



# New artificial teats to improve goat milking device laboratory tests

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# Context : goat udders

- **Huge diversity** for udder morphologies:

- Udders: volumes, attaches, ...
- Teats: lengths, diameters, shapes, angles,...
- Teat canal (length and diameter) and sphincter (diameter et strength), ...



Short and cylindrical



Long and cylindrical

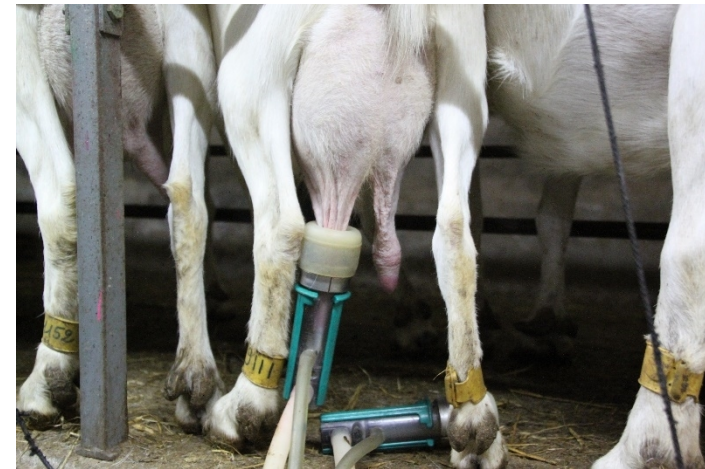


Globular



Conical

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<https://idele.fr/detail-dossier/anatomie-et-physiologie-de-la-mamelle-caprine>

# Contexte : goat milking devices

- **Diversity quite importante** for used milking clusters:

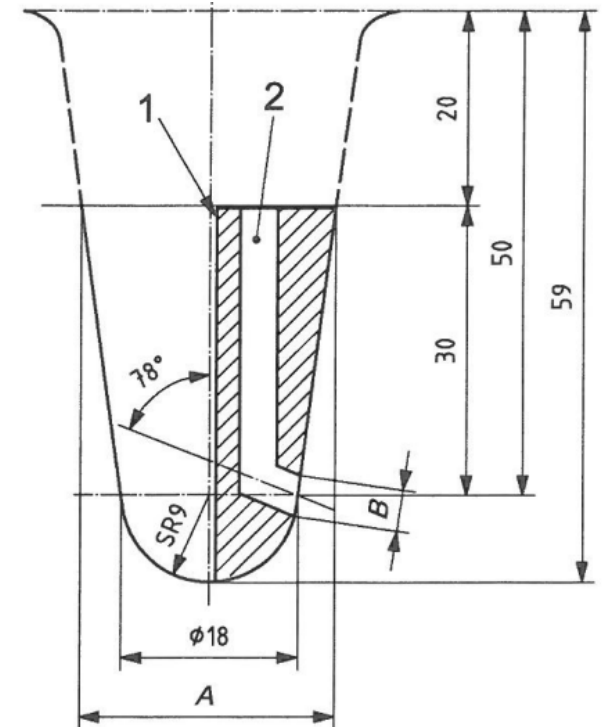
- Brands: well known manufacturers, ... and others...
- Milking cluster global design:
  - Automatic teat-cup valve(s) or not,
  - Automatic shutt-off valve or not,
  - Claw or not,
  - Model, from simplest to more complex or « specialized »
  - Air vent(s) position/fonction,
  - ...
- **Milking liners:** material (rubber vs silicone), shape, pliancy, ...
- State of cleanliness and maintenance...
- ... and appropriated use... or not !



<https://idele.fr/detail-article/faisceaux-trayeurs-caprins>

# Contexte : too restrictive standards? ...

ISO 6690:2007 (Milking machine - Mechanical tests)  
offers only 1 **HAT** (Hard Artificial Teat)  
and 2 **milk flows** (0,8 and 1,3 L/min)  
for **milking devices characterisation tests**  
and teat/liner interactions studies!



