Master Brewers Association of the Americas
Dedicated to the technology of brewing.
MBAA Annual Conference

Experience-based simplification of the lautering process – scientific results of a flow optimization at the lauter tun

Brewing Summit 2014 (June 4-7), Chicago
MBAA Annual Conference, June 5-7

M-29 Tobias Becher, ZIEMANN International GmbH (Germany)

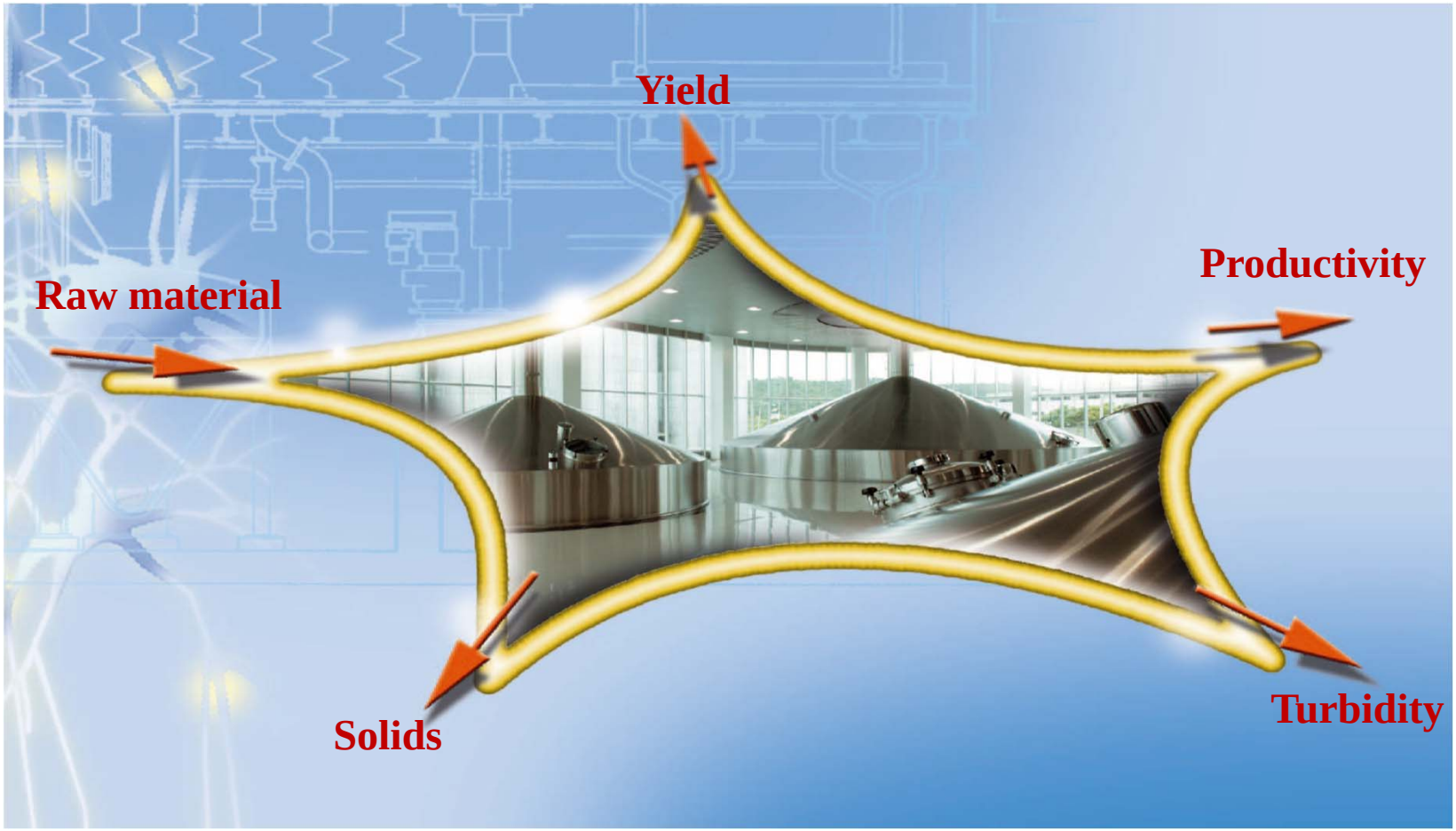
Agenda


State of the art
Simulation
Field trial
Prototype
Result
Product

Objectives of lautering

Mash separation of liquid (wort) from the solids (spent grains)

Washing out of the extract remaining in the spent grains



Lautering equipment

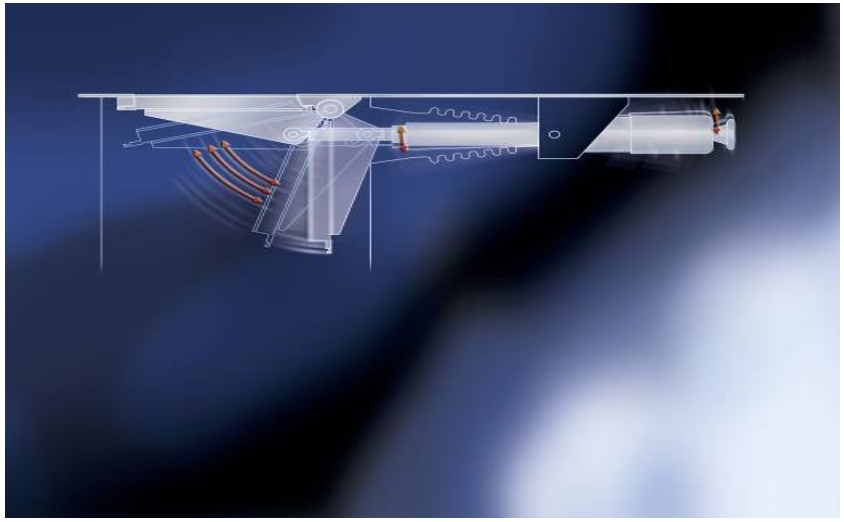
Approved State of the Art (i.a.)

Racking machine with up to 8 arms
Slow rotational speed

- Dynamic Lautering Mode
- Optimum build-up of spent grains cake

Spent grains flap

- completely made of stainless steel, maintenance-free
- the flap closes even with bottom, therefore no CIP residues and no losses



Lautering equipment

Approved State of the Art (i.a.)

