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Automatic cutting of pinbones and optimization of white fish fillet production

FHF conference – Program for hvitfiskindustrien

Raddison Blu – 23.10.2014

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Valka ehf / Valka AS

Main objectives

- Reduce the amount of labor needed for trimming
- Unique cutting instead of done by many
- Same consistency / yield from beginning to end
- Increase yield by minimizing the bone off cut
- Increase the yield into higher value products
  - Commonly by maximizing the size of the loins

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Background

- Started on the project in 2010 with a grant from AVS research fund and in co-operation with HB Grandi
- First machine delivered in 2012
- Three additional machines are up and running in Iceland
- First machine delivered to Norway to Gryllefjord

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Research project FHF/Innovation Norge

- Originally invited for a FHF workshop on the topic in March 2012 – applied for grant late that year
- Project approved in May 2014 – started June 2014 -
- Project will be completed no later than September 2015
- Project partners
  - Nofima / NTNU
  - Båtsfjordbrygget / Gryllefjord Seafood / HB Grandi

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Research topics

- Improving bone detection on soft bones
- Obtain the 3D position of bones and cut at an angle
- Testing of the methods above
- Definition of a complete processing line
- Formation and elimination of white material on salmon fillets
- Automation of sorting of portions after cutting

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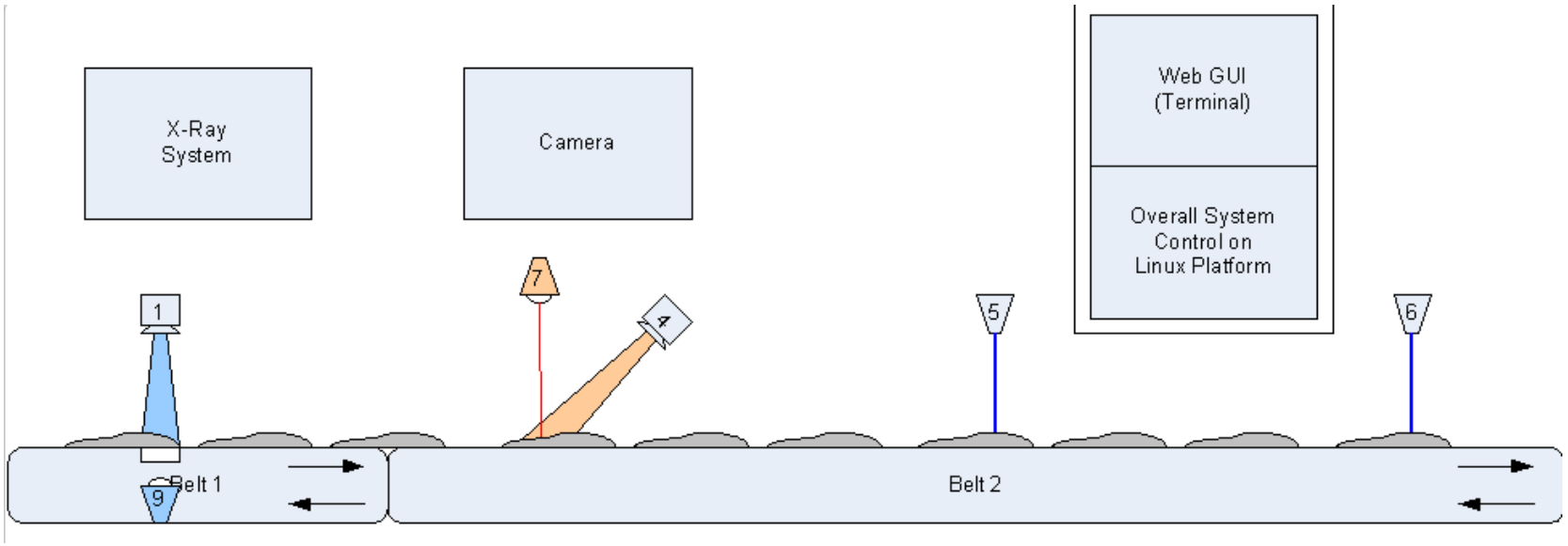
System overview



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System overview

- Extremely sensitive X-ray detector with resolution of 0,2 mm for fish bones
- High speed online inspection up to 450mm/sec
- Low energy X-ray inspection gives higher contrast & more reliable detection of small bones

