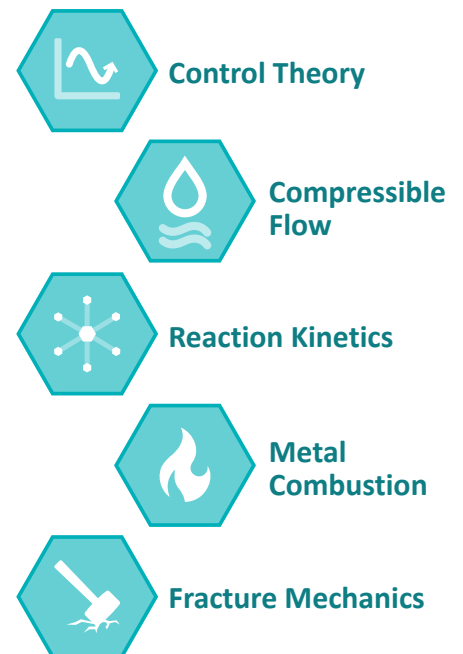
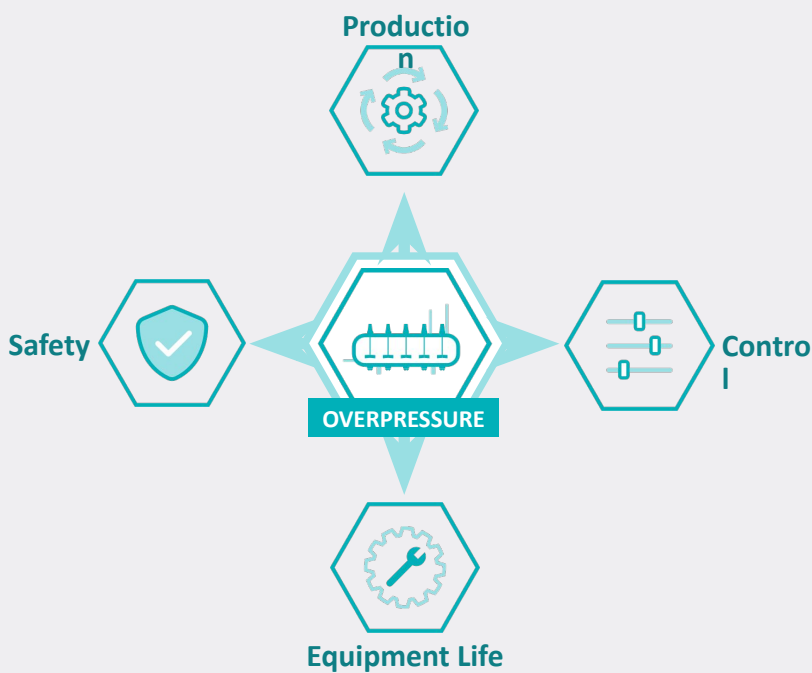


# Autoclave Overpressure: The Hidden Variable

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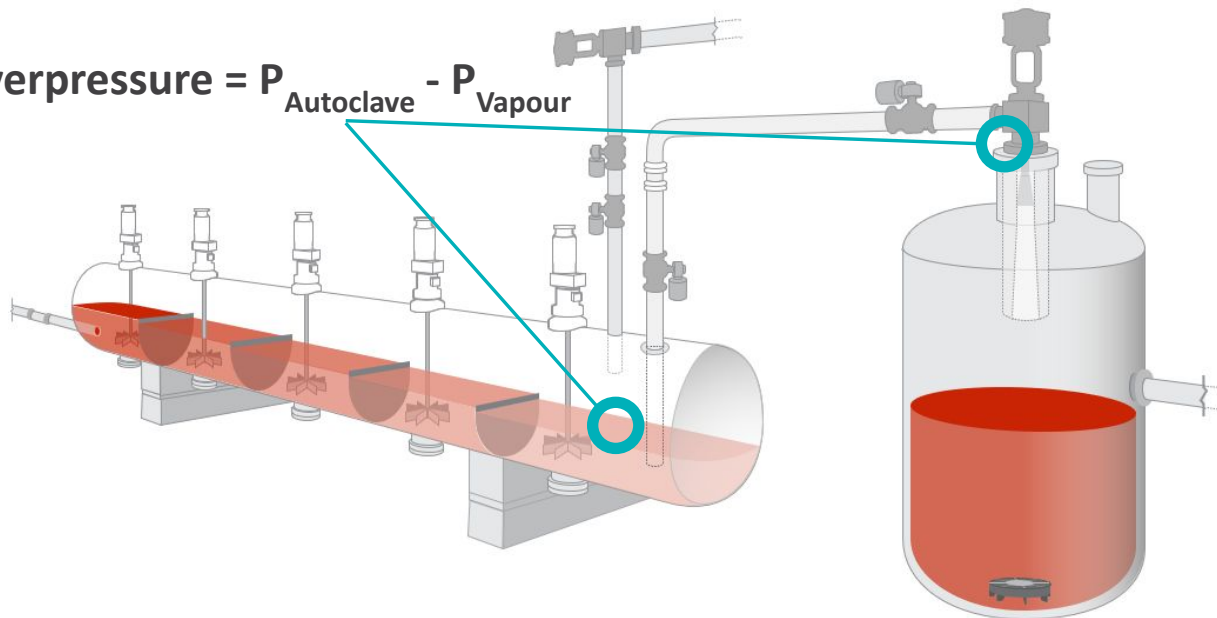
## Overpressure Effects





