

A **BiTT** OF FLUX TUNING SIMULATIONS

Results based on a M45 laminated steel core AC model

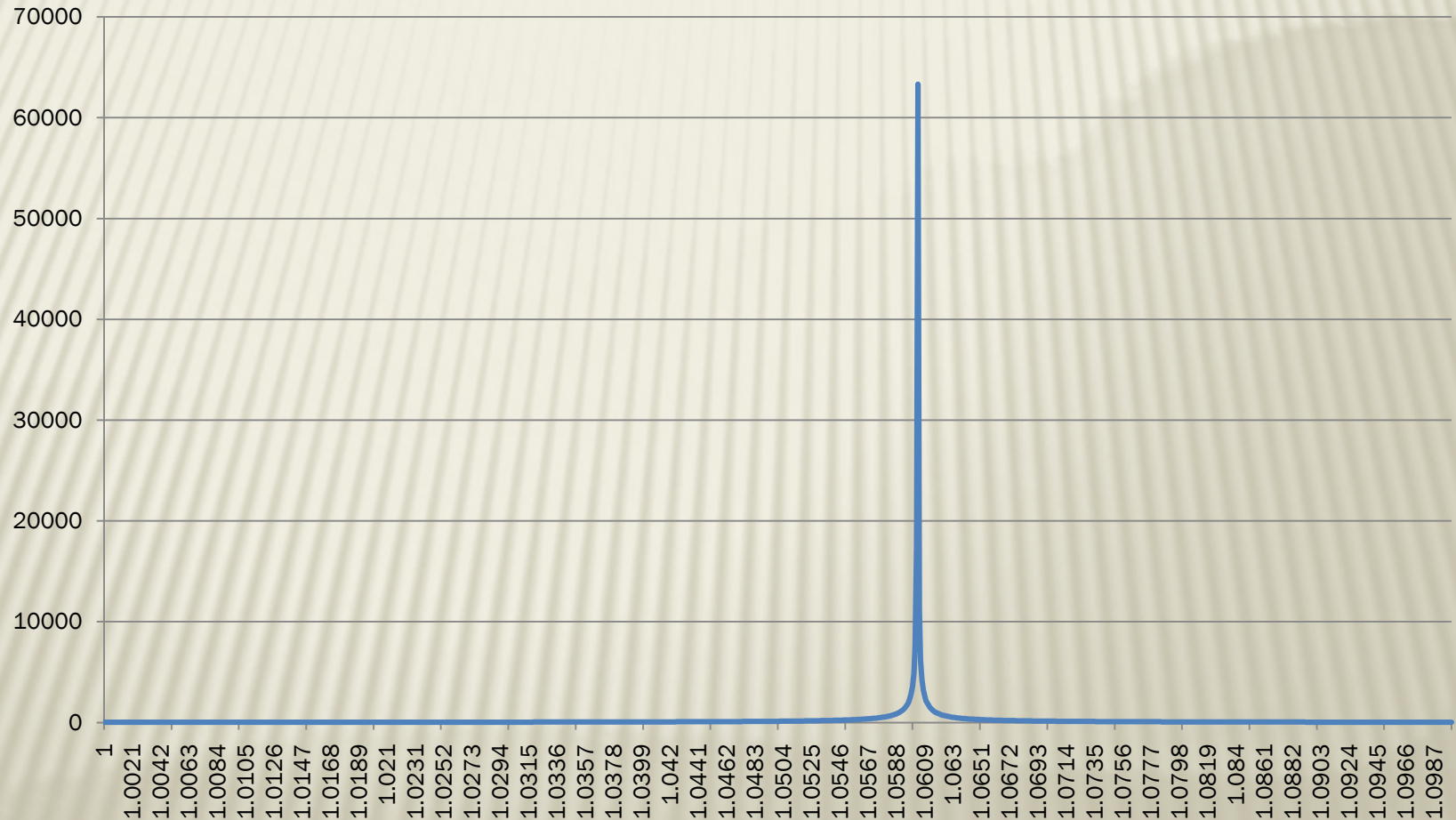
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APPLIED INPUT / OUTPUT SIGNALS

