Innovative X-ray Solutions

Food inspection: Fish

FHF konference
Oslo 27 Nov. 2013

InnospeXion
the invisible made visible

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Innovative X-ray Solutions

INNOSPEXION

X-RAYS: Our business

InnospeXion uses the knowledge on X-ray interaction with matter to develop innovative techniques for inspection and characterisation, by imaging or by measurement of the spectrum of transmitted or scattered radiation. Since 2000, we have applied these principles for non-destructive testing services, prototype characterisation, manufacturing prototyping and for the continuous development of state-of-the-art industrial solutions. Since 2003, we have supplied intelligent and unique on-line, at-line or off-line x-ray based solutions to improve the productions cost-effectiveness. **The main success product is the low energy X-ray inspection systems that was awarded the Innovation Award 2007**

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Low energy X-ray inspection: 2007

The new MCIS from InnospeXion

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MCIS is based on low energy X-rays:

- Improved contrast
- Less radiation
- Low weight
- Simple design

FOOD PHARMA TECH 07

Innovation Award

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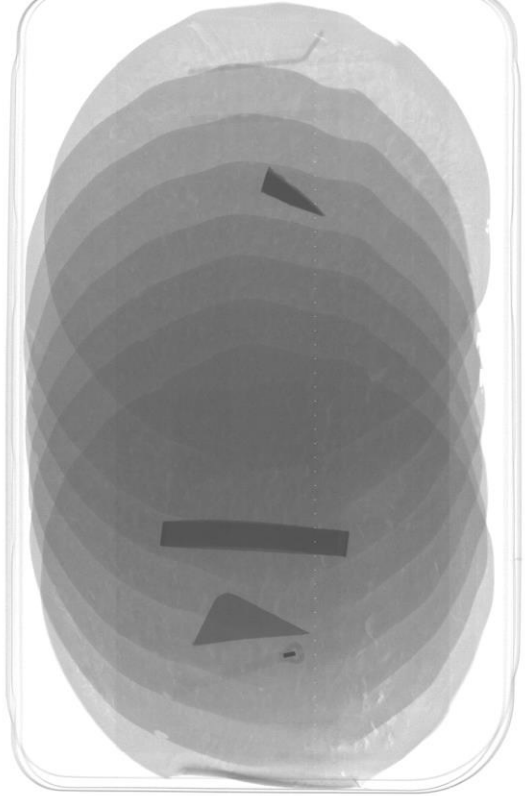

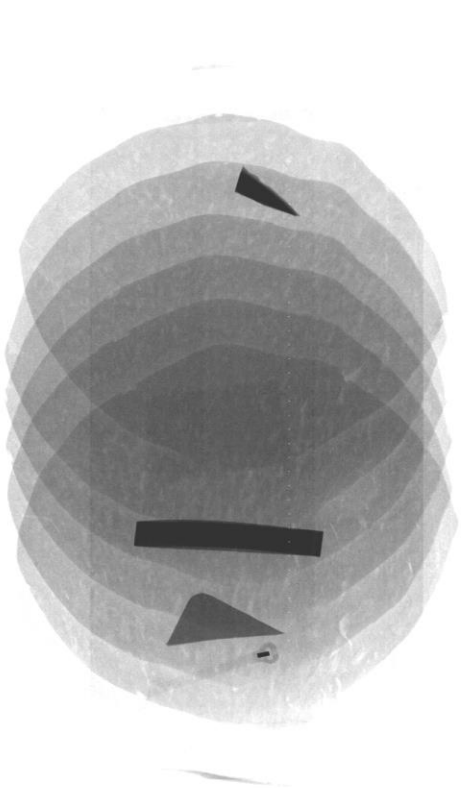

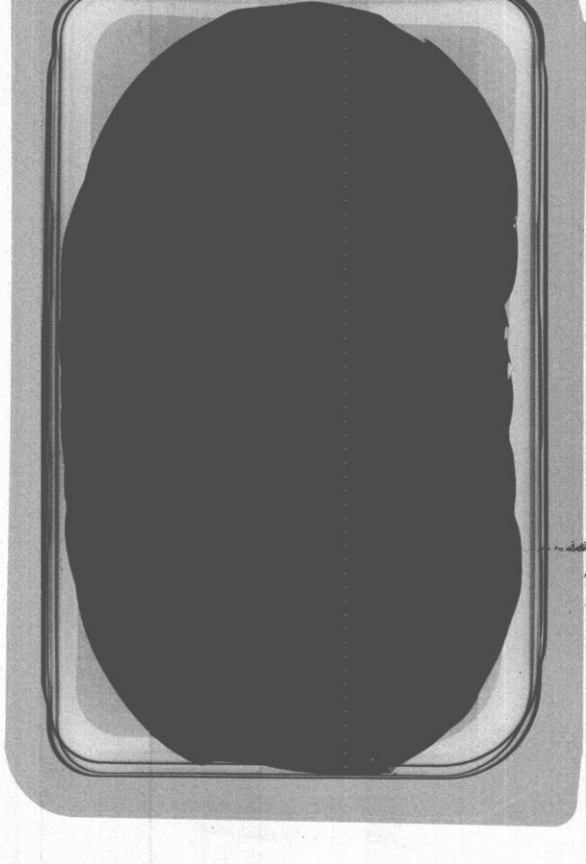

WORLD CLASS X-RAY IMAGE QUALITY

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Low energy X-ray inspection: 2009

The HYMCIS from InnospeXion

Second generation:

Hygienic design

Full PLC control

Innovation Award

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Low energy X-ray inspection: 2010-2011

The HYMCIS from InnospeXion

Available in tailored versions from 150 to 1600 mm conveyor width:

Hygienic design

Full PLC control

0.1 mm detection

Ultra high sensitivity

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Low energy X-ray inspection: 2011-2012

The HYMCIS from InnospeXion

Third generation:

PLC master - Versatile I/O design

Various Conveyor widths

Tailored design options

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Why is the technology interesting for fish bone detection?

