

Advancements in Ice Load Measurements: *A Case Study on Icebreaker Baltika*

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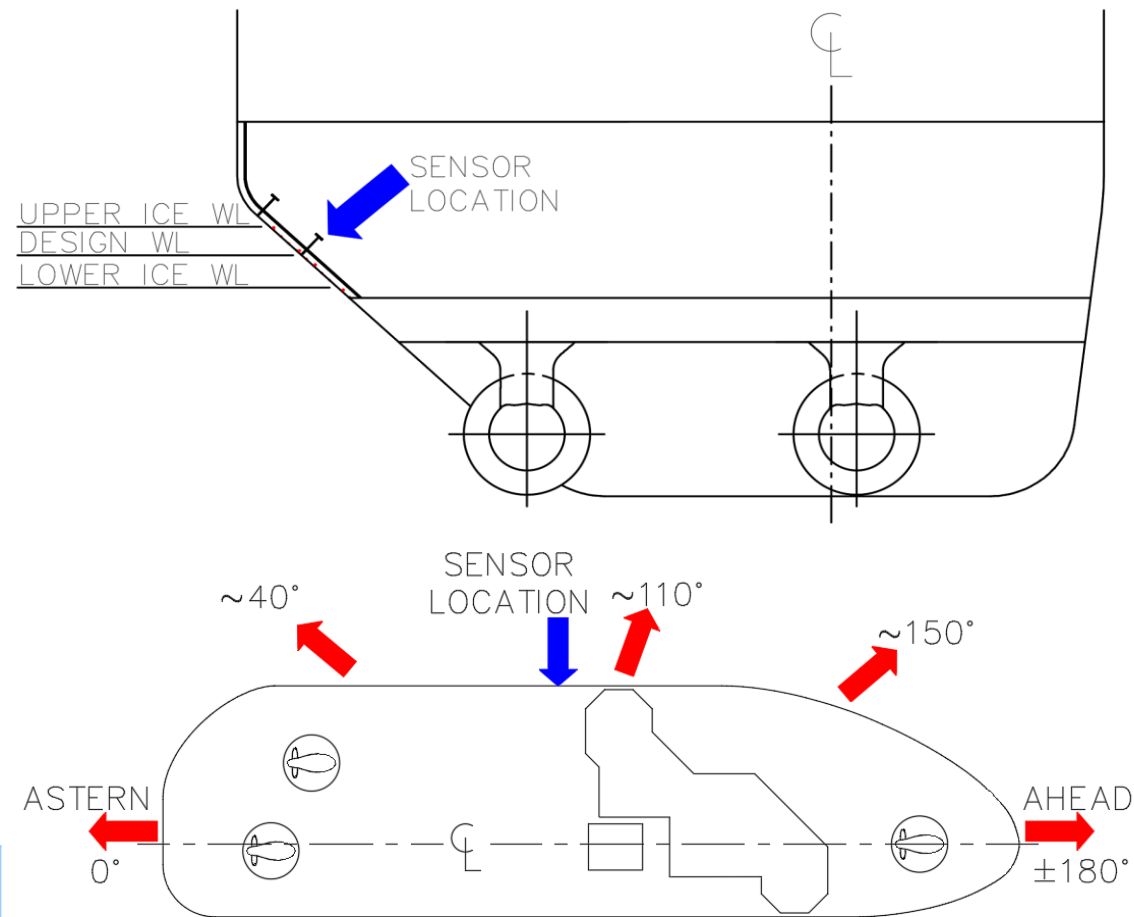
Ice Load Measurements



