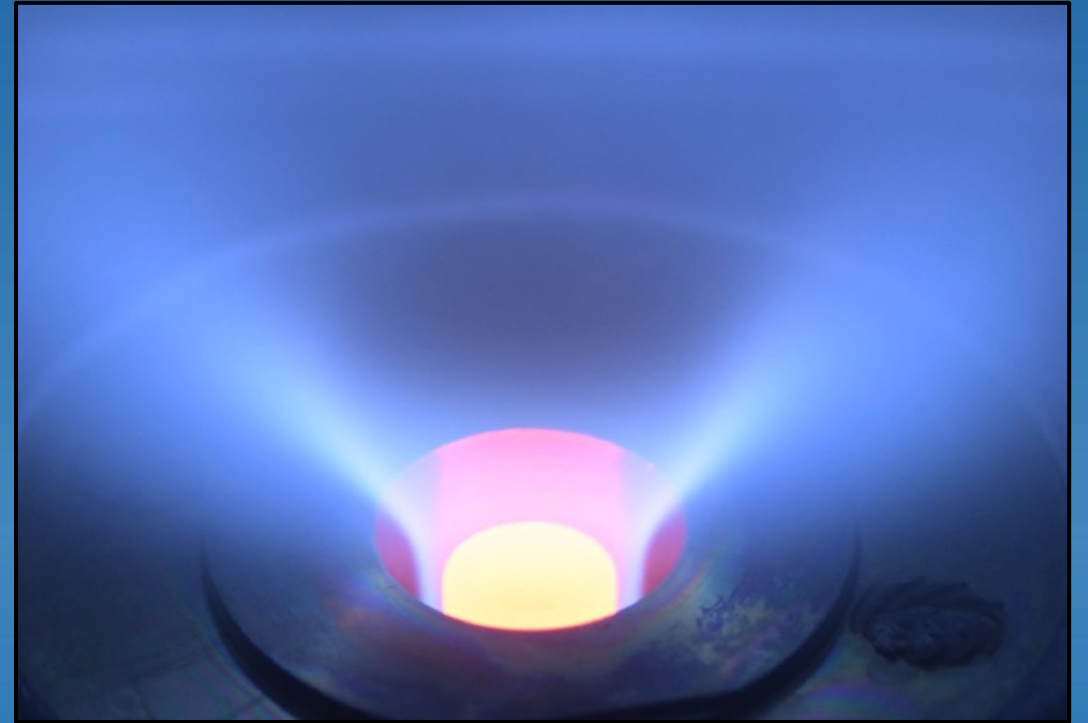




FIRST CAW-H2-CFD WORKSHOP FOR HYLON Toulouse H2 week 2024



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H. PANIEZ, T. RIOU, K. CHAPLET, T. SCHULLER, L. SELLE, T. POINSOT

24/02/2023

IMFT – Institut de Mécanique des Fluides de Toulouse
UMR 5502 – CNRS / Toulouse INP / UT3 – 2 allée du Pr Camille Soula 31400 Toulouse

Introduction : we are here to talk about CFD of H2 / air flames...

Sponsors

- The CAW-H2-CFD workshop is followed by:
 - Pr E. Mastorakos, Cambridge
 - Dr T. Poinsot, IMFT and CERFACS
 - Pr H. Pitsch, RWTH Aachen
- The CAW-H2-CFD exercise is encouraged by the CLEAN AVIATION program of the EU (JF Brouckaerts, C. Elmi) -> presentations of CAW-H2-CFD results planned at CLEAN AVIATION meetings
- The H2 week is paid for by the ERC advanced grant Scirocco of IMFT and CERFACS (cerfacs.fr/scirocco)
- **Two other experiments are available in CAW-H2-CFD:**
 - TU Berlin
 - NTNU Trondheim

TODAY WE DISCUSS ONLY HYLON at 1 bar in Toulouse (IMFT)

Context and recommendations

We are here to discuss science only. Noone got funded to be here.