Small fish bones gives small contrast. At low energy, the contrast is much higher, and therefore detection is more reliable

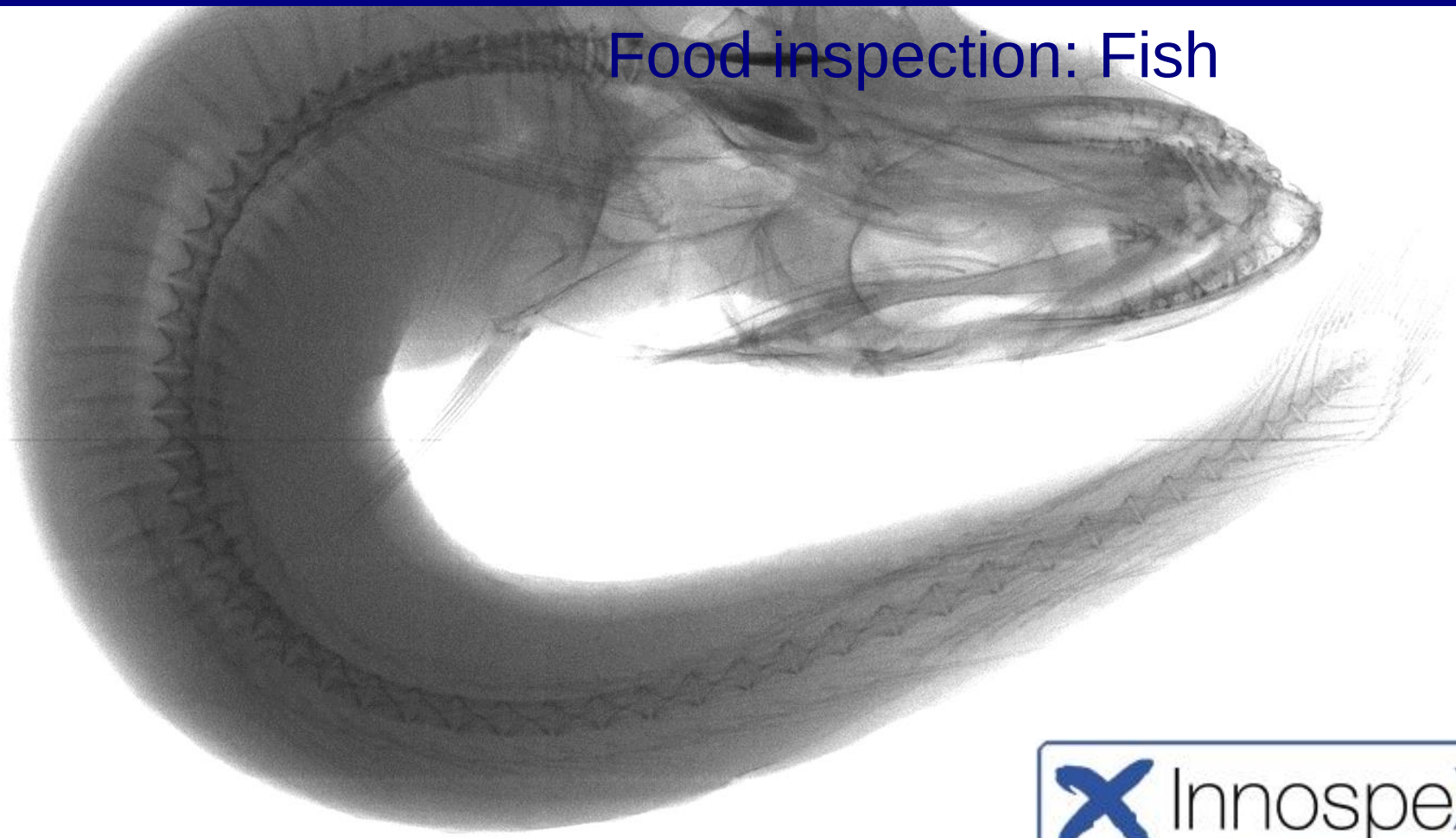
Small fish bones requires a high resolution for their detection. 0.1 mm resolution enables detection of bones down to 0.15 mm Ø.

Tailoring to meet the requirements in the fish industry is possible.

LOW-ENERGY X-RAYS

Application Examples

Food inspection: Fish



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Low energy X-ray inspection

The HYMCIS from InnospeXion

What's that to do with fish?

The ordinary X-ray systems are not - in general - suitable for fish bone detection. There are two main reasons:

1. The systems operate with a pixel size of 0.4x0.4 or 0.8x0.8 mm. This resolution is too coarse for fish bones. We use a special technology involving 0.1 x 0.1 mm resolution.
2. The systems use a detector that converts the X-ray information "image" using a crystal called Gadox, Gadolinium Oxysulfide. This material is however only effective at X-ray energies above 25 kV. But the contrast between meat and bones in fish is unfortunately optimal at a LOWER energy. Therefore the traditional X-ray systems have difficulty in detecting fish bones, EXCEPT when these are very large, typically mm-sized in diameter.

Our technology is very different as we use a detector that is effective from about 5 kV, meaning that we actually gets a very clear image even of tiny bones.

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FACTS

- → The lower the X-ray energy (in KeV), the better the contrast;
- → The smaller the pixel dimension, the better the spatial resolution
- → Röntgen unveiled the potential for low E X-rays a century ago

CONTRAINTS

- → Low energy X-rays are easily absorbed – also by air!
- → When a pixel is small, it receives very little ”light”, or radiation. Hence, the SNR in a low E X-ray image may be very poor
- → For industrial automation, line speed may be high. Hence, even less radiation is received per pixel per time unit.

