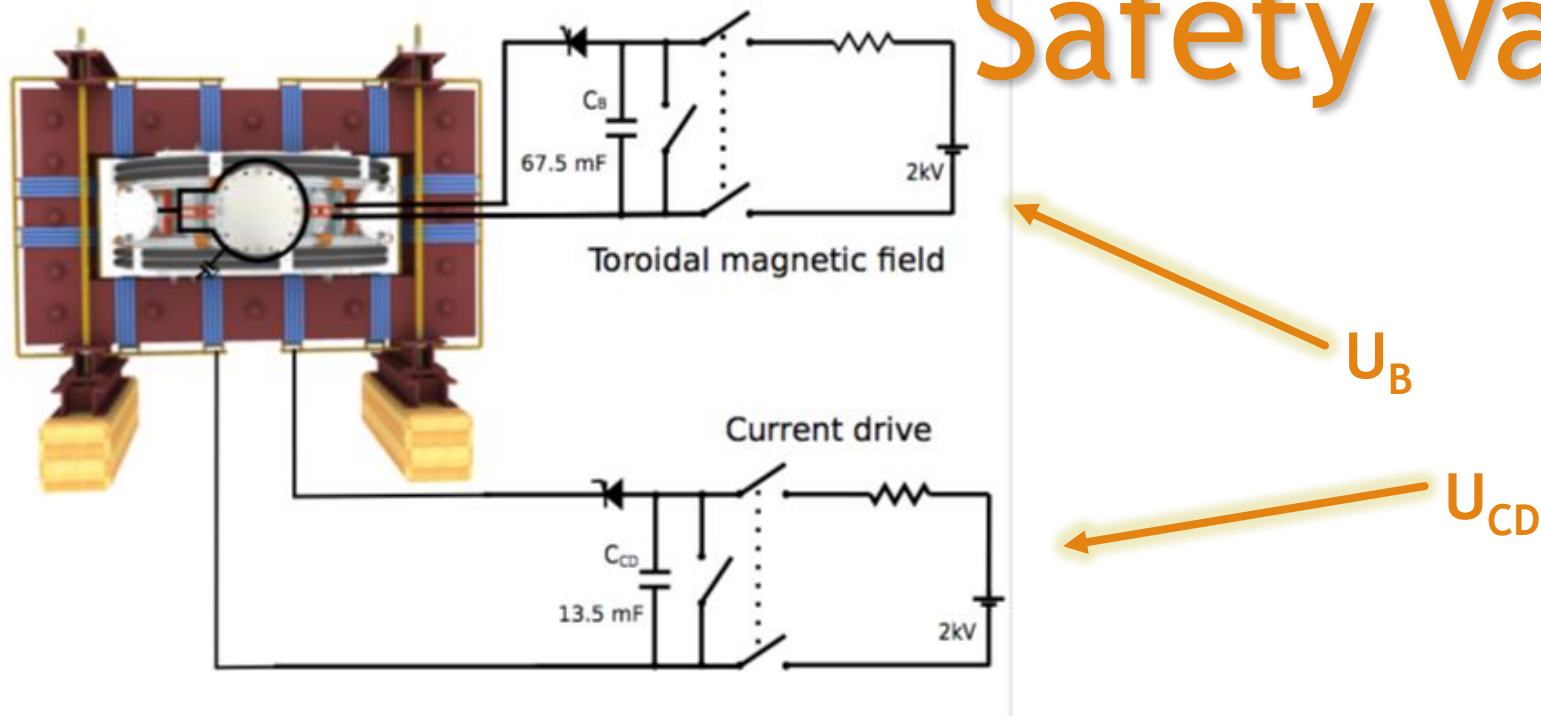


Variation of U_B and U_{CD} on Plasma Duration and Safety Value



ASPNF Jan 29 - Feb 2, 2018

Tokamak GOLEM for the The 4th ASEAN School on Plasma and Nuclear Fusion

- GROUP 3 PRESENTATION-

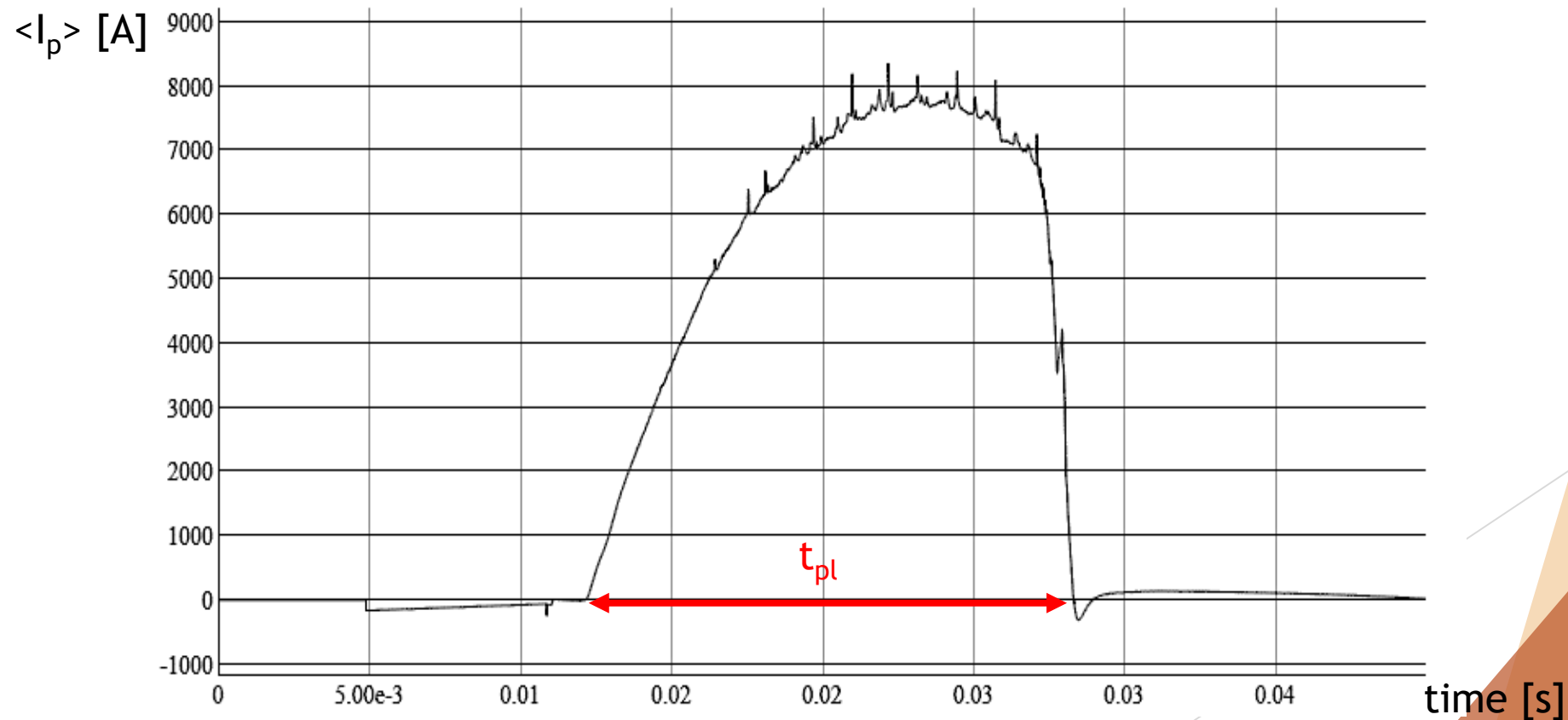
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Context - What we want to do?

- ▶ Find if there is a correlation between:

(U_B ; U_{CD}) and Plasma Duration Time (t_{pl})



Context - What we want to do? [cont.]

- ▶ Find if there is a correlation between:
(U_B ; U_{CD}) and Edge Safety Factor (Q_{edge})

$$Q_{edge}(r = r_0) = \frac{r_0 B_\phi}{R_0 B_\theta}$$

- ▶ Find if there is a correlation between:
Plasma Duration Time and Safety Factor