Not all groups which work on HYLON will present today: this is fine

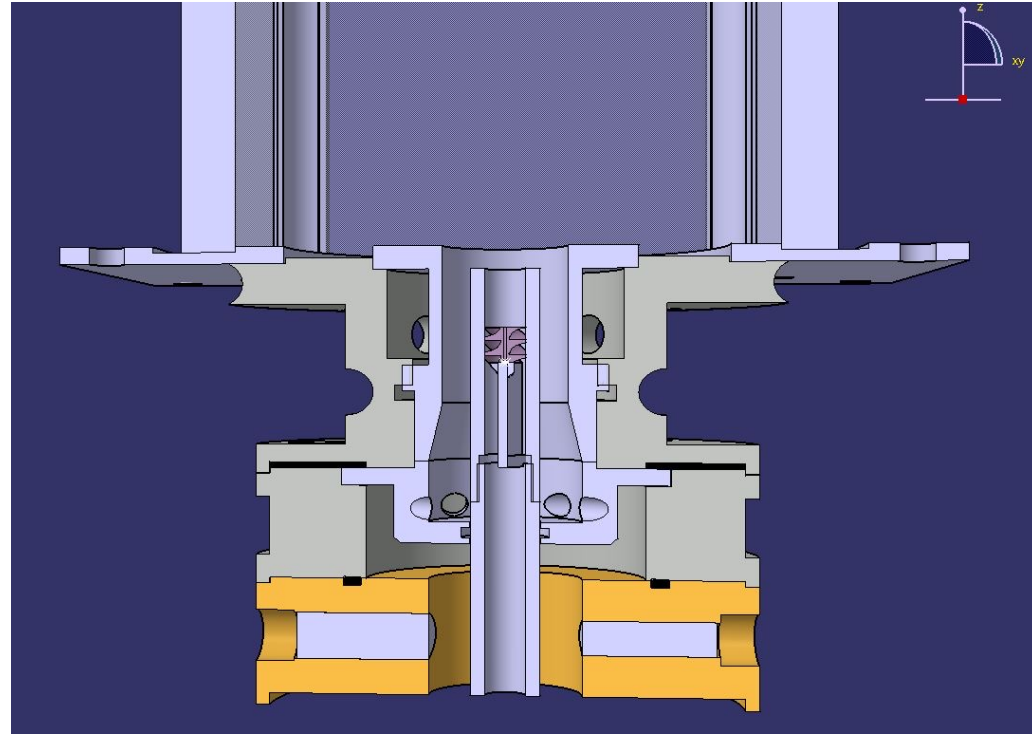
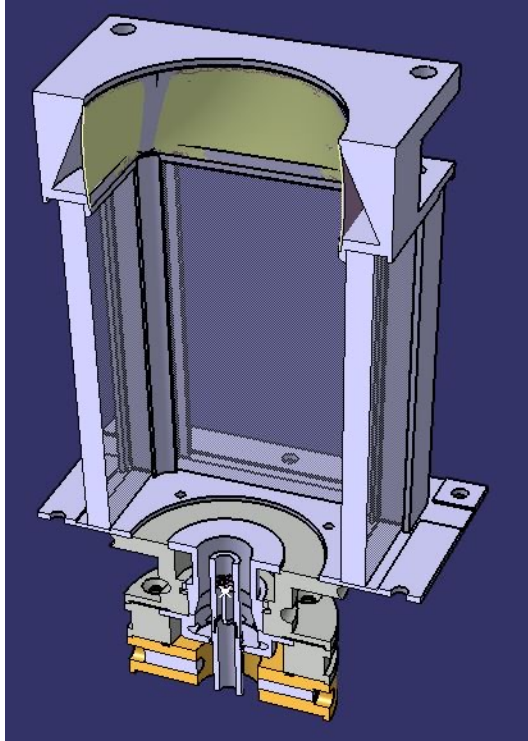
Groups which will present may have not finished all cases: this is fine too

Do not **tell us that you code is good or why, **show** it**

Today's agenda is very crowded but we will have time during the breaks and the full day tomorrow to dive into details: keep long questions for tomorrow

We might ask you for information during the day to prepare tomorrow's discussion: Theo and Kennie are the main investigators in charge of gathering information