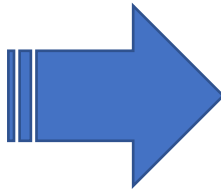
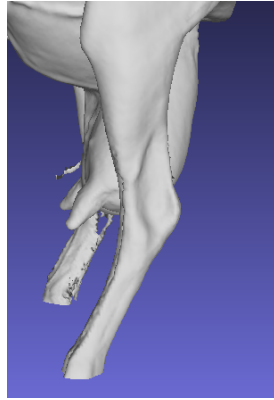
ISO 6690:2007 extract

# Witch type of AT (Artificial Teat)?

following the valuation of measurements carried out by Maëline DESPINASSE (trainee 2021 DUT Biological Technologies Angers) on Le Pradel and INRAe Bourges herds

Teat morphologies (in mm)	Length	Diameter (at upper side)	« Reactive thickness »
<i>Median</i>	60	35	15
<b>Average</b>	60	38	15
<b>Small</b>	40	30	14
<b>Large</b>	90	55	16

# SAT (Soft Artificial Teat) conception...

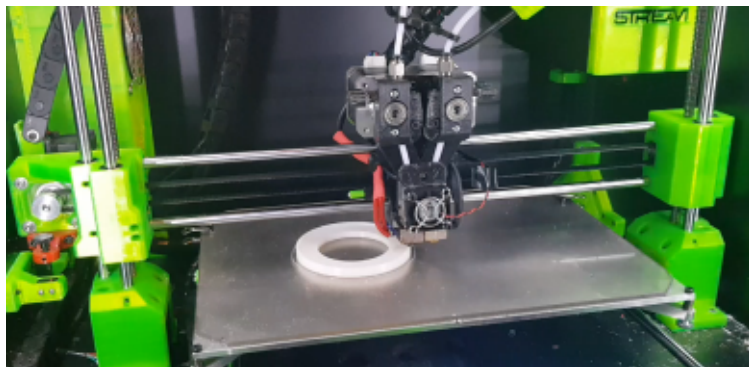


Molds and counter-molds  
3D designed and printed  
based on actual dimensions

Udder characterisation  
on 2 experimental farms  
(INRAe Bourges and Le Pradel Agricultural school)  
including 3D devices



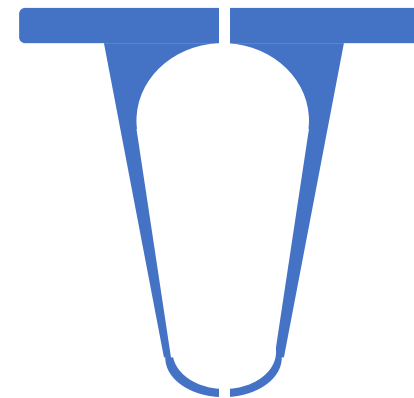
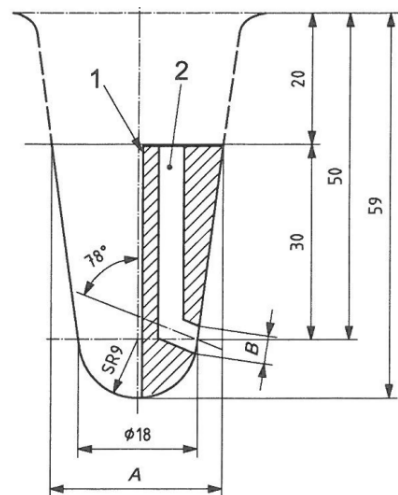
Silicone casting  
with selected hardnesses



