

Best Practice in Efficiency Data

RINACube OPTIMUM



Fuel



Is your fleet really efficient?



- A ship might sail for months with a **rope accidentally tied around the propeller**, heavily impacting on the fuel consumption, **without the crew being aware**. Similarly, **hull and propeller fouling**, or the main engine needing cleaning and maintenance, can heavily **compromise** the ships' **energy performance**.
- **Interventions** to fix these and other comparable issues **can be costly** and need to be **accurately planned** taking into account the **ships' schedules** and **cost-benefits** of any initiative.

Vessel Monitoring to Enhance Ship Performance



DATA
COLLECTOR

EFFICIENCY
TARGETS

ANALYTICS &
MONITORING

- Navigation, Automation, Sensors
- Manual Input
- External Data

- Realtime Monitoring
- Traditional Methods
- Machine Learning

- Drydock Planning
- Intervention Analysis

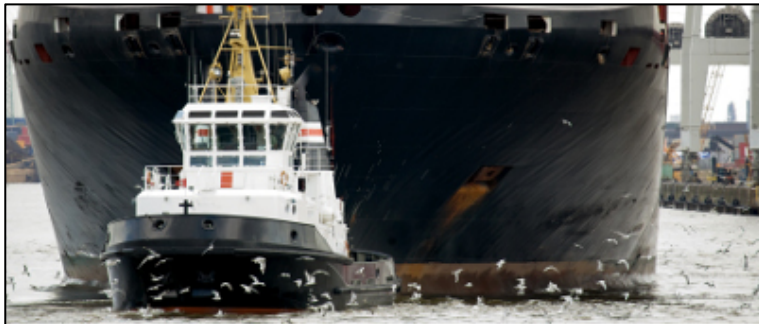


Propulsive Power Targets Computation



BIG DATA USAGE

Propulsion Targets Computation



SHIP4

22° 15' 33.36" N 110° 0' 38.76" W

Sun, 12 Mar 2017 09:55:00 GMT

Route Planning no

Route Explorer

Description	Value
Speed over ground	19.055 kn
Course over ground	0 °
Propulsive Power	23924 kW (-10% target)
Shaft RPM	n/a
ME Consumption	4.469 kg/h (-17% target)
ME SFOC	187 g/kWh (-7% target)



TARGET:

Propulsive Power



SHIP VARIABLES:

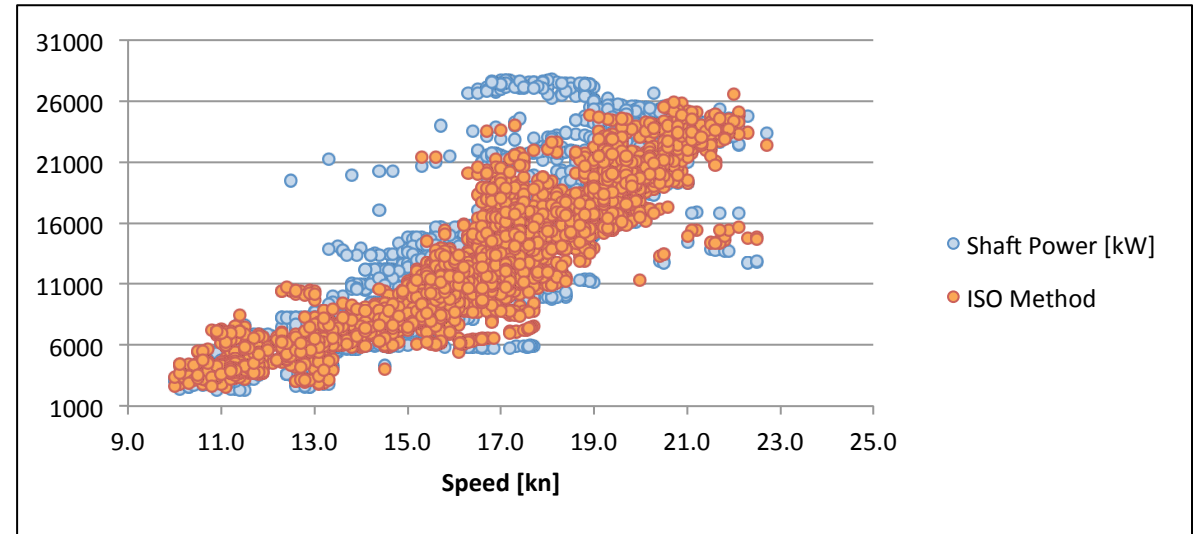
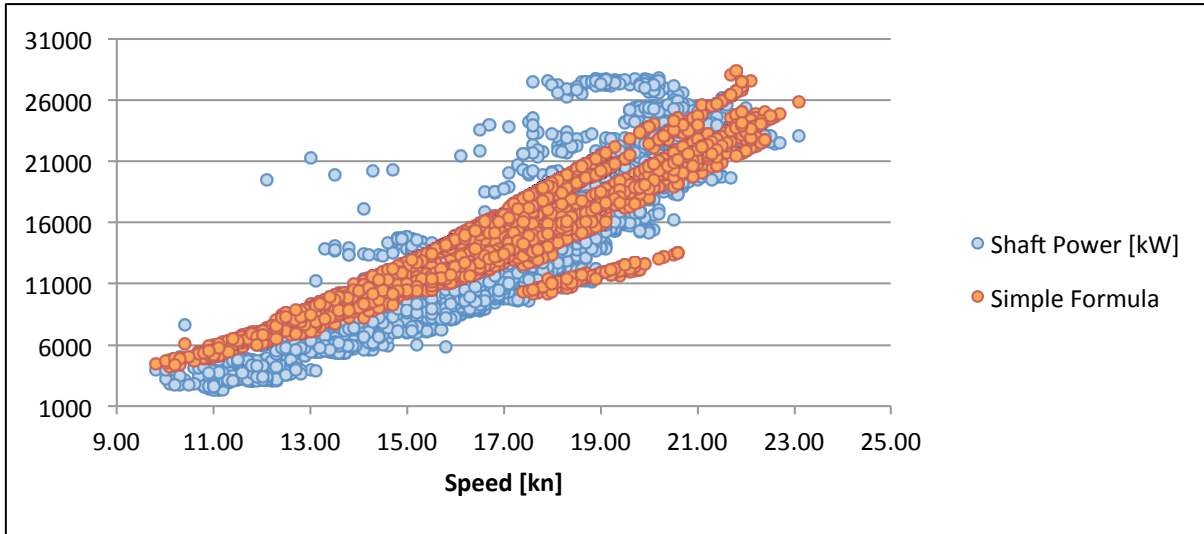
- Speed Trough Water
