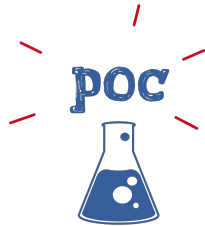


Projection of cryogenic fluids: a comparison between liquid nitrogen and liquid carbon dioxide



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University of Twente • Nov 4, 2019

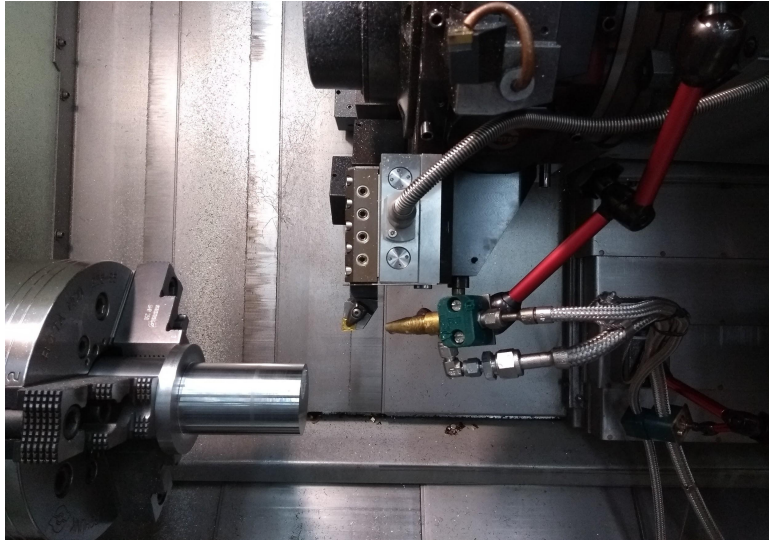
Raphaël Grandeau (R&D engineer) • Paris Innovation Campus



1

Scope of the study

Cryo-machining



Air Liquide - turning of Ti6Al4V with CO2 + air.

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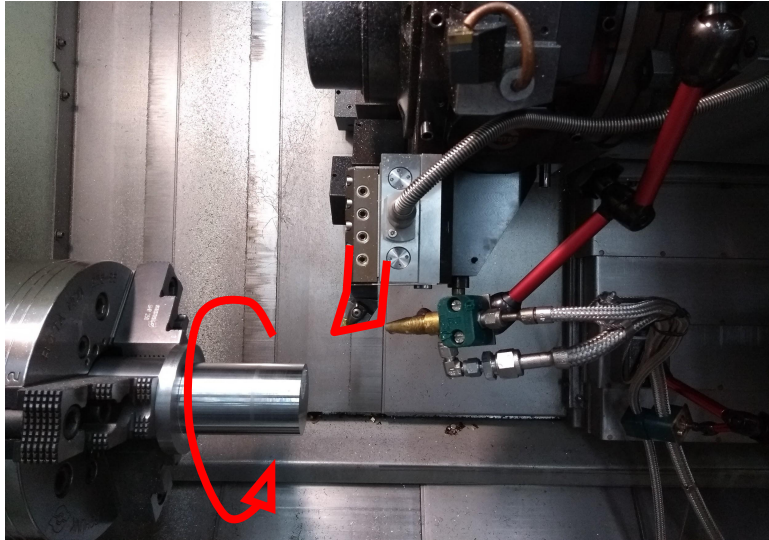
Nov 4, 2019