THE SOLUTION

- → Very stable X-ray source
- → Very high quantum efficiency detection technology
- → Design that limits the physical constraints

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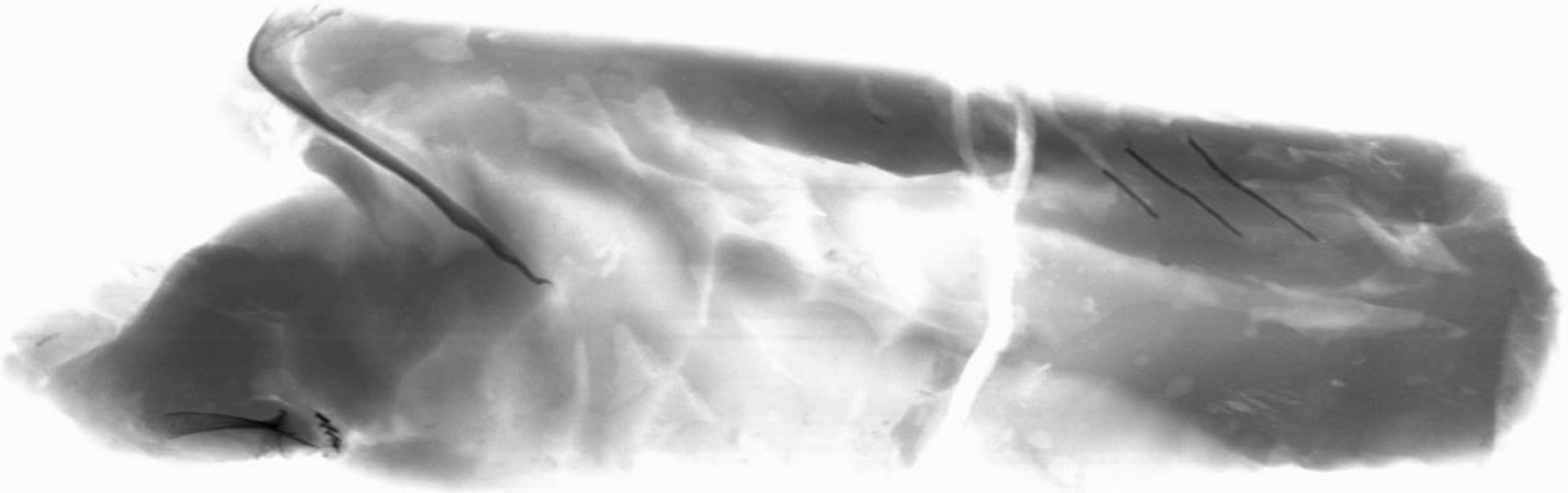
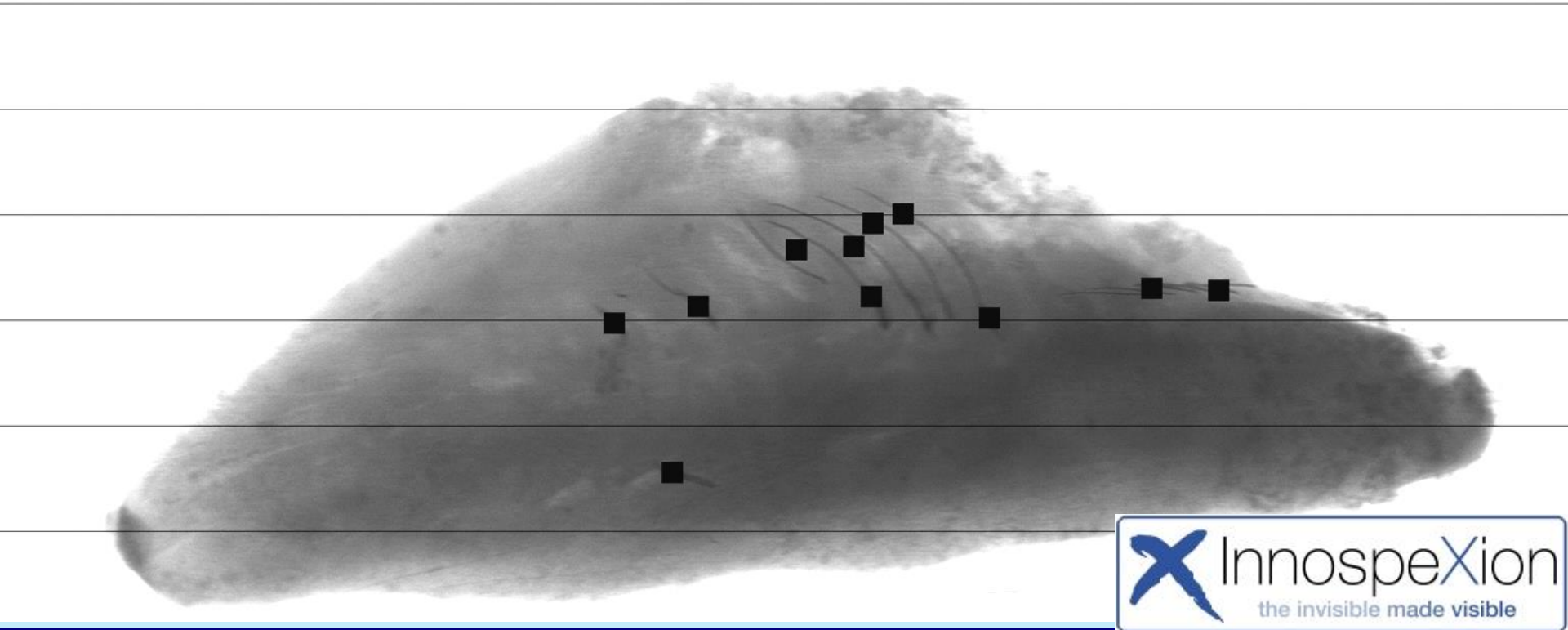


