Enhanced FOD for medium power

Multipoint calibration for slotted FOD with decay method

WPC1904

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innovation you

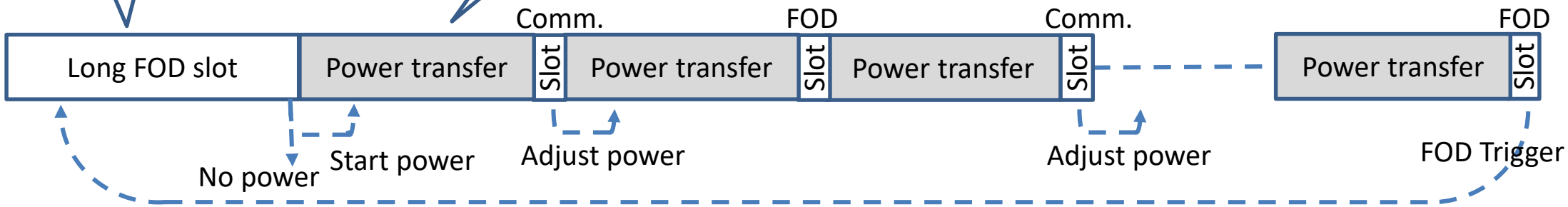
PHILIPS

Recap earlier WPC meetings (1)

Long Slot
- E.g. Q curve method
- Determine safe maximum field
  - $I^2 \leq \frac{P_{FOmax}}{\Delta R}$

Power transfer
- Apply safe maximum field

Short Slot
- E.g. Δdecay method
- FOD trigger: decay-value < threshold



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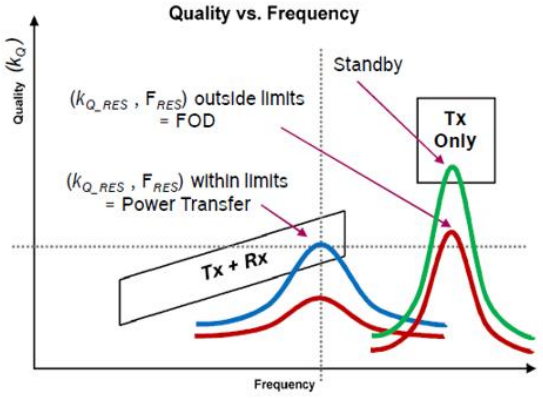
Recap earlier WPC meetings (2)

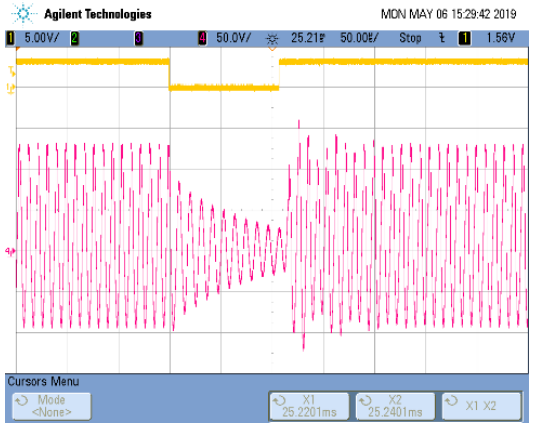
FOD in long slot

- E.g. Q-factor method
  - Typically 10-100 mSec
  - Multiple parameters, e.g. Q,f



FOD in short slot

- Q-factor method
  - Typically 1-2 mSec
  - Predefined settings (f)
- Δdecay method
  - Typically 100 µSec
  - No predefined settings

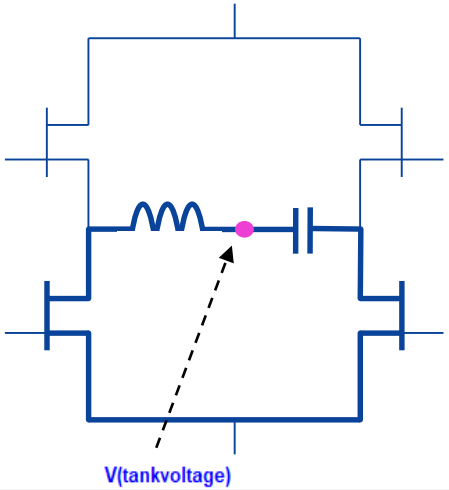


Multiple FOD methods enables

- Design freedom
- Increased reliability
- Smart combinations, e.g.
  - Q-factor method in long slot
  - Fast Δdecay method in short slot

