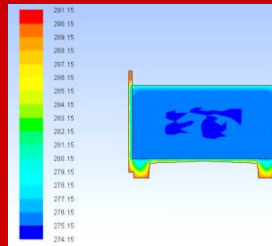
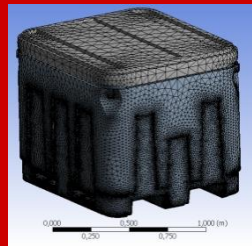


shaping plastics beyond the obvious



# Leiðir til bættrar hitastýringar við sjó- og flugflutning á ferskum fiski

Sjávarútvegsráðstefnan  
Reykjavík, 21. nóv. 2013

Dr. Björn Margeirsson vélaverkfræðingur  
Rannsóknastjóri Promens Dalvík/Promens Tempra  
[bjorn.margeirsson@promens.com](mailto:bjorn.margeirsson@promens.com)

# Dagskrá

- Inngangur
- Hitastýring í flug- og sjóflutningskeðjum
- Leiðir til bættrar hitastýringar
  - Forkæling fyrir pökkun
  - Kælimottur
  - Pakkningalausnir
  - Ferilvöktun ferskfiskútflutnings („MiND your value chain“)



**AVS** rannsóknasjóður  
í sjávarútvegi



Rannsóknasjóður HÍ

# Modelling of temperature changes during transport of fresh fish products

Defense of PhD thesis

**Björn Margeirsson**

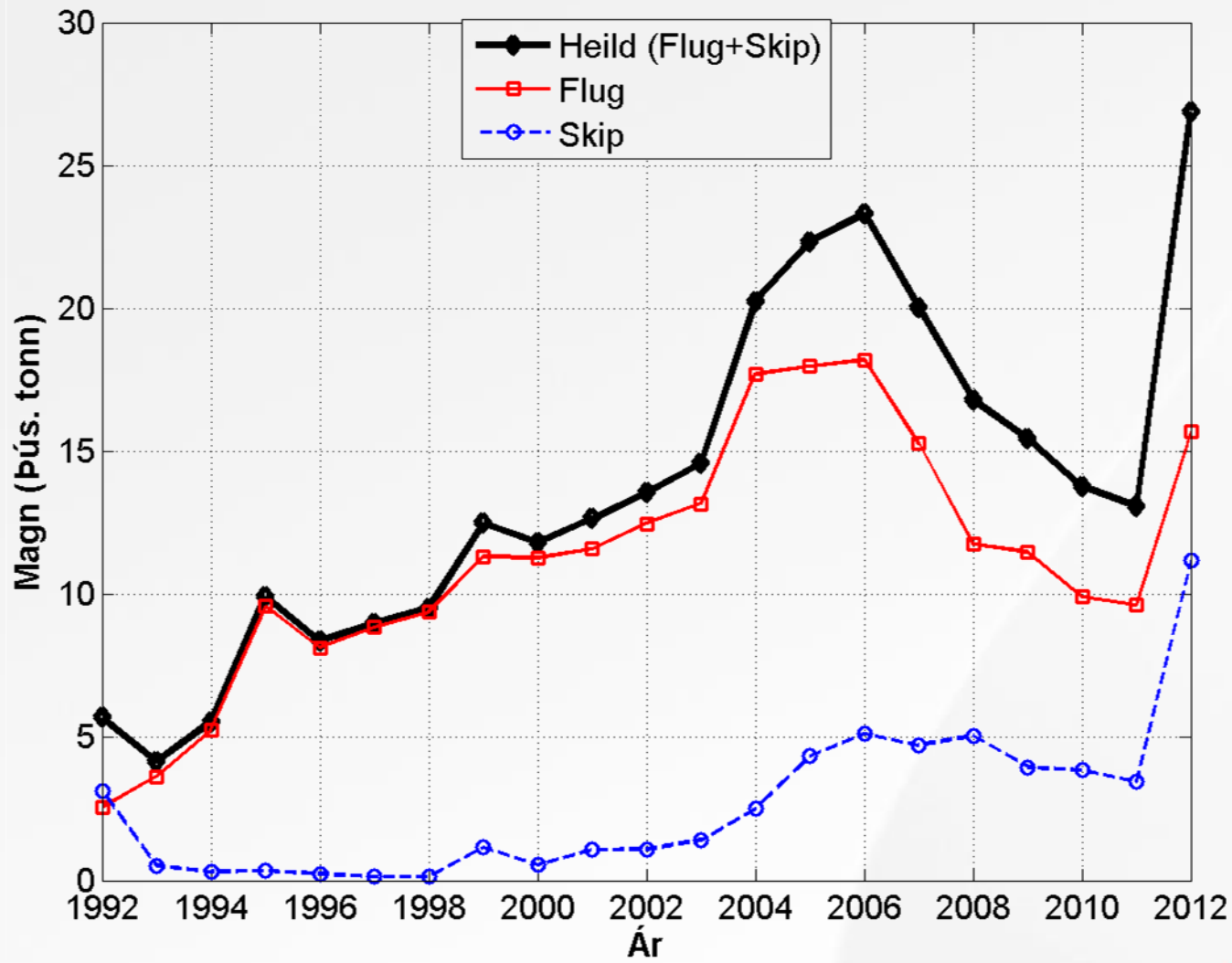
University of Iceland, May 2, 2012



**SAMHERJI HF**



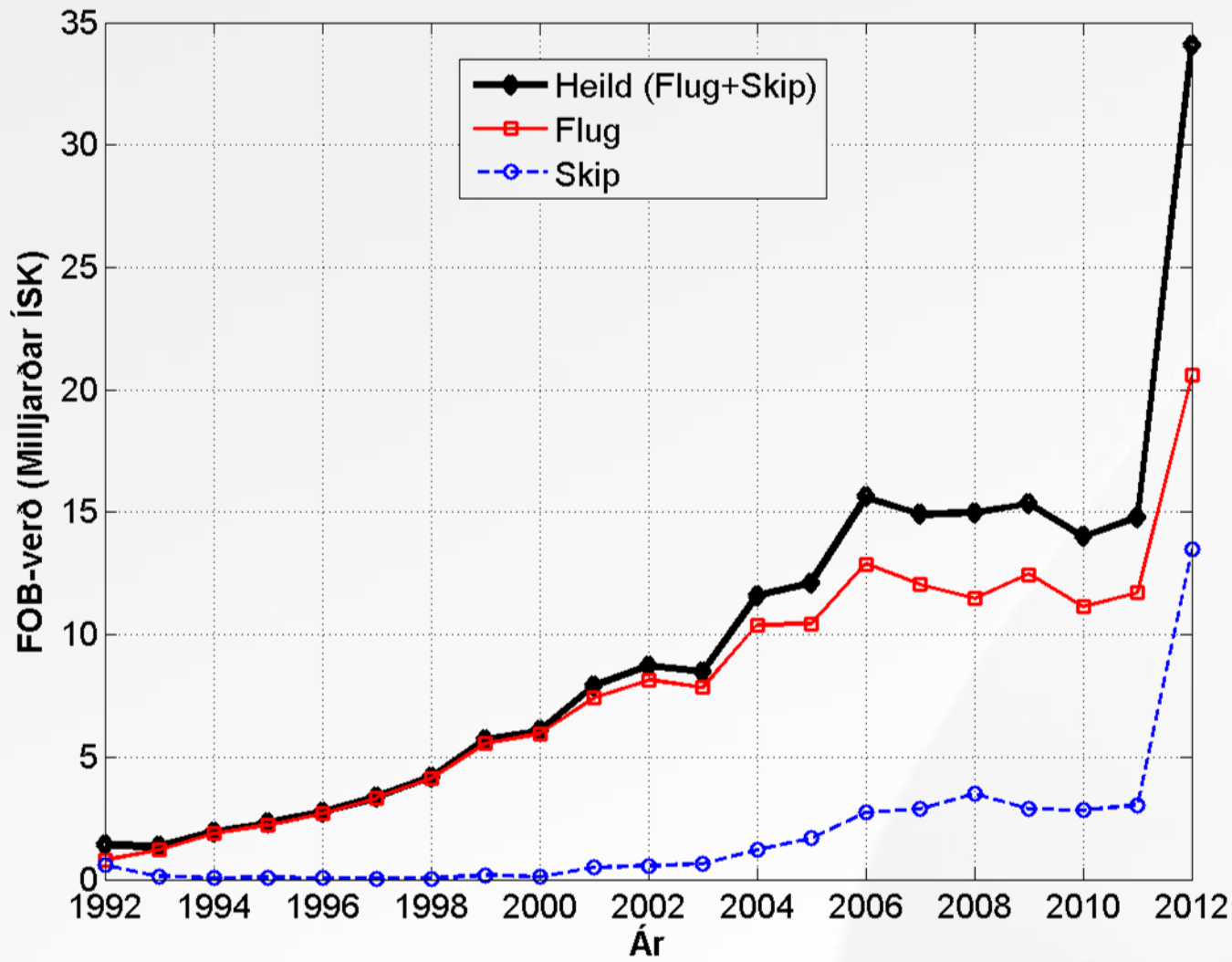
# Inngangur: flug- og sjóflutningur sl. 2 áratugi