LOW-ENERGY X-RAYS

Application Examples

Food inspection: Fish bones
Automatic detection & identification in fillets



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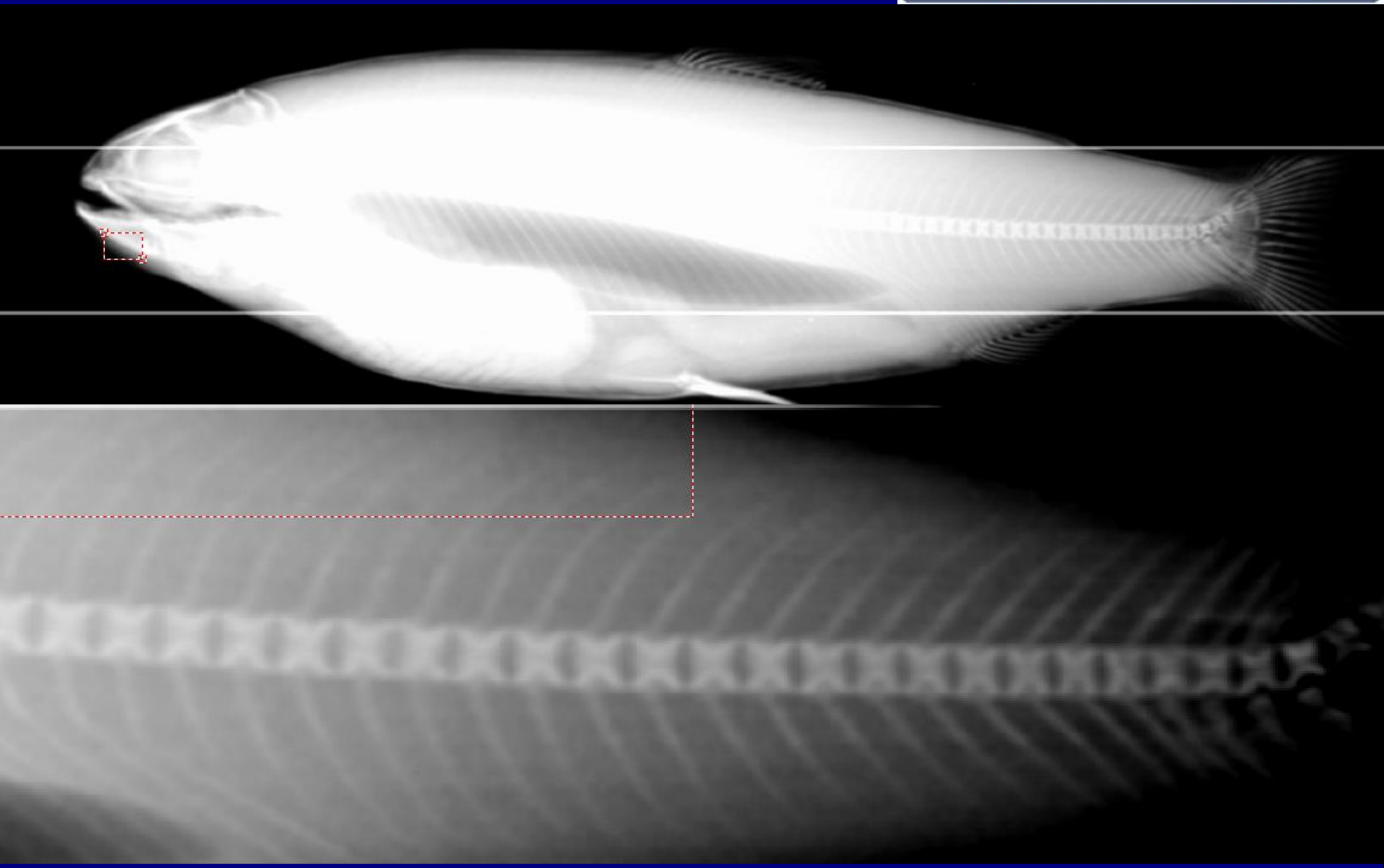
mm	mm	%	mm	mm	%	mm	mm	%	mm	mm	%	mm	mm	%
Bone diameter	Bone length	POD	Bone diameter	Bone length	POD	Bone diameter	Bone length	POD	Bone diameter	Bone length	POD	Bone diameter	Bone length	POD
0,25	5	60	0,35	5	75	0,45	5	81	0,55	5	90	0,65	5	92
0,25	7	61	0,35	7	77	0,45	7	83	0,55	7	92	0,65	7	94
0,25	9	62	0,35	9	78	0,45	9	84	0,55	9	93	0,65	9	95
0,25	11	63	0,35	11	80	0,45	11	86	0,55	11	95	0,65	11	97
0,25	13	64	0,35	13	81	0,45	13	87	0,55	13	96	0,65	13	98
0,25	15	65	0,35	15	83	0,45	15	89	0,55	15	98	0,65	15	98
0,25	17	66	0,35	17	84	0,45	17	90	0,55	17	98	0,65	17	98
0,25	19	67	0,35	19	86	0,45	19	92	0,55	19	98	0,65	19	98
0,25	21	68	0,35	21	87	0,45	21	93	0,55	21	98	0,65	21	98
0,25	23	69	0,35	23	89	0,45	23	95	0,55	23	98	0,65	23	98
0,25	25	70	0,35	25	90	0,45	25	96	0,55	25	98	0,65	25	98
0,25	27	71	0,35	27	92	0,45	27	98	0,55	27	98	0,65	27	98
0,25	29	72	0,35	29	93	0,45	29	98	0,55	29	98	0,65	29	98
0,25	31	73	0,35	31	95	0,45	31	98	0,55	31	98	0,65	31	98
0,25	33	74	0,35	33	96	0,45	33	98	0,55	33	98	0,65	33	98
0,25	35	75	0,35	35	98	0,45	35	98	0,55	35	98	0,65	35	98

Living fish X-ray image



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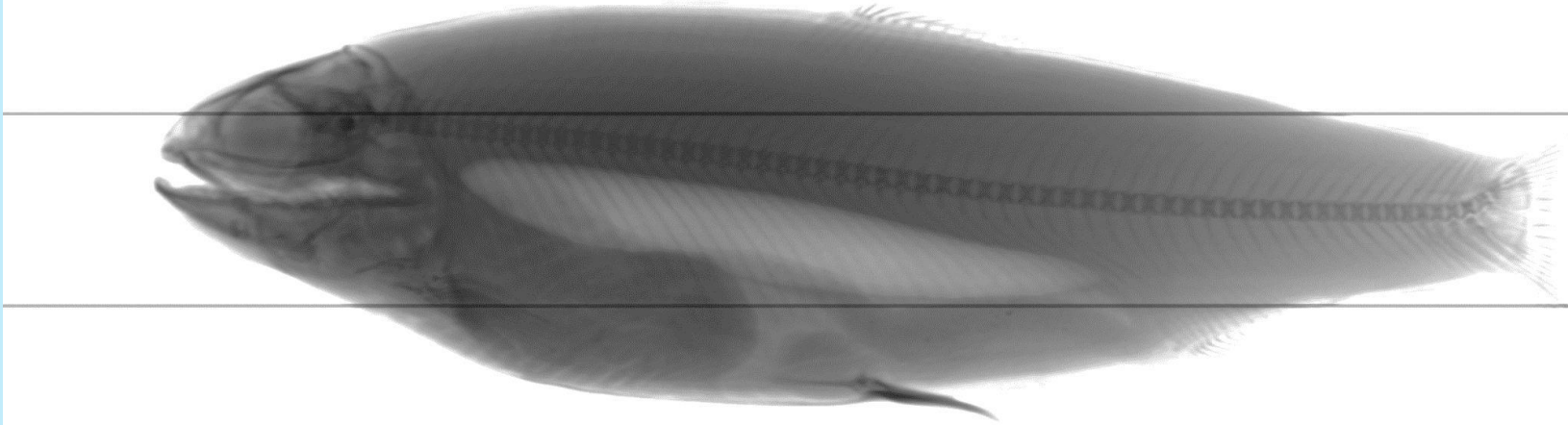