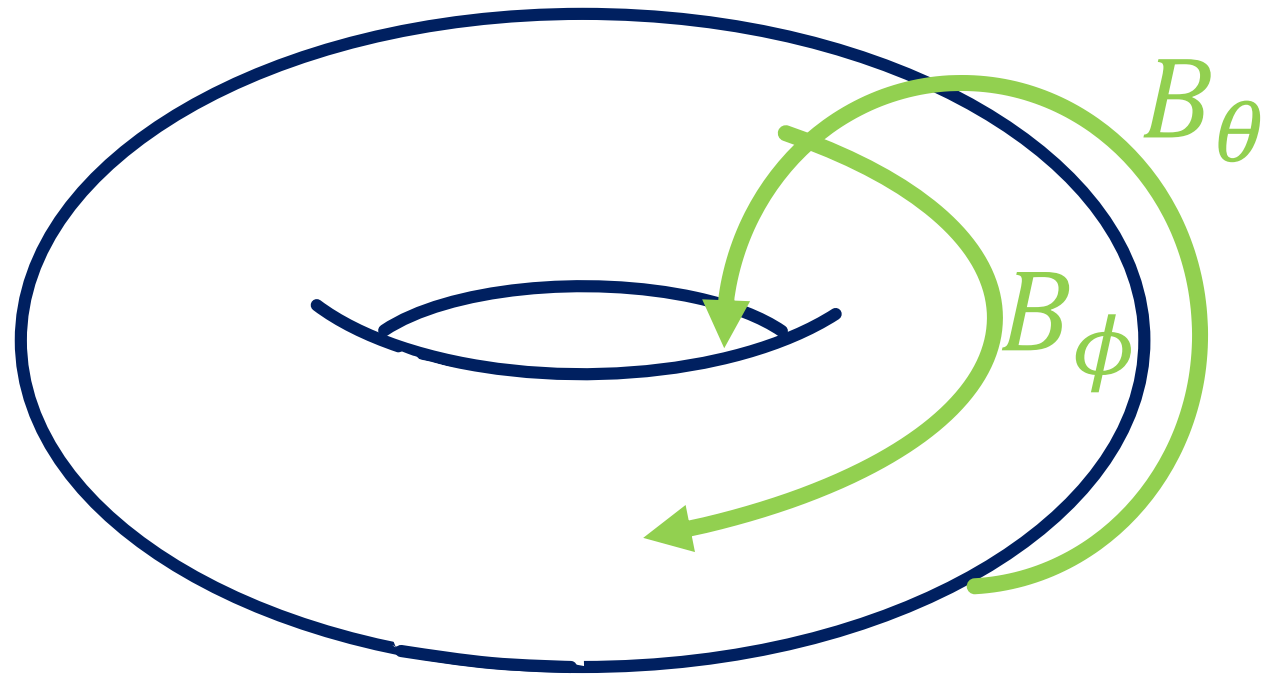
Context - How do we do it?

Control Parameters	Symbols	Value
Delay Time	τ_{CD}	$(6000 \pm 0) \mu s$
Pressure	P	$(26 \pm 6) mPa$
Working Gas	H_2	
Preionization	Top electron gun	1
Independent Variables	Symbols	
Toroidal coil voltage	U_B	600, 850, 1100 V
Current drive voltage	U_{CD}	400, 550, 700 V

$U_{CD} \backslash U_B$	600 V	850 V	1100 V
400 V	#1	#6	#3
550 V	#9	#5	#7
700 V	#4	#8	#2

