

# University of Nottingham 10 hL Research Pilot Brewery





# Brewery view from FV's (foreground) to BBT's and packaging





# Brewery view from beer chiller to FV's and hot side (background)





# Research Pilot Brewery (RPB) Nottingham

Located on the **Sutton Bonington campus of the University of Nottingham** and is used for **liquid, process and raw material R&D initiatives.**

## Capabilities:

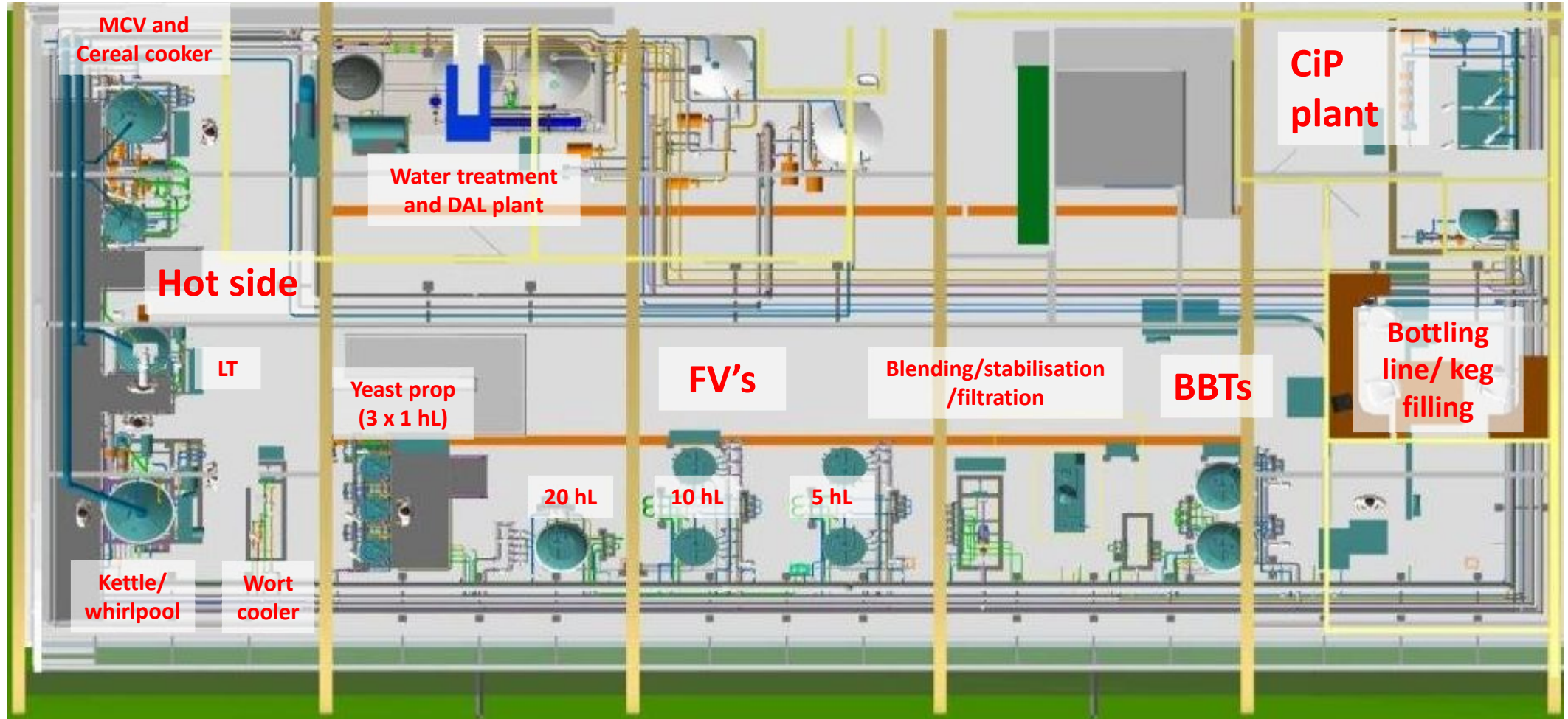
- RO water plant.
- Milling – hammer mill & 2-roller mill.
- Yeast propagation.
- Brewhouse of 10 hL containing Mash Conversion Vessel, Cereal Cooker, integrated Lauter Tun or bypass for Mash Filter (micro Meura hybrid). Kettle/Whirlpool including gas sparging (simmer and strip).
- 5 x fermentation uni-tanks (50 hL capacity), with 3 DFT (isomix) mixing systems.
- Inline dilution and filtration
- 2 x 10 hL BBTs
- In tank aeration/carbonation
- Semi-automated packaging line for glass bottles at 500 BPH

Independent operation as all utilities are managed/maintained in the RPB (Glycol, EUWA Reverse osmosis water plant, steam generating boiler, air compressor).





