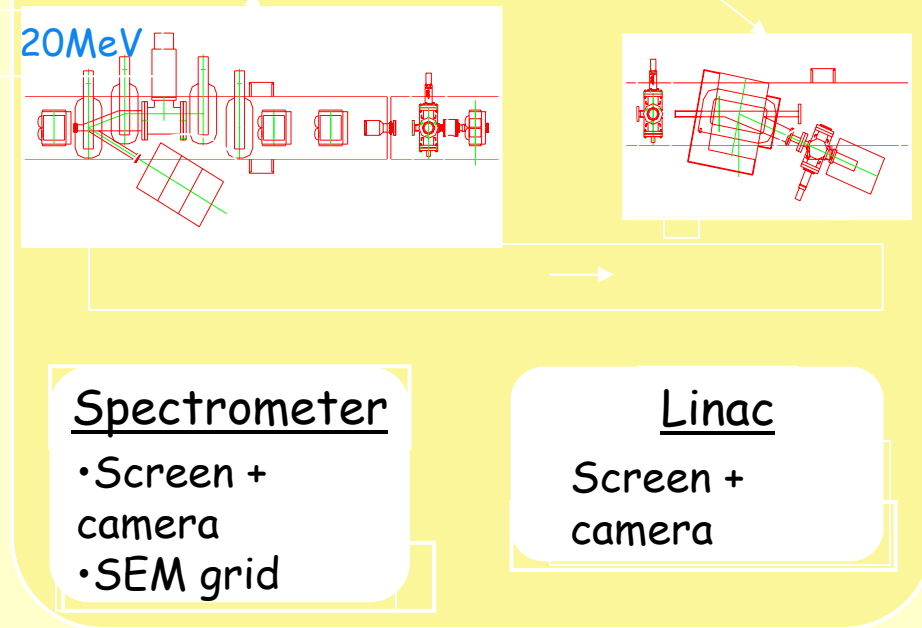
Wall current monitor
(J. Durand;P.Odier)



Total outgassing before bakeout
>1x10^{-5} mbar l/s.(teststand)
Total outgassing after bakeout
<1x10^{-7}mbar l/s.(teststand)

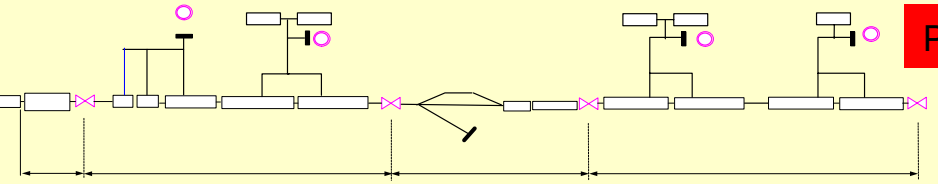
Reference: Stainless Steel unbaked outgassing rate <**5x10^{-10}mbar l/s cm^{-2}**

Spectrometer Lines
(T.Lefevre)

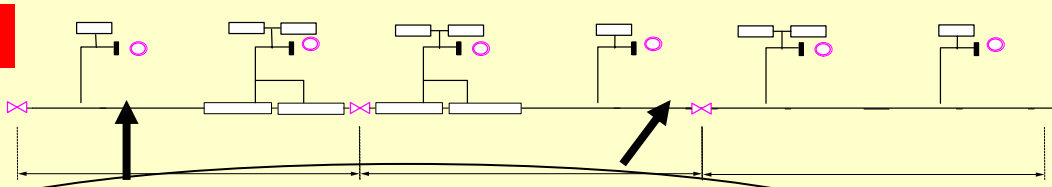


-Limit pressure 2 month after installation >6x10^{-8}mbar without bakout.
-Limit pressure after bakeout <5x10^{-9}mbar.

