IR Vacuum Systems first thoughts

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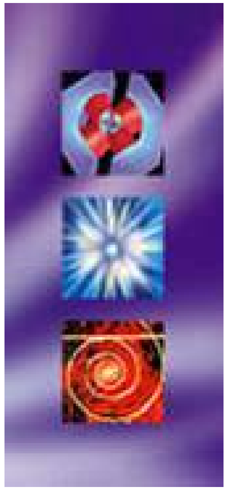
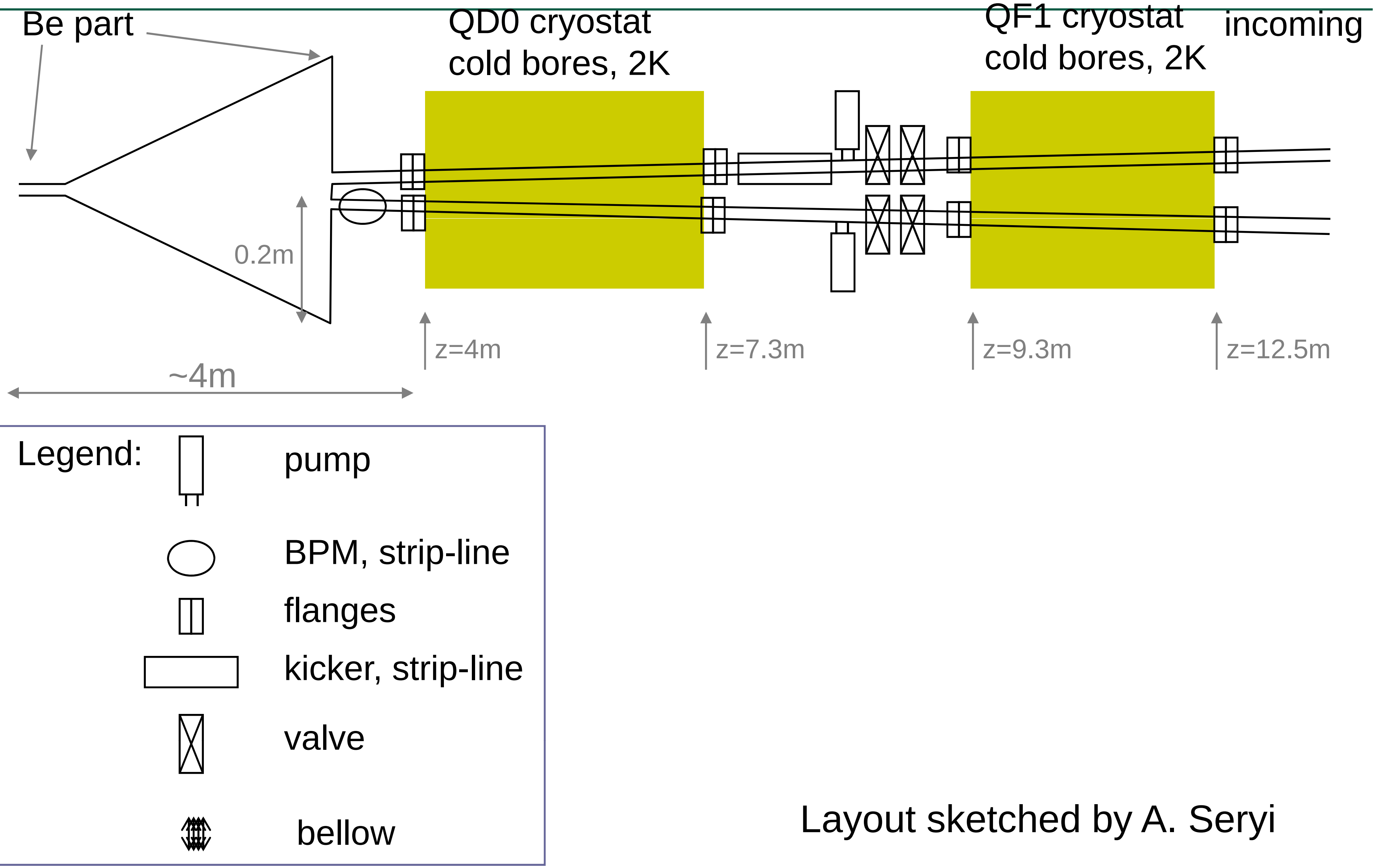