# Autoclave Overpressure: The Hidden Variable

$$\text{Overpressure} = P_{\text{Autoclave}} - P_{\text{Vapour}}$$

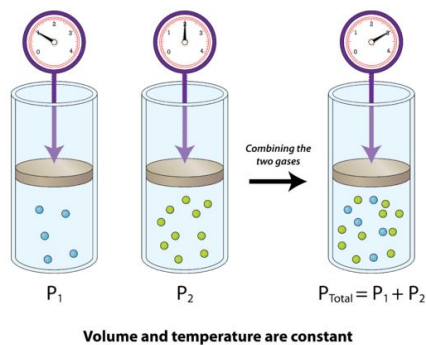


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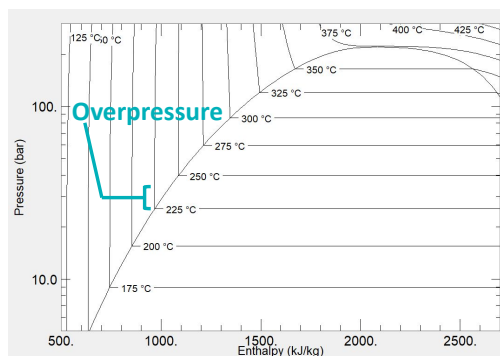


## What is Overpressure?

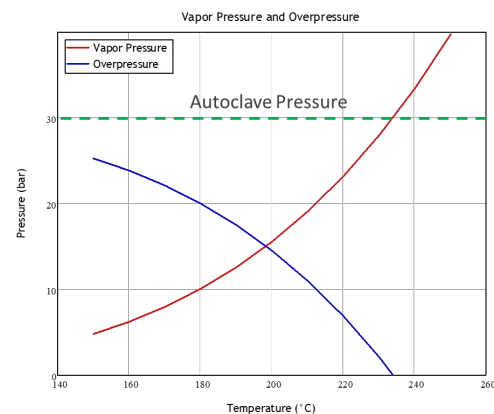
### Partial Pressures



### Steam Dome



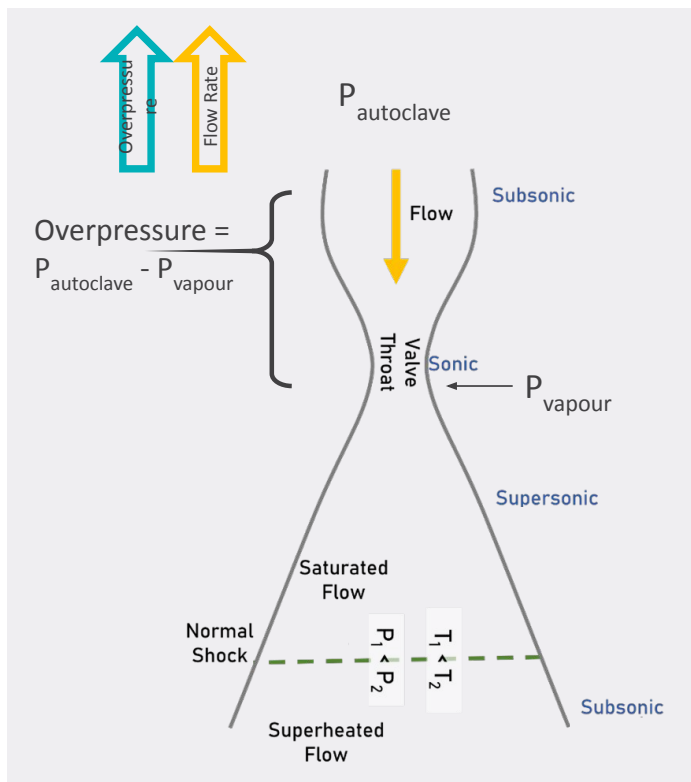
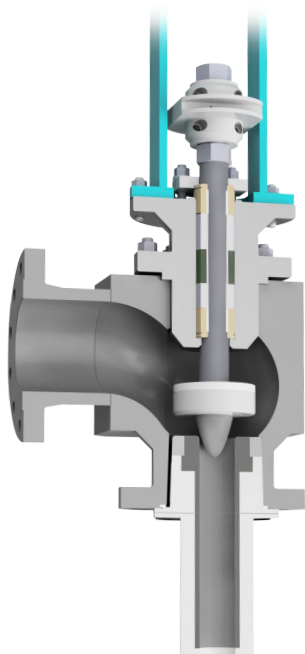
### Simplifying Variables



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## Overpressure: driving force for the flashing flow



