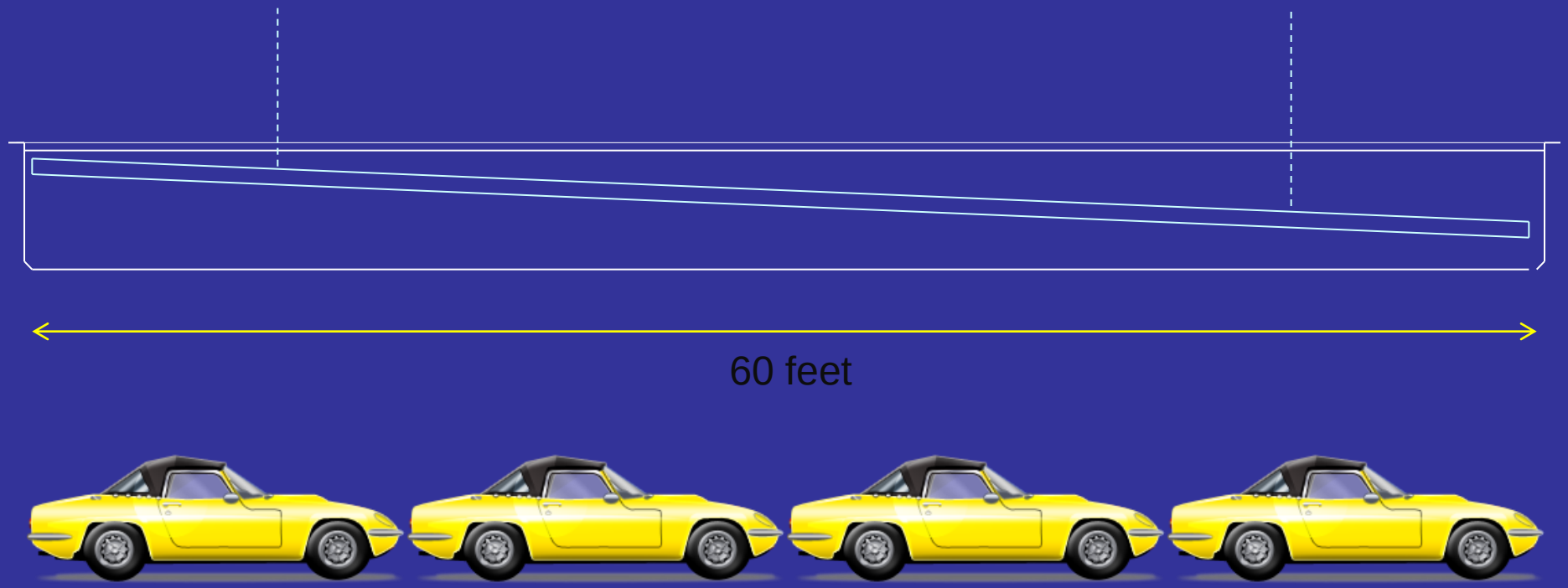
Heating of Galvanizing Furnaces
AGA Tech Forum, New Orleans, LA
2016

Please note that data contained on these slides is intended only to illustrate principles and should not be used for design purposes

Galvanizing Furnace Heating Technology

Galvanizing Furnace Heating Technology



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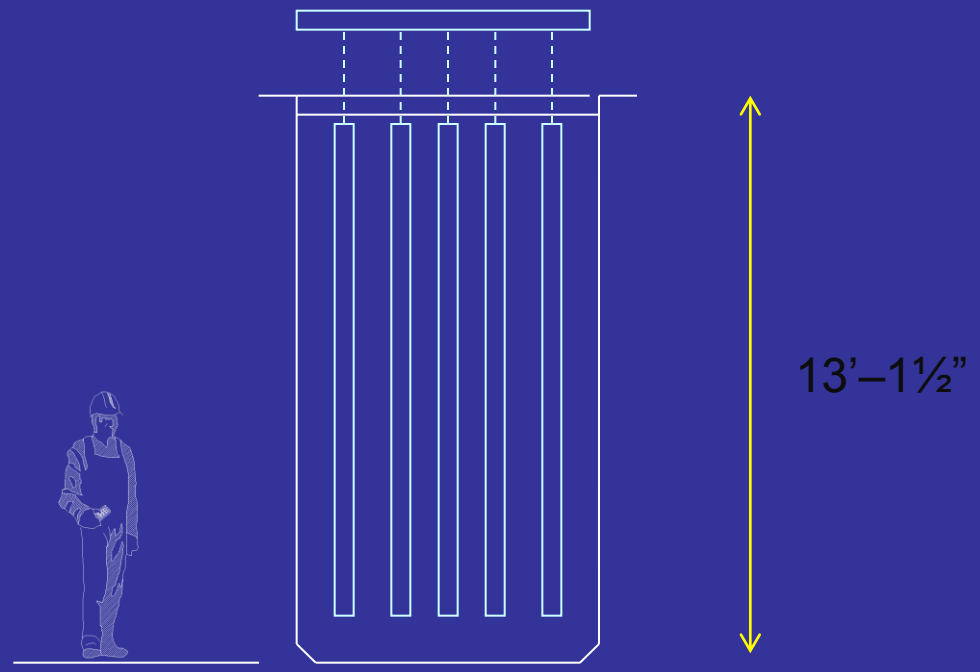
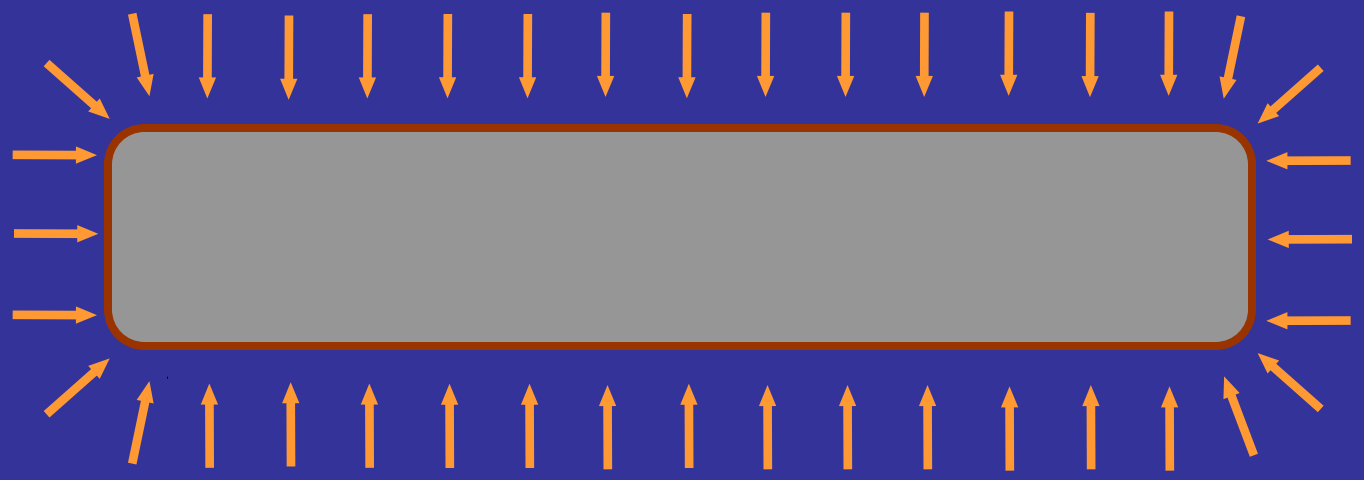


Principles of Heating Galvanizing Kettles
Part 1: Principles for extending kettle life

Galvanizing Furnace Heating Technology



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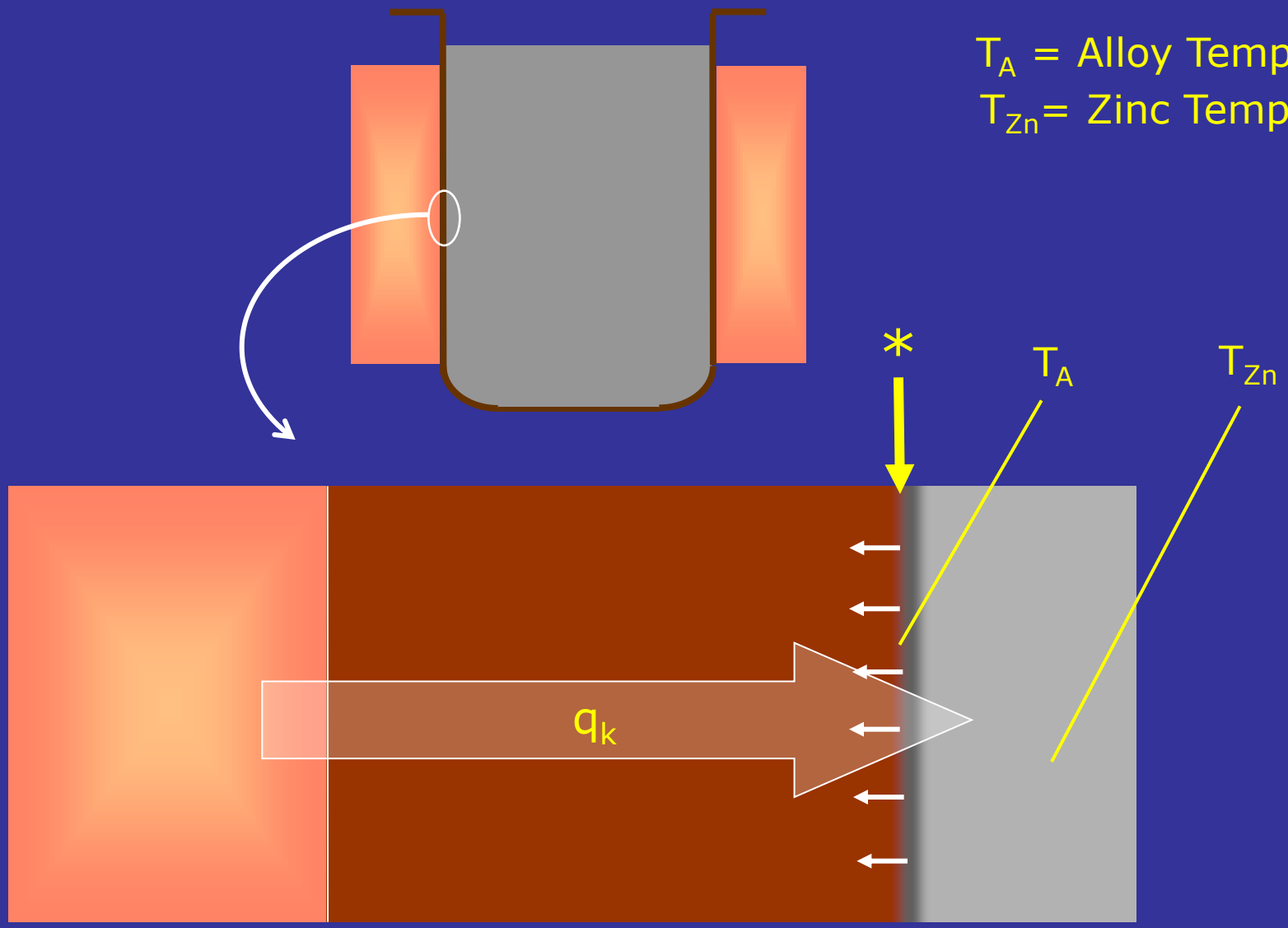

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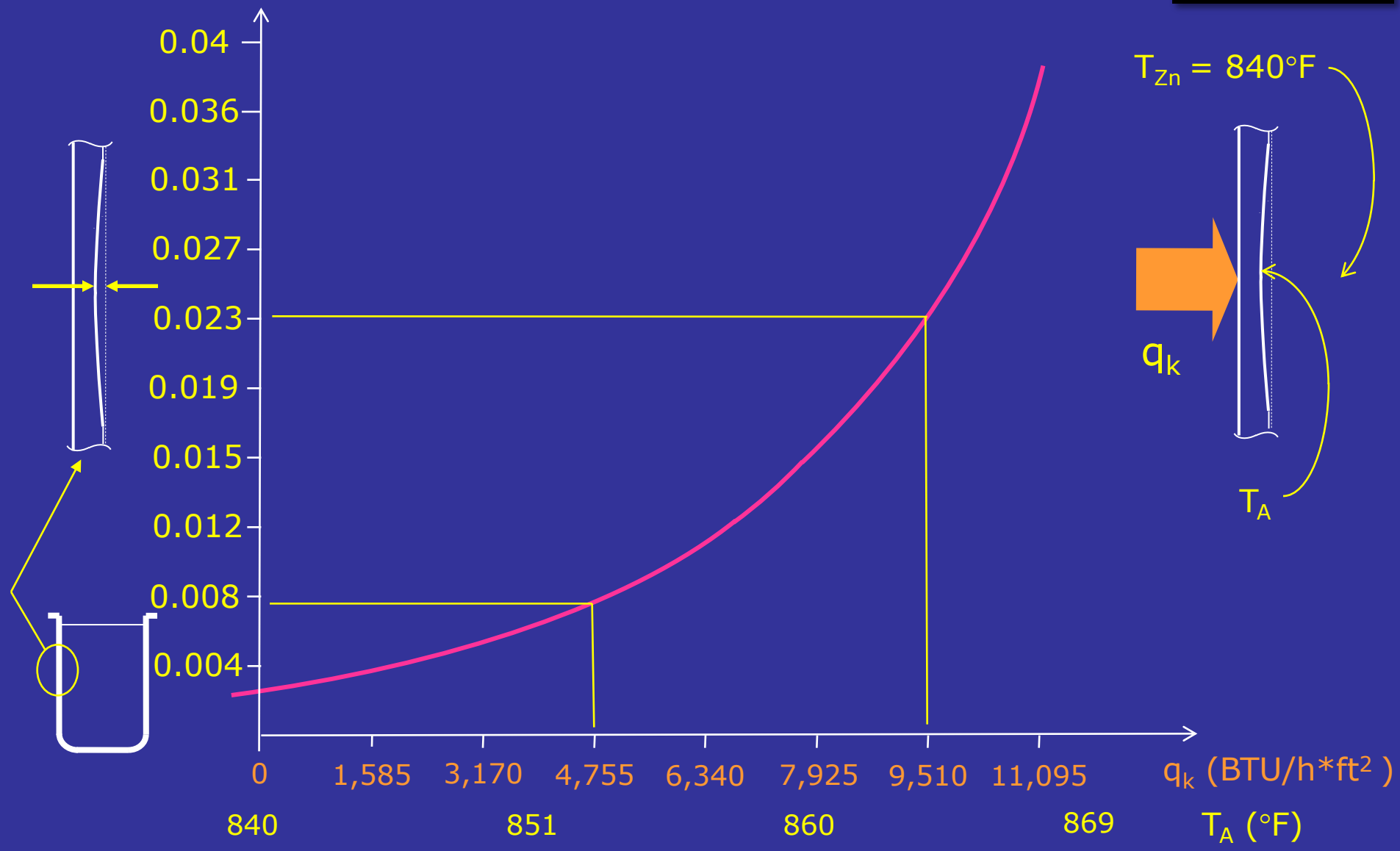

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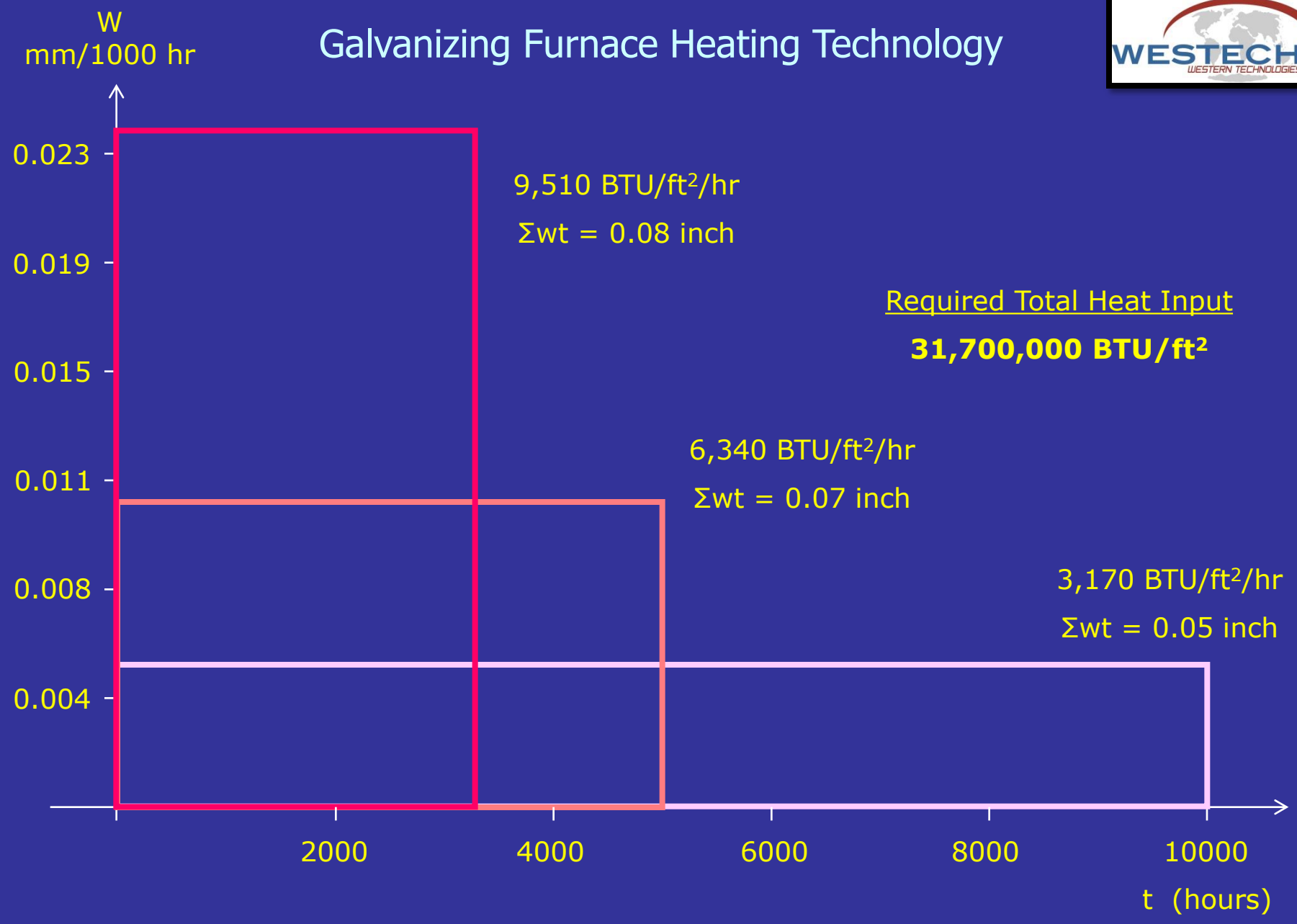

