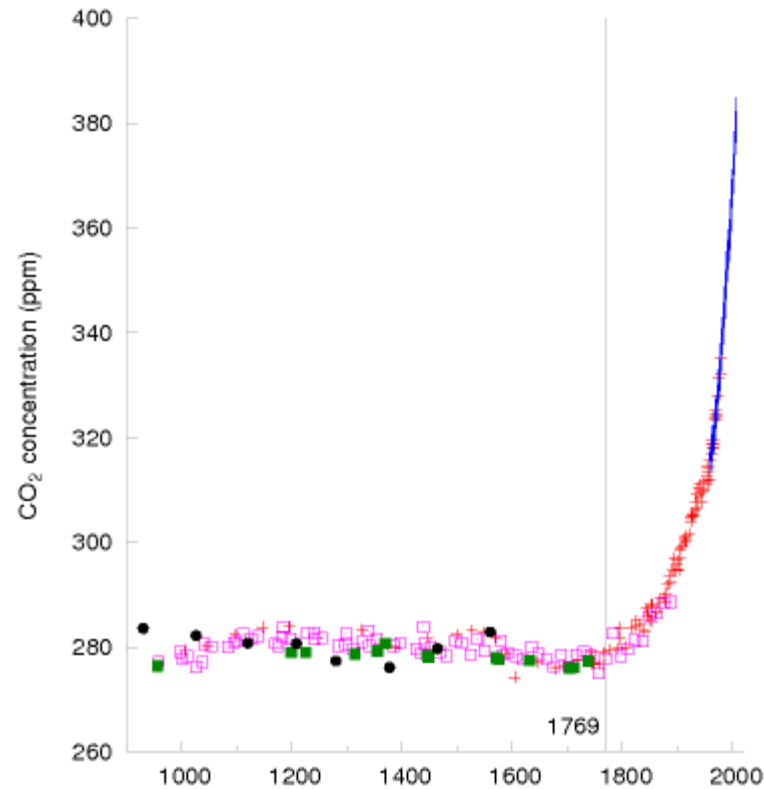


Towards efficient milk production

Peter de Jong PhD
Professorship Dairy Process Technology

25 September 2019

Sustainability



Source: David JC MacKay 2009 "Without hot air"



Example: footprint of cheese manufacturing

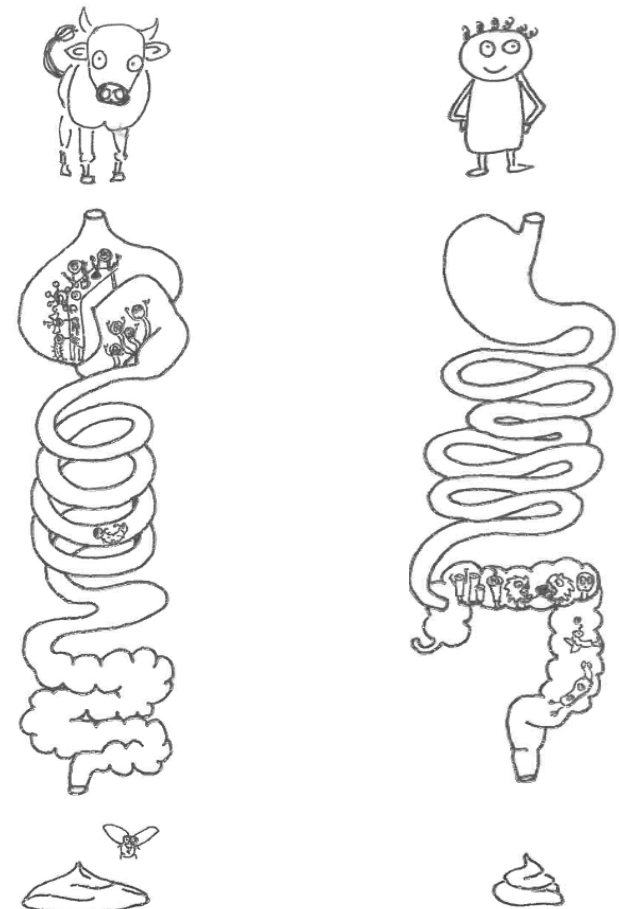
	CO ₂ -eq/kg cheese	H ₂ O kg/kg cheese	Cost (€/kg)
Cheese product	9	5000	4
Cheese manufacturing	1	10	0.4