HYLON injector

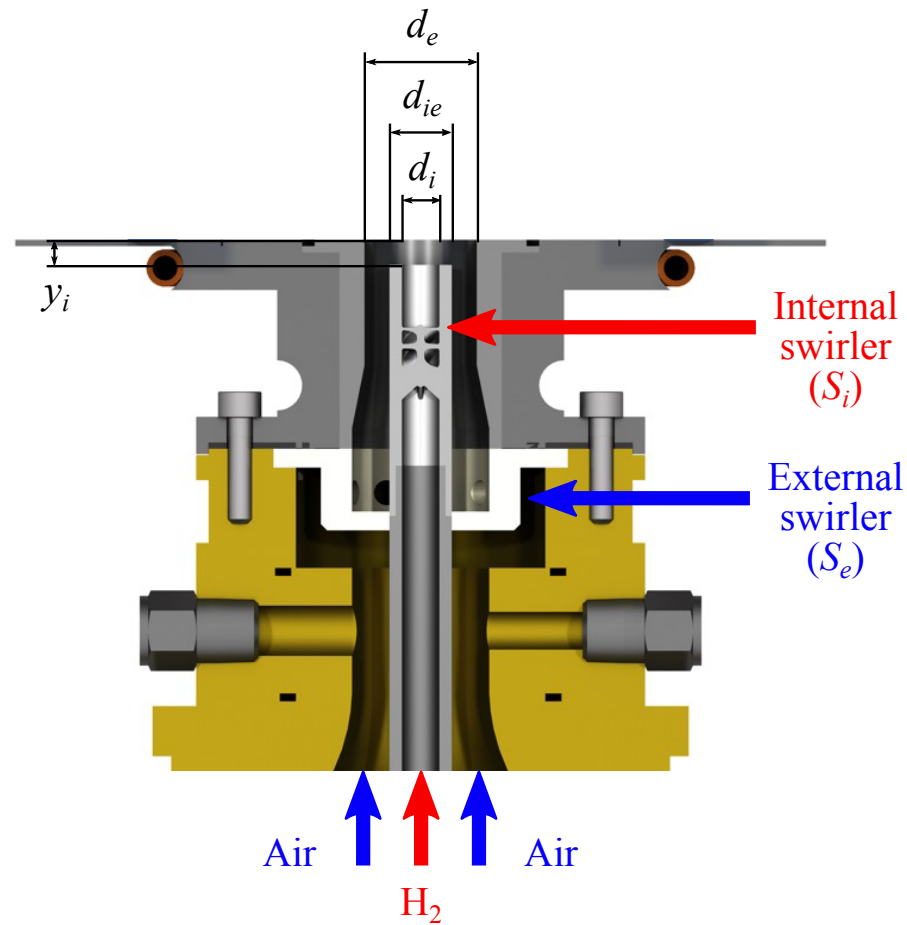


Designed during SCIROCCO ERC. Patented with SHE in 2021

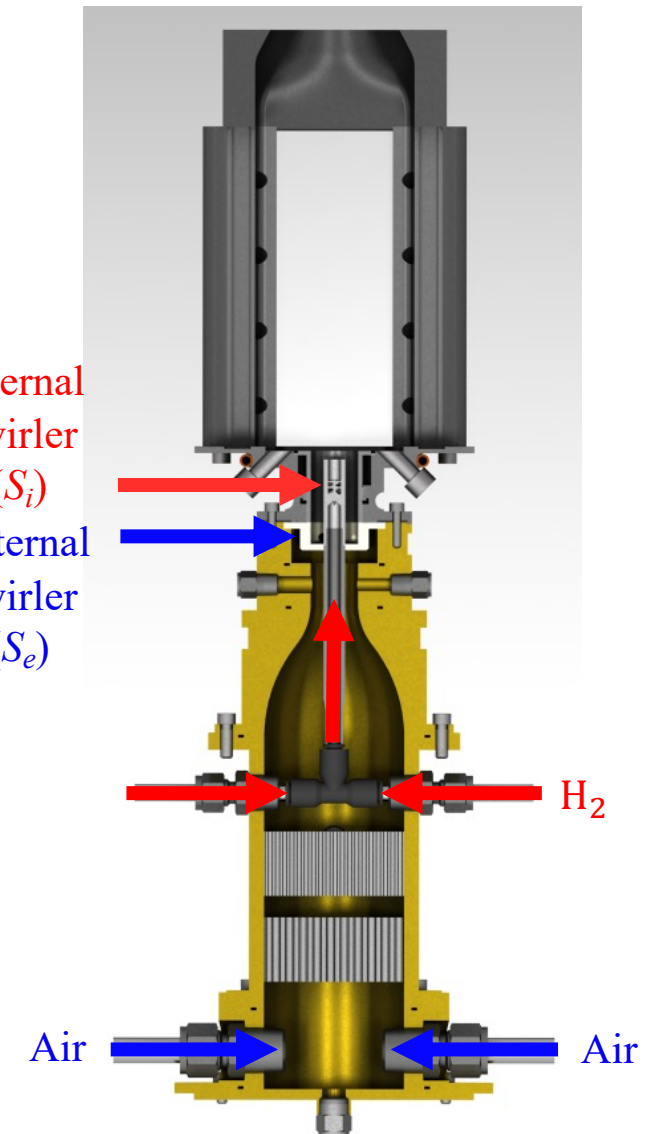
HYLON concept: the dual swirl coaxial injector

