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Work package 1
Production

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WP1 - Production

WP1 - Production

- General control
  - Egg collection
  - Register; feed amount, survival and avg. larvae size
- Assessing substrates
  - Wet
  - Dry
- Optimizing feed compositions
  - Additives
  - Probiotics
  - FCR

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WP1 - Production

- Optimizing temperature
  - Larvae for growth
  - Adults for fecundity
  - Larval survival
- RH
  - Hatching rate
  - Larval survival
  - Larval growth

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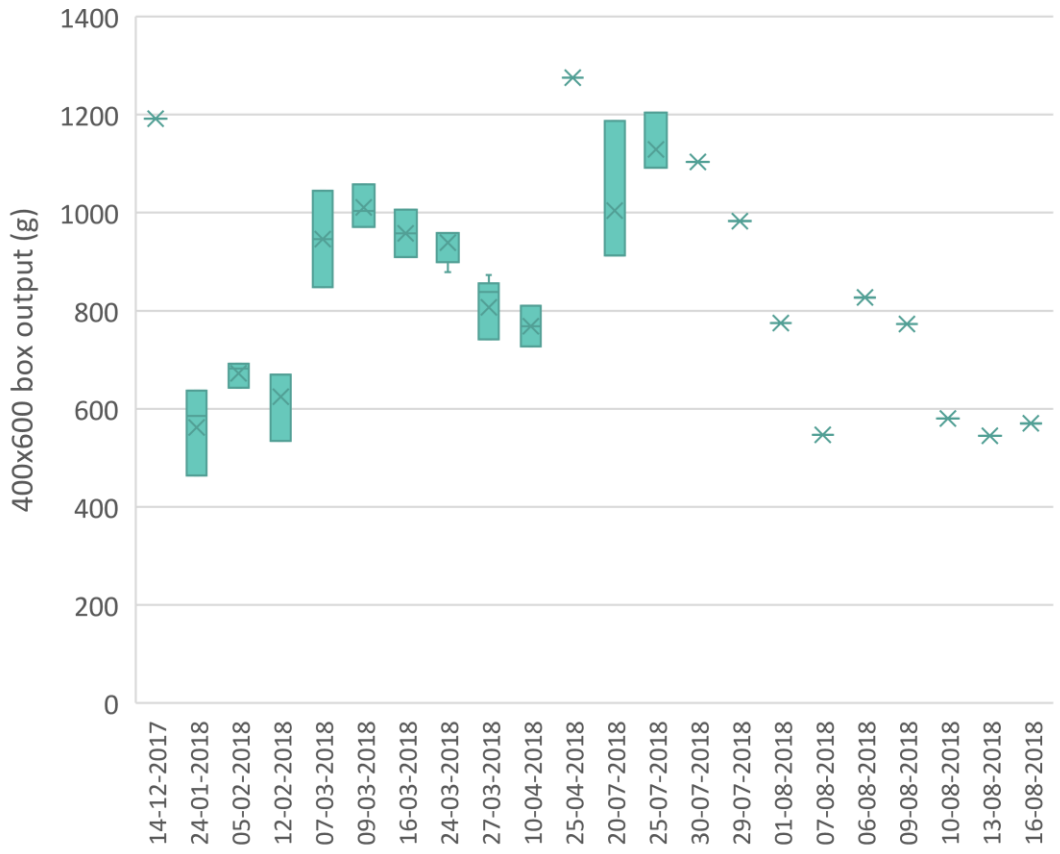
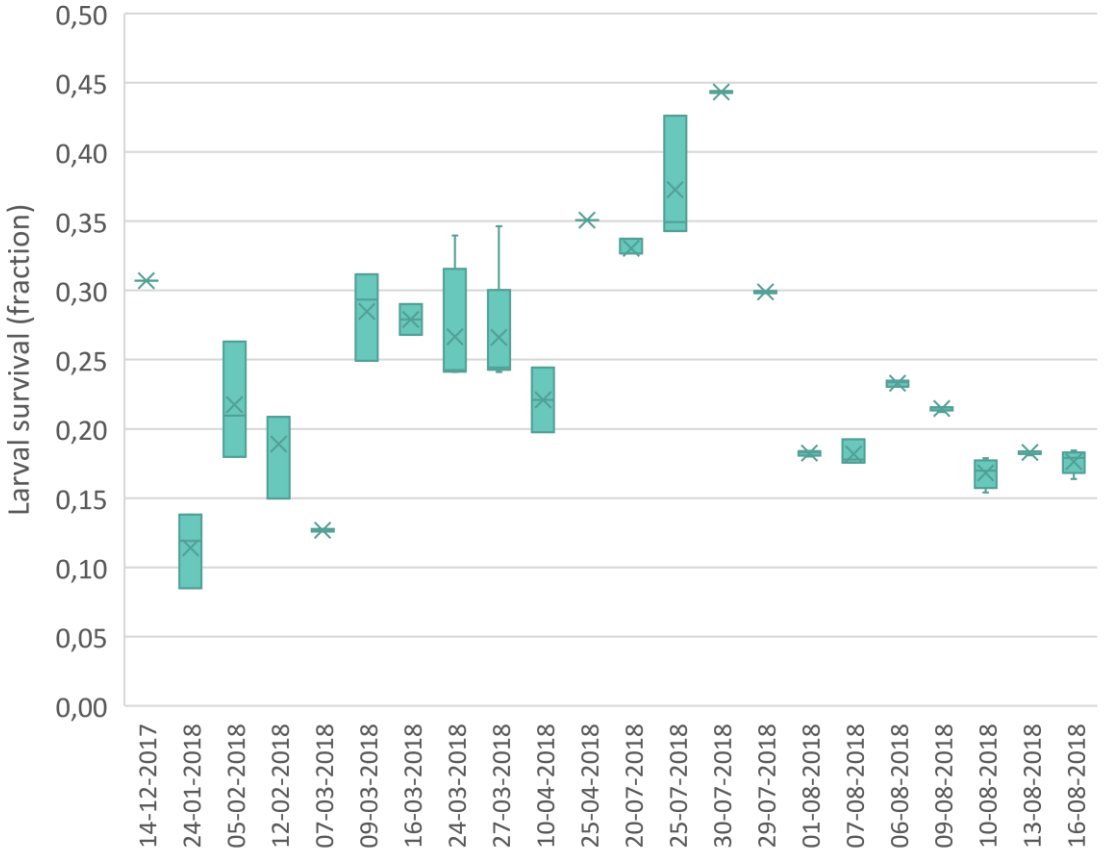
Larvae output

Pilot-production





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WP1 - Production

- Optimizing temperature
  - ~~Larvae for growth~~
  - Adults for fecundity
  - Larval survival

- RH
  - Hatching rate
  - Larval survival
  - Larval growth

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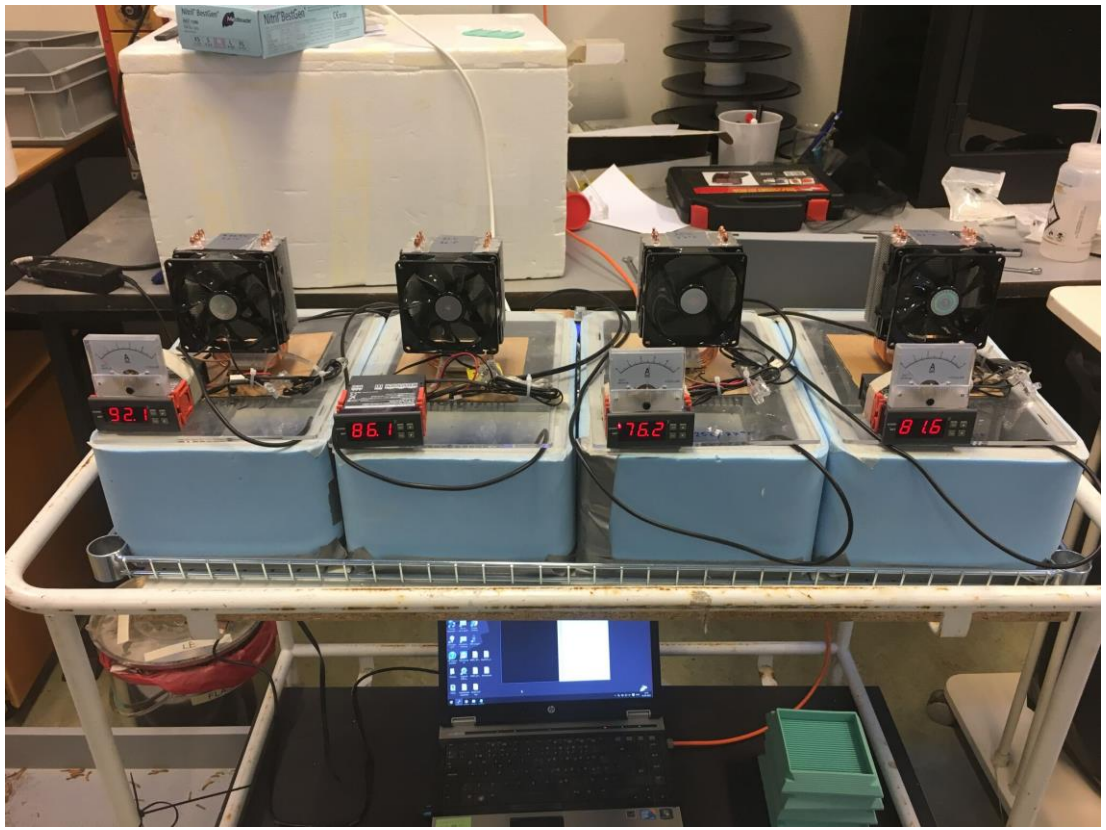
WP1 – Adult fecundity