1. A. Flysjö & A.K. Modin-Edman, How to use LCA in a company context – the case of a dairy cooperative. In: Proc. 9th International Conference on Life Cycle Assessment in the Agri-Food Sector. 2014
2. A.Y. Hoekstra, The water footprint of food, 2008
3. J. Hiddink et al. Case study sluiting waterkringlopen in de voedingsmiddelenindustrie, IMD, 1997
4. DOC annual report 2017



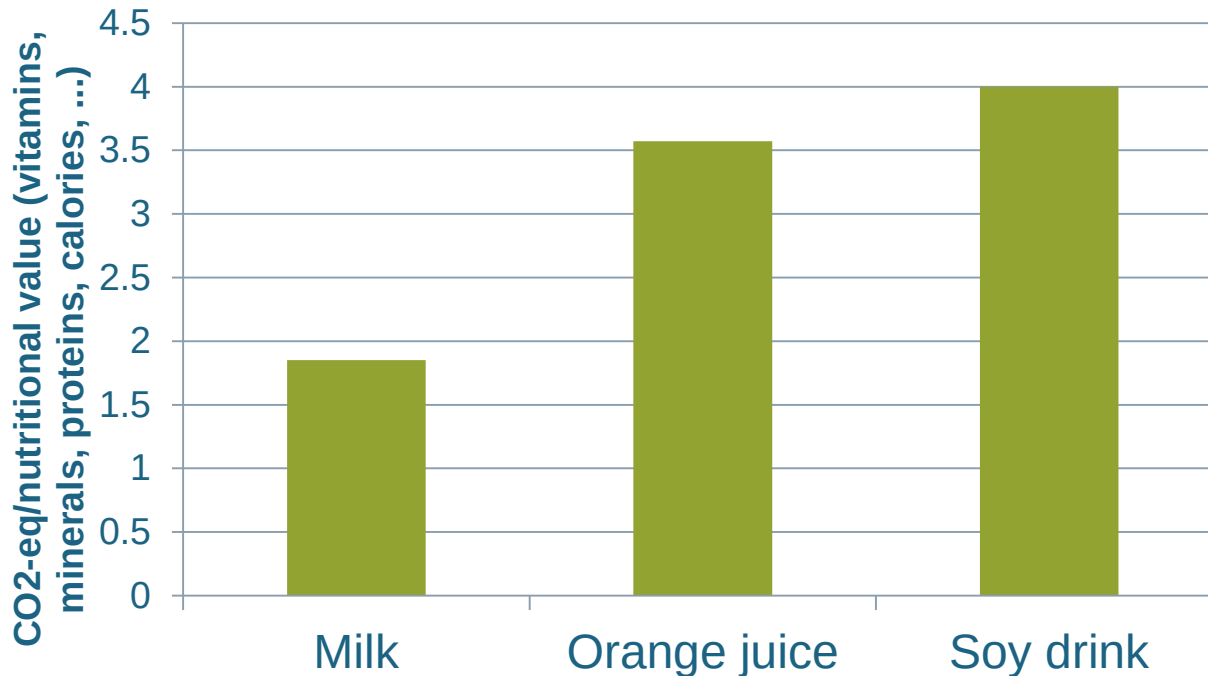
Where is Global Warming Potential coming from?

- >60% from primary sector (CH₄ has 25 times higher impact on GWP than CO₂)
- **10-20% from processing**
- 15% consumer

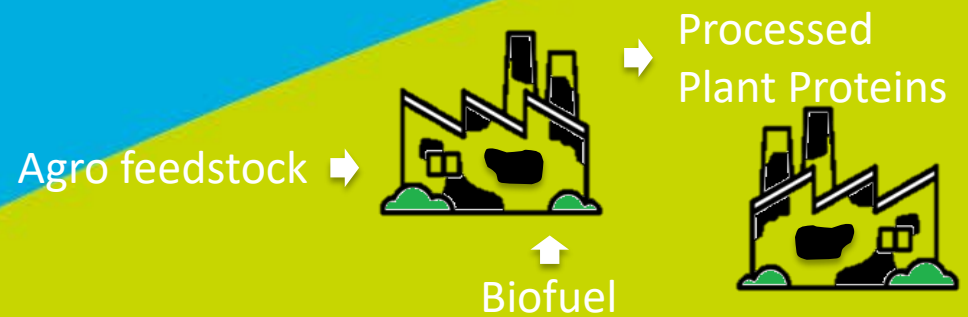


Milk is nutritious and sustainable!

