

# Smart spectroscopic sensors contribute to an efficient and sustainable food industry

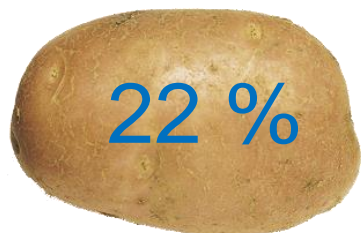
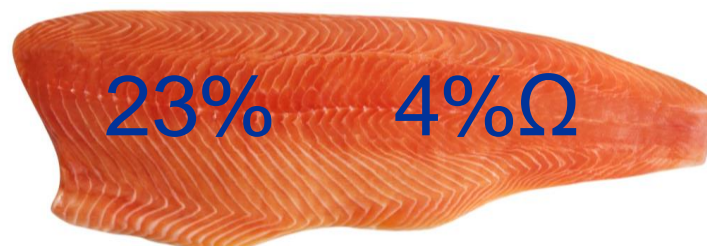
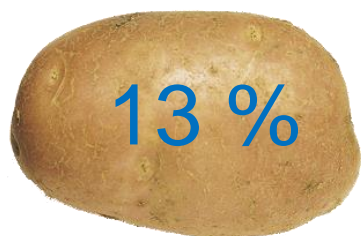


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Senior Research Scientist



Enormous variation in raw material quality!



We must utilize this variation in the best possible way!

- Sustainability
- Increased profitability

**If you cannot measure, you cannot control!**



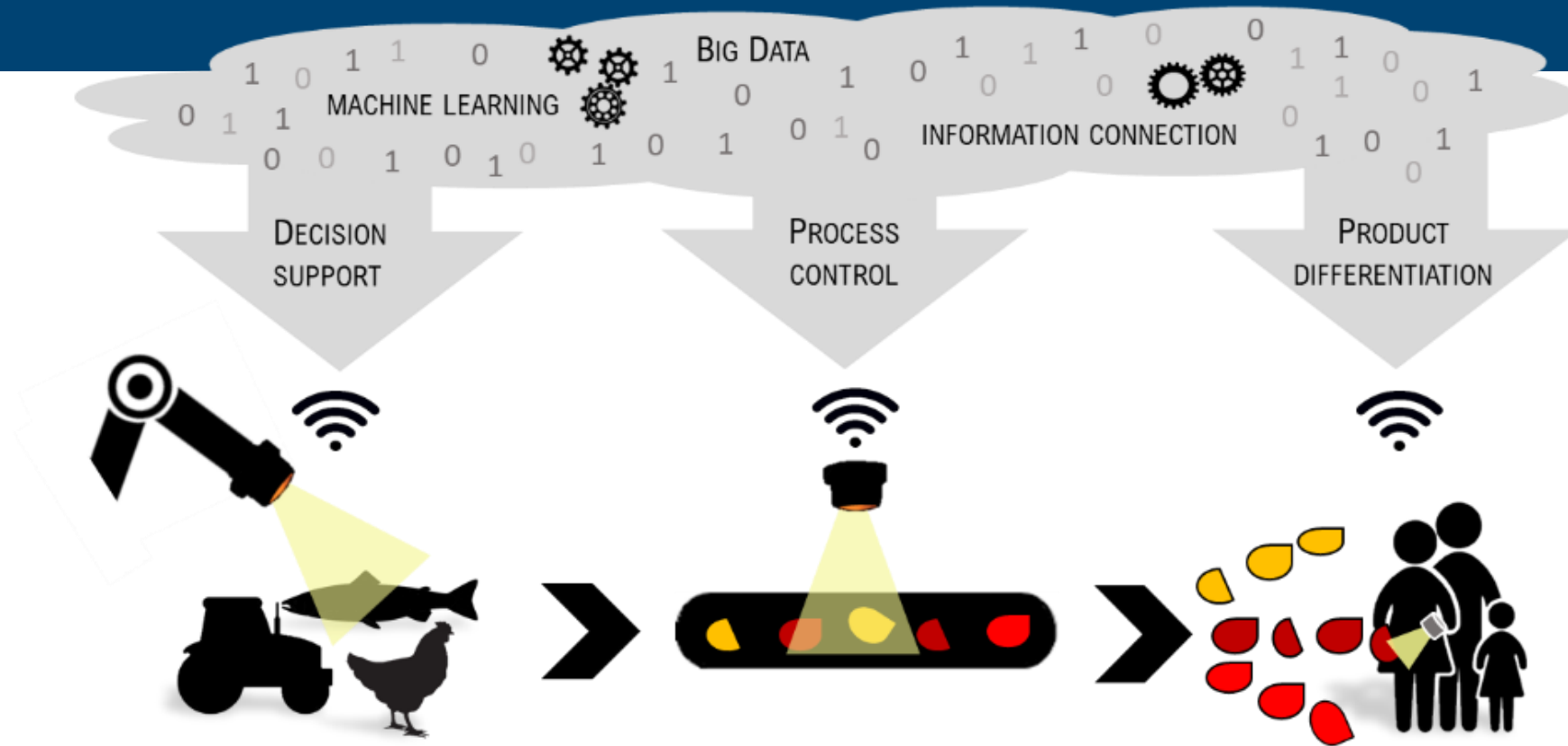
# Smart sensors – sustainable foods



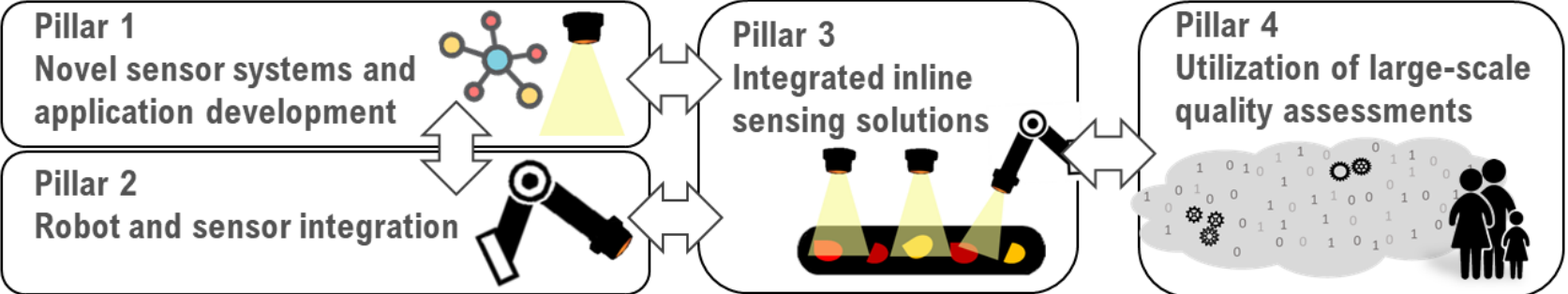
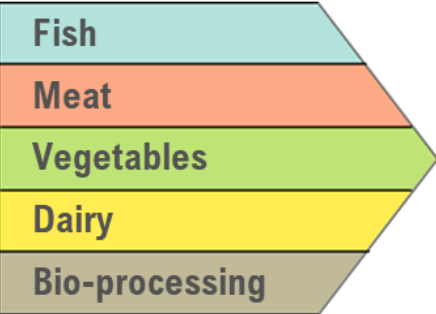
# Main messages