Vacuum pressure in CTF3 Linac

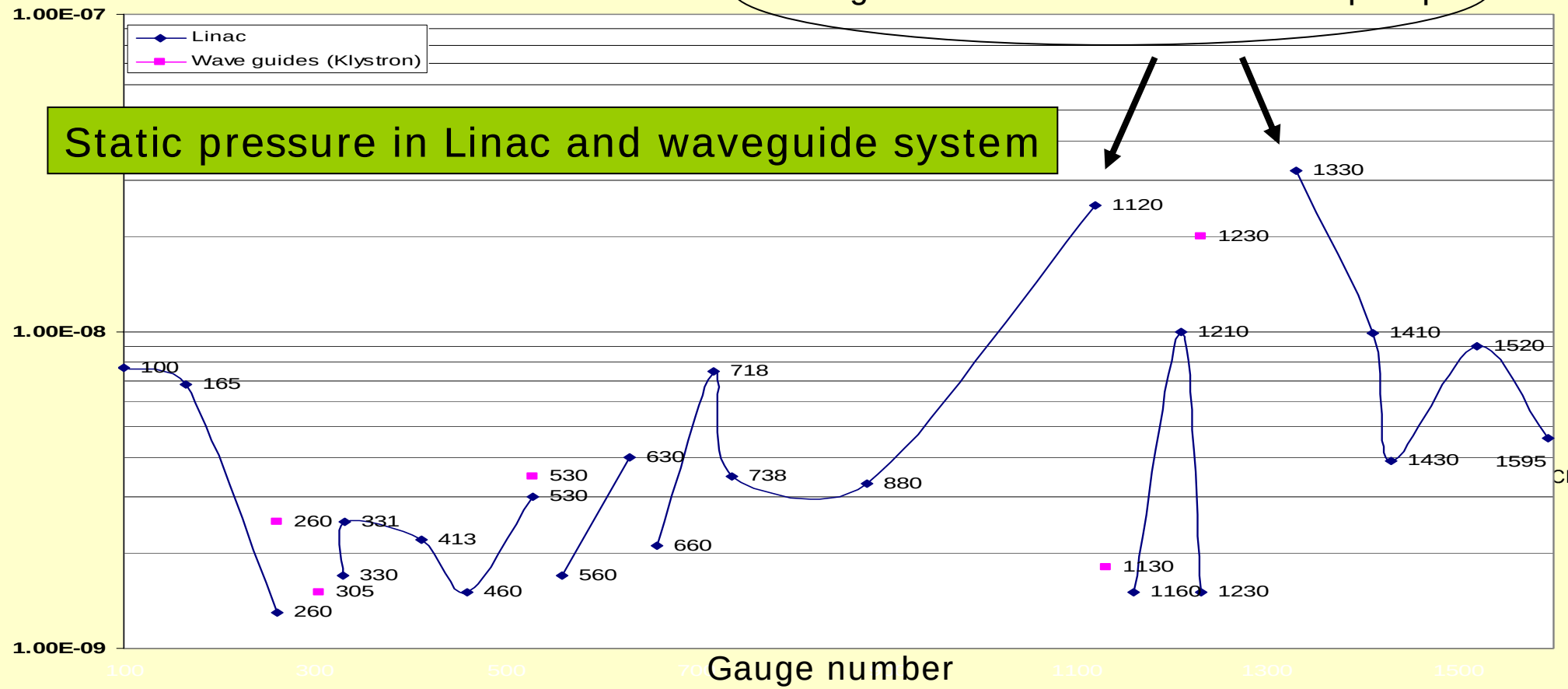


PETS



Missing acceleration structures and pumps

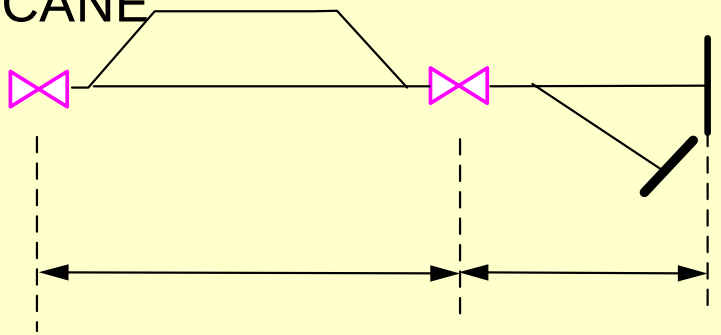
mbar



Static pressure in Linac and waveguide system

Vacuum pressure in CHICANE

CHICANE

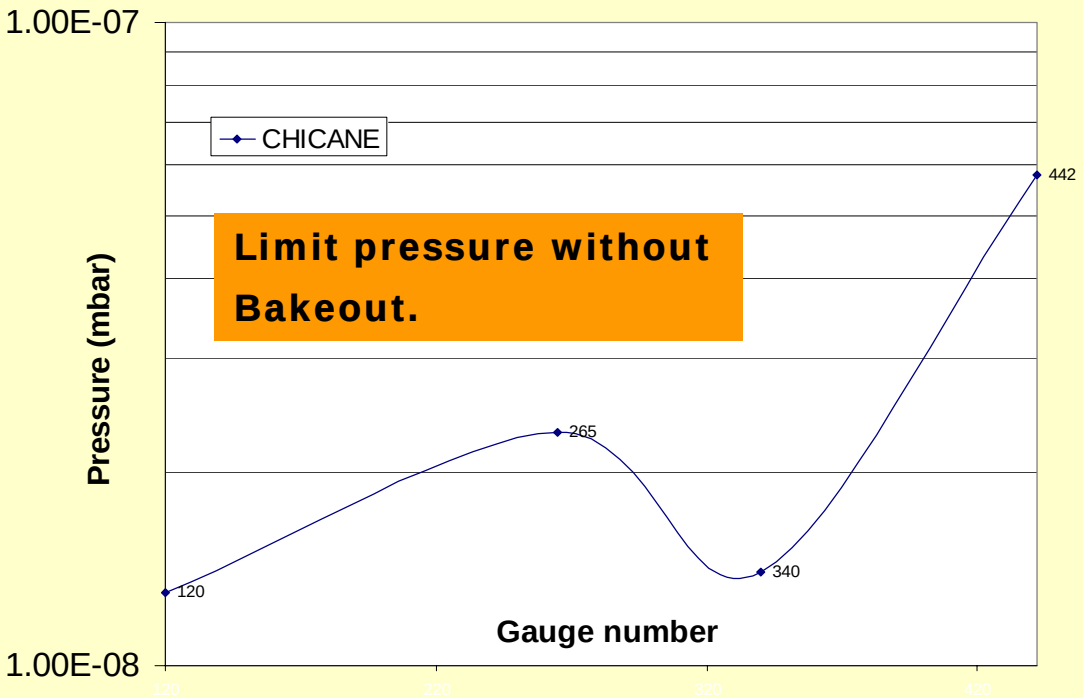


IMPORTANT:

- All CHICANE vacuum chambers, flanges and seals are made of aluminium (similar to the old LEP design).

- All pumps and gauges on the CHICANE are made of stainless steel.

- Static vacuum pressure in CHICANE and spectrometer line (Date:15-11-2004)