Square-shaped false bottom elements

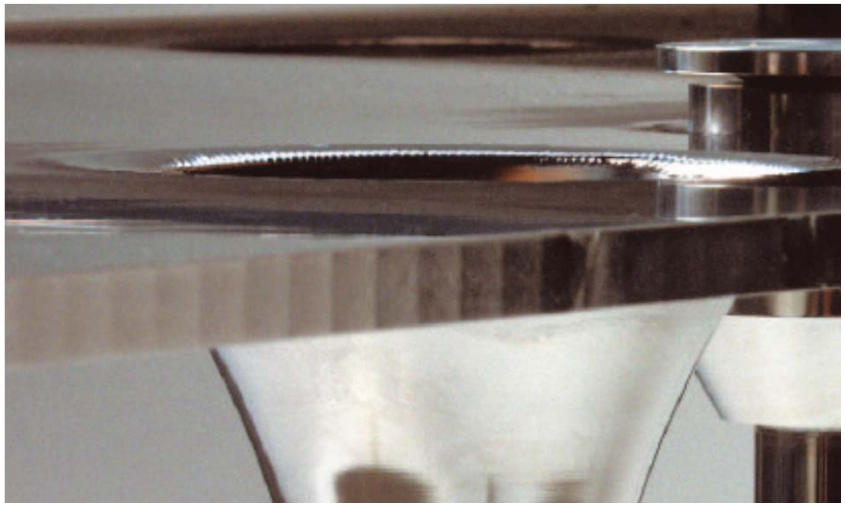
•Easy handling for maintenance work

•Large available flow area

Special `Tulip´ design without separation edge

•Gentle and continuous drawing-off

•Perfect “de-watering”



Lauter tun – design

Current situation

✓Exhausted technology

✓Proven design

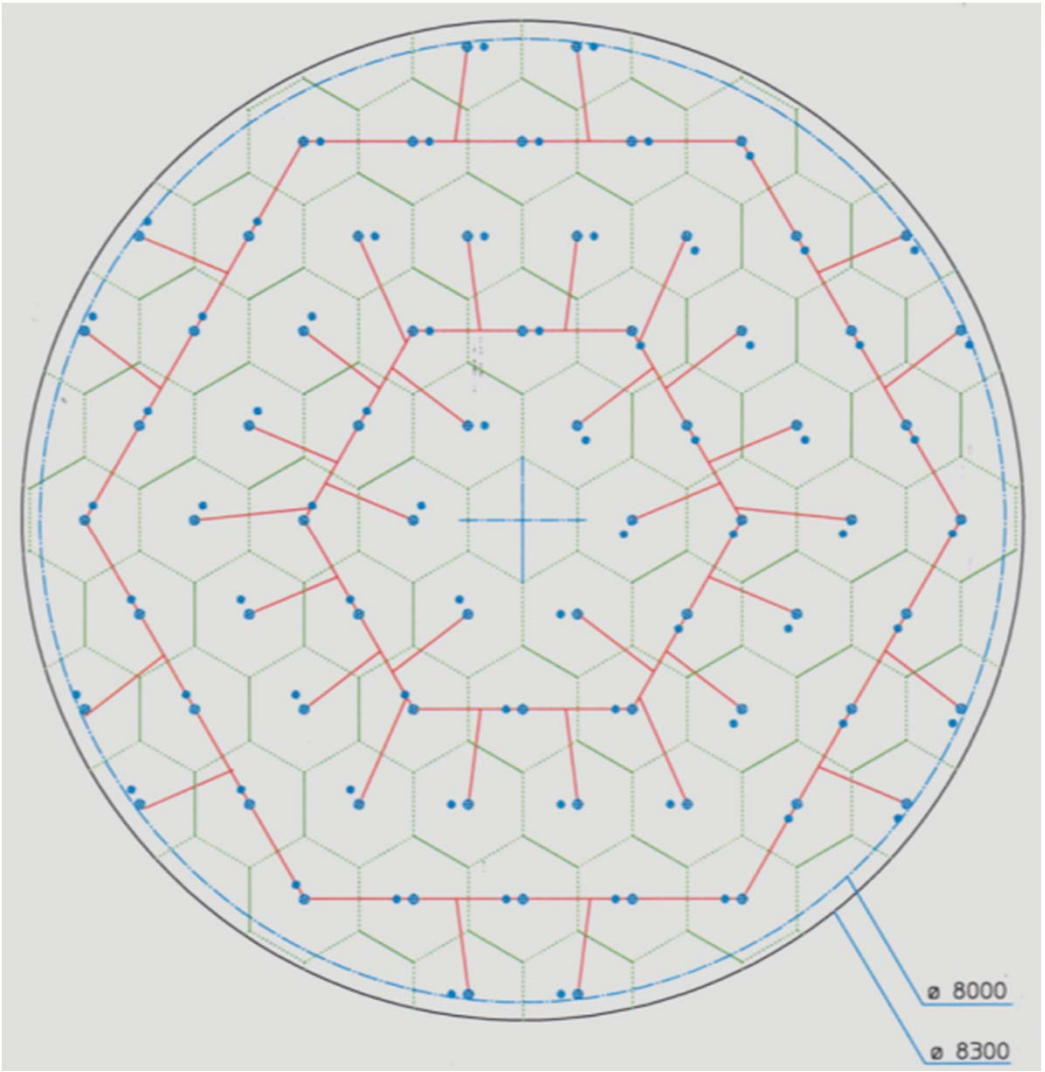
How to further optimise?