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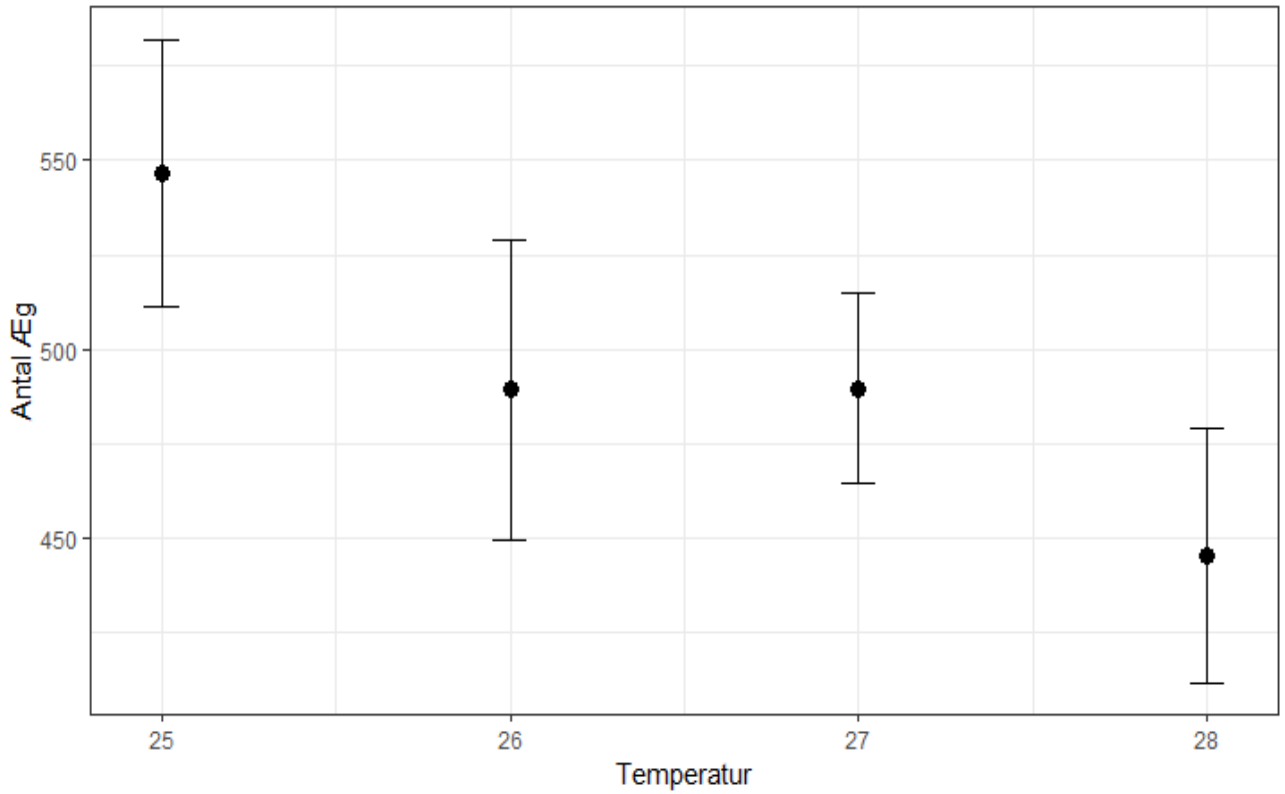
WP1 – Adult fecundity

Number of eggs pr. day over 15 days



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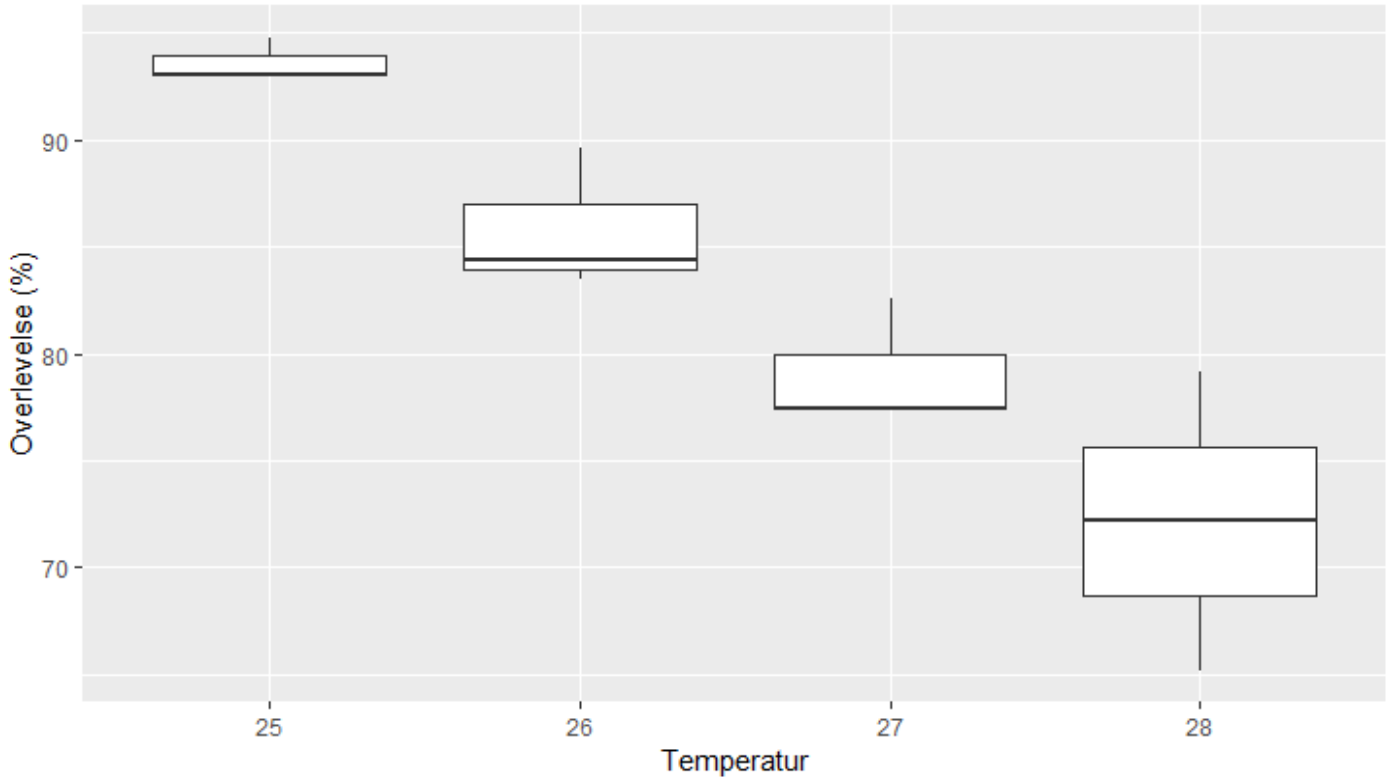
WP1 – Adult fecundity

Survival of beetles at different temperatures



WP1 - production

- Optimizing temperature
  - ~~Larvae for growth~~
  - Adults for fecundity – Significant difference in survival (more eggs over time)
  - ~~Larval survival~~

- RH
  - Hatching rate
  - Larval survival
  - Larval growth

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Larvae survival and growth

Pilot-production

Salt	Theoretical %RH at 30°C
Lithium chloride	11.28 ∓ 0.24
Potassium acetate	21.61 ∓ 0.53
Magnesium chloride	32.44 ∓ 0.14
Potassium carbonate	43.17 ∓ 0.50
Magnesium nitrate	51.40 ∓ 0.24
Potassium iodide	67.89 ∓ 0.23
Sodium chloride	75.09 ∓ 0.11
Potassium chloride	83.62 ∓ 0.25
Potassium nitrate	92.31 ∓ 0.60

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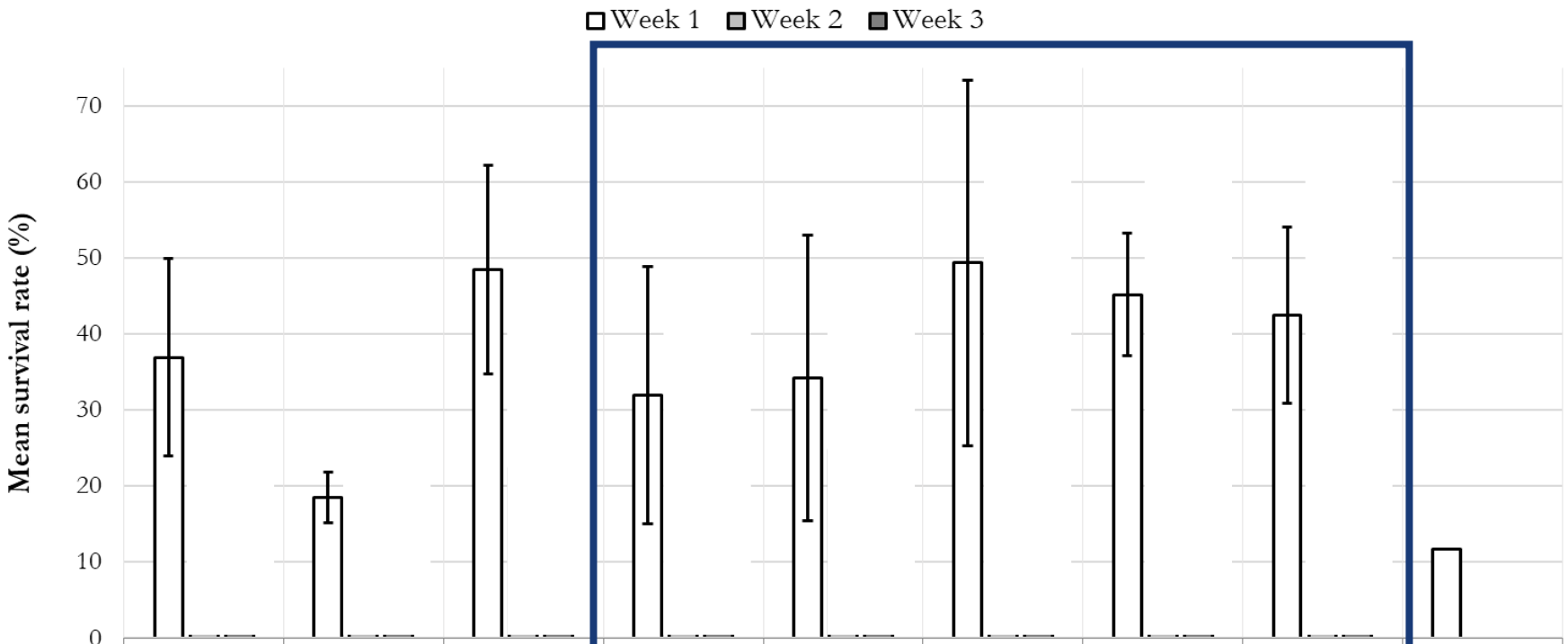
Survival rate