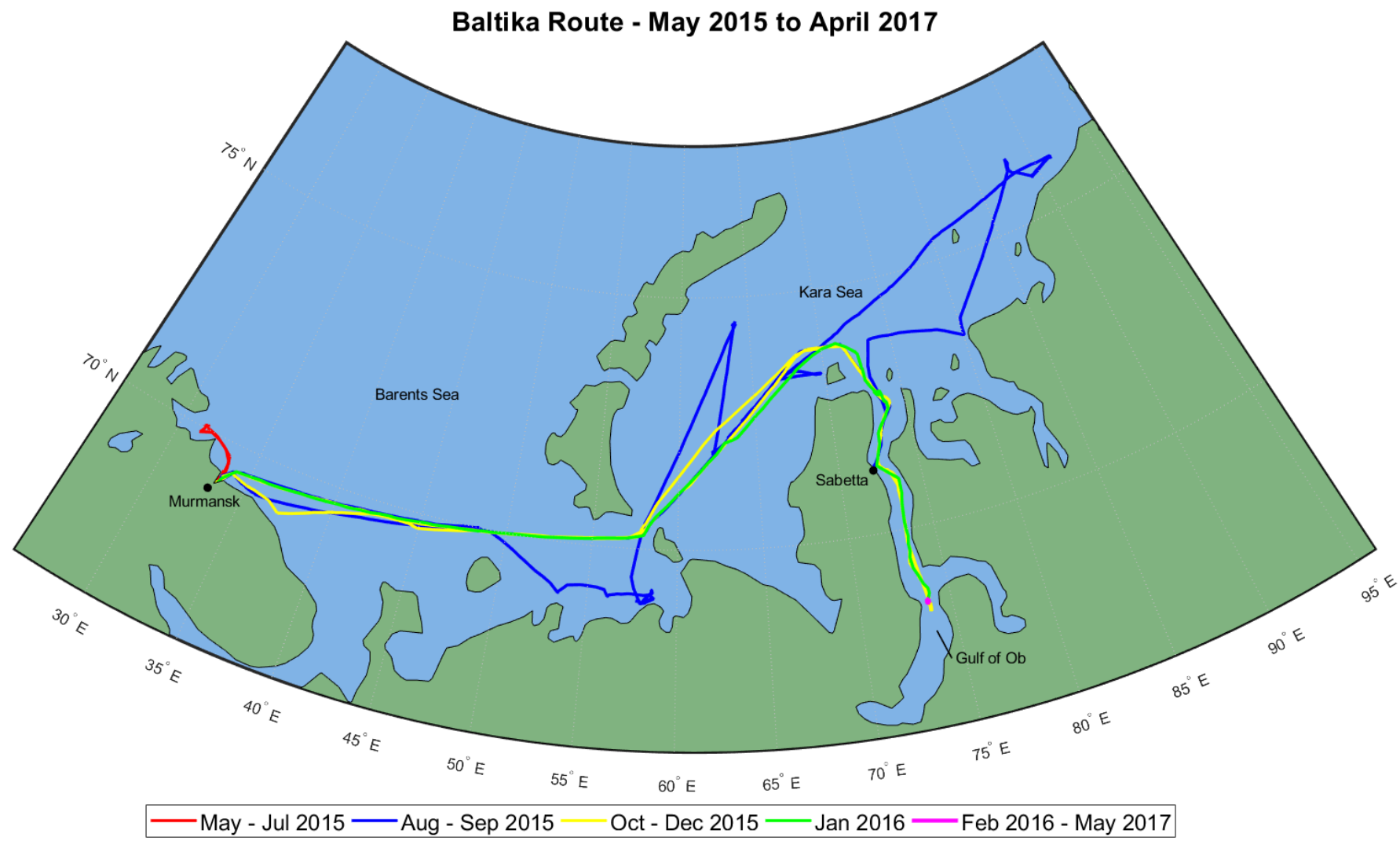
Icebreaker *Baltika*



Length	Beam	Draft	Ice Class
76.4 m	20.5 m	6.3 m	RMRS Icebreaker 6

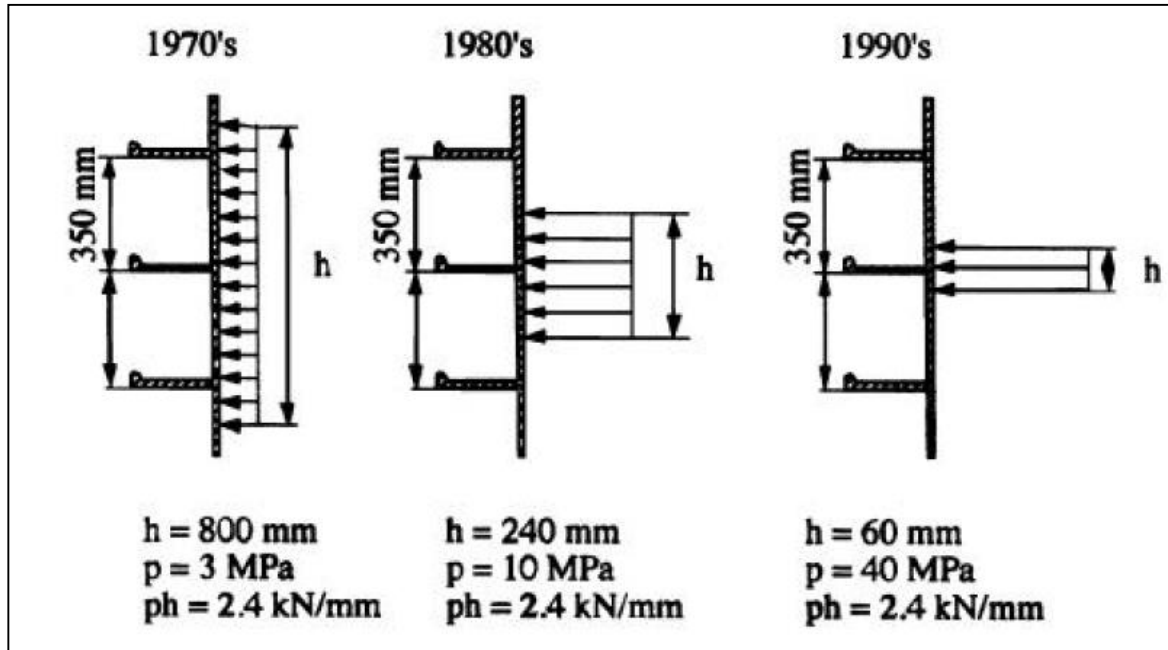