- From a measurement point of view – foods are challenging!
- Well working sensor systems are usually tailor-made
- To succeed, we need to collaborate: Food companies, food scientists, experts in sensors and instrumentation, and instrument suppliers
- We need to understand the food chemistry and physiology in depth
- We need to cope with heterogeneity

# DigiFoods – digital food quality



# Focus research areas



✓ Novel sensors and robotics designed for online use

✓ Novel strategies for online success

✓ Novel solutions for process and value chain optimization





*Interdisciplinary collaboration provides solutions and innovation*

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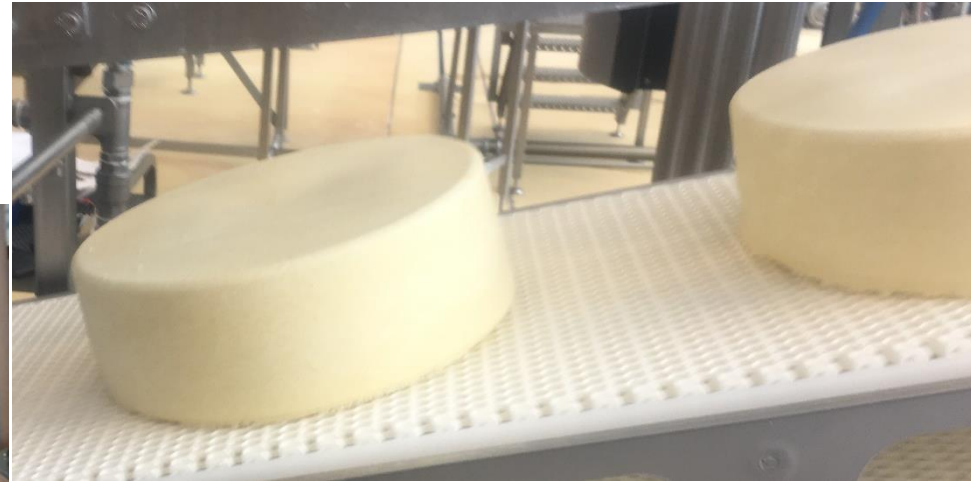
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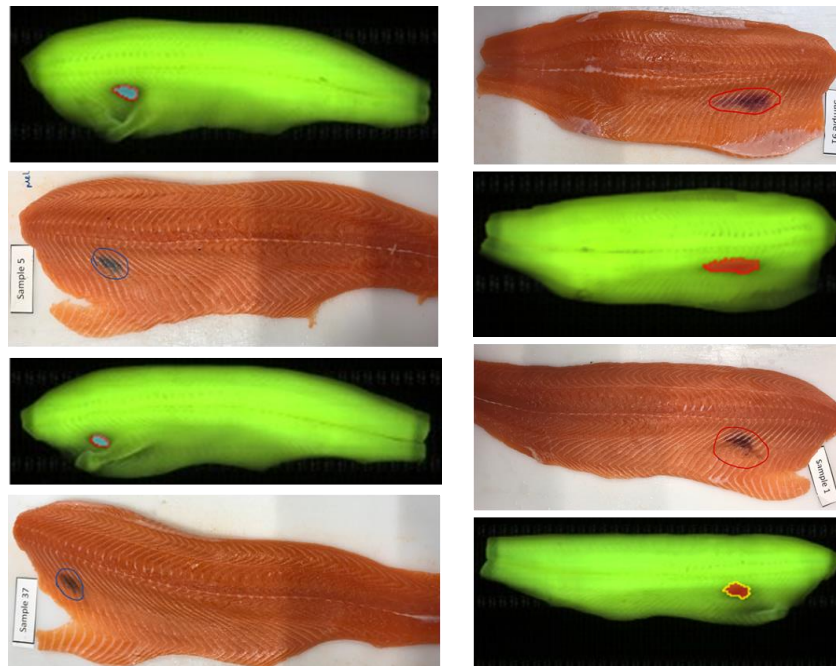
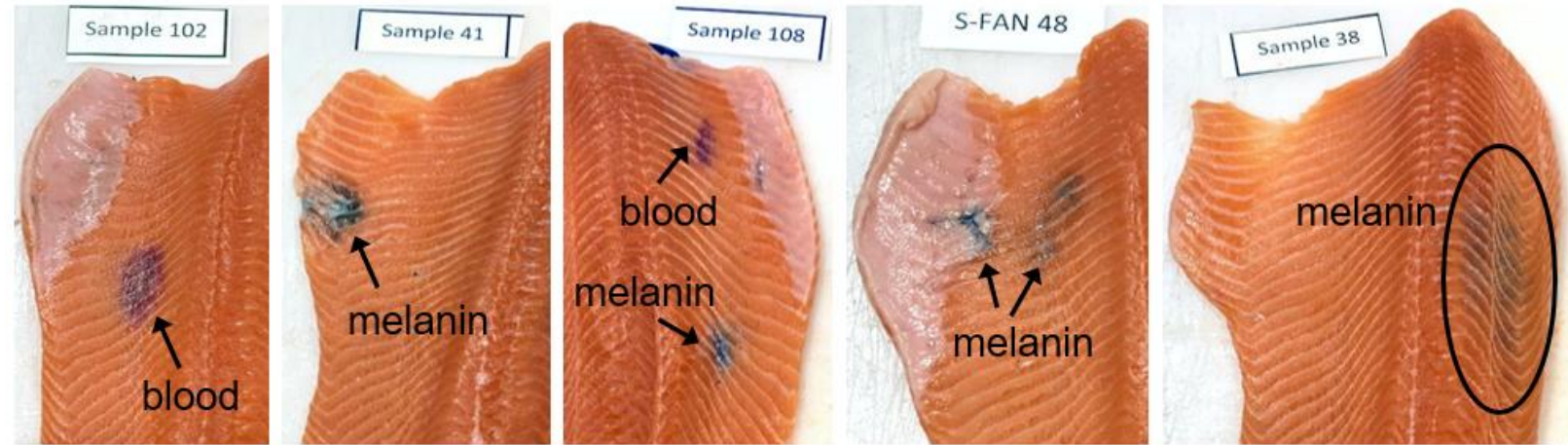
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# Heterogeneous foods Representative sampling!