HYLON specifications :

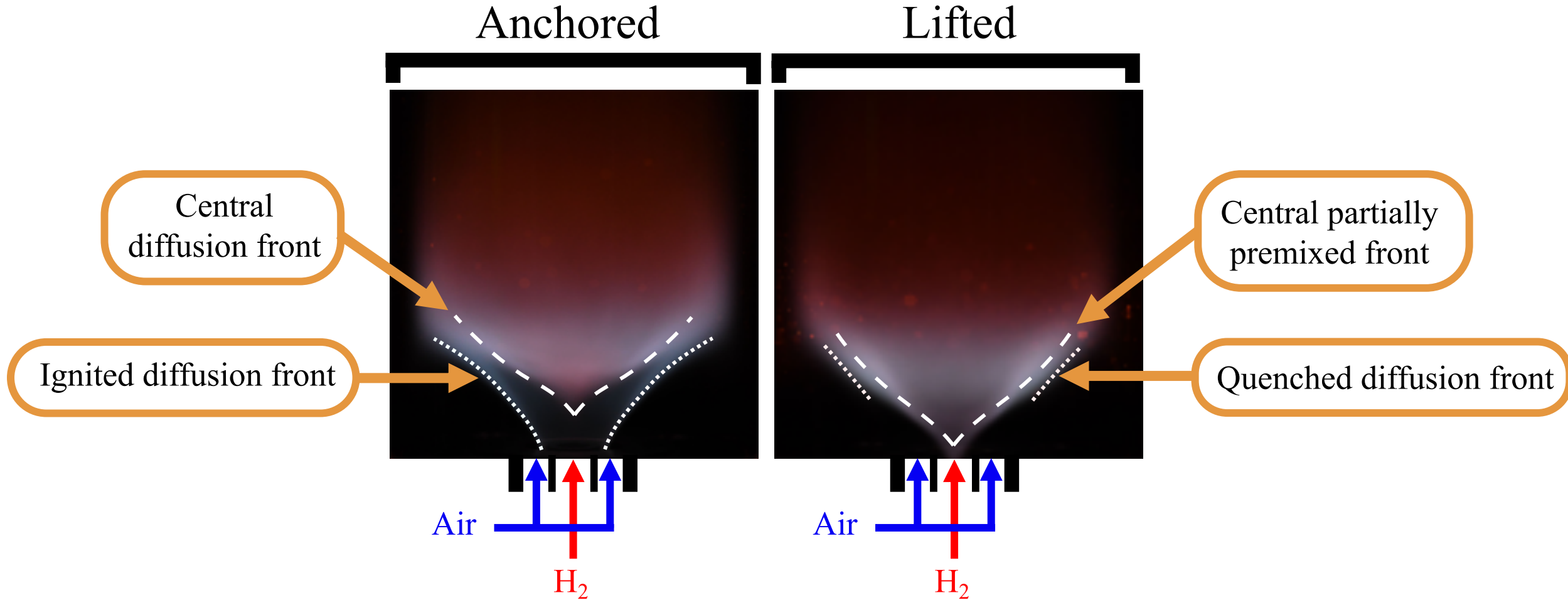
- $d_i = 6$ mm
- $d_{ie} = 10$ mm
- $d_e = 18$ mm
- $y_i = 4$ mm
- $S_i = 0.9$
- $S_e = 0.67$



Internal swirler (S_i)
External swirler (S_e)