&Learn from accidents
and observations

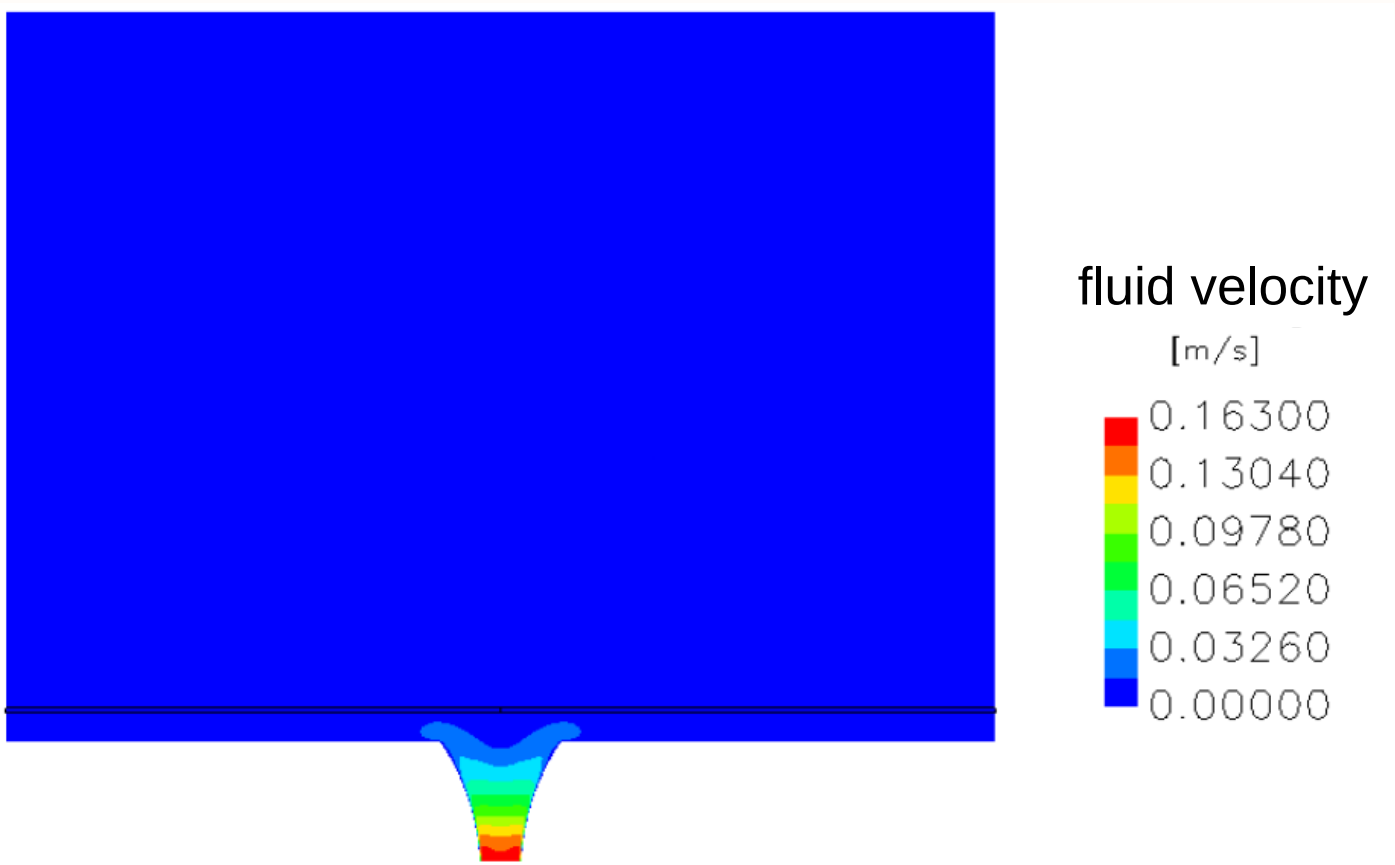
&Check interfering advantages

&Eliminate overlapping effects

&KISS - keep it simple and smart



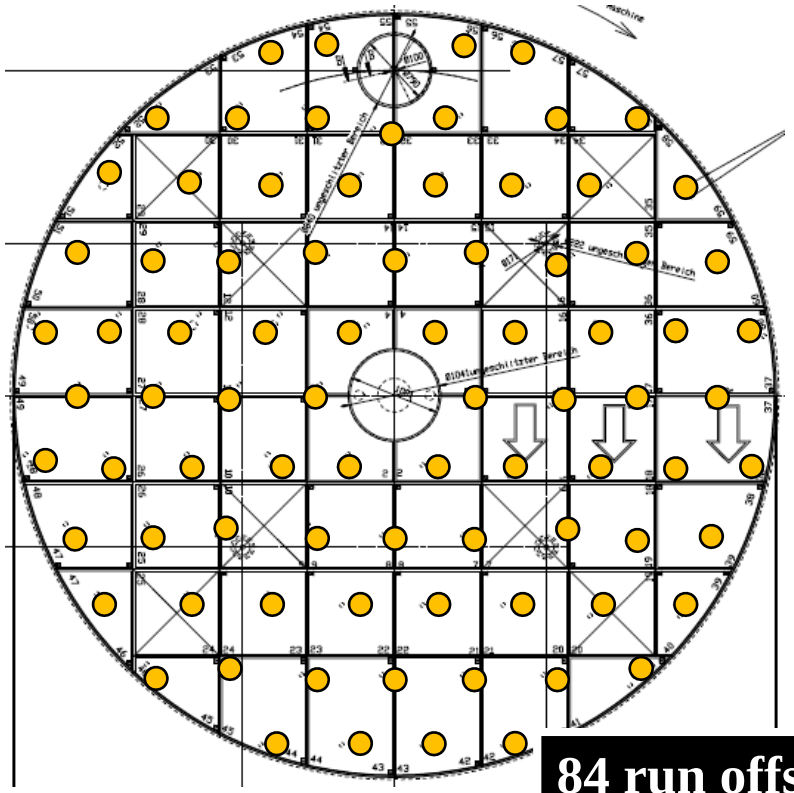
Simulating of the fluid velocity



- Noticeable rate increase takes place only in the tulip (run-off design)
- 25 mm fluid space (false bottom) → decoupling of the system