- Loading Condition (Displacement/Mid Draft)
- Trim



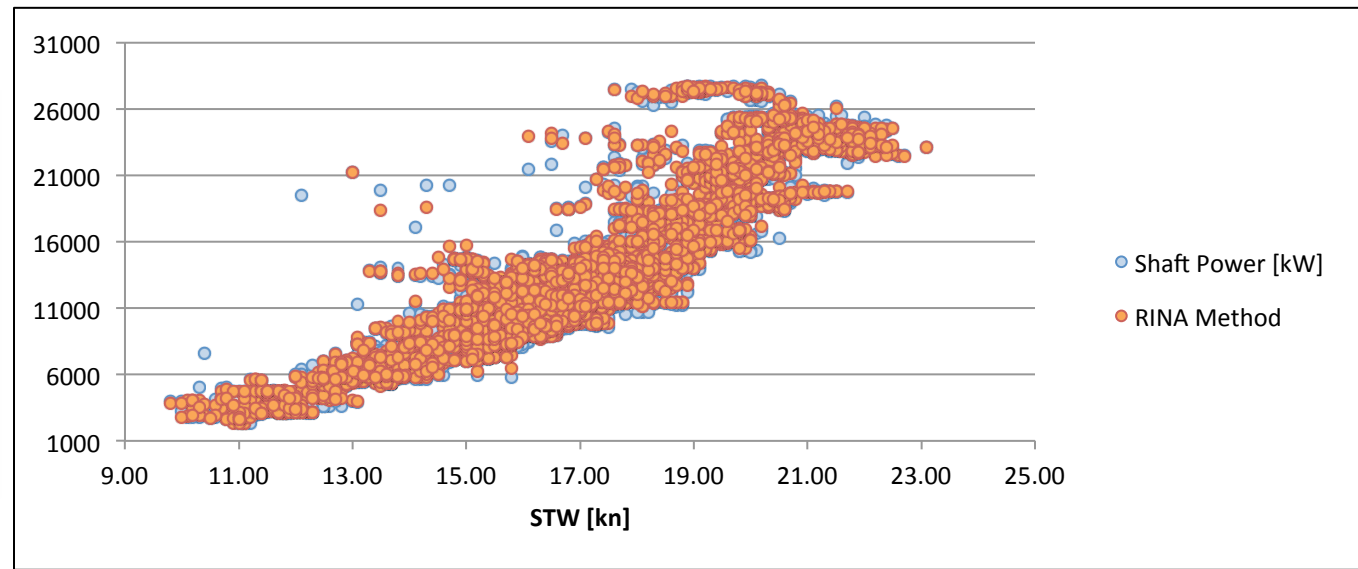
ENVIRONMENTAL VARIABLES:

- Sea State
- Wind State
- Sea and Wind Relative Directions
- Water depth
- Water density

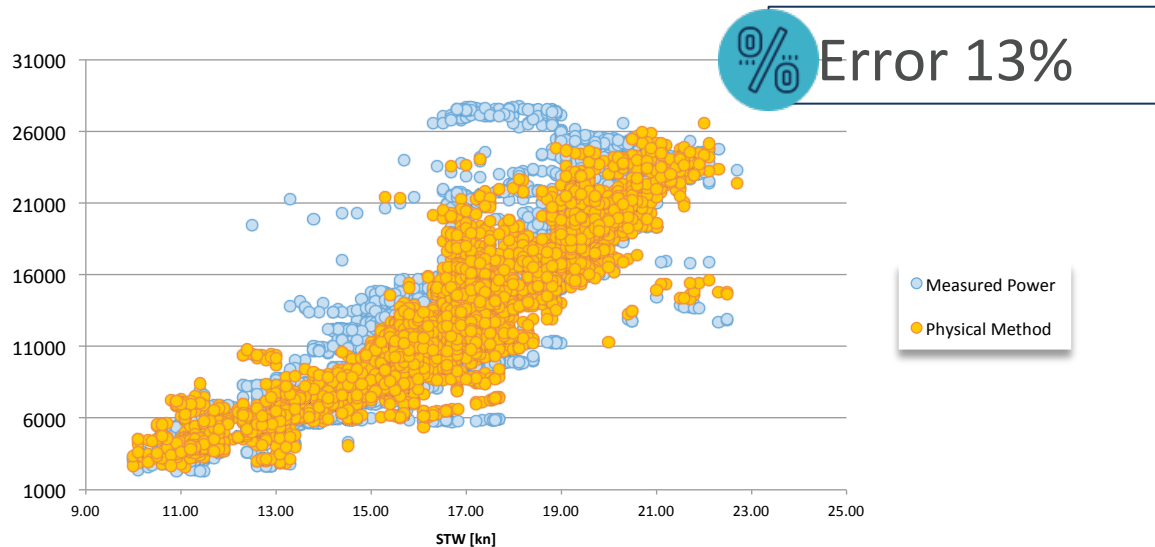
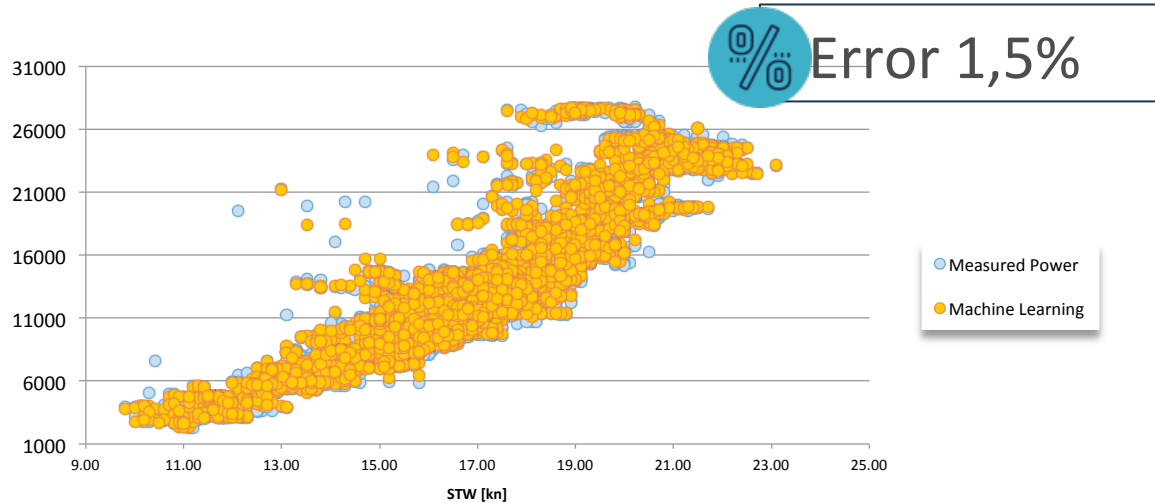
Comparing different methodologies of targets computation