SAT finalized  
ready to use  
on artificial udder



# AT evolution



**HAT**

Hard Artificial Teat

**SAT**

Soft Artificial Teat

**ASAT**

« Anatomical »  
Soft Artificial Teat

# AT spectrum (prototypes)



**HAT**

**Medium**

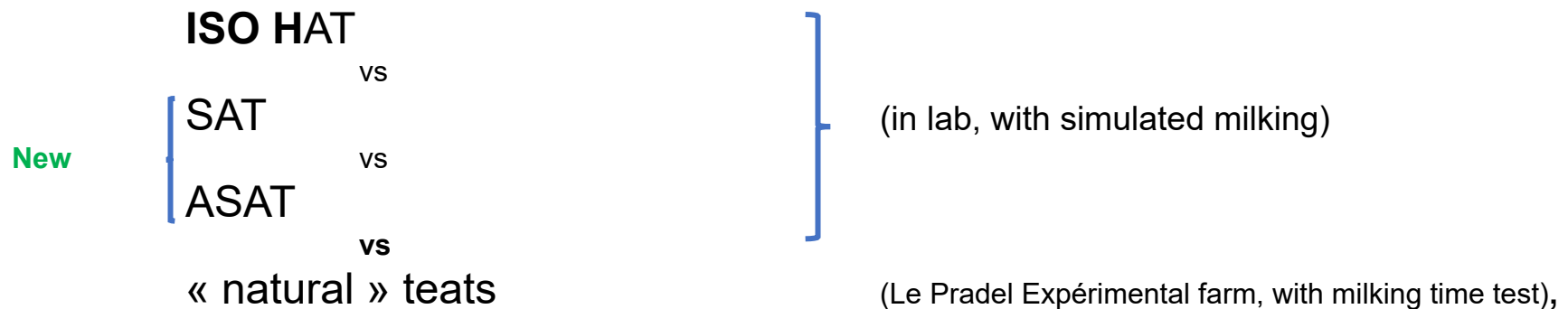
**SAT  
Small**

**Huge**



# Exploratory tests on teat/liner couple

## Comparative trials



## for 2 liners:

- ⇒ DeLaval G50+, used on the 2 goat experimental farms,
- ⇒ GEA TopFlow, supposed to be contrary.