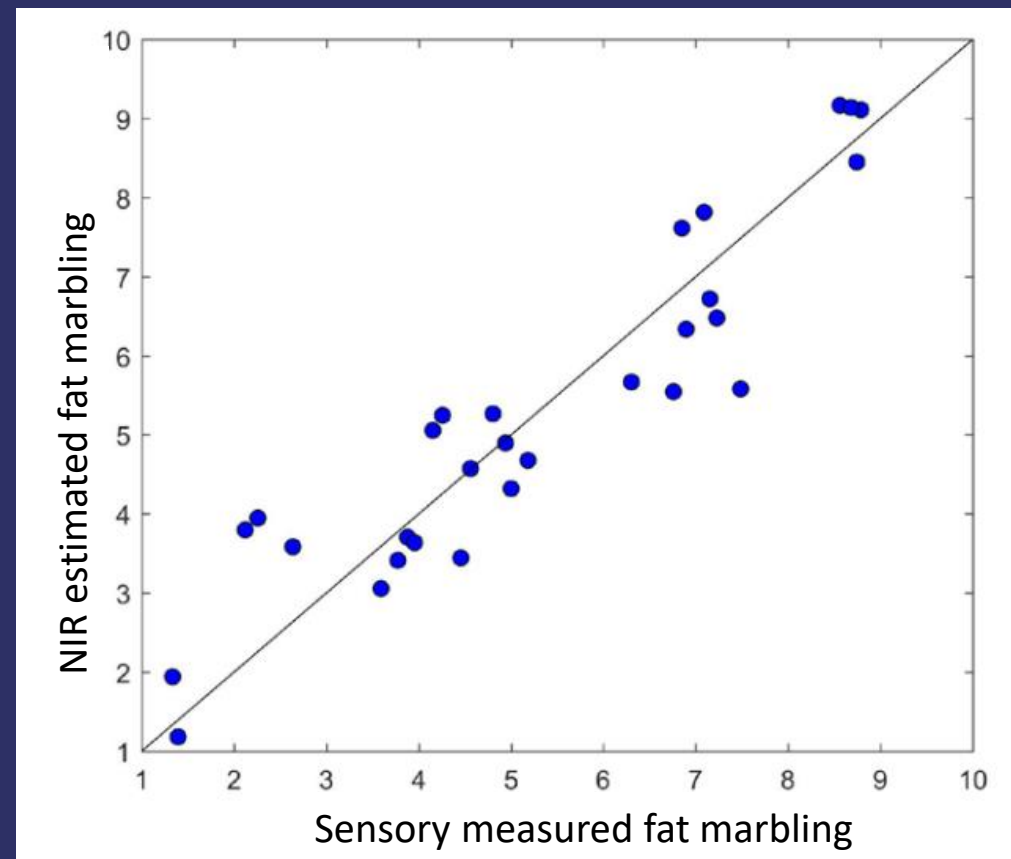
# Industrial hyperspectral imaging



- Detection of
- Blod spots
  - Melanin spots

- Quantification of
- Pigment/color
  - Fat content

# Classification of whole beef loins into fat marbling classes

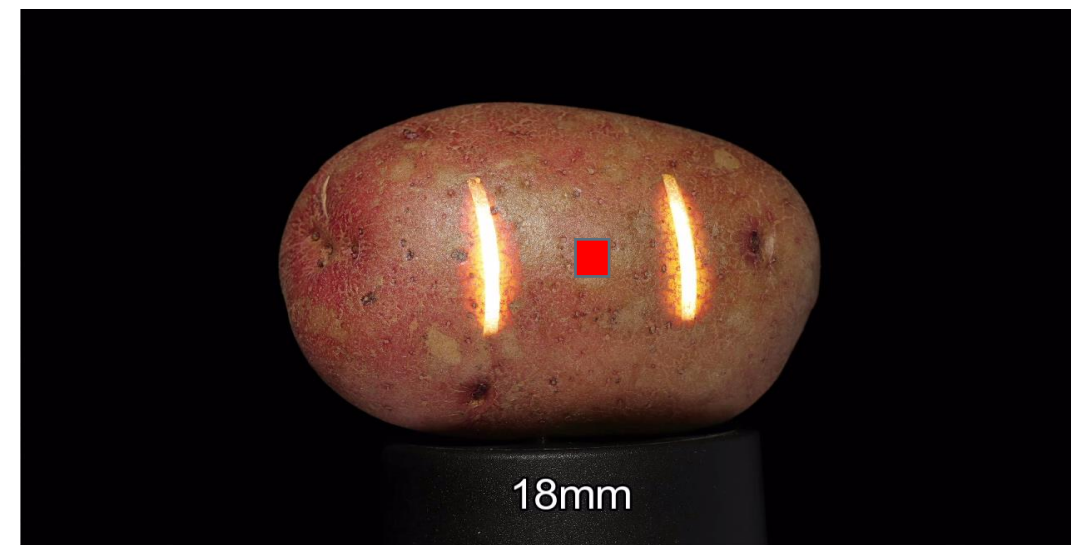






Production of French fries

Deeper sampling without  
physical contact is needed!







Non-contact NIR interactance



MicroNIR reflectance

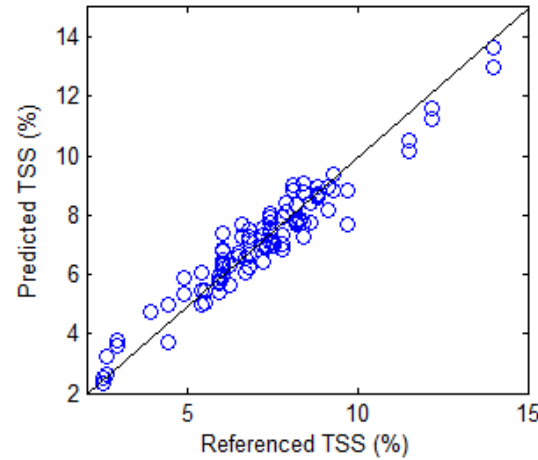


Sugar calibrations are comparable, but...