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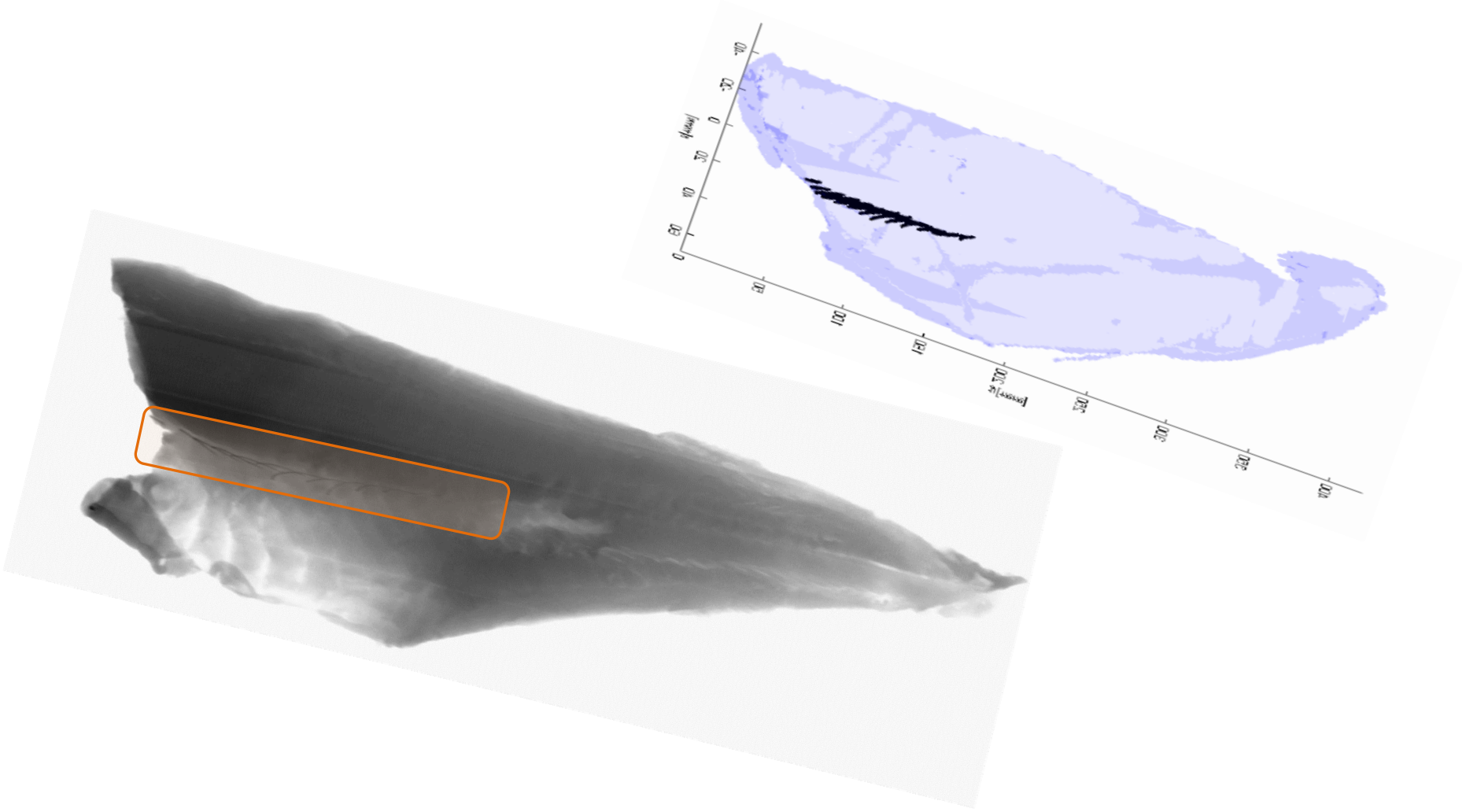
System overview