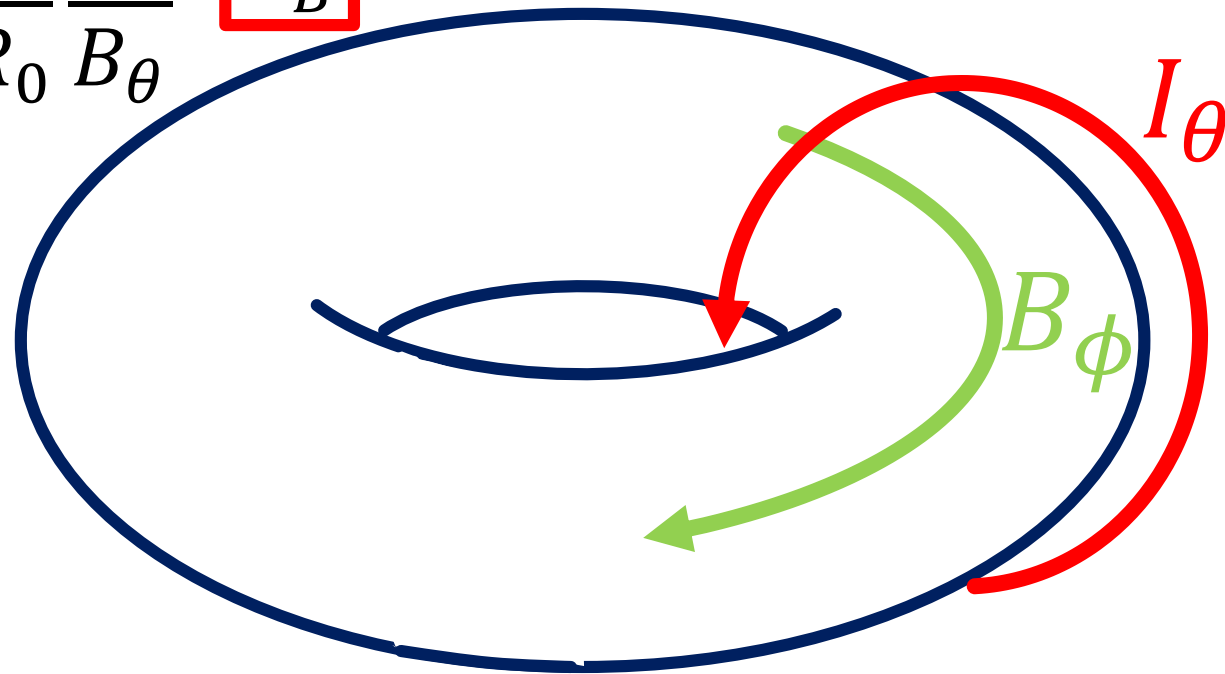
- ▶ Only 9 points
 - ▶ time limitation
 - ▶ Uncommon pressure