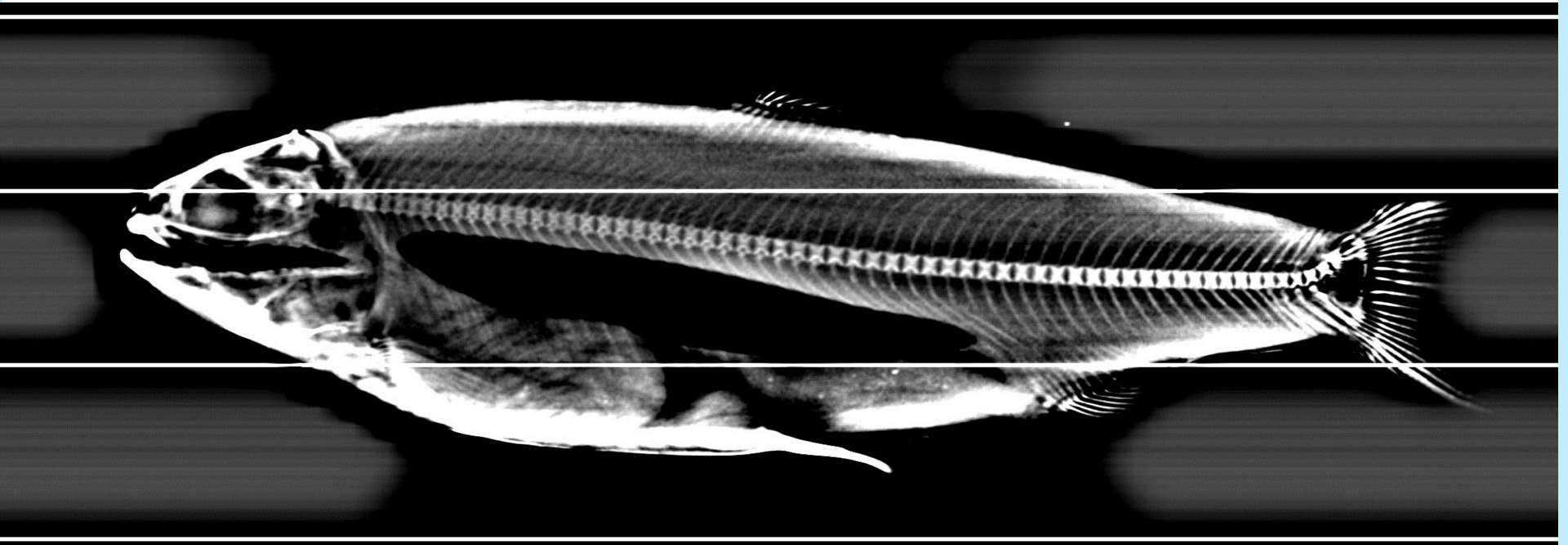

X-ray imaging at high speed: Solutions offered by Low-Energy X-rays

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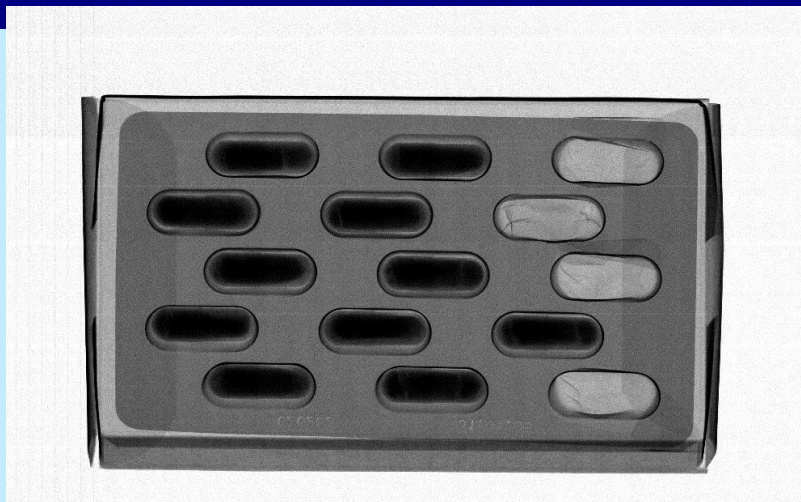
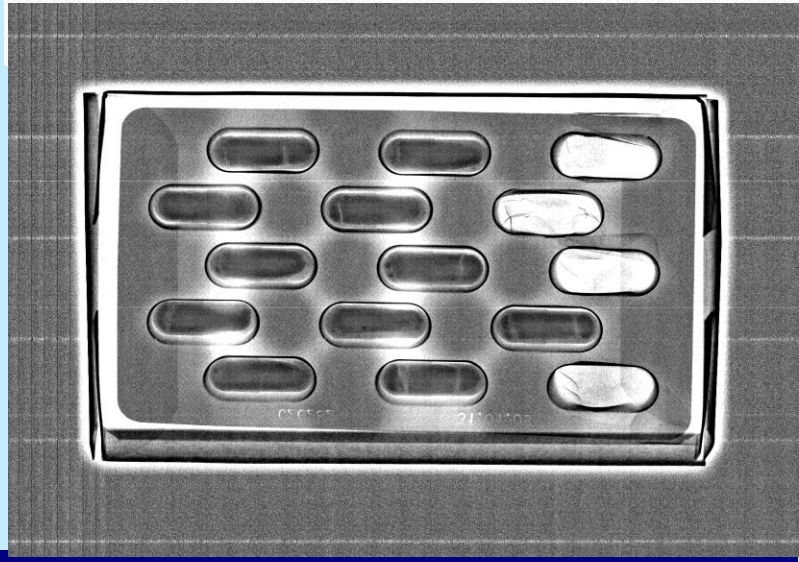
Low-Energy X-ray discloses packaging imperfections

LOW-ENERGY X-RAYS

APPLICATION EXAMPLES – Blister packaging





Blister packaged products with defects: missing objects and damaged objects (cracks).