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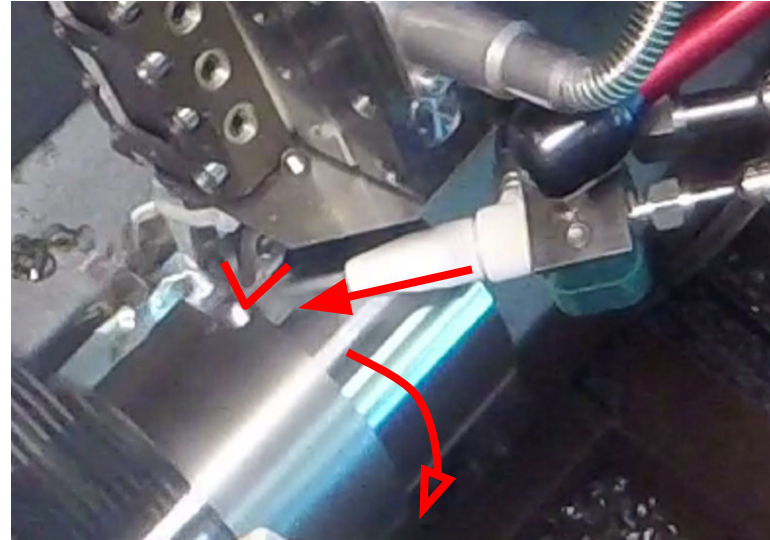
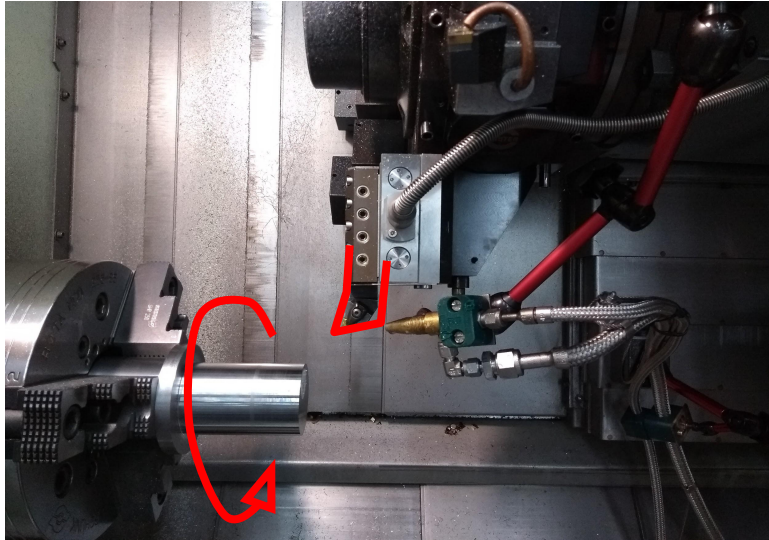
Air Liquide - Paris Innovation Campus
Projection of cryogenic fluids



Cryo-machining



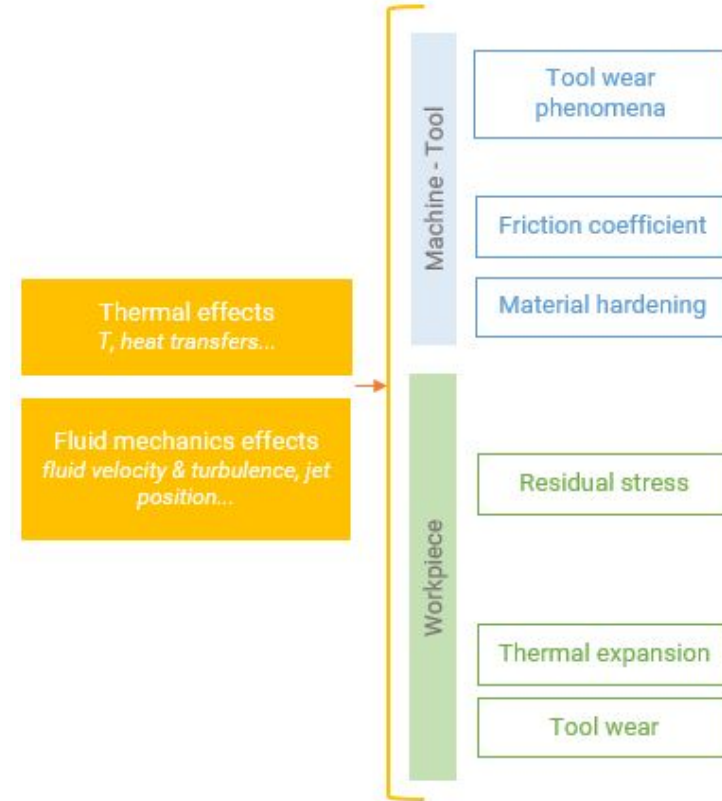
Cryo-machining



Key factors



Key factors



Our scope:

Experimental study of cryogenic jet impingements

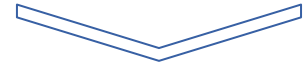
Assumed:

Turning
External jet spraying



Studied:

LIN or LCO₂
Flow rate
Distance

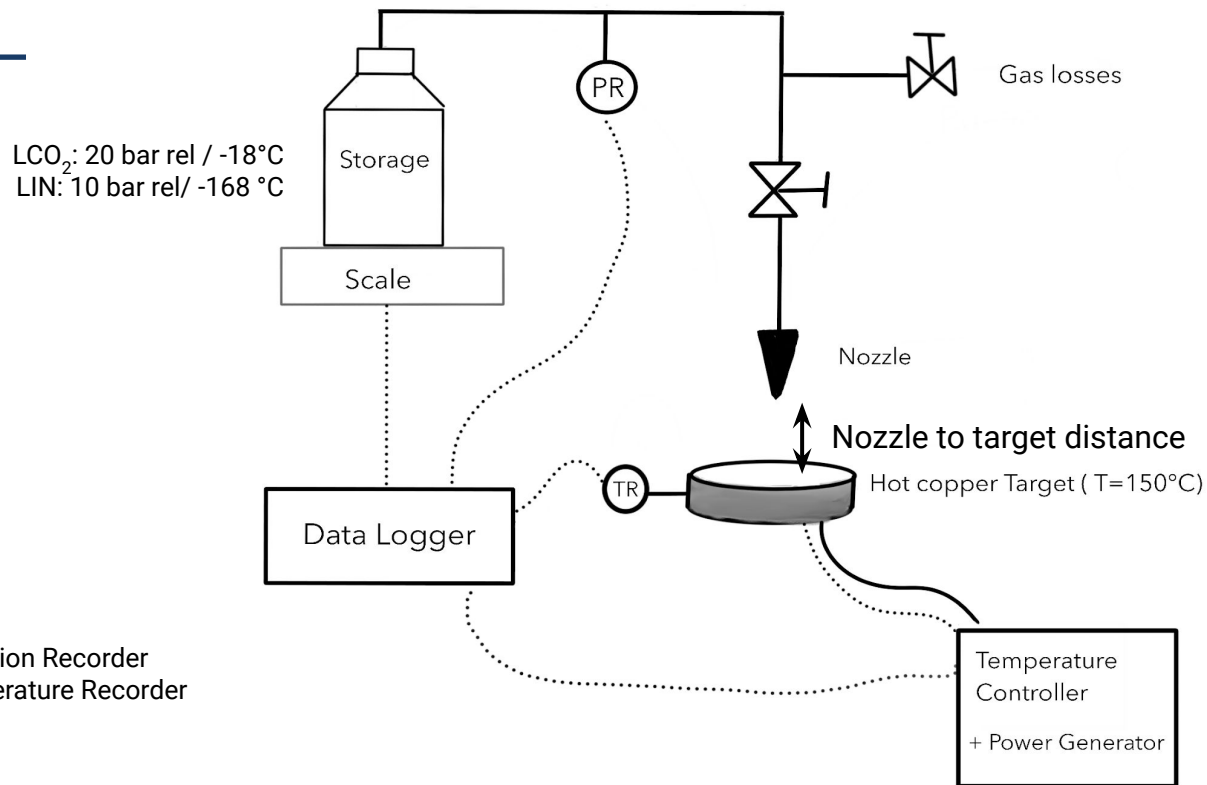


Heat transfers ?