Layout sketched by A. Seryi

IR vacuum chamber

- Be cone vacuum chamber (half):
  - $A = \sim 2\ m^2$
  - Thermal desorption rate **after 24 hrs bakeout at 250°C:**
    - $\eta\ (H_2) = 10^{-11}$ Torr·l/(s·cm^2)
    - $\eta\ (CO) = 10^{-12}$ Torr·l/(s·cm^2)
  - Total thermal desorption:
    - $Q(H_2) = 2 \cdot 10^{-7}$ Torr·l/s; $Q(CO) = 2 \cdot 10^{-8}$ Torr·l/s
  - Requred pumping speed for $P = 10^{-9}$ Torr:
    - $S(H_2) = 200$ l/s; $S(CO) = 20$ l/s
  - Available tube conductance is very low:
    - $U(H_2) = 15$ l/s; $S(CO) = 4$ l/s

IR vacuum chamber

- Present layout does not allow reaching required pressure by using conventional technology even for thermal outgassing, i.e. with no beam.
- Solution is the NEG coated vacuum chamber:
  - 1-µm TiZrV coating
  - Activated by bakeout for 24 hrs at 180°C
  - Pressure without a beam is below 10^{-13} Torr
  - Low photon, electron and other particles induced gas desorption
  - Low secondary electron emission

IR vacuum chamber in presence of the beam

- Photon, electron, ions, lost positron and electron stimulated desorption

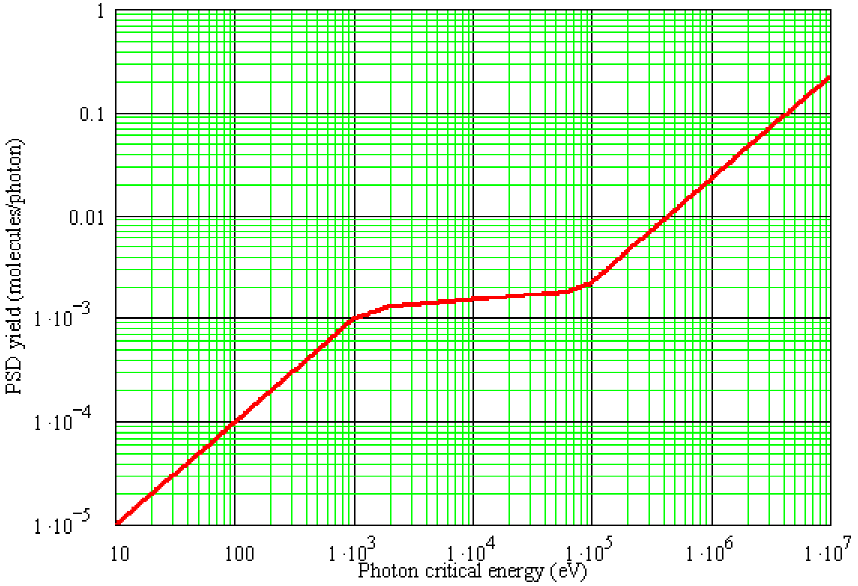
- $Q = \eta\ \Gamma$, where
  - η is desorption yield, number of desorbed gas molecules per impact photon or particle
  - Γ is a number of photon or particle hitting a surface per second

Vacuum modelling - unknowns:

The critical energy of photon spectrum from dipoles at BDS ε_c ~1 MeV

PSD yield at ε_c ~1 MeV is not well studied (LEP data only)

- Beam conditioning studied at DCI at ε_c =~20 keV
- LEP data over lifetime (Al and SS)
- Different materials for vacuum chamber ?
- Coatings (Cu, Au, TiZrV)?