Area of Operation

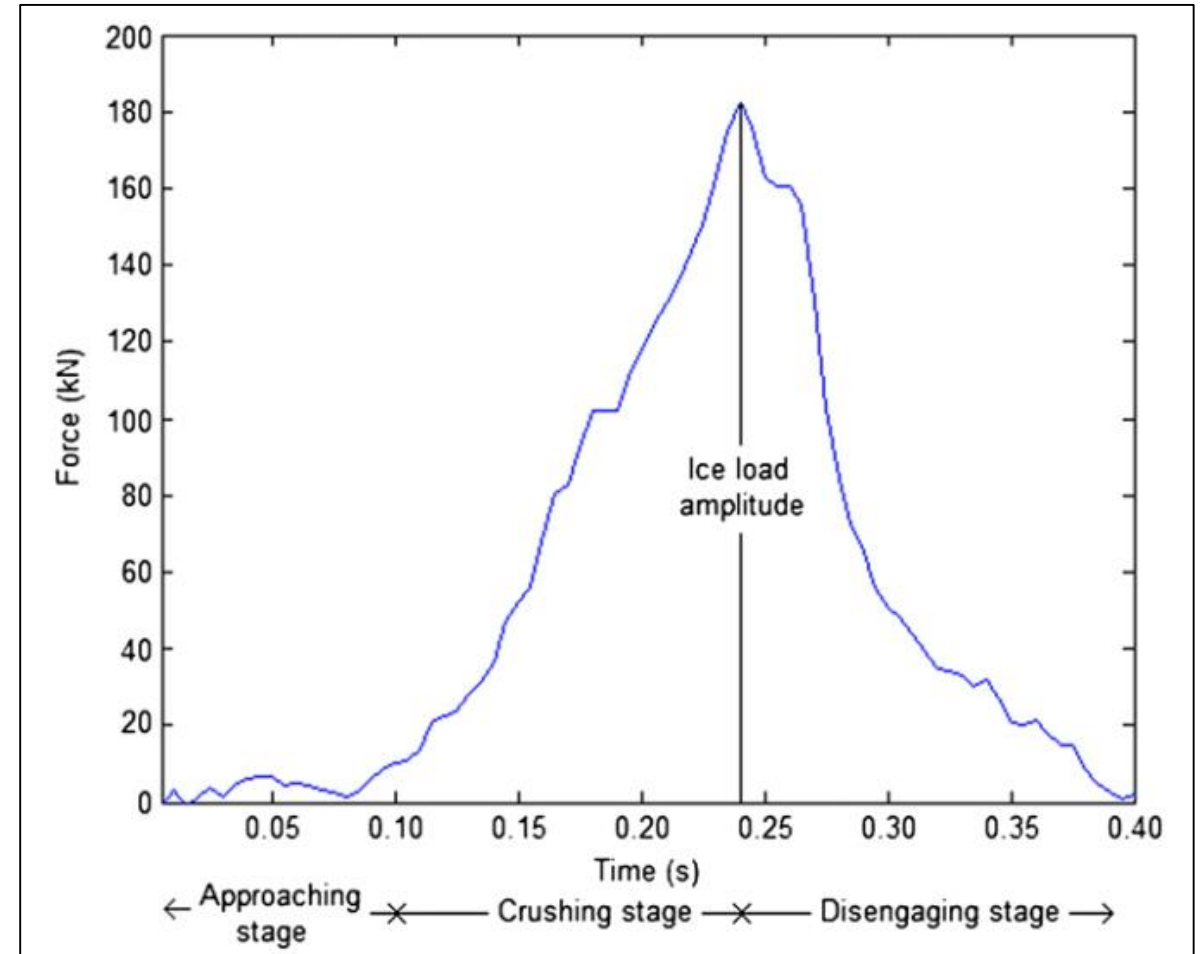


Ship-Ice Interaction

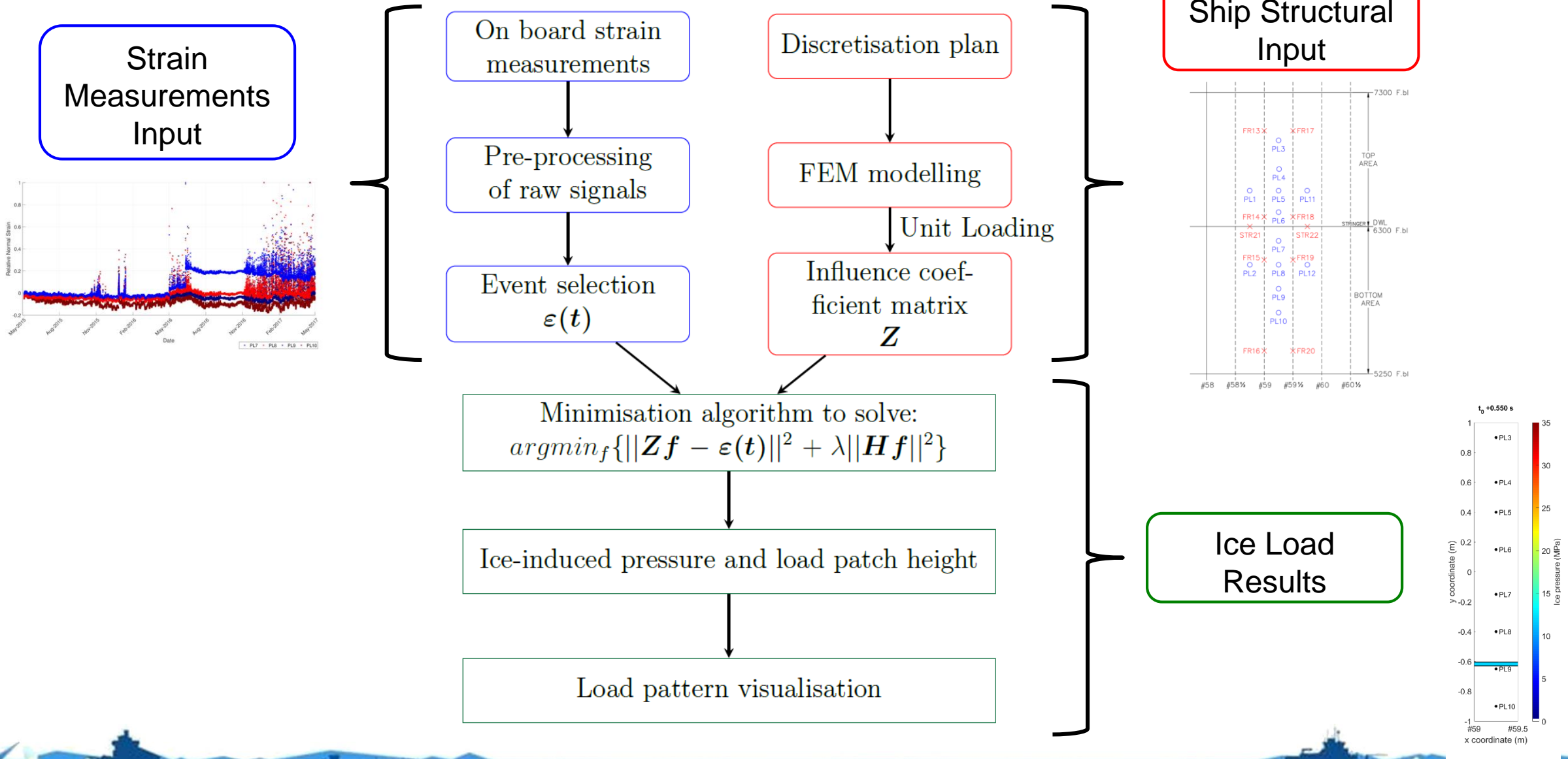
Development of ice load heights [1]