Required Total Heat Input

31,700,000 BTU/ft²

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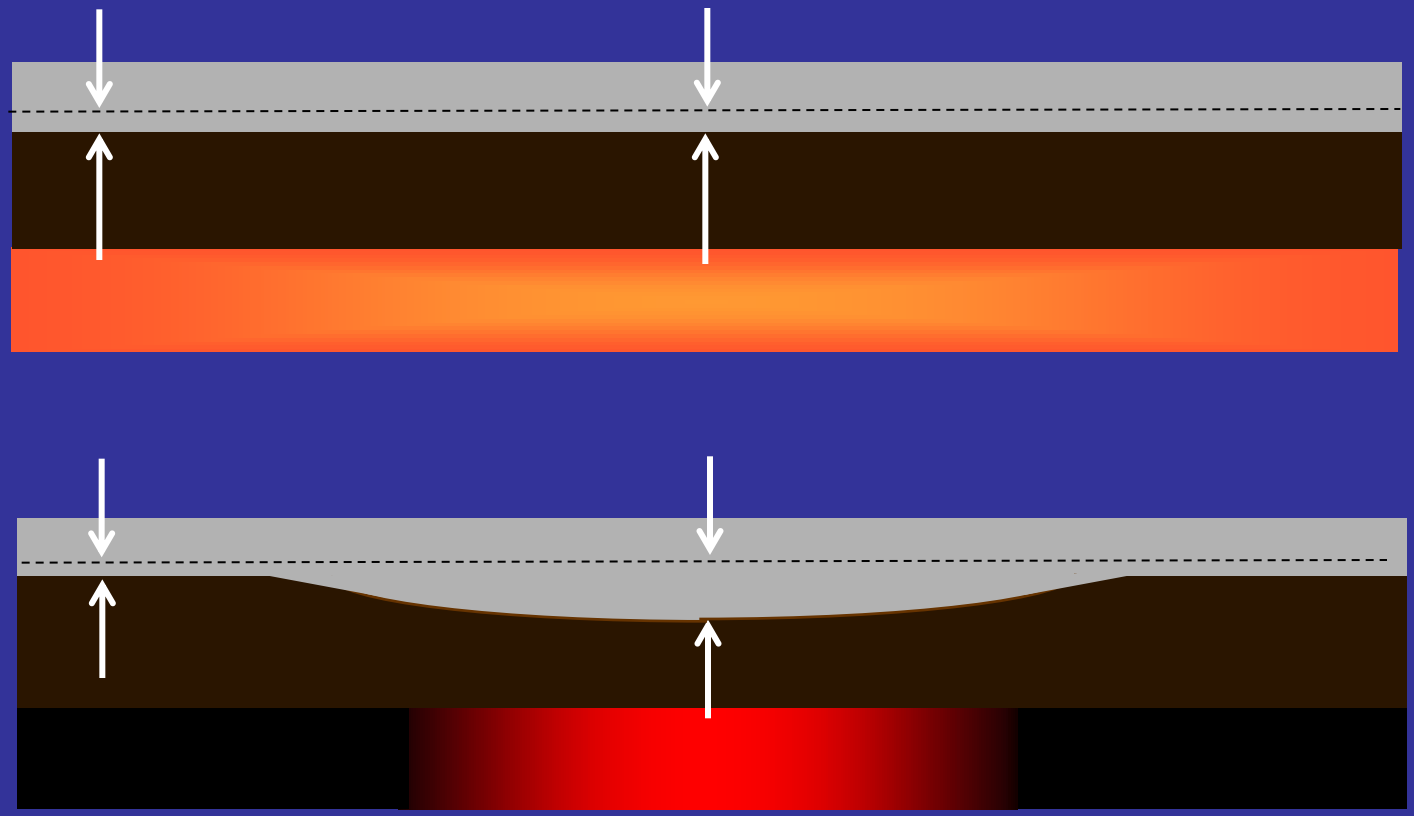

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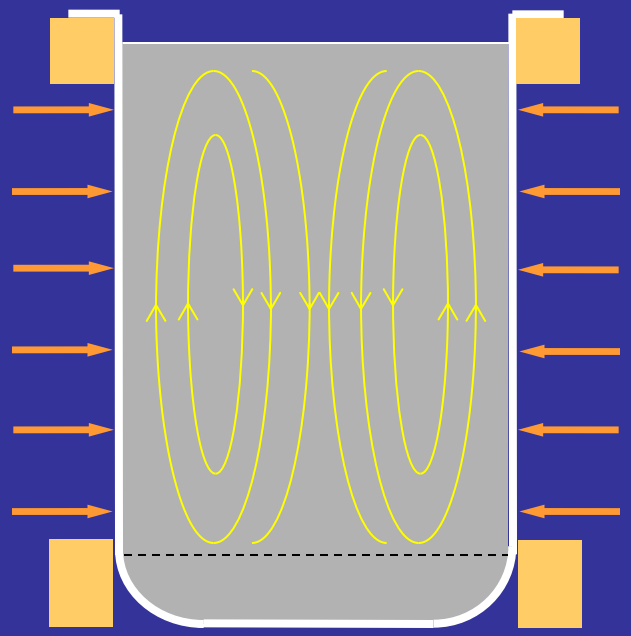

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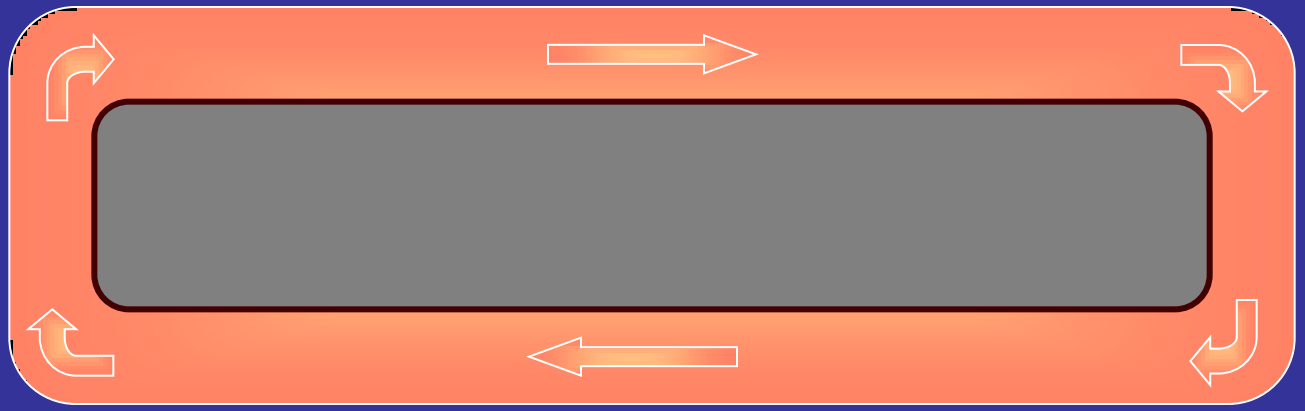

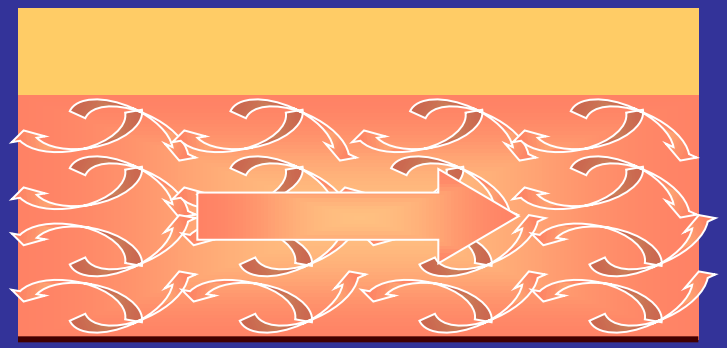

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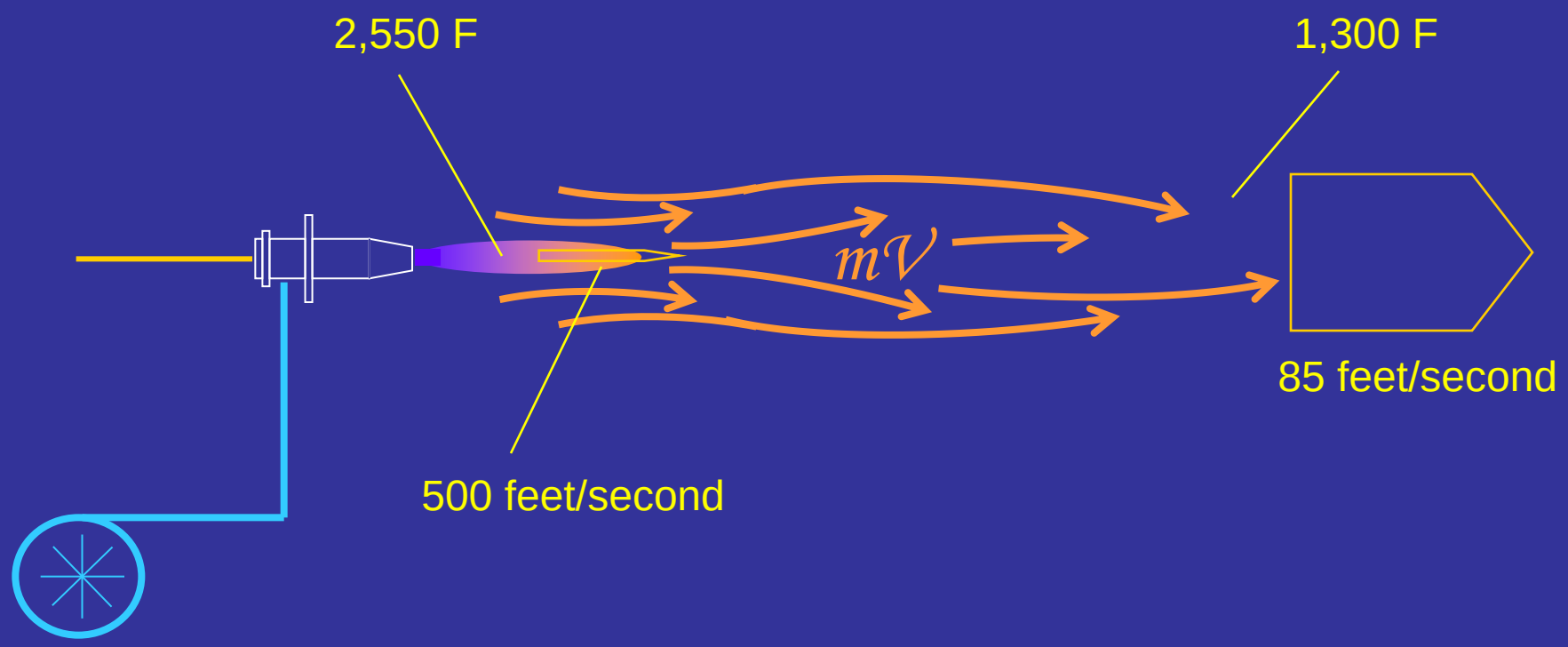

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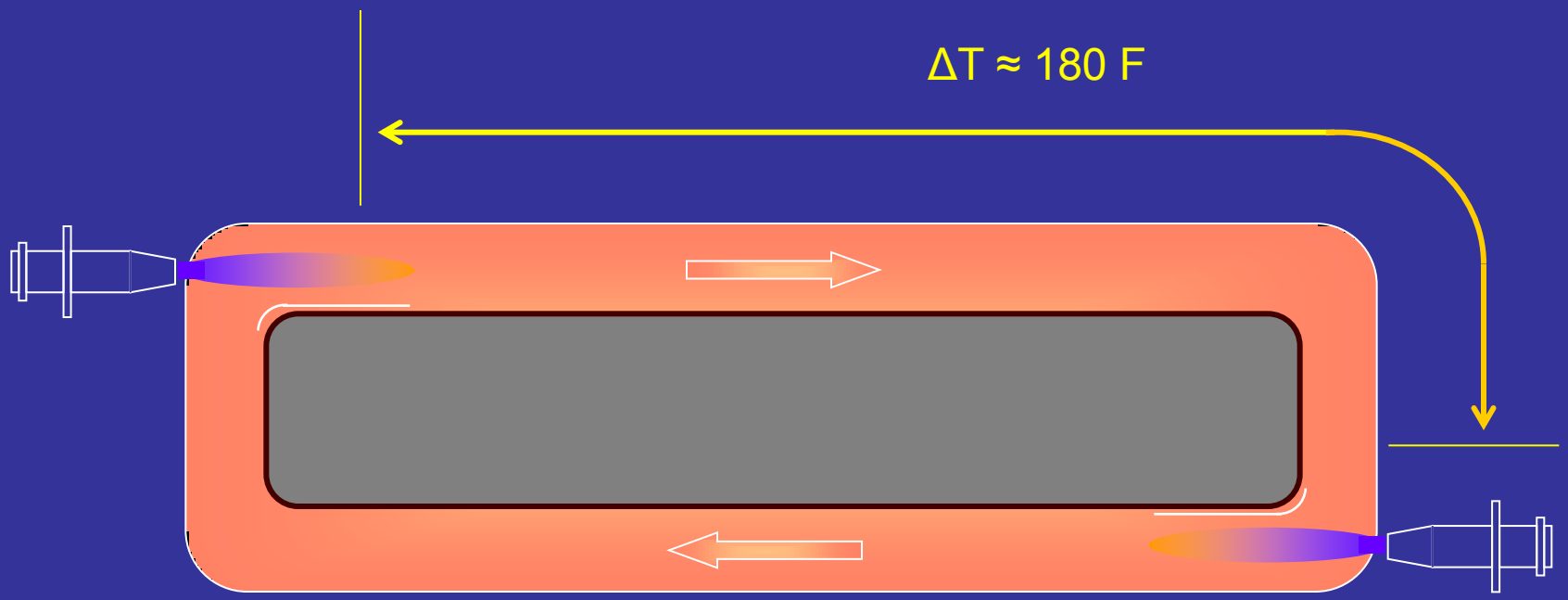

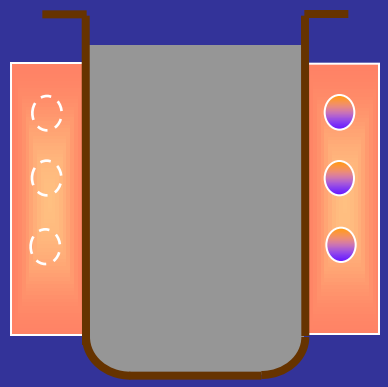

Reference data:

Kettle 49’ x 6’ x 8 ‘ deep

Total heat input 9,000,000 BTU/hour

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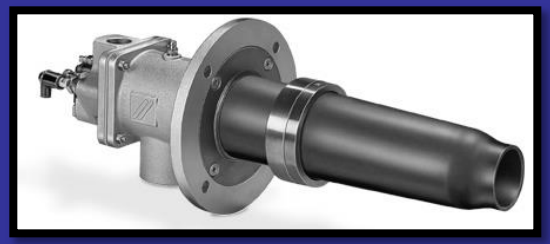