Reasoning (1/2) - Plasma Duration Time

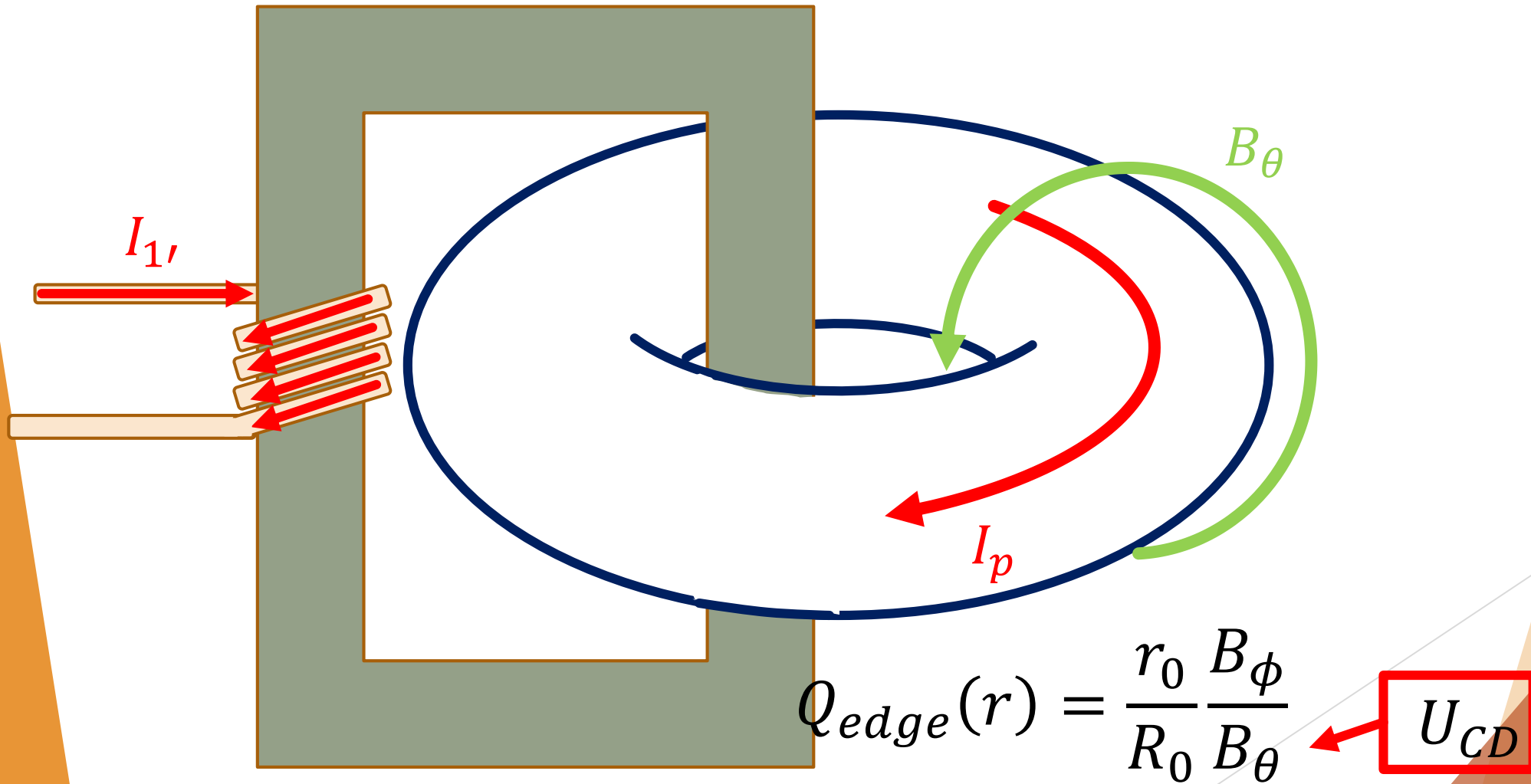


Reasoning (2/2) - Edge Safety Factor

$$Q_{edge}(r_0) = \frac{r_0 