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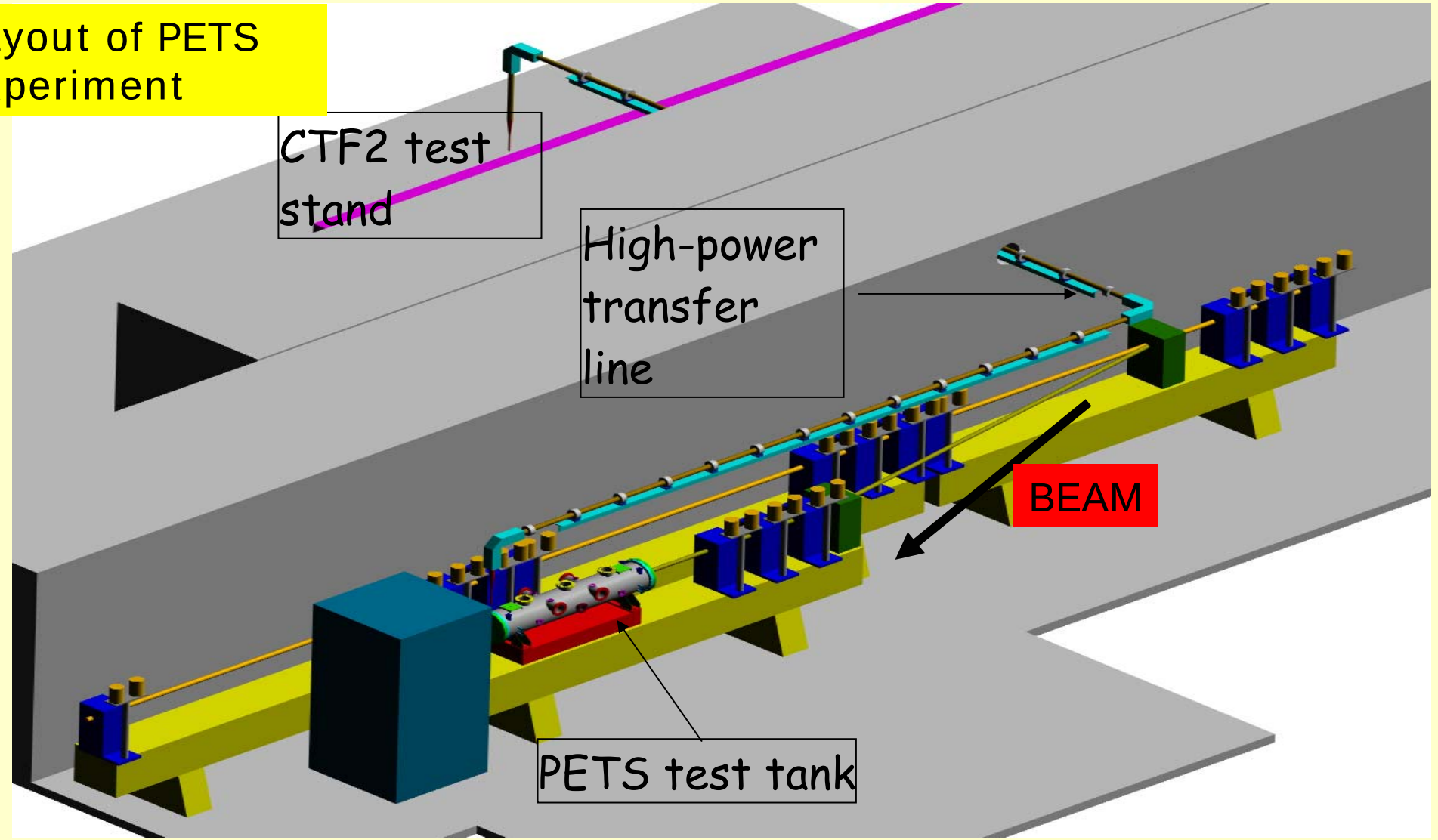
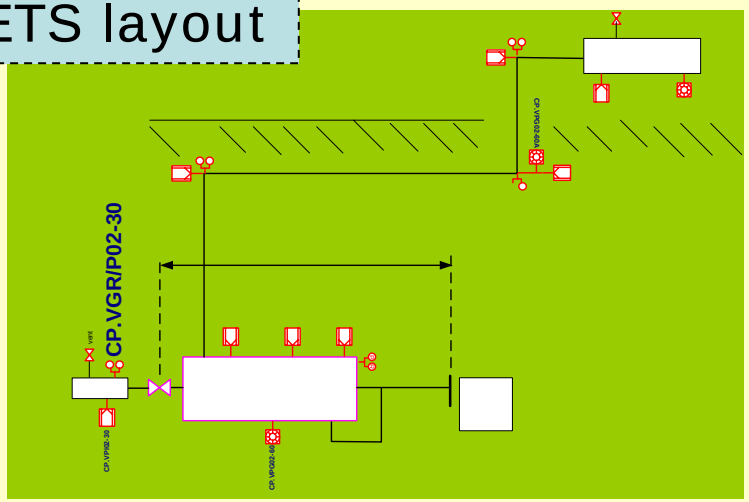
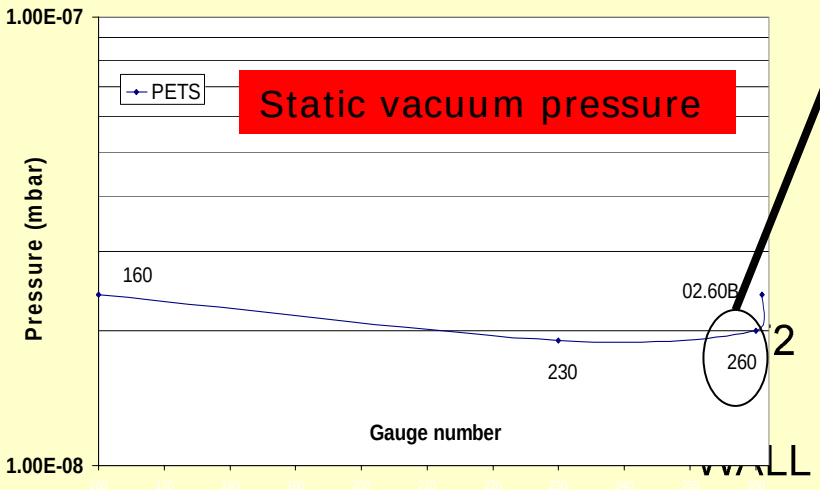
Layout of PETS experiment