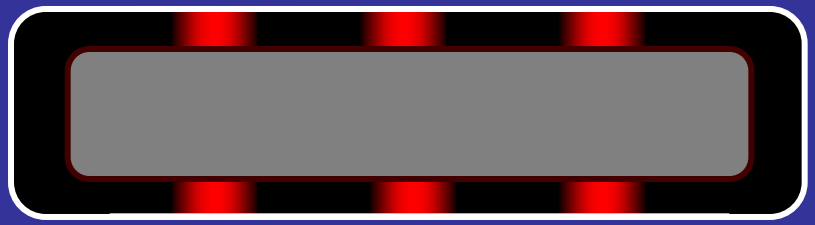

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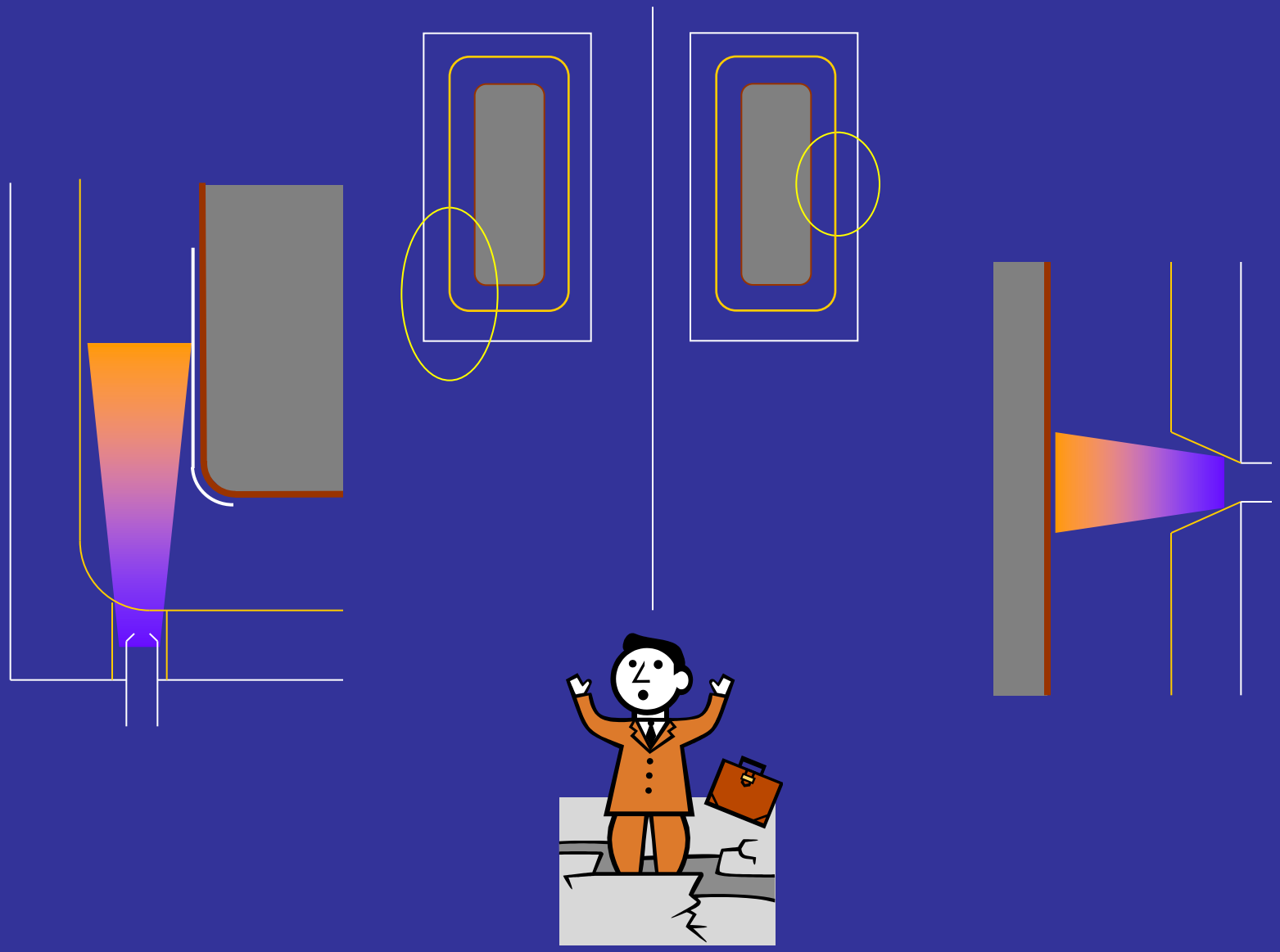
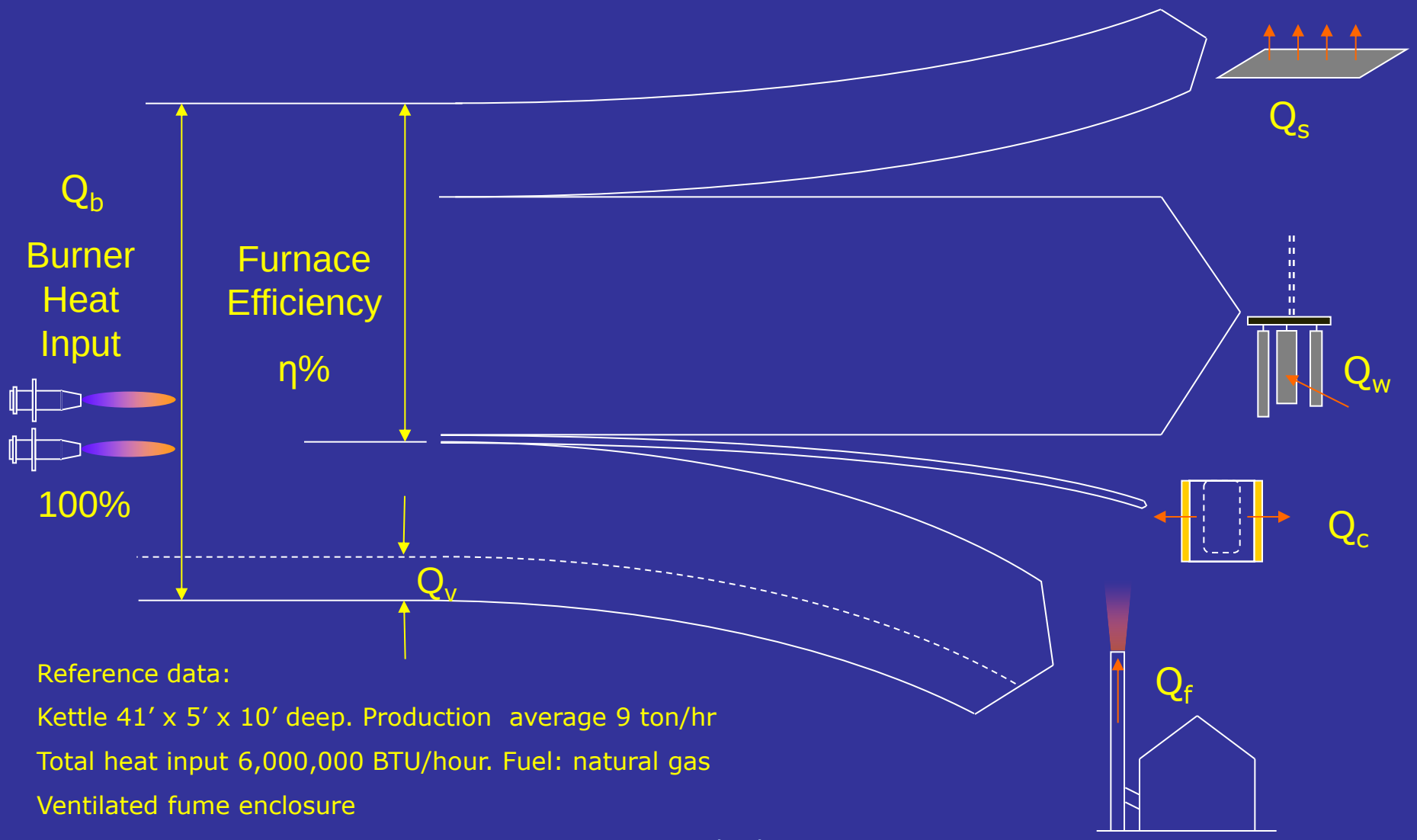


Principles of Heating Galvanising Kettles
Part 2: Principles for efficiency

Galvanizing Furnace Heating Technology



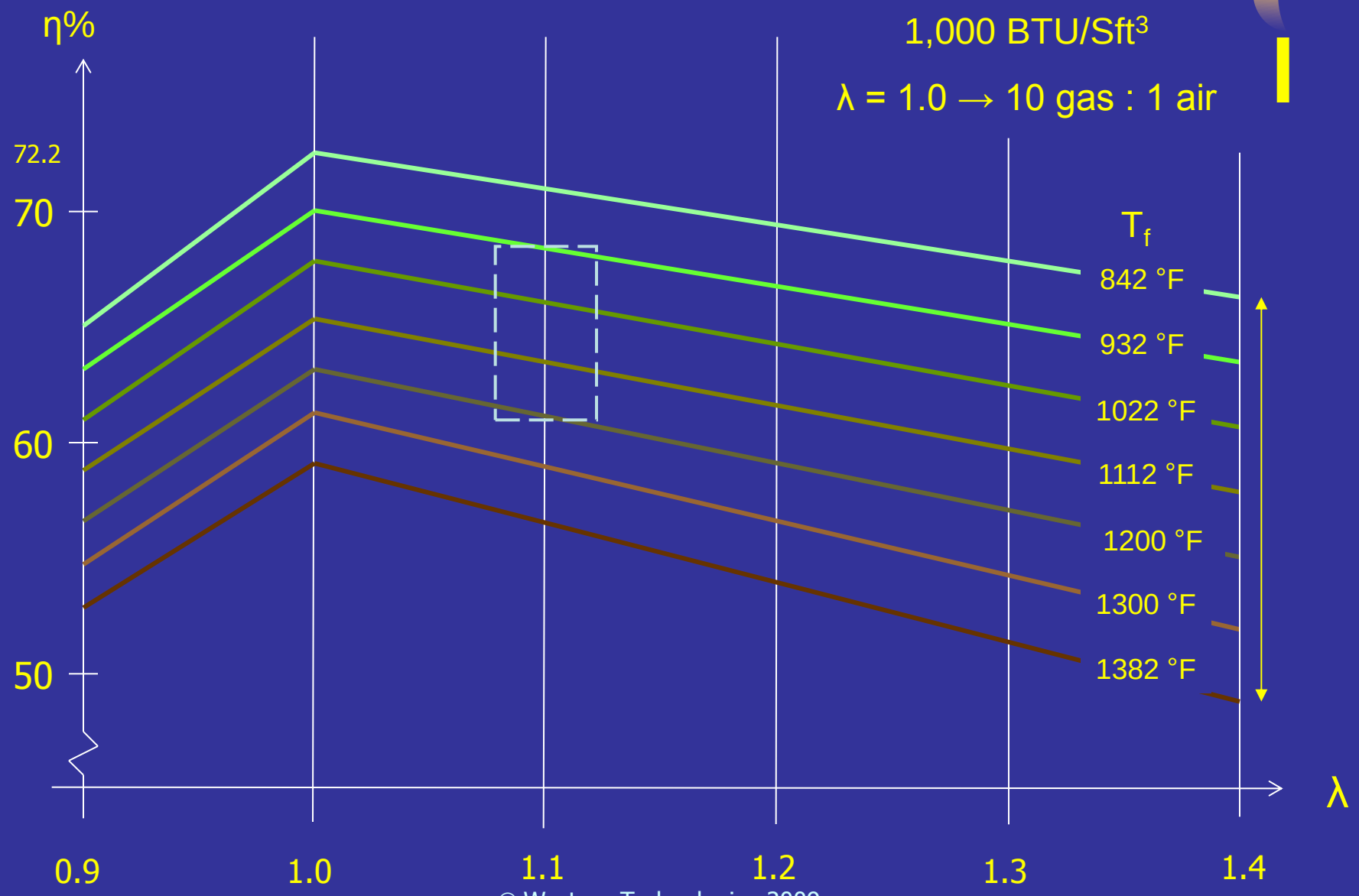
Reference data:

Kettle 41′ x 5′ x 10′ deep. Production average 9 ton/hr

Total heat input 6,000,000 BTU/hour. Fuel: natural gas

Ventilated fume enclosure

Galvanizing Furnace Heating Technology



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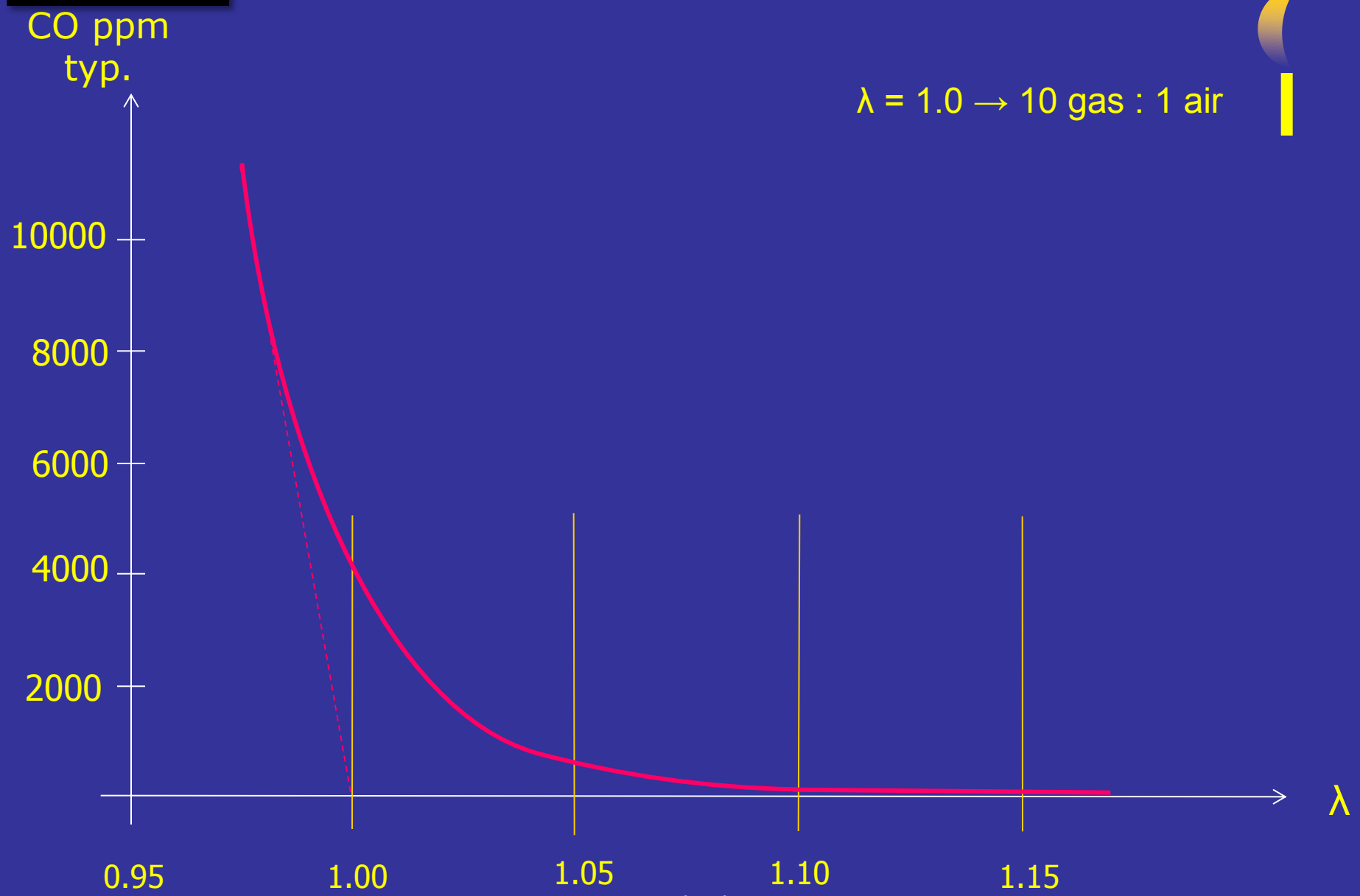

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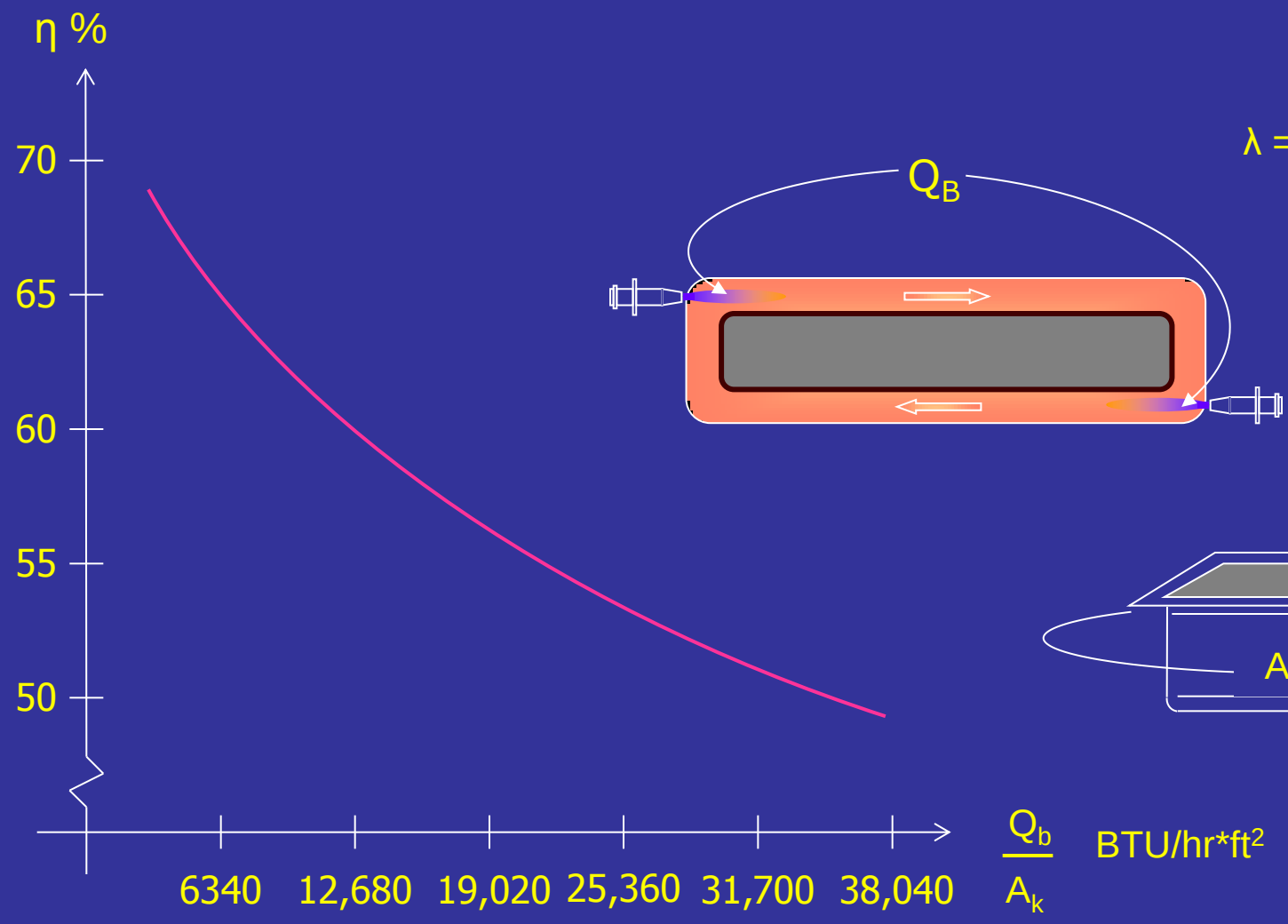