PHILIPS

Recap earlier WPC meetings (3)



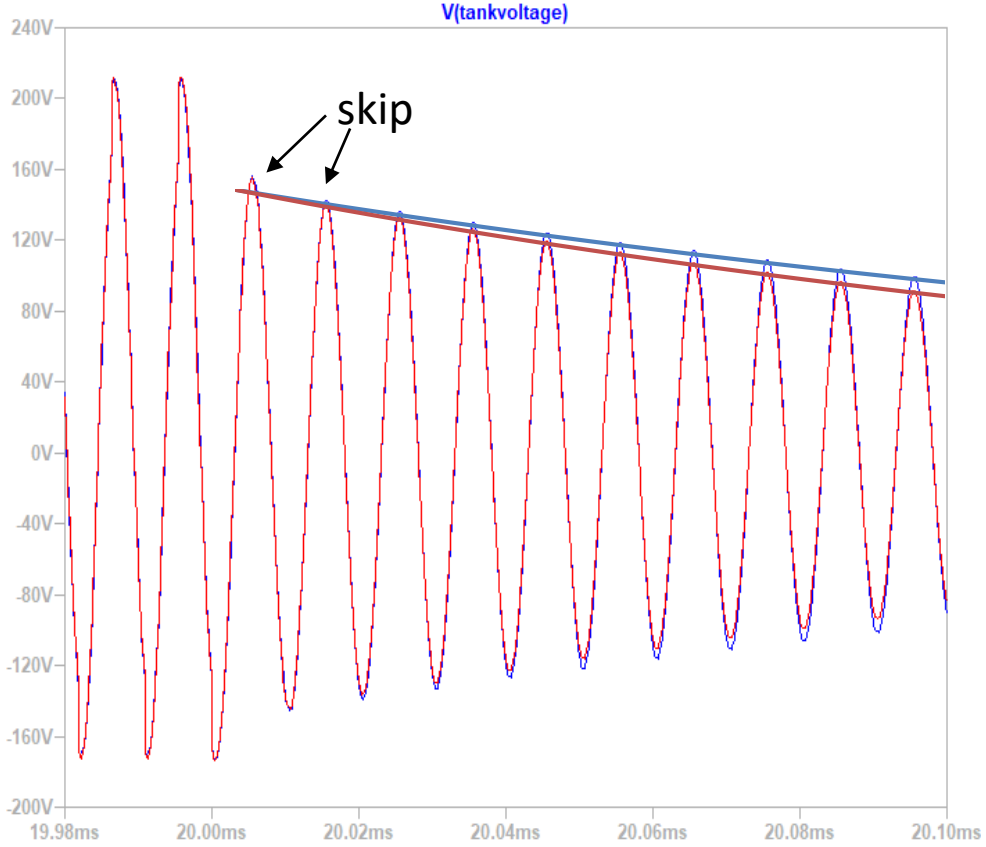
Δdecay method

- Short-circuit the resonant tank
- Load is 'disconnected' (after 2 cycles)
- Decay influenced by Foreign Object

- Improve accuracy by averaging over multiple slots
  - E.g. during 2 sec @ 75 slots/sec

- Compare average decay against threshold
  - FOD trigger: $\frac{U(t)}{U(0)}$ < Threshold