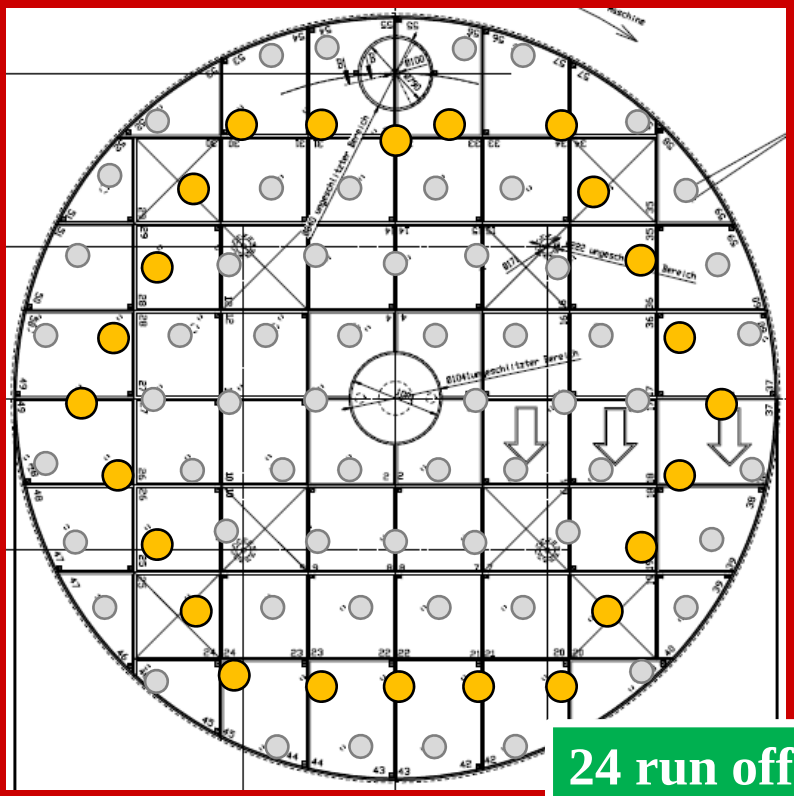
Lauter tun – field trial

Check plot - current lauter tun design



84 run offs
D=8,600 mm
2 pipe rings

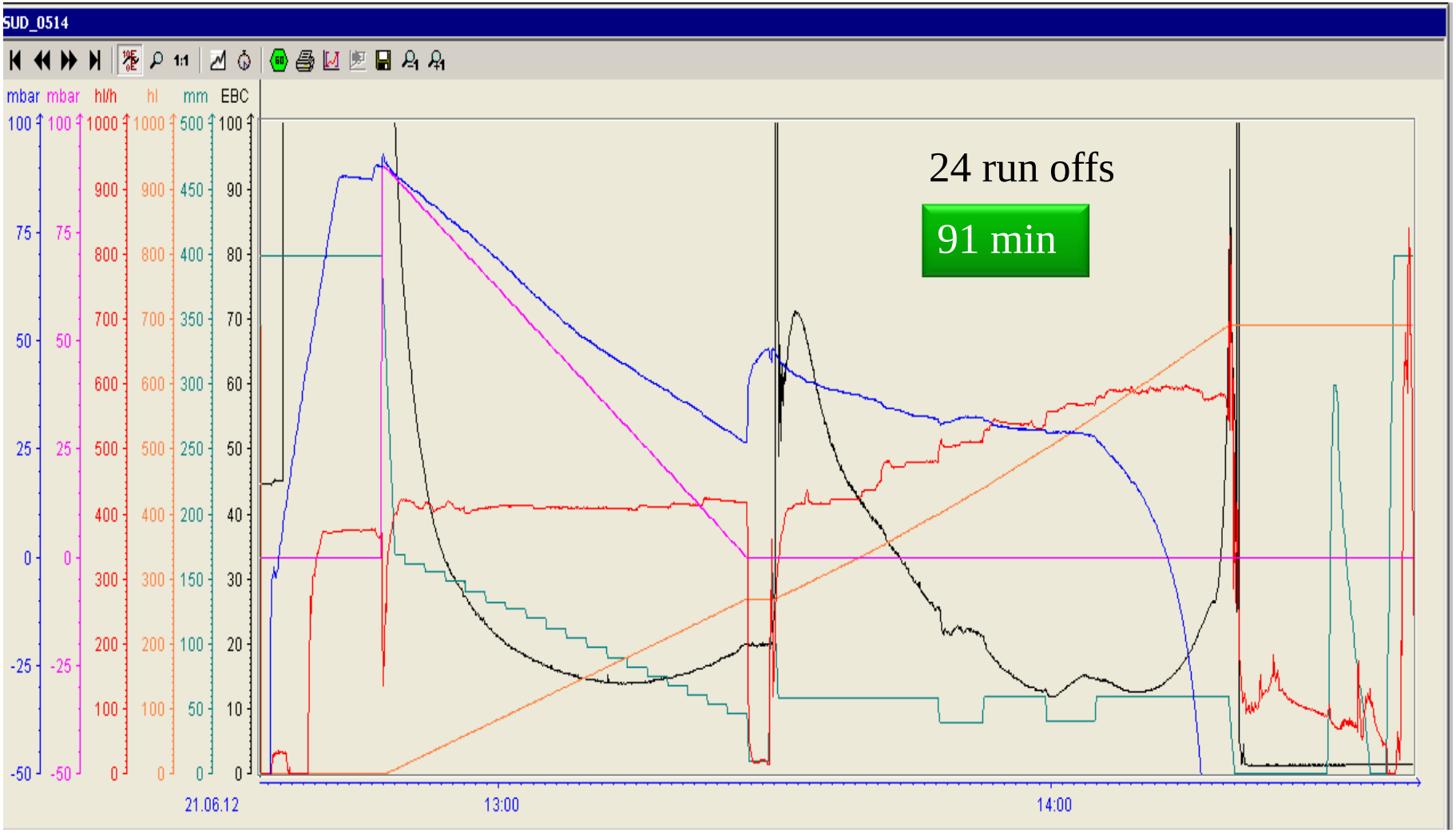
New technology - extreme trial



24 run offs
D=8,600 mm
1 pipe ring

Field trial 1 – check plot

Field trial 2 - new technology



Field trials - first results

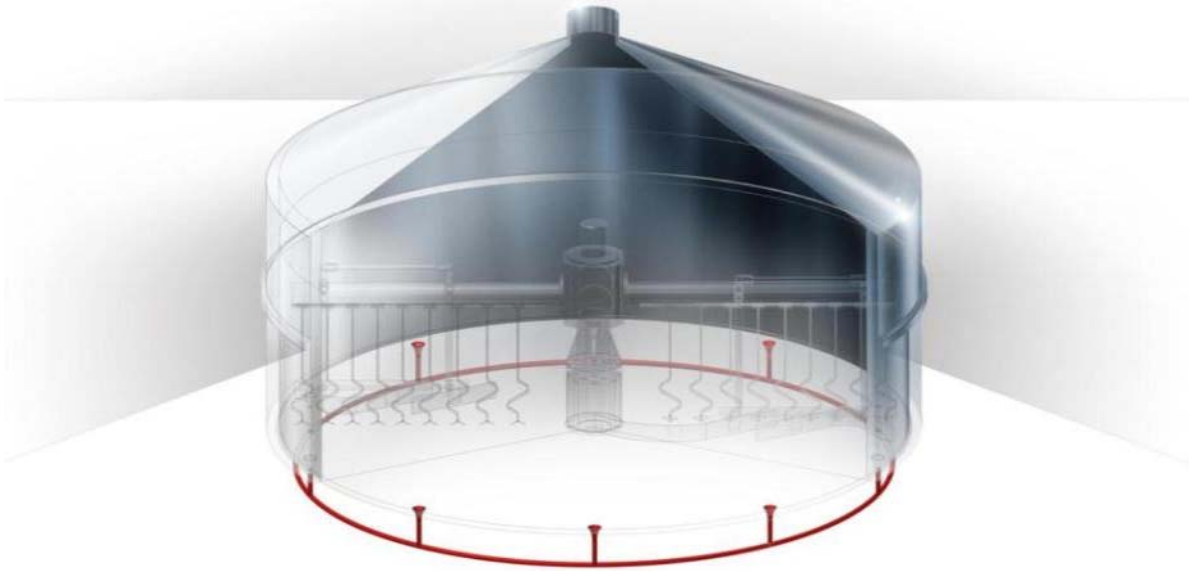
Promising progress !