- Three Methods:**
- “Simple” Multivariable Regression
 - Method based on ITTC
 - Machine Learning



Propulsive Power Prediction



MACHINE LEARNING:

- Based on recorded data (at least 3 months, 5 minutes detail)
- Importance of dataset completeness
- Data previously analyzed and filtered

PHYSICAL METHOD:

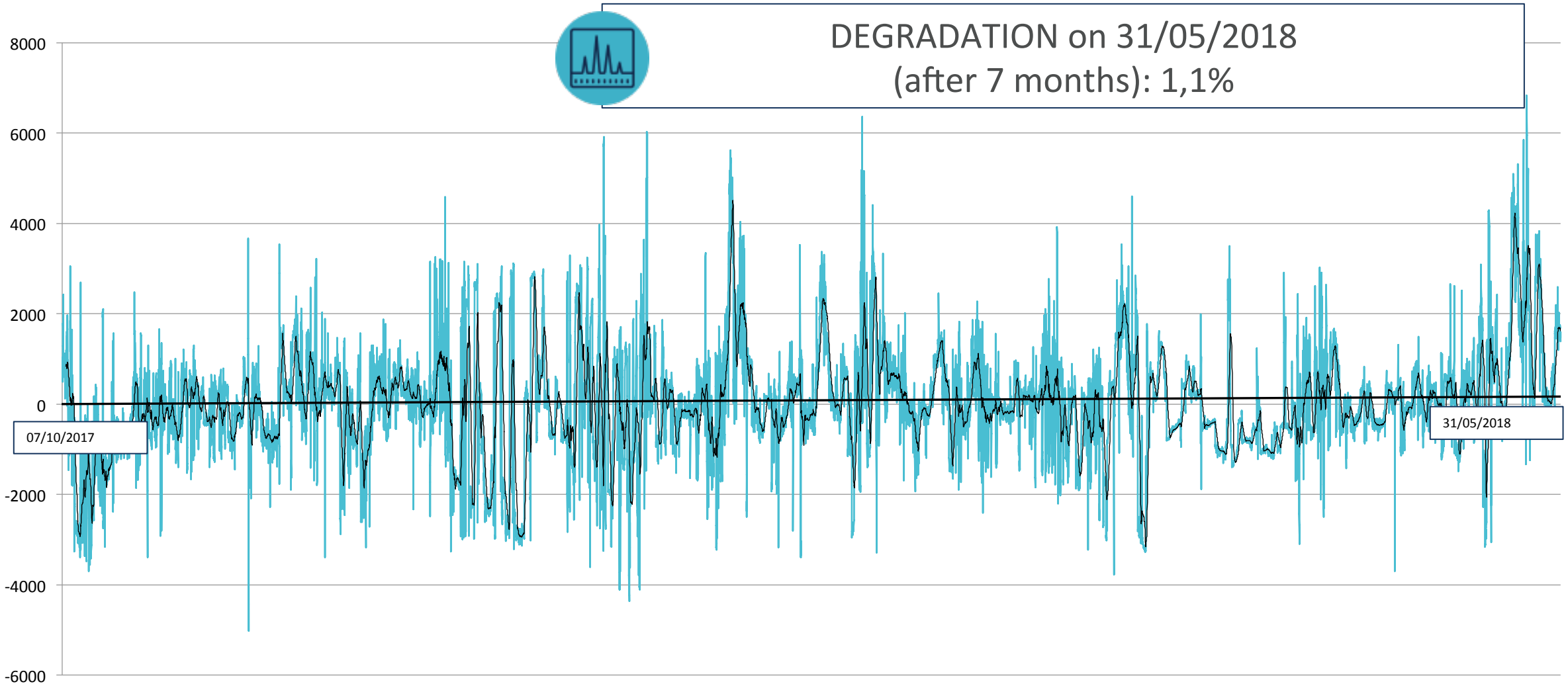
- Based on Ship Characteristics (Tank Tests, Open Water Propeller Diagram, ...)
- Model as by ISO 15016 / ITTC

Degradation and Intervention Analysis



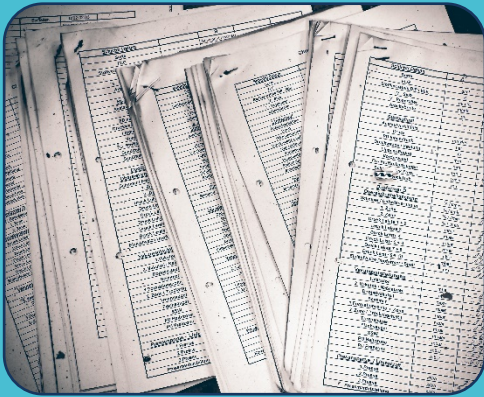
DEGRADATION ANALYSIS

Target & Measured Power



INTERVENTION ANALYSIS

Manual Input & Automatic Data Acquisition



MANUAL INPUT

- Data retrieved once a day
- Prone to human error

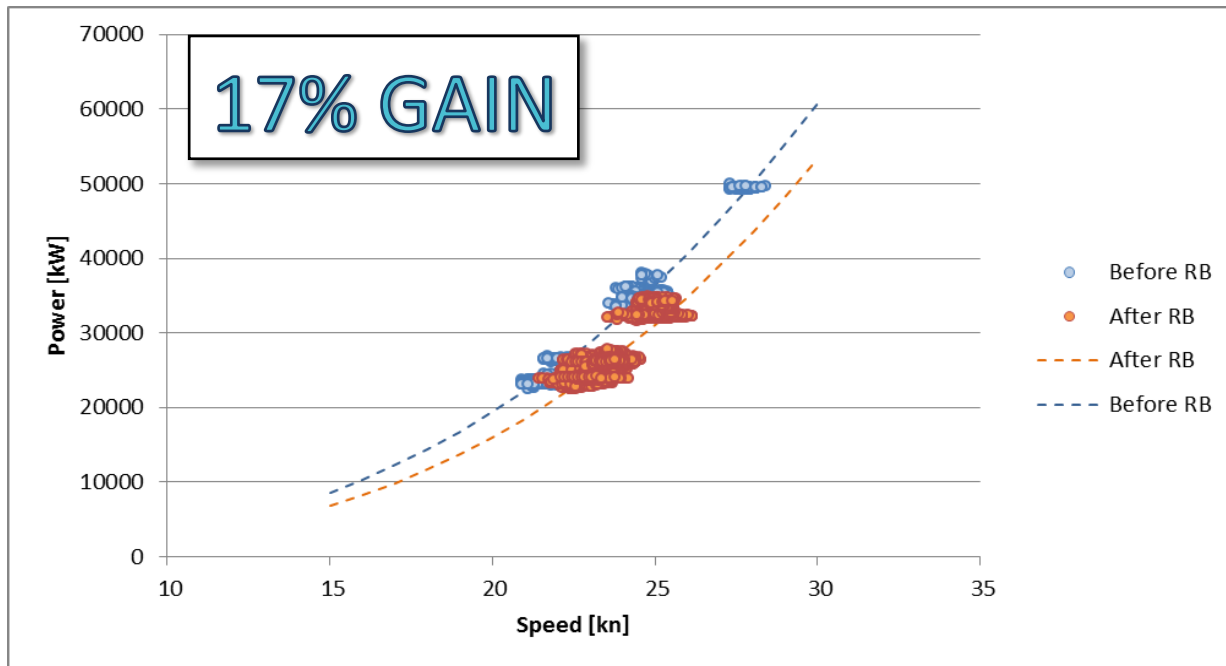


AUTOMATIC DATA ACQUISITION

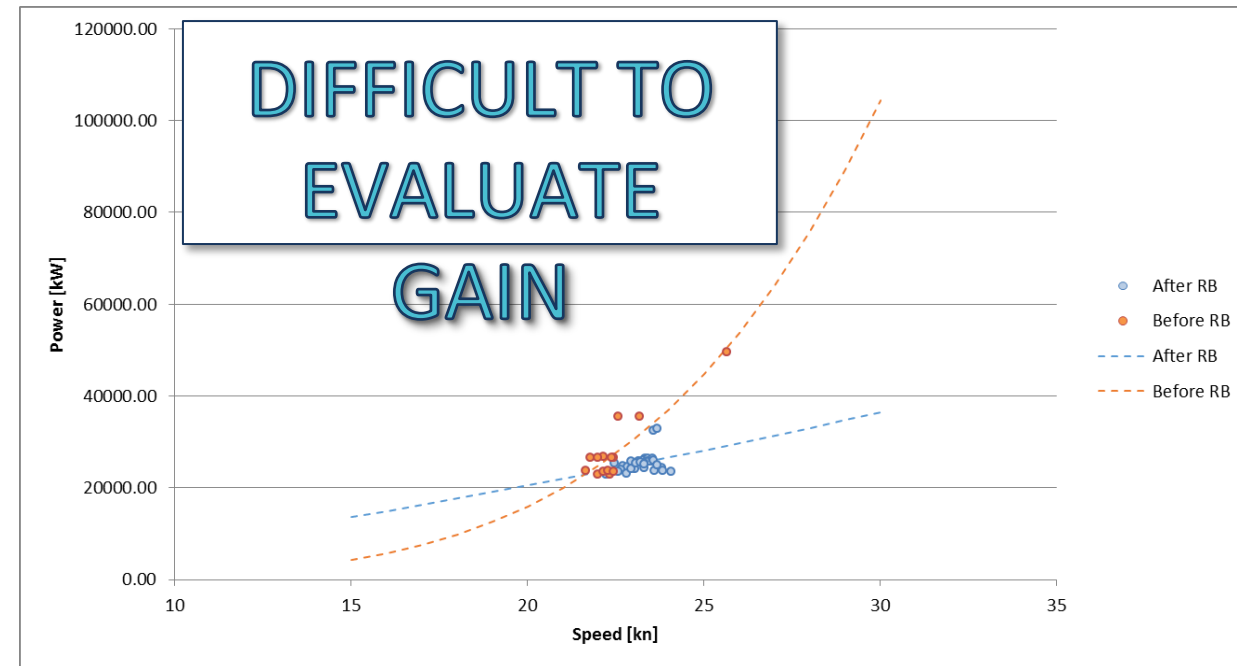
- Data retrieved every 5 minutes
- No / limited human intervention

INTERVENTION ANALYSIS

Manual Input & Automatic Data Acquisition



ADA result



MI result



ANALYSIS CONDITIONS:

Before = Three months before reblading

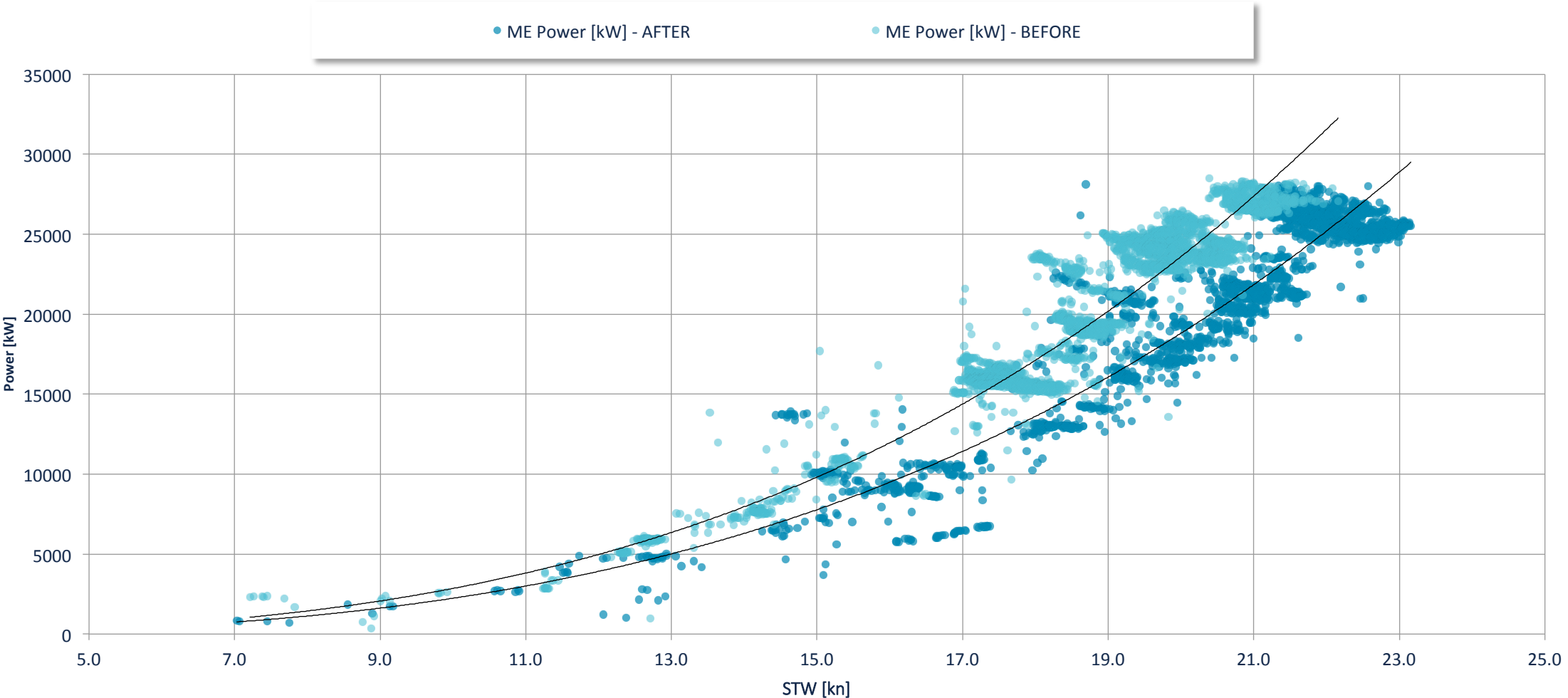
After = Three months after reblading

BF \leq 4

24500-2% \leq Displacement \leq 24500+2%

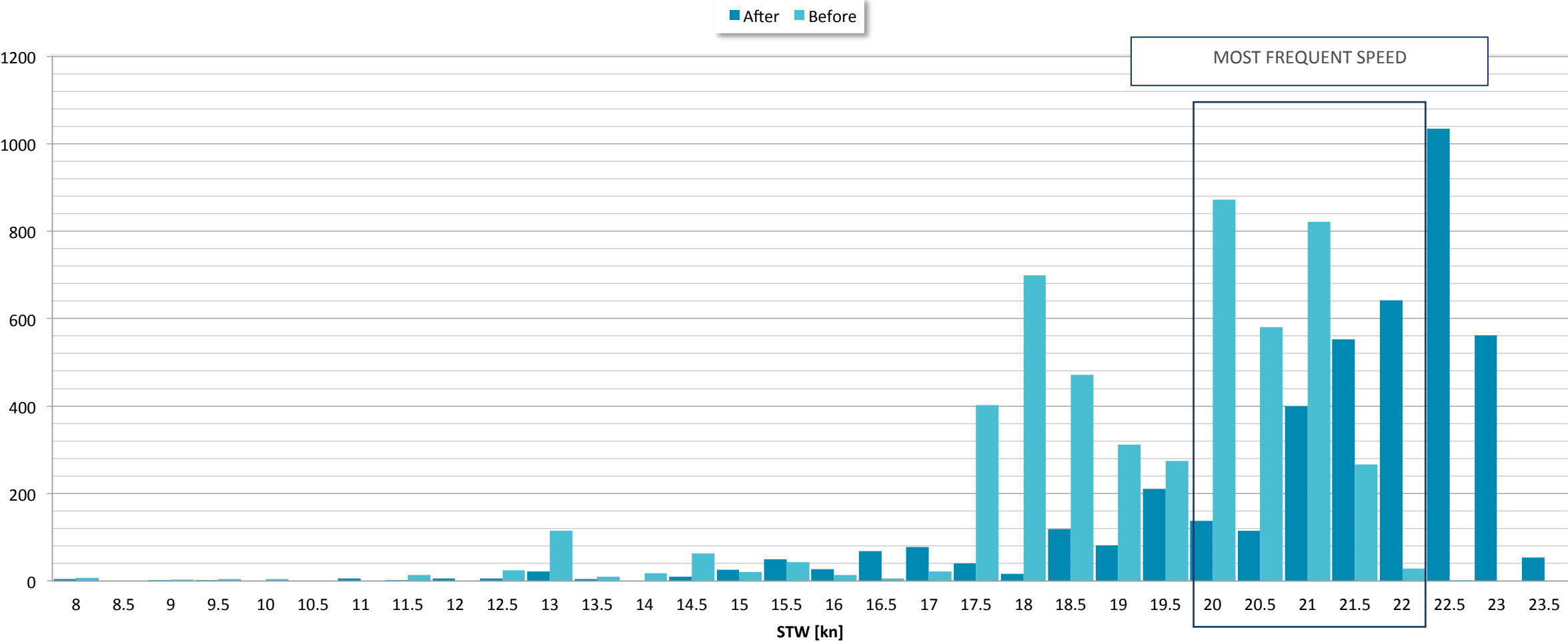
REBLADING PAYBACK

Before & After - Comparison at different speed



DRY DOCK ANALYSIS

Before & After - Speed Profile



DRY DOCK ANALYSIS

Before & After - Payback



HP: Dry Dock Cost 1'000'000\$



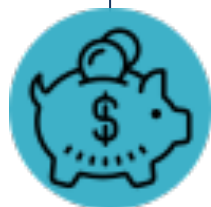
FUEL CONSUMPTION:
127 t/Day @ 21 kn



FUEL SAVING:
25 t/Day @ 21 kn

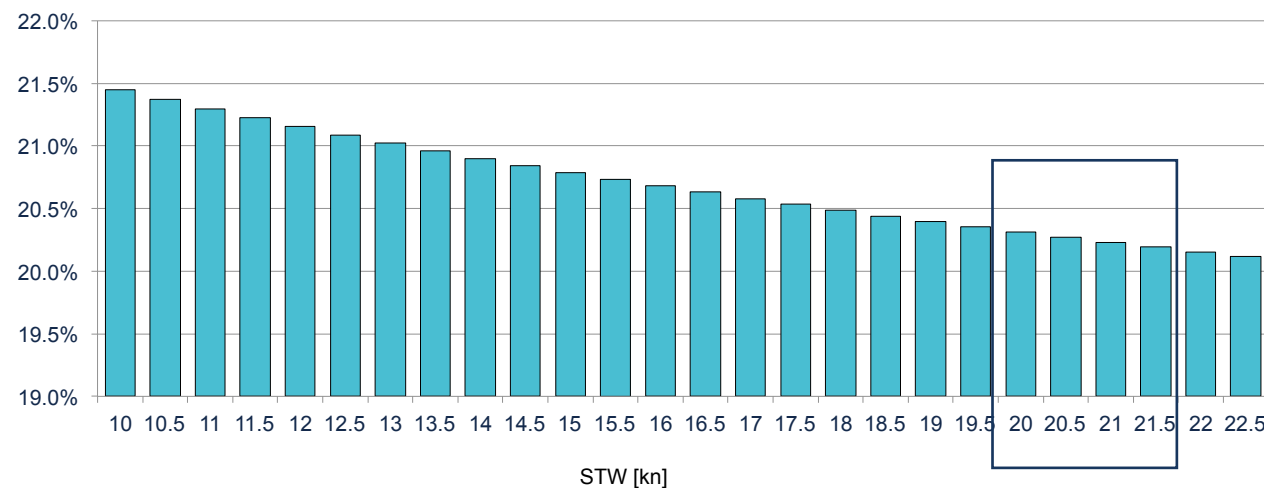