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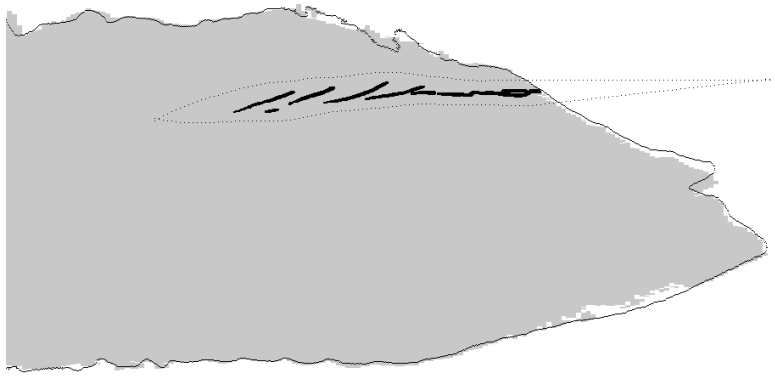
System overview

- The distance of the cutting path from bones is controlled with a single offset parameter

- The distance at the end of the final bone is a user settings as well



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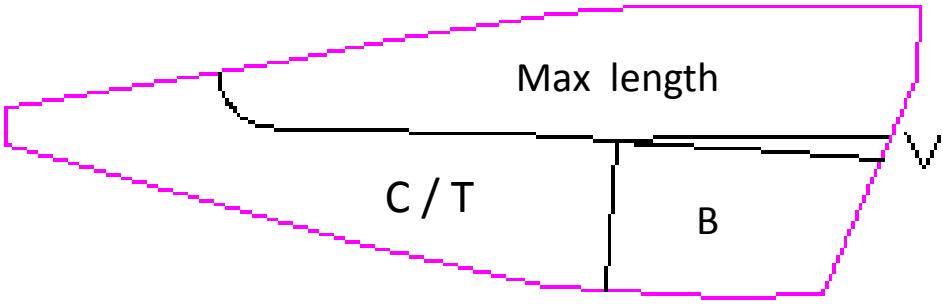
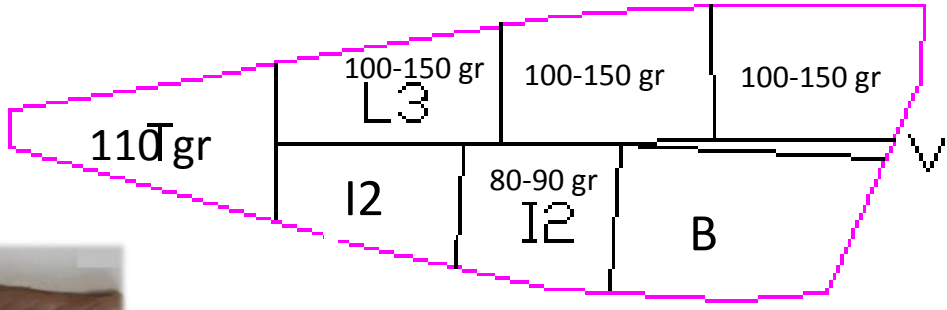
There is almost no limit on cutting patterns