# Lab test

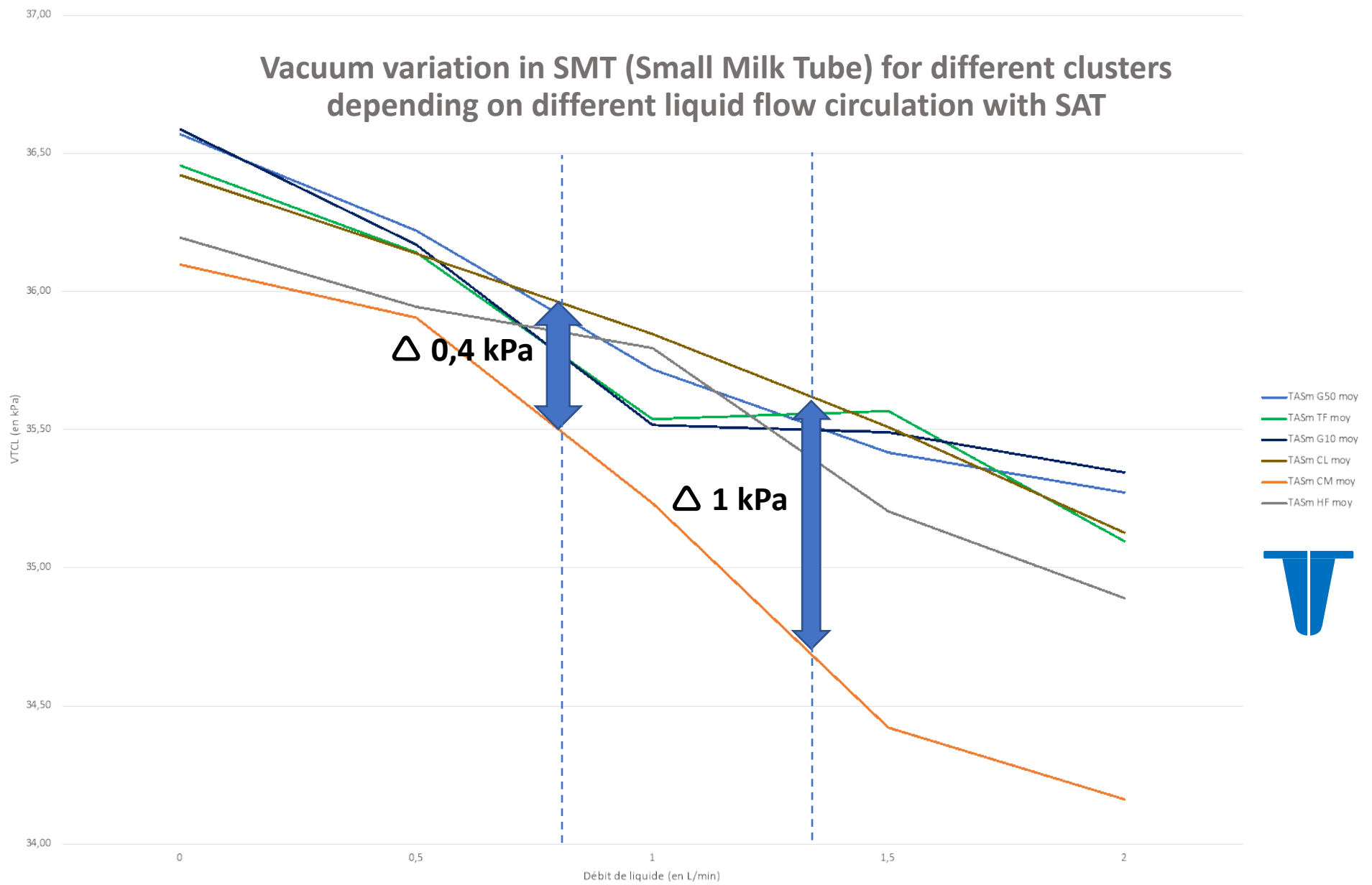




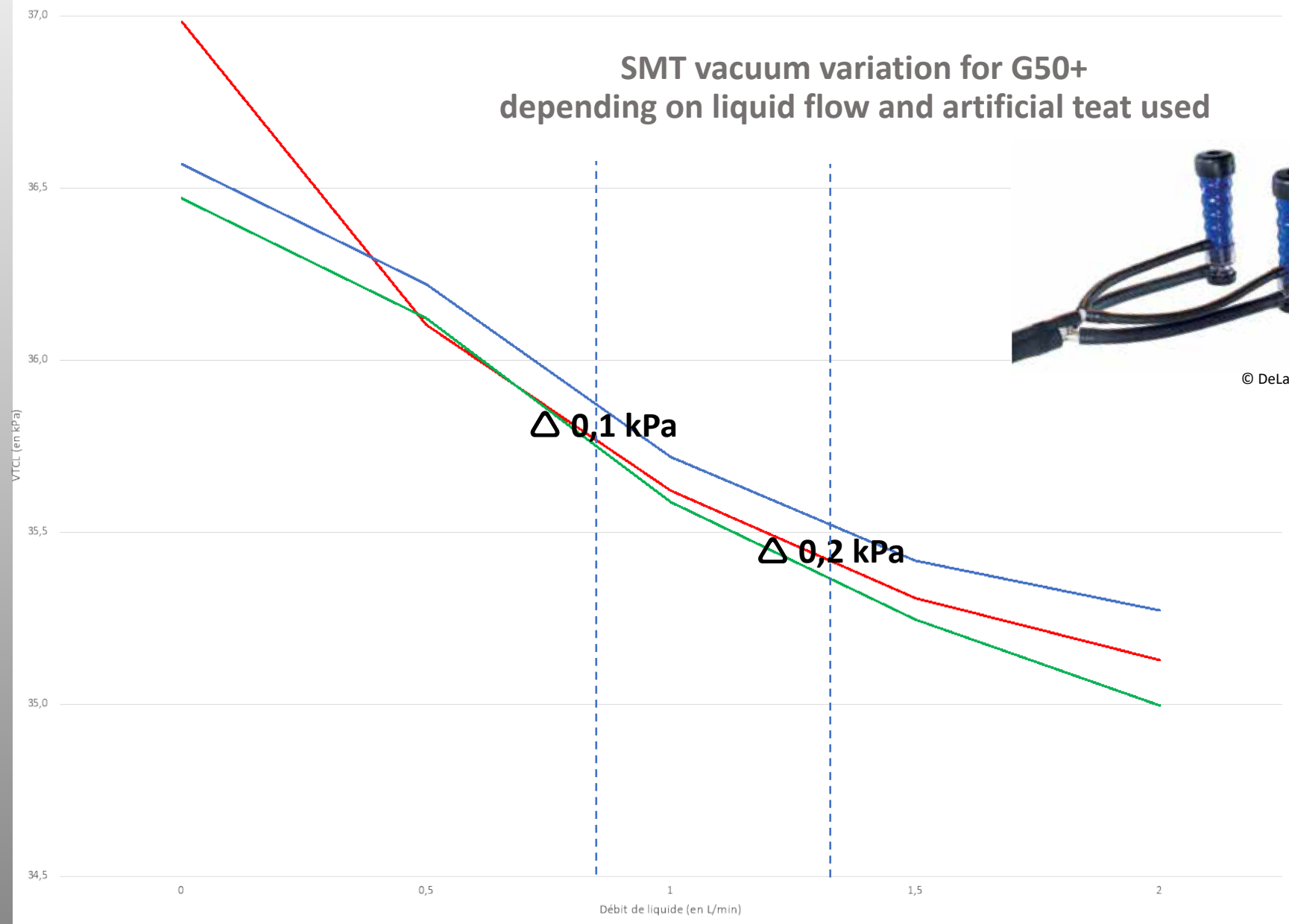
# First results

Different characterisations...