Note the huge dynamic range showing packaging, sample (product) integrity as well as defects.

Imaged at production speed = 22 m/min

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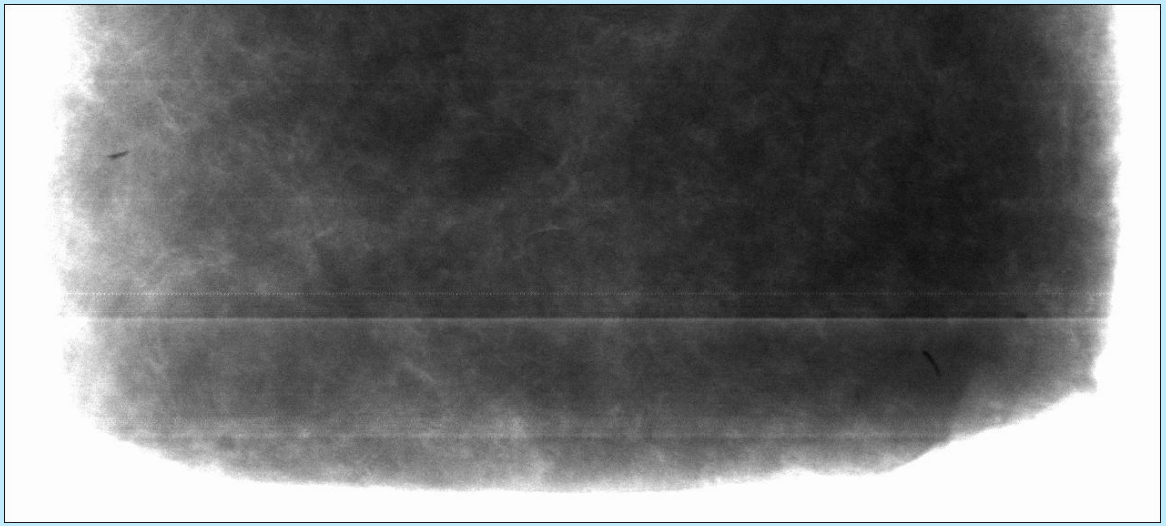