2

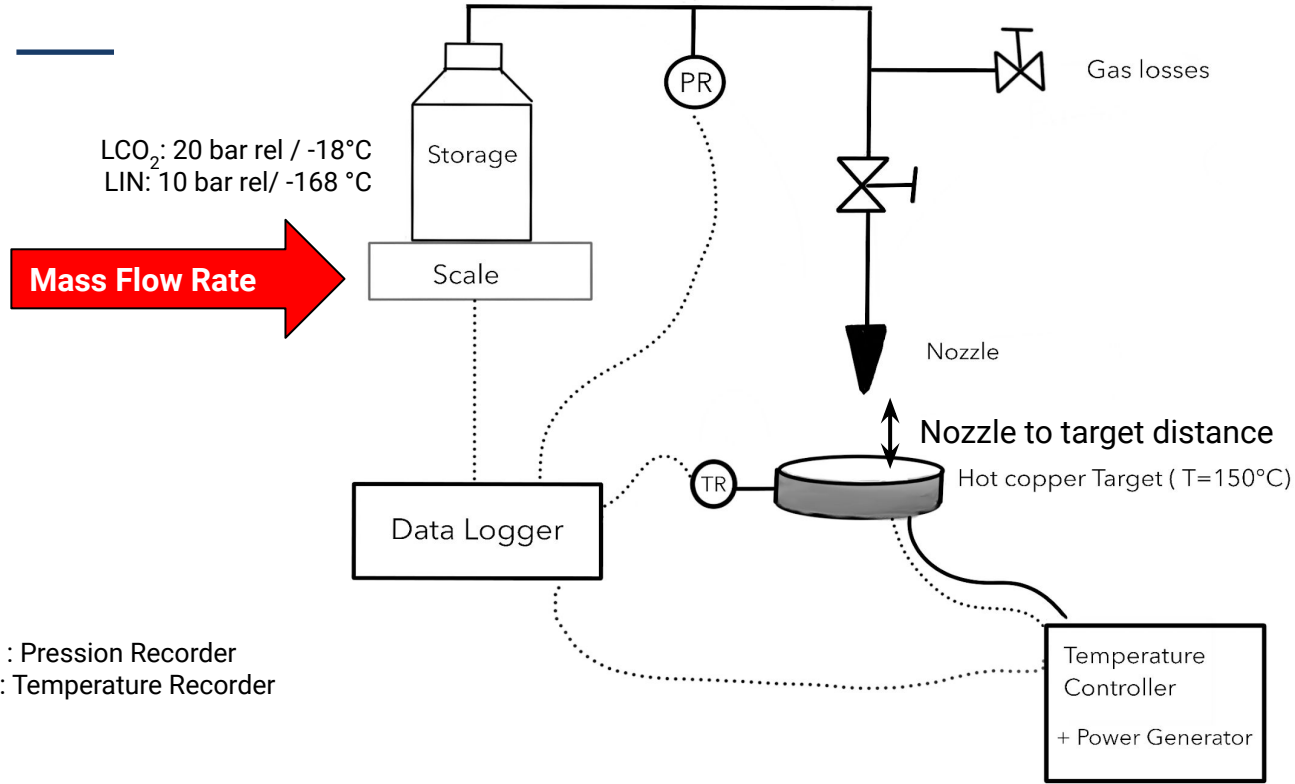
Experimental set-up @ Paris Innovation Campus