ATH: aðeins flök og flakabitar (ekki heill fiskur)

Heimild: [www.hagstofa.is](http://www.hagstofa.is)

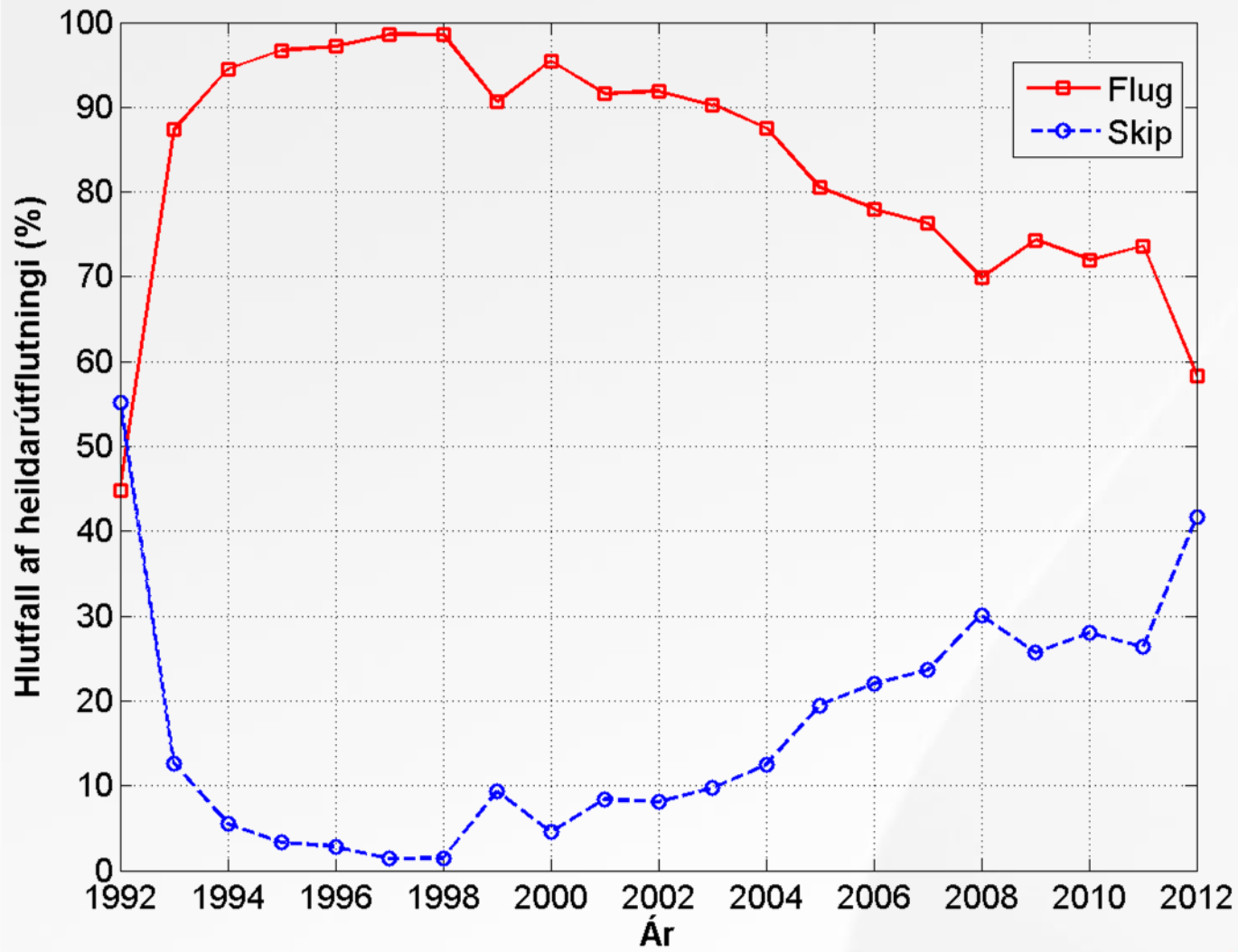
# Inngangur: flug- og sjóflutningur sl. 2 áratugi



ATH: aðeins flök og flakabitar (ekki heill fiskur)

Heimild: [www.hagstofa.is](http://www.hagstofa.is)

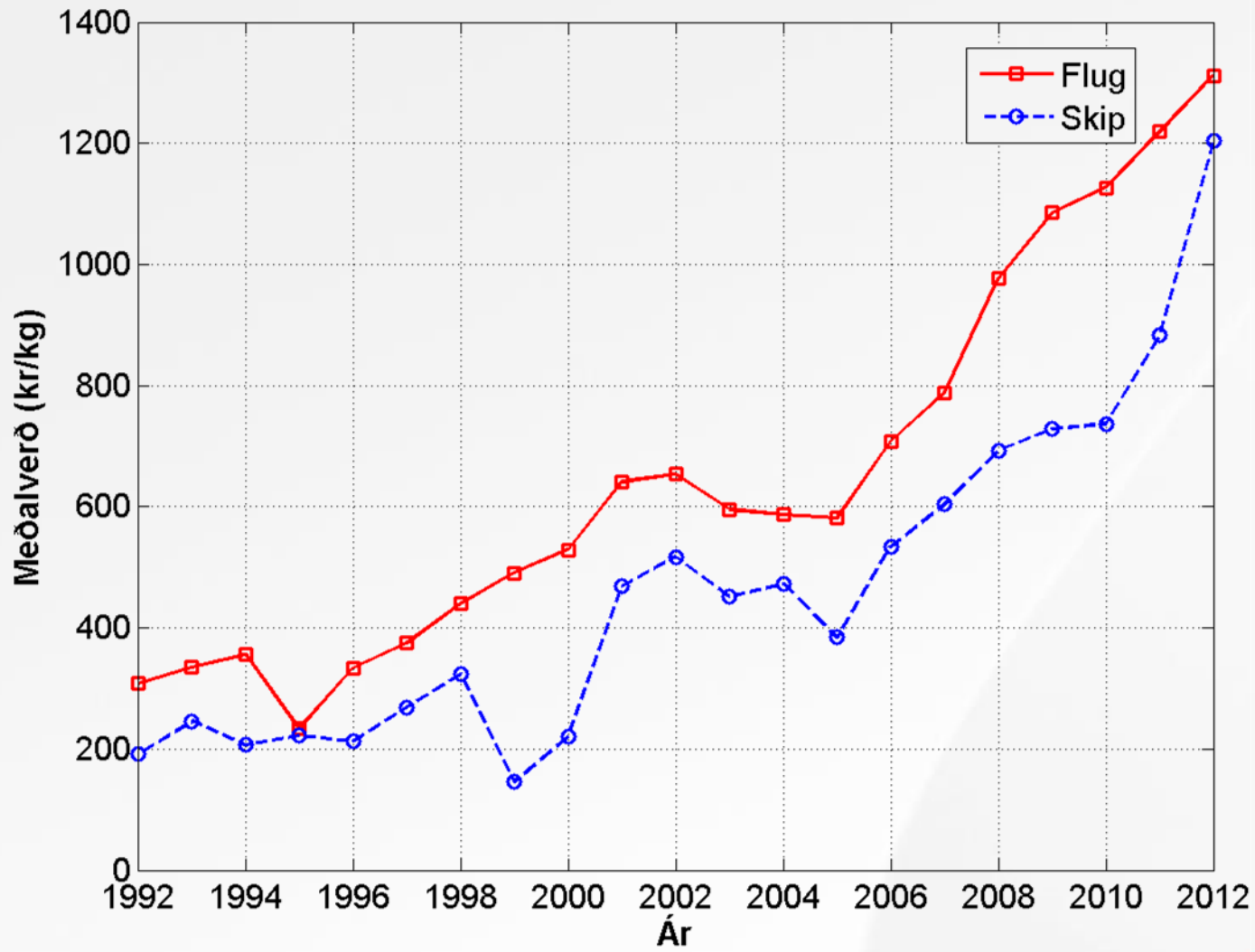
# Inngangur: flug- og sjóflutningur sl. 2 áratugi



ATH: aðeins flök og flakabitar (ekki heill fiskur)

Heimild: [www.hagstofa.is](http://www.hagstofa.is)