Ice impact stages [2]

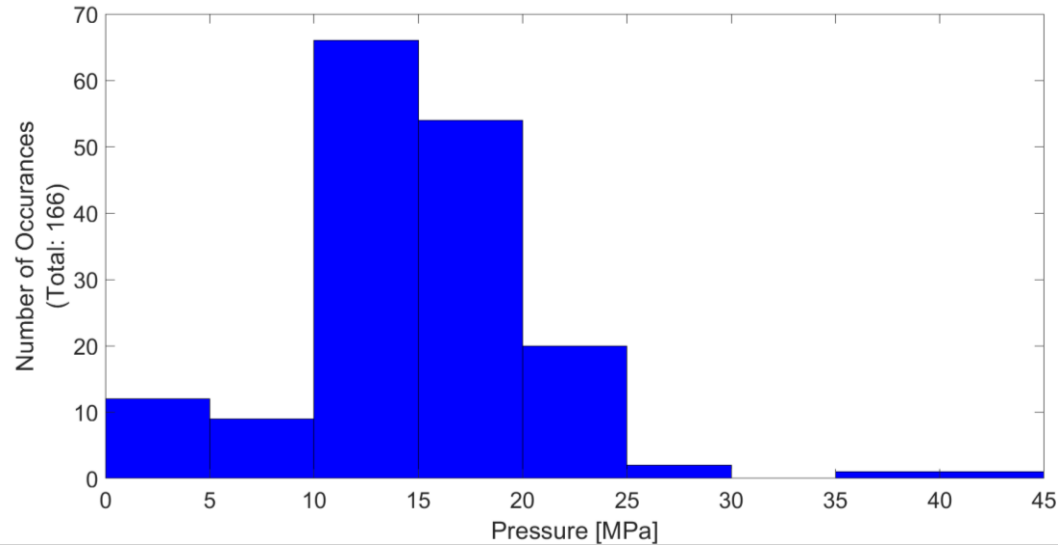


Inverse Method

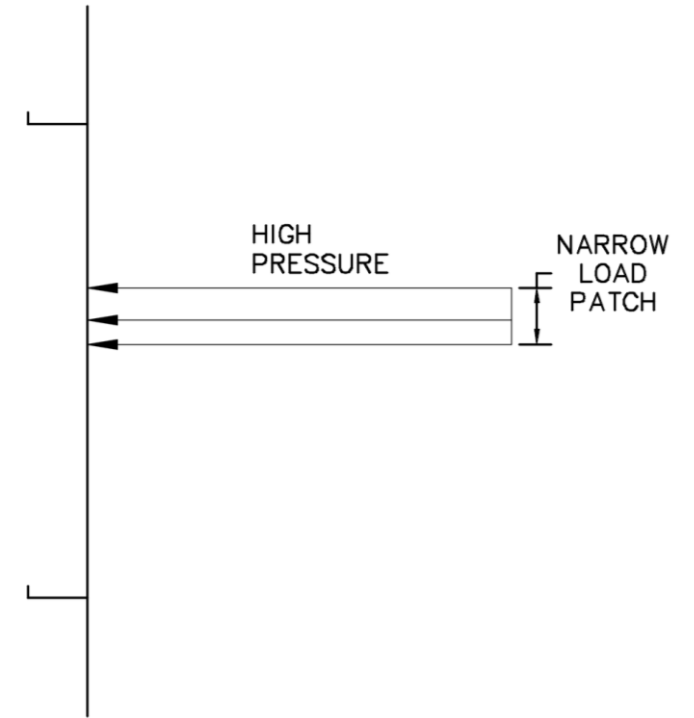
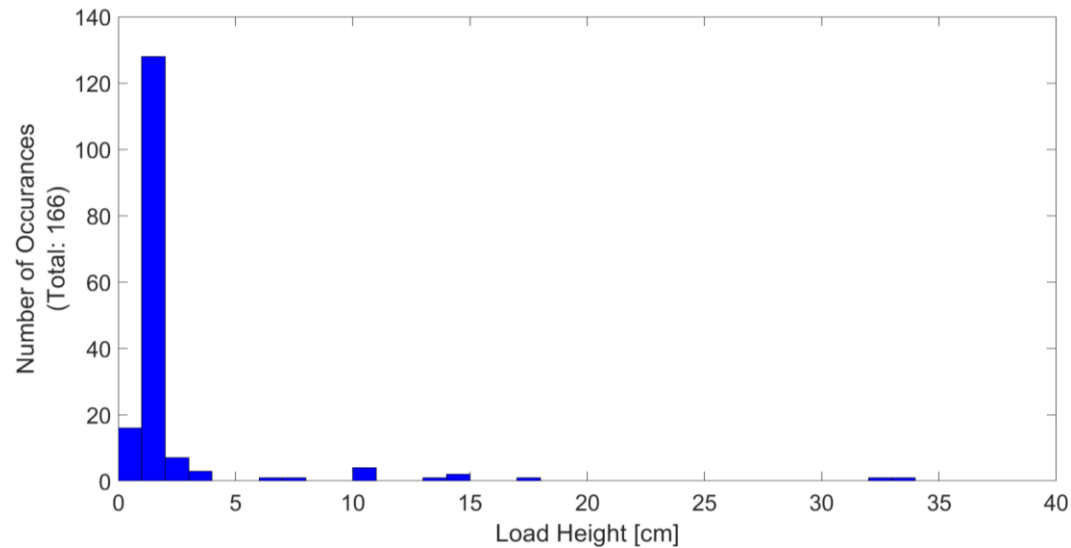