	11%	22%	32%	43%	51%	68%	75%	84%	92%
Week 1	37.0	18.5	48.5	32.0	34.2	49.4	45.2	42.5	11.7
Week 2	11.9	12.9	22.4	24.3	24.7	37.0	35.6	27.2	0.0
Week 3	11.3	10.3	20.8	23.3	25.2	33.9	34.7	27.1	0.0

Relative humidity (%)

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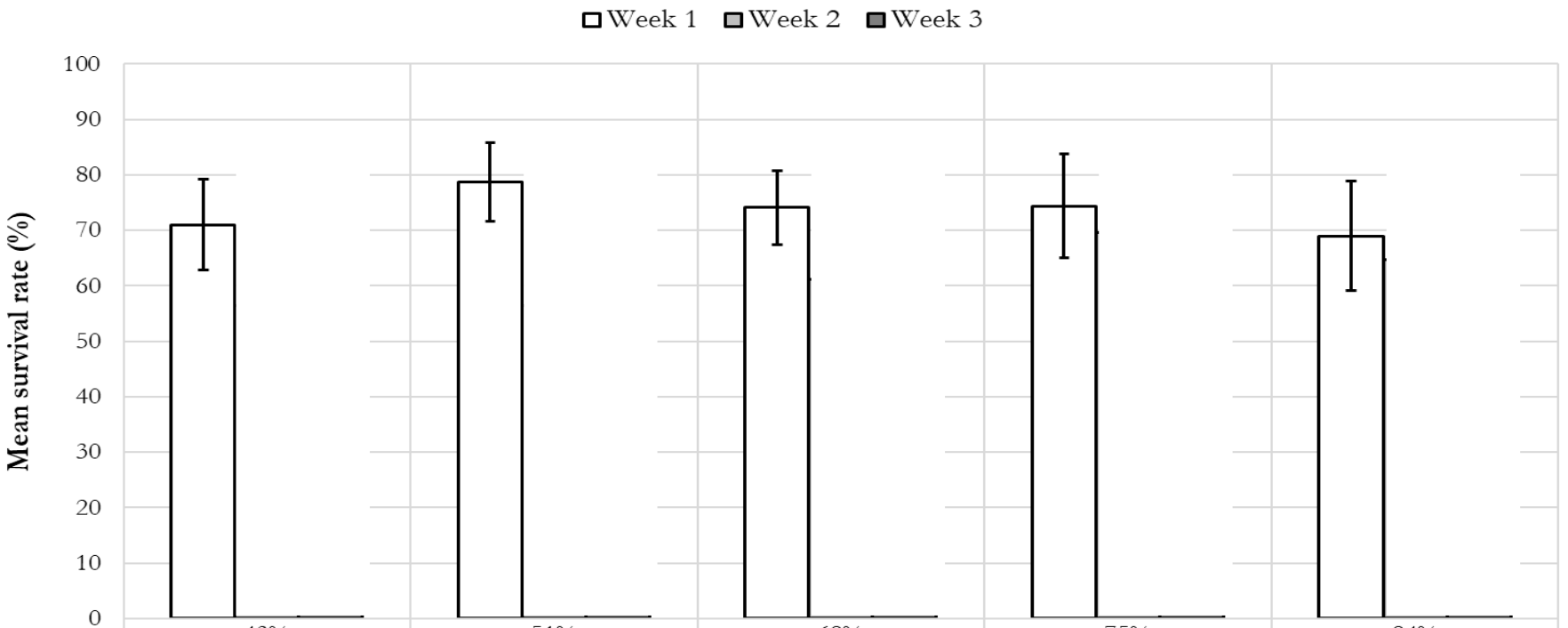
Survival rate



	43%	51%	68%	75%	84%
Week 1	71.0	78.8	74.1	74.4	69.0
Week 2	56.5	56.4	61.3	69.6	64.8
Week 3	53.8	53.9	59.4	67.5	61.6

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WP1 - production

- ~~Optimizing temperature~~
  - ~~Larvae for growth~~
  - ~~Adults for fecundity~~
  - ~~Larval survival~~

- RH
  - ~~Hatching rate~~
  - ~~Larval survival~~
  - Larval growth

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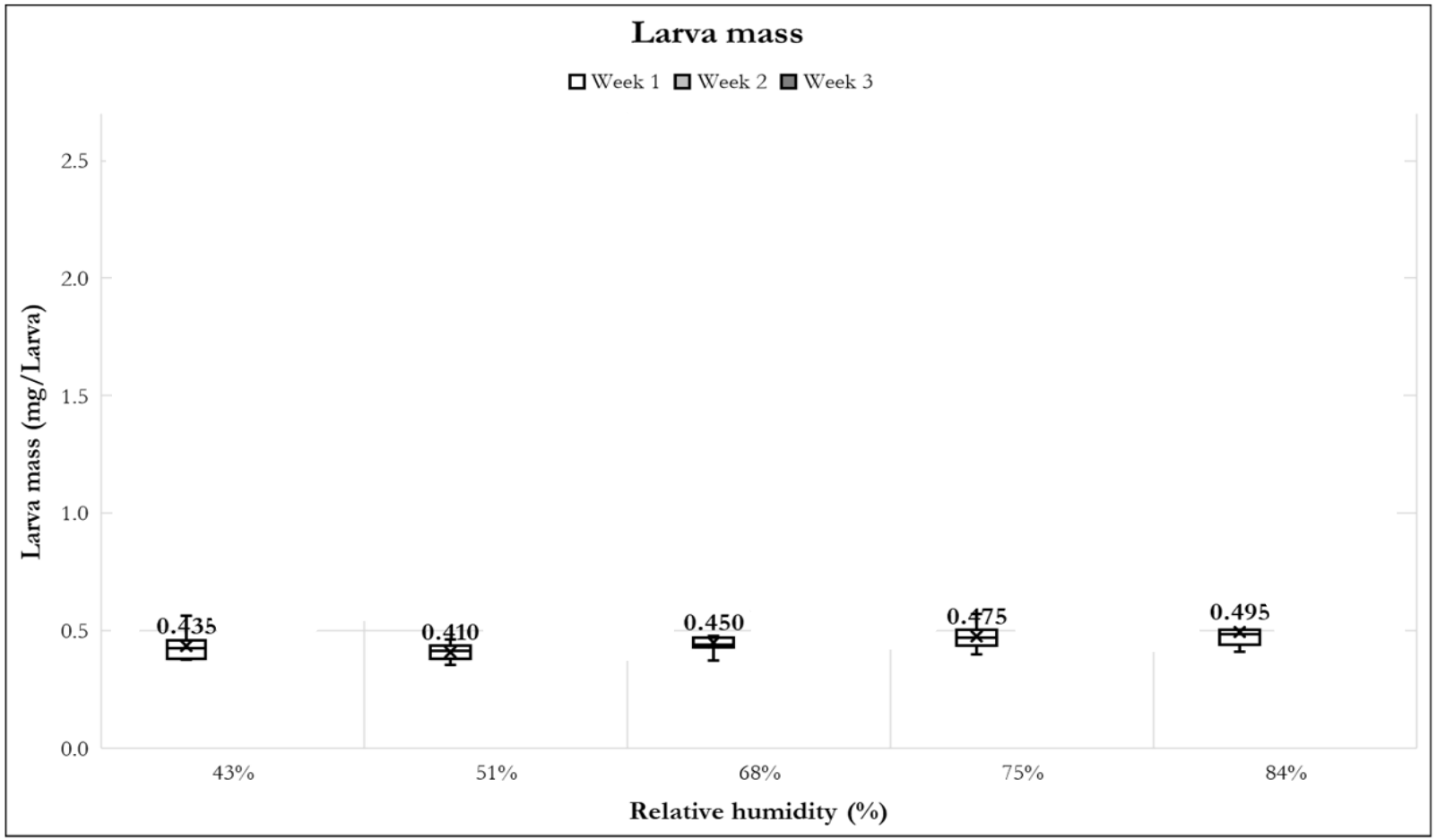
Larvae growth