Multiphase  
Compressible  
Flow



Converging  
Diverging  
Nozzle



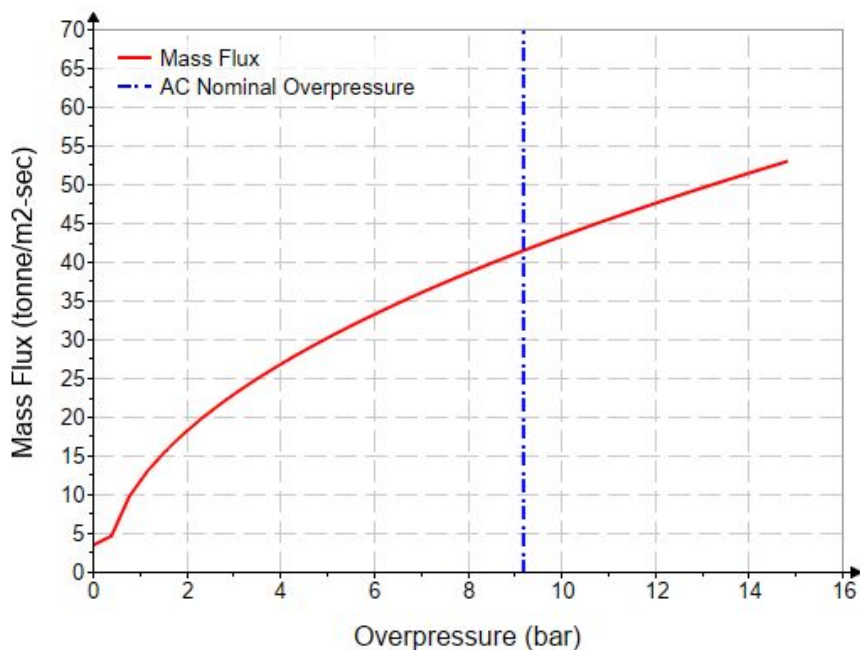
Gas  
Dynamics

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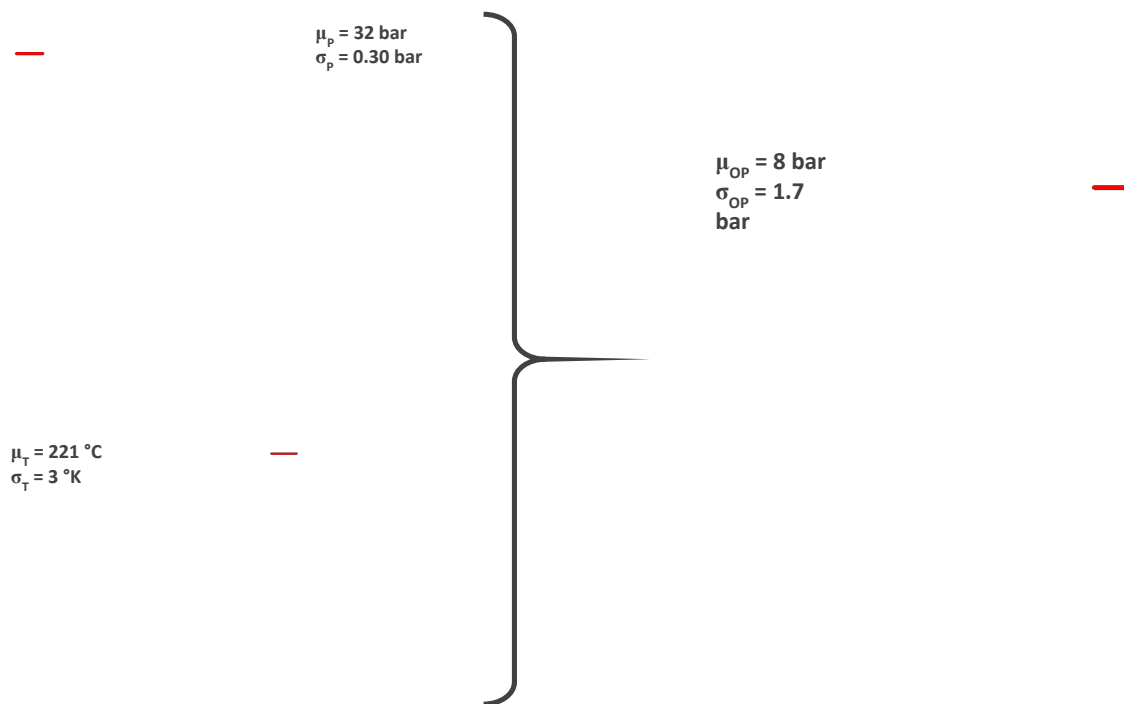