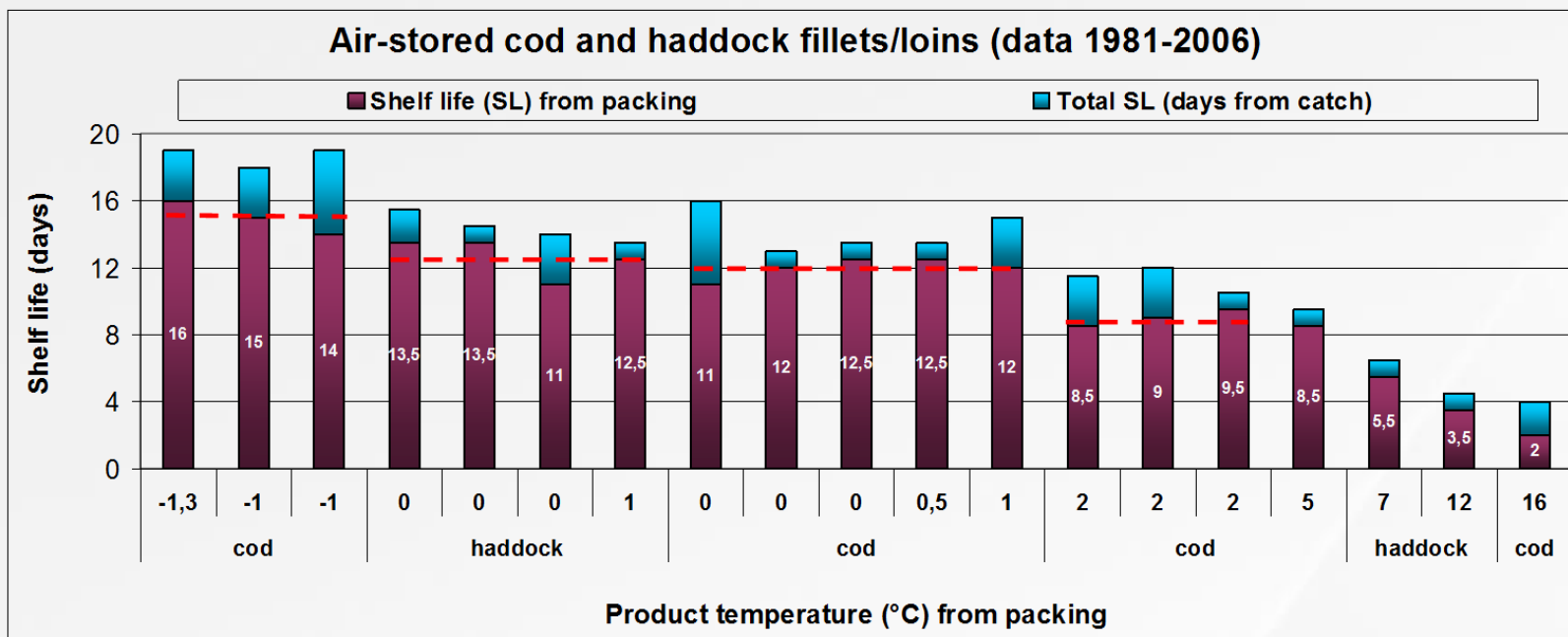
# Inngangur: flug- og sjóflutningur sl. 2 áratugi



ATH: aðeins flök og flakabitar (ekki heill fiskur)

Heimild: [www.hagstofa.is](http://www.hagstofa.is)

# Geymsluþol ferskra hvítfiskafurða er mjög **hitaháð!**



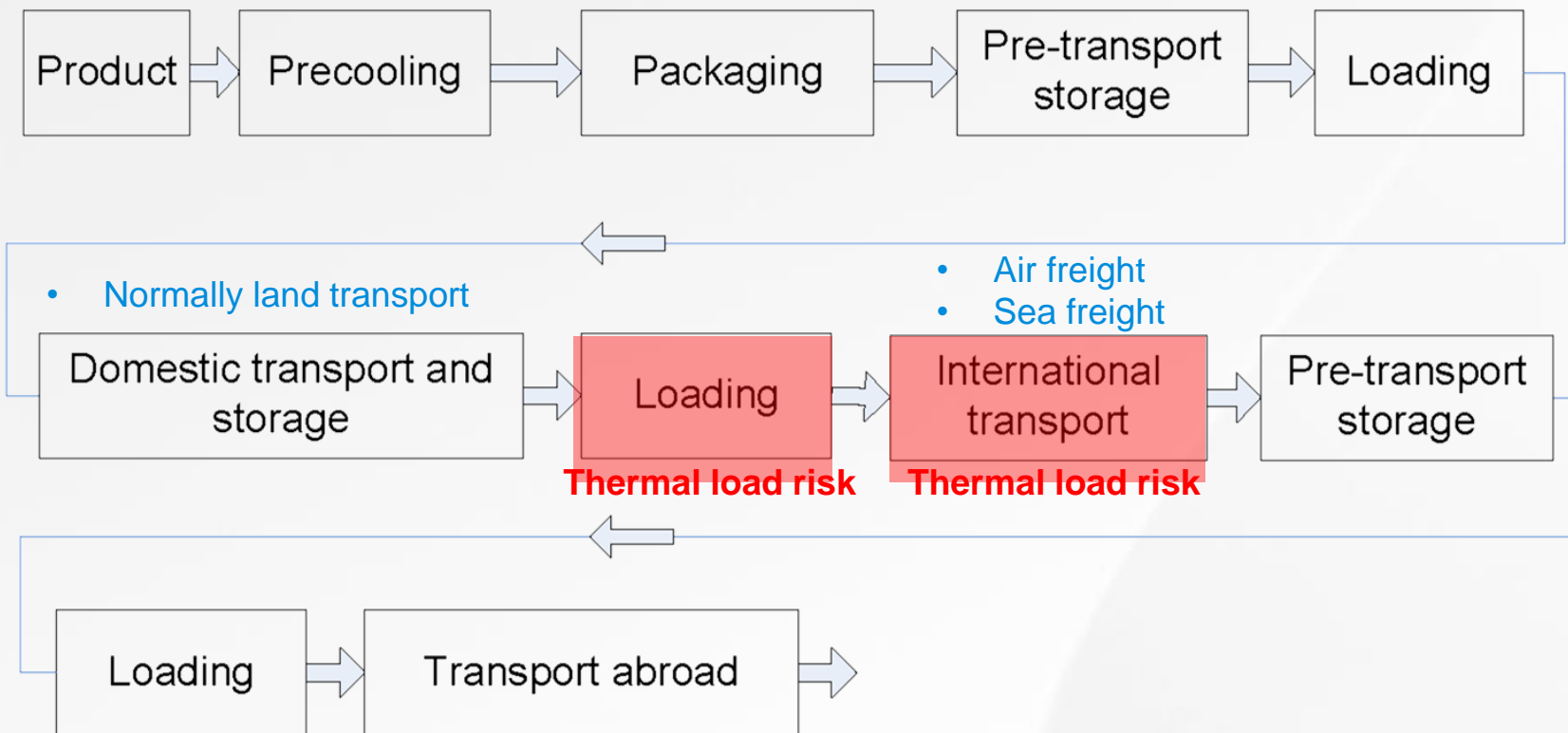
Effect of temperature on the storage life of cod and haddock products (Lauzon et al., 2010)

Storage life of fresh whitefish products (processed from gutted, iced whitefish) is highly temperature dependent (see figure above) and usually ranges between 10–13 days assuming storage at 0–1 ° C



