IPB Reactor Calorimetry Coefficient of Performance (COP) Note

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January 25, 2017

P : power deposit to the core either by DC or Q-pulse in watts, since there is no precise measurement of power be deposited to the core in Q-pulse, we assume P is Q Pi Filter power (Pi) minus termination thermal power ($term$) deposited by the heatsink water stream divided by a efficiency, and efficiency is measured by passing core.

$$P = Pi - term/efficiency$$

$Hpdrop$ heater power drop after power deposit to the core in watts
V_1 voltage measured at the core entrance
V_2 voltage measured at the core exit
$V^2 = (V_1 - V_2)^2$

$$C = \frac{Hpdrop}{V^2}[watts/volts^2], [watts/volts^2] = 1/[ohms] \tag{1}$$

Where C is constant at any given core temperature of power DC or Q-pulse, gas hydrogen or helium of ipb1-30b and sri-ipb2-27b.

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

Where R is constant at any given core temperature for all DC.

$$cop = \frac{Hpdrop_Q(P) - Hpdrop_{DC}(P)}{P} \tag{3}$$

For any given V_{DC}^2,

$$\begin{aligned} cop &= \frac{Hpdrop_Q - Hpdrop_{DC}}{P} = \frac{C_Q V_{DC}^2 - C_{DC} V_{DC}^2}{P_{DC}} \\ &= \frac{C_Q V_{DC}^2 - C_{DC} V_{DC}^2}{V_{DC}^2/R_{DC}} = (C_Q - C_{DC})\, R_{DC} \end{aligned} \tag{4}$$

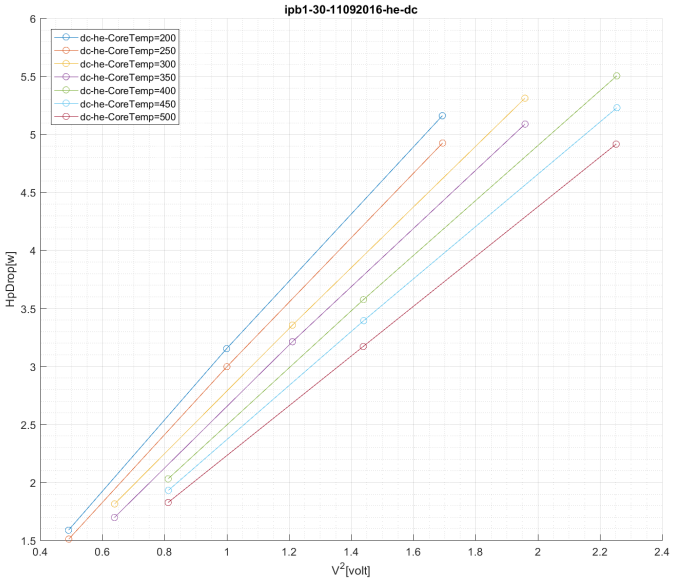

Figure 1: Inner Core Temperature and Heat Power vs. Running Hours

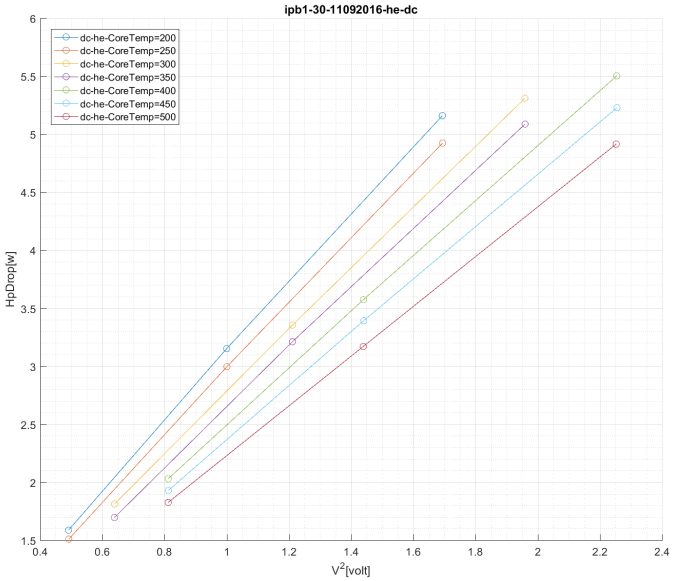

Figure 2: Inner Core Temperature and Heat Power vs. Running Hours