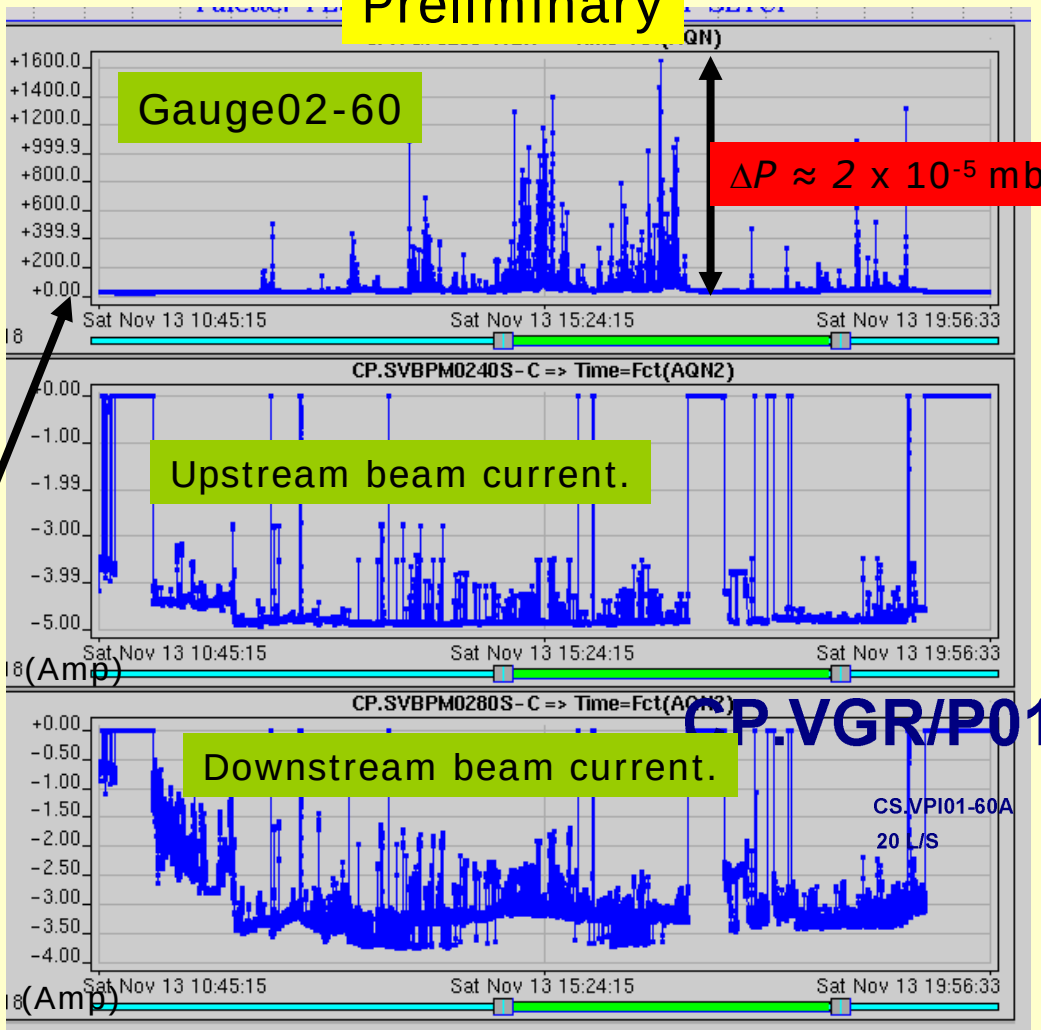
Dynamic an static pressure in PETS experiment