CO2-eq per 100 g product compared to nutritional value







Sustainability



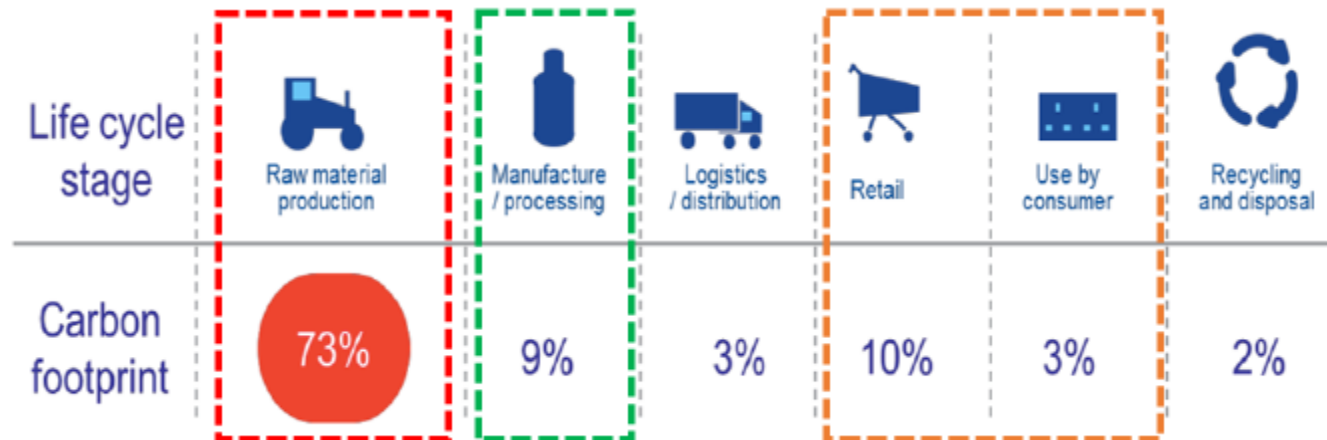


Outline

1. Optimization or innovation?
2. Examples of sustainable, efficient technologies
3. New way of process design



Impact of sustainable process design



Example: milk chain

2. Optimization or innovation?

Where to start?



2. Optimization or innovation?

Optimization or innovation?



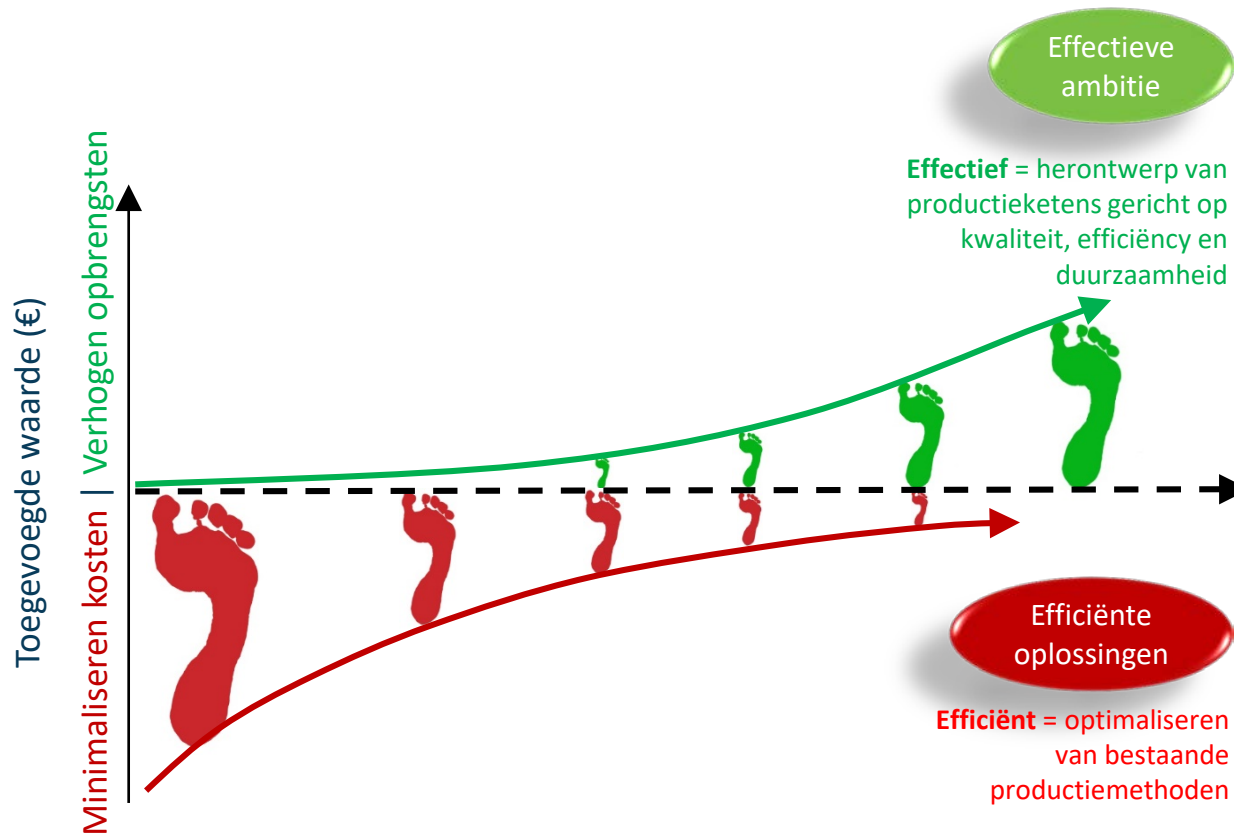
Improving the old...