B_\phi}{R_0 B_\theta} U_B$$



Reasoning (2/2) - Edge Safety Factor [cont.]



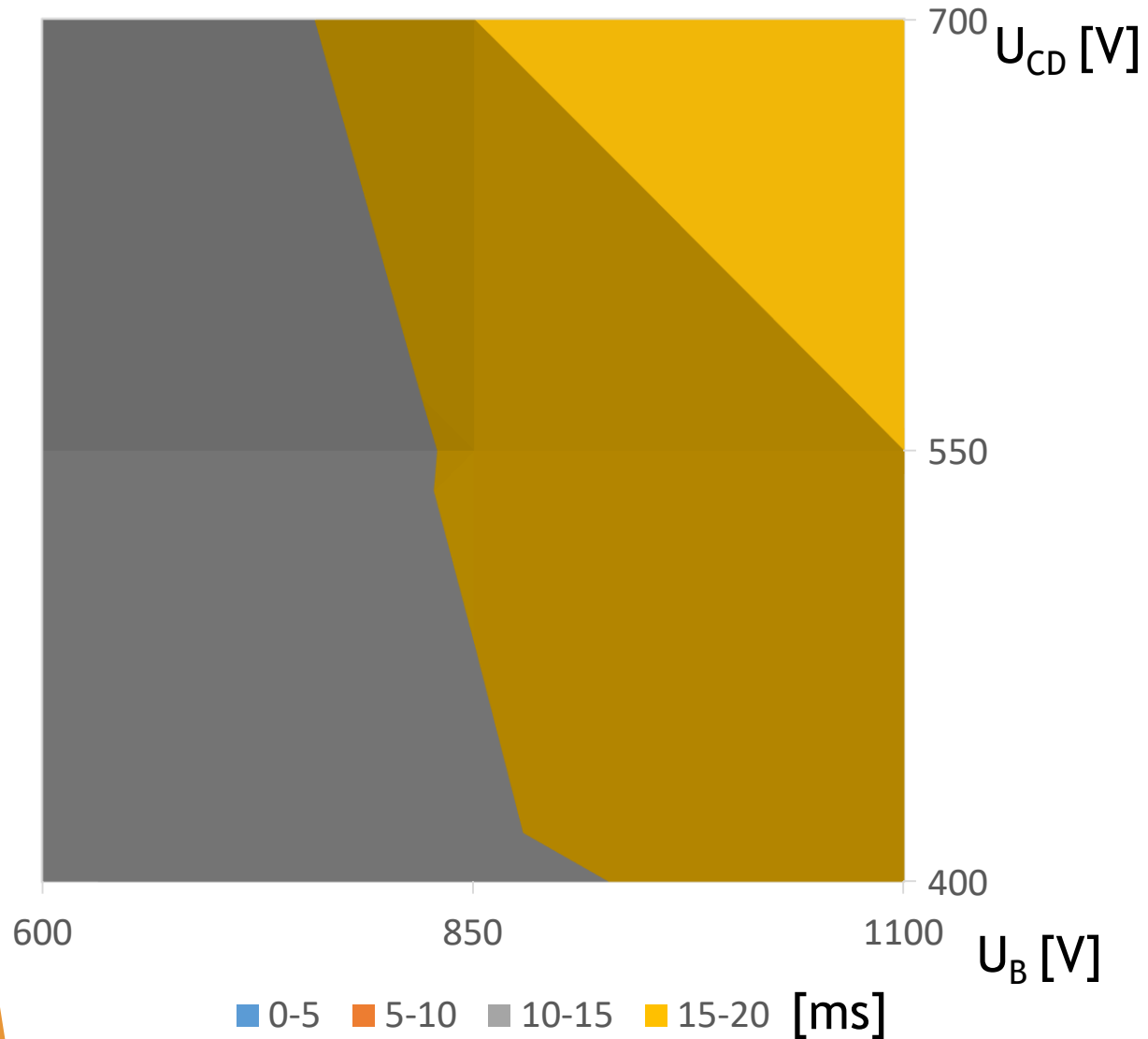
Hypothesis - What we expect to find?