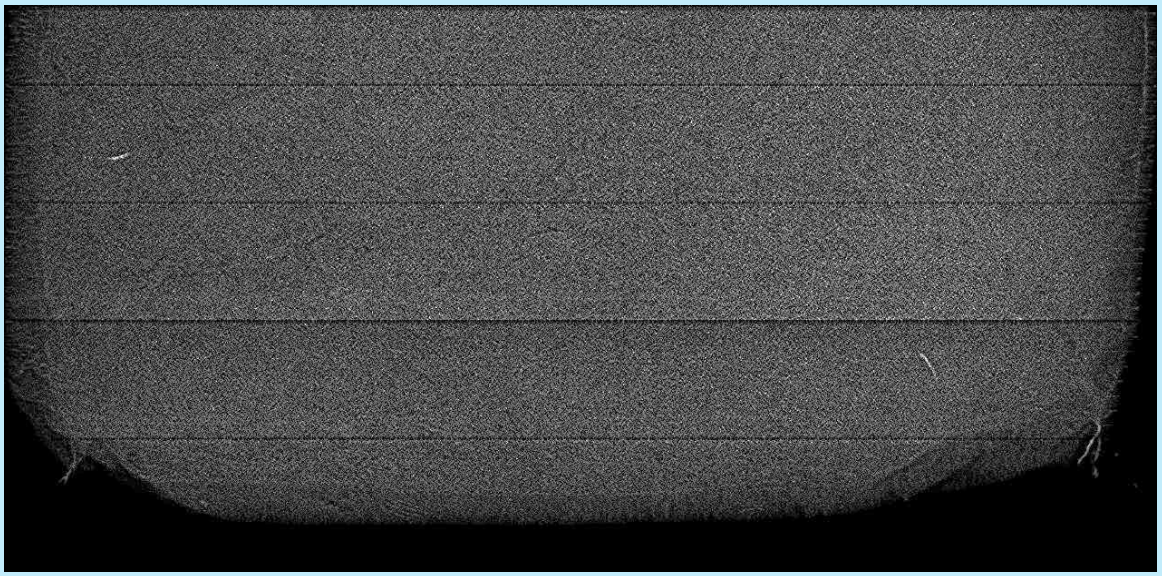

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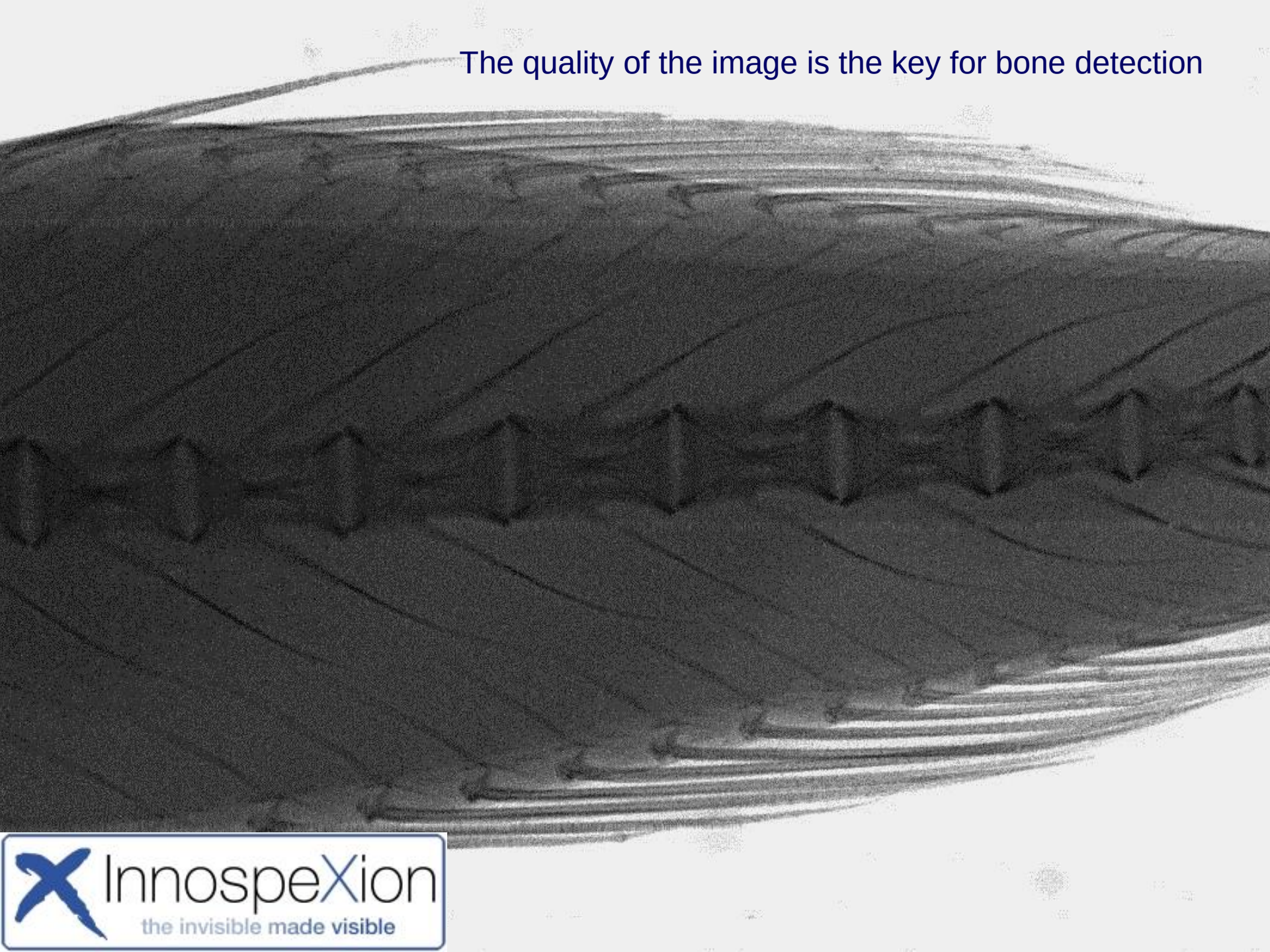
FISH BLOCKS – 4-5 CM THICK TUNA

The quality of the image is the key for bone detection



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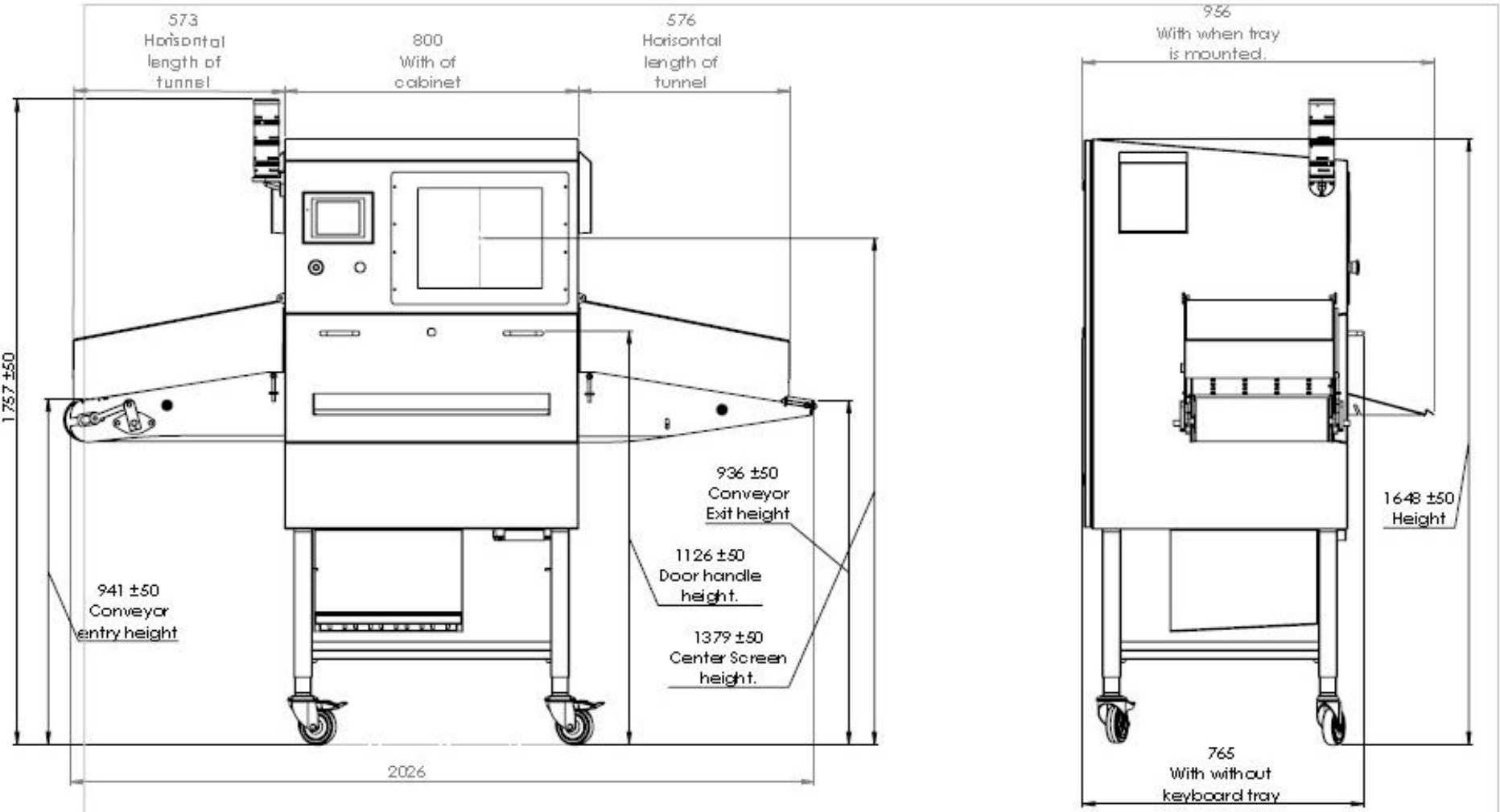

The machine have the posibility to be ajusted +/- 50 mm in height. For easy adaptation to the process line.