Galvanizing Furnace Heating Technology

Burner Output Regulation
Part 1: High-Low Regulation

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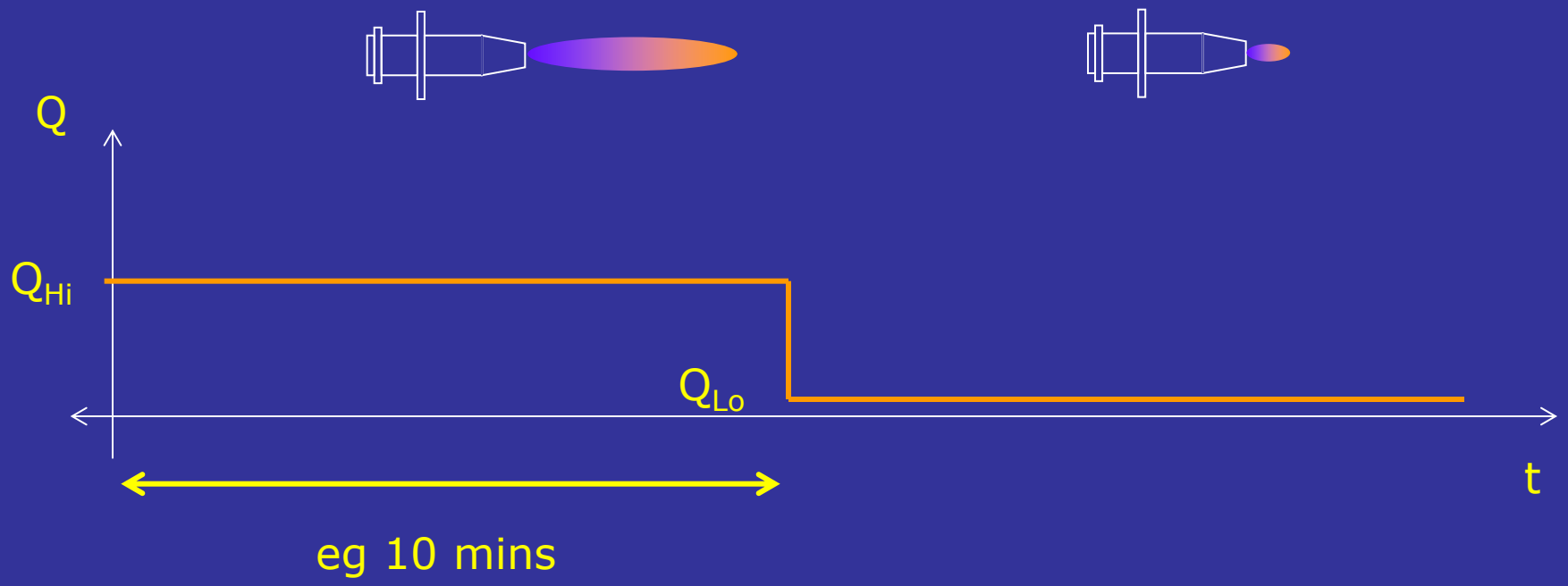

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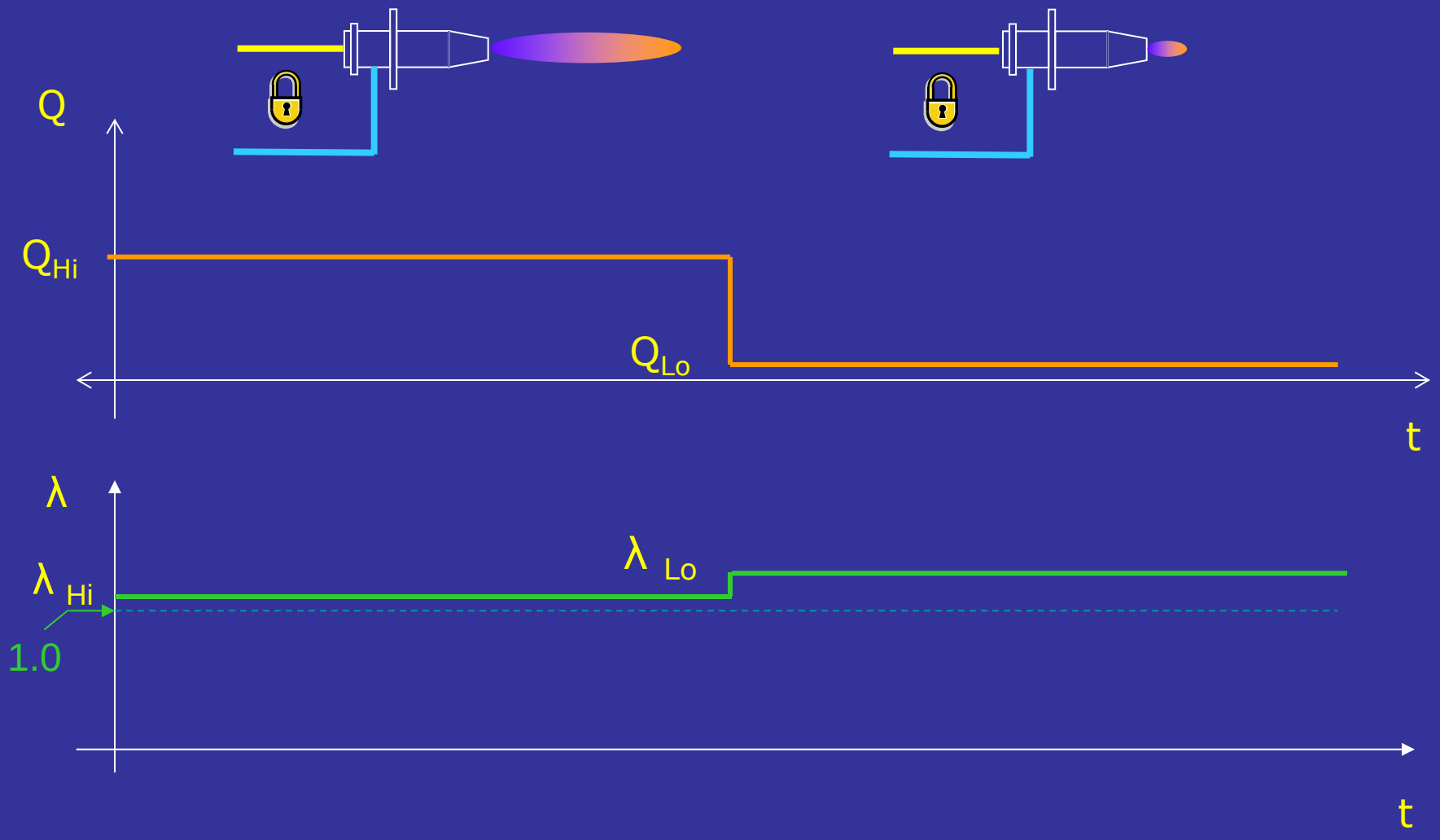

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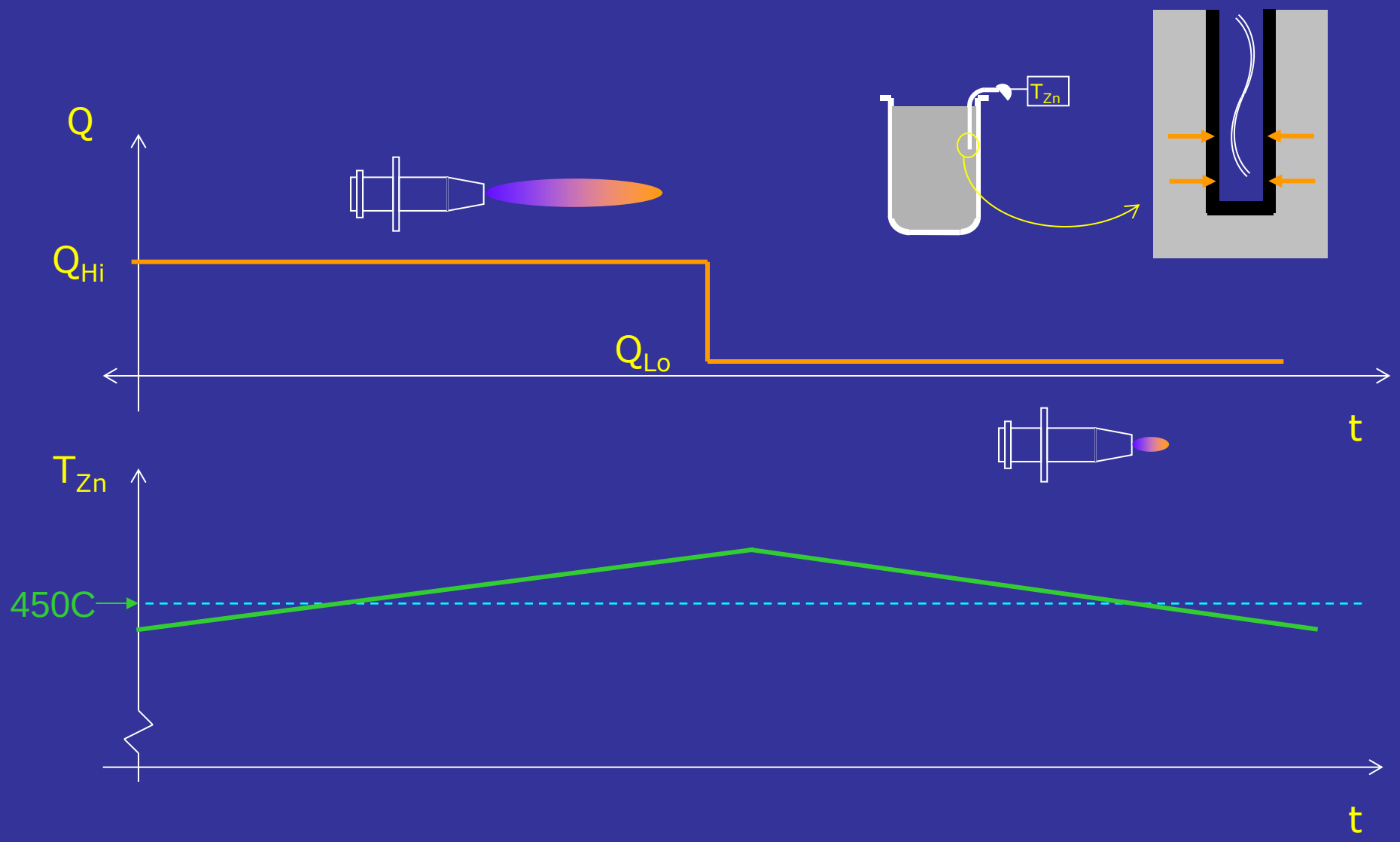
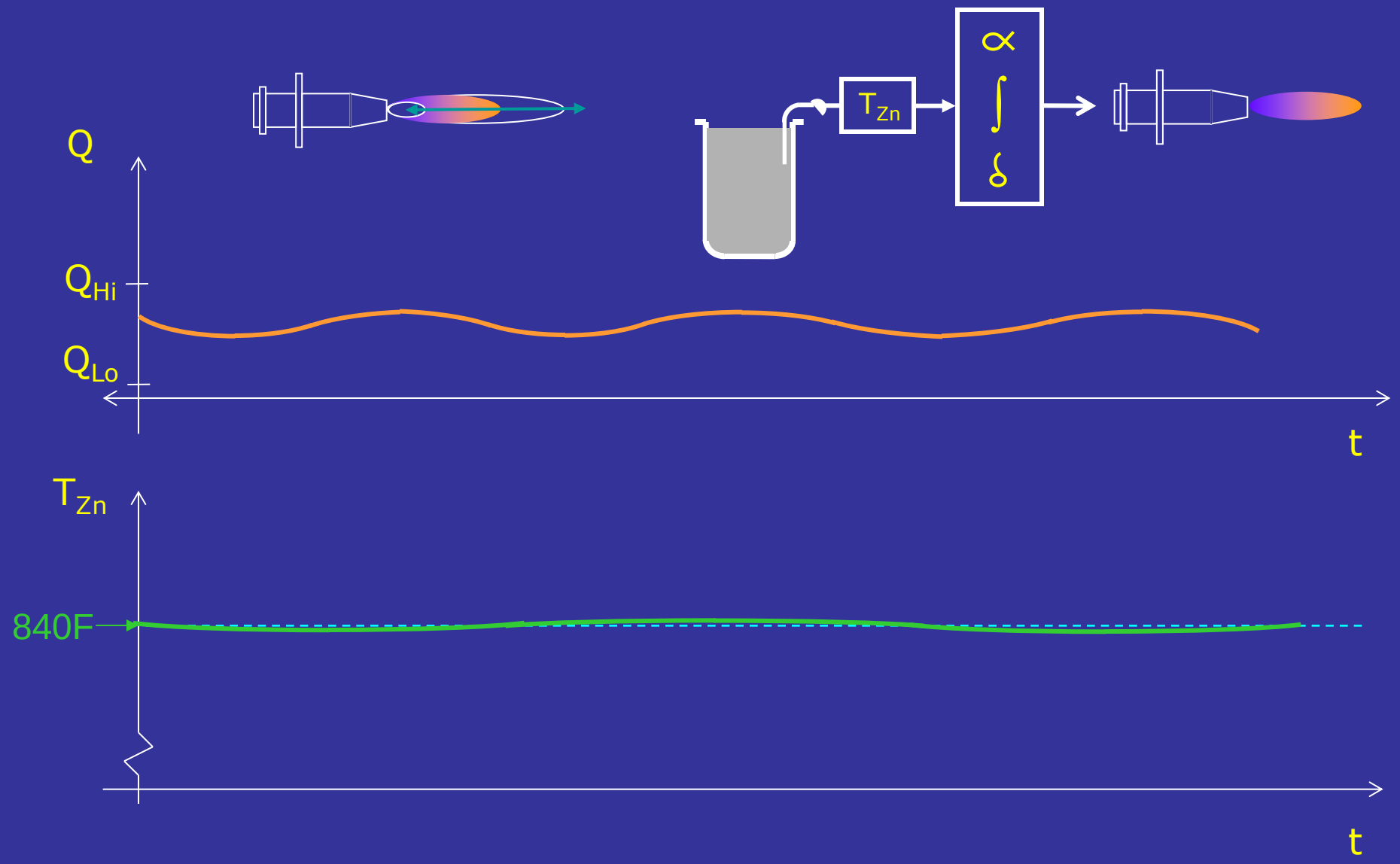


Galvanizing Furnace Heating Technology

Burner Output Regulation
Part 2: Modulated Regulation

Galvanizing Furnace Heating Technology



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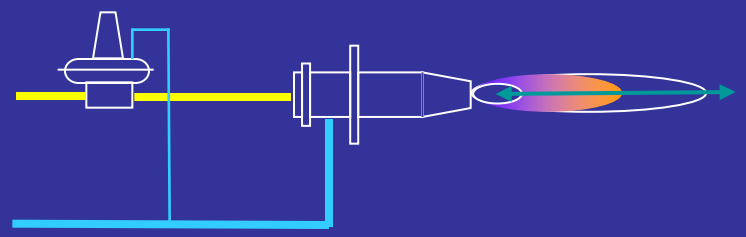