## Mass Flow is Sensitive to Overpressure

Mass Flux vs Overpressure

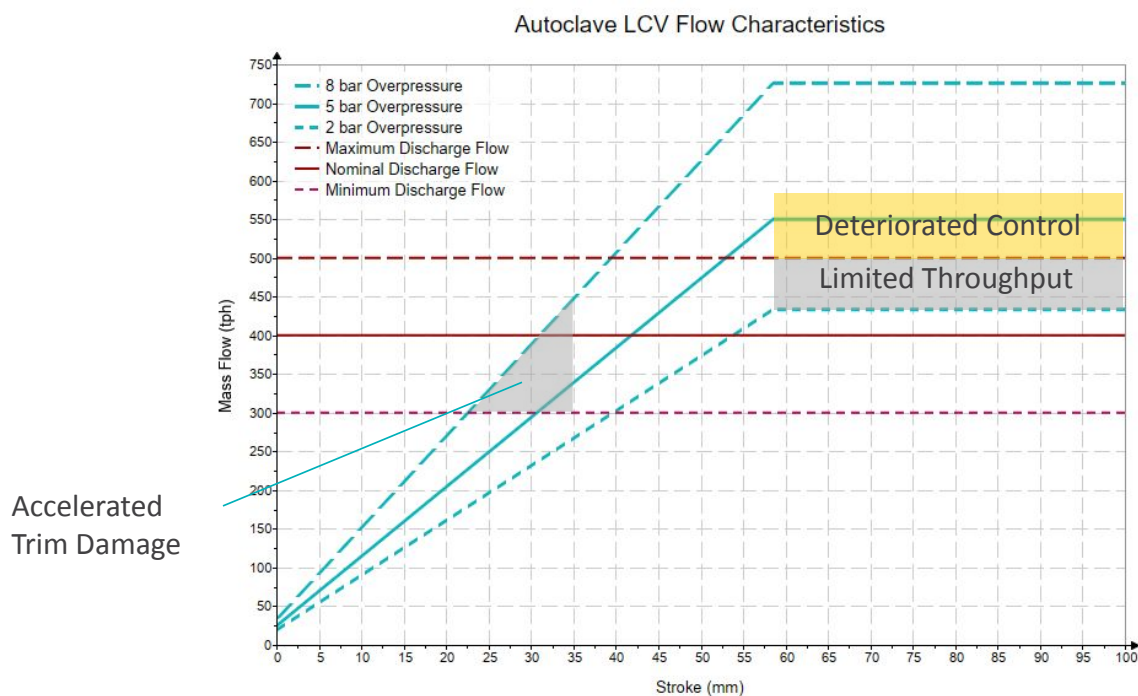


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# Statistical Representation of Overpressure