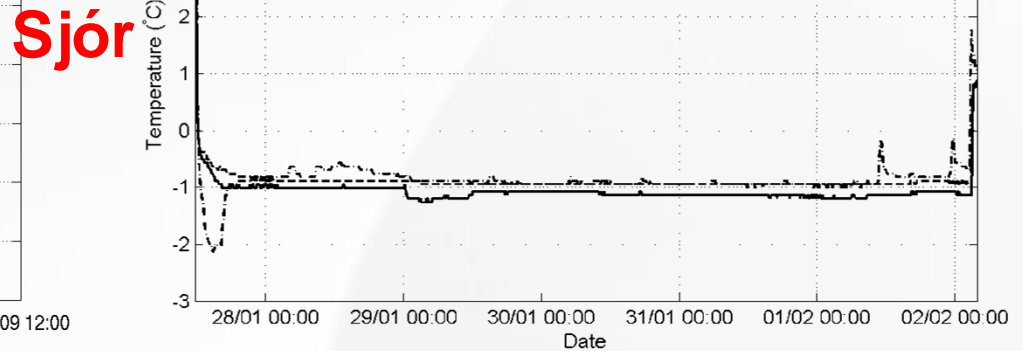
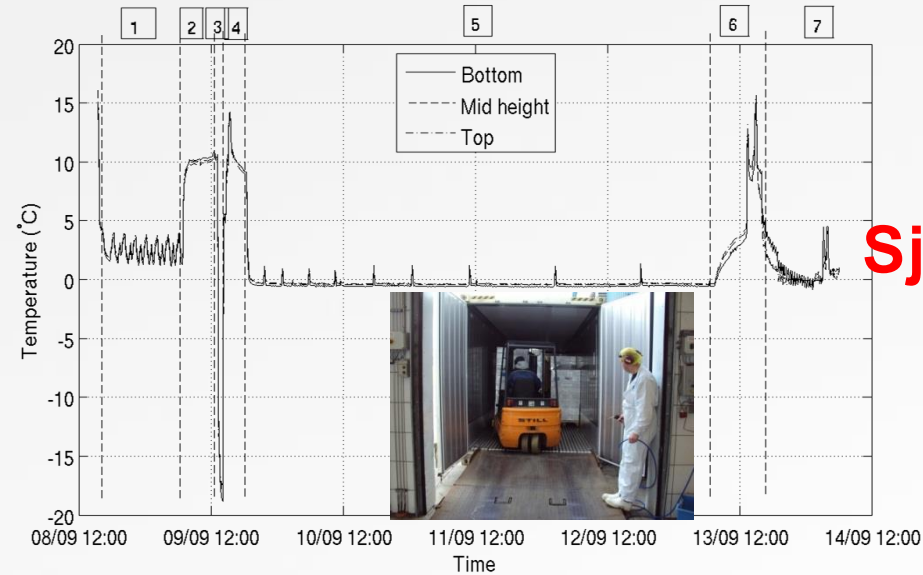
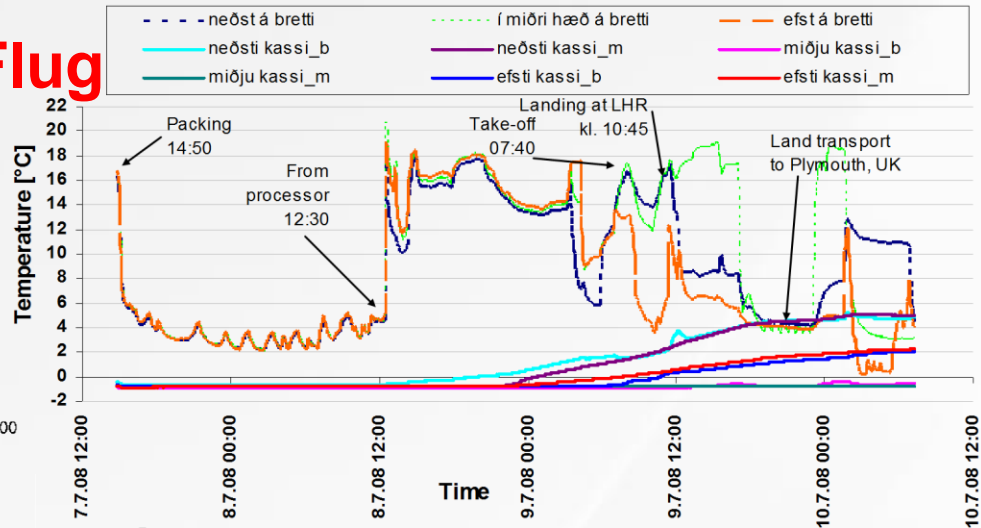
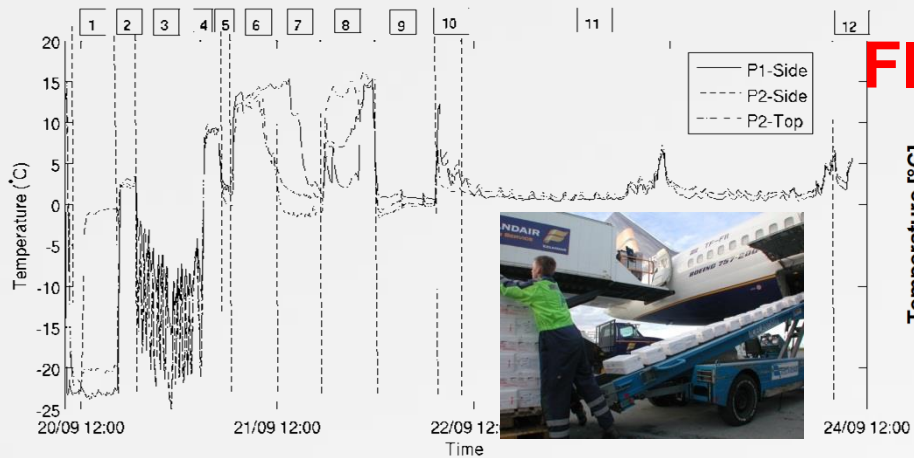
# Kælikeðja ferskfisks frá vinnslu til markaðar

- CBC cooling
- Slurry ice/liquid cooling
- Corrugated plastic (CP, PP=polypropylene)
- Expanded polystyrene (EPS)
- Improved EPS
- Ice/Gel packs
- Excessive cooling/freezing possible



Simplified flowchart for processing and transport of fresh fish products

# Hitastýring í flug- og sjóflutningskeðjum

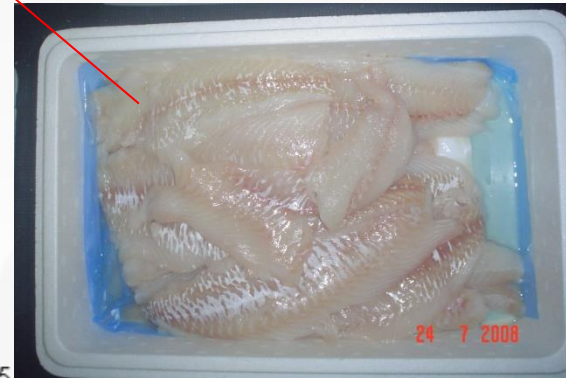
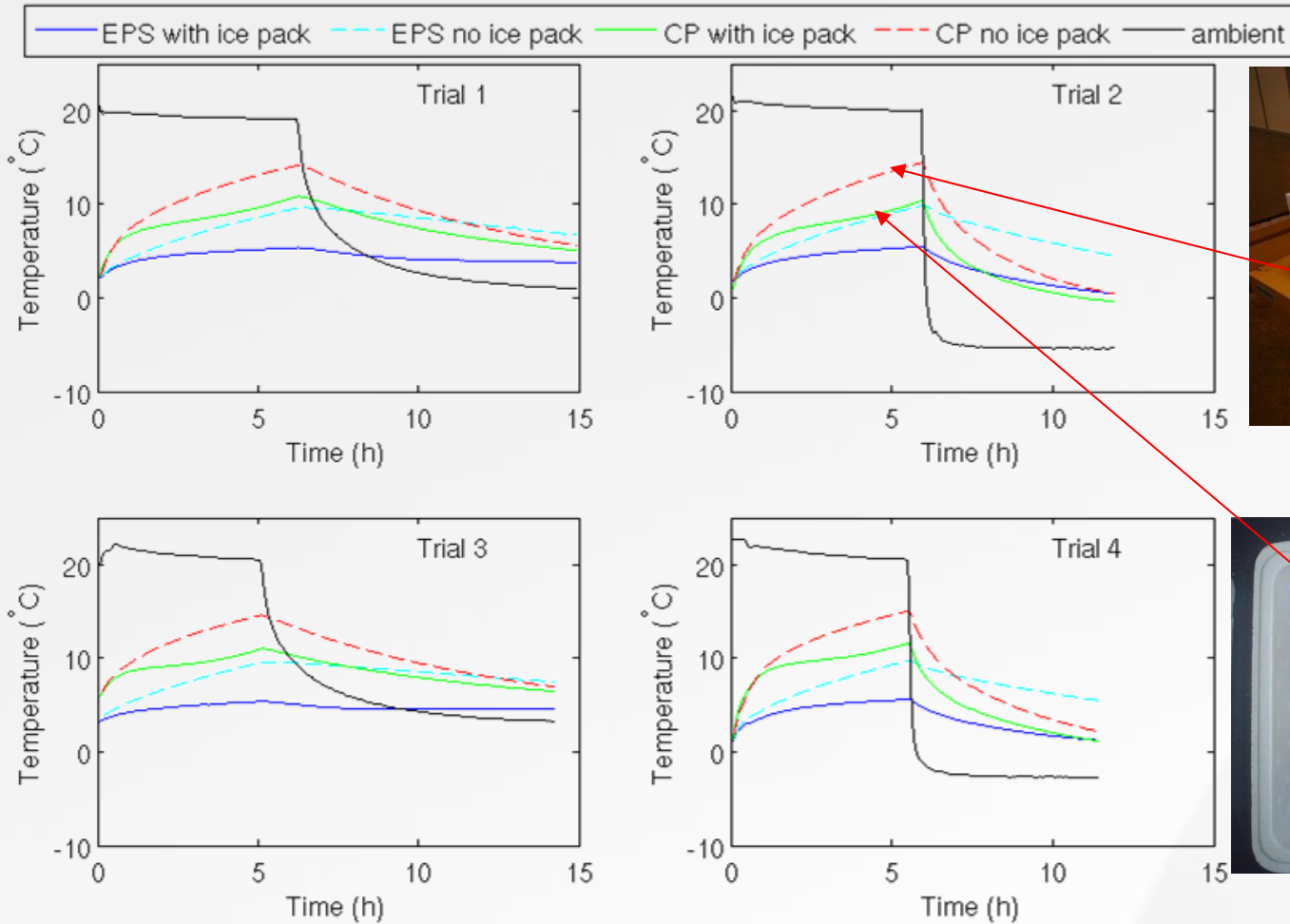


# Leiðir til bættrar hitastýringar

- Bætt umhverfishitastýring (sérstaklega milli mismunandi hlekkja kælikeðjunnar)
- Forkæling afurða fyrir pökkun
- Frosnar ís- eða kælimottur, þurrís
- Einangrandi pakkningar