PETS layout



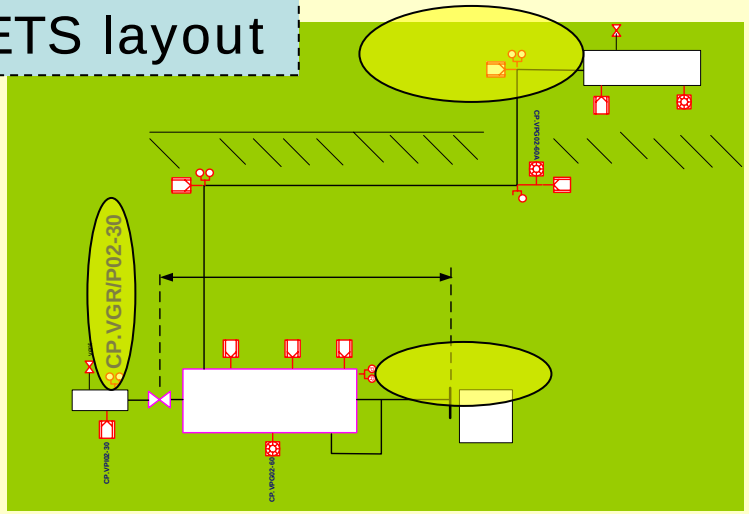


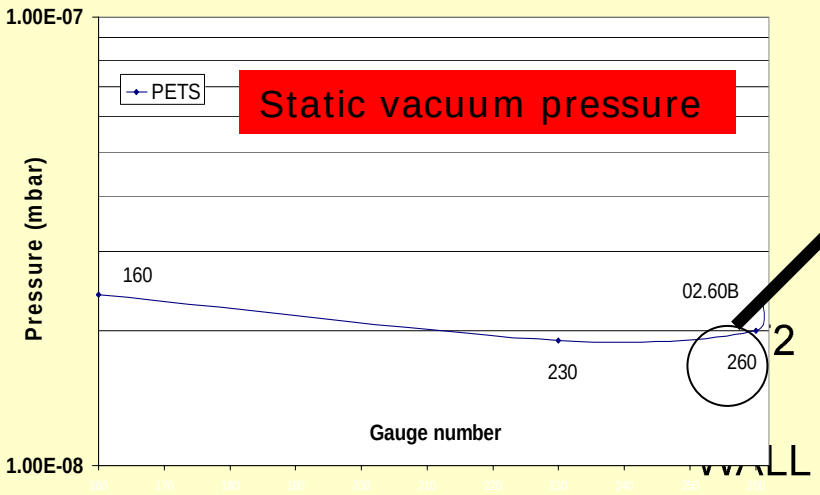
Preliminary



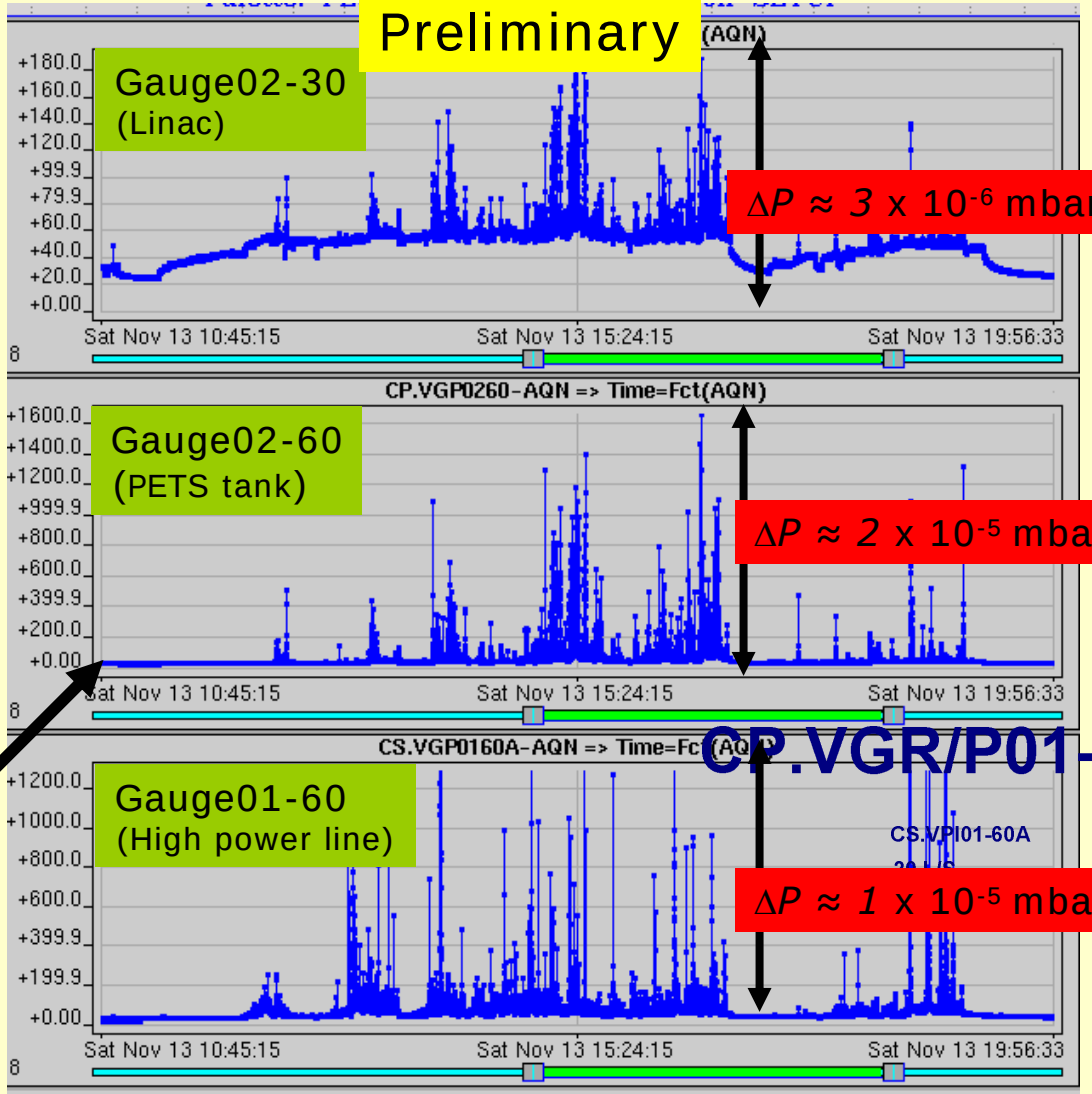
Dynamic and static pressure in PETS experiment

PETS layout





Preliminary



Summary and outlook

- Average static pressure in CTF3 Linac is $<1x10^{-8}$ mbar (This is within design specification).

- Next step.