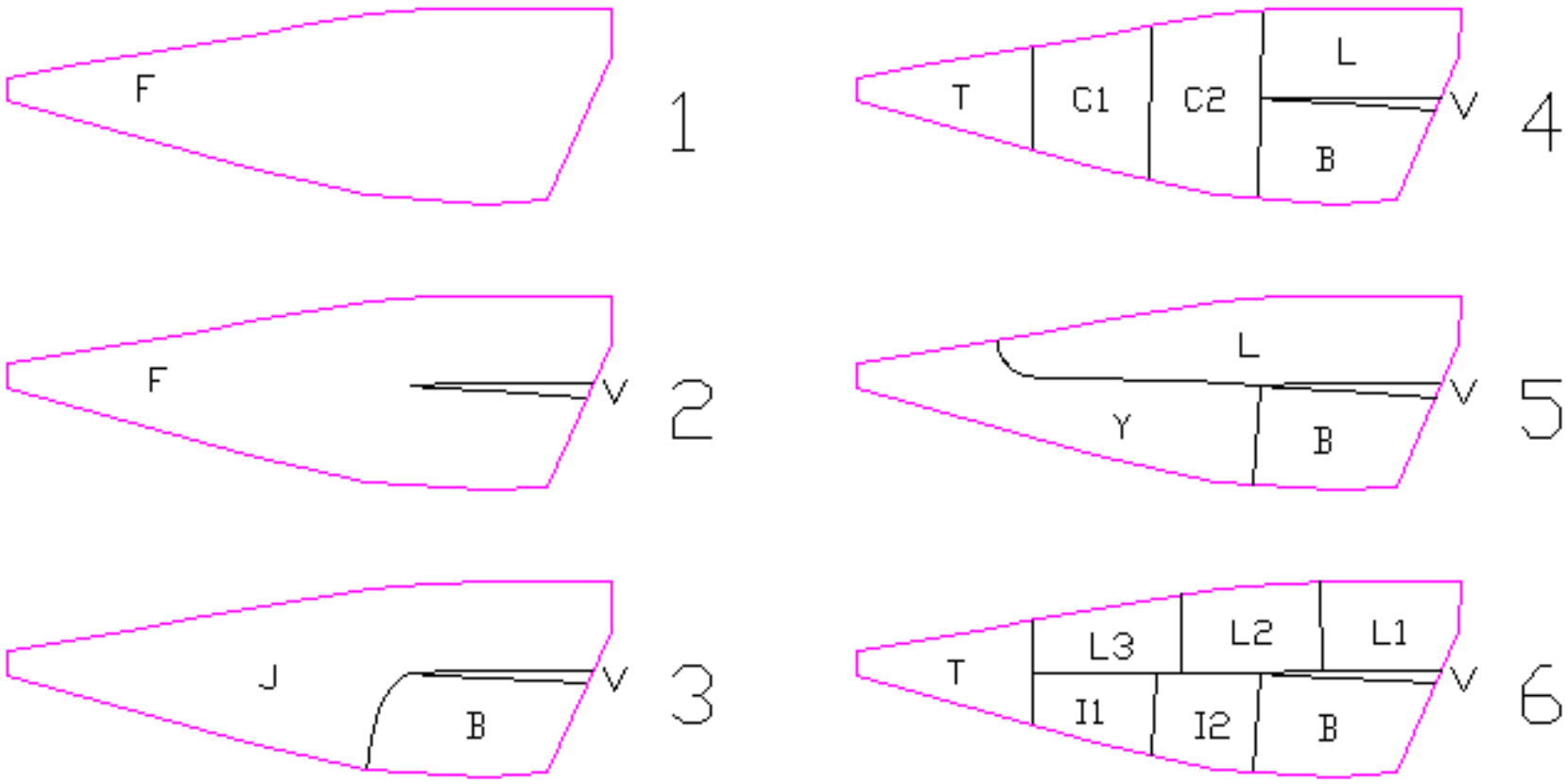
Portions constraints

- Min / Max Lenght
- Min / Max Width
- Min / Max Weight
- Target weight
- Price / Orders
- Min / Max position





Typical cutting patterns in the whitefish industry



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Maximizing the value of fresh fillet products

- Fishing – cooling – deheading – filleting – skinning
- Improved material handling
- One pice flow
- Speed up the process from filleting to packing
- Optimization of the cutting of every fillet to maximize the amount of fish that goes into the most valuable products
- Minimize the give-away in packing
- Reduce the labour needed to produce each kilo of products

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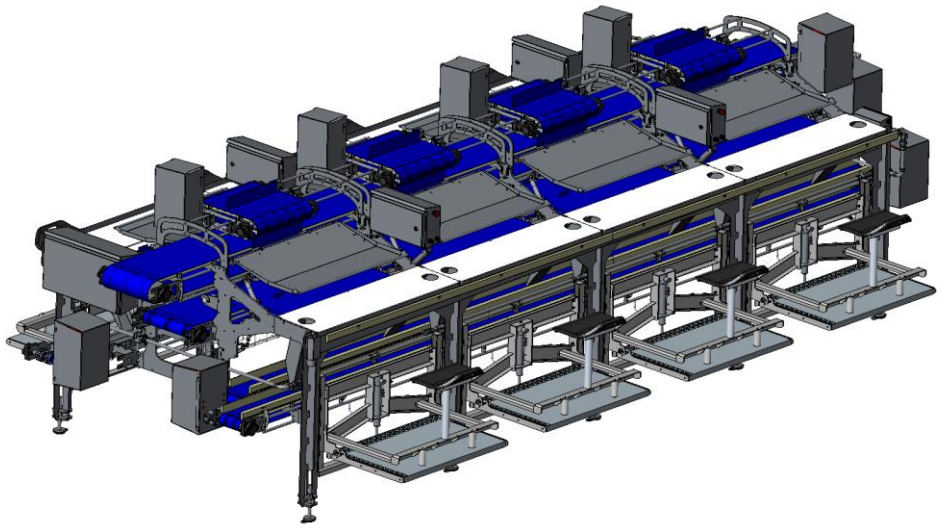
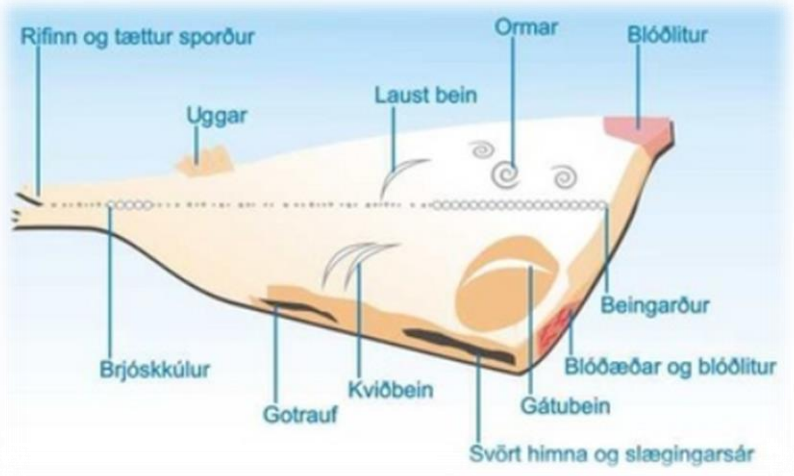
Pre trimming