### Vacuum variation in SMT (Small Milk Tube) for different clusters depending on different liquid flow circulation with SAT



### SMT vacuum variation for G50+ depending on liquid flow and artificial teat used

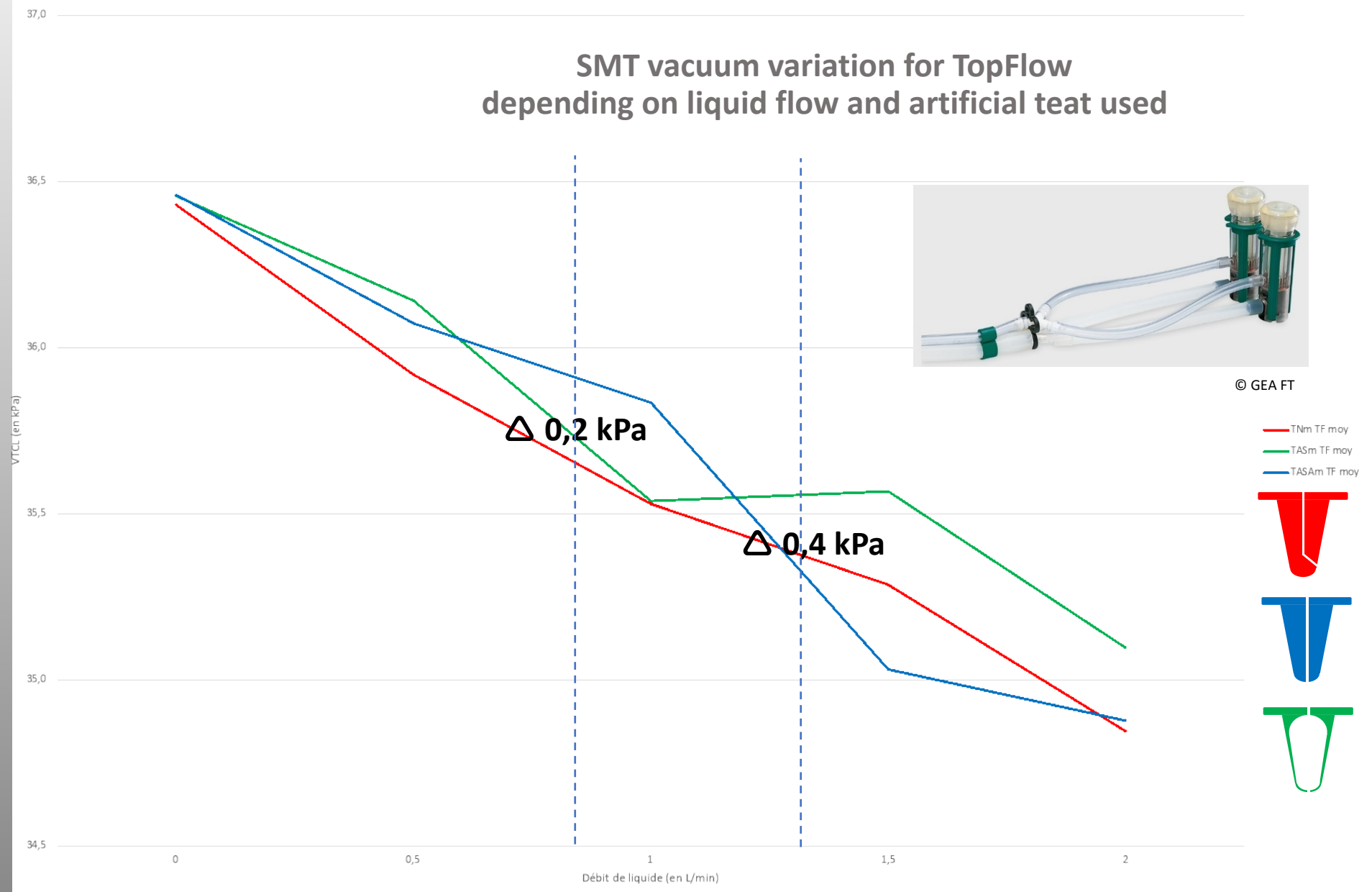


© DeLaval

- TNm G50 moy
- TASm G50 moy
- TASAm G50 moy



## SMT vacuum variation for TopFlow depending on liquid flow and artificial teat used





# Prospects

- Lab test finalisation

(ASAT « small » and « huge »),

- Global analysis for lab results,
- Cross analysis with on field results

(Le Pradel experimental farm, DeLaval G50+ vs GEA TopFlow)



# Thanks for your attention!

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