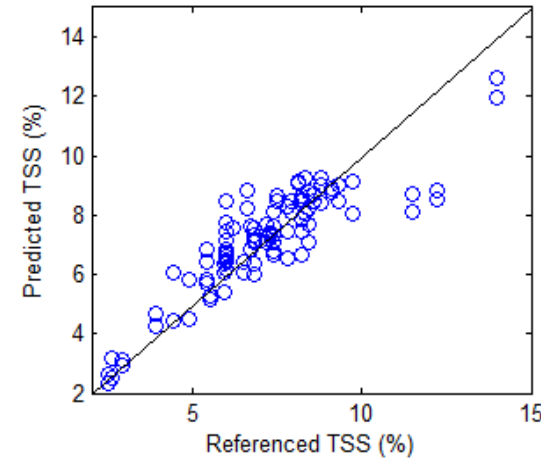
# Predictions of sugar on test set in field

**Test set same season:**

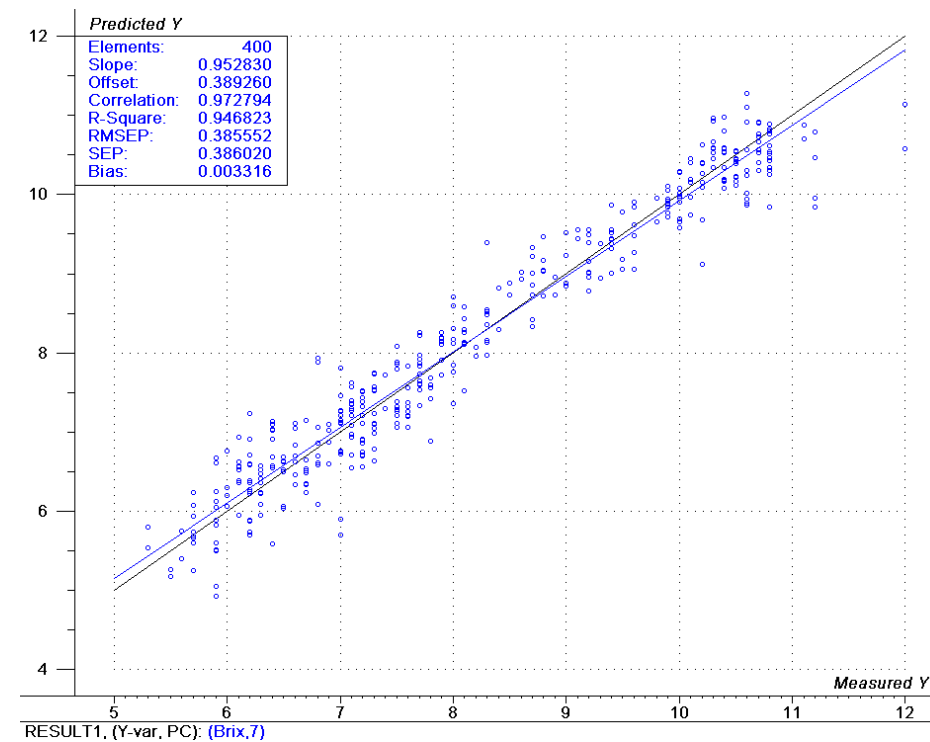
Non-contact interactance



Reflectance



# Sweetness in cherry tomatoes



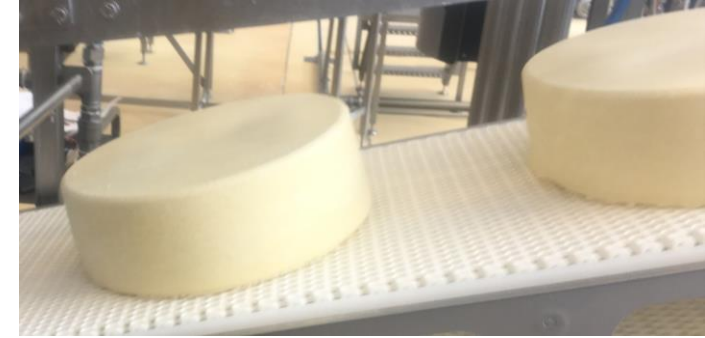


**What is your product  
variation?  
We don't know...!!**

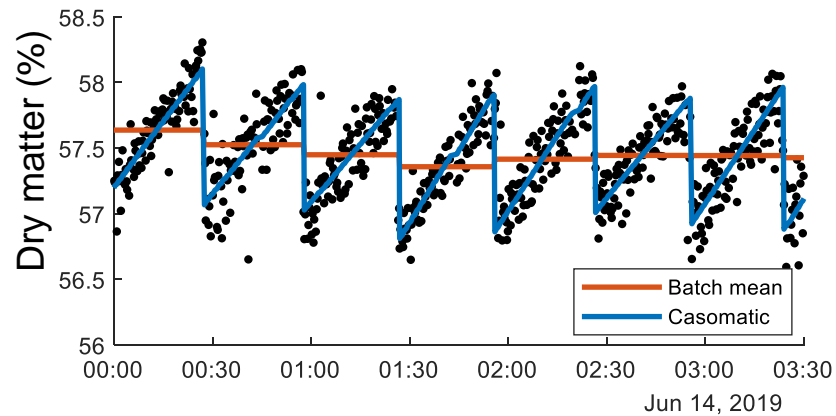


# Variation in dry matter in the cheeses

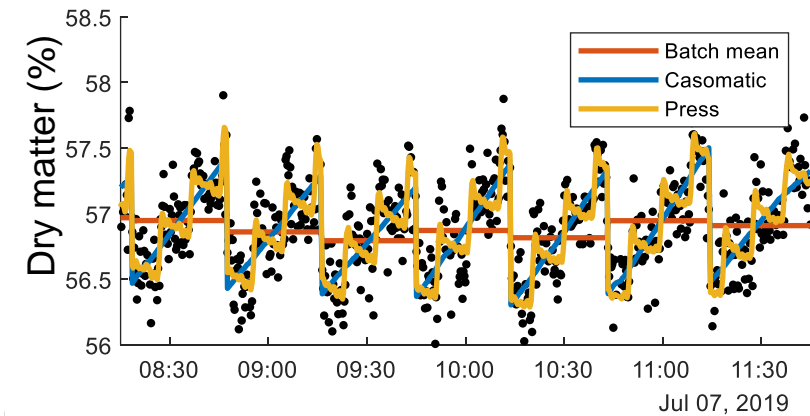
- Aim is to reduce variation in dry matter
- In-line monitoring of complete production gives clues on how – **now implemented**



