Formula for converting DAQ data channels to correct gradient and phase settings

The DAQ data channels including notations for I and Q in term of vector-sum and individual cavity signals. These data have to be converted to get the correct values for amplitude and phase.

For the vector-sum-channels this reads as:

$$A_{vs} = \frac{\sqrt{I^2 + Q^2}}{sca} \tag{1}$$

$$P_{vs} = \frac{180}{\pi} \arctan\left(\frac{I}{Q}\right) \tag{2}$$

Here *sca* is given as the global scaling coefficient which converts the bits in voltages. If this coefficient is not in the DAQ data, you can find it as:

TTF2.RF LLRF.CONTROLLER MAIN.ACC67 SETPOINT.SCALEFACTOR.

This factor has been constant during the study period. I checked the number which was:

238.8

For the individual cavities the gradients and phases are determined as:

$$A_{cav} = \frac{\sqrt{I^2 + Q^2}}{sca \cdot l \cdot n} \cdot A_{sca} \tag{3}$$

$$P_{cav} = \frac{180}{\pi} \arctan\left(\frac{I}{Q}\right) + p_{rot} \tag{4}$$

The scaling factor is the same as for the vector-sum given before. In addition to compute the gradient values, the cavity length l, number of cavities in one module n and the amplitude scaling and phase rotation factor is needed. These values have been:

$$\begin{aligned} l &= 1.036(m) \\ n &= 8 && (5) \\ a_{sca} &= 1.3660 && (6) \\ p_{rot} &= -21(deg) && (7) \end{aligned}$$