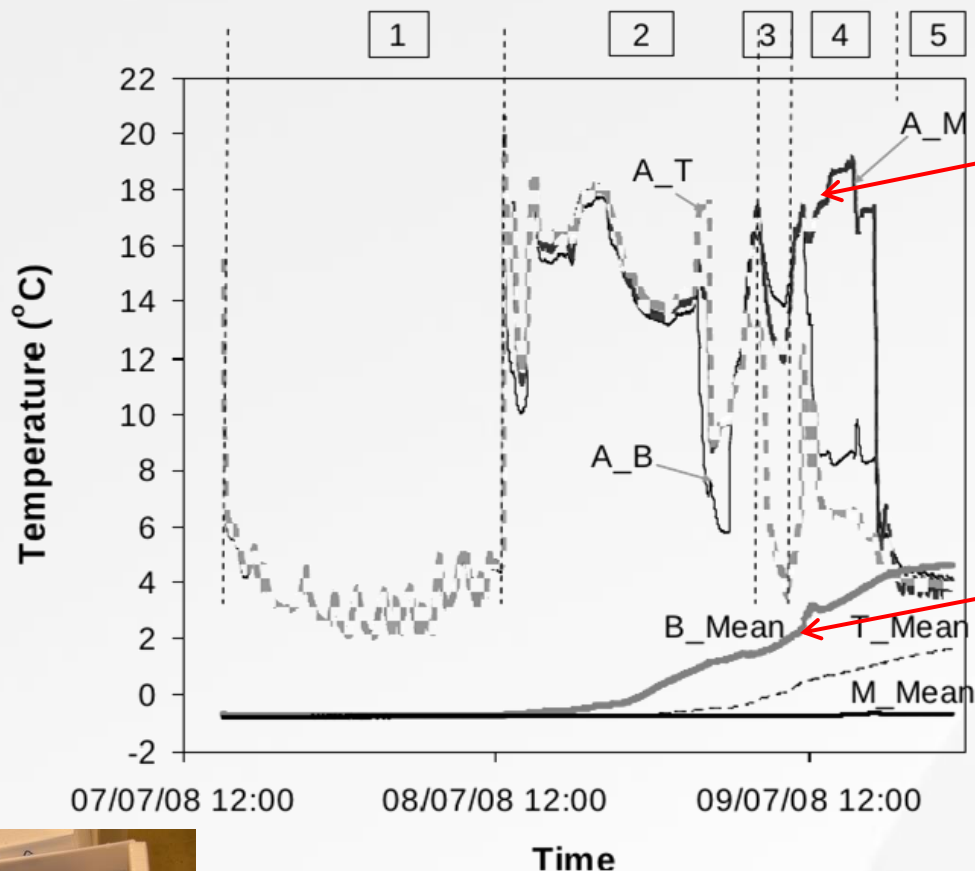
# Frauðplast (EPS) vs. bylgjuplast (PP), áhrif kælimotta



Umhverfis- og meðalfiskhiti í fjórum hitaálagstilraunum með 3 kg af ýsuflokum í stökum kössum.

# Mikilvægi forkælingar fyrir pökkun

**B:** bottom box  
**M:** middle box  
**T:** top box



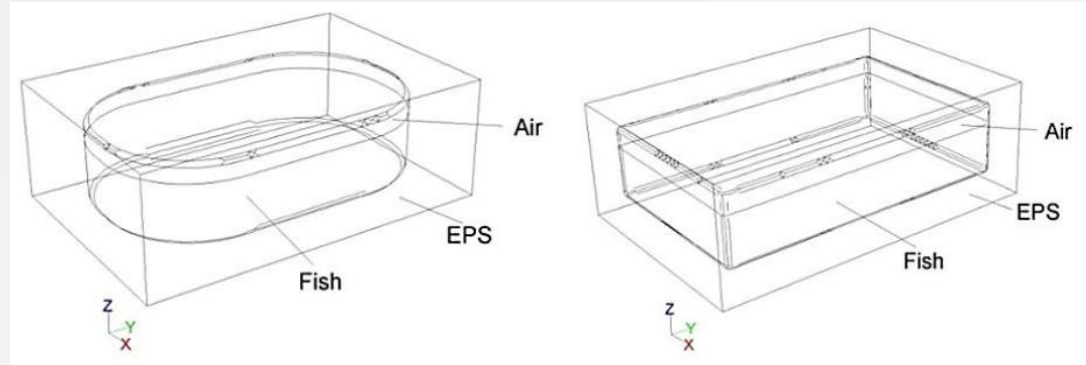
**Ambient  
(A)**

**Product**

**Kæligeta 250 g ísmottu nægir til að  
lækka hitastig á þorskhökkum úr**

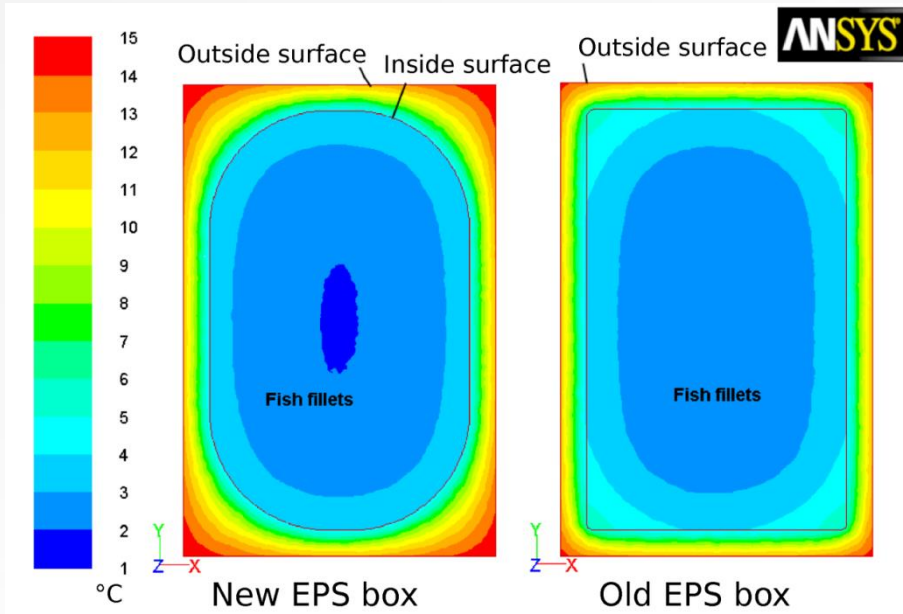
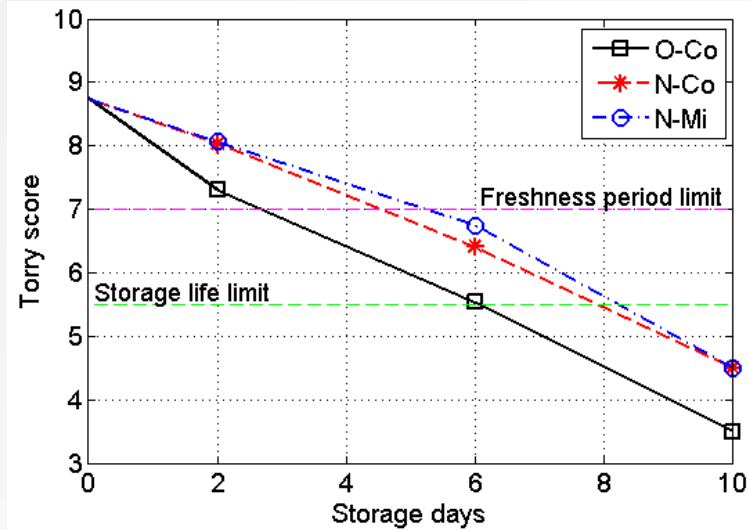
- **4,5 °C í 0 °C (m.v. 5 kg af fiski)**
- **7,5 °C í 0 °C (m.v. 3 kg af fiski)**

# Endurbættir frauðkassar Promens Tempru



Nýi kassinn

Gamli kassinn



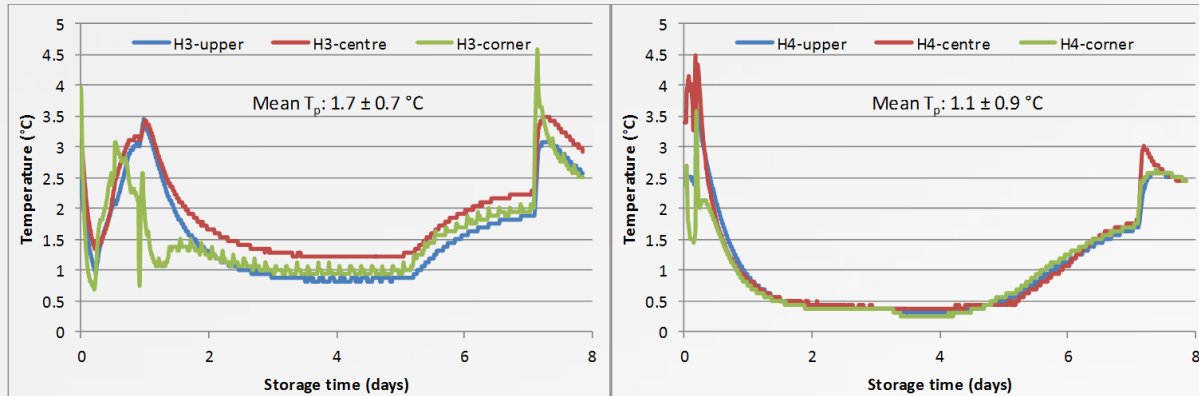
$T_{init} = 1^{\circ} C$   
 $T_{amb} = 15^{\circ} C$   
 $t = 4 \text{ hours}$

Contours of Static Temperature (c) (Time=1.4400e+04)  
 Björn Margeirsson, Matis ohf.