Process point A



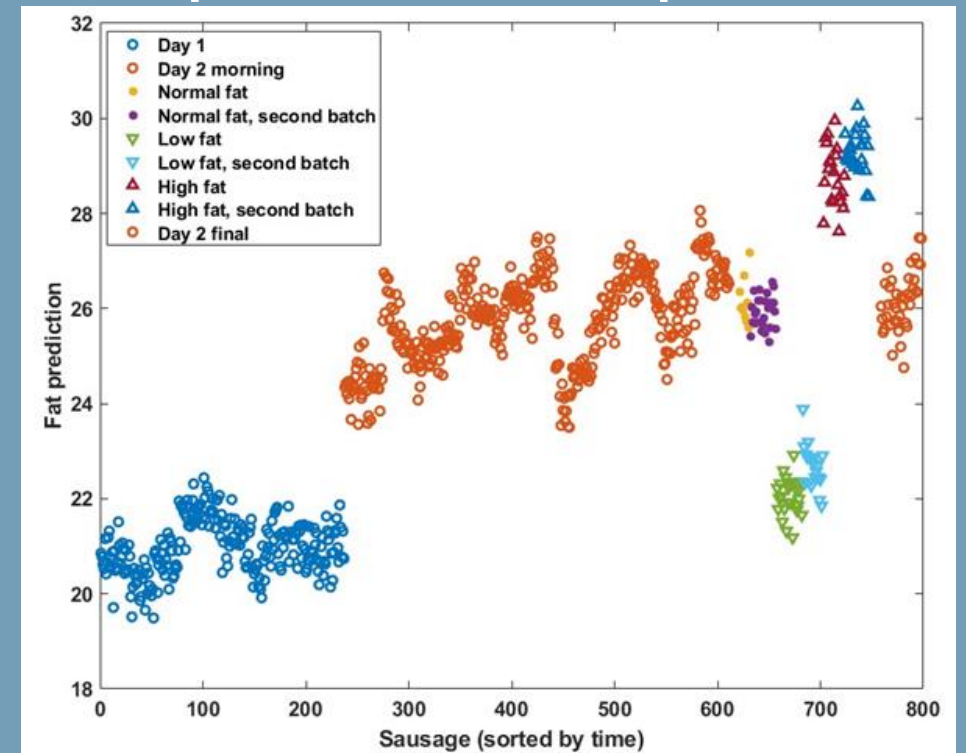
Process point B





# Process exploration – dry cured sausages

Explore and improve!

