PRESLHY

WP3 – Release and mixing: UU update

2nd Project meeting, Paris, 17th October 2018

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Pre-normative REsearch for Safe use of Liquid HYdrogen

Karlsruher Institut für Technologie

Air Liquide

HEALTH & SAFETY LABORATORY

hySafe
INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY

INERIS

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Pro-Science

Ulster University

WARWICK
THE UNIVERSITY OF WARWICK

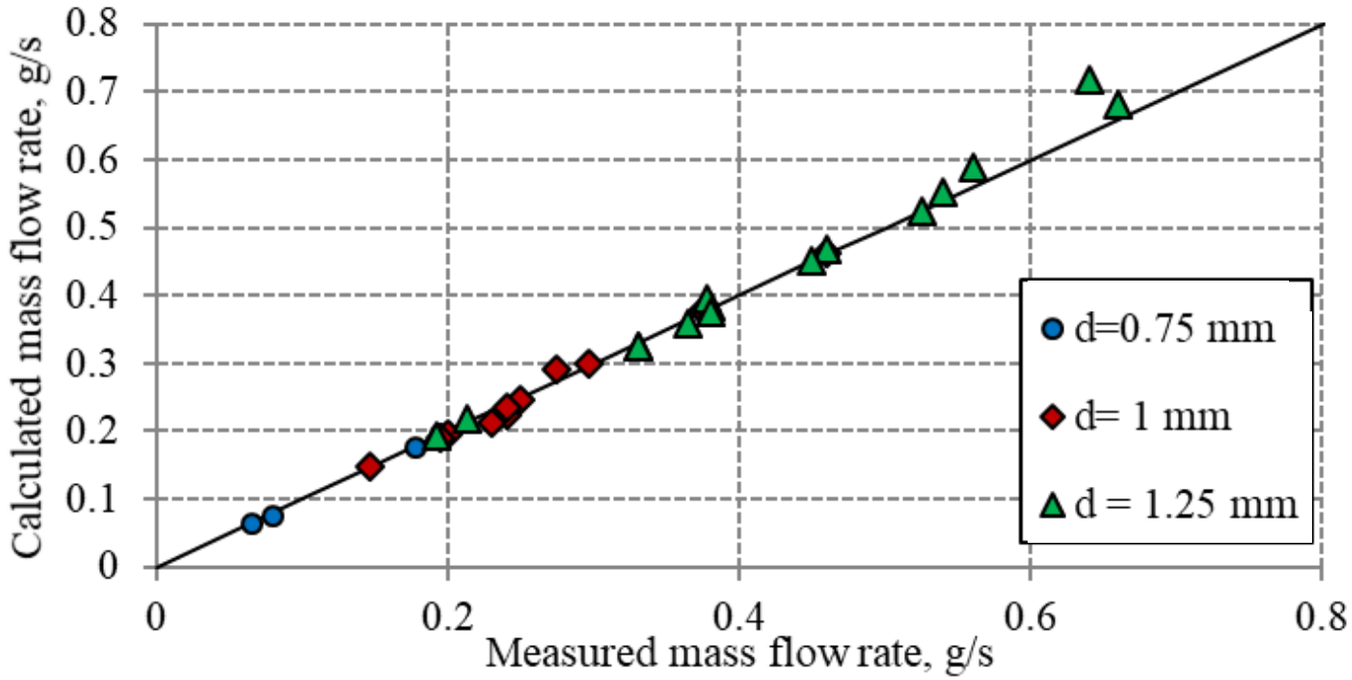
WP3 - Activities plan

- Analysis of the applicability of notional nozzle theory and volumetric release source concept for prediction of concentration decay in cryogenic under-expanded jets:
  - Low pressure releases (P < 10 bar)
  - High pressure releases (P > 10 bar): E3.1-KIT and previous experiments
- Perform simulations of experiments on multi-phase releases:
  - Contemporary engineering tool for evaluation of mass flow rate from LH2 tank
  - Inclusion of conjugate heat transfer
- Studies on formation of cryogenic mixtures of H2/O2 and H2/air (connected to WP4-Ignition)

Cryogenic hydrogen releases (1/2)

The notional nozzle theory developed at Ulster was employed to model cryogenic and warm hydrogen releases by SNL from:

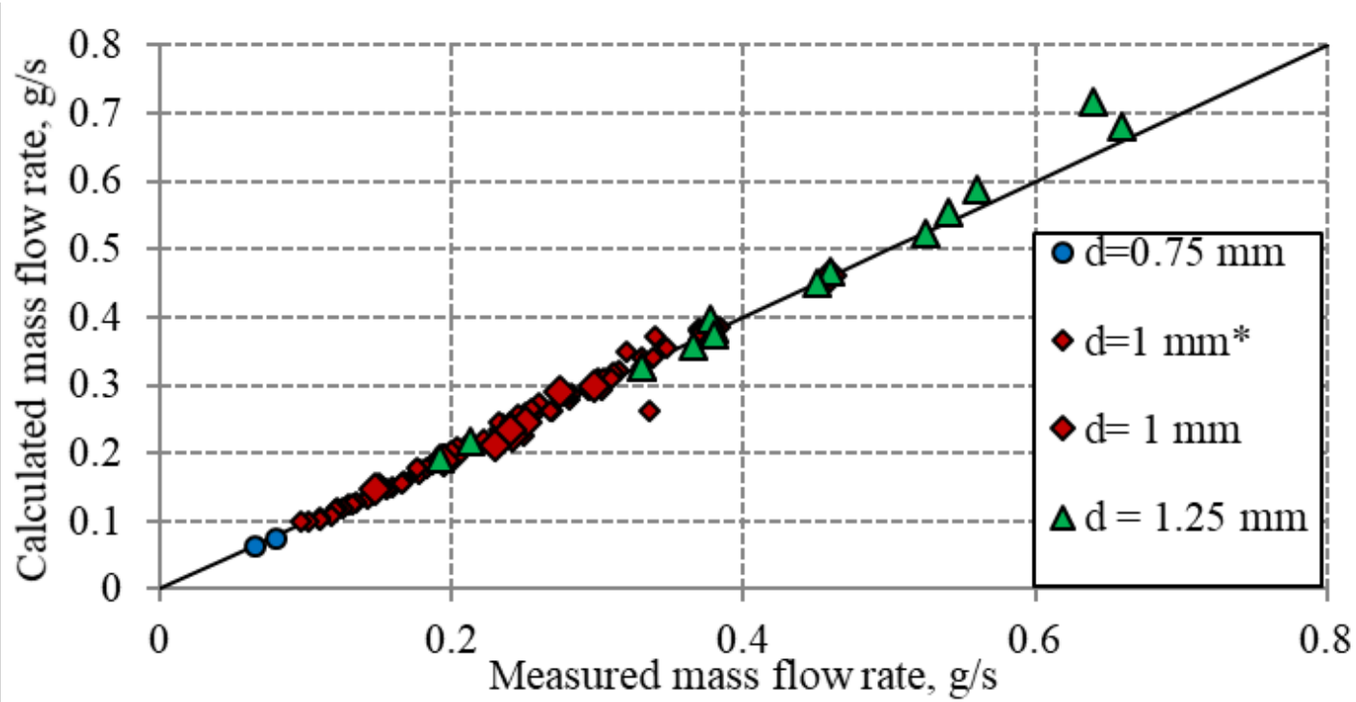
- Storage pressure = 2 - 6 bar abs
- Storage temperature = 48 - 295 K
- Orifice diameter = 0.75, 1.00, 1.25 mm



Cryogenic hydrogen releases (1/2)

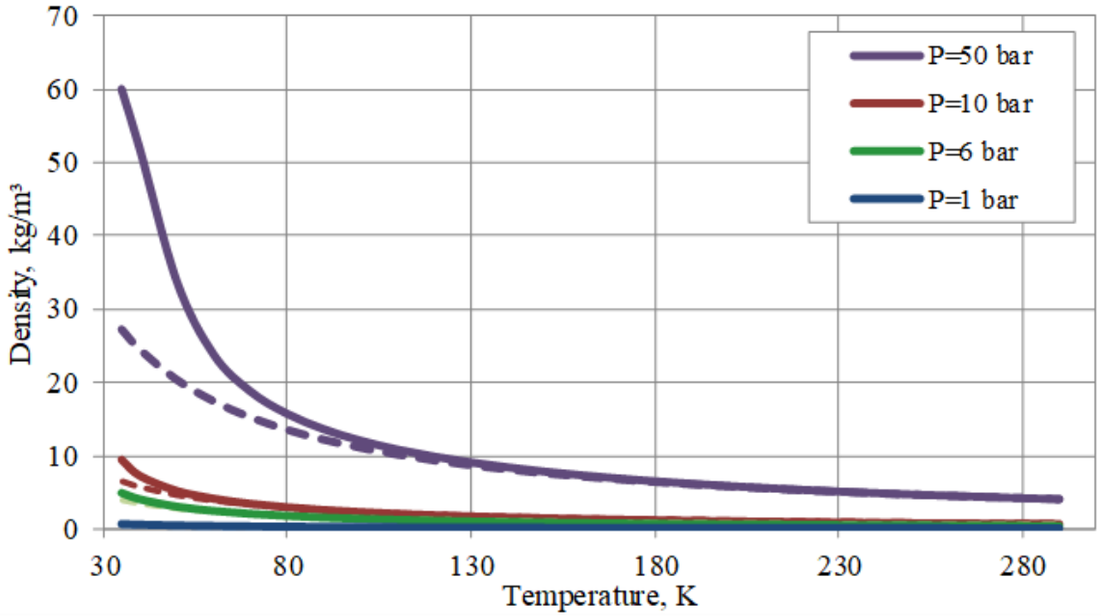
The notional nozzle theory developed at Ulster was employed to model cryogenic and warm hydrogen releases by SNL from:

- Storage pressure = 2 - 6 bar abs
- Storage temperature = 40 - 295 K
- Orifice diameter = 0.75, 1.00, 1.25 mm



Cryogenic hydrogen releases (2/2)

Validity of Abel-Noble equation of state (EOS) for cryogenic releases: Abel-Noble EOS (--) is compared to NIST EOS (—).



- Deviation is negligible for the range of pressure under study (2-6 bar) whereas it becomes significant as the pressure increases.
- Extension of the study to prediction of concentration decay for low pressure releases and modelling of high pressure cryogenic releases.