General Analysis

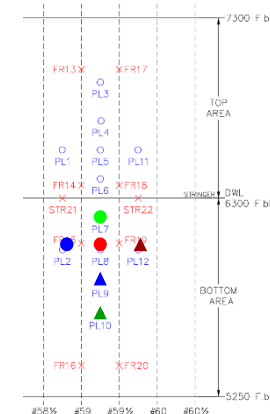
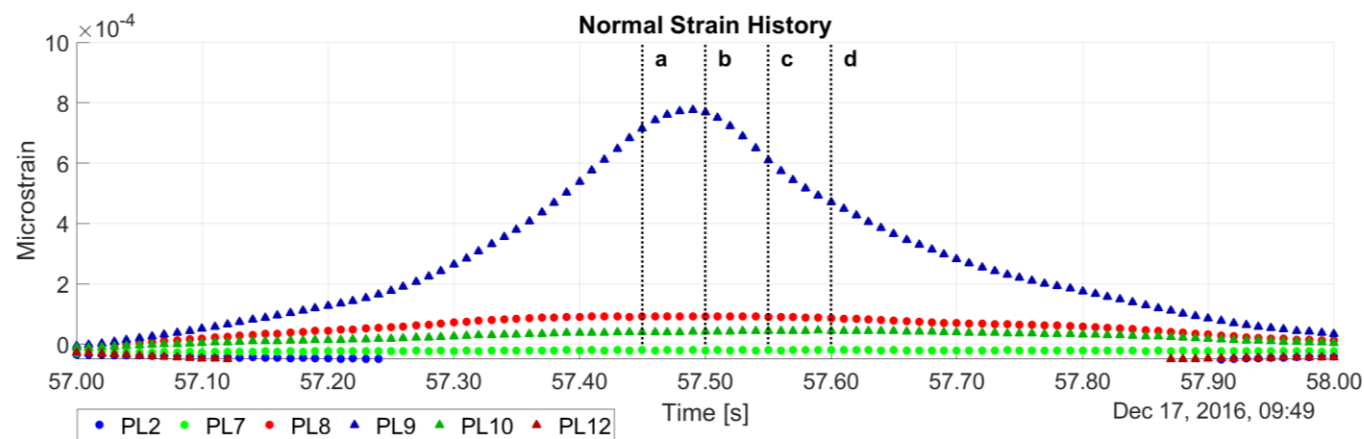
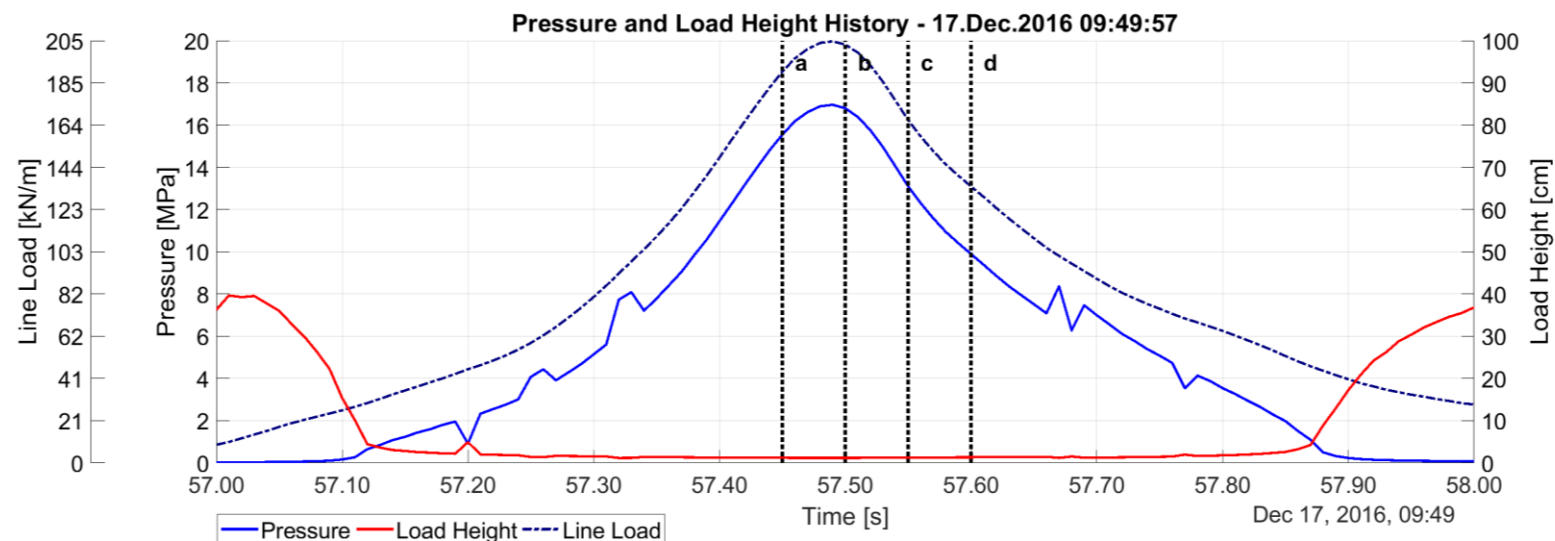
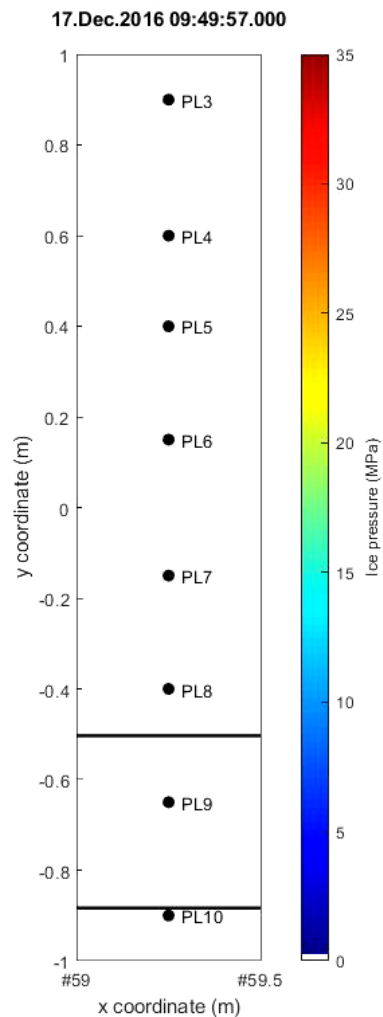
Maximum
Pressure at
Impact



