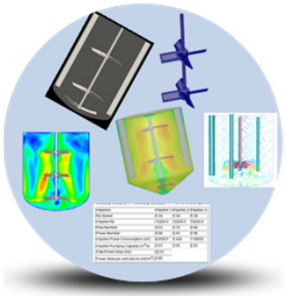
BPF added value

Fermentation & Downstream Processing

Typical fermentation & DSP challenges

Key parameters

- Purity of materials
- O_2, CO_2, heat and mass transfer
- Dissolved oxygen tension at scale
- Optimal mixing
- Gas-liquid separation
- Product yields
- Cost efficient process design



Insights & experience

Labscale optimized process for maximum productivity likely runs into scale–up limitations:

- Choice of DSP process and volumes, residual products
- Limiting transport phenomenon (heat, momentum, mass)
- Process sensitivity to gradients (nutrients, titrants, under aeration, CO2)

→ BPF brings industrial scale experience translated into right set of piloting conditions

Biotech Campus Delft

The Bioprocess Pilot Facilty

Pretreatment section

Steamexplosion

BIOPROCESS
PILOT FACILITY

Bioprocessing

Pretreatment

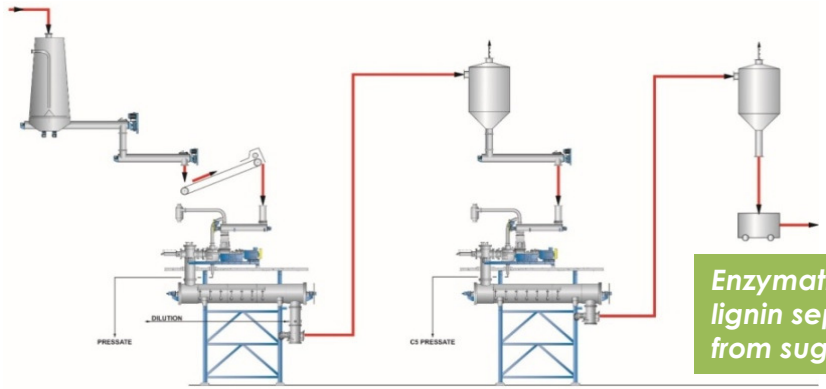
Feedstocks

- agricultural side streams & residues
- energy crops
- waste materials
- other on request

Process

- aqueous
- chemical
- biomass
- hydrolysis
- decanter
- evaporator
- heat shock

Pilot	**Bench**
40 kg/hr	4kg/ batch
pre-hydrolysis	**ATEX**



Enzymatic Hydrolysis lignin separation from sugar

Hot water/Steam

Steam explosion

Hydrolysis

BPF added value

Pretreatment & enzymatic hydrolysis

Track record (examples)

- BIOETHANOL
  scale up steam explosion based pretreatment process
  from cellulosic feedstocks

- AGRIMAX BBI 2015
  technical and economic feasibility of applying
  biorefinery processes for valorising crops & food processing derived wastes

- BIOFOREVER BBI 2015
  BIO-based products from Forestry via
  Economically Viable European Routes

- Multiple other projects covering i.e. pretreatment of hard / soft wood
  (details can't be shared because of confidentiality)

Benefits of scaling up / piloting at BPF

- Industrial scale knowledge
- Extensive and hands-on experience with multiple products and processes
- High flexibility in equipment

