IPB Reactor Observation Note

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Definition

$Hpdrop$: heater power drop after power deposit to the core in watts

V_1 : voltage RMS measured at the core entrance when Q-pulse

V_2 : voltage RMS measured at the core exit when Q-pulse

V_3 : voltage RMS measured across the RF termination resistor at the end of the transmission line. The termination resistors are mounted in a copper block that is water cooled . It has constant RF impedance in the freq range we are operating in. With this method we can measure the pulse current directly by measuring V_3 and knowing the R_{term} resistance, $I = V_3/R_{term}$

P : power deposit to the core either by DC or Q-pulse in watts
in Q-pulse

$$P = \frac{(V_1 - V_2) * V_3}{R_{term}} \tag{1}$$

$V^2 = (V_1 - V_2)^2$ when Q-pulse or voltage drop when DC

Observation

$$R = \frac{V^2}{P}\ [volts^2/watts], [volts^2/watts] = [ohms] \tag{2}$$

Where R is constant at any given core temperature for power DC or Q-pulse, gas helium or hydrogen.

$$M = \frac{Hpdrop}{P} \tag{3}$$

Where M is constant at any given core temperature for power DC or Q-pulse, gas helium or hydrogen.
COP Estimation
At a given core temperature

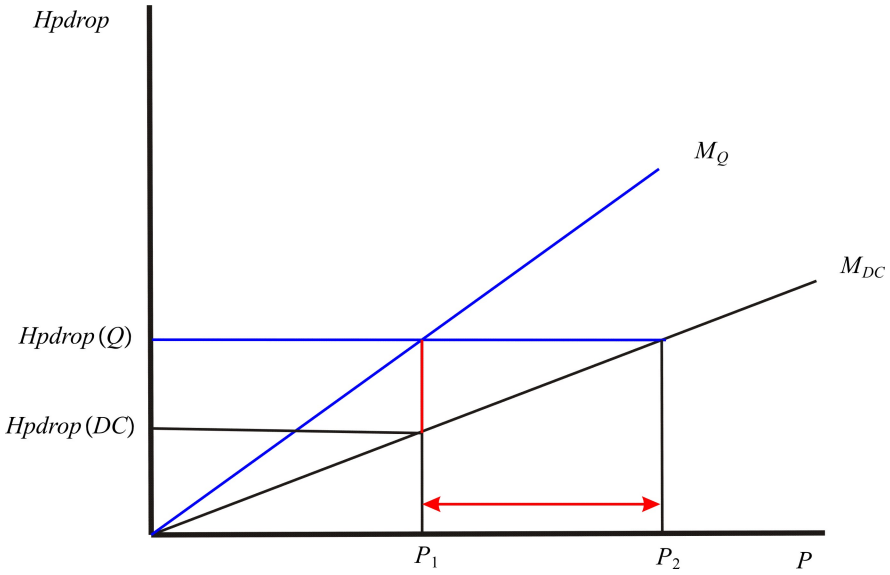

Figure 1: Hpdrop vs. P

Method 1:

$$cop = 1 + \frac{Hpdrop(Q) - Hpdrop(DC)}{P} = 1 + M_Q - M_{DC} \tag{4}$$

Method 2:

Assuming $LENR = P_2 - P_1$ see the Figure 1.

$$cop = 1 + \frac{LENR}{P_1} = 1 + \frac{Hpdrop(Q) - Hpdrop(DC)}{M_{DC} * P_1} = \frac{M_Q}{M_{DC}} \tag{5}$$

COP calculation of ipb1-30b and sri-ipb2-27b based on the method 2, normalized at the temperature 200c, which means at 200c COP = 1, and x axis is the temperature in below Figure 2 and 3.

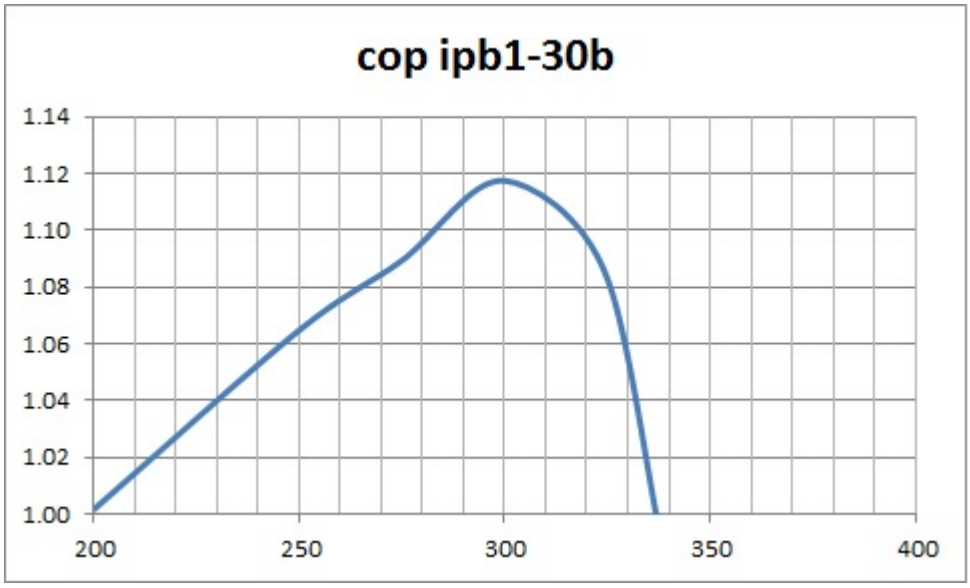

Figure 2: cop vs. temperature of ipb1-30b

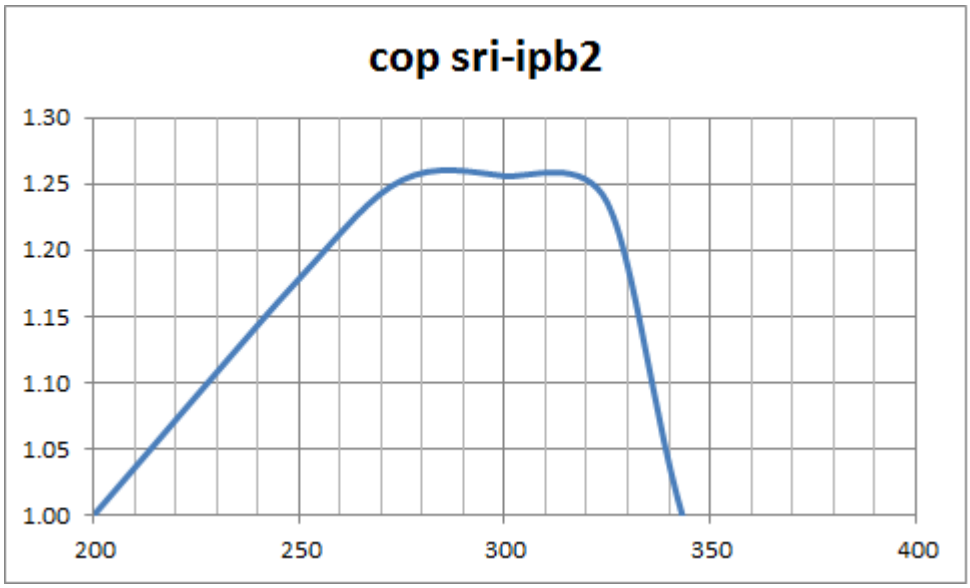

Figure 3: cop vs. temperature of sri-ipb2-27b