Parameter	Brew 504	Brew 505	Brew 506	Brew 507	Brew 513	Brew 514
Run-off #	**84**		**48**		**24**	
1/sqm	**1,27**		**0,73**		**0,36**	
First Wort	16,10°P	16,10°P	16,20°P	16,3°P	16,25°P	16,20°P
Kettle full	11,95°P	11,90°P	12,20°P	12,1°P	12,00°P	11,95°P
Weak wort	2,35°P	2,50°P	2,20°P	2,1°P	2,45	2,20°P
Cast out	12,80°P	12,80°P	12,70°P	12,70°P	12,70°P	12,70°P
Pressed spent grains	--	1,84°P	1,62°p	1,66°P	2,51°P	1,21°P
Cast out volume	590 bbl	590 bbl	590 bbl	590 bbl	590 bbl	590 bbl
Yield	76,2%	75,6%	75,0%	75,0%	75,1%	75,0%

Lotus - lauter tun

Reliable concept for latest development

- Expert workmanship
- Long service life
- Flow optimized false bottom for higher lautering performance
- Less water underlet
- Simple cleaning



Karmeliten
Brauerei

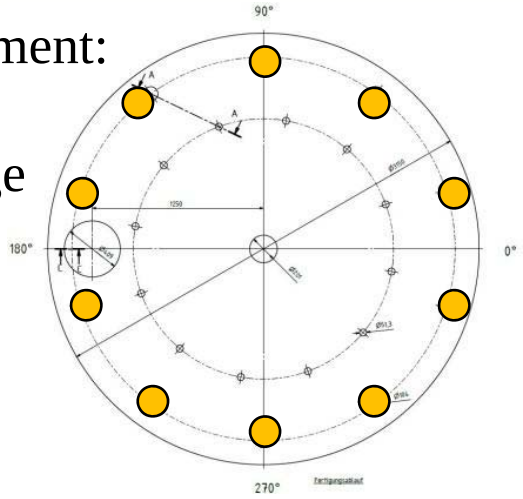
Lotus – sophisticated design

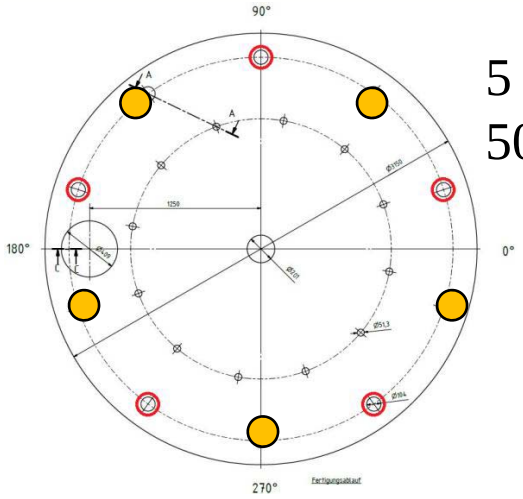
Lotus requires approximately 50 per cent less pipes

- Water admission is reduced to 45 to 55 per cent.
- This volume is then available as sparging water
- an adequately higher yield is expected to be achieved