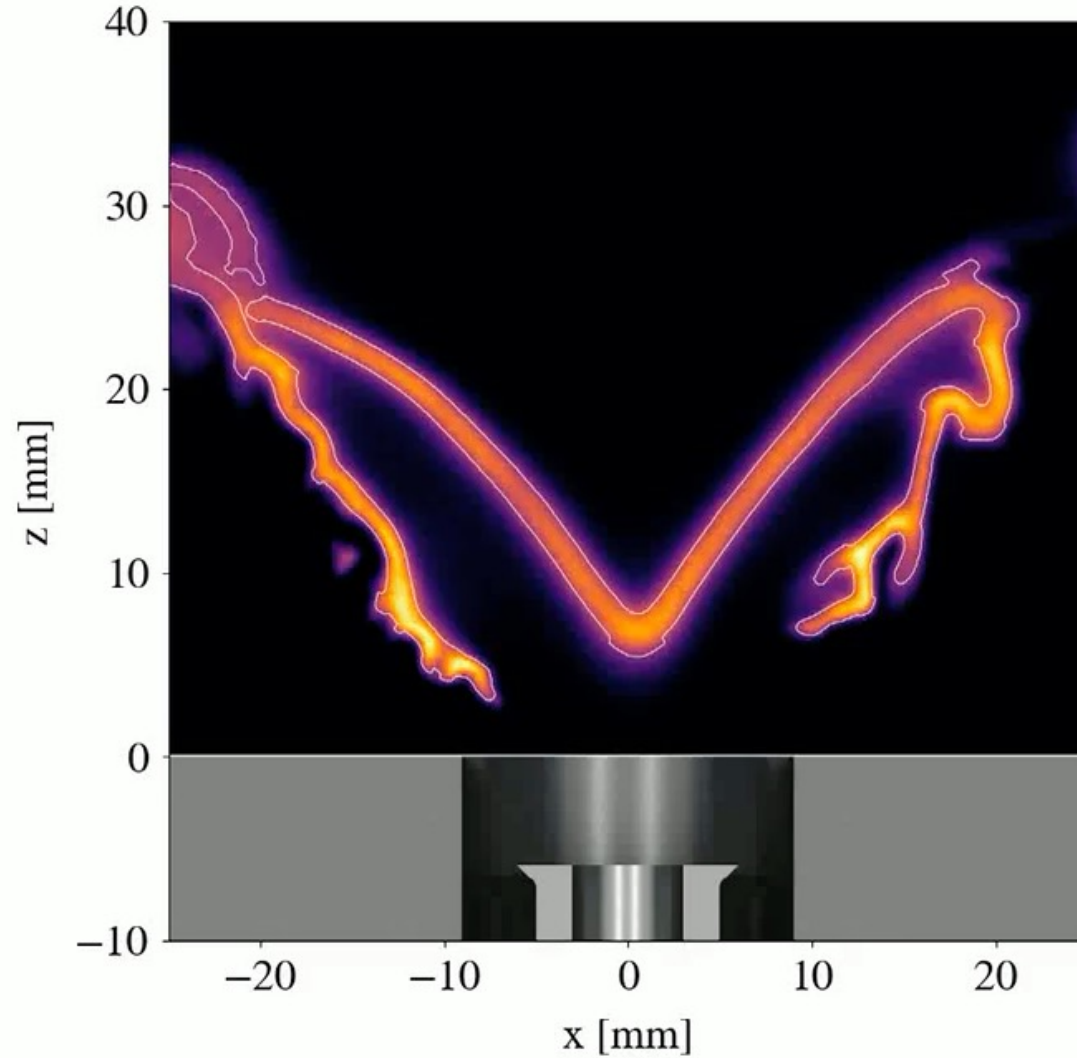


HYLON flames have two topologies: anchored (not good) or lifted (good)



S. Marragou *et al.*, International Journal of Hydrogen Energy 47 (2022)

Blind test: Experiment or simulation ? (courtesy: H. Magnes, IMFT)