▶ $t_{pl} \propto U_B, U_{CD} ?$

▶ $Q_{edge} \propto \frac{U_B}{U_{CD}}$

▶ Q_{edge} and t_{pl} correlated ?

Results - Plasma duration time



▶ $t_{pl} \propto U_B$

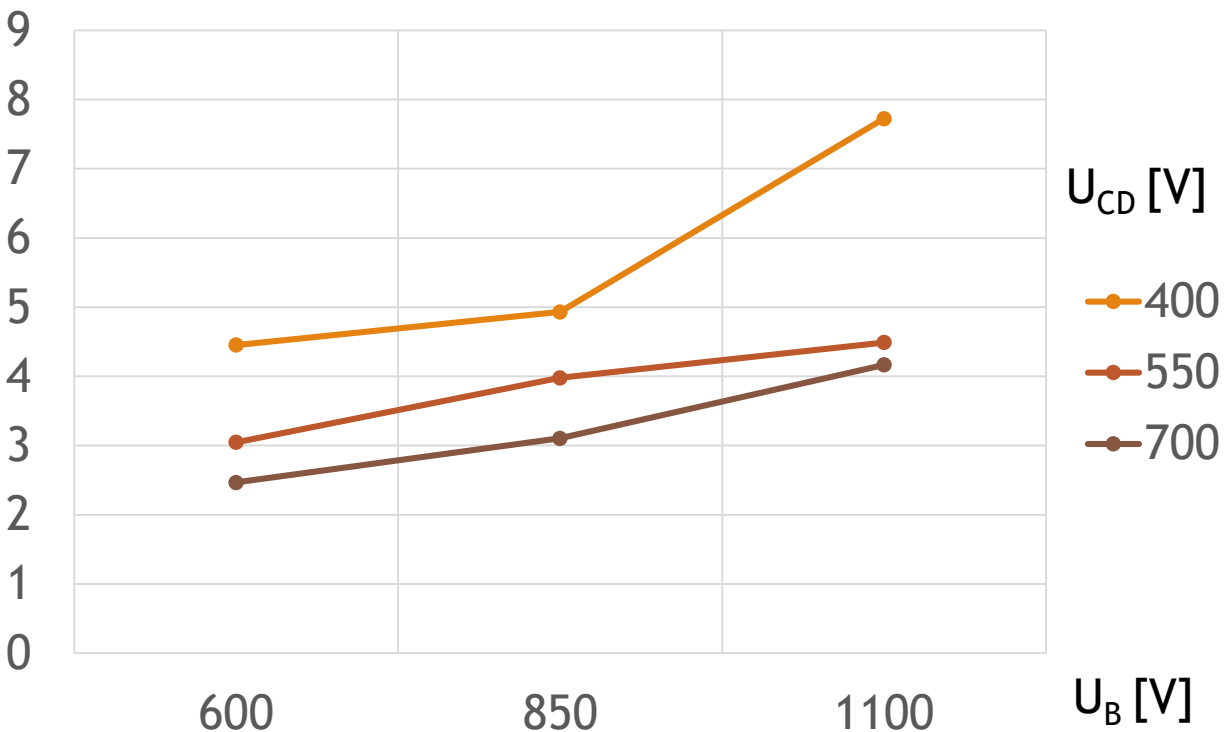
▶ $t_{pl} \not\propto U_{CD}$

Results - Edge Safety factor

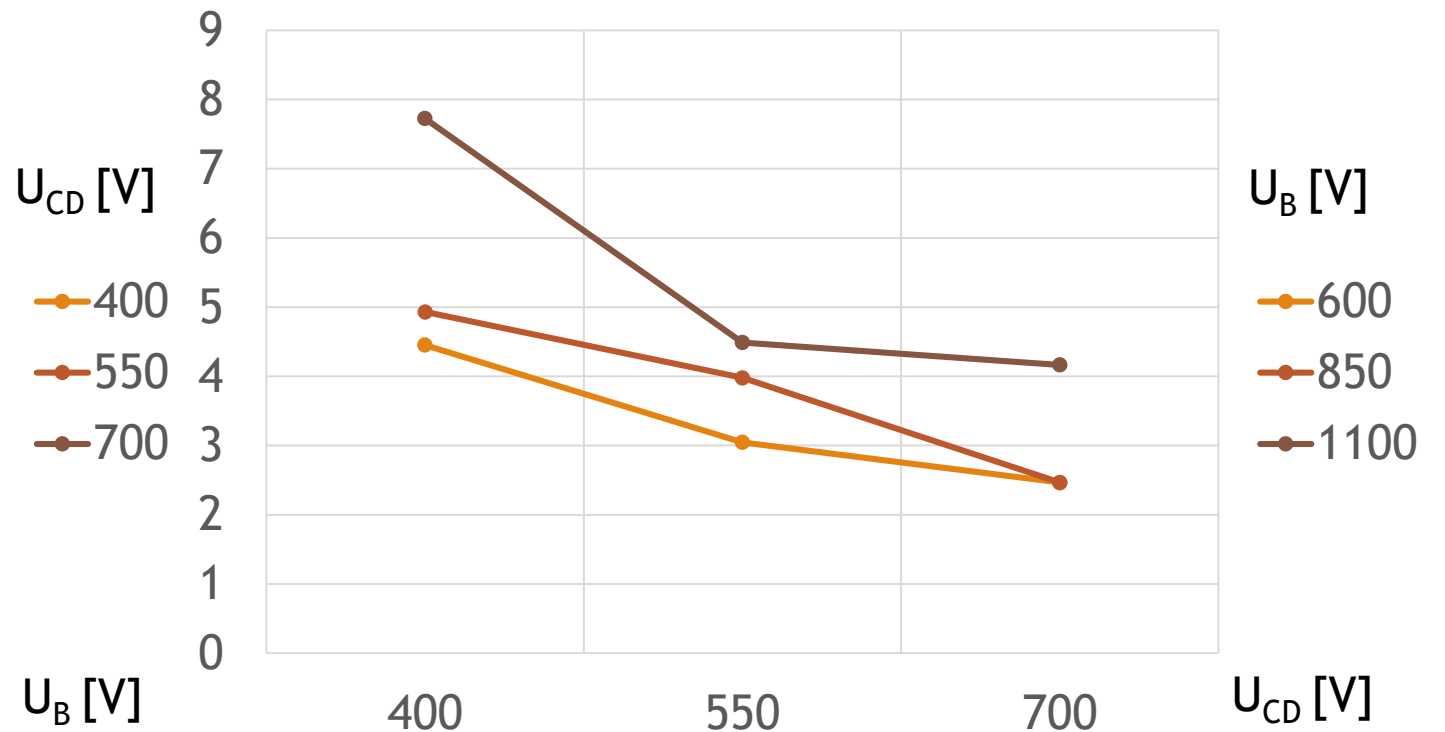
$$Q_{edge} \propto \frac{U_B}{U_{CD}} \longrightarrow q_a = \frac{2\pi a^2 B_{Tor}}{\mu_0 I_P R}$$

source: R. Guirlet, "Hands-on project: Experiment on GOLEM"