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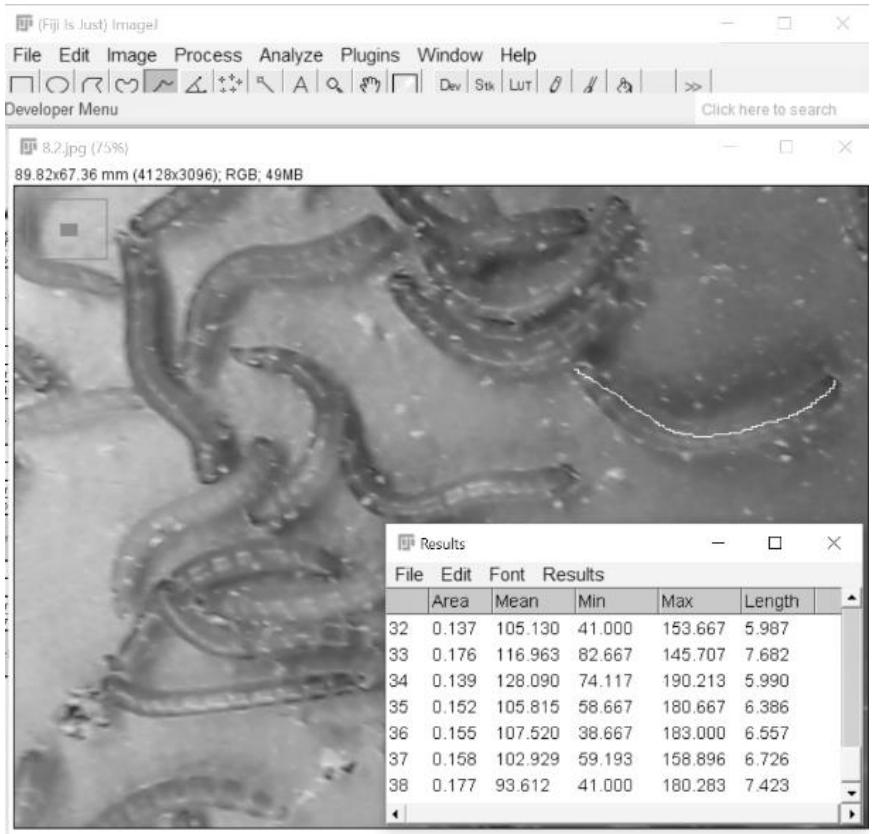
Larvae growth

Pilot-production



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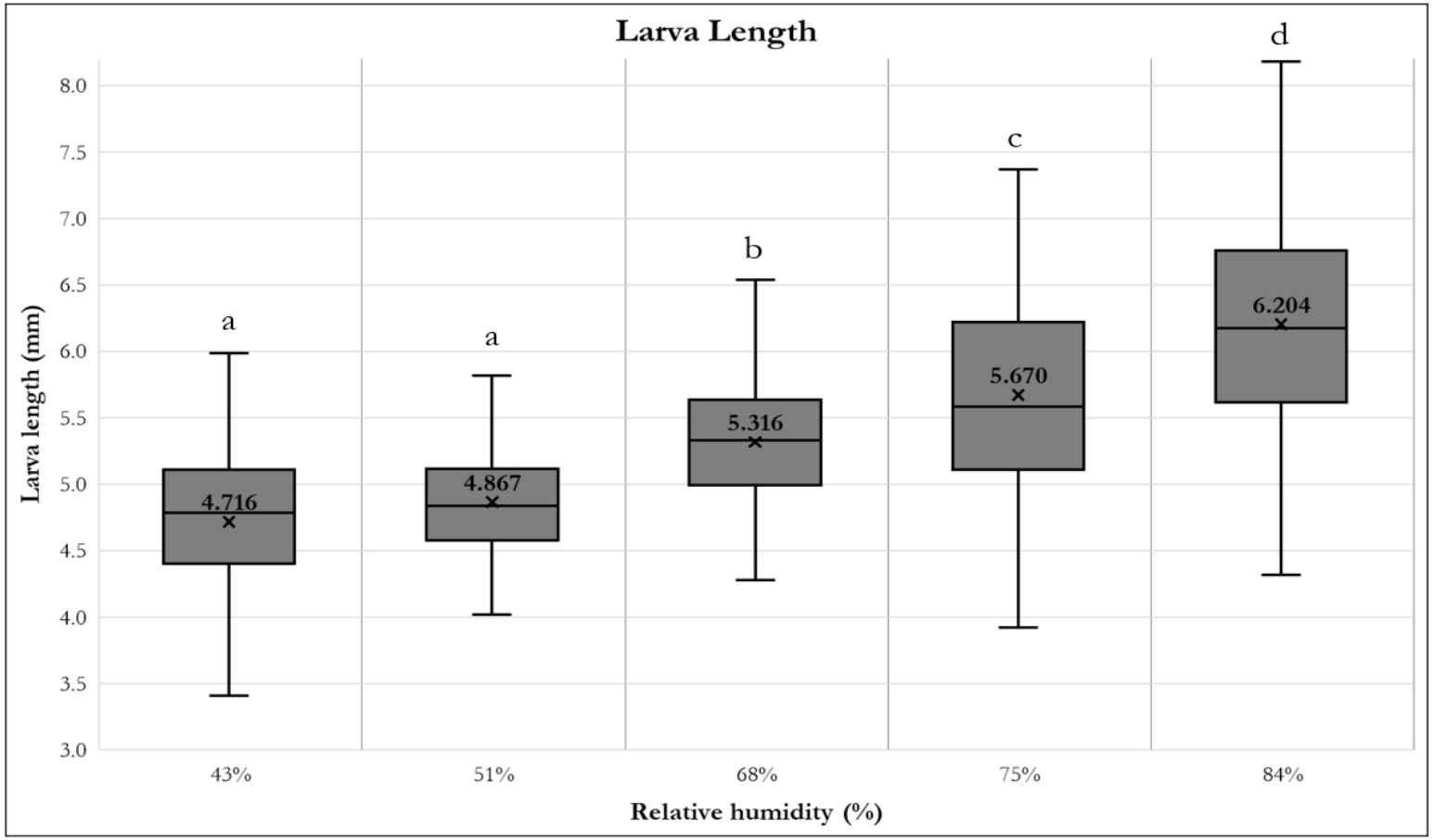
Larvae growth



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WP1 - production

- Optimizing temperature
  - Larvae for growth
  - Adults for fecundity – Significant difference in survival (more eggs over time)
  - Larval survival

- RH
  - Hatching rate – No significant effect
  - Larval survival – No significant effect
  - Larval growth – Significant positive correlation (up to 84% RH@27°C)

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Insect Farm – BONUS DATA

Water for beetles

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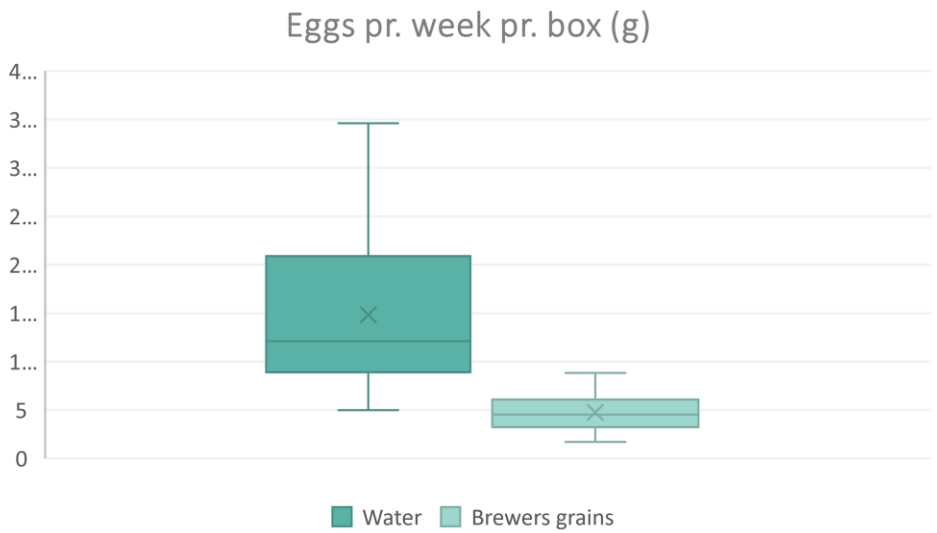
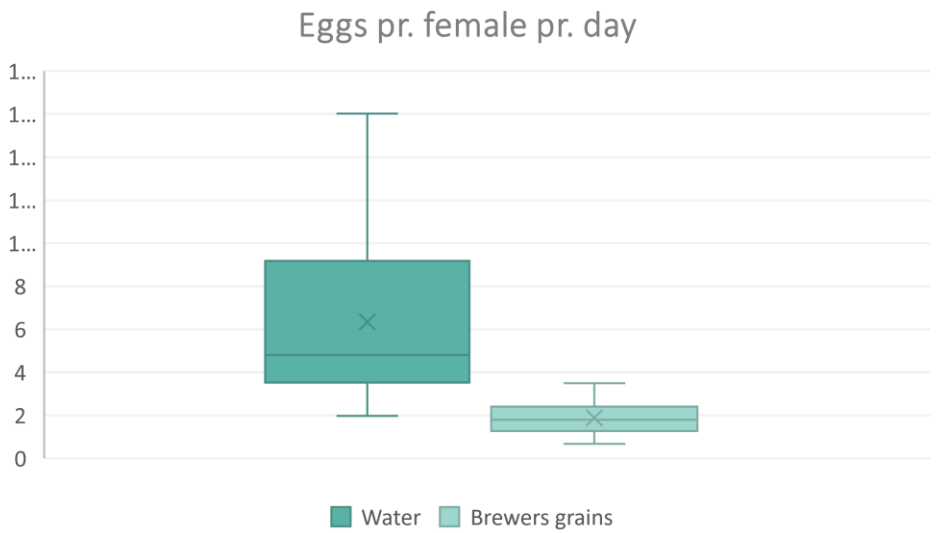
Insect Farm – BONUS DATA