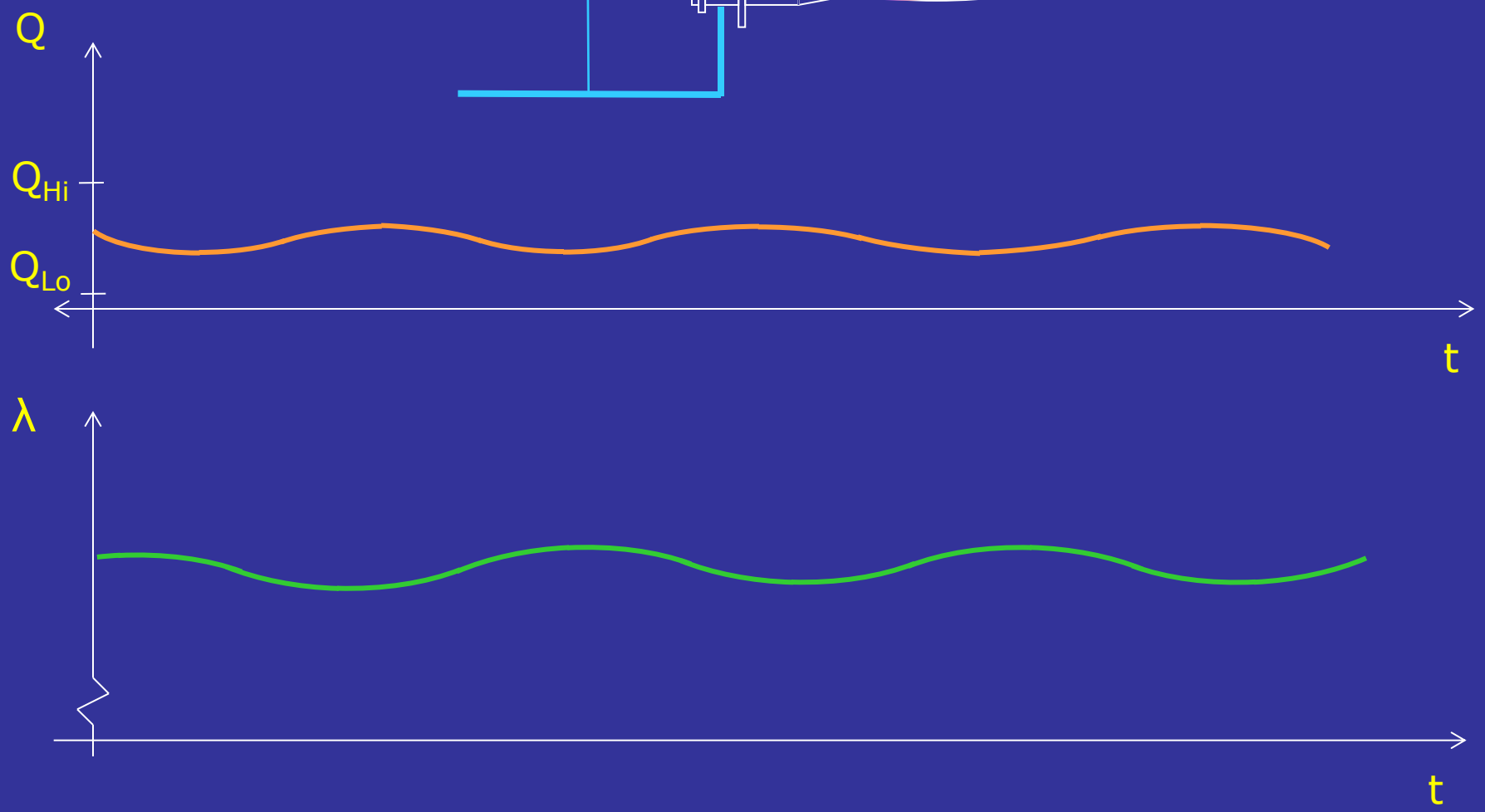

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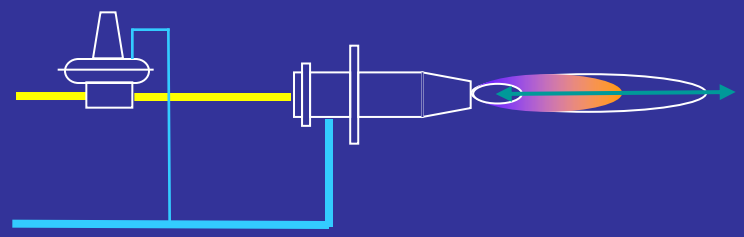

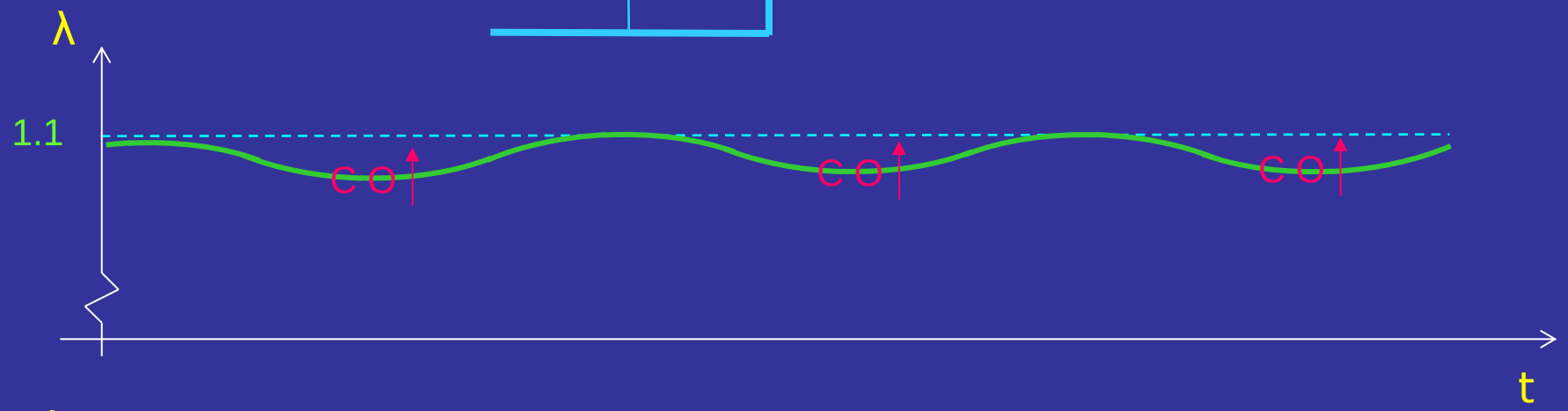

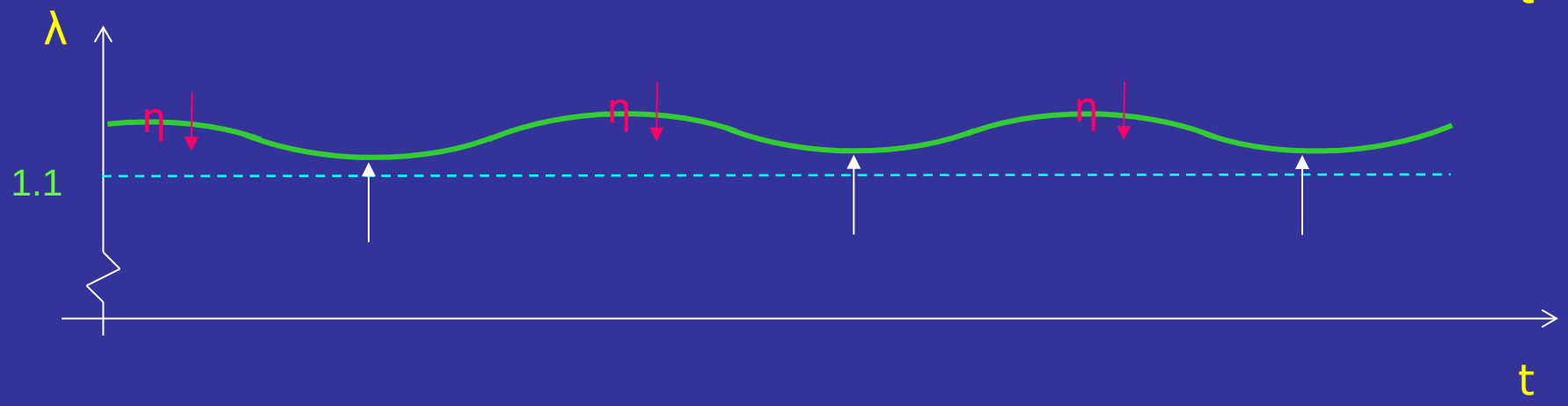

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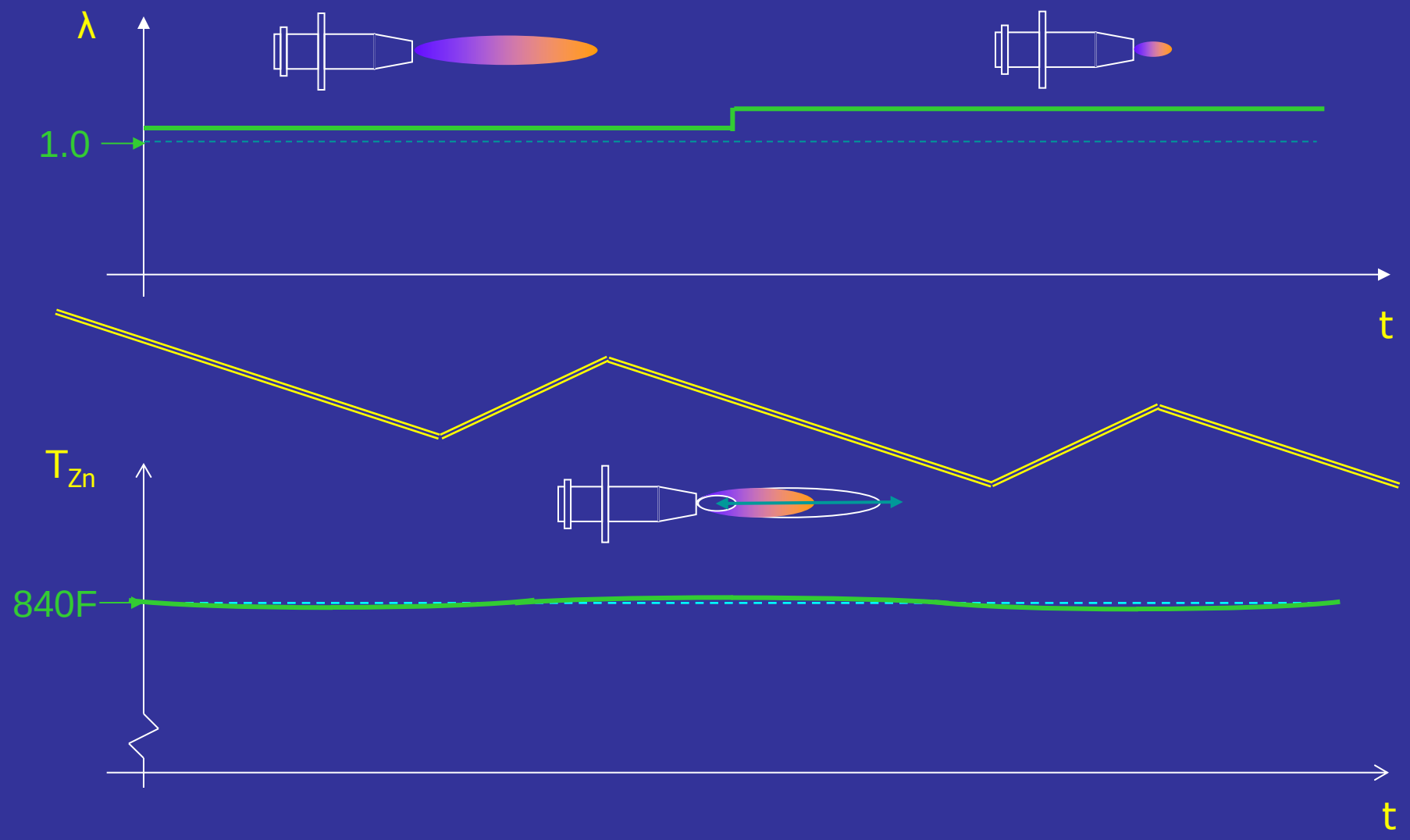
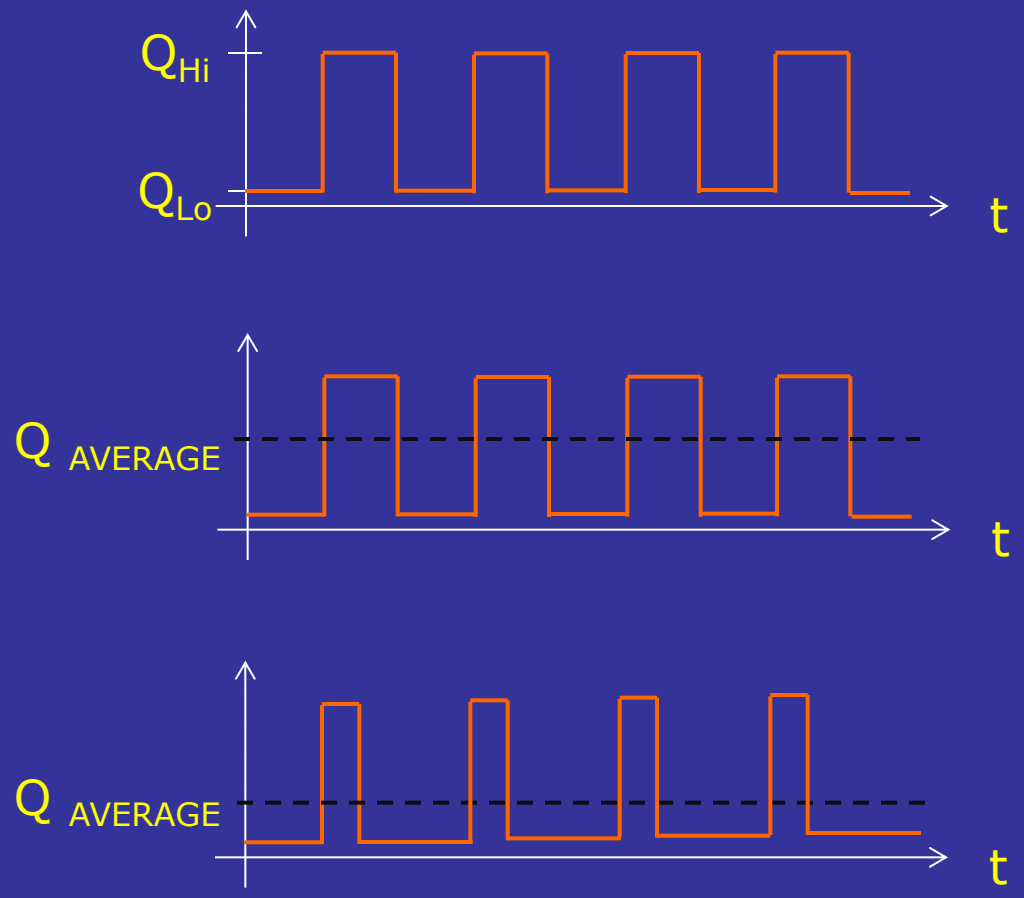


Galvanizing Furnace Heating Technology

Burner Output Regulation
Part 3: Pulse fired regulation

Galvanizing Furnace Heating Technology



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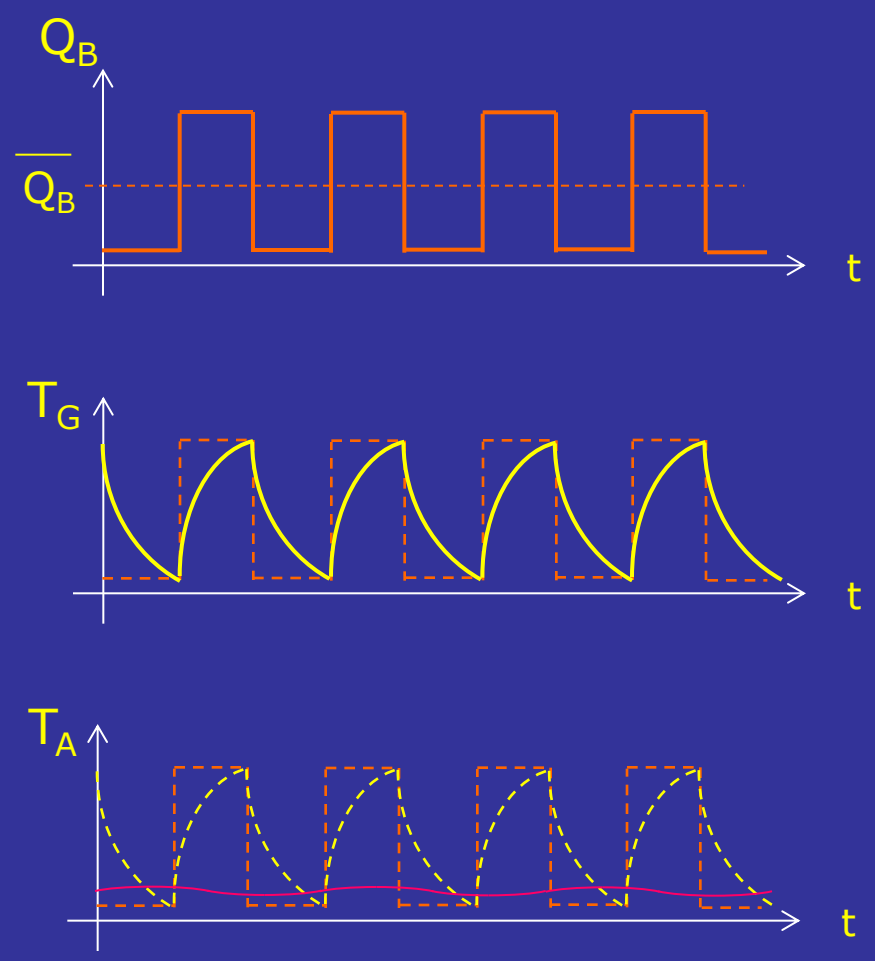