- No portioning or pinbone removal as in traditional lines
- Necessary to remove parasites, loose bones and blood spots
- All fillet defects apart from parasites can be eliminated or greatly reduced with correct handling and effective filleting machines
- Skin on or skin of?





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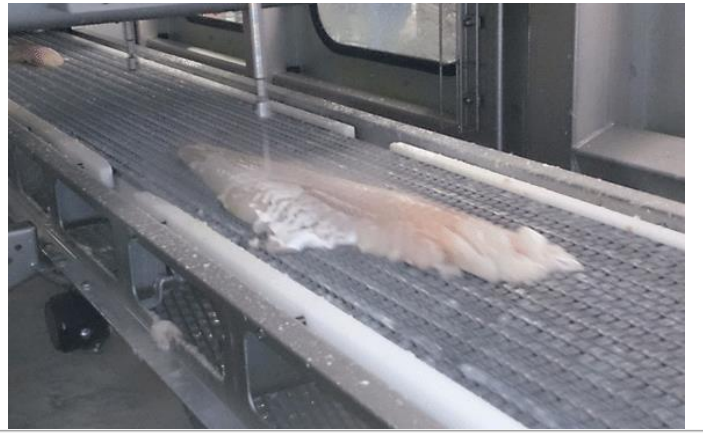
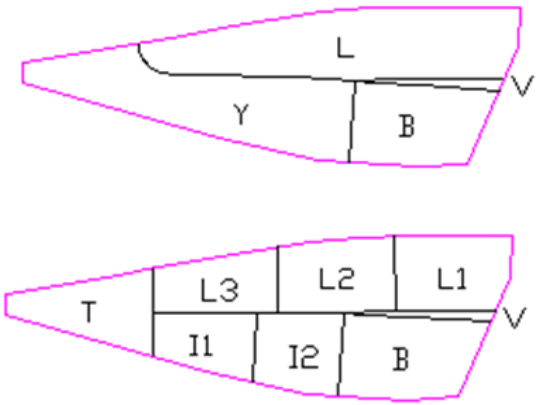
Cutting of the fillets

- X-ray guided cutting machines delivers:
  - Automatic cutting of pinbones with better yield
  - Optimization of the cutting of every fillet based on the value of each portion
  - The fillets are always cut in the same way
  - One machine can complete any type of cut in one step without limitations
  - Possible to cut fins and belly flap bones





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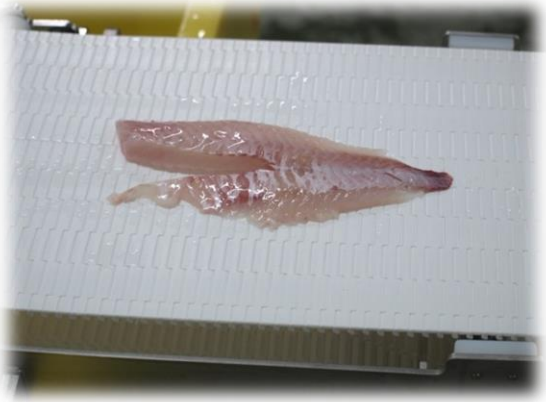
Experience of the cutting machine- redfish