Biotechnology perspective

Relevance of scale down expertise

Pretreatment & enzymatic hydrolysis challenges

Typical parameters

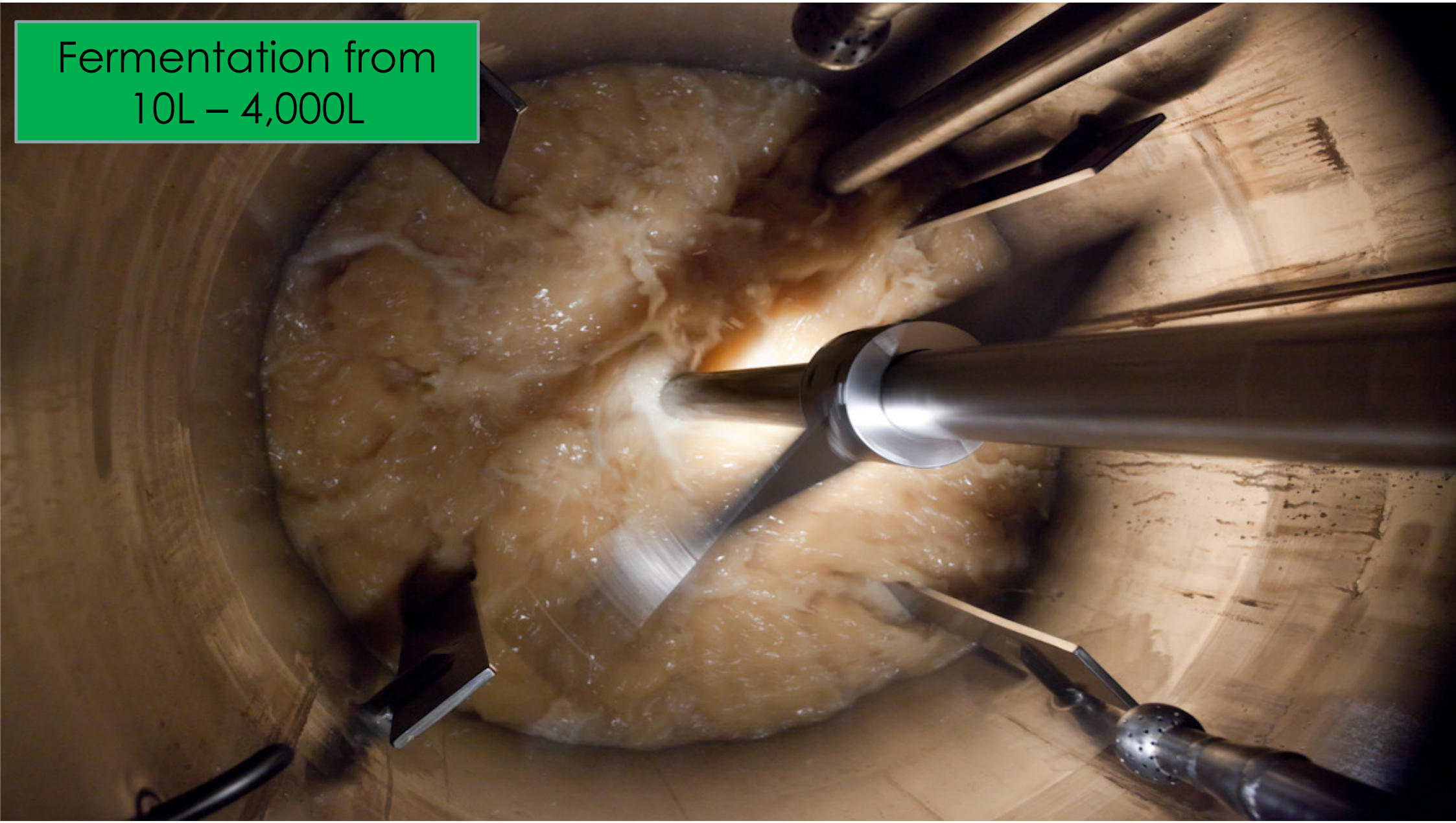
- Biomass composition variations
- Right balance (hemi) cellulose yield and inhibitor formation
- Setting optimal processing conditions (T, p, pH,..)
- Solid /liquid separation (sugars)
- Cost efficient process design