- Decay depends on operating point
  → calibration for multiple operating points



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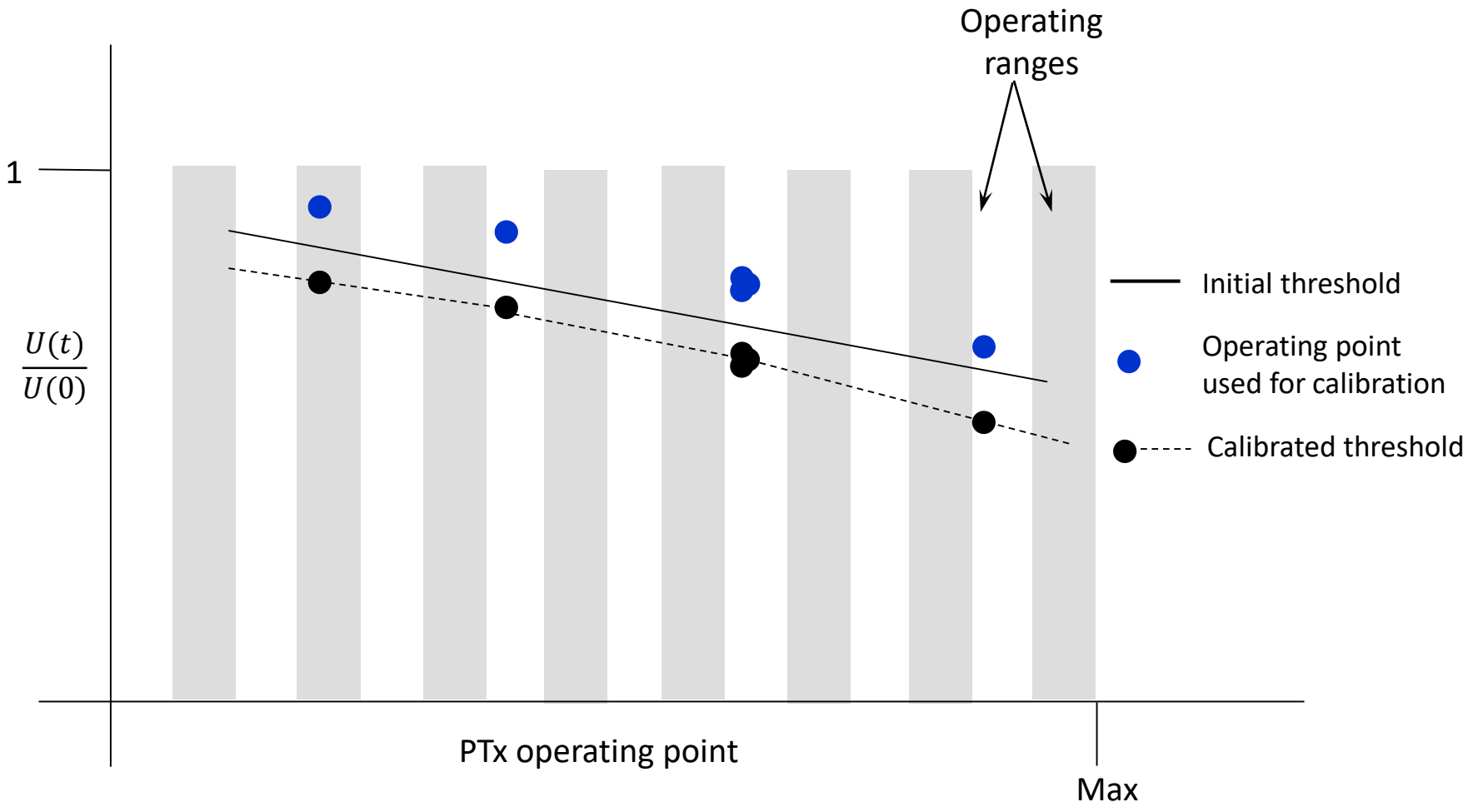
Self-calibration for Δdecay



Decay depends on operating point

- Estimate initial threshold

In power transfer phase

- Apply self-calibration

<u>Trigger for calibration at:</u>

- Start of power transfer
  - Up to e.g. 10s
- Change of operating range
- Periodically
  - E.g. every 10s
- Improve threshold