Comments:

DRAWN BY	
Client	
Project	
Supplier	

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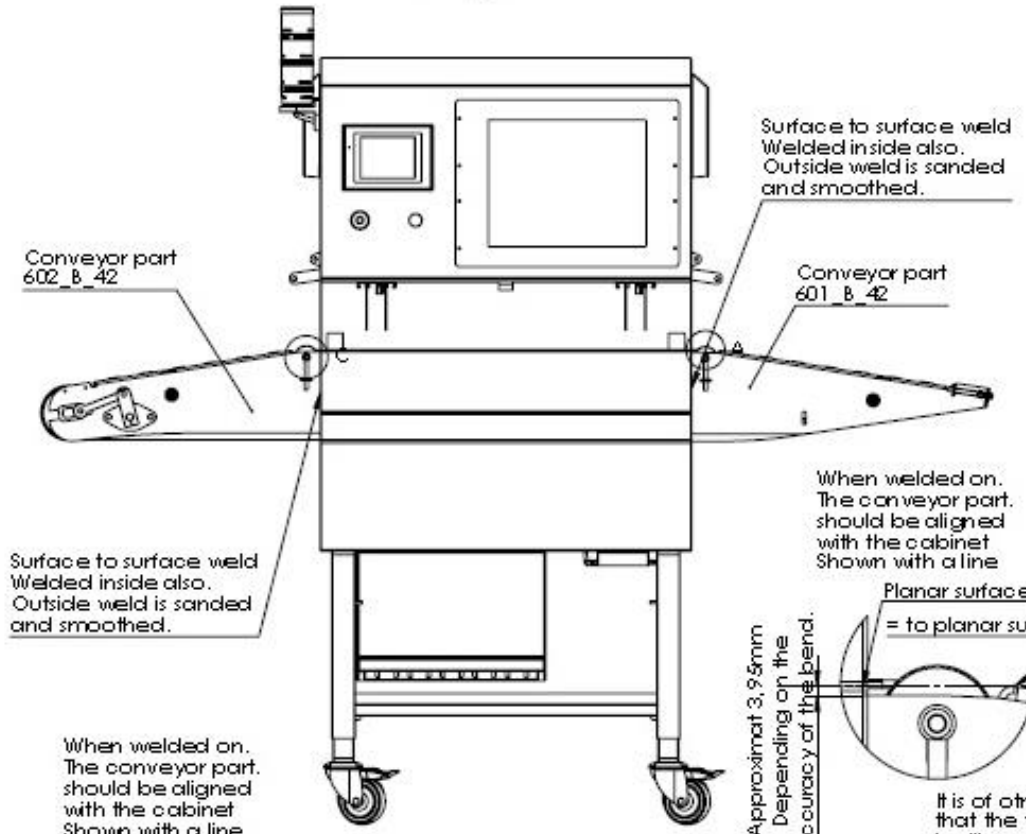
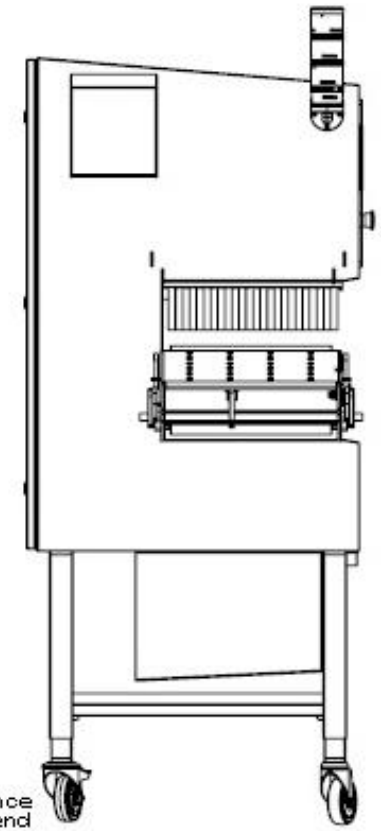
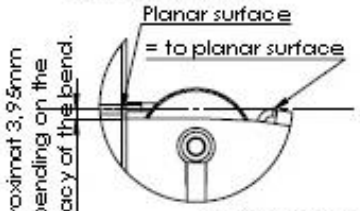
101_A_42_welded_conveyor

Welding instruktions to conveyor welded on cabinet.
Conveyor parts should bee fuly welded, no gaps alowed.





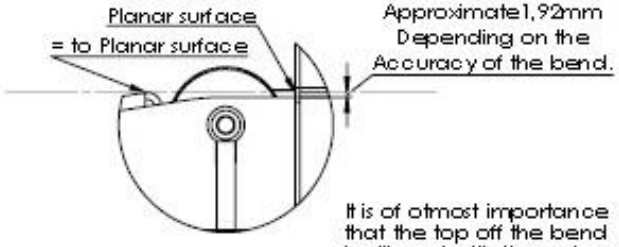
When welded on.
The conveyor part.
should be aligned
with the cabinet
Shown with a line



DETAIL A
SCALE 1 : 2

It is of otmost importance that the top off the bend is alligned with the surface of the conveyor.

When welded on.
The conveyor part.
should be aligned
with the cabinet
Shown with a line



It is of otmost importance that the top off the bend is alligned with the surface of the conveyor.

Comments:

DRAWN By			
Chkr			
Projectr			
Supplier			

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101_A_42_welded_conveyo

Low energy X-ray inspection

The HYMCIS from InnospeXion

(probably) **The worlds most sensitive, and highest resolution, X-ray systems for on-line control at manufacturing speeds up to 120 m/min**

Danish engineering – Made in Denmark

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