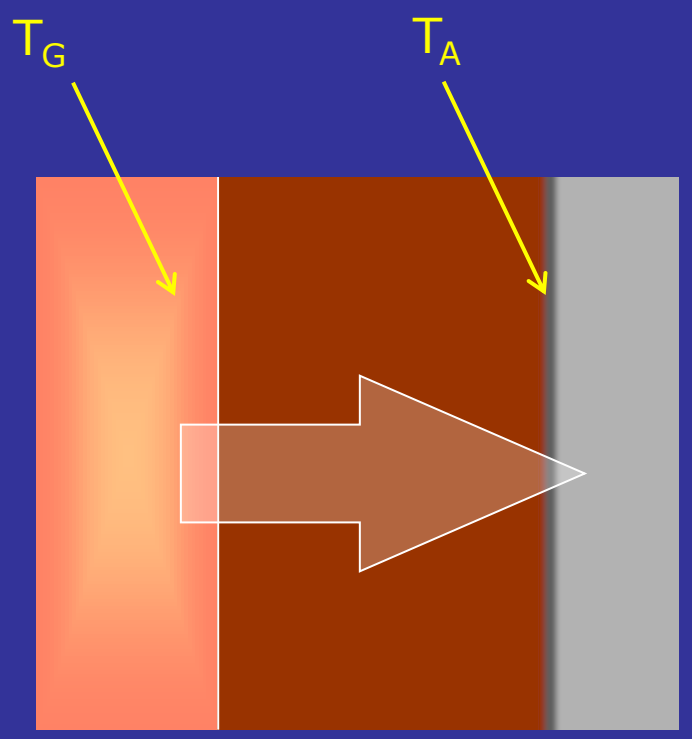

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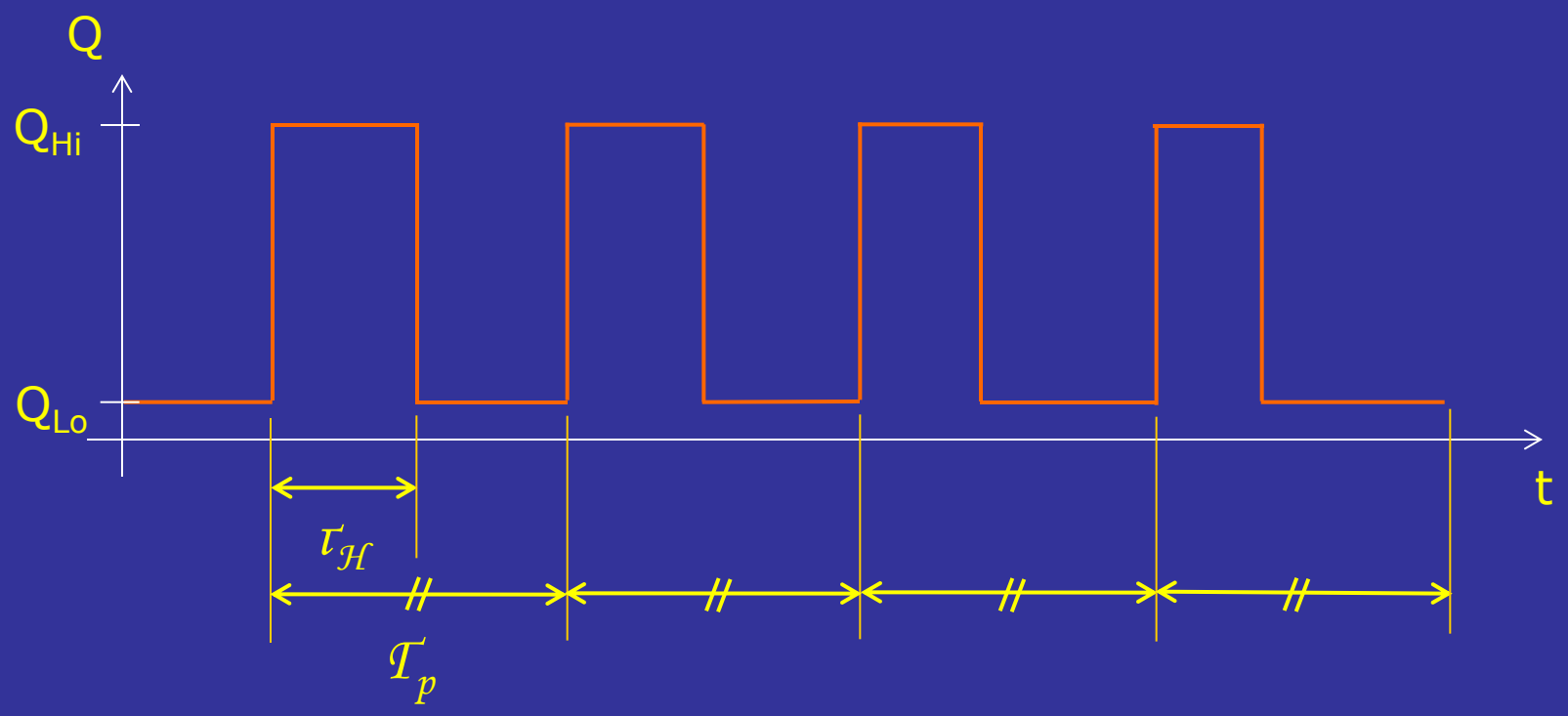

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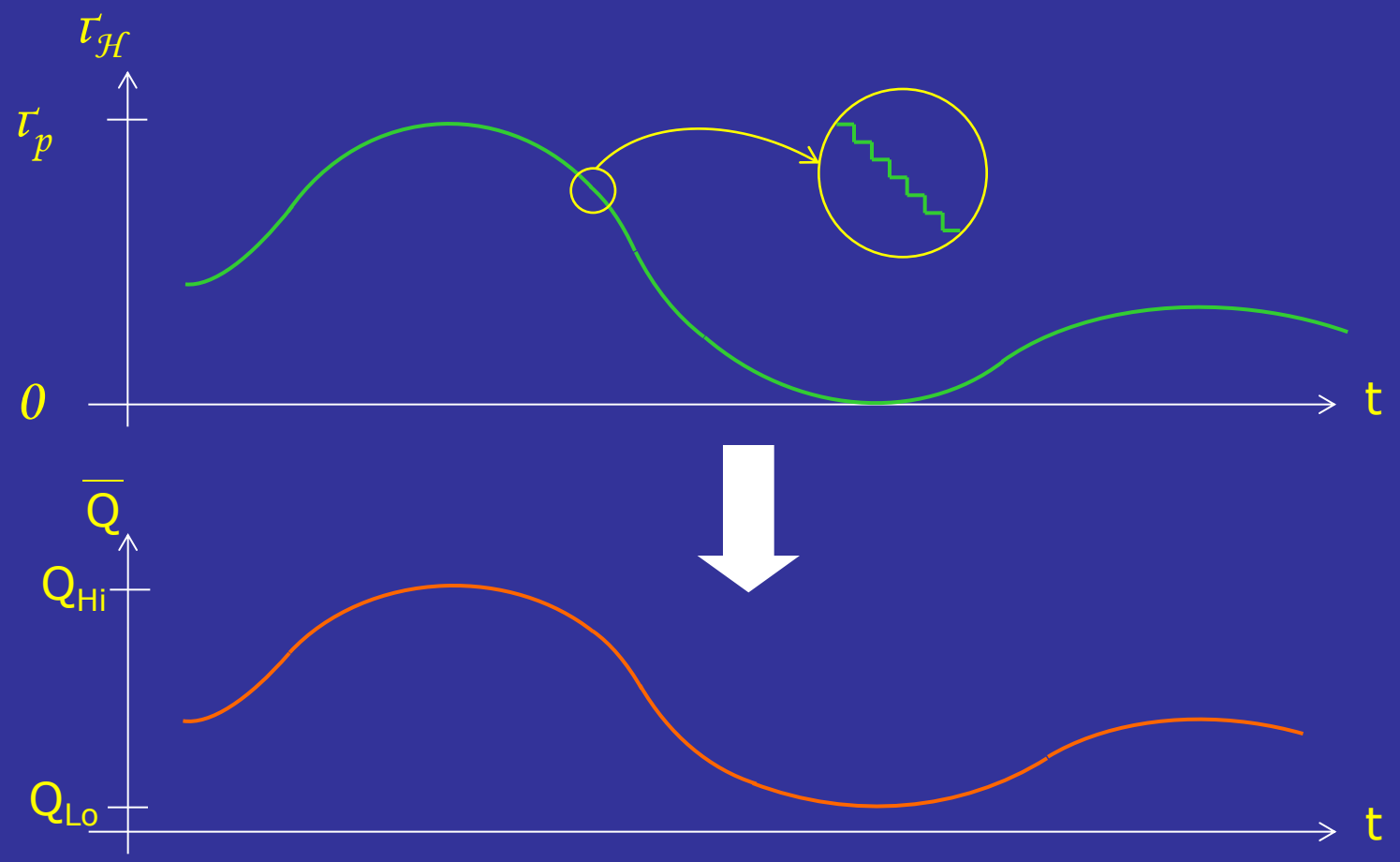
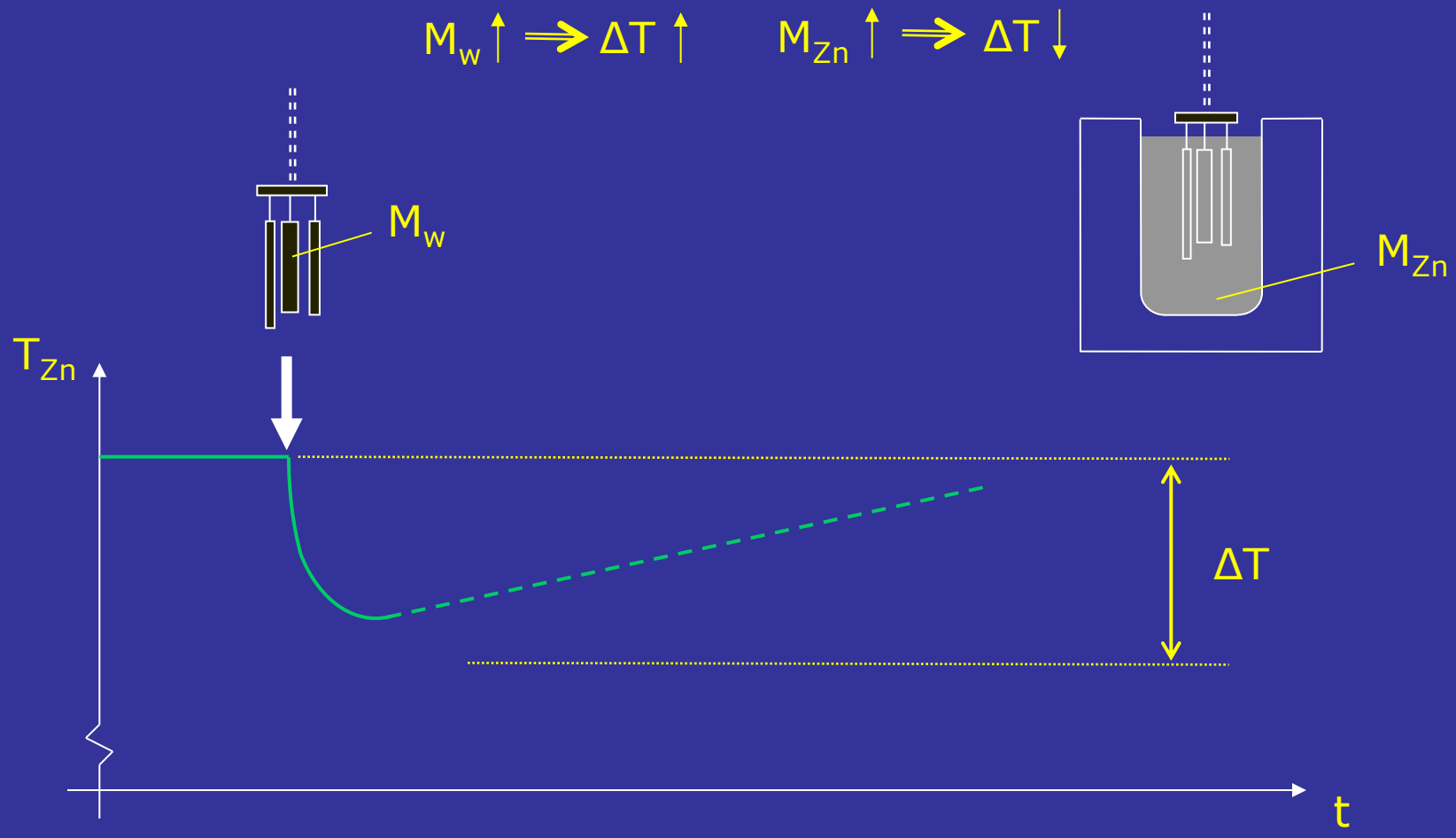


Galvanizing Furnace Heating Technology

Burner Output Regulation
Part 4: Pulse fired + Turbo regulation

Galvanizing Furnace Heating Technology

$M_w \uparrow \Rightarrow \Delta T \uparrow$ $M_{Zn} \uparrow \Rightarrow \Delta T \downarrow$



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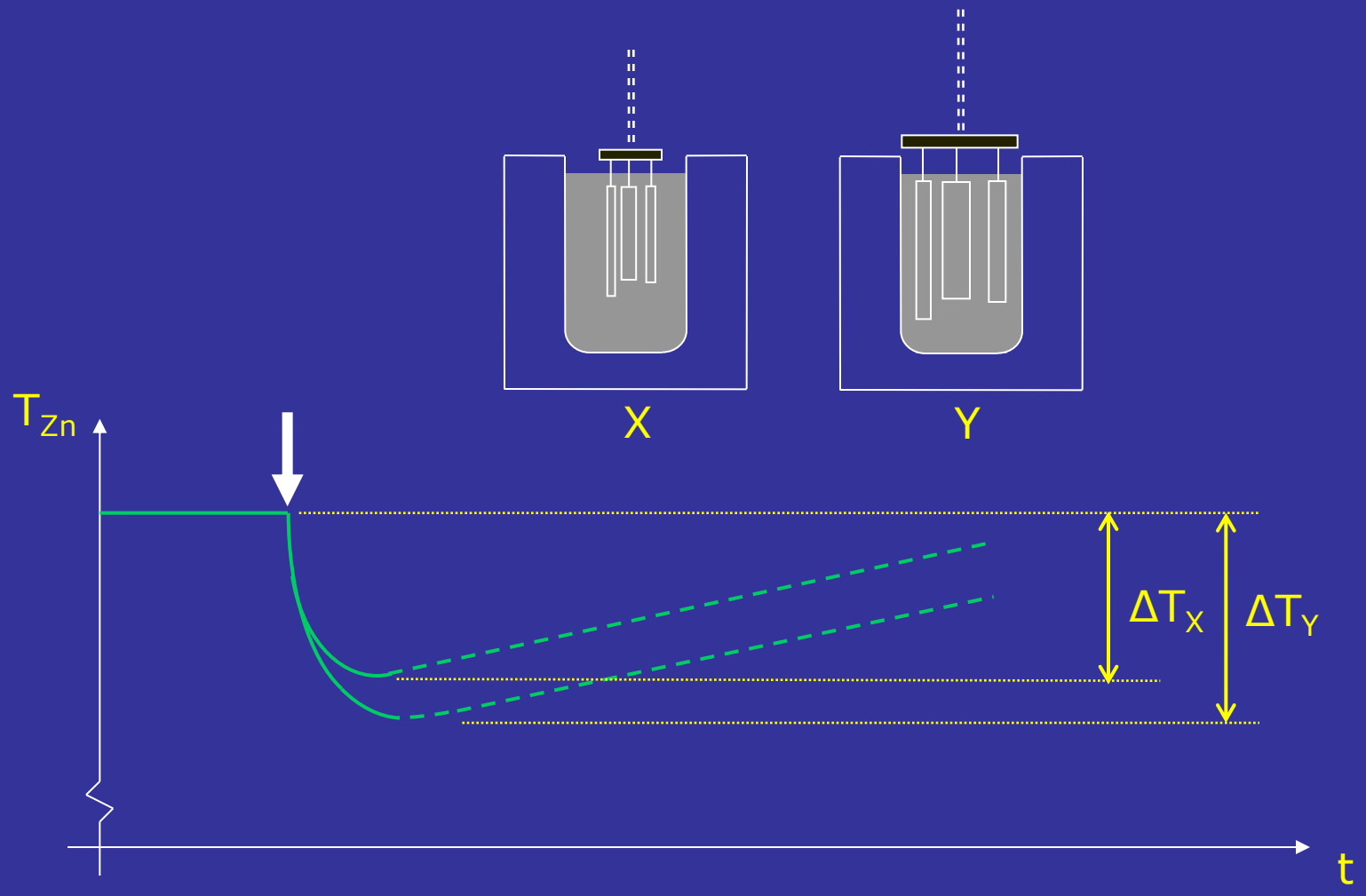