Water for beetles





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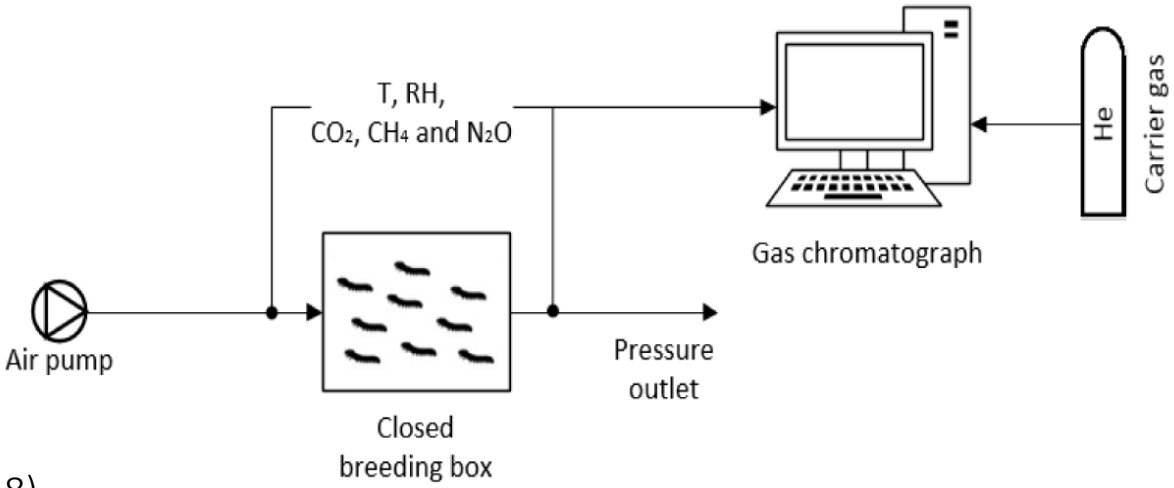
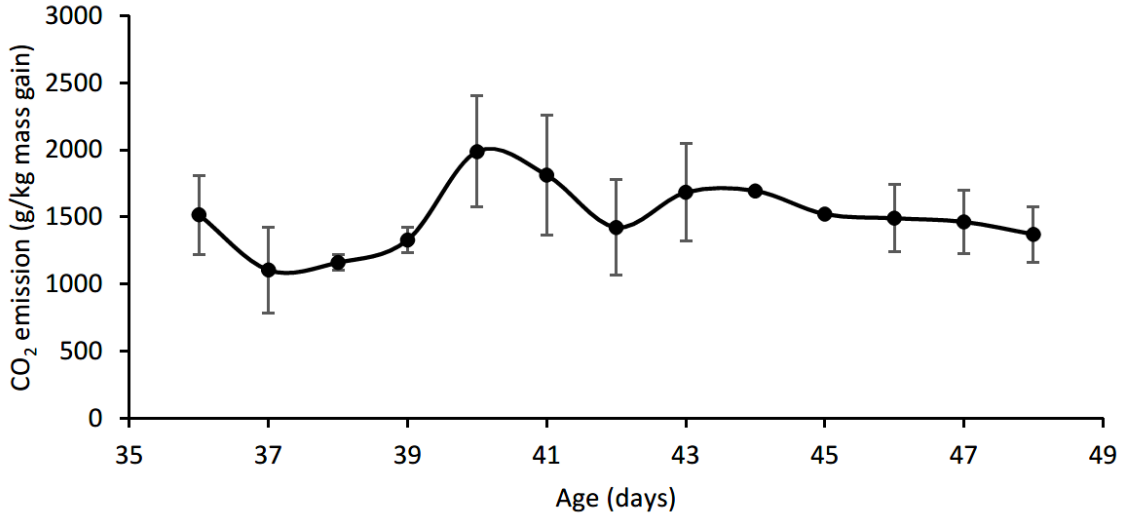
Insect Farm - CFD

Respirometer, CO_2 (and other GHG)



GHG emission as CO_2-equiv. of *T. molitor* larvae (age 36-48)



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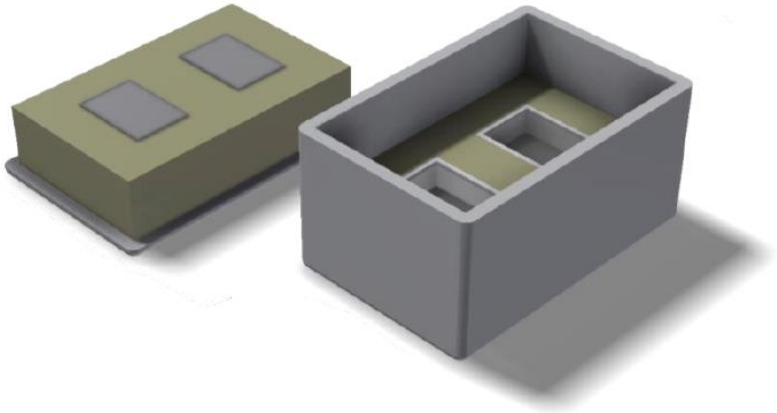
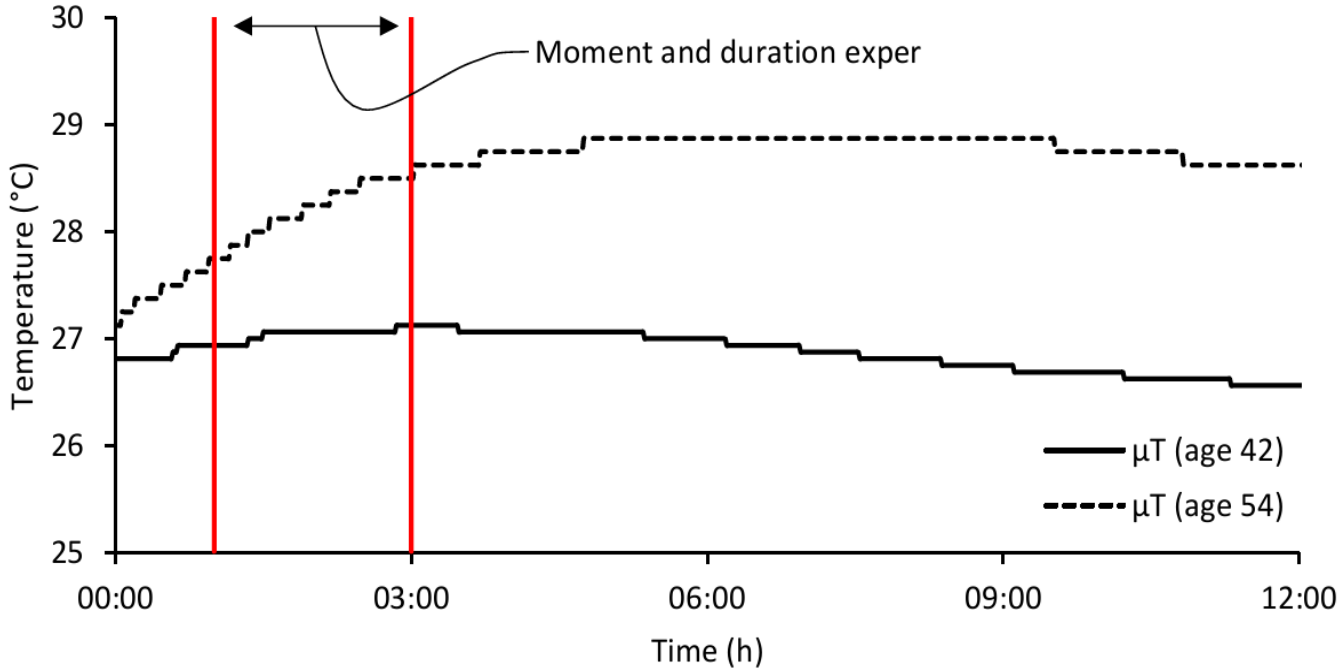
Insect Farm - CFD

Direct heat measurement





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Insect Farm - CFD

Heat and CO_2

- **Before harvest**
  - **2-3 watts** per 10.000 larvae
  - **40-50 daily gCO_2** per kg larvae

  - **Factory scale** (100.000 boxes, 1/8 harvest ready larvae)
    - C. 30.000 watt
    - C. 750 $kgCO_2$ daily

  - Cooling solution?
  - Venting?

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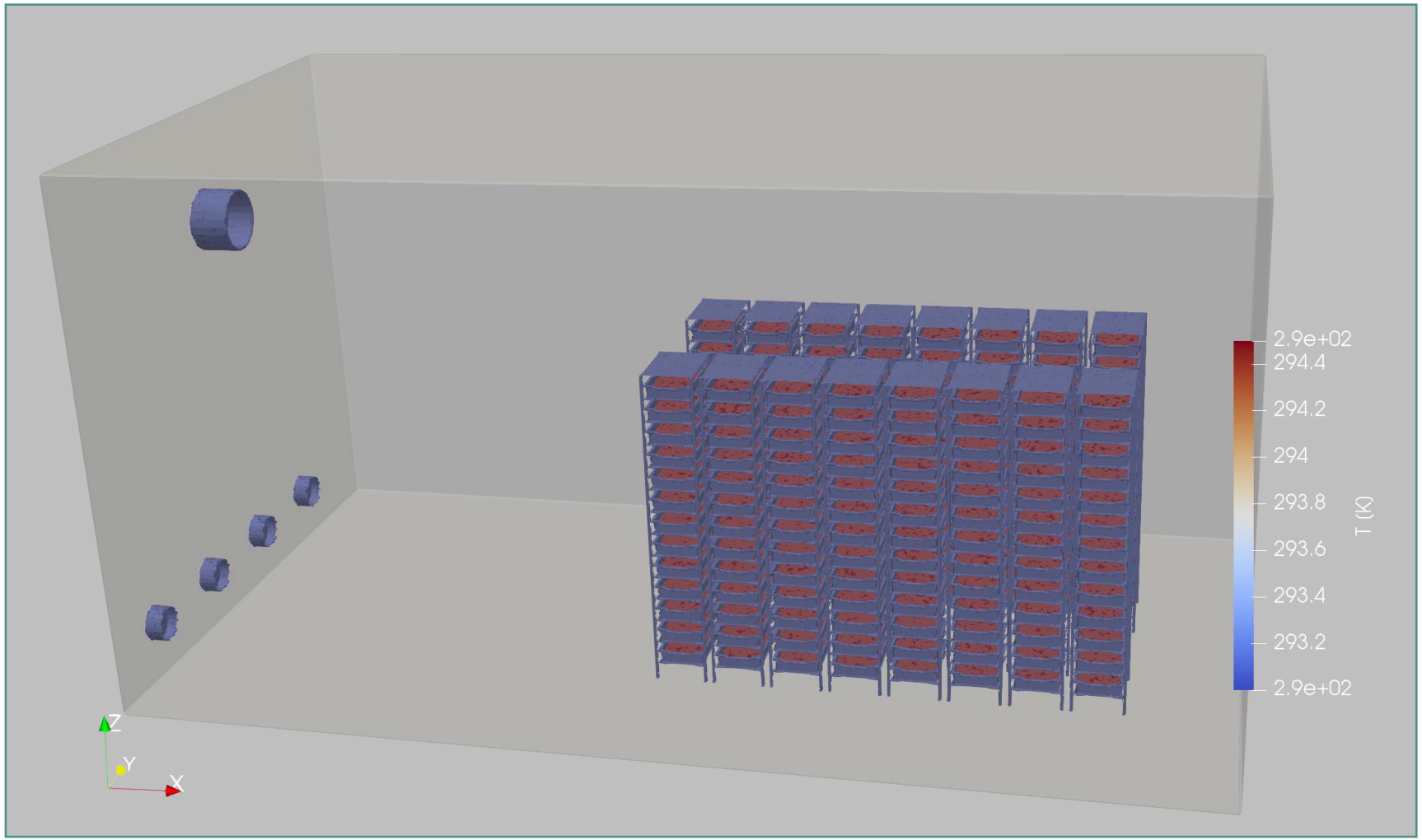
Insect Farm