  - Analyse the pressure data from the last run (PETS).
  - Install temperature sensors on the PETS structures (heating?).
  - Study if we could save conditioning time by baking the waveguides.

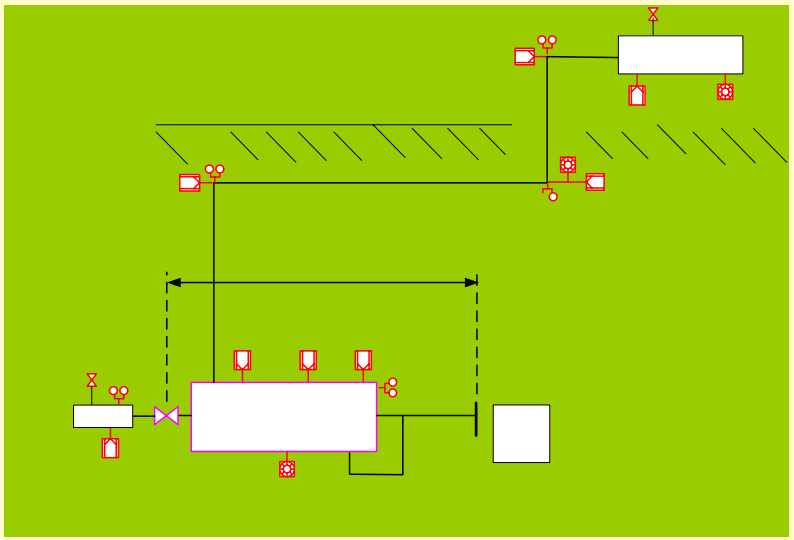
  - Study if we need to bake the CHICANE, TL, Delay Loop and the Combiner-Ring(''$1x10^{-9}$mbar'' design report, pressure in CHICANE $1x10^{-8}$mbar) ?