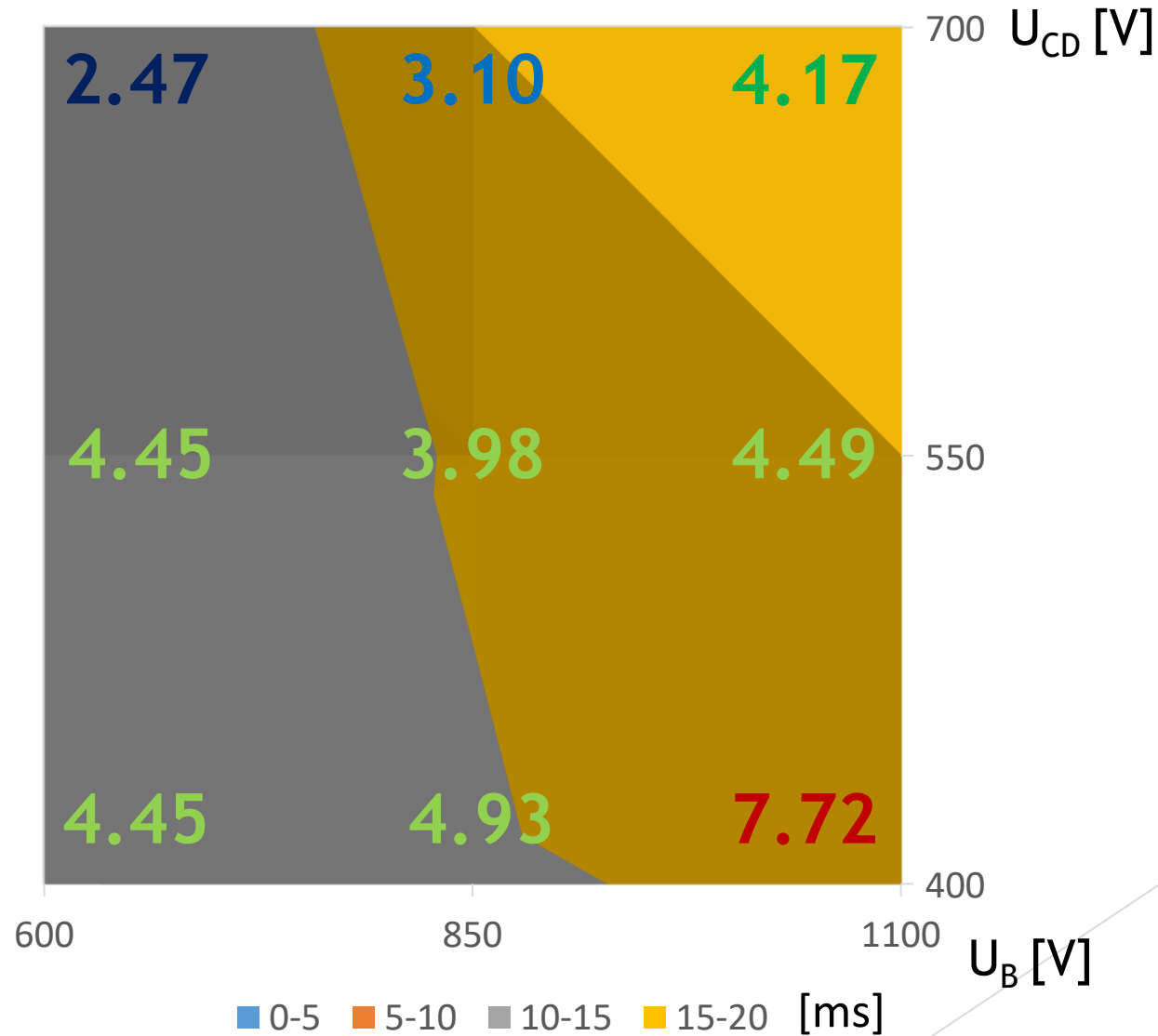
Calculated $Q_{ED}(U_B)$; U_{CD} fixed



Calculated $Q_{ED}(U_{CD})$; U_B fixed



Results - $t_{pl} \times Q_{edge}$ Correlation?



Summary

▶ Plasma Duration Time

▶ $t_{PL} \propto U_B$

▶ $t_{PL} \not\propto U_{CD}$

▶ Edge Safety Factor

▶ $Q_{ED}^{CALC} \sim C * Q_{ED}^{GOLEM}$ (with $C \sim 2$)

▶ Data Validate Hypothesis (qualitatively)

▶ $t_{pl} \times Q_{edge}$ Correlation?

▶ No apparent correlation

Thank you for your attention