QD0 cold bore

- Required vacuum:
  - 10^{-9} Torr at RT => 3.2 10^{12} molecules/m^3
- d=21-36 mm, L=3 m
- Gas density with no beam is negligible.
- Gas density with a beam increase due do:
  - Photon, electron, ions, lost positron and electron stimulated desorption.
  - Desorbed gas cryosorbed and accumulated on the cryogenic walls
  - Accumulated molecules will be desorbed by photon, electron, ions, lost positron and electron.
  - => Gas density is growing with time

Cold bore – behaviour under SR

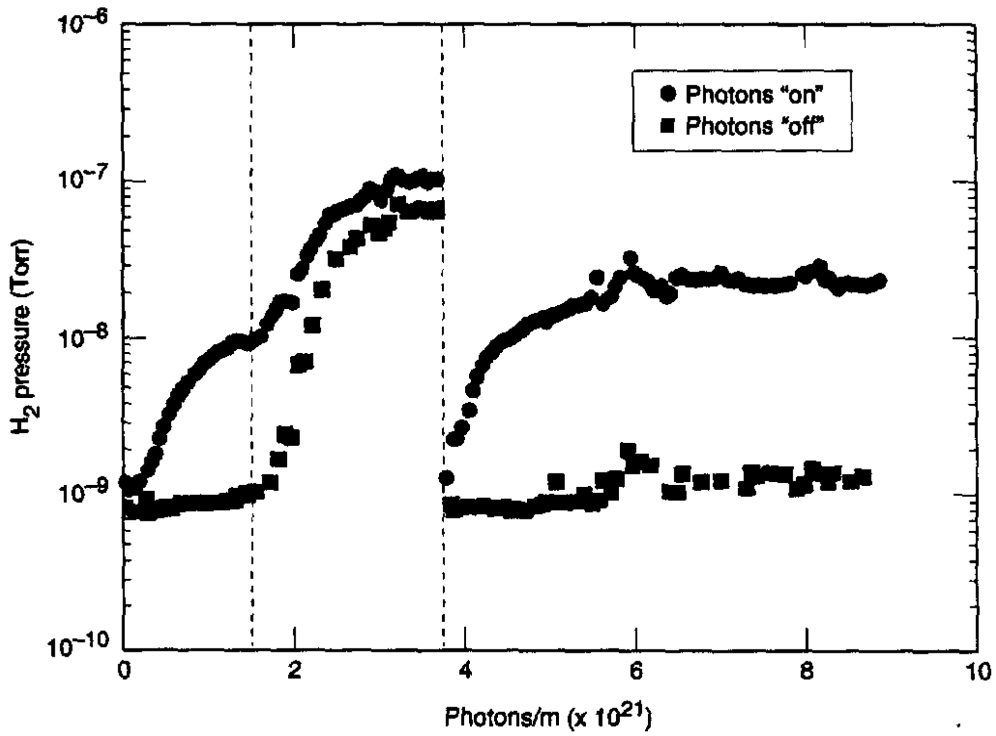


FIG. 1. Room-temperature RGA H_2 pressure measured at the center of the 4.2-K beam tube vs integrated photon flux with photons on and photons off. The raw pressure difference "on" minus "off" has been normalized to 1×10^{16} photons/m/s. The vertical dashed lines correspond to features discussed in the text.

- Experiment was performed with photons with ε_c = 300 eV

Investigation of synchrotron radiation-induced photodesorption in cryosorbing quasiclosed geometry