# Floorplan (ground floor)





# Milling

- **Hammer mill** (malt, corn, oats, wheat, cassava...)
- **2-roll mill** (malt)
  - Smaller 2-roll mill also available (to minimize process losses)

## Time

- Milling - ca. 1h ,occurs the day of the brew



Hammer mill (green/foreground) & 2-roll mill (grey/ background)



# Brewhouse (10 hL brew length)

- Mash conversion vessel (10 hL)
- Cereal cooker (5 hL)
- Lauter Tun
- Mash Filter
- Kettle / Whirlpool
  - Simmer and strip capability
  - External Wort Heater
- Wort cooling
- 200 kg max dry matter input

**Kettle**

**Lauter Tun**



**MCV**

**Cereal  
cooker**

## Times

- Full brewhouse process- ca. 8h
- CIP brewhouse- ca. 1 full day
- CIP fermentation tank- ca. 3h



# Meura mash filter (foreground) and EUWA water treatment plant (sand and charcoal filters/ RO plant)



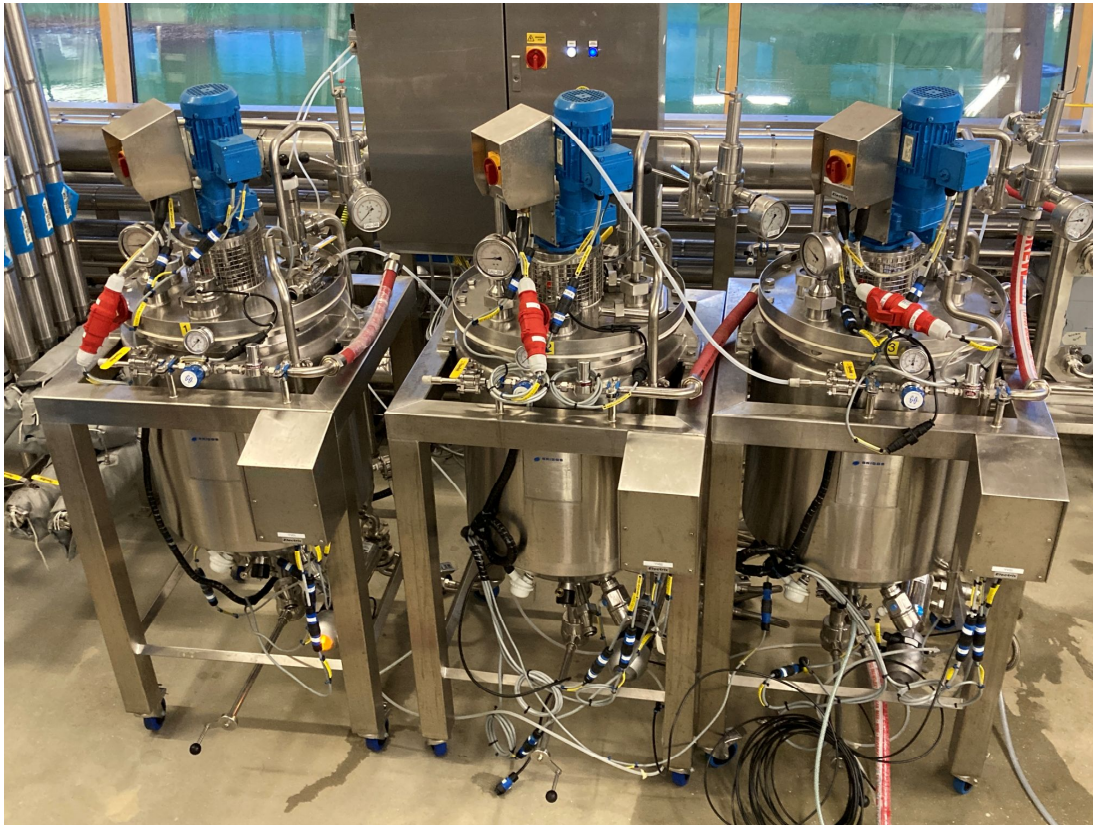


# Fermentation

- 5 Uni-tanks:
  - 1 x 20 hL
  - 2 x 10 hL
  - 2 x 5 hL
- Mixing capability in 3 vessels
  - 10 hL and both 5 hL vessels with DFT (Alfa Laval Isomix)
- Aeration in 2 tanks (5 hL, 10 hL)
- Full process - ca. 10-14 days; pending on type of beer
- CIP fermentation tank- ca. 3h







3 x 1 hL stirred vessels (multi-purpose propagaters/fermenters/blending vessels)



FV tank farm



# Beer finishing to BBT

- Beer chiller (glycol)
- Centrifuge (Seital)
- Cartridge Filtration
- Dilution (with DAL)
- BBTs 2 x 10 hL (in-tank carbonation)
- Packaging