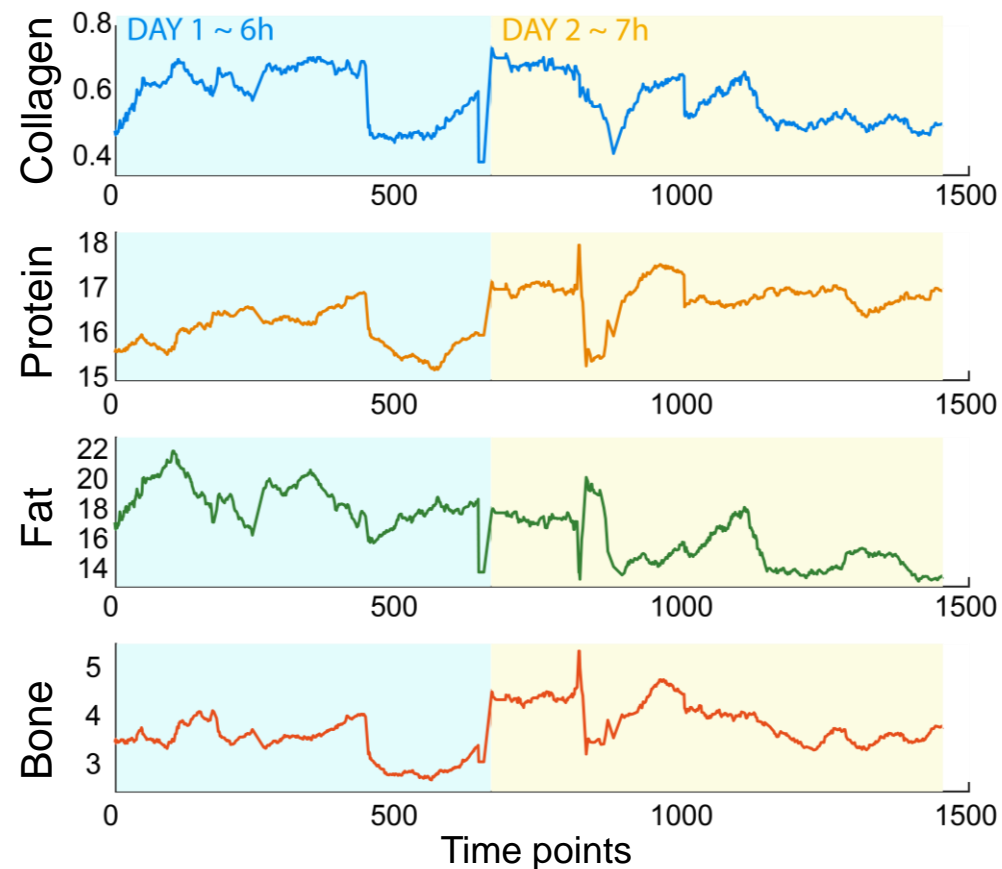




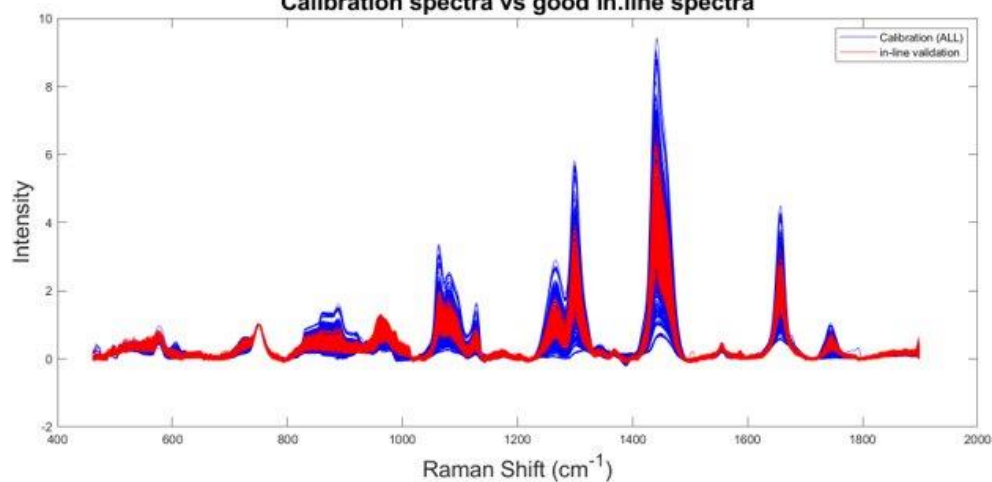
# In-line Raman in the food industry



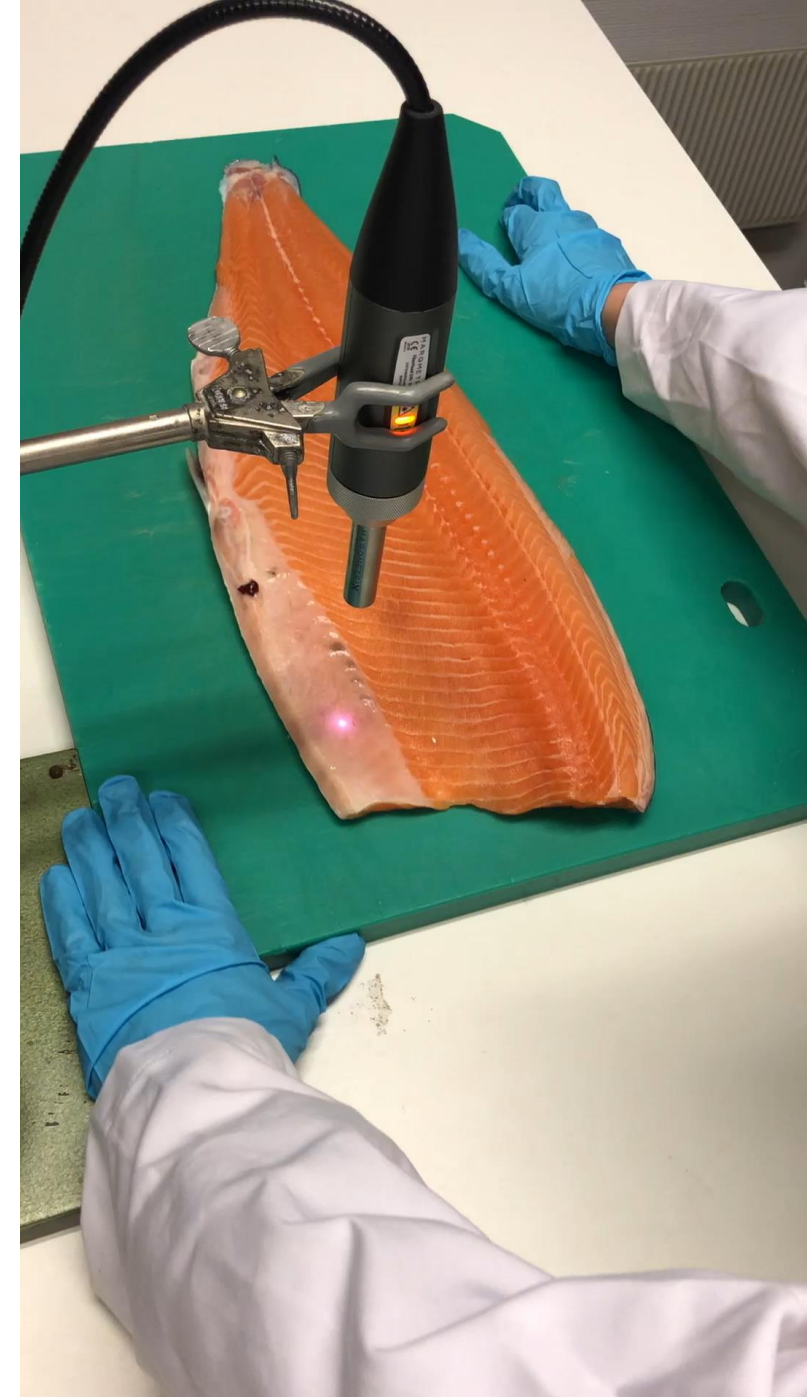
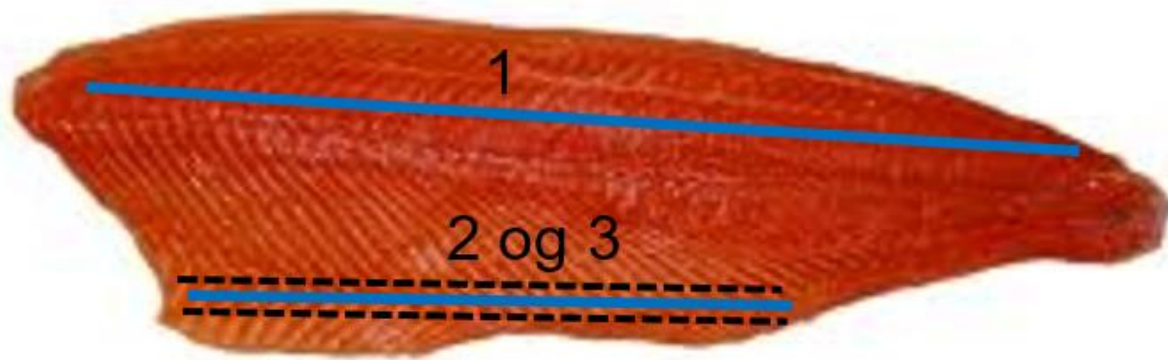
Average trends (15 min window)