  - Study what type of sector valves can be used for the Transfer Lines and Combiner-Ring (Standard valves or valves with RF contact) ?

Daniel Allard (Vacuum technician) in action.

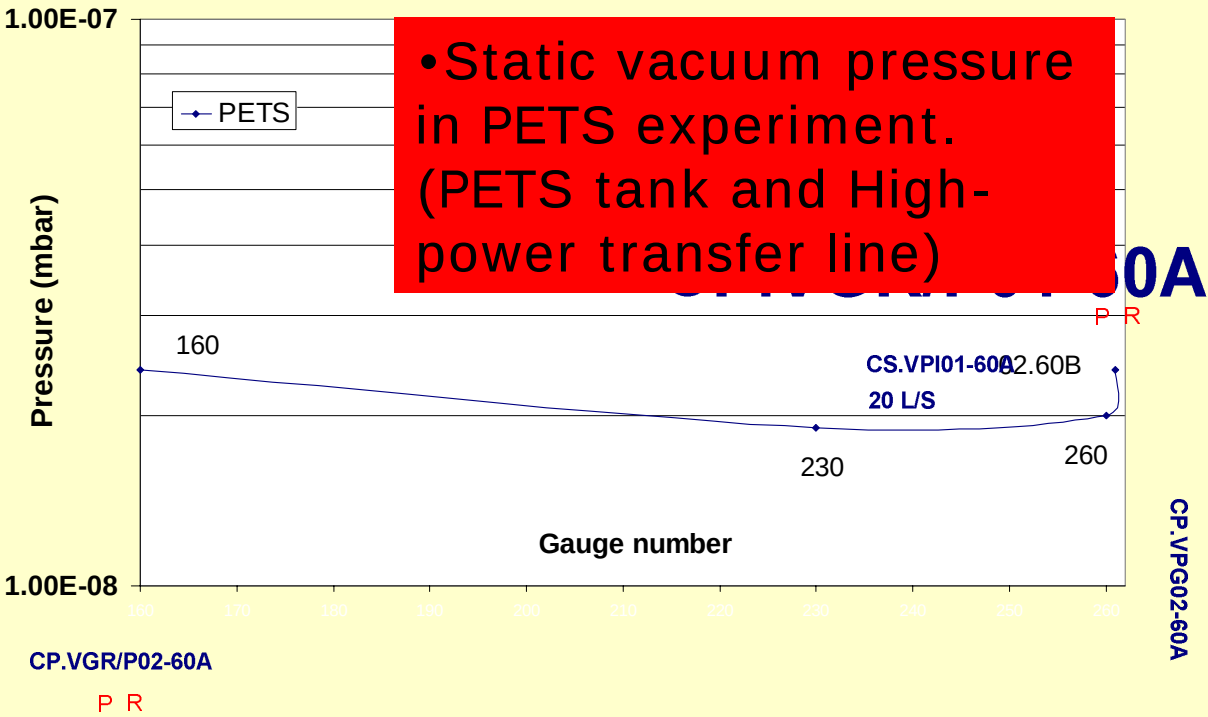
Thanks for your attention

Vacuum pressure in CTF3 Linac



PETS

- **The aperture between the down stream beam line and the PETS tank is id 6.7 mm.**
- **The high power transfer line has an aperture of id 50 mm and an aperture to the PETS tank of 0.34”x0.42”.**



- Static vacuum pressure in PETS experiment. (PETS tank and High-power transfer line)