Experimental set-up

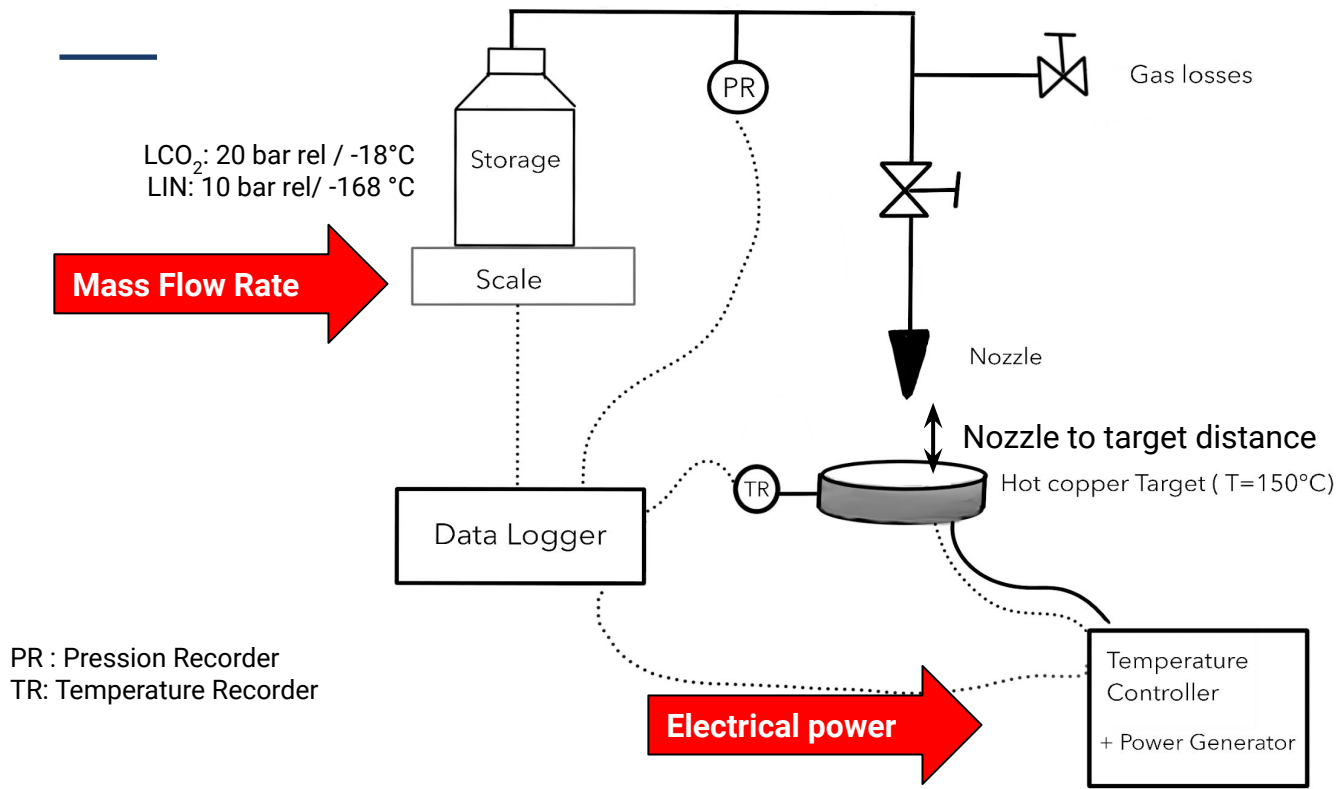


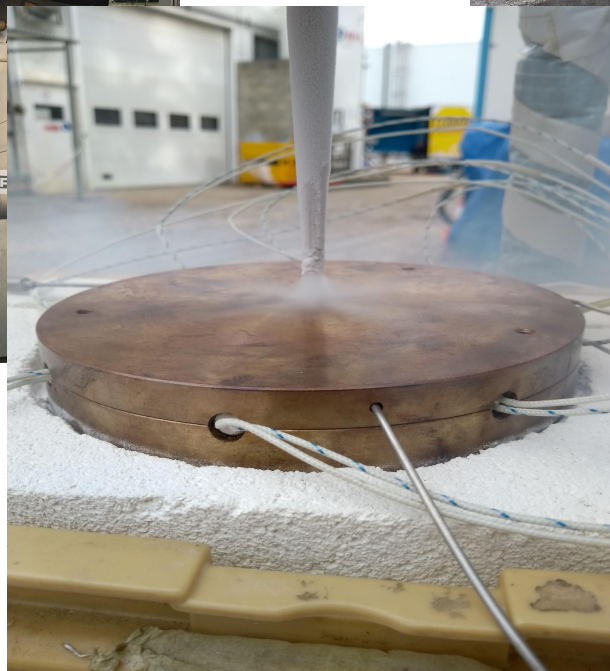
PR : Pression Recorder
TR: Temperature Recorder