Calibration spectra vs good in.line spectra

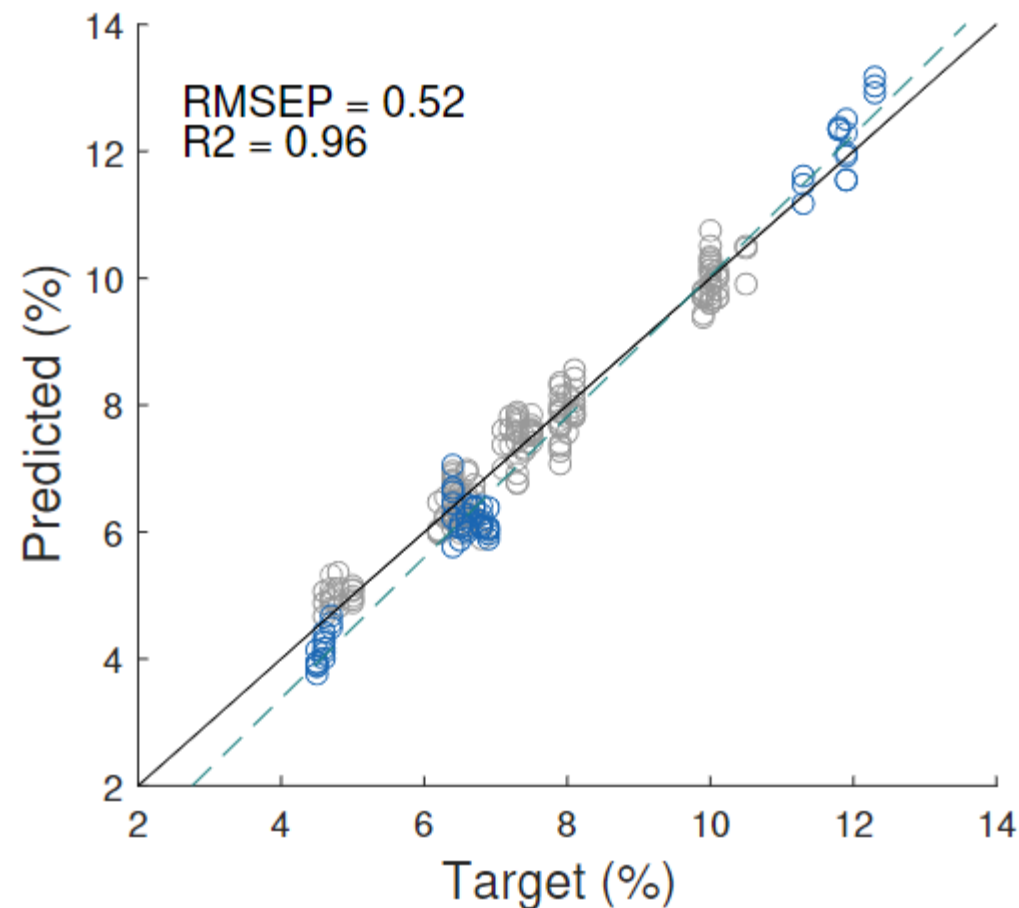
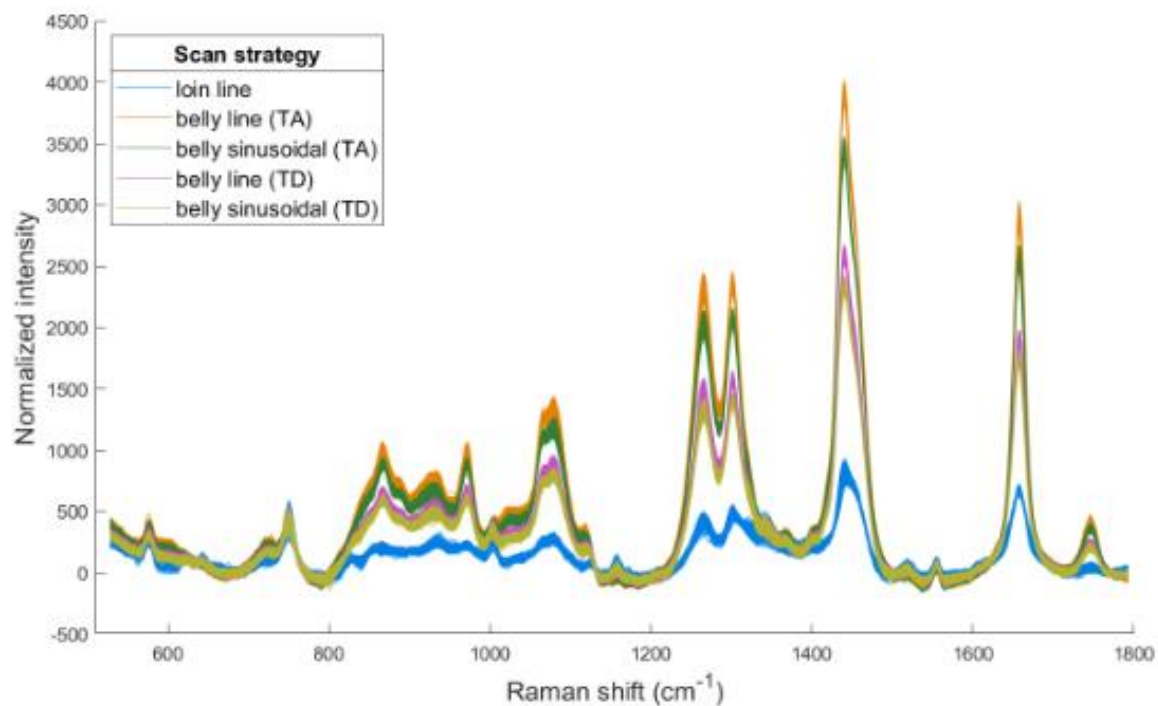