- ✖ This simulation analysis contains only the relevant parameter values where the typical advantages occur within a specific output current range
- ✖ AC current @ 60 Hz sinus values were applied
- ✖ Losses included in the simulations:
 - + Hysteresis and eddy current loss in the laminations
 - + Proximity and skin effects in the transformer windings

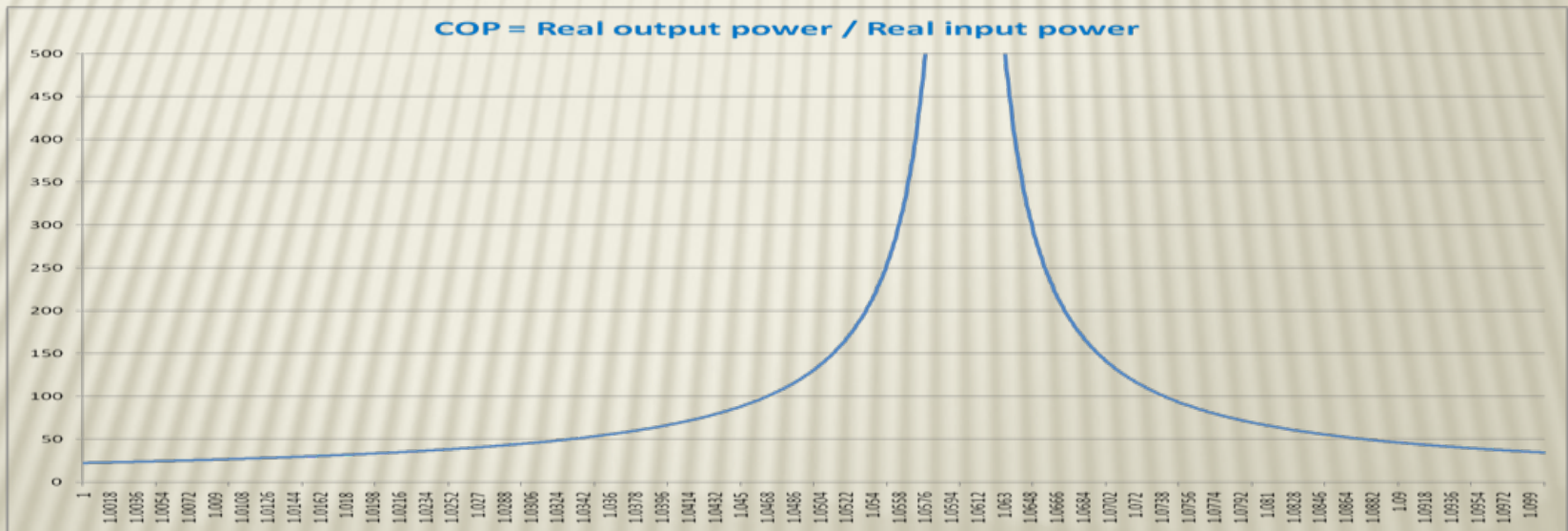
COP vs OUTPUT CURRENT (1)