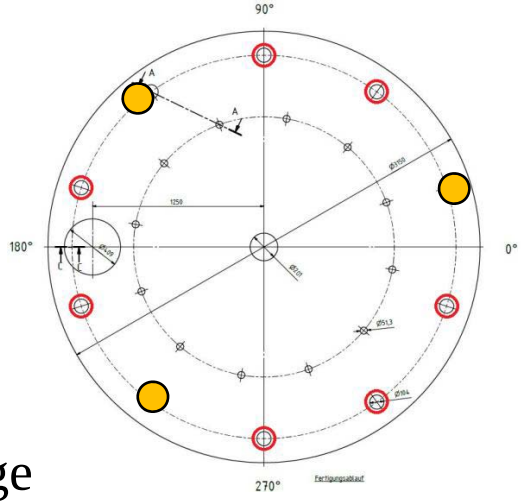
Lotus - Prototype trial set-up

blank experiment:
10 run-offs
100% passage

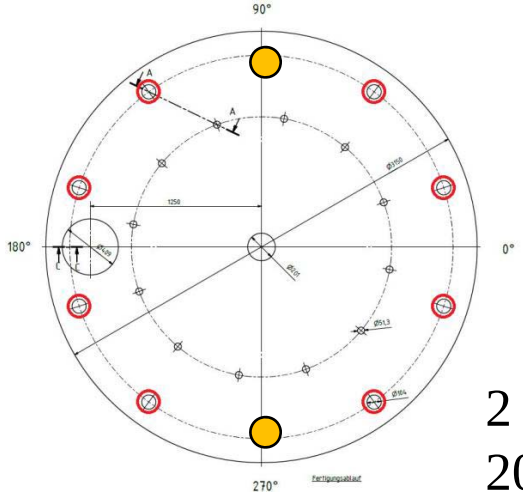




5 run-offs
50% passage

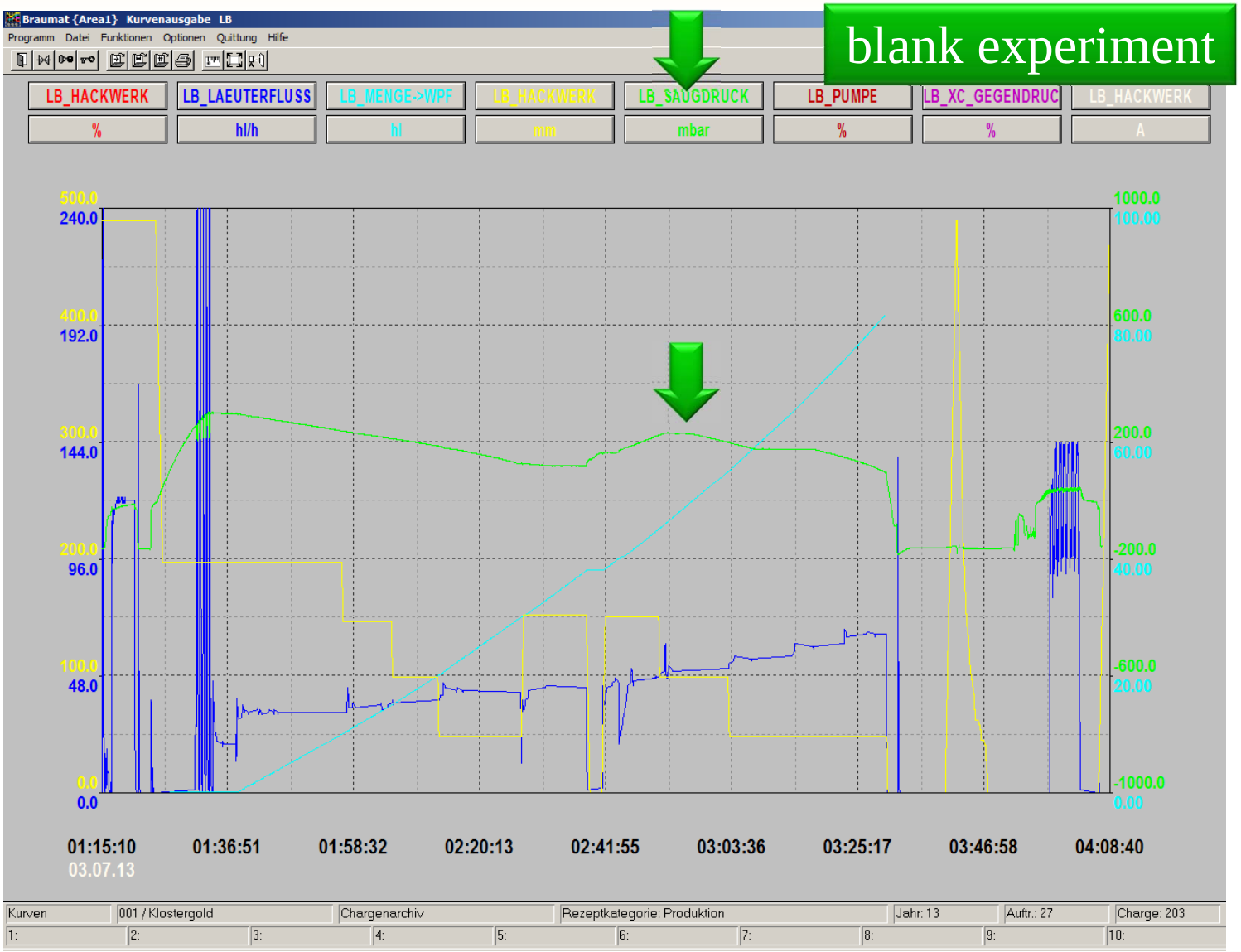


3 run-offs
30% passage



2 run-offs
20% passage

Lauterdiagram – 100% passage



Lauterdiagram – 20% passage

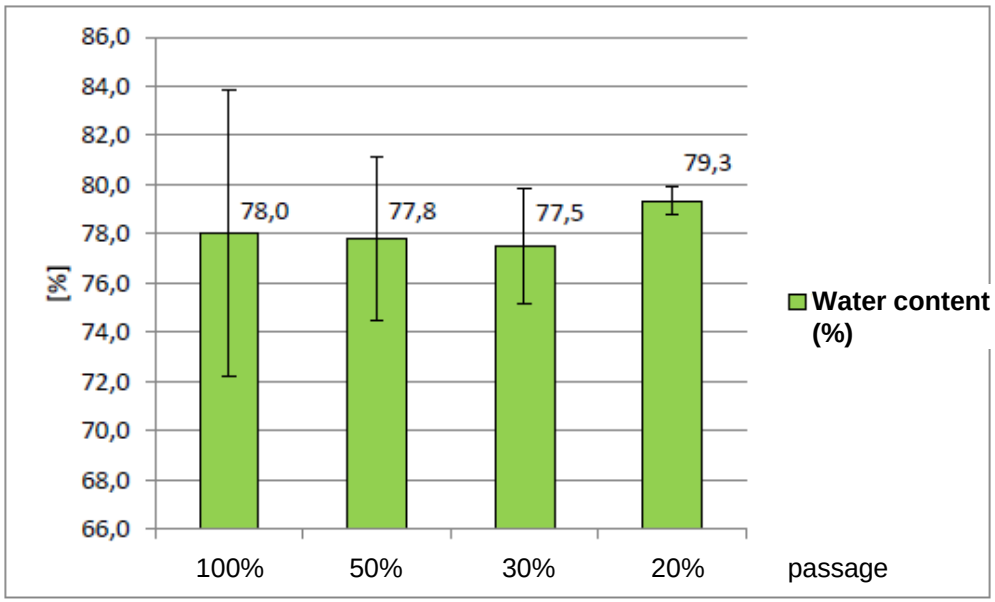
Suction pressure

- Important parameter to evaluate and control the lautering process

	Number of run-offs	Run-offs [1/sqm]	Suction pressure [mbar]
100 % passage (blank experiment)	10	1,28	95
50% passage	5	0,64	90 – 95
30% passage	3	0,38	90
20% passage	2	0,26	70

- Suction pressure decreases slightly when reducing the passage
- Point of inflection < 0,4 run-offs/sqm

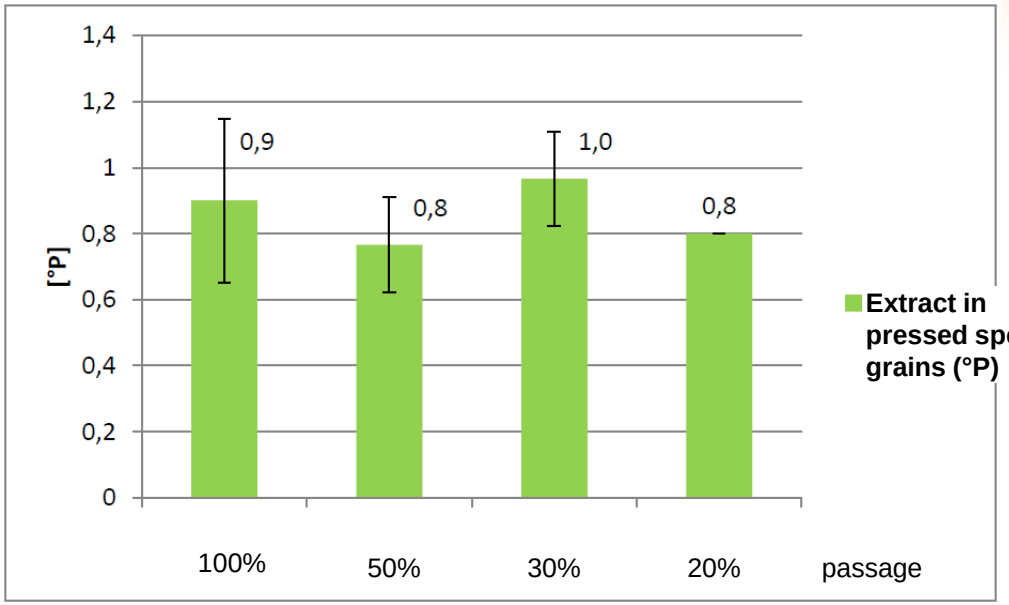
Water content in spent grain



- As per MEBAK (2009) a water content of less than 80% in dripped spent grain is aspired
- Conspicuous: the less run-offs, all the less the statistical spread of the value

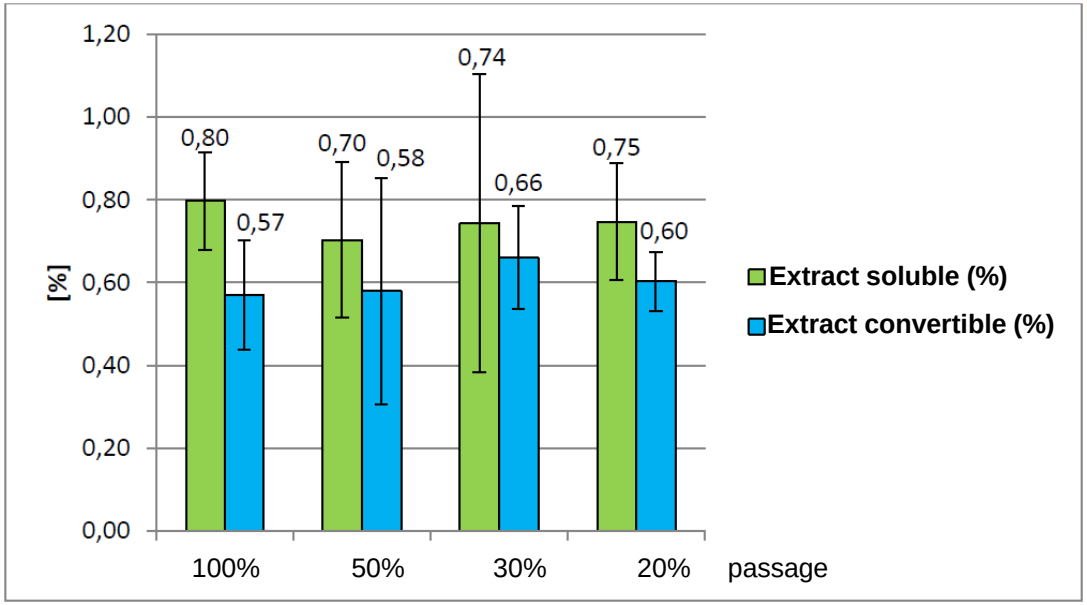
  → constant dripping of the spent grain is possible due to low suction pressure during lautering across the false bottom

Pressed spent grains



- No significant influence on the yield
  → values are close to weak wort / dripping water concentration
- Confirmation of findings during field trials

Soluble and convertible extract



- No significant influence on the yield
  → As per MEBAK (2009) remaining extract in spent grain is aspired as < 1,6% in total
- Confirmation of findings during field trials
- Confirmation of field measurement of pressed spent grains

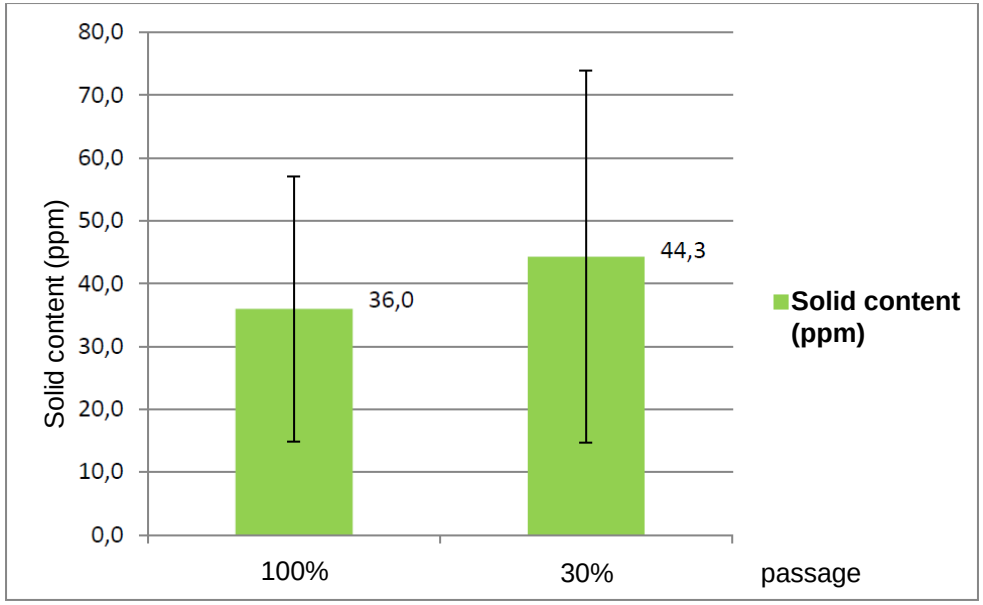
Lautering time

- Lautering time is the same at all trials (reduced number of run-offs)
- No influence on production time
- Even higher flow rates as specified are feasible

Turbidity / Haze monitor

- Consistent turbidity during the lautering process with 10, 5 or 3 run-offs
- With only 2 run-offs: significantly higher turbidity can be detected (only after run off of 20% of the first wort, the turbidity was in an acceptable range)
- Confirmation of findings during field trials
- Remark - no online measurement device was available, therefore analysis of solids in the laboratory was executed

Solid content of the lautering process



- Solid content in the kettle full volume shall be lower than 100 ppm (Schwill-Miedaner, A., Miedaner, H. (2011))
- Blank experiment and trial with 3 run-offs (<0,4 run-offs/sqm) as well show a very low solid content

Conclusion

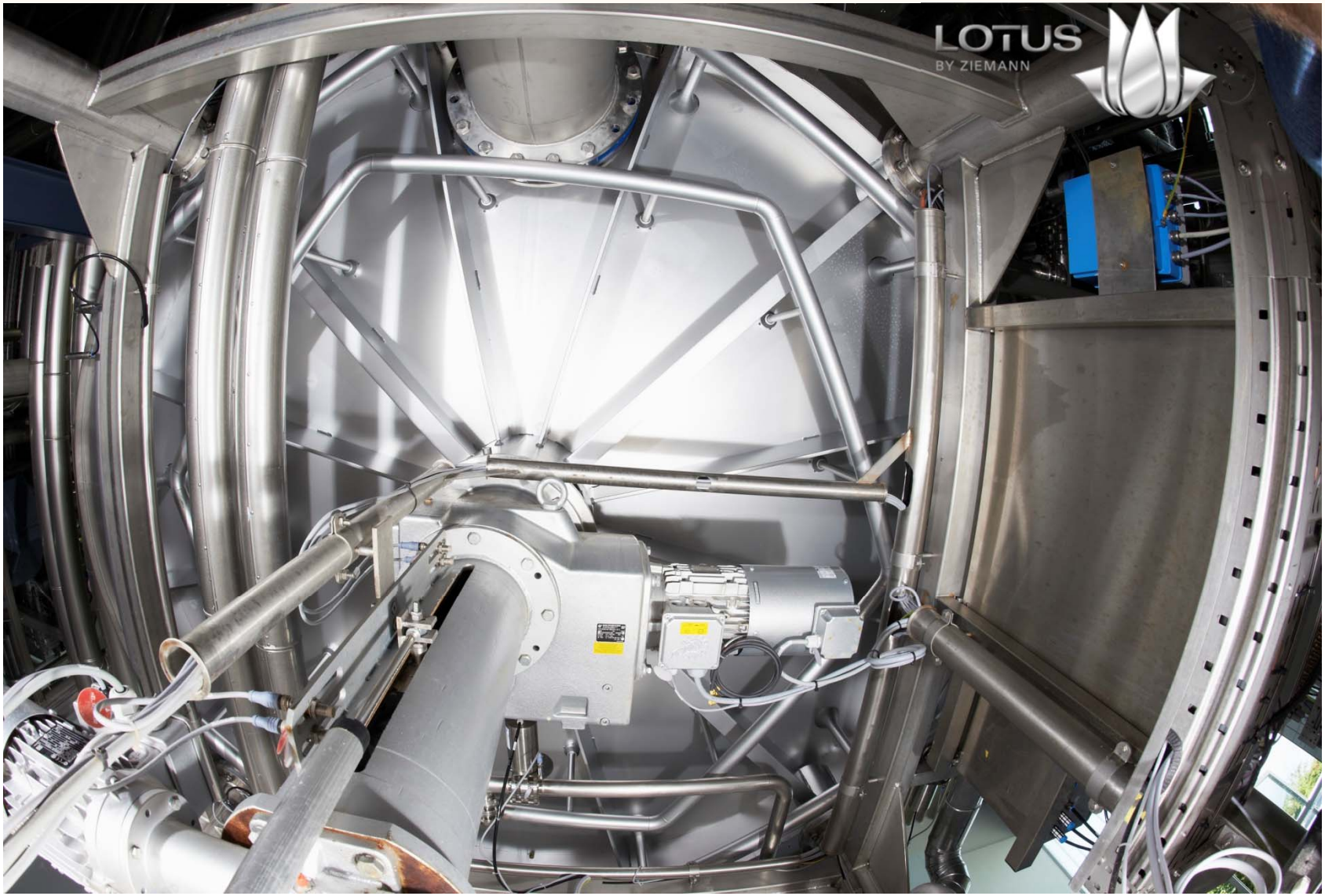
By reduction of number of run-offs towards 0,4 per sqm

- No significant degradation of the lautering process
- No increase of production time
- No significant influence on the yield
- No increase of turbidity and amount of solids
- No decrease of suction pressure
- No negative influence on dripping of spent grains

New design criteria for lauter tuns (LT)

- At least 50% less tulips
- Importance of perimeter higher than area
  - Number of rings (e.g. 1 ring for LT @ 600 bbl brew house)
  - Position of run-offs on a ring is reflected by perimeter of LT

Lotus - tulips on a ring



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Taking care of brewing

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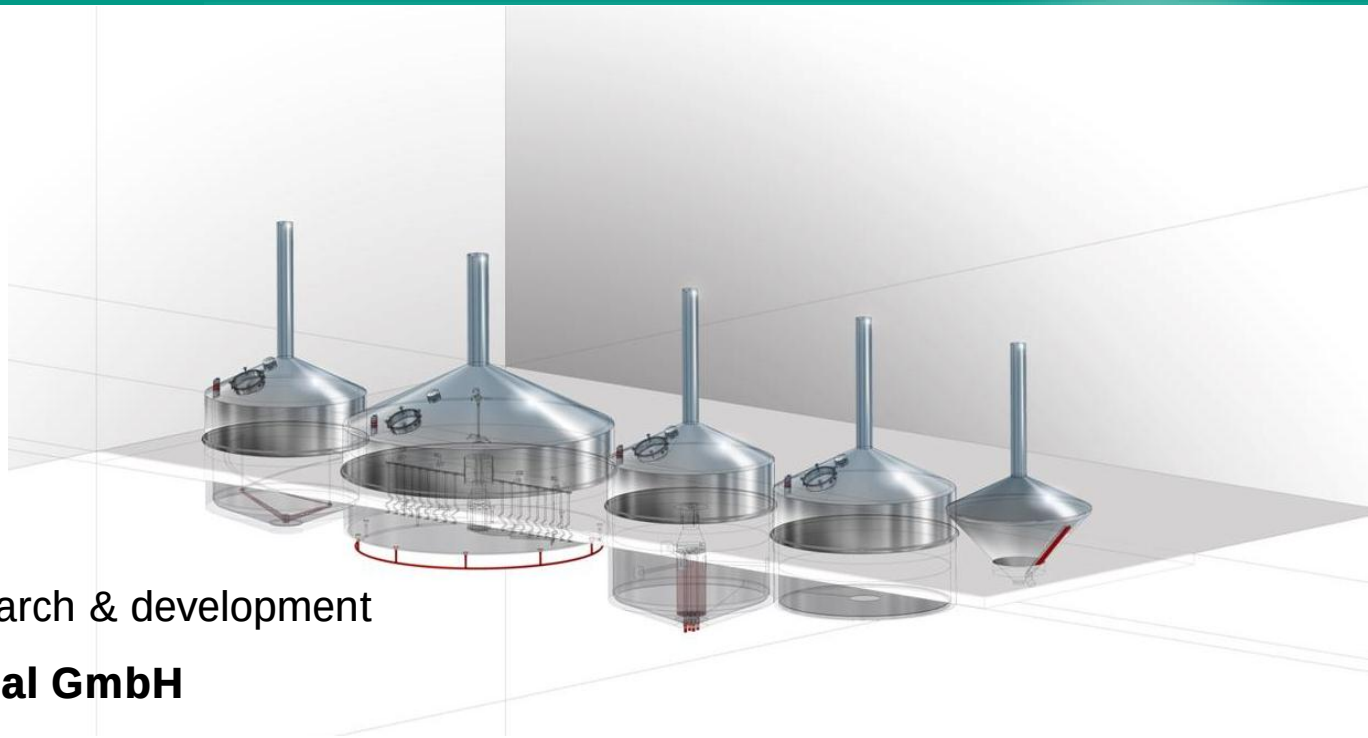

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Taking care of brewing

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