Innovation...



From optimization to innovation



Innovation power?!



Bible History Online

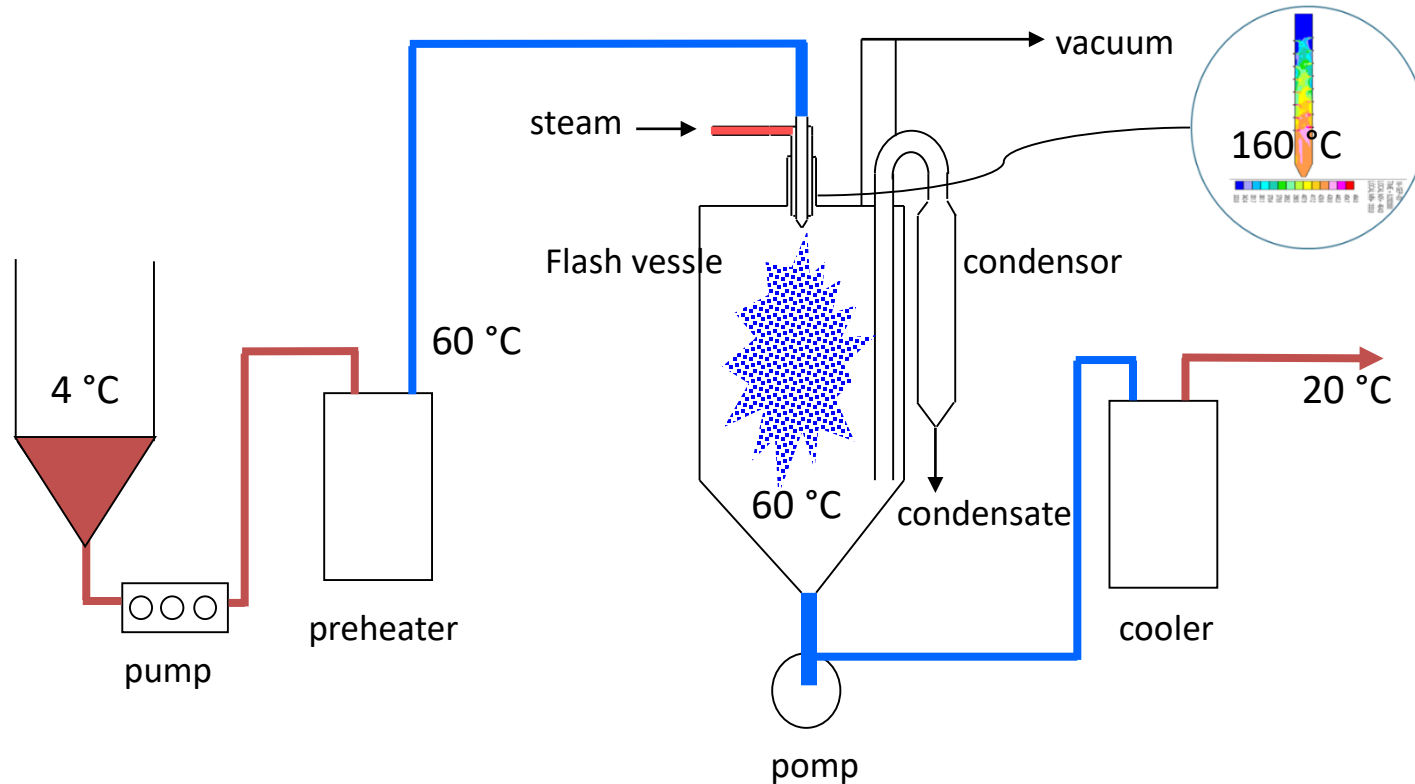
Drogen (vis)
1600 v.Chr.
door de
Egyptenaren



Drogen (pasta)
3500 jaar later
door
Europeanen



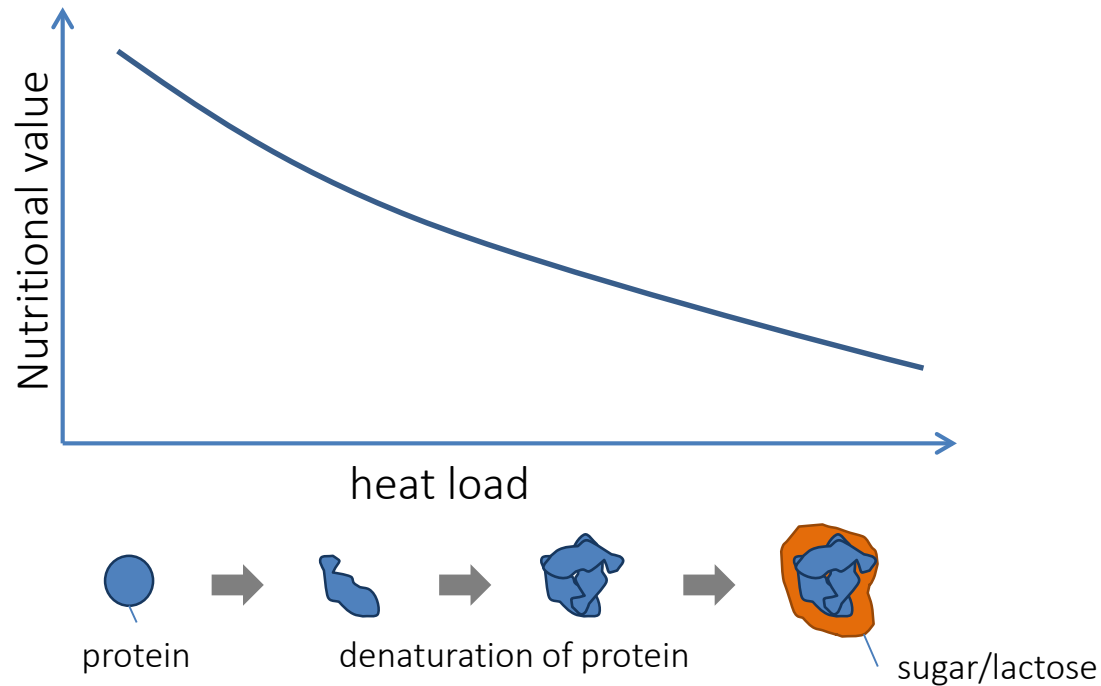
1. Mild processing



Result: 60 day shelf life of pasteurized milk!

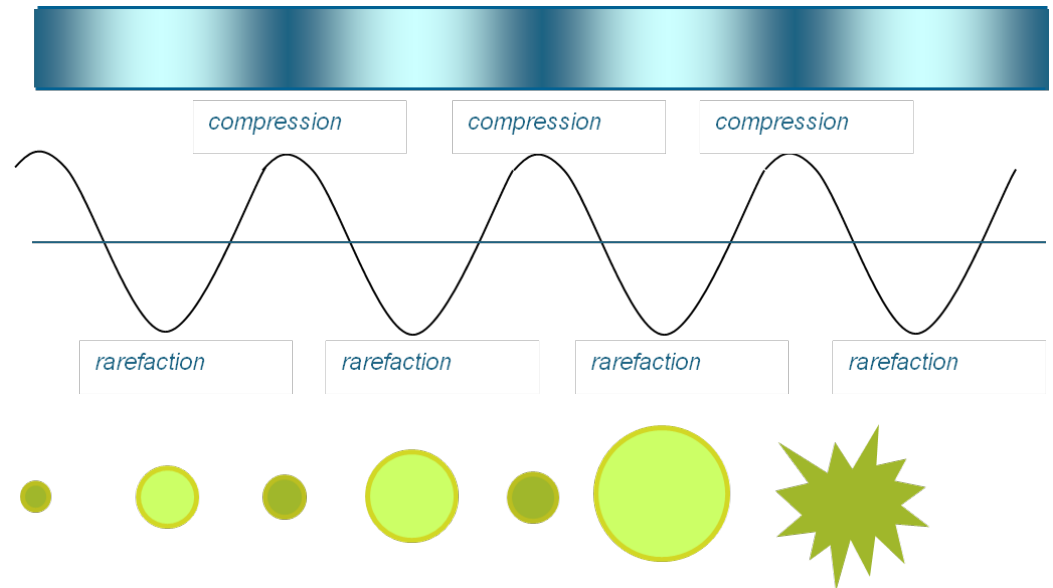
1. Mild processes

- Aim industry: decrease and control of glycation of proteins in processes

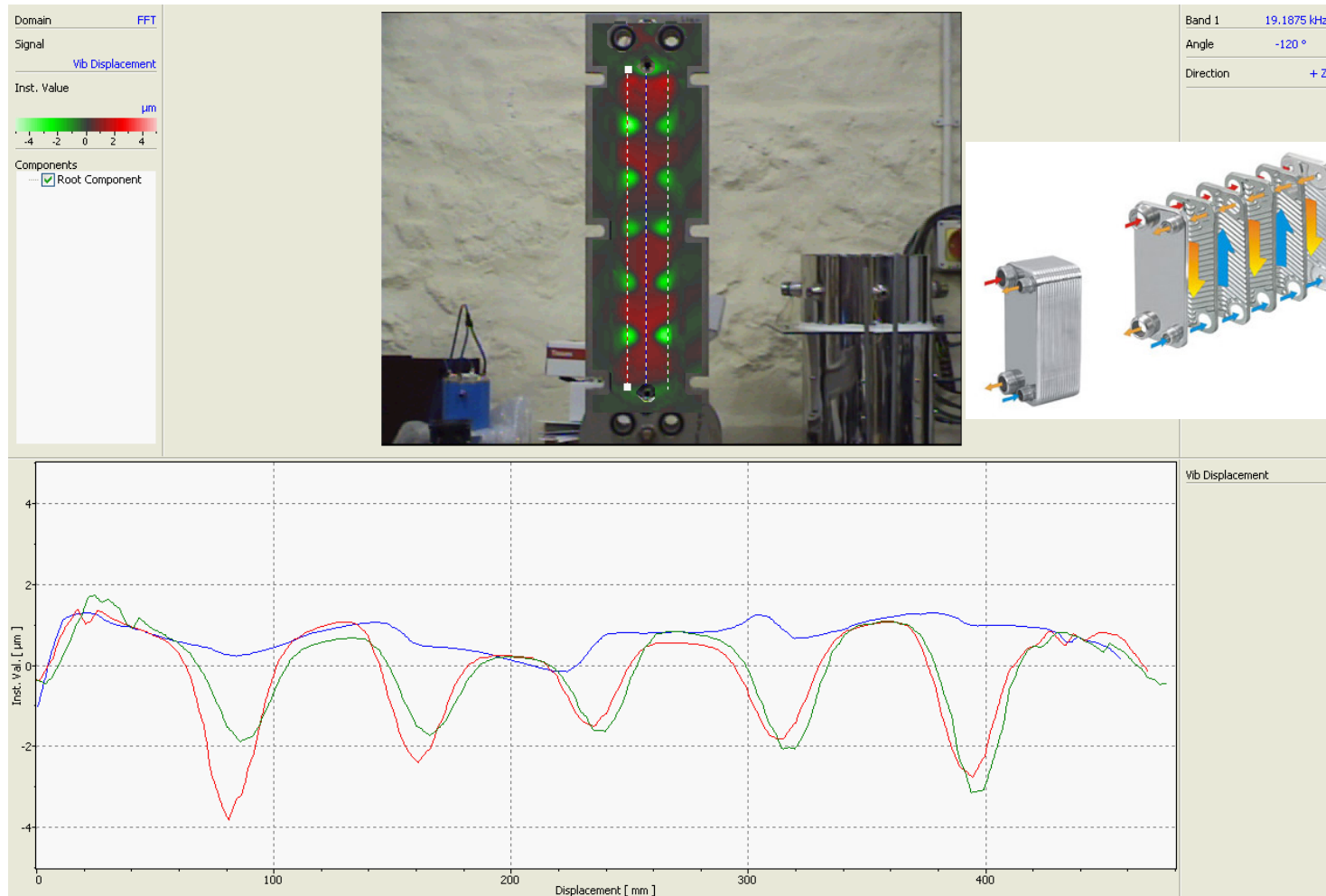


2. Ultrasound add-on

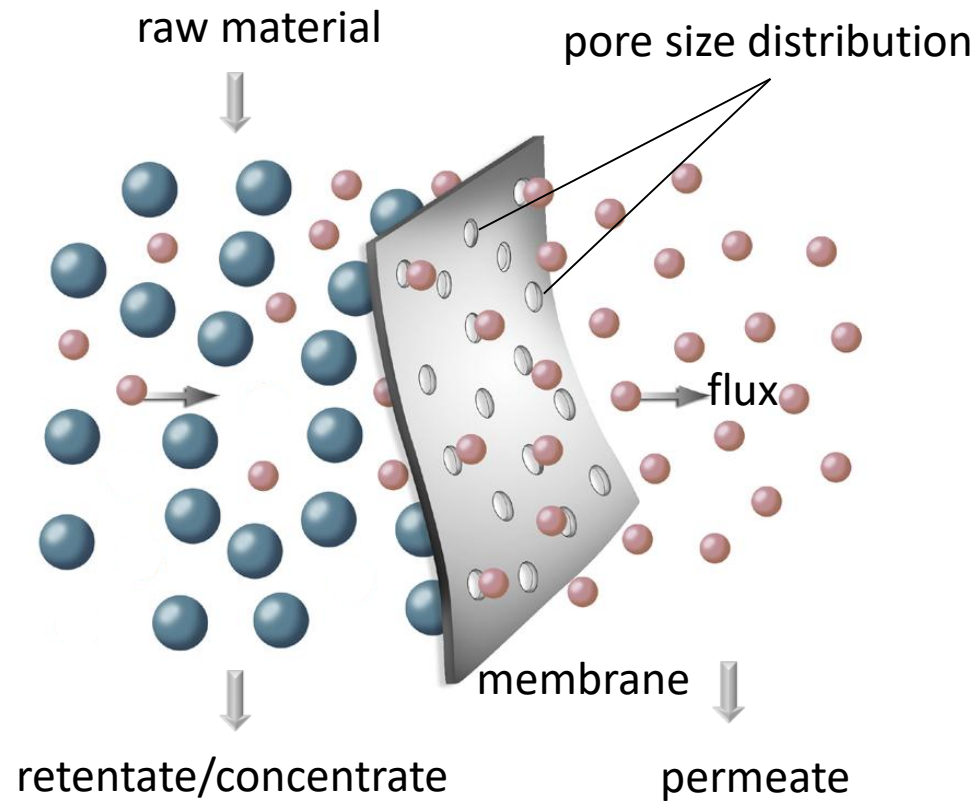
- Ultrasound principle:



2. Ultrasound add-on



3. Separation technology

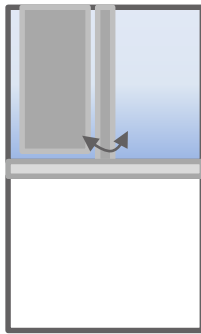


3. Separation technology

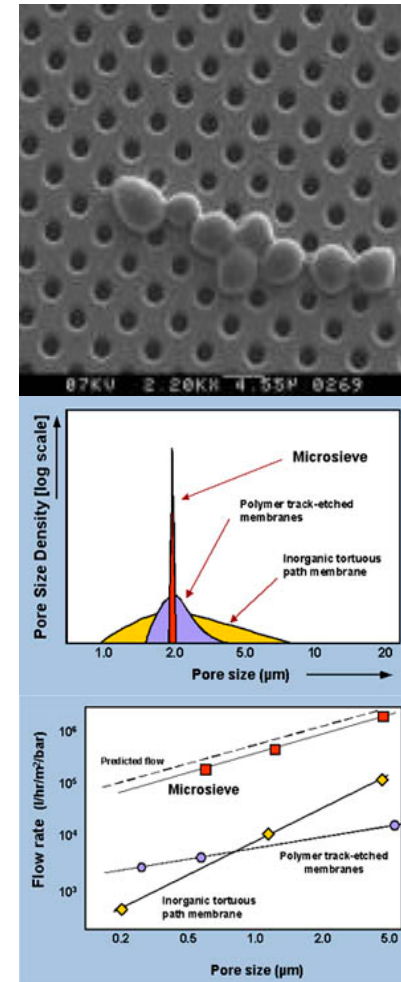


3. Separation technology

- Rotating Micro Sieves

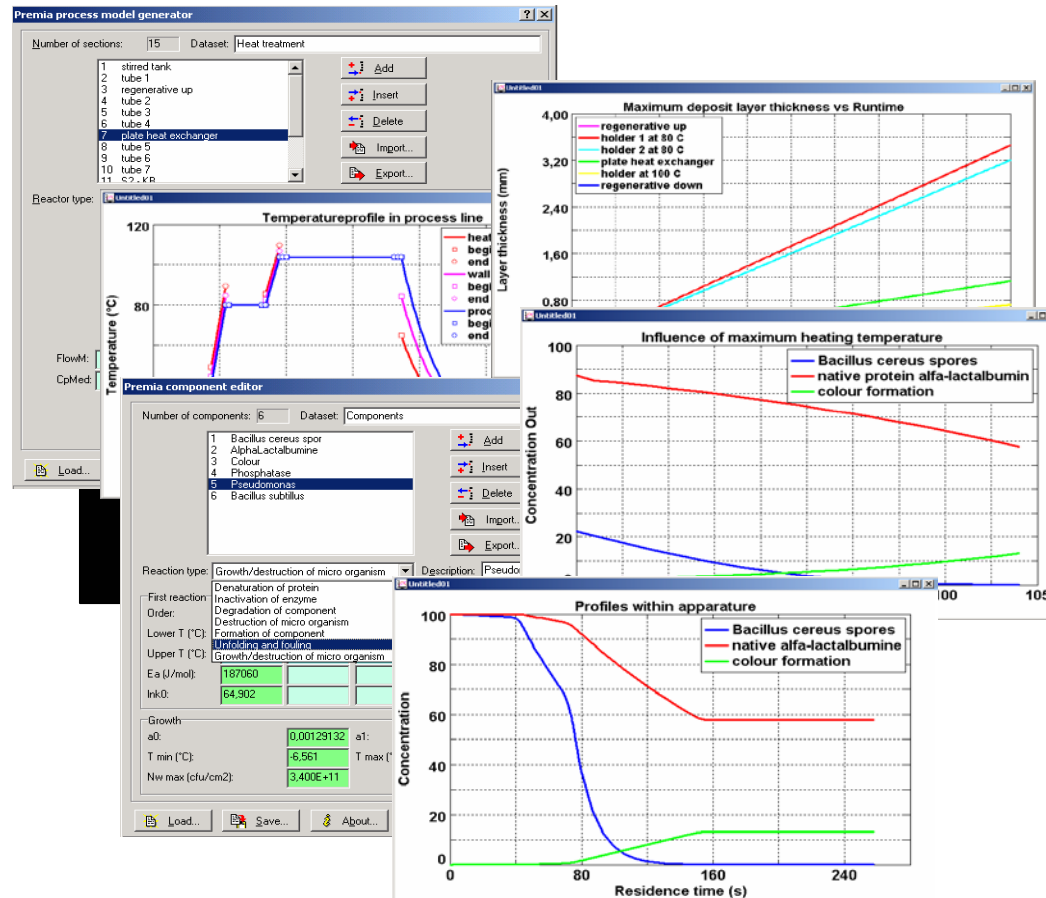


- 100 times higher fluxes
- Long run times
- Defined retention



4. Computer models & sensors

raw
milk



premium
product

1. Safety
2. Nutrition
3. Taste
4. Convenient



Conclusions

1. Optimization of current processes will not really help us, **innovation in the entire production chain** is needed!
2. To avoid high economic risks, companies have to develop innovative process technologies **together**
3. Be critical, be aware of subjective interests and do you your **own calculations** on climate impact of food production (including dairy)