## Times

- Centrifuge - Full process ca. 1 day including CIP (before) & sterilization (after)
  - CIP / Deaeration of collection tank ca. 3h (done same day as centrifugation)
- Filter & Chiller- full process ca. 1 day including sterilisation & cleaning (done same day as centrifugation)



**BBTs**

**Filtration &  
Blending**

**Centrifuge**

**Beer chiller**



# Packaging & Pasteurisation

## Bottling

- Automatic rinsing, filling, capping operations
- Filling from keg and tank possible
- Glass bottles: 33cl
- Closures: 26mm crowns
- Batch code and best before date printing
- ca. 500 BPH

### Times

- Full process ca. 1 day including sterilisation & cleaning

### -Notes:

- Standard bottles: APO Amber 33cl, Libra flint 33cl
- Additional time to be taken into account for rinsing in-between various prototypes; especially for liquids with strong flavouring

### Batch pasteurizer @ 775 bottles per 4-hour cycle

- Full process, including manual loading/unloading ca. 2-3 hours (depending on PU-target)
- The bottles / cans are typically only available 1 day after the batch pasteurization
- 2 runs can be done on 1 day; depending on number of bottles / cans & PU-target



## Keg Filling



# RPB Analytical facilities

## Brewery quality lab:

- Spectrophotometer (IBU's, Colour, TBA Index, etc.)
- Automated and manual cell counting methods
- Anton Paar
- pH meter
- Incubator
- Turbidity Meter
- Haffmans and Orbisphere (DO/CO<sub>2</sub>)
- Flavour Stability via ESR (Lag time/T150)
- Rapid VDK analysis (GC-IMS)

Many other analyses can be arranged in **UoN labs**, e.g:

- Foam stability (NIBEM)
- Gas Chromatography (FID/ECD/PFPD)
- Dionex-LC
- Metal ions (ICP-MS)
- Yeast/ molecular biology lab (laminar flow, centrifuge, shakers, autoclave, PCR, microscopy)
- Sensory panel

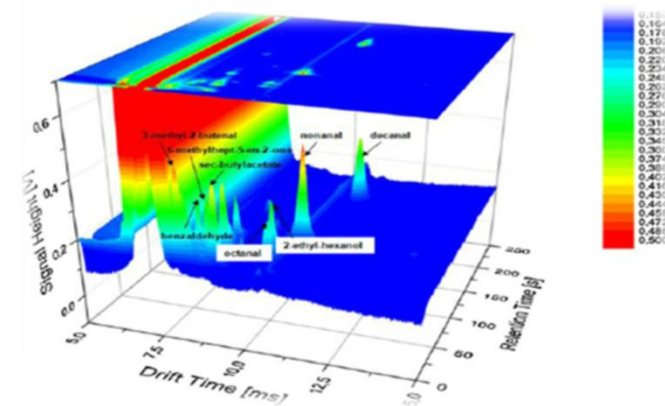




# RPB Lab Analyses (Advanced)

## GAS FlavourSpec – Rapid VDK Assessment

- Novel chromatographic method for rapid VDK assessment (GC-IMS)
  - Operator training minimal
  - Infrequent calibration regime
  - Fast turnaround
  - Capacity increase

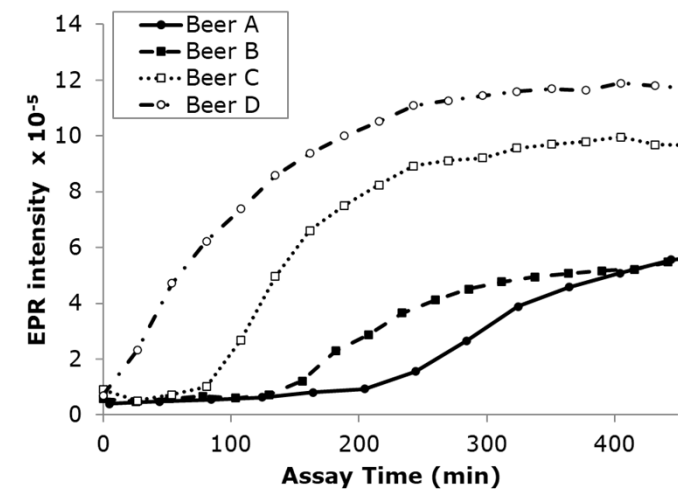


## Bruker ESR – Flavour Stability Analysis

- Electron-spin Resonance Spectroscopy for detailed assessment of liquid stability
  - Freshness
  - Shelf life
  - Severity of staling
  - Process improvements can be monitored



*The Bruker E-Scan ESR instrument*





# RPB Nottingham