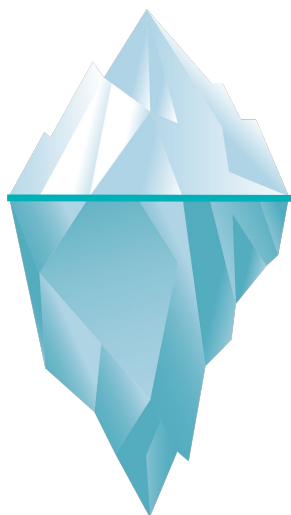


# Trim Damage vs. Throughput Limitation



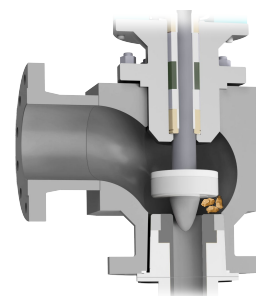


# Obvious and Hidden Losses



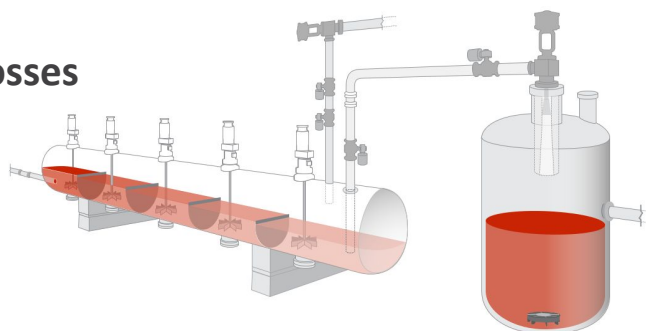
## Obvious Trim Failure Losses

0.1-1% production loss + spare parts



## Hidden Throughput Limitation Losses

1-5% production loss

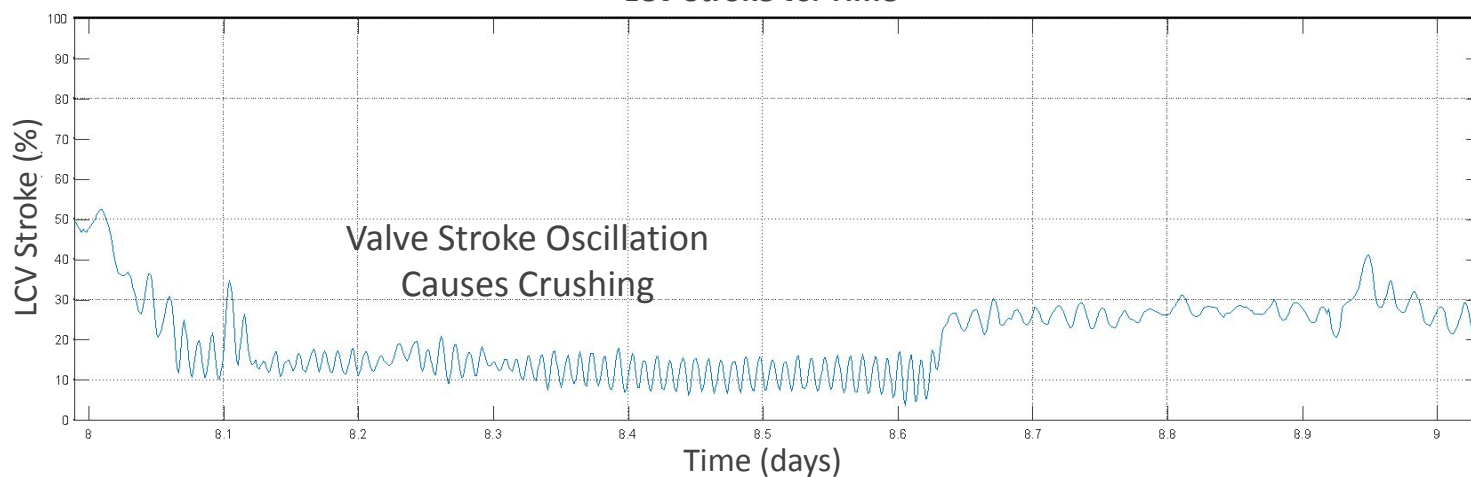


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# Adding Crushing to Sieving