CFD



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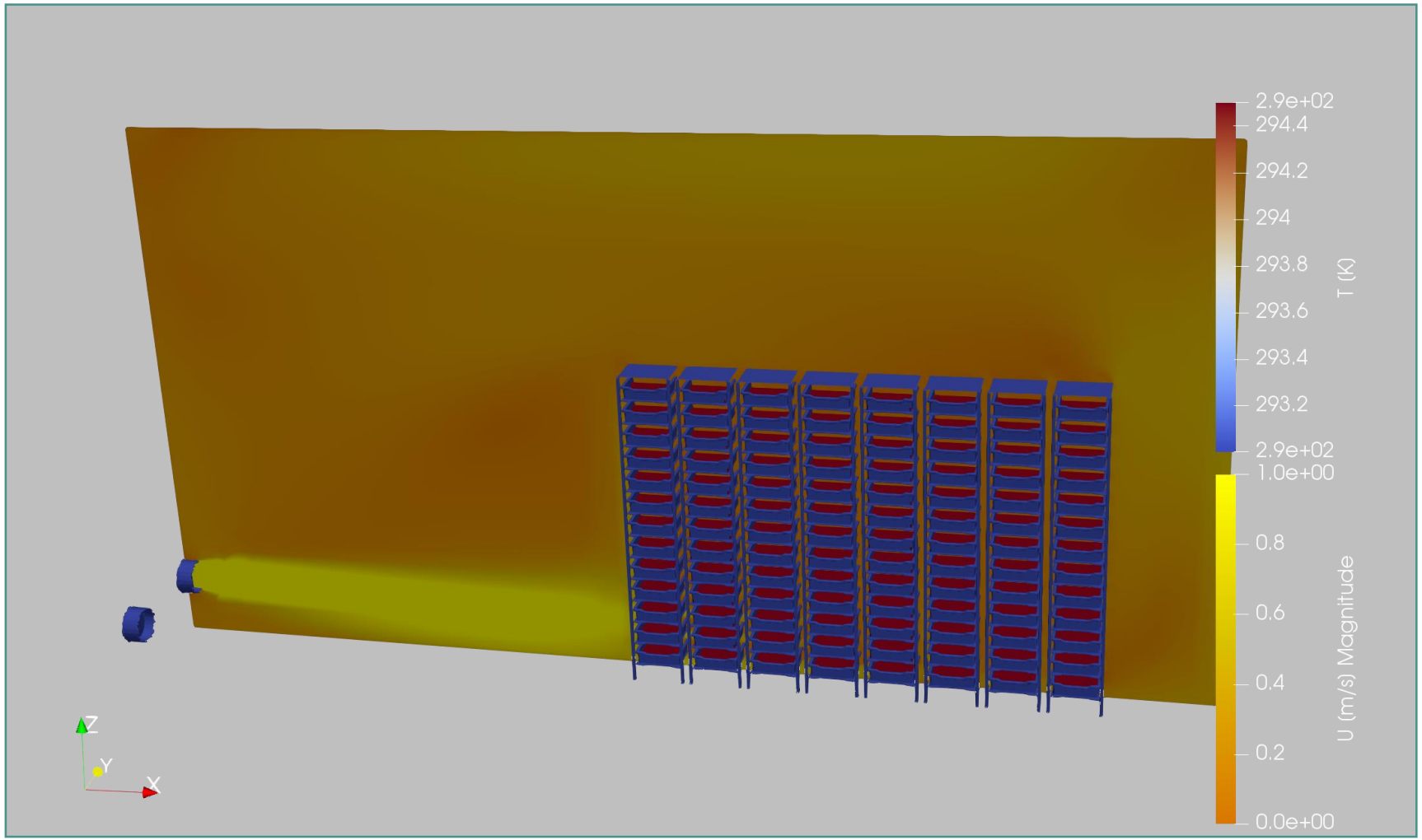
Insect Farm

CFD



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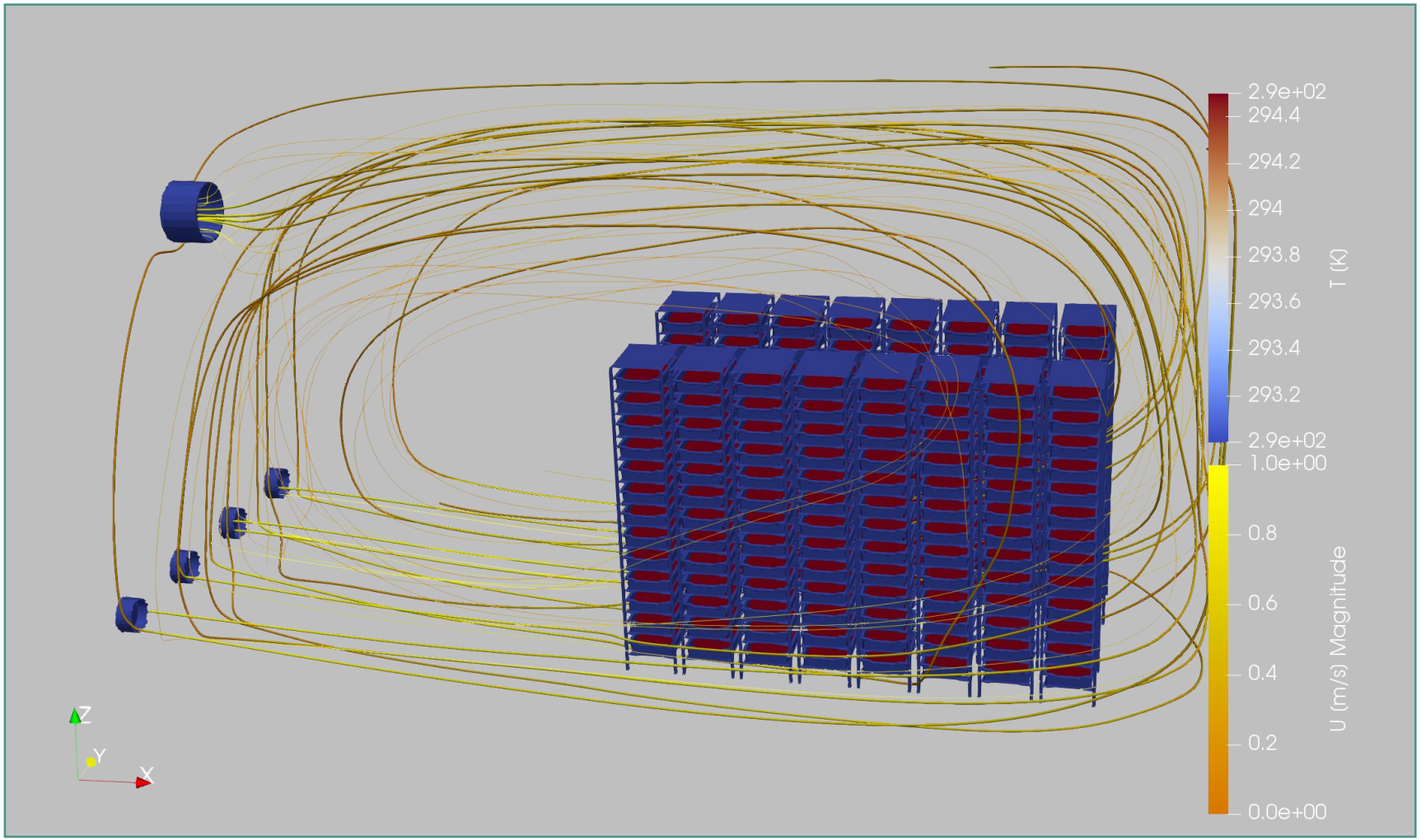
Insect Farm