Feb 17, 2010  
 ANSYS FLUENT 12.0 (3d, dp, pbns, lam, transient)

# Gámakassar með gati óþarfir?

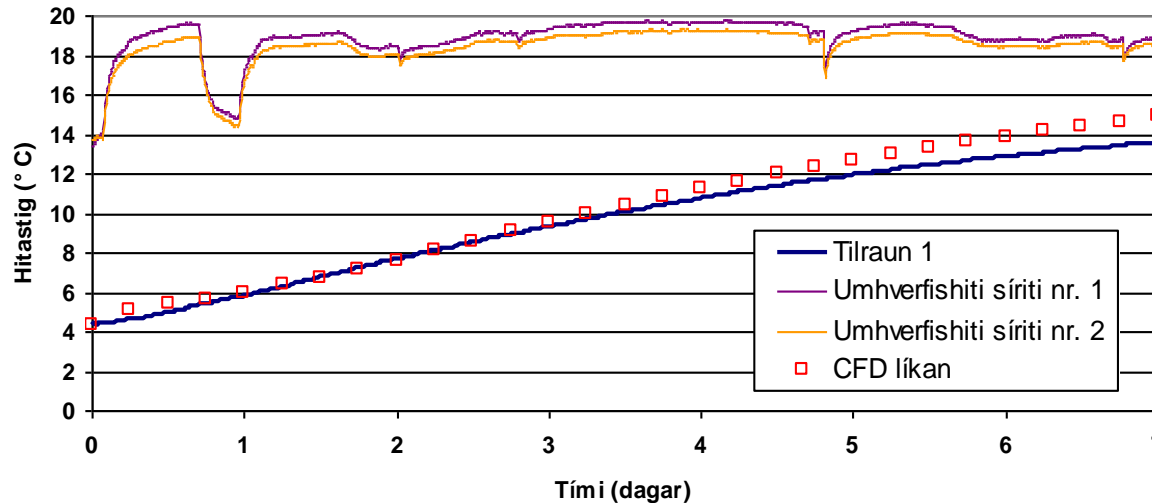
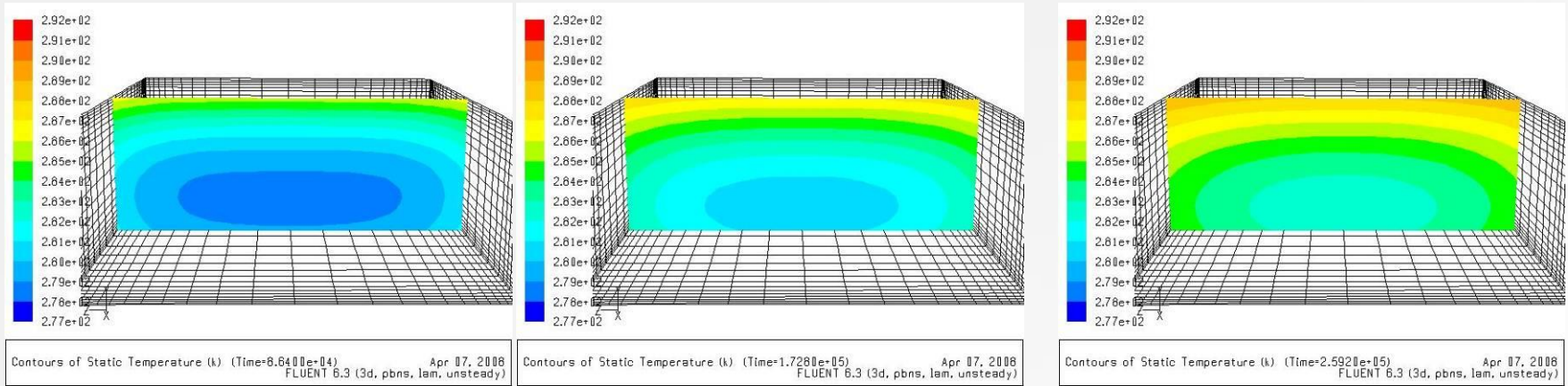
Niðurstöður úr geymslupólstilraun Matís frá júní 2013 bendir til að ógataður flugkassi með rakamottu skili betri afurð



Treatment	H1 – 5 kg sea freight	H2 – 5 kg air freight	H3 – 3 kg air freight	H4 – 5 kg air freight with CO <sub>2</sub> pads
Mean $T_{product}$ (SD °C)	1.7 (0.7)	1.9 (0.7)	1.7 (0.7)	1.1 (0.9)
Sensory shelf life (days)	7	~ 7.5	~ 7.5	8
TMA: low-high (mg N/100 g fish)	23-25	14-15	18-28	9-18
Drip (%)	1.8	1.3	2.2	4.8
TVC* (17 °C, IA)	7.4	7.4	7.7	6.7
H <sub>2</sub> S-producing bacteria*	5.7	6.0	6.5	4.4
Pseudomonads*	6.5	6.5	7.2	4.7
<i>Photobacterium phosphoreum</i> *	6.5	7.0	7.5	7.0



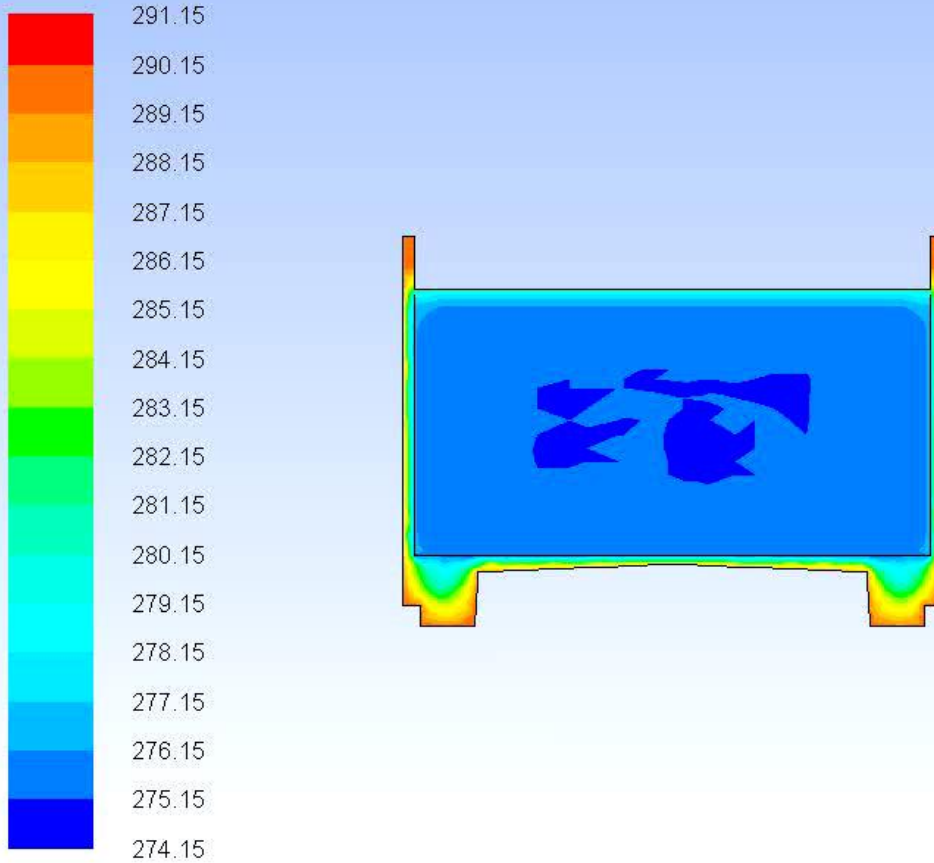
# Varmaflutningslíkön af fiskikerum



Heimild: Margeirsson, 2008. Comparison between insulation of tubs with experimental and numerical methods. Matis report 09-08.