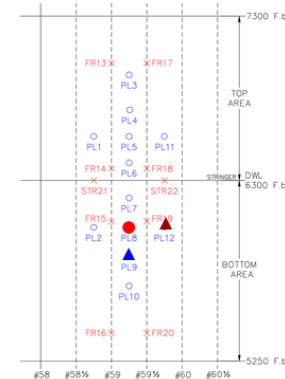
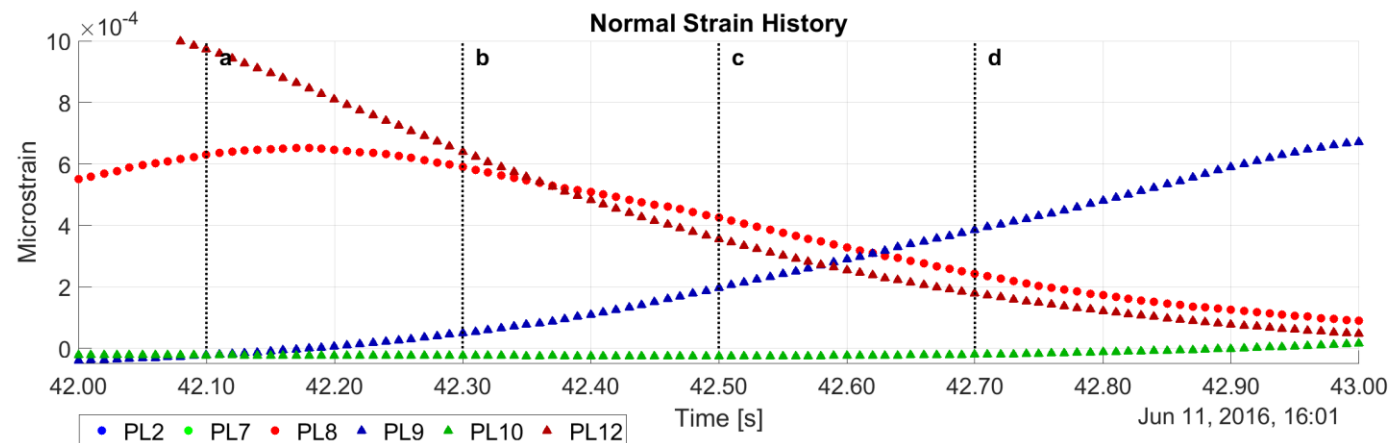
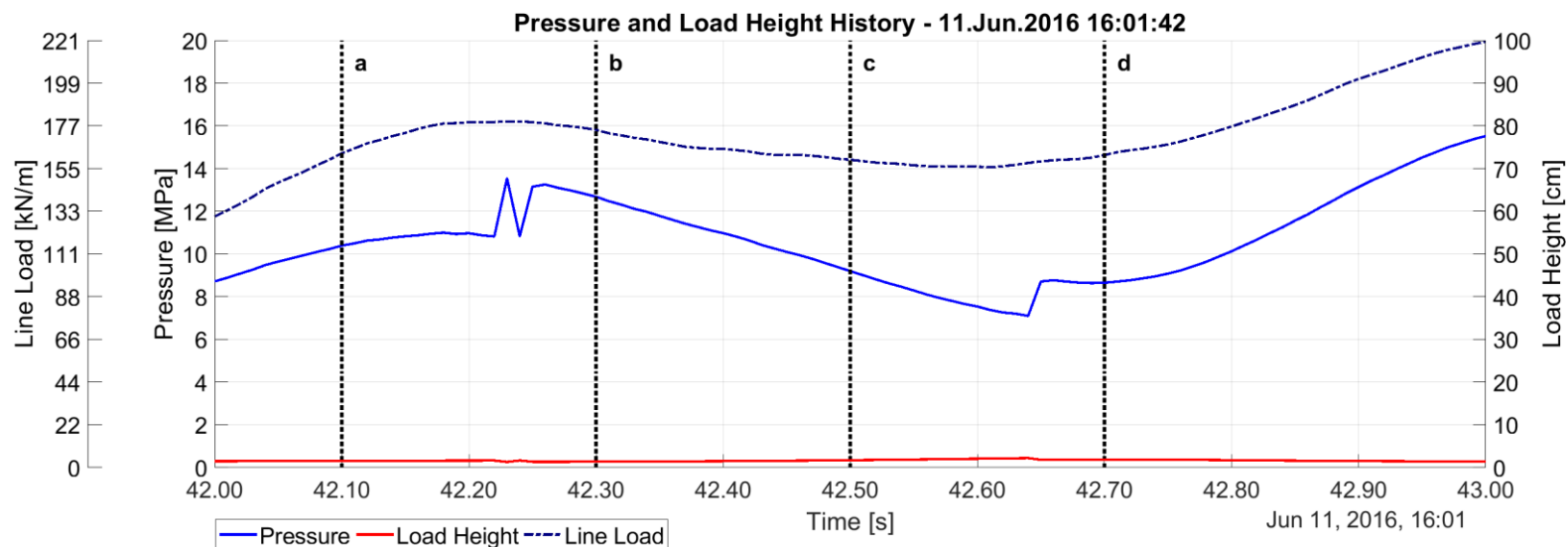
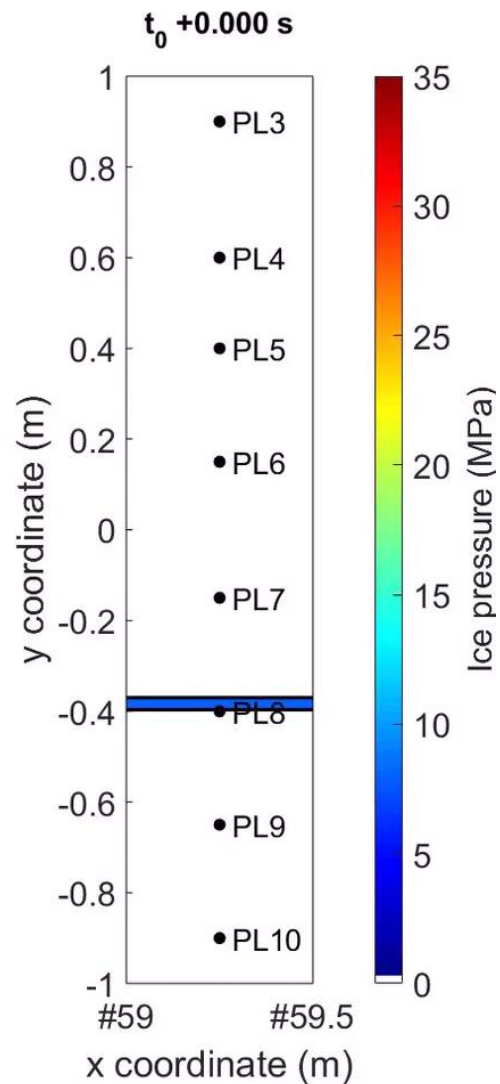
Load Height
at Impact