- Made it feasible to cut pinbones from redfish fillets down to a weight of 50g
- Cuts also j-cut and loins
- The yield in v-cut fillets increased from 89%-91% to 94-96%
- Throughput is 500-1200 kg/hour depending on the size of the fillets
- Less than 1 bone / 2 kg
- Very reliable



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Experience of the cutting machine – cod

- Throughput in the factory has increased by c.a. 50%
- The throughput is from 1.500 - 6.000 kg/hour of fillets depending on the fillet size
- The ratio of loins from fillets has increased by 6-8% primarily because the machine always cuts in an identical way
- The pin bone percentage is a little bit better than with manual cutting or from 4.5%-6.5%
- Less than 1 bone / 10 kg
- Very relieable

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Gryllefjord Seafood – First machine in Norway

- The factory reopened in February 2014 when the line was delivered
- Good experience has been obtained when cutting haddock – typical yields – skin-off
  - Pinbone - 5.0%
  - Belly flap - 3.6%
  - J-cut fillets - 91.4%
- Skin off - J-cut yield in haddock with skin on 3.2% - 6.4% - 90.4%
- Results in cod are compatible to HB Grandi results

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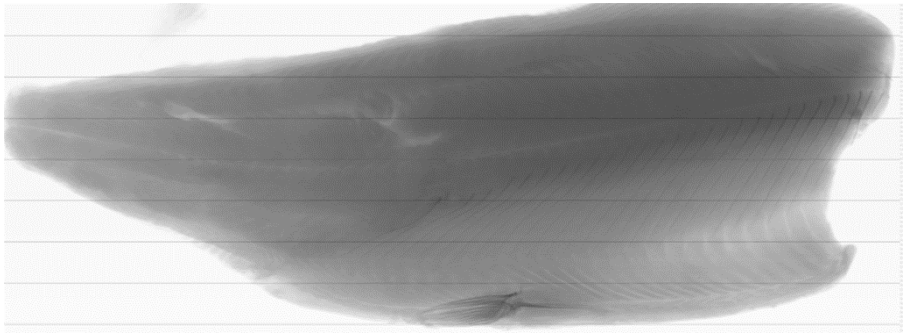
Cutting of salmon

Only preliminary testing done so far

- Bones can be identified – soft part can be lost
- With the right nozzle and right pressure the water does not cut through bones
- White material in cut is an issue
- Angular cut is essential
- Further testing planned early November this year



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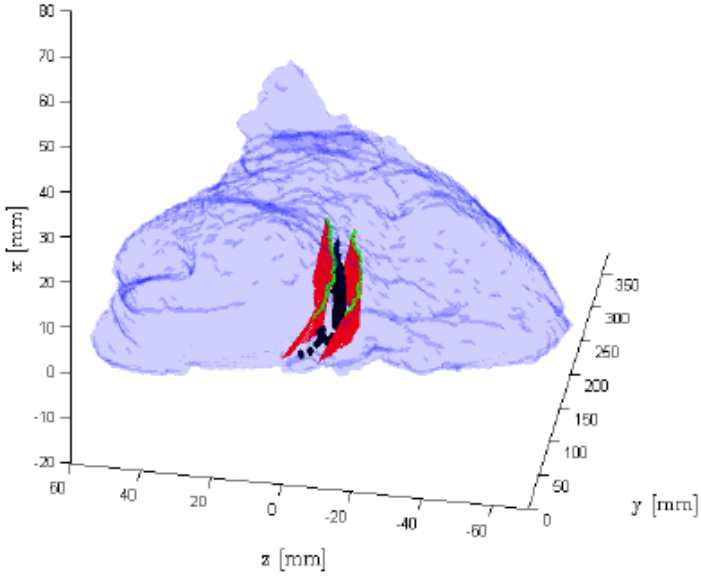
Angular cuts

- 3D images from SINTEF/FHF have been very valuable
- Estimated improvement in yield for cod is about 1-2 % of fillet weight
- Optimal robot is being evaluated
- X-ray analyses is being evaluated for obtaining 3D position of bones – good progress has been made
- Huge demand on computer power
- Existing machines will be upgradeable