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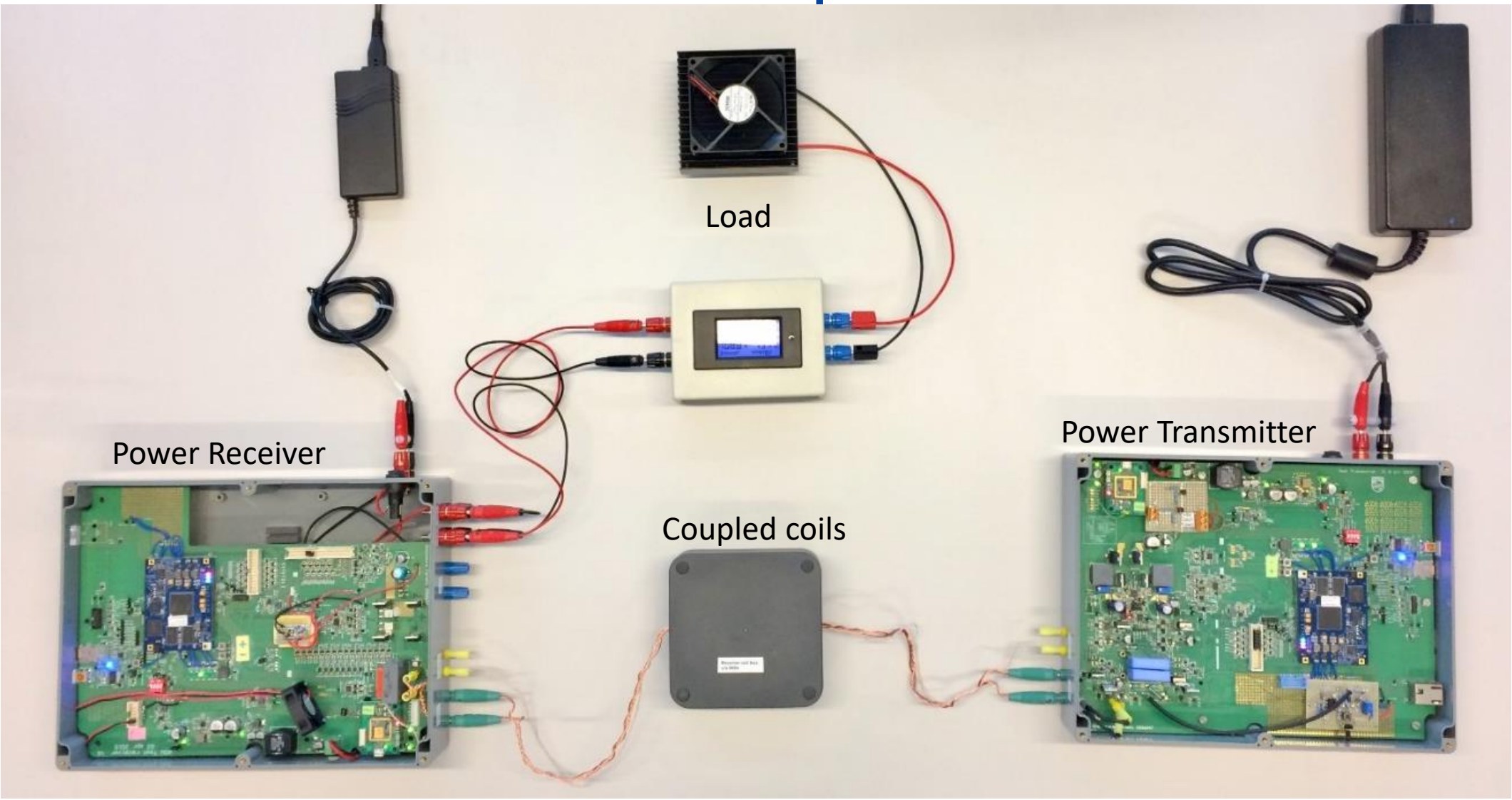
Setup



PHILIPS

1

CALIBRATION
@ START OF POWER TRANSFER

(UP TO E.G. 10 SEC)

CURRENT DECAY ↓

CURRENT THRESHOLD ↓

COM23 - PuTTY

```
Ratio       Threshold
--------    ---------
0.894283    Invalid

Setpoint    Threshold
--------    ---------
 0 -   5:   0.000000 <---
 5 -  10:   0.000000
10 -  15:   0.000000
15 -  20:   0.000000
20 -  25:   0.000000
25 -  30:   0.000000
30 -  35:   0.000000
35 -  40:   0.000000
40 -  45:   0.000000
45 -  50:   0.000000
50 -  55:   0.000000
55 -  60:   0.000000
60 -  65:   0.000000
65 -  70:   0.000000
70 -  75:   0.000000
75 -  80:   0.000000
80 -  85:   0.000000
85 -  90:   0.000000
90 -  95:   0.000000
95 - 100:   0.000000
```

FO INDICATION ←

OPERATING RANGES (0-100 %) →