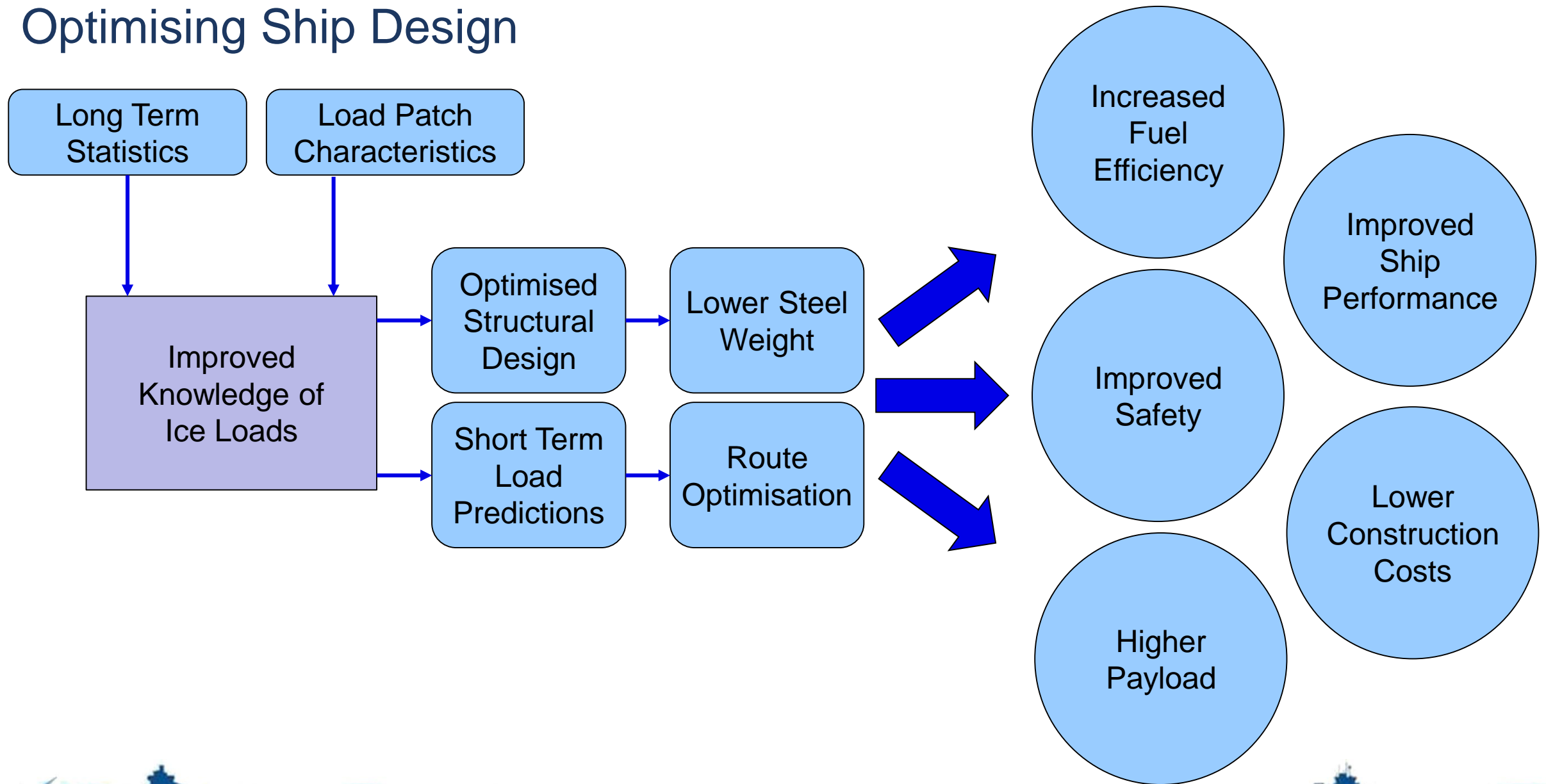
Impact Event – 17 December 2016



Impact Event – 11 June 2016

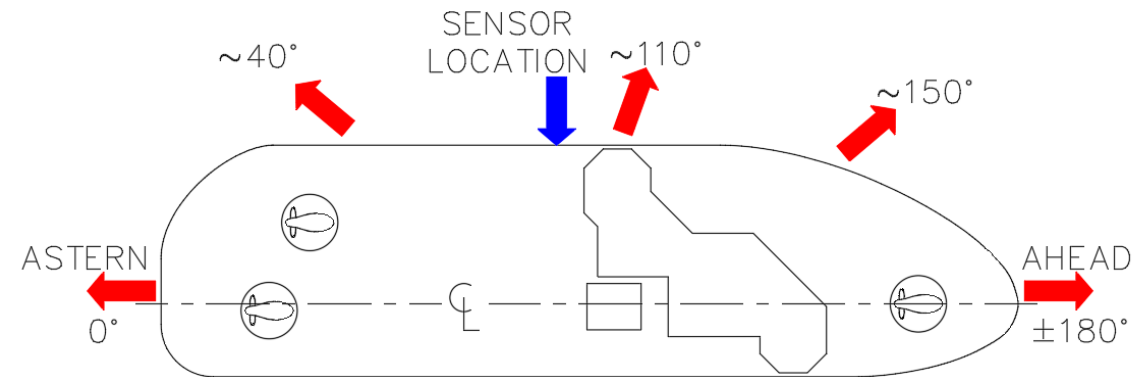


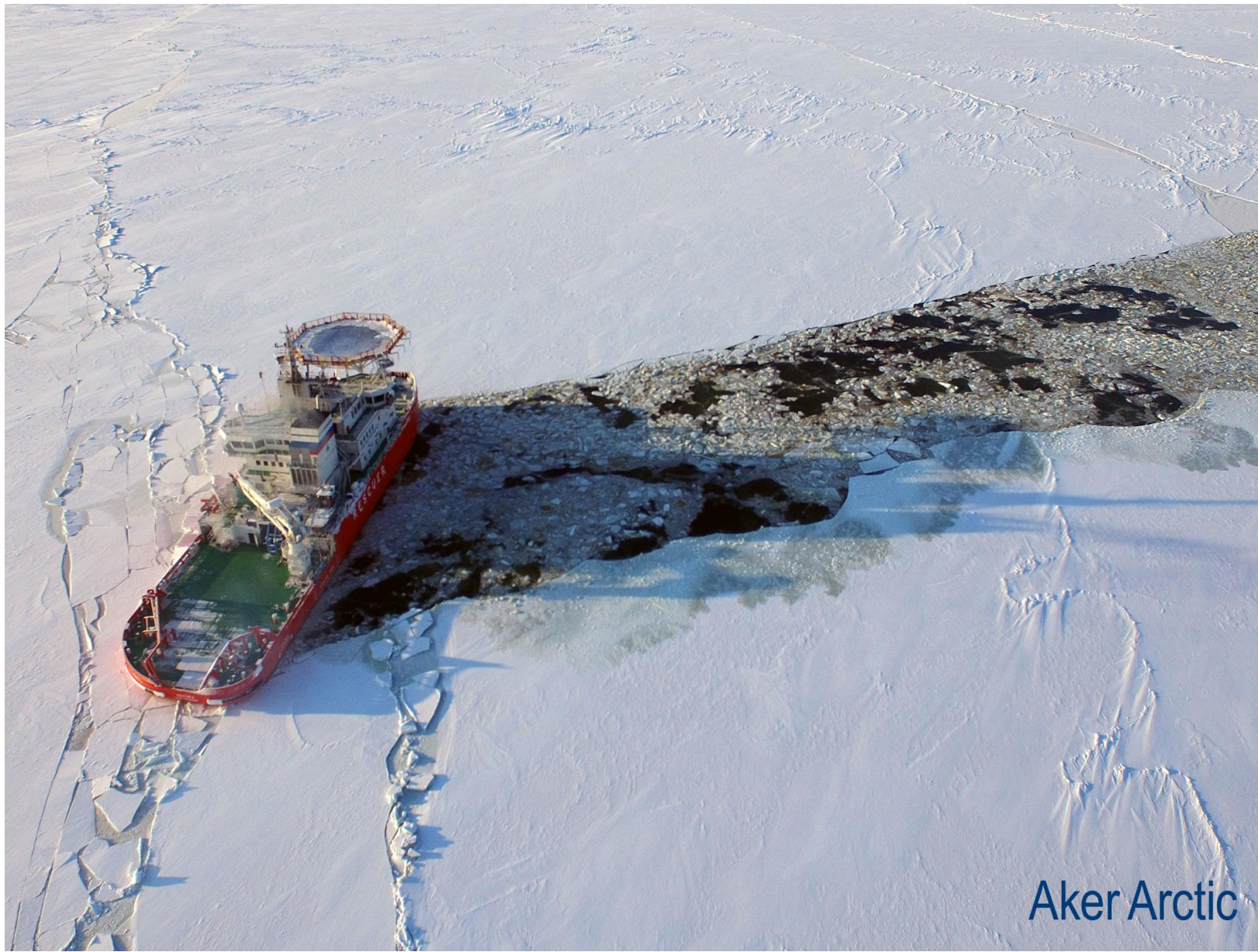
Optimising Ship Design



Conclusion

- Measurements are still on-going on Baltika
- Full-scale data is crucial to improve understanding of ship-ice interactions
- Future research ideas:
 - Structural implications of more concentrated ice loads on dimensioning practices
 - Statistical analysis of the 4-years of continuous measurements
 - Influence of angle of attack on pressure magnitude





Thank
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References

- [1] P. Kujala, “*Ice Strengthening Rules*” [Lecture Notes], Aalto University, 2017.
- [2] M. Kotilainen, J. Vanhatalo, M. Suominen, and P. Kujala, “Predicting Ice-induced Load Amplitudes on Ship Bow Conditional on Ice Thickness and Ship Speed in the Baltic Sea,” *Cold Regions Science and Technology*, vol. 135, pp. 116–126, 2017. [Online].