HYLON setups

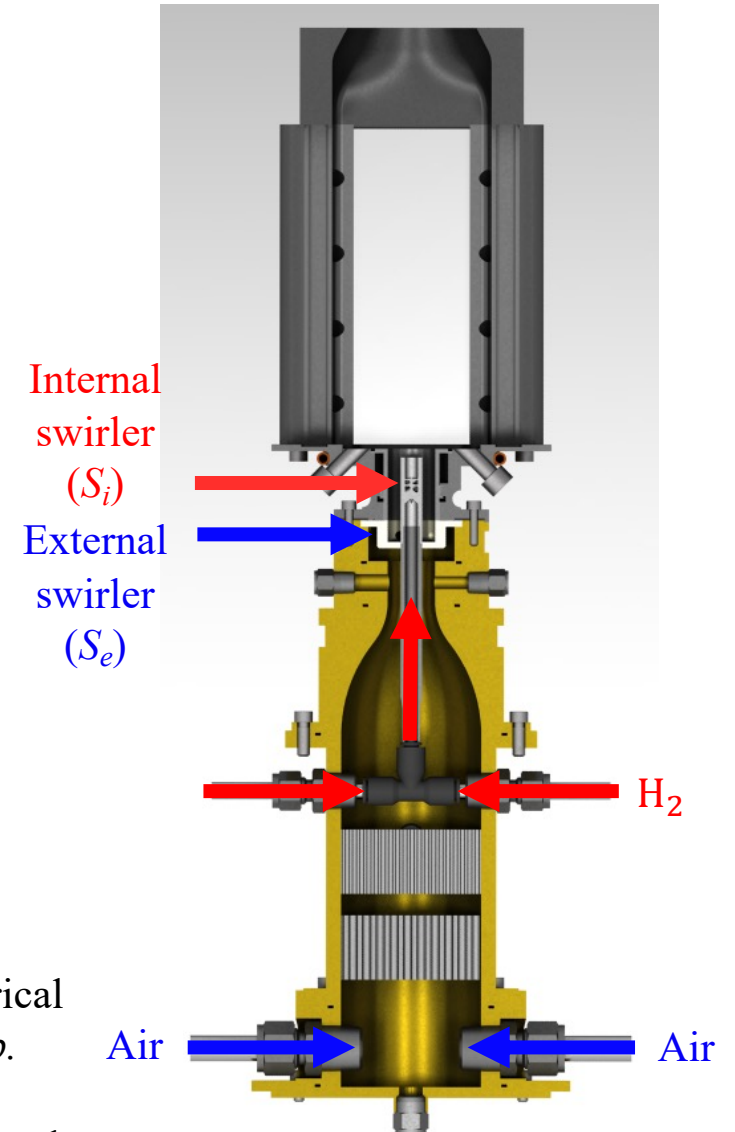
Three versions of HYLON exist and are available:

- HYLON TNF: the one we discuss today.
1 bar at IMFT (papers below and TNF)
- HYLON HP: will start in 2024 at IMFT and operate up to 3 bar
- HYLON KAUST: operates up to 10 bar.
Discussed tomorrow

S. Marragou, H. Magnes, A. Aniello, T. Guiberti, L. Selle, T. Poinsot, T. Schuller. Modeling of H₂/air flame stabilization regime above coaxial dual swirl injectors. *Comb. Flame* 255, 112908, 2023.

Aniello, D. Laera, S. Marragou, H. Magnes, L. Selle, T. Schuller, T. Poinsot. Experimental and numerical investigation of two flame stabilization regimes observed in a dual swirl H₂-air coaxial injector. *Comb. Flame* 249, 112595, 2023.

A. Aniello, T. Poinsot, L. Selle, T. Schuller. Hydrogen substitution of natural-gas in premixed burners and implications for blow-off and flashback limits. *Int. J. Hydrogen Energy*. 2022.



PROGRAM OF DAY

9.00	A. Tyliczszak (CZESTOCHOWA UNIVERSITY OF TECHNOLOGY)
9.20	N. Bertier and J. Ruan (ONERA) -> later
9.40	A. Van-Bruygom, A. Walker and A. Garmory (LOUGHBOROUGH)
10.00	A. Ballotti and A. Andreini (UNIFI)
	<i>10.20 BREAK</i>
10.50	C. Mehl (IFPEN)
11.10	F. Ghioldi and F. Piscaglia (POLIMI)
11.30	I. Mir, S. Zhao and P. Boivin (M2P2 MARSEILLE)
11.50	J. Massey (CAMBRIDGE)
	<i>12.10 LUNCH AND PHOTOGRAPH IN CASTEX BUILDING</i>
14.00	L. Palanti and L. Mazzei (ERGON RESEARCH)
14.20	W. Jones (IMPERIAL COLLEGE)
14.40	M. Vilespy (IMFT), A. Aniello (IMFT) and N. Rouland (CERFACS)
15.00	S. Dillon (EM2C), V. Moureau (CORIA) and R. Mercier (SAFRAN TECH)
	<i>15.20 BREAK</i>
15.50	D. Bessette, S. Patil (ANSYS), K. Vasudevarao and Y. Zhang (GE)
16.10	V.R. Hasti (NORTH CAROLINA STATE) -> later
16.30	S. Nambully, R. Kulkarni and D. Lee (CONVERGENT SCIENCE)
16.50	Cross comparison of results, future work, presentation at the TNF workshop in Milano.

15 minutes talk
5 minutes questions

30' break to discuss in the morning
1h50' lunch to argue at noon
30' break to fight in the afternoon

Tomorrow, we'll talk specifically about high pressure, NO_x, ignition, thermoacoustics, etc.
Let us focus today on the existing HYLON data at 1 bar.



Thank you for
your attention

Any question, please contact us at martin.vilespsy@imft.fr