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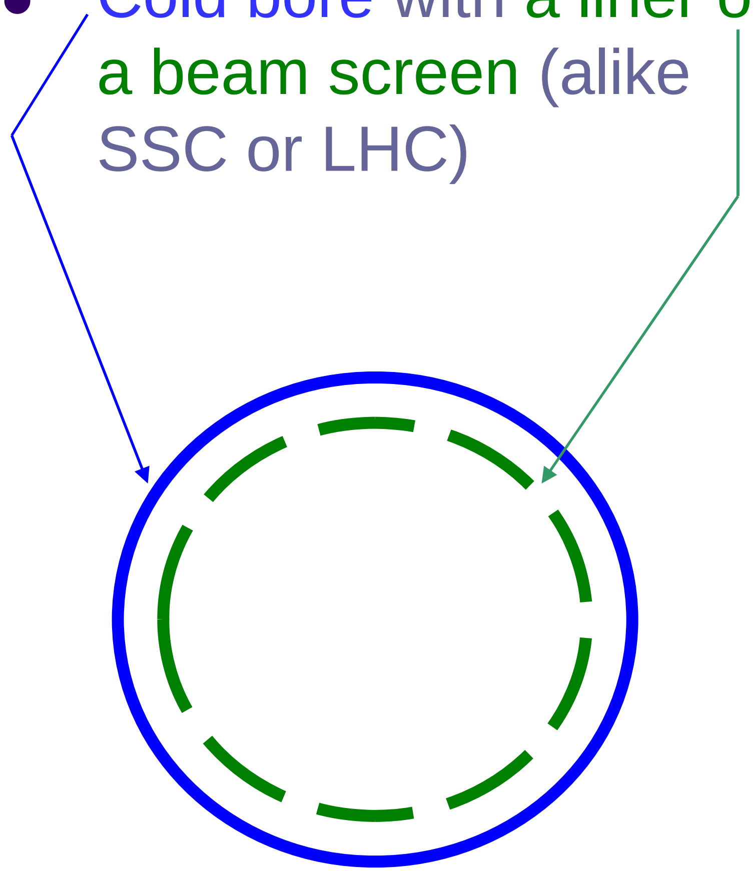
Possible solution:

- Cold bore with a liner or a beam screen (alike SSC or LHC)