LCV Stroke vs. Time



Data Science

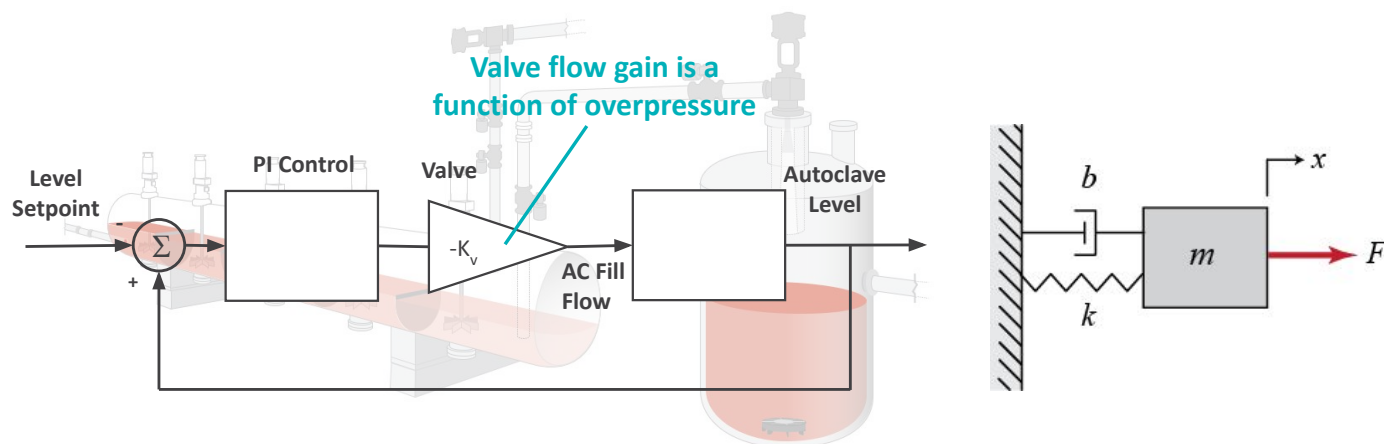


Control Theory

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# Overpressure Affects Level Control