$\text{COP} = \text{Real output power} / \text{Real input power}$



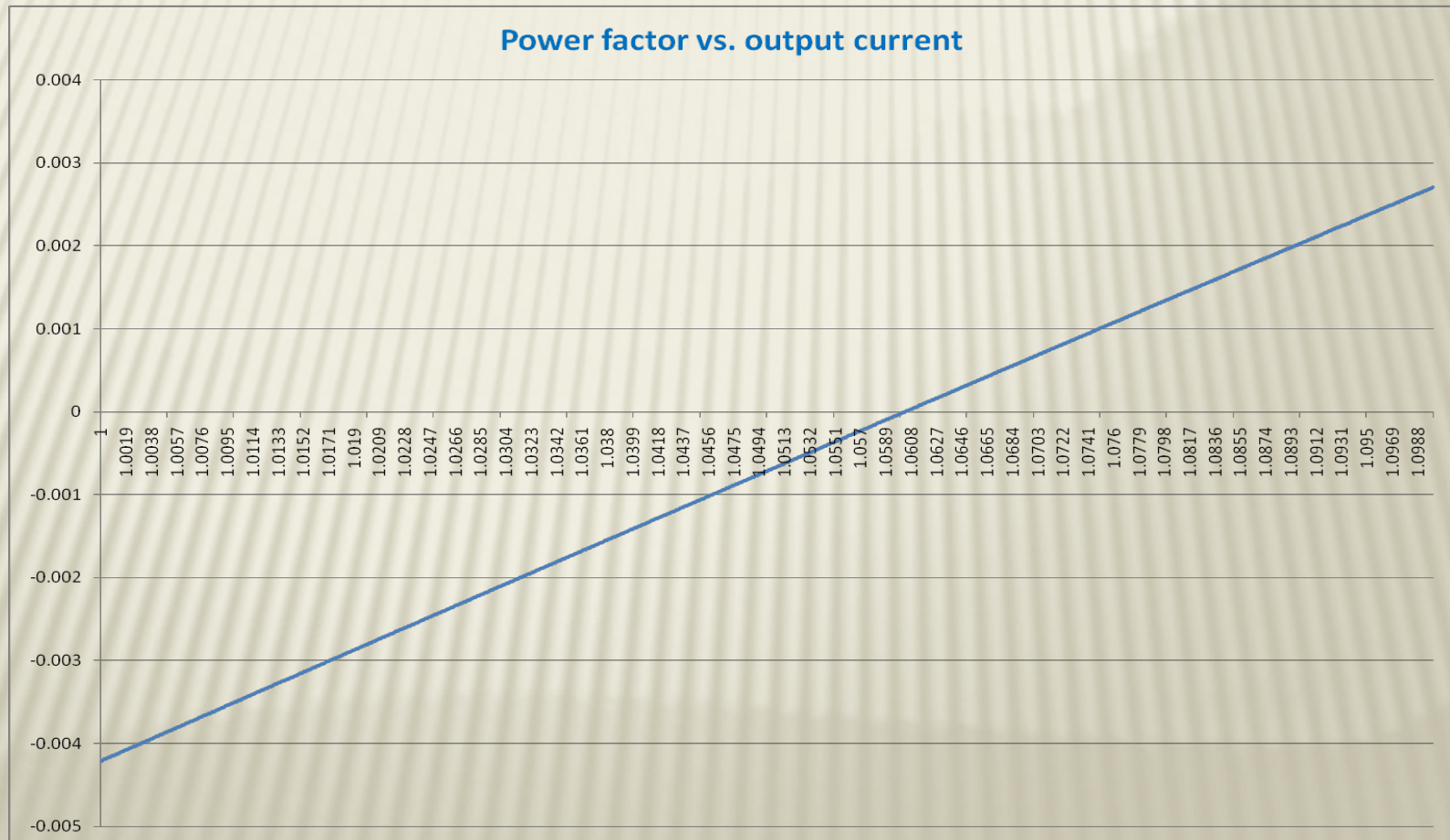
COP vs OUTPUT CURRENT (2)

- ✗ High COP is caused by Power Factor = 0 (see next slide)
- ✗ Increased sample accuracy on current value will result in **COP = infinity**
- ✗ Lower COP values at wider current range are shown below:



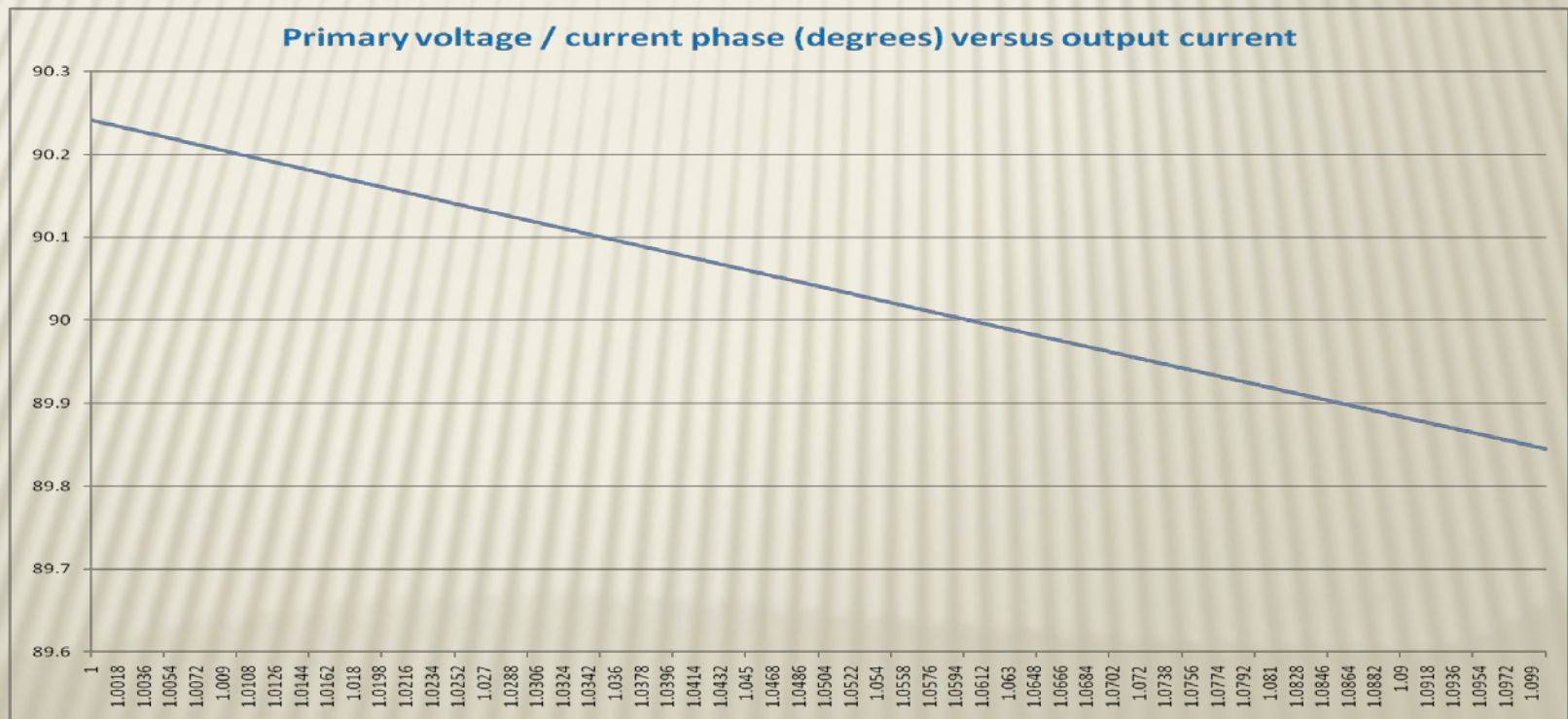
POWER FACTOR vs CURRENT

- ✗ Power factor can be tuned to positive or **negative** values:



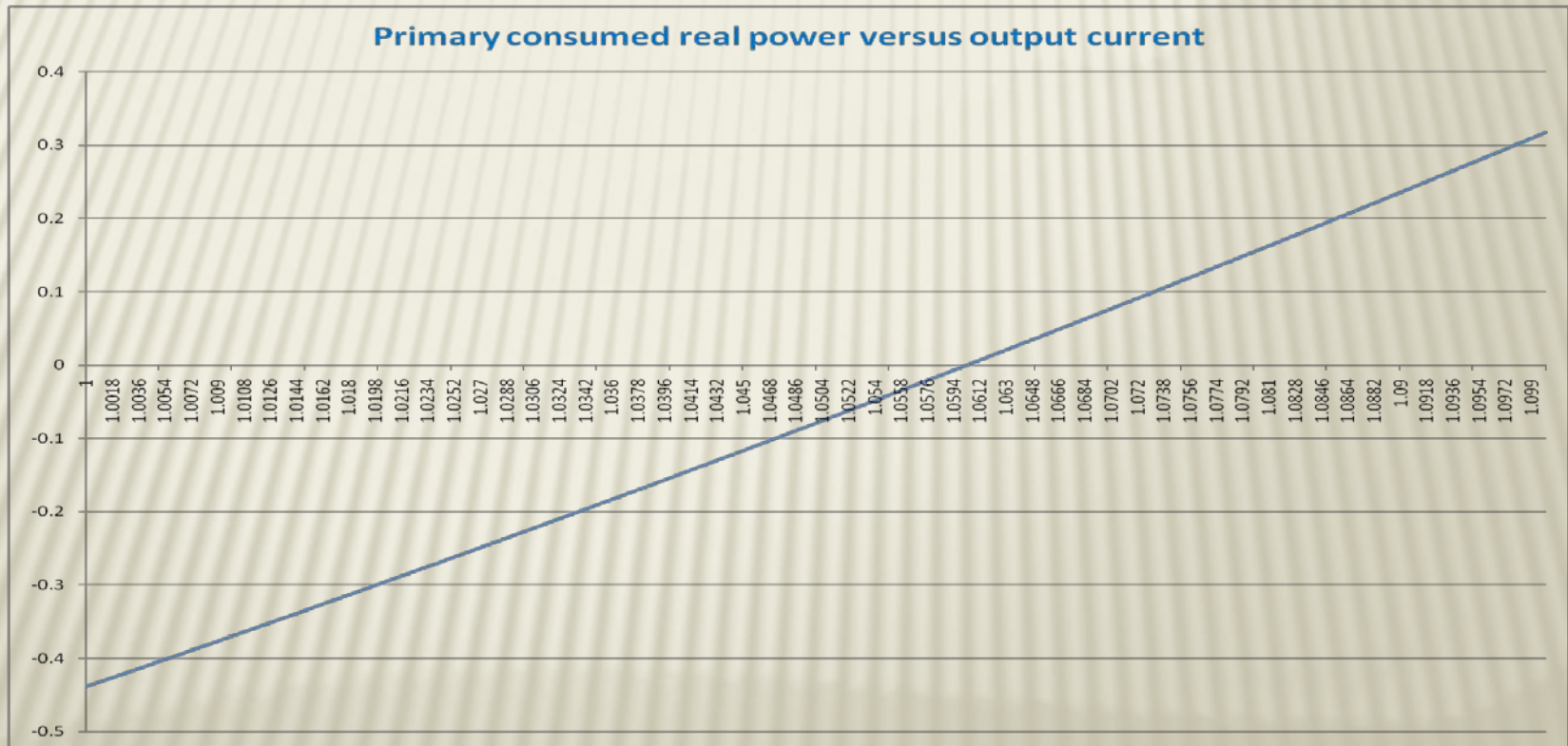
PRIMARY COIL VOLTAGE / CURRENT PHASE

- ✖ Phase between V and I of primary coil reaches 90 degrees at given output current range:



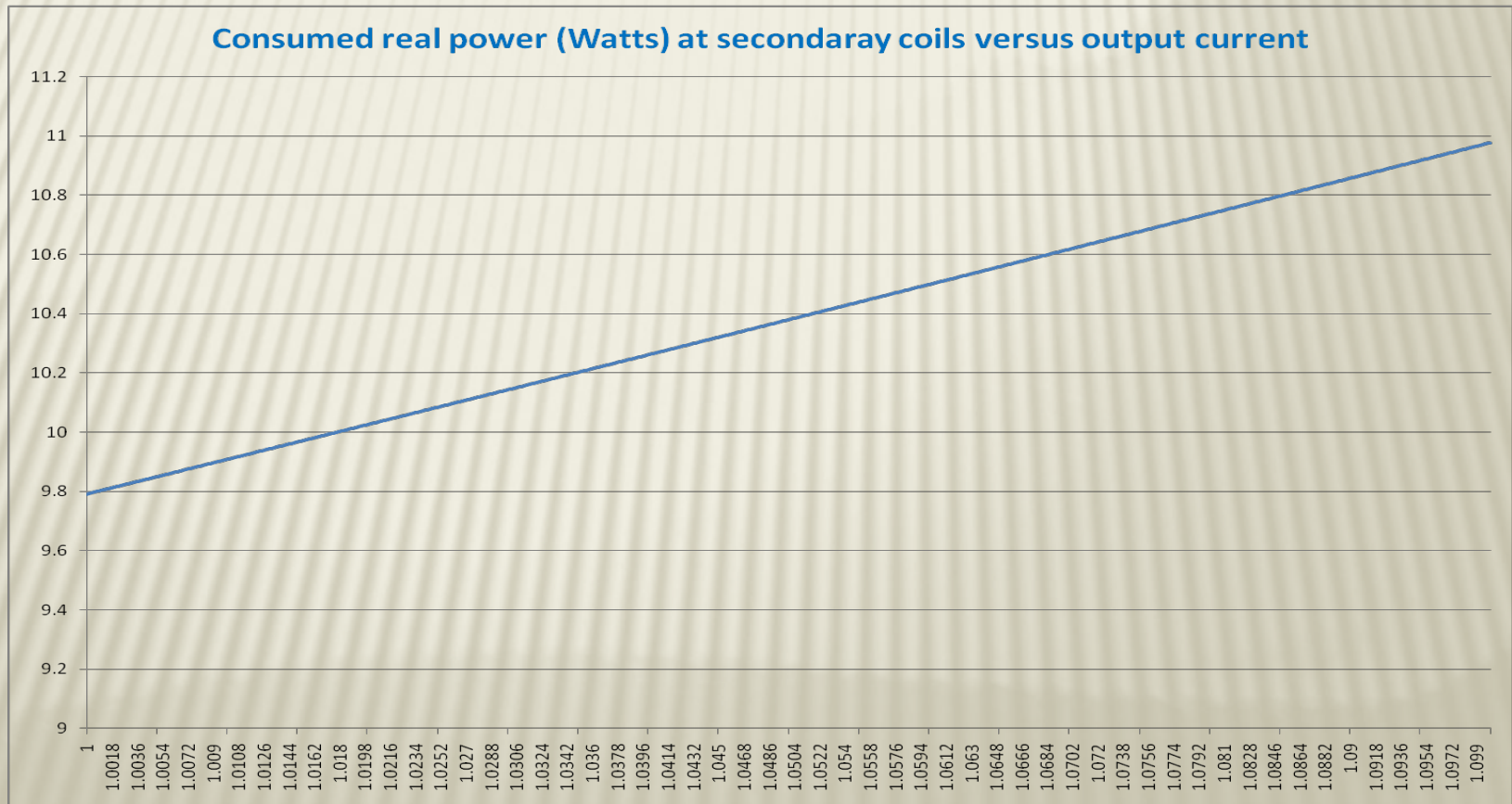
REAL POWER OVERVIEW (1)

✖ Primary consumed real power:



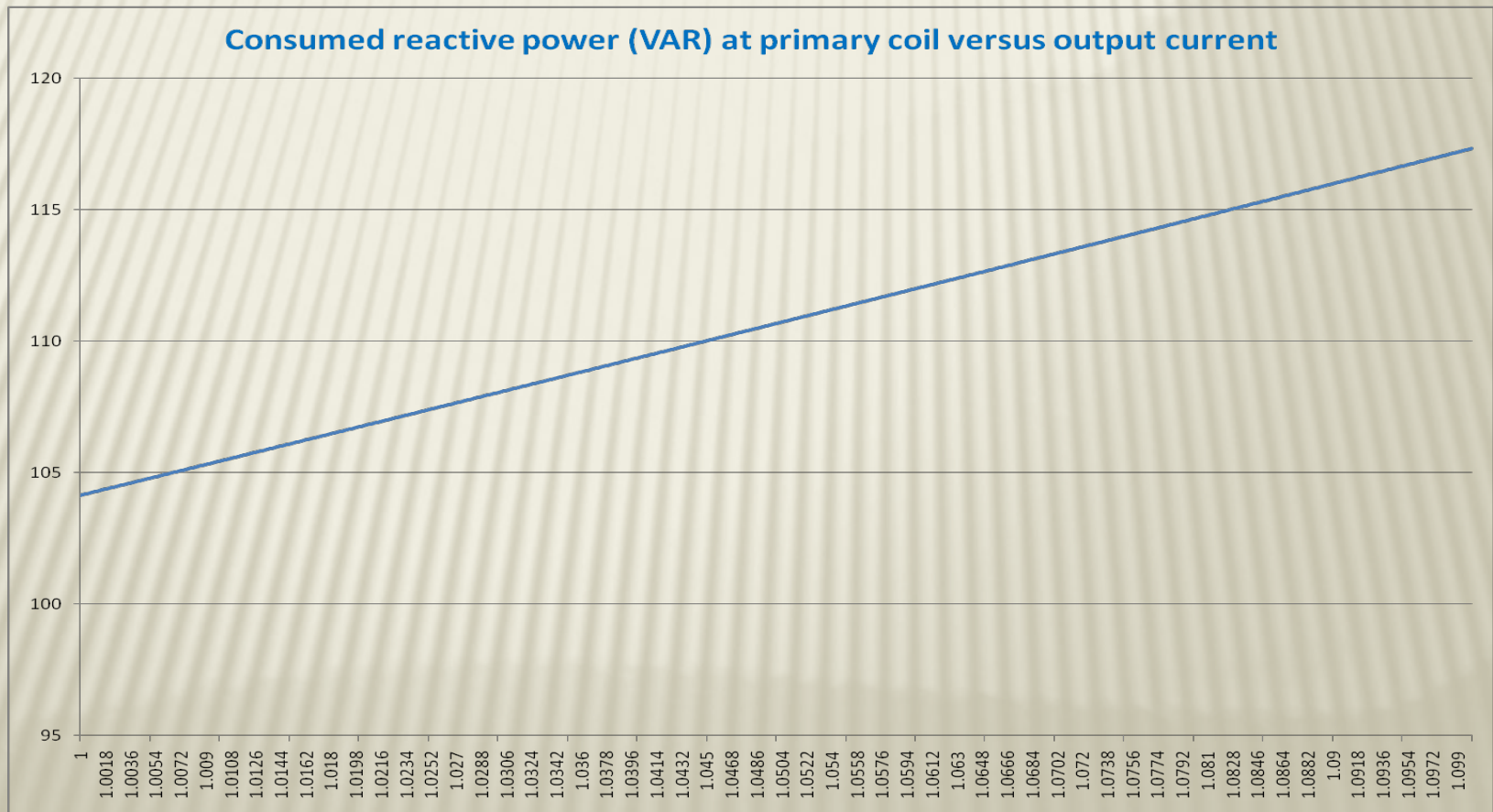
REAL POWER OVERVIEW (2)

✖ Consumed real power at secondary coils:



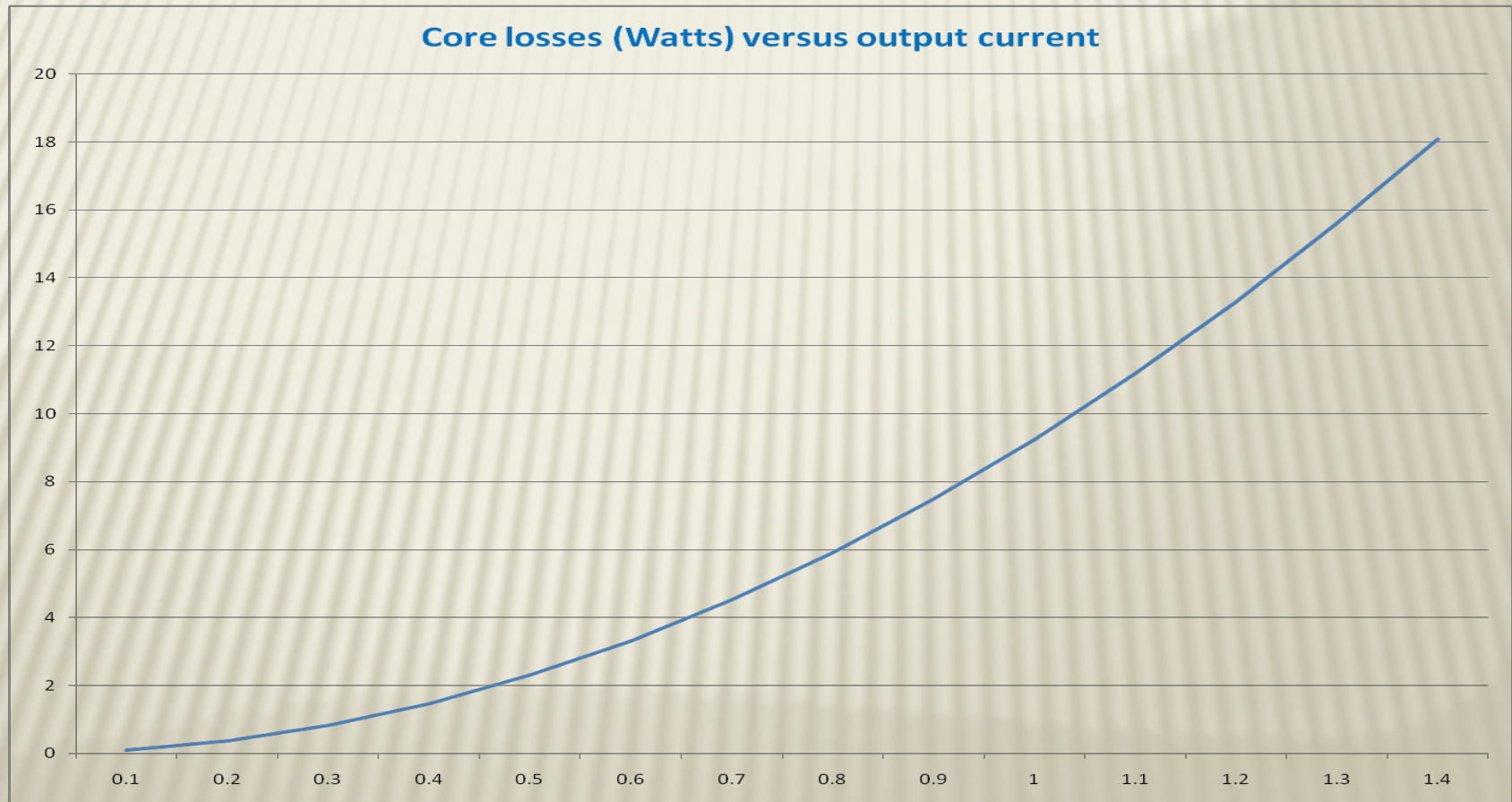
REACTIVE POWER AT PRIMARY COIL

✖ Primary involved reactive power:



COIL LOSSES

Total coil (primary + secondary) losses as function of output current:



GENERAL OBSERVATIONS AND CONCLUSIONS

- ✗ Unique COP values appear at various output current values
- ✗ At specific output current values Power Factor can be tuned to positive, negative values or even exactly zero
- ✗ Negative PF values only occur at low current values.
- ✗ In this setup, involved reactive input power is significant
 - + Options for lowering the VAR / Watt ratio of the primary are:
 - ✗ Using an air gap in the core*
 - ✗ Using higher AC frequencies*

* Note: needs further research