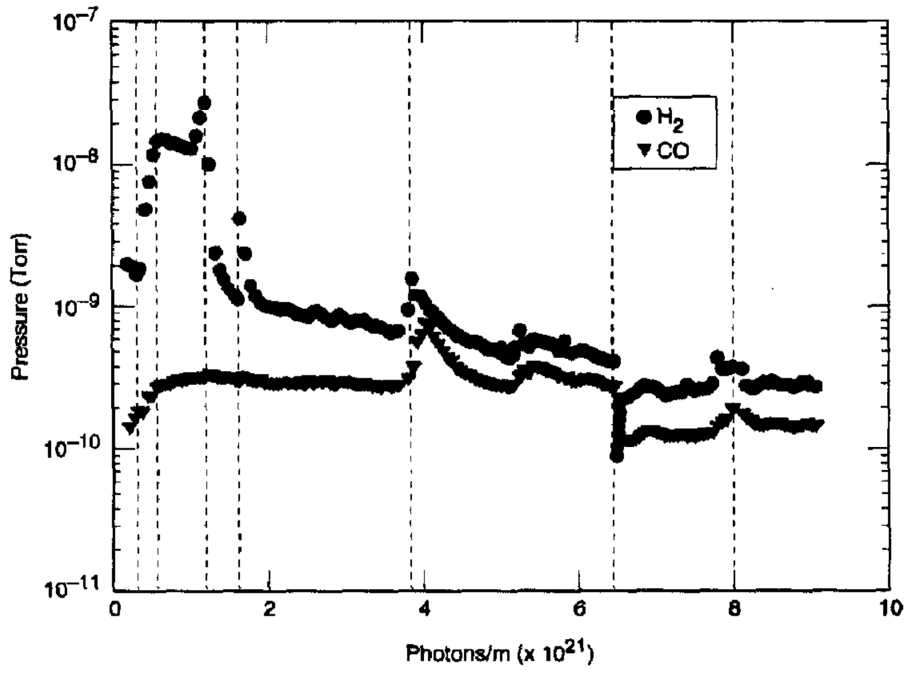
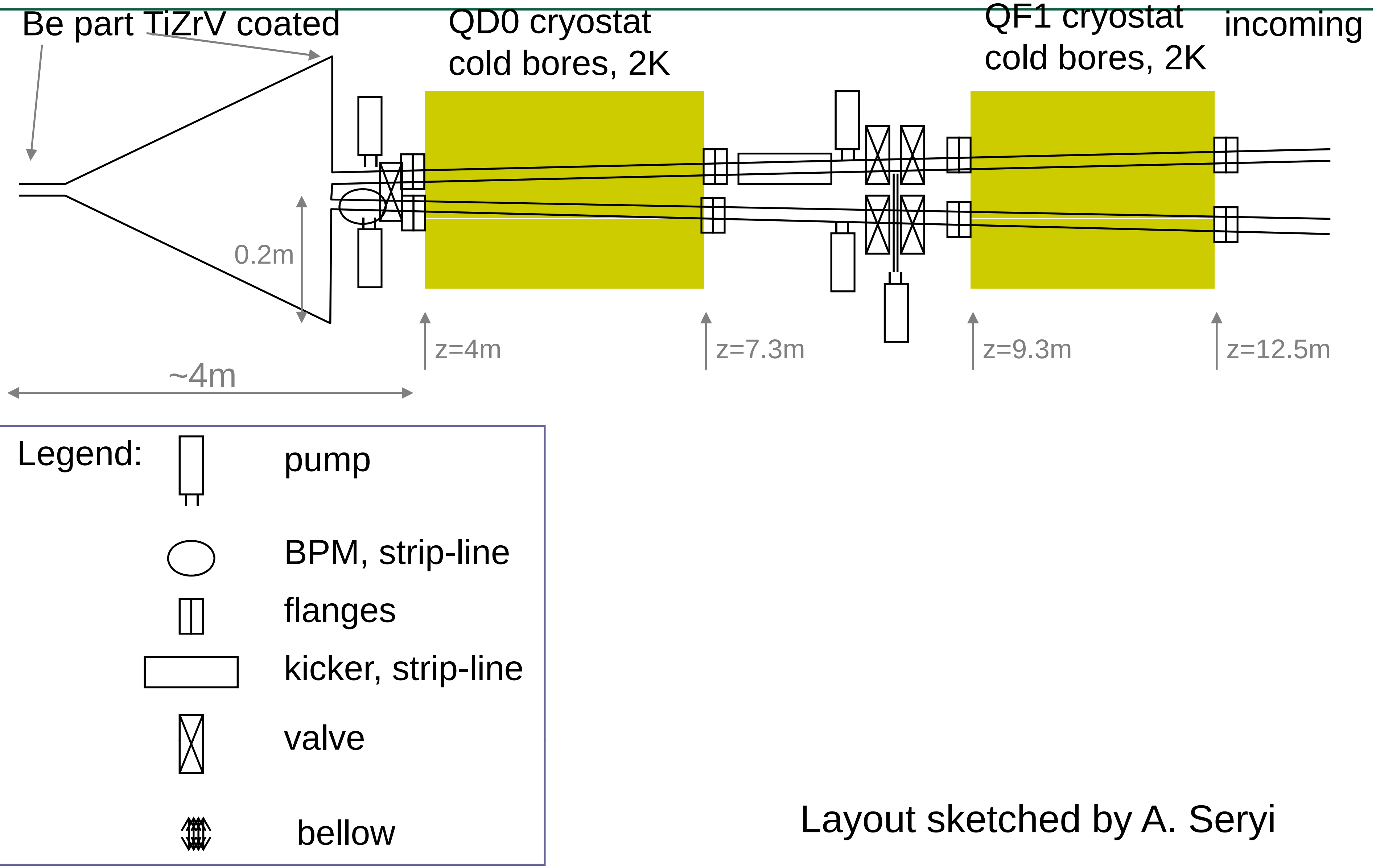


FIG. 2. Room-temperature RGA H_2 and CO dynamic pressures measured at the center of the liner configuration. Dynamic pressure is normalized to 1×10^{16} photons/m/s.



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