Experimental set-up



Experimental set-up





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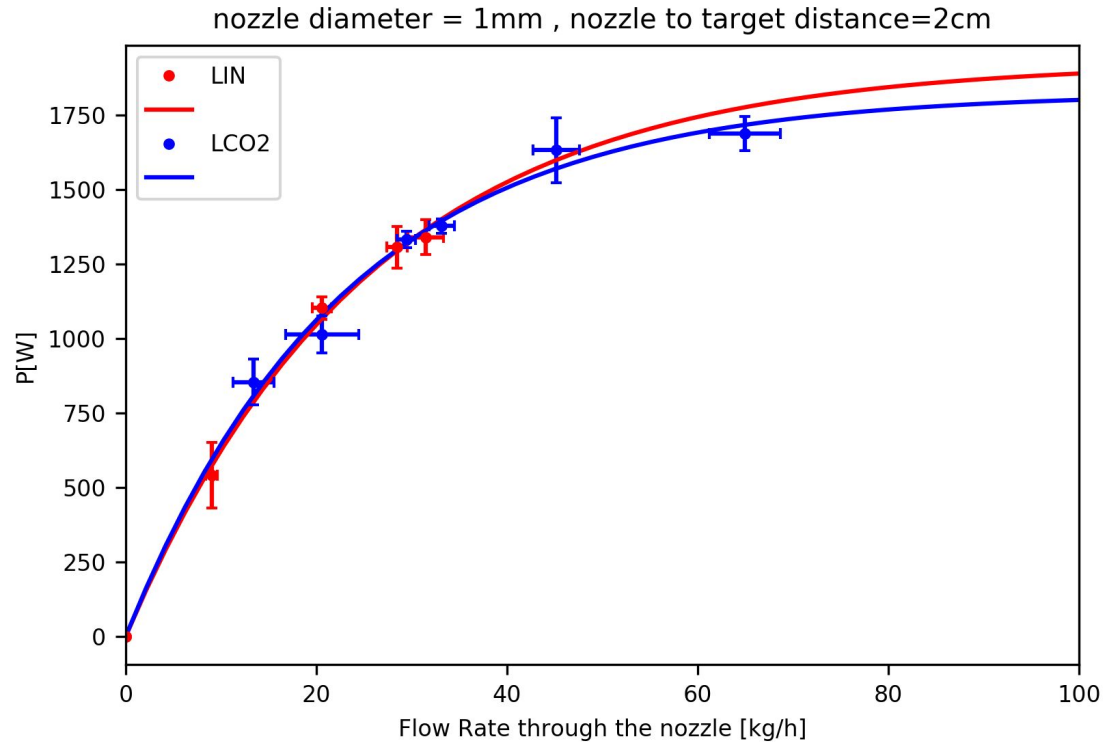
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Projection of cryogenic fluids