CFD



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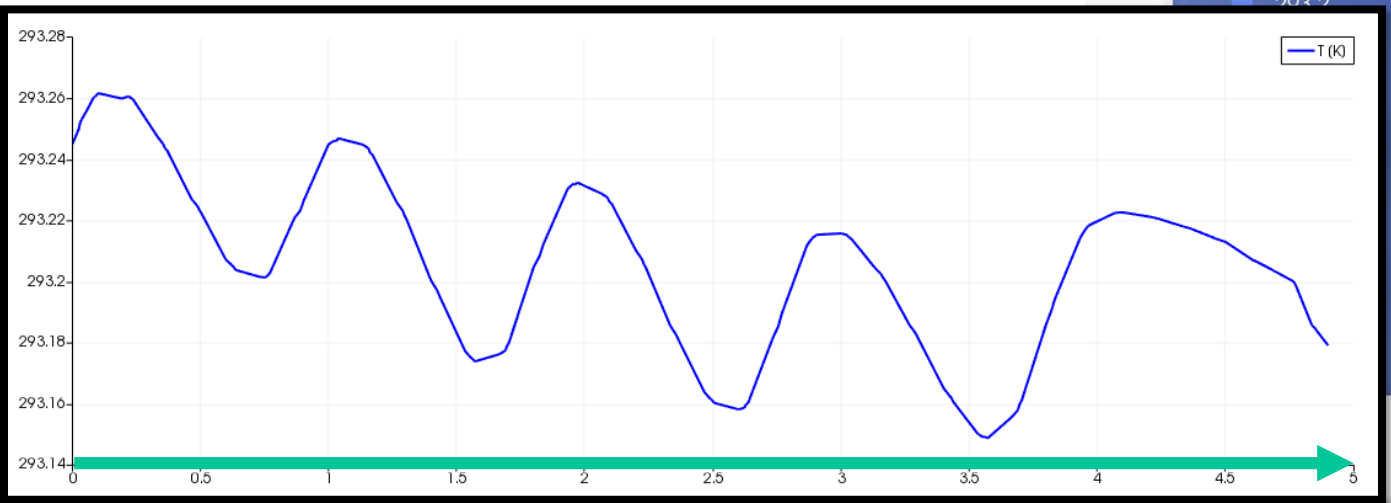

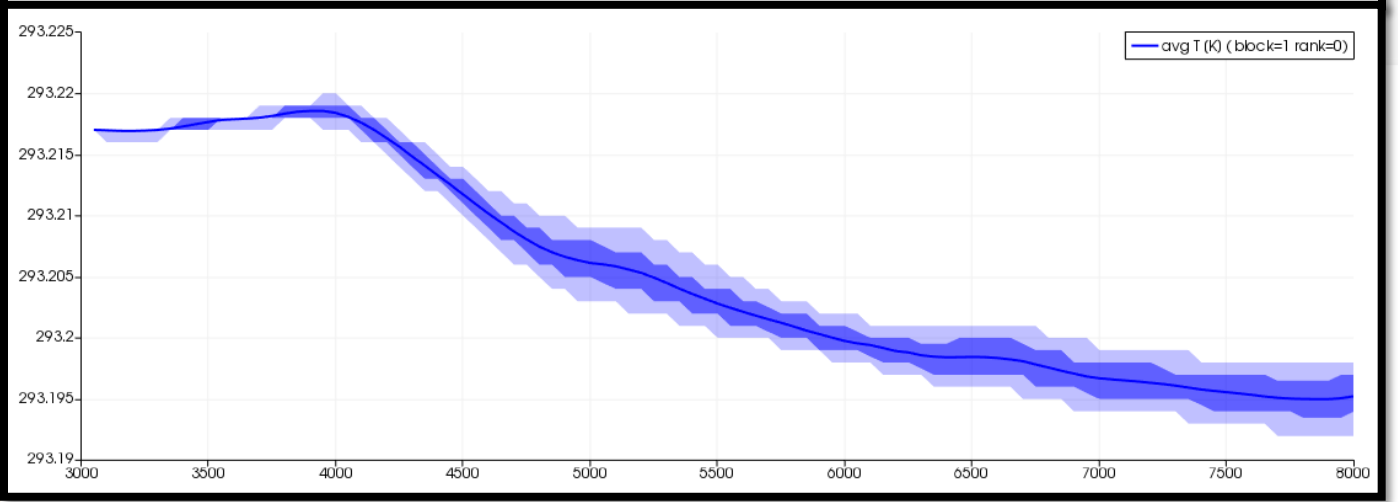

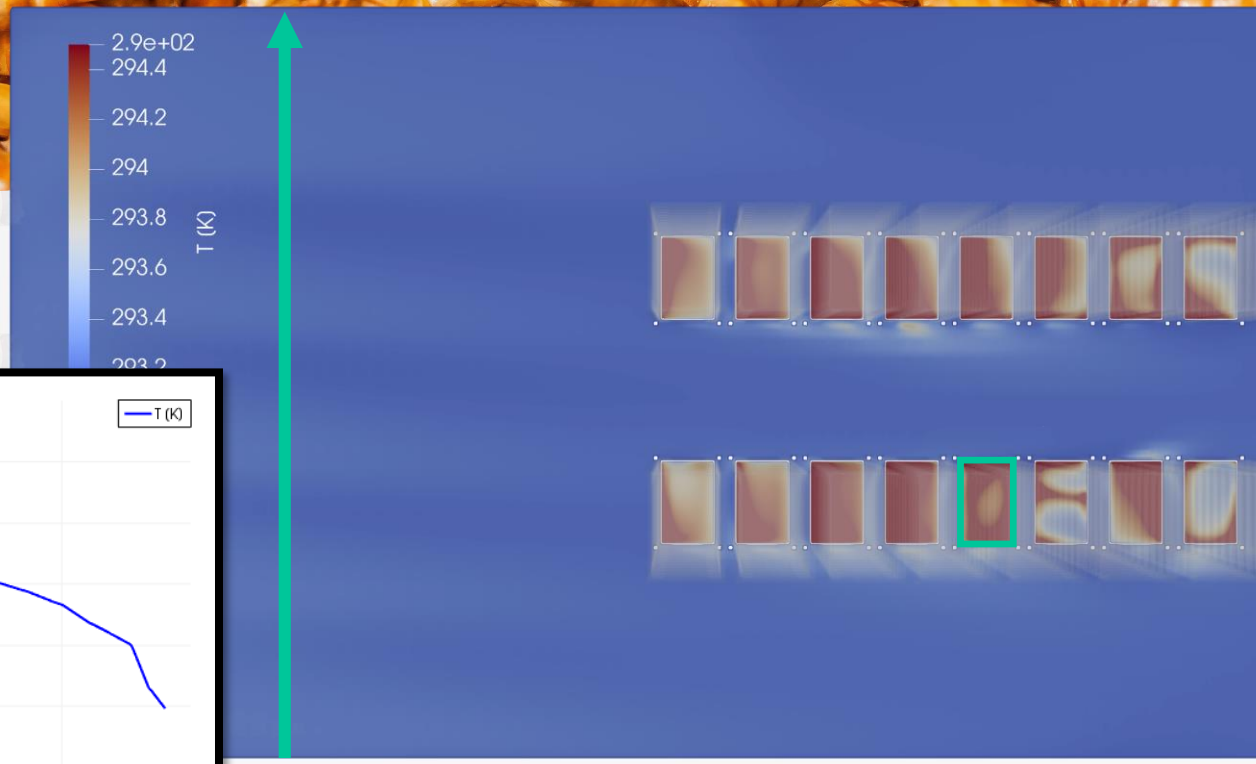

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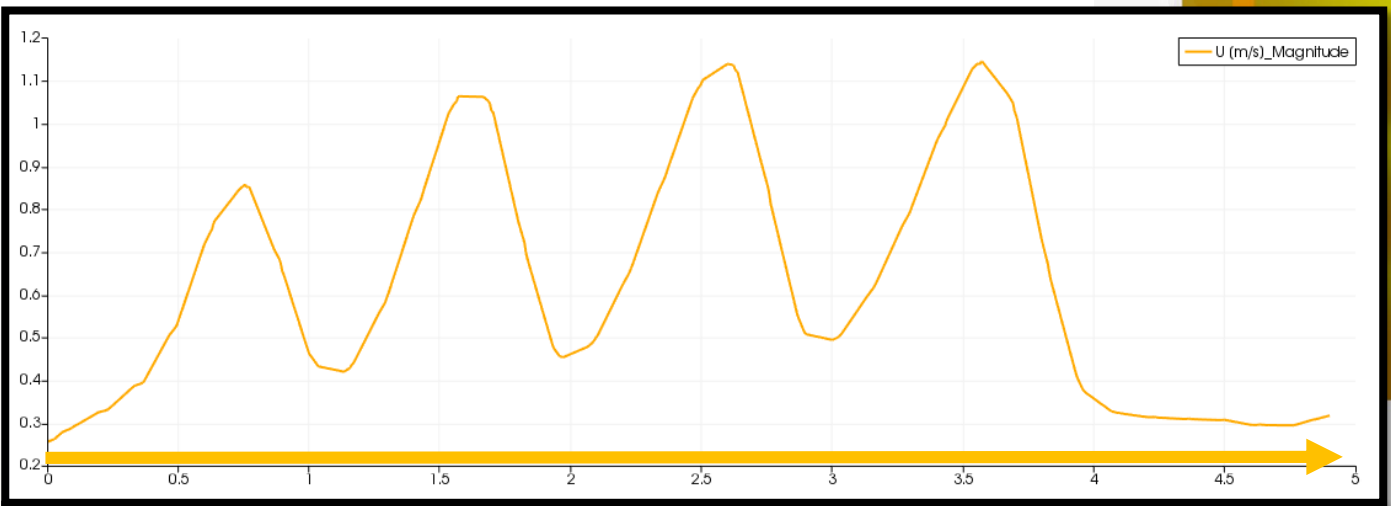