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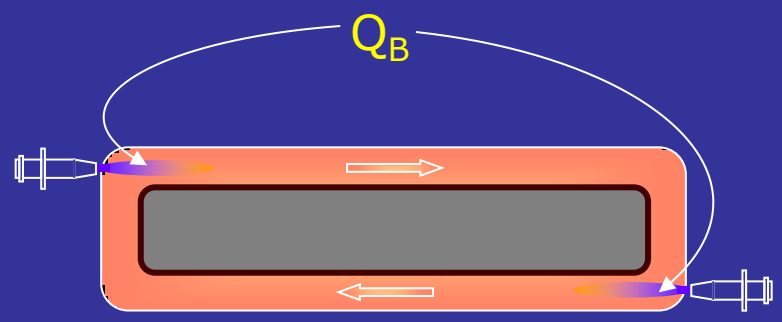
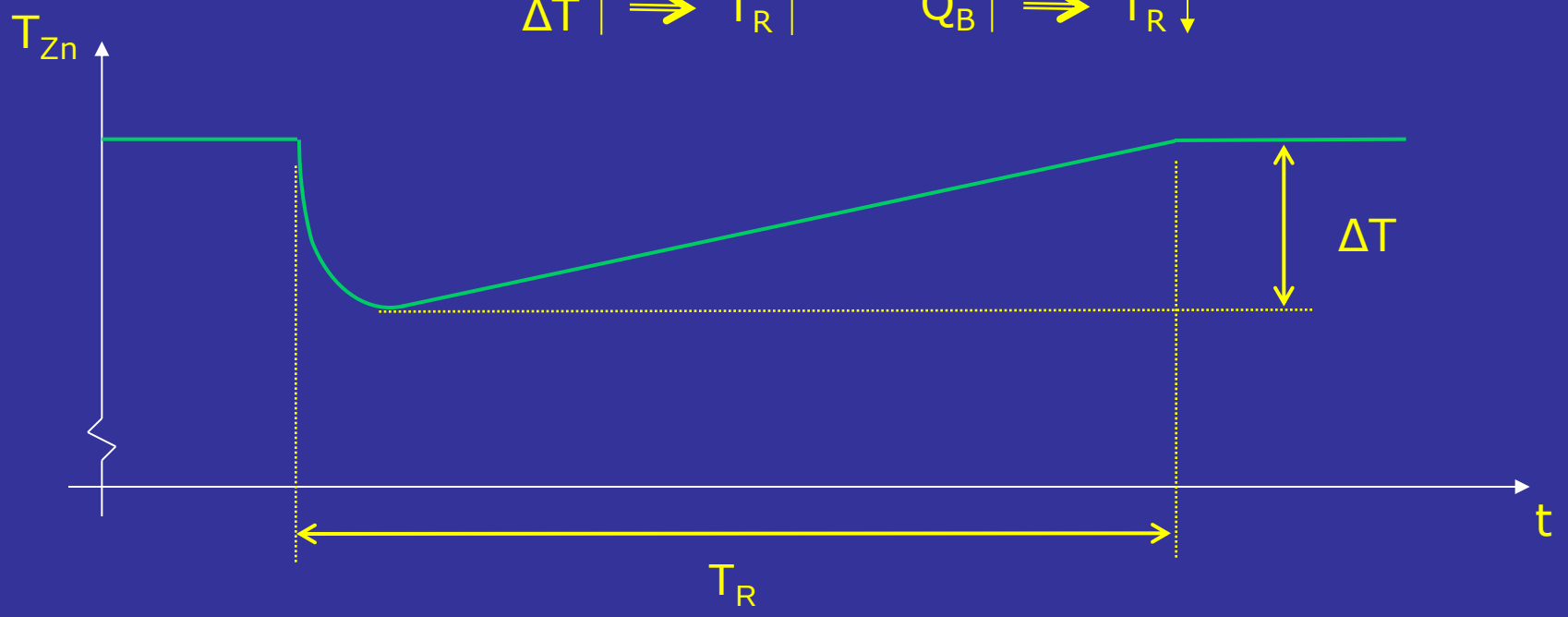


$\Delta T \uparrow \Rightarrow T_R \uparrow$ $\quad$ $Q_B \uparrow \Rightarrow T_R \downarrow$



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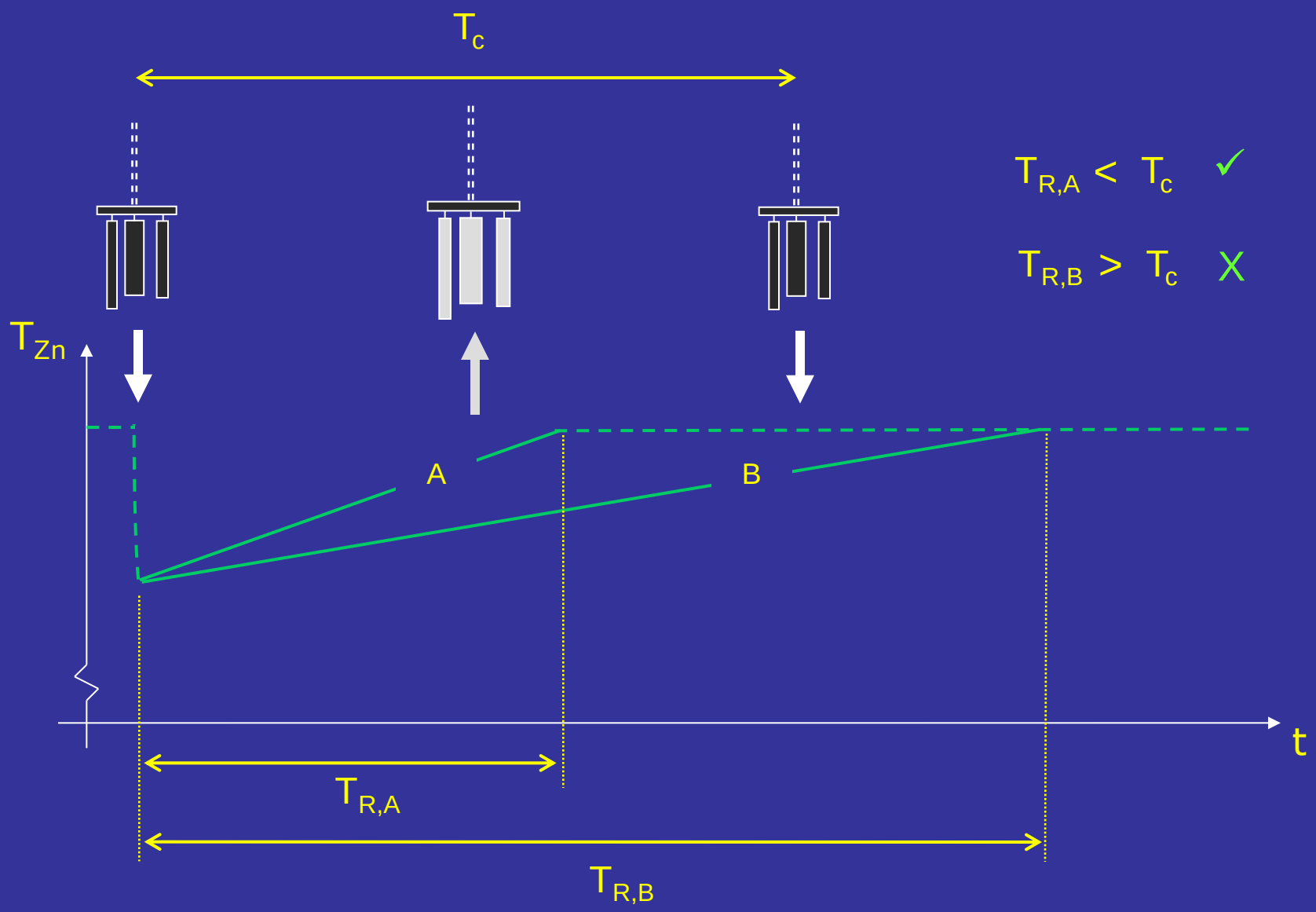

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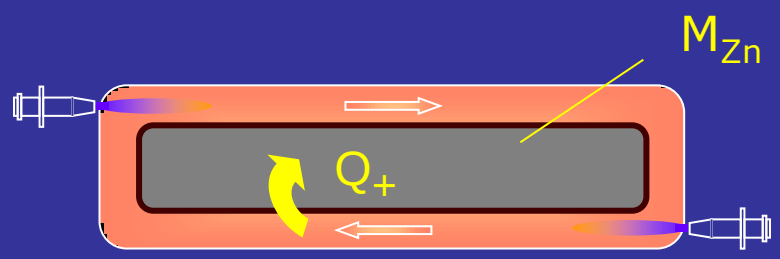
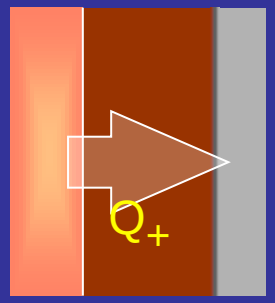
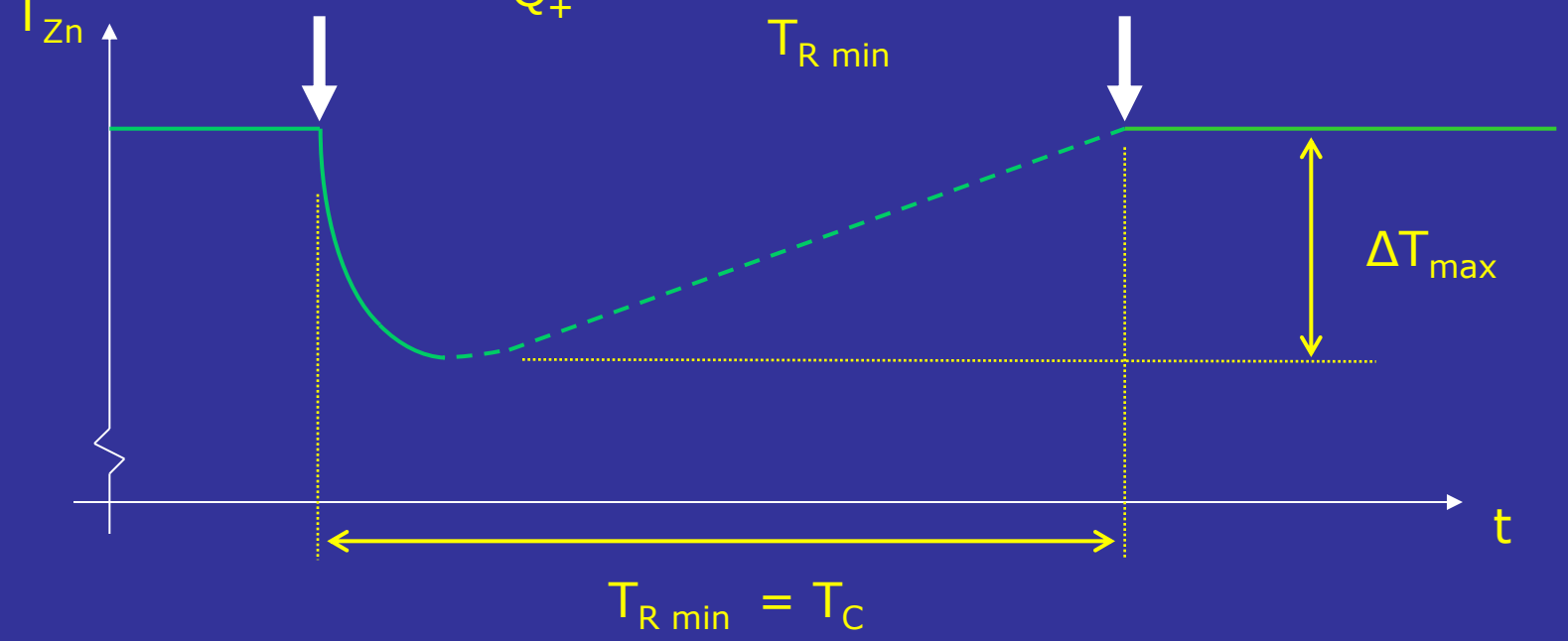




$$Q_+ \approx \frac{\Delta T_{max} \times M_{Zn} \times C_{Zn}}{T_{R\ min}}$$



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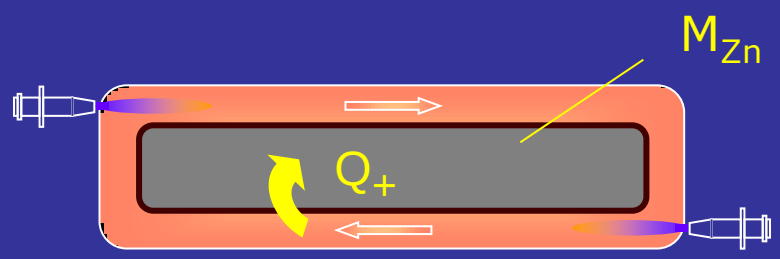

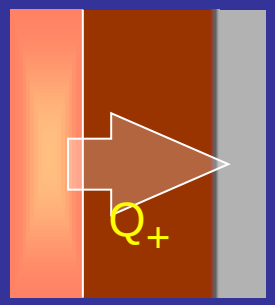

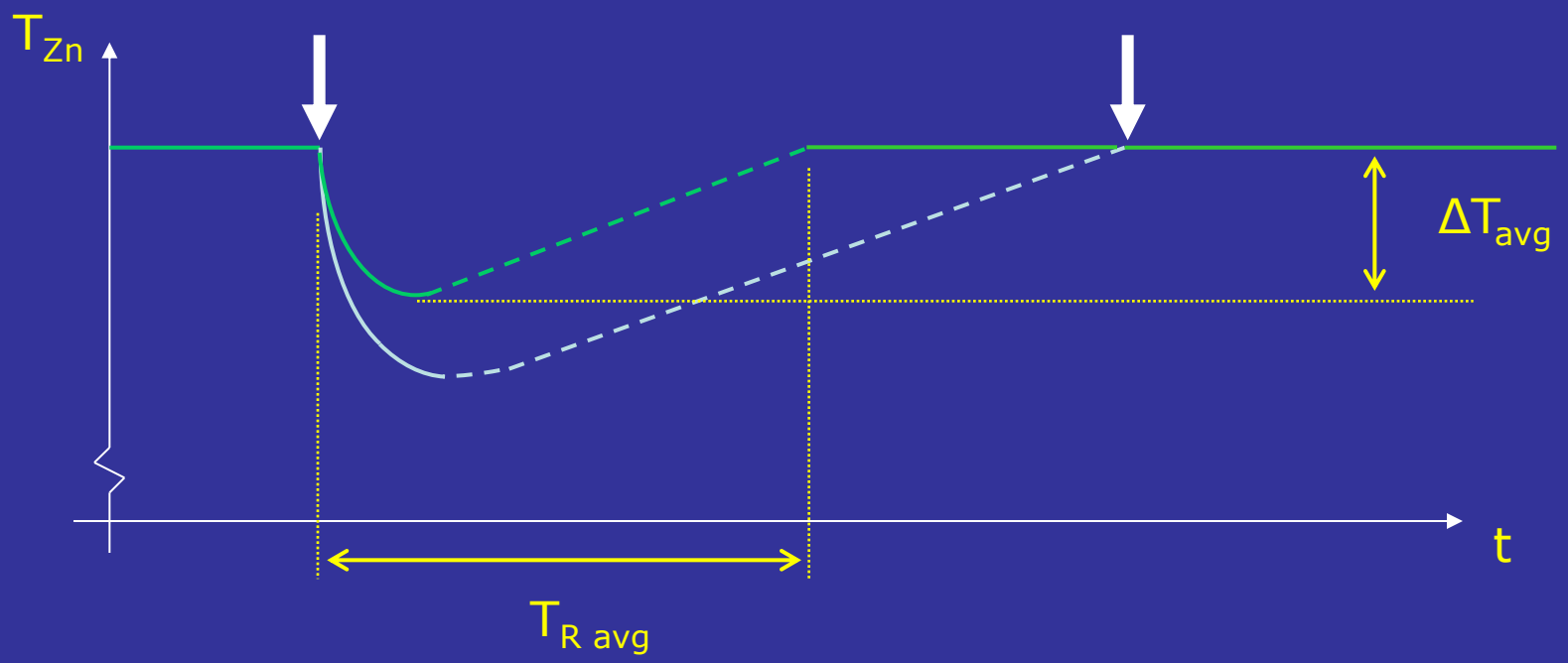

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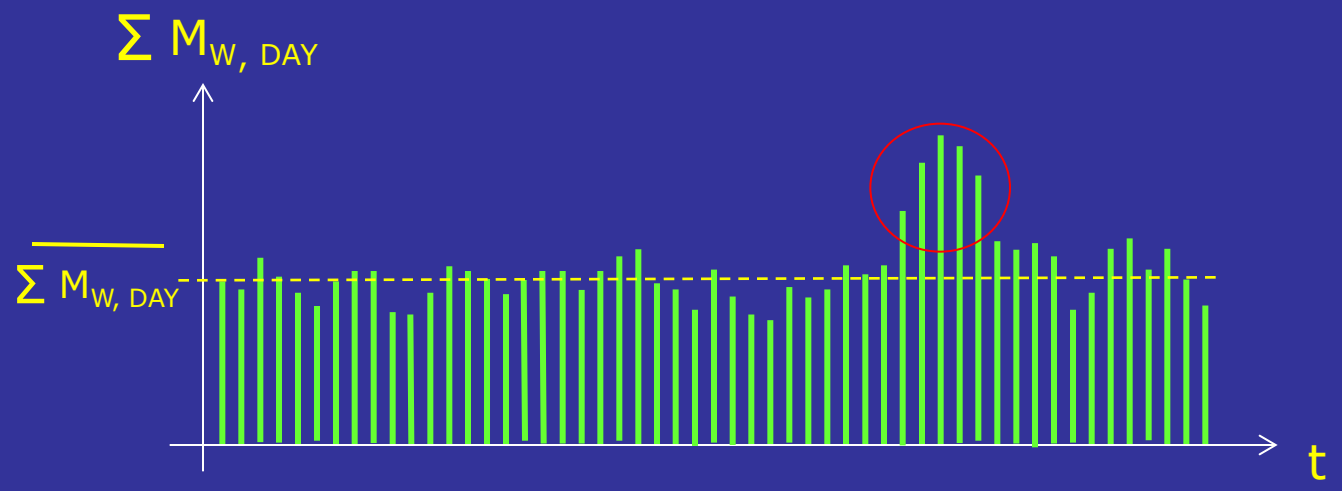