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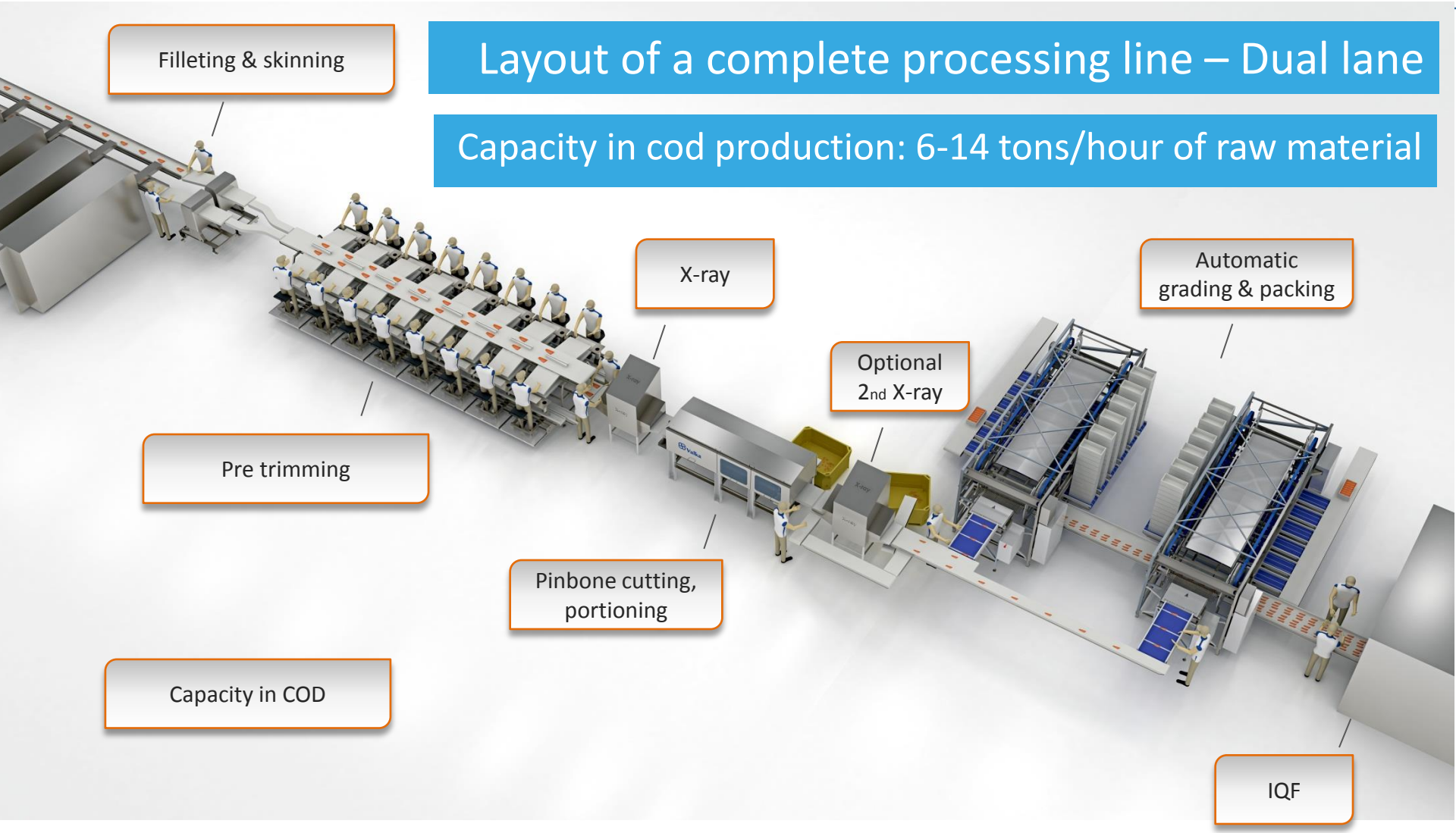
Layout of a complete processing line – Dual lane

Capacity in cod production: 6-14 tons/hour of raw material



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Video

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Summary

- Valka is doing extensive work to help revolutionize the white fish fillet production
- Good progress has been made in all aspects of the development project
- Testing has been started – e.g. on thawn up fish from Norway
- Work has started with NTNU and a master student is working on the project
- Nofima experts will come to Iceland in November for testing and project meeting
- Gathering information on new production line has started

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