# In-line Raman

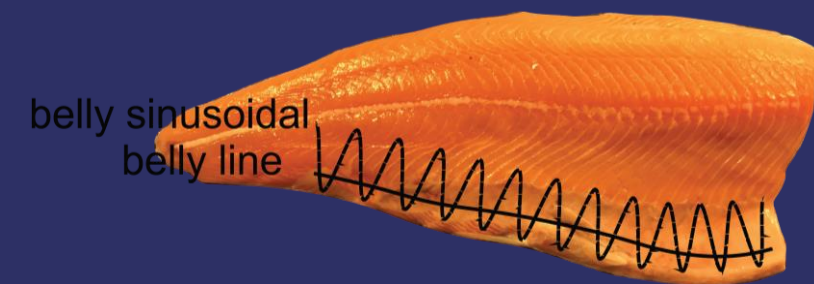
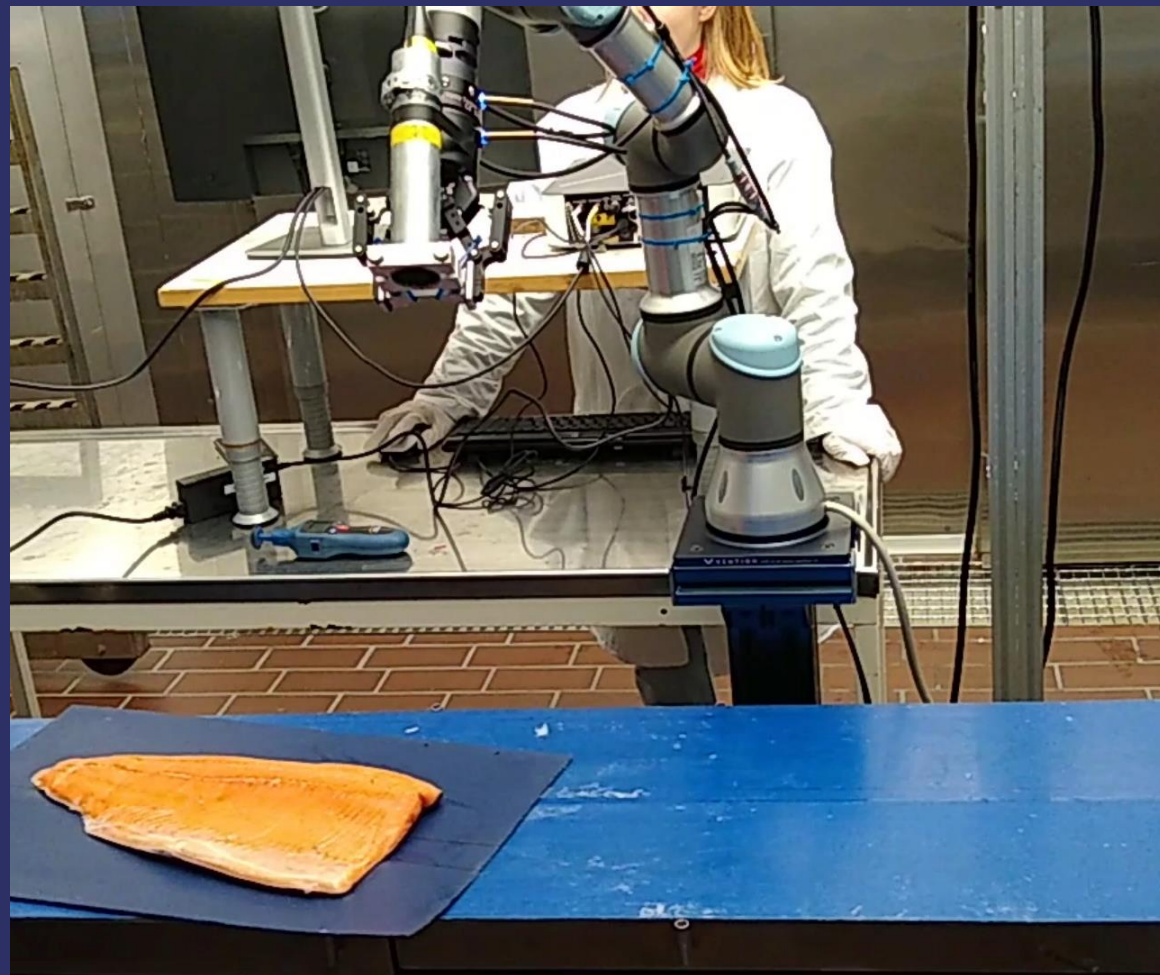




# Prediction of EPA+DHA fatty acids in salmon fillets based on Raman scanning



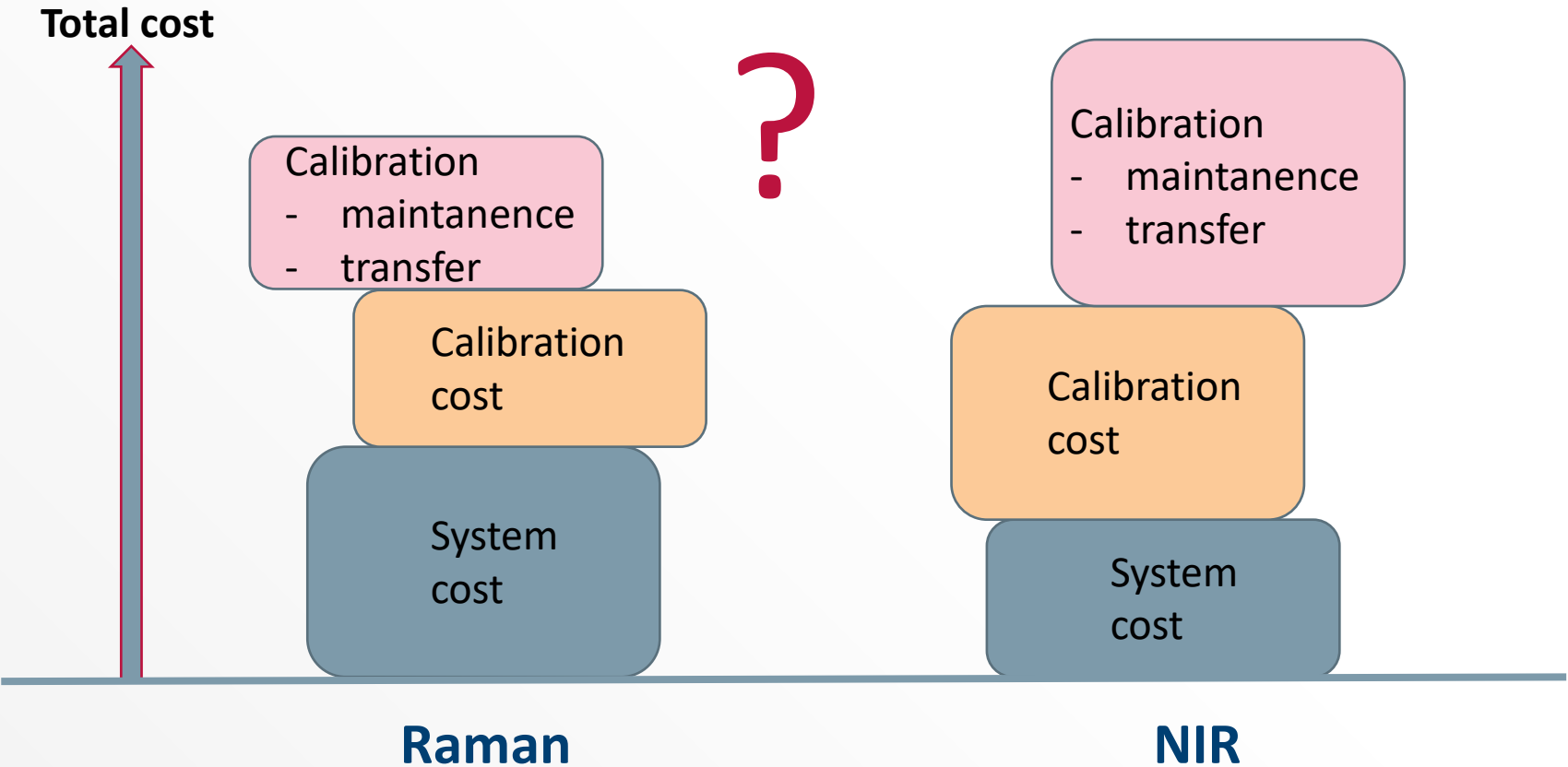
*Now we need robot!*





# Comparisons of Raman and NIR

- What are the total costs for Raman vs. NIR?



# Annual reports

[www.digifoods.no](http://www.digifoods.no)