Underdamped

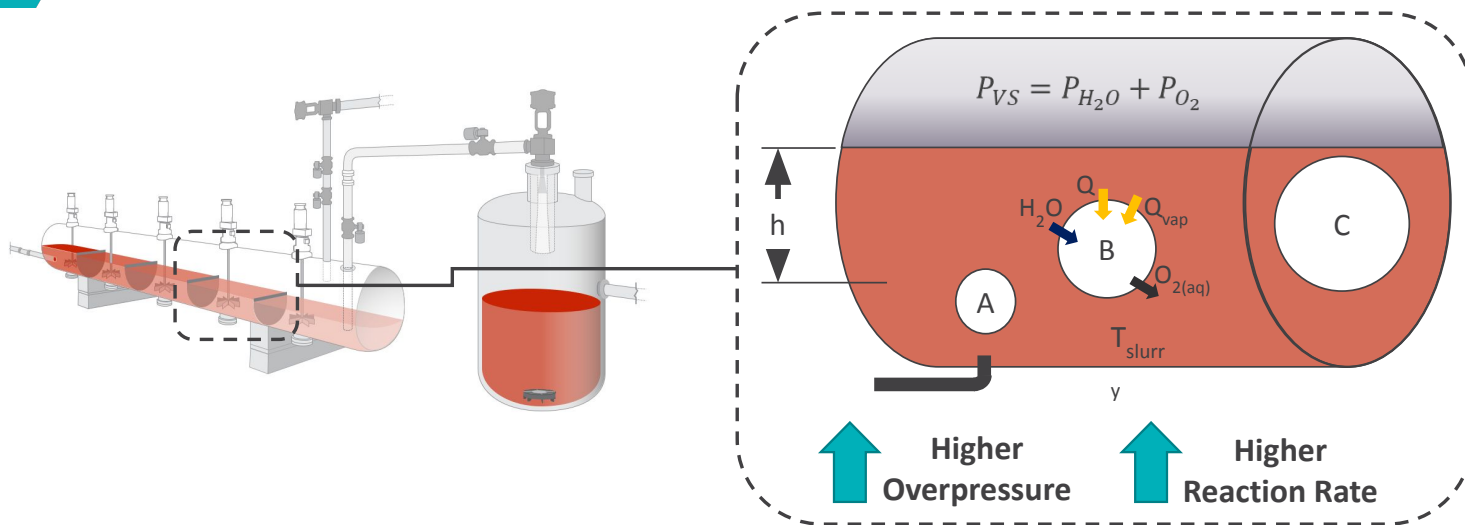
Damped

Overdamped

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# Micro Scale Overpressure



Partial Pressure



Diffusion Mass Flux



Solubility



Temp. Dependence



Gas Diffusion

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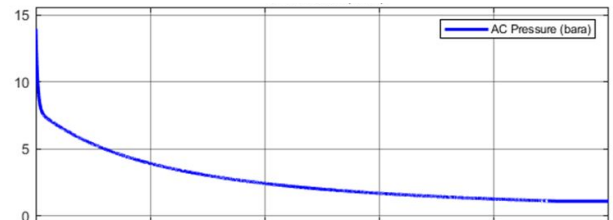
# Overpressure Control



1.8 tph fixed gas  
flow

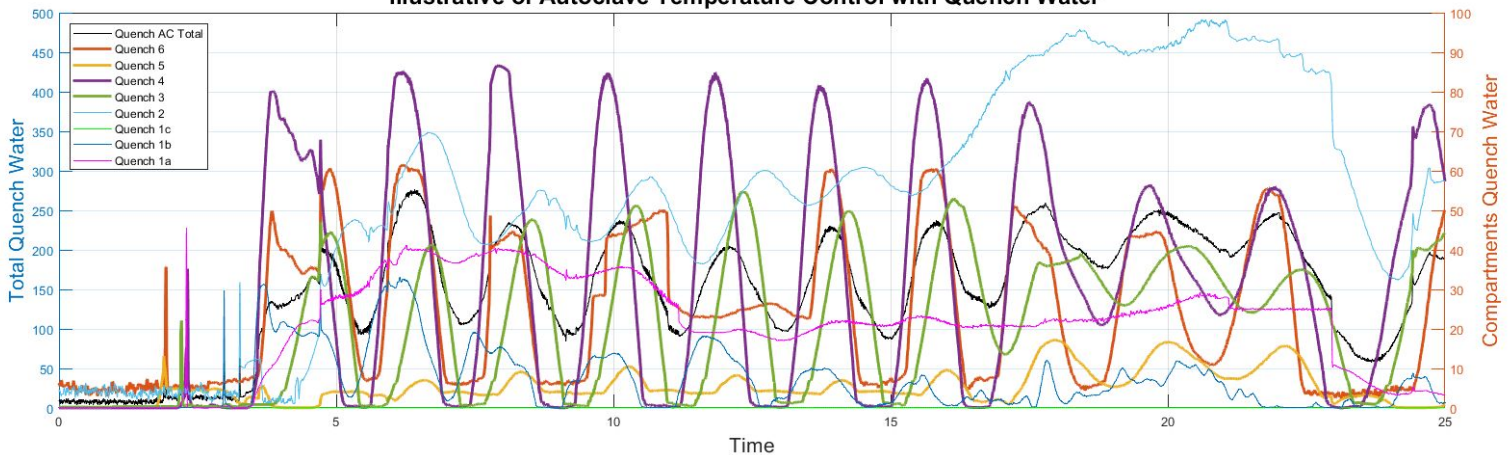
small  
margin

AC Pressure Over Time



# Autoclave Temperature Control

Illustrative of Autoclave Temperature Control with Quench Water



Temperature  
Control



Overpressure



Level Control

# Overpressure Control Value Proposition



## Low Capital Investment

Little or No Hardware Required



## Optimize Your Process

Leverage Existing Data and Assets



## High Return Potential

Increase Throughput

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# Thank You!

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