General considerations

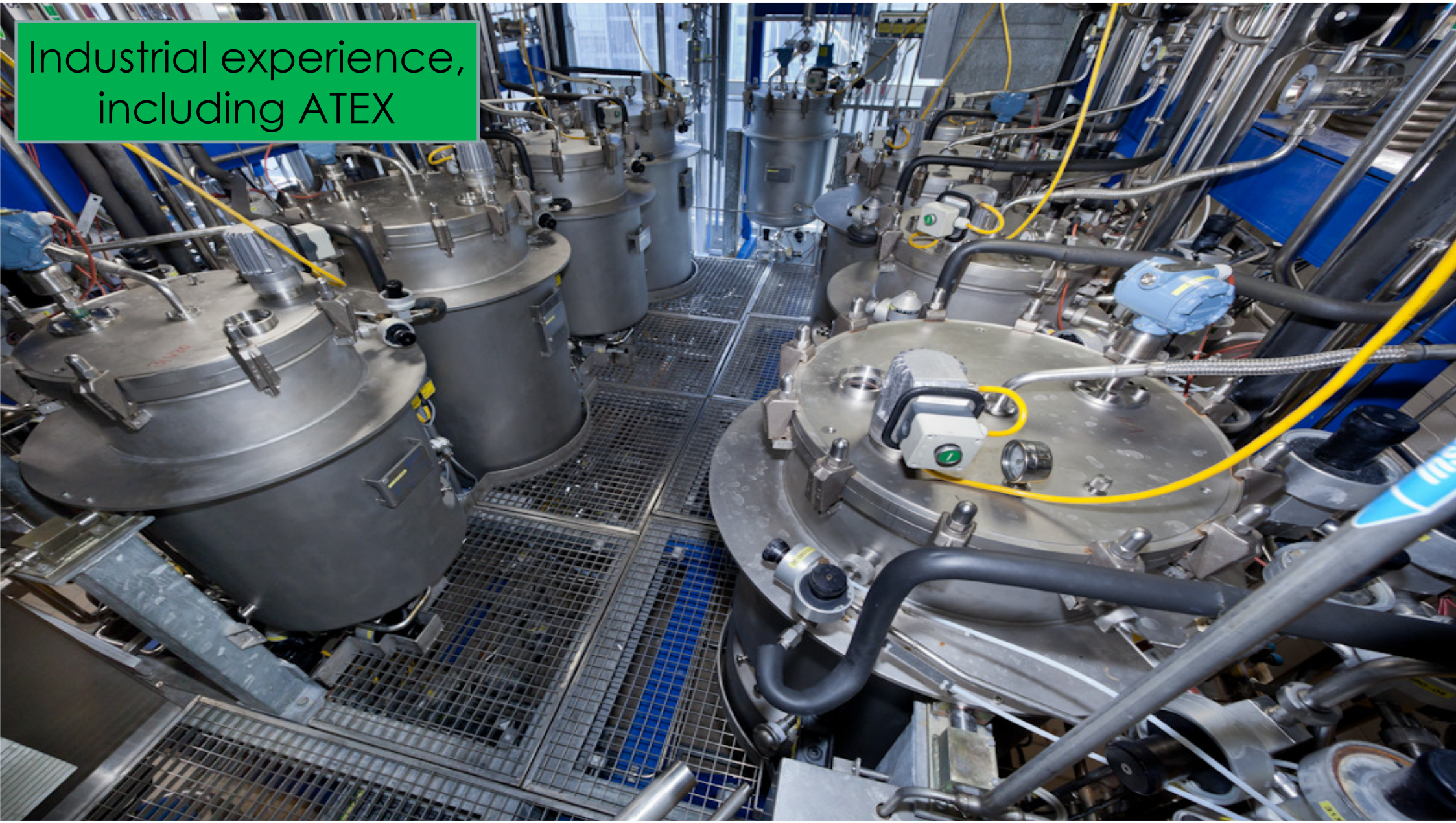
- Public domain knowledge limited (IP)
- Hands-on experience required

Technology

BPF uses steam explosion to yield C5/C6 sugars from lignocellulosic / agricultural biomass

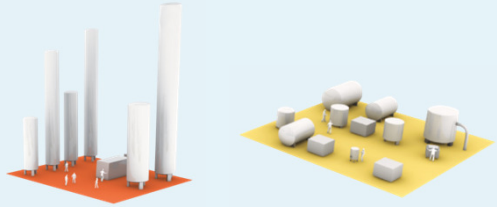

Fermentation from
10L – 4,000L

Industrial experience, including ATEX



BIOPROCESS
PILOT FACILITY

Bioprocessing



Fermentation

Process

- pre-sacc only, SSF
- clean/mixed substr.
- physical/ionic conditions
- C_5 & C_6, each/mix
- batch/continuous

Enzymes

- natural cocktail
- component cellulases
- enhanced cocktail
- produced in situ
- shipped in plant
- combinations

ATEX

Organism

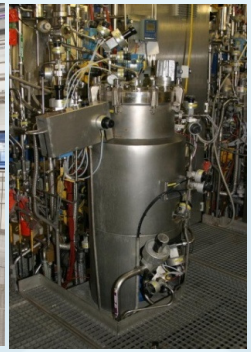
- bacterial
- fungal
- yeast
- GMO
- non-GMO

Equipment

- 15 & 70 L
- 4 x 100 L
- 4 x 300 L
- 1 m^3
- 4 m^3

FOOD

- 4 L
- 40 L
- 400 L
- 2 x 2000 L



Fermentation

Centrifugation