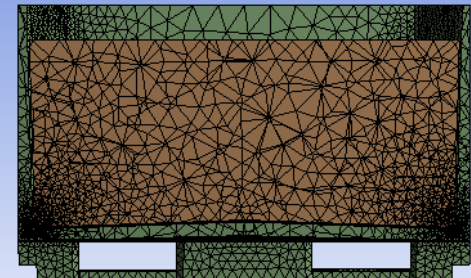
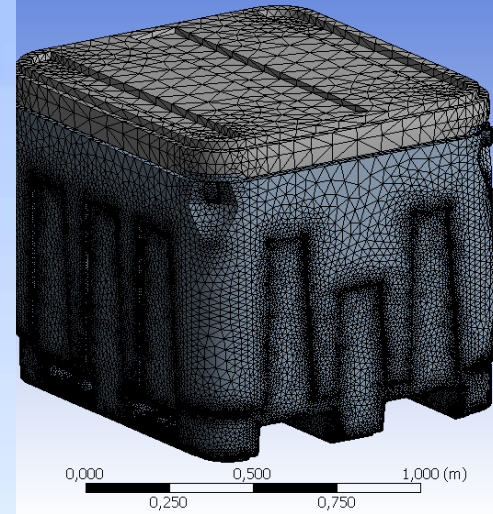


# Líkan af 660 L PUR kerri



Contours of Static Temperature (k) (Time=3.6000e+03)

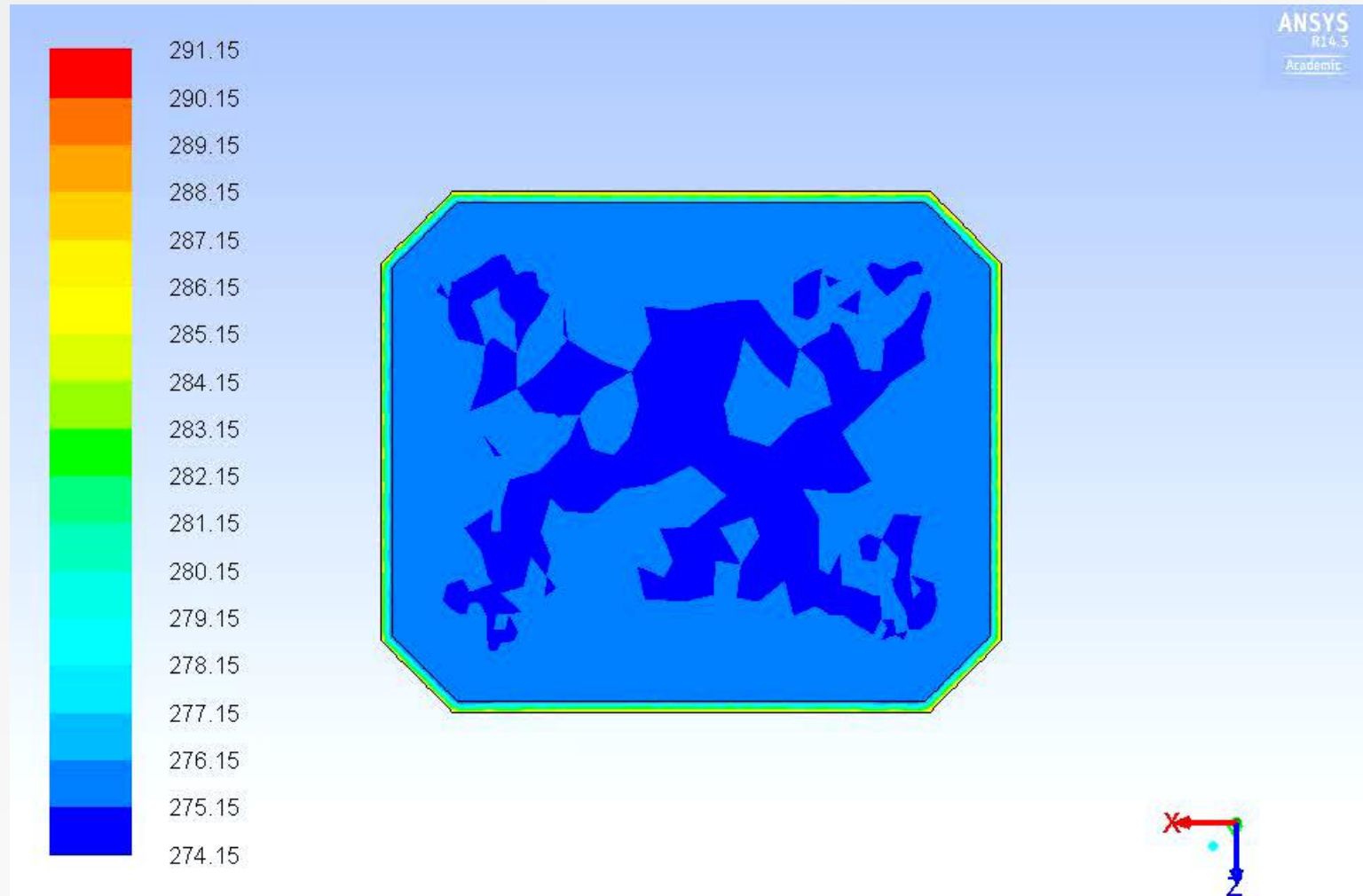
ANSYS  
R14.5  
Academic



Jun 25, 201  
ANSYS Fluent 14.5 (3d, pbns, lam, transien)

0,000 0,300 (m)

# Líkan af 660 L PUR keri – lárétt snið



Contours of Static Temperature (k) (Time=6.0000e+02)

Jun 25, 2013  
ANSYS Fluent 14.5 (3d, pbns, lam, transient)

NS

# Möguleikar varmaflutningslíkana

- Geta tekið með í reikninginn
  - Breytilegan umhverfishita
  - Mismunandi lögun og efnisval pakkninga (kera/kassa)
  - Mismunandi afurðir (fiskur, kjöt, mjólkurafurðir,...)
- Nýtast til að
  - Spá fyrir um vöruhitabreytingar undir umhverfishitaálagi
  - Þróa og endurbæta pakkningar í takt við þarfir

# Vakúmpökkuð flök í kerum – betri hitastýring en í frauðkössum

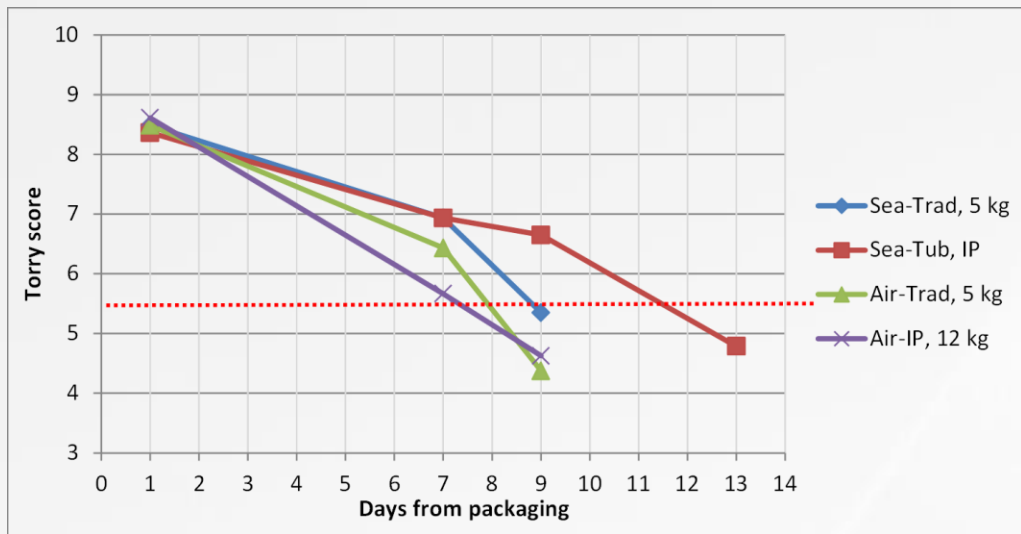
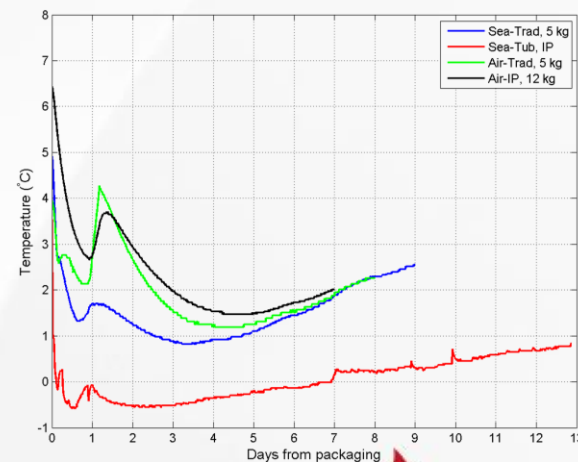


Figure 1. Average Torry freshness scores. Legends: Sea: simulated sea transport conditions, Trad: traditional packaging method, Air: simulated air transport conditions, IP: individually packaged.

**Table 1. Storage life according to sensory evaluation. Legends: Sea: simulated sea transport conditions, Trad: traditional packaging method, Air: simulated air transport conditions, IP: individually packaged.**

Group	Storage life (days)
Sea-Trad, 5 kg	8–9
Sea-Tub, IP	11–12
Air-Trad, 5 kg	7–8
Air-IP, 12 kg	7

nB: days post packaging  
(+3 days from catch)



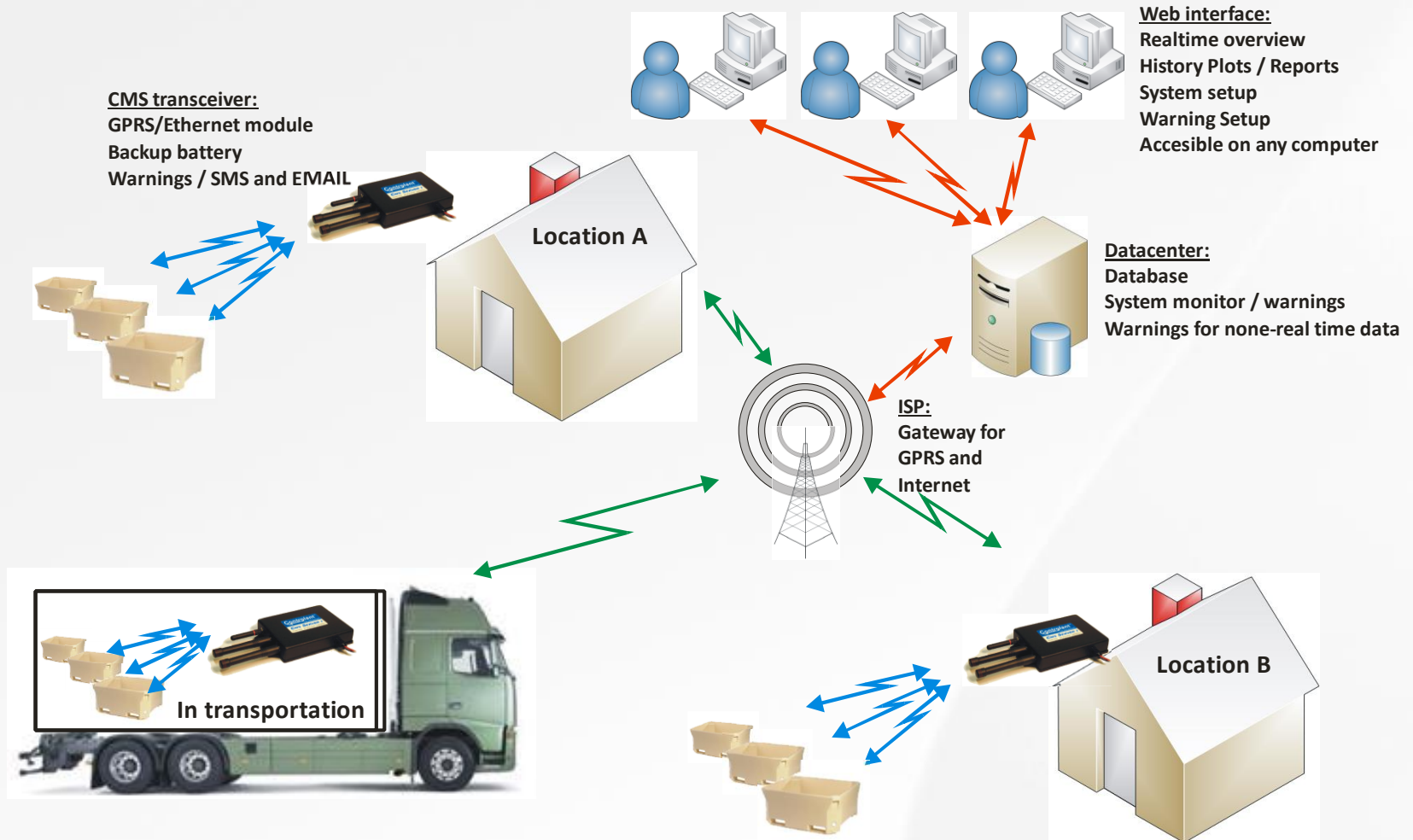
shaping plastics beyond the obvious



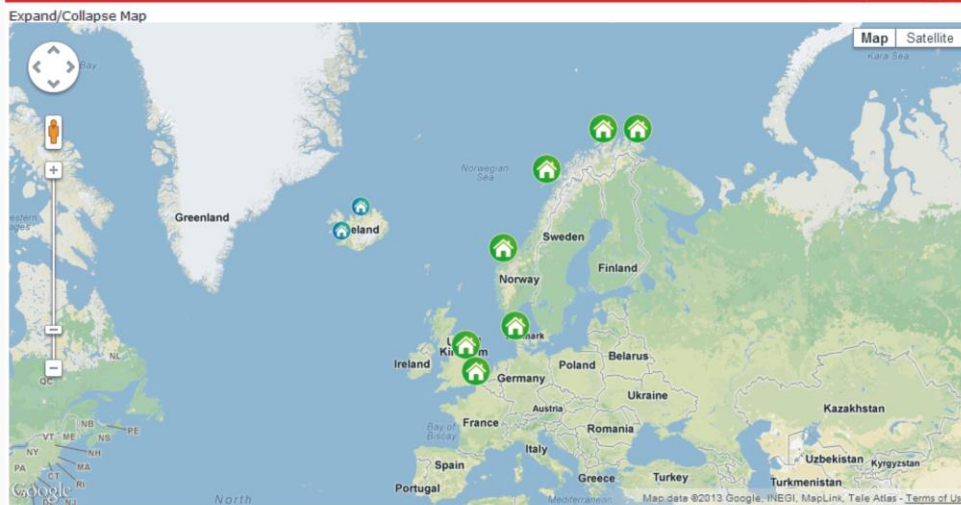
# Promens Container Management System



# Uppbygging MiND



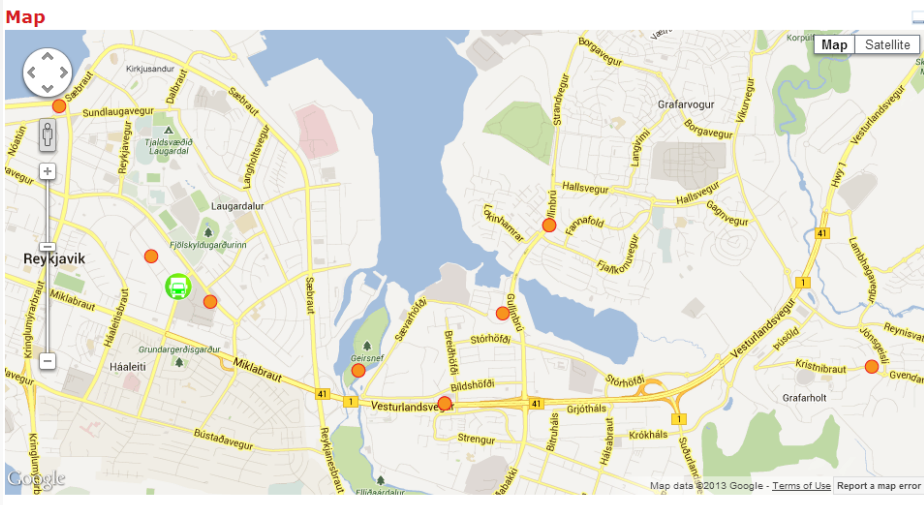
# Ferilvöktun - dæmi



Locations  Transit

Filter:

Name	Address	Items	City	Name	Items
Controlant G7	Grensásvegur 7	73	Reykjavík		
Promens	Gunnarsbraut 12	489	Dalvík		
Norway Seafoods AS Avd Båtsfjord	Holmen	611	Båtsfjord		
Norway Seafoods Stamsund	Buøyveien 7	347	Stamsund		
Norway Seafoods Hammerfest	Havneveien 44	424	Hammerfest		
Halle à Marée	Crée de Boulogne sur mer	279	Boulogne sur mer		
PPS East Ltd	Unit 1. Omega Business Park	267	Grimsbý		
Dansk Karudlejning	Auktionsgade 2	100	Esbjerg		
Promens Aalesund AS	Tverrvegen 37	61	Aalesund		
			2651		
			0		
			Row count: 9		
			0		
			Row count: 0		



**Locations**

Items On Unknown Locations

Filter:

Item Id	Sensor Id	City	Transceiver	Temperature	On location	Last data	Function
Mjókursamsalan - VJ090	01000326		01000326		50W 2D		Locate
Mjókursamsalan - LY110	01000368		01000368		50W 1D		Locate
Mjókursamsalan - BP209	01000368	Reykjavík	01000368		50W 0D		Locate
Móttaka	0300038F	Reykjavík	01000327	23	10W 6D	1M	Locate
Hita- og rakanemi	03000765	Reykjavík	01DDDDDD		50W 2D		Locate
Hita- og rakanemi	03000768	Reykjavík	01DDDDDD		50W 2D		Locate
Ferilvöktunarnemi - GH test	040000A5		01000327		55W 1D		
ITUB CON	05000041	Reykjavík	01000290		17W 5D		Locate
ITUB CON	05000045	Reykjavík	01000290		17W 5D		Locate
							Row count: 20

# Af hverju sjálfvirkt, þráðlaust ferilvöktunarkerfi?

- Auknar gæðakröfur og áhersla á fullkomna hitastýringu
- Strangari reglugerðir
- Skortur á verðmætum upplýsingum
- Framkvæmd ferilvöktunar tímafrek
- Notendur háðir móttakanda
- Veikir hlekkir í keðjunni
- Traust á milli aðila



- Sjálfvirk ferilvöktun
- Miðlægni upplýsinga
- Raunhæfur möguleiki á að vita hitastig allra sendinga
- Upplýsingar
  - Sjálfvirkar skýrslur - greining
  - Yfirlit allra sendinga
  - Sendingar út fyrir tímamörk
- <http://www.controlant.com>
- <http://dalvik.promens.com>



**SAMHERJI HF**



**controlant**

**E EIMSKIP**



**AVS** rannsóknasjóður  
í sjávarútvegi



Rannsóknasjóður HÍ



Rekstrarfélagið Eskja  
Festi



Takk fyrir samstarfið og athyglina!  
[bjorn.margeirsson@promens.com](mailto:bjorn.margeirsson@promens.com)

shaping plastics beyond the obvious