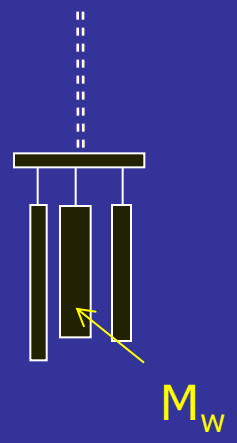

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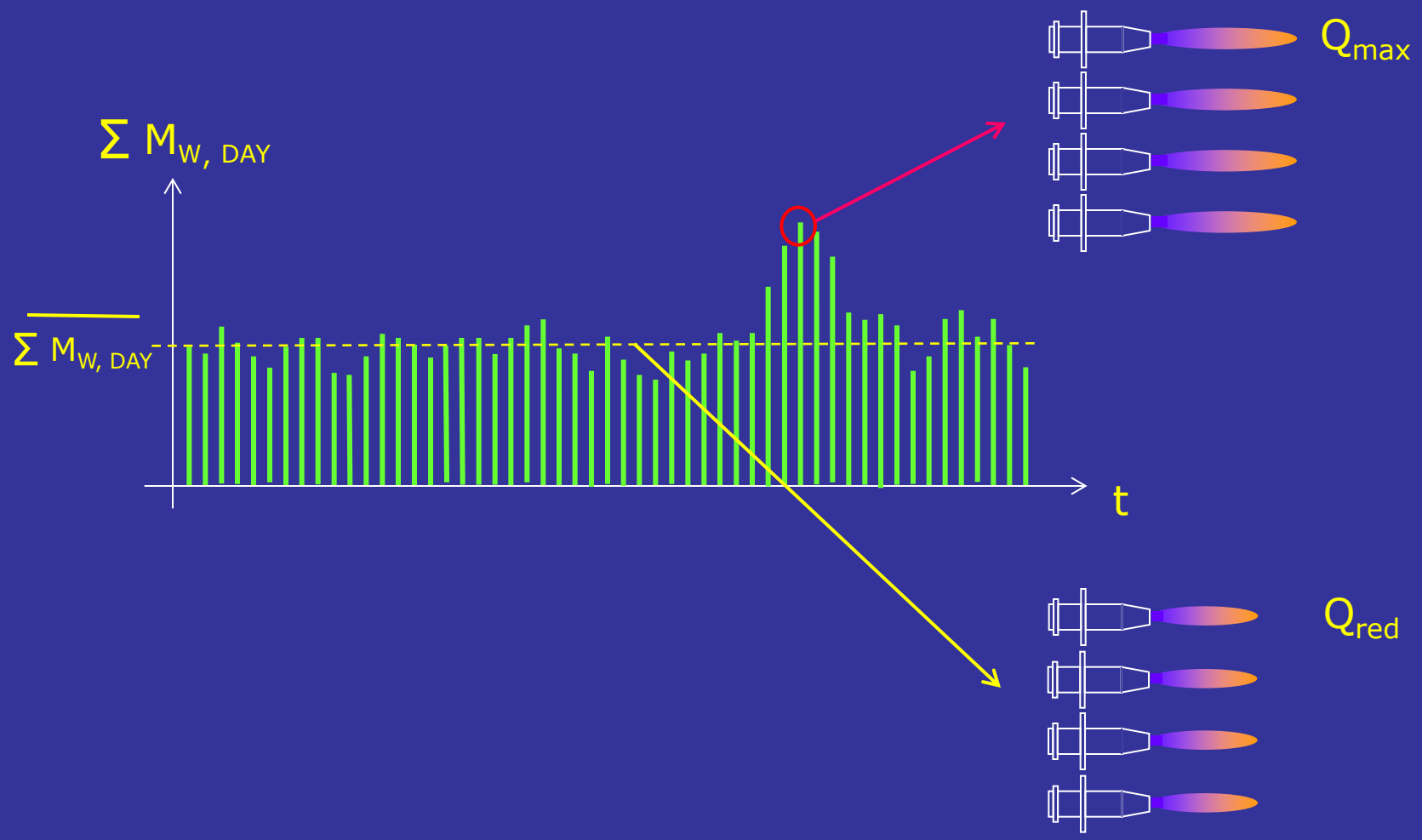

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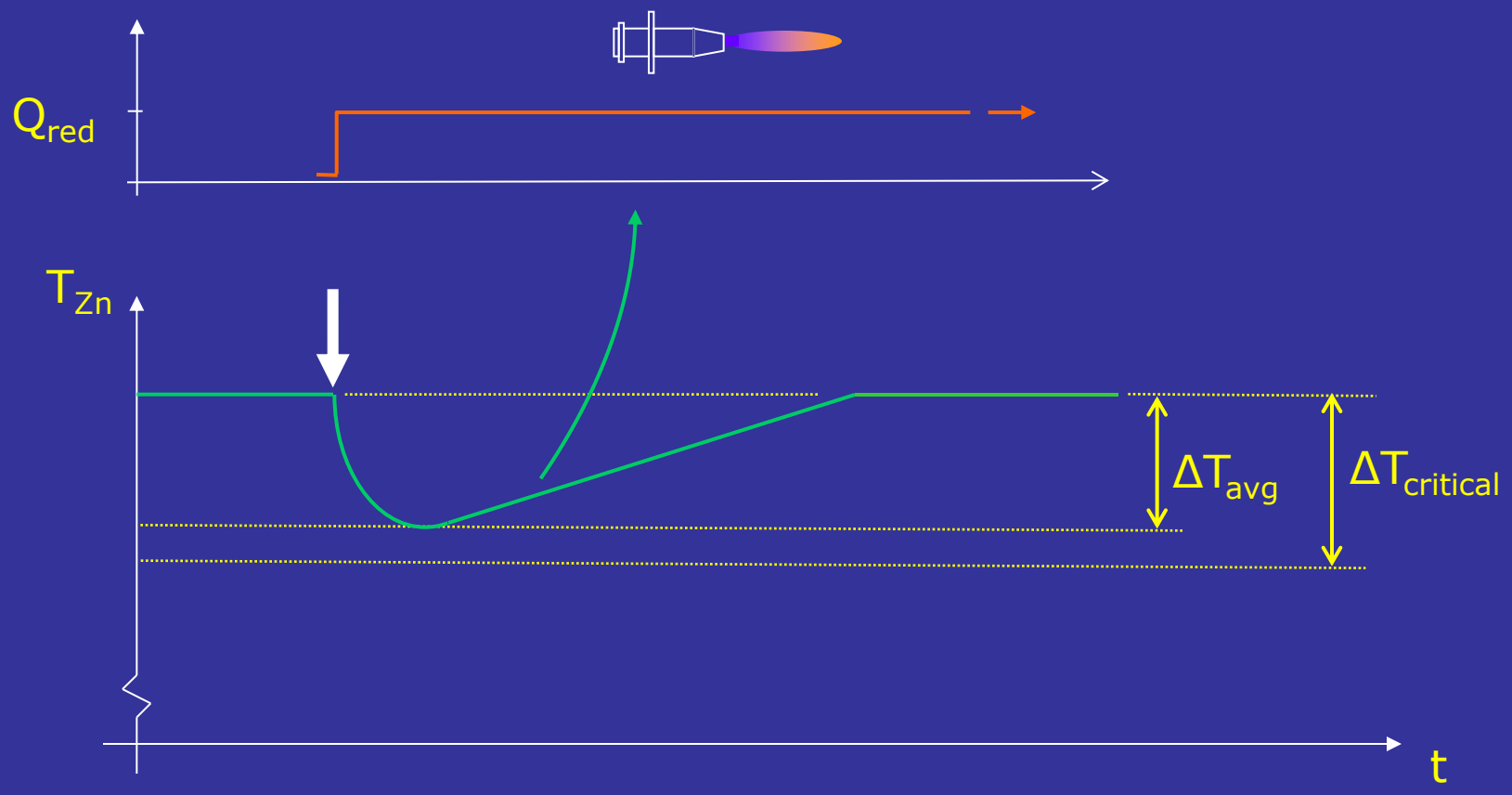

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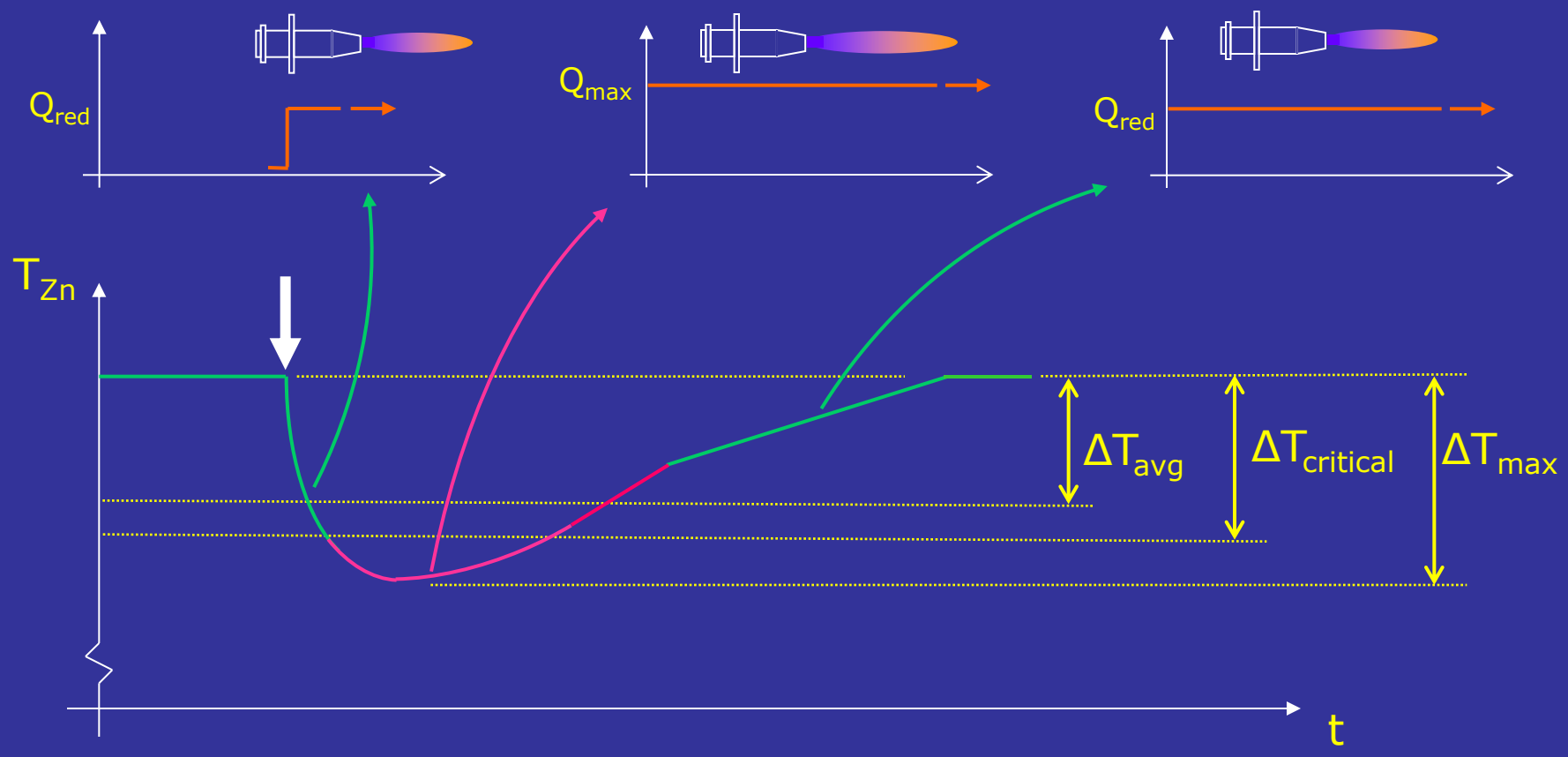

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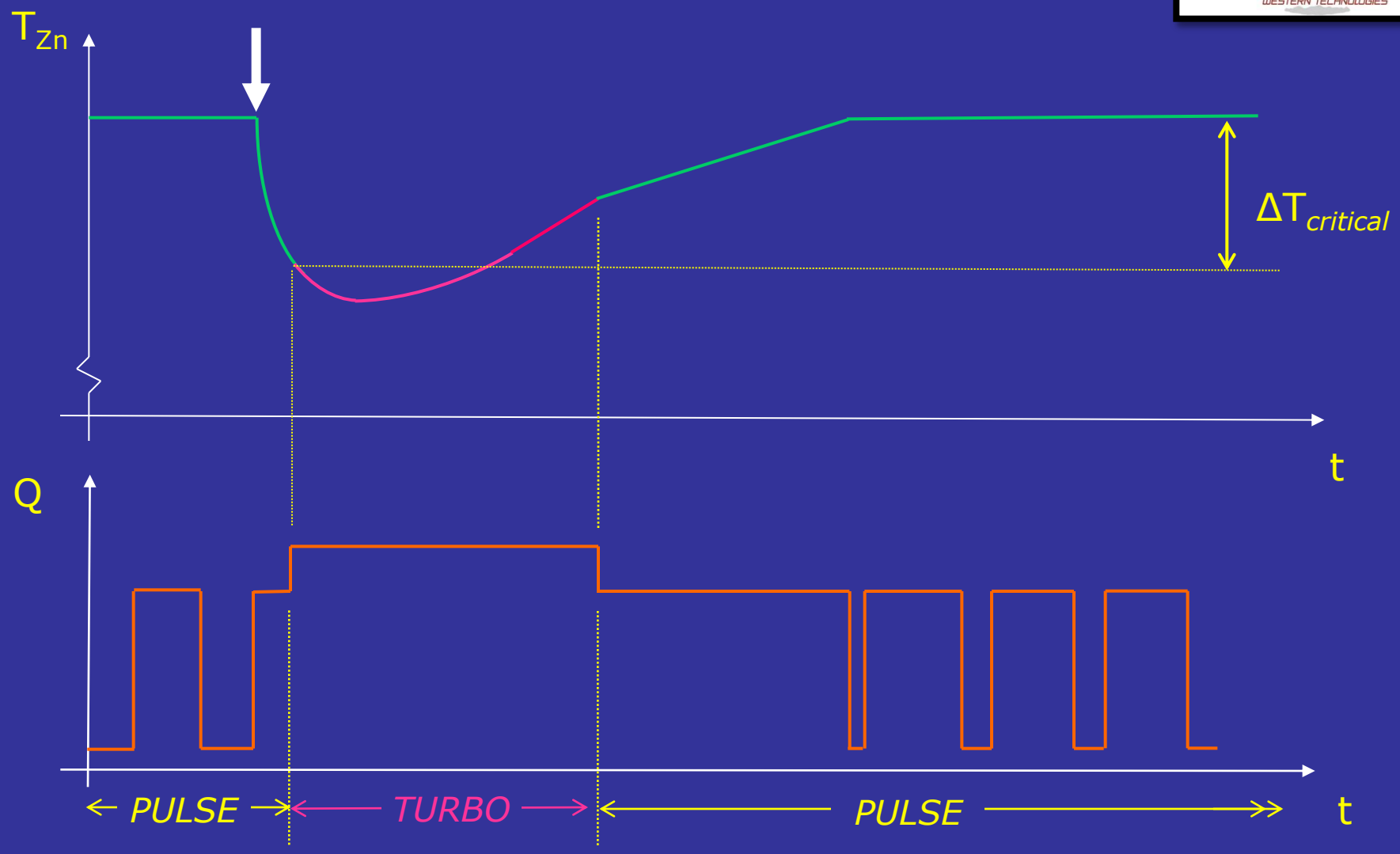

Galvanizing Furnace Heating Technology

Reference data:

Kettle internal dimensions: 41’ long x 5’ wide x 10’ deep

Production

Average: 11 tons/hour (22,000 lb/hr)

Maximum: 17.6 tons/hour (35,200 lb/hr)
for estimated 10% of working & standby time

4 dips per hour

Operating times

Production: 4,000 hours/year

Standby and zinc melting: 600 hours/year

Unused and covered: 4,160 hours/year

Solid zinc added outside working times

Ventilated enclosure during working times

Maximum burner heat output: 8,128,126 BTU/hr

Fuel: Natural gas

Galvanizing Furnace Heating Technology

		Standard System	***System with Turbo***
Production Rate 11 ton/hr	Burner high output % time at production rate Recovery time Cycle Time Predicted max. kettle heat transfer rate for recovery Kettle steel loss rate for time at this production rate	8,128,126 BTU/hr (constant) 90% 9.4 mins 15 mins 12,045 BTU/ft^2 0.126 inch/year	**5,669,197 BTU/hr (reduced)** **90%** **15 mins** **15 mins** **8,876 BTU/ft^2** **0.098 inch/year**
Production Rate 17.6 ton/hr	Burner high output % time at production rate Kettle steel loss rate for time at this production rate	8,059,823 BTU/hr 10% 0.019 inch/year	**8,059,823 BTU/hr** **10%** **0.019 inch/year**
Combined Production	Kettle steel loss rate	0.145 inch/year	**0.118 inch/year (19% reduction)**

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