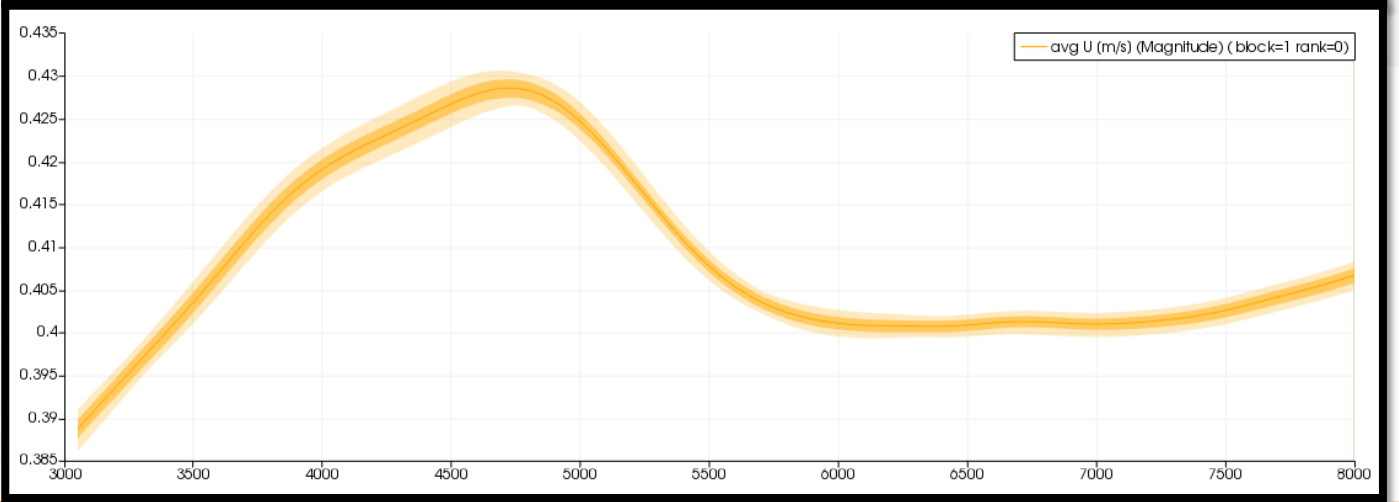

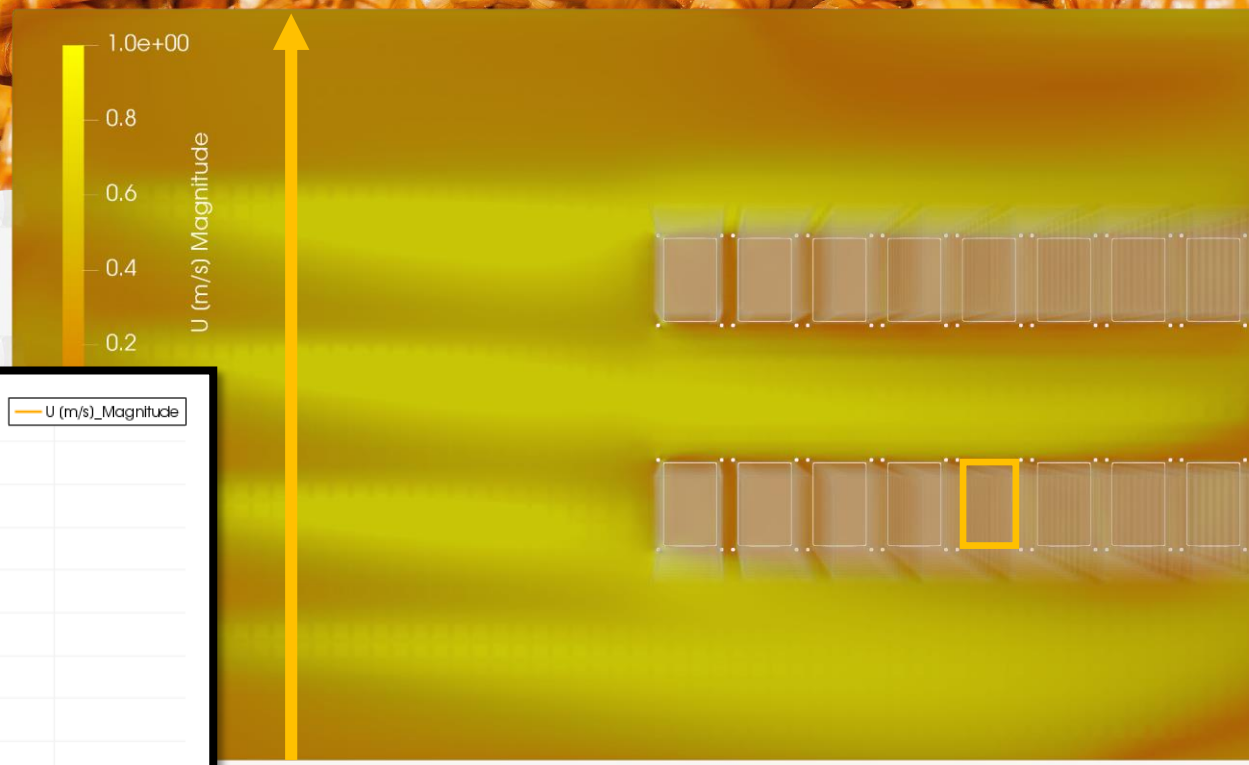

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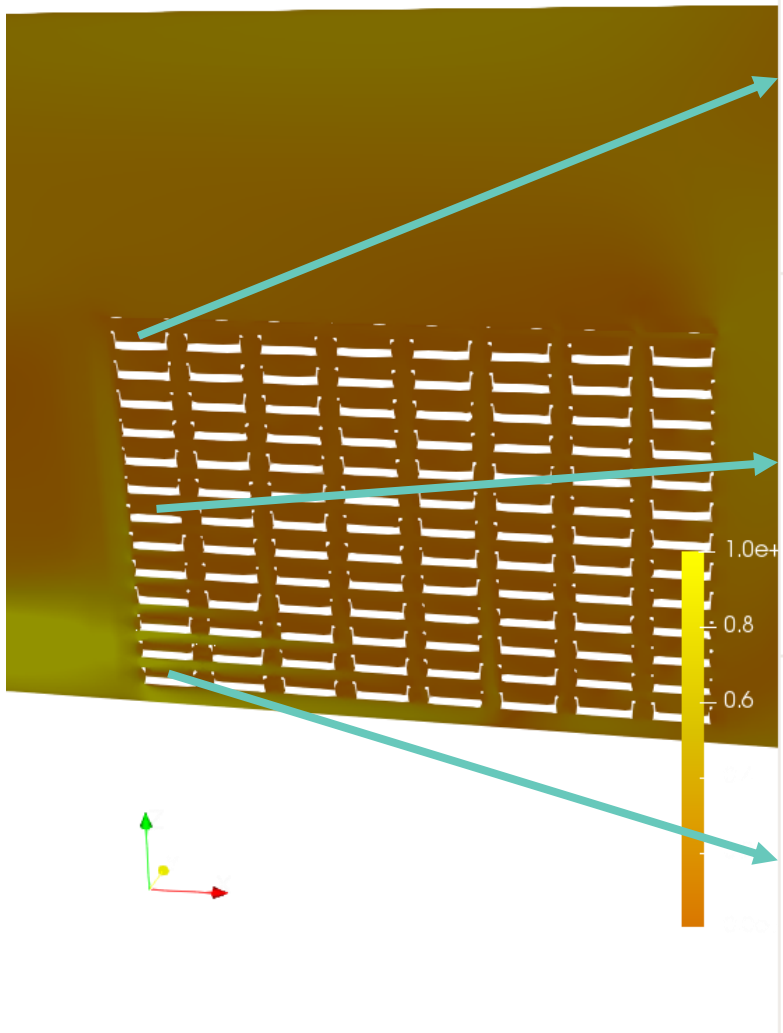

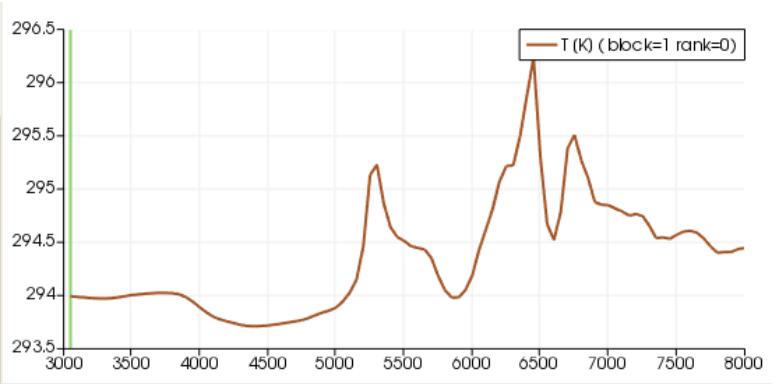

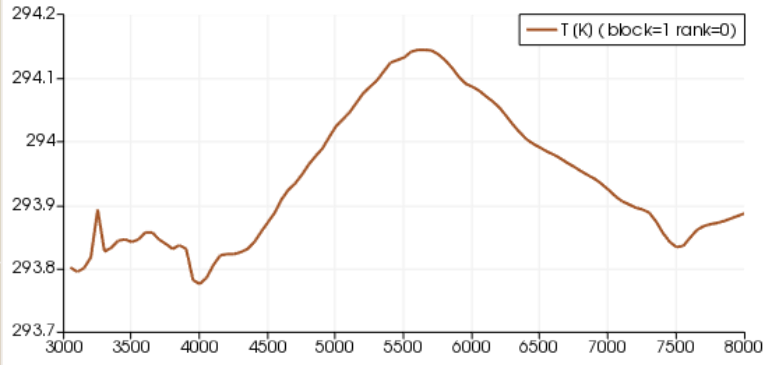

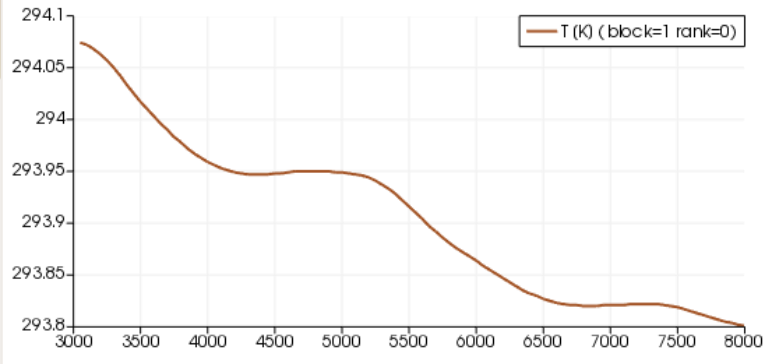

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