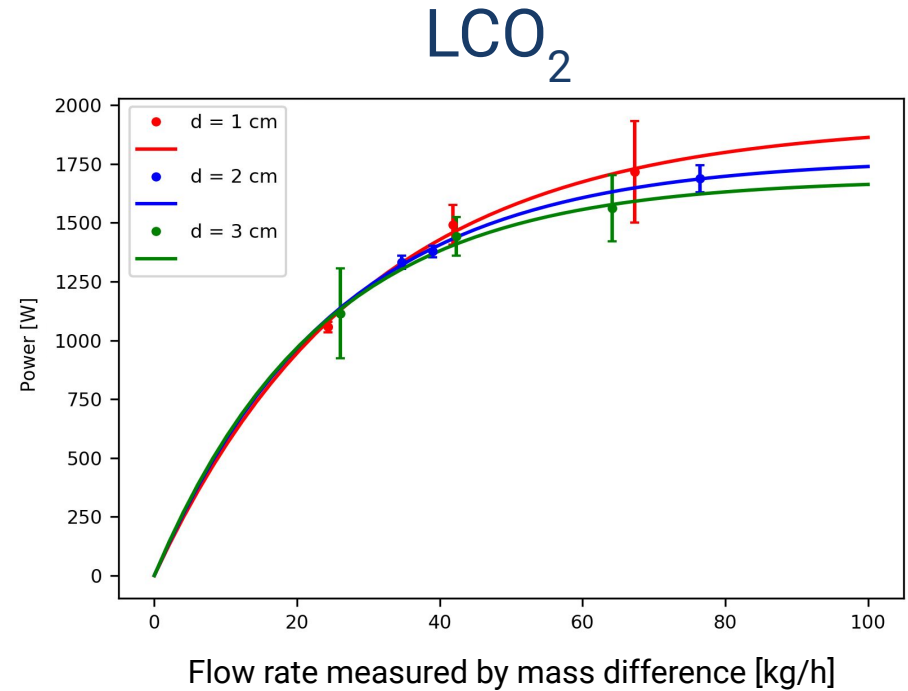
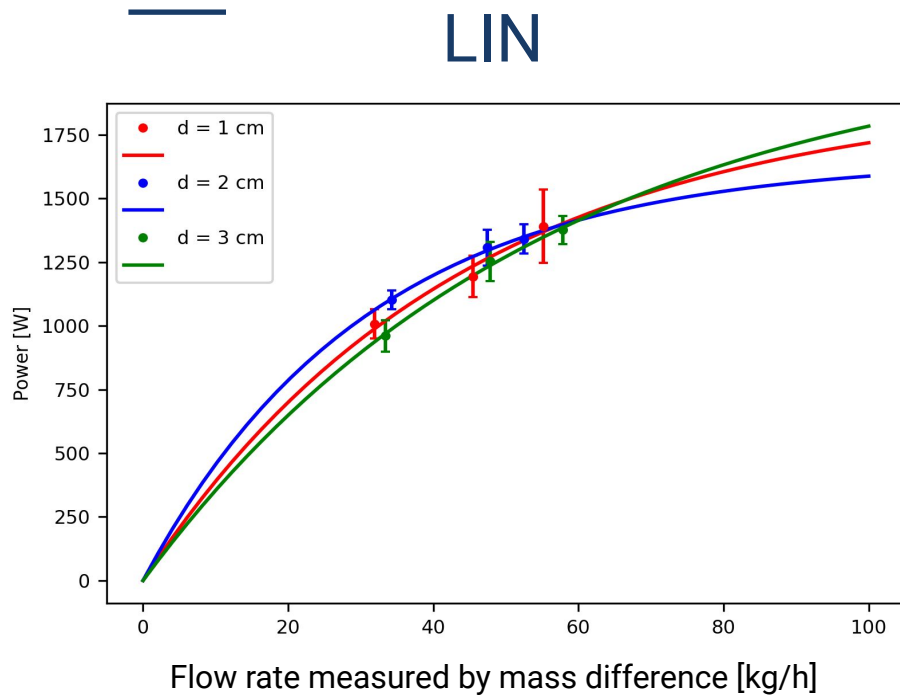
3

Experimental results

LIN vs. LCO₂: Flow Rate Through the Nozzle



Influence of the nozzle to target distance



Conclusion

Assumed:

Turning
External jet spraying



Studied:

LIN or LCO₂
Flow rate
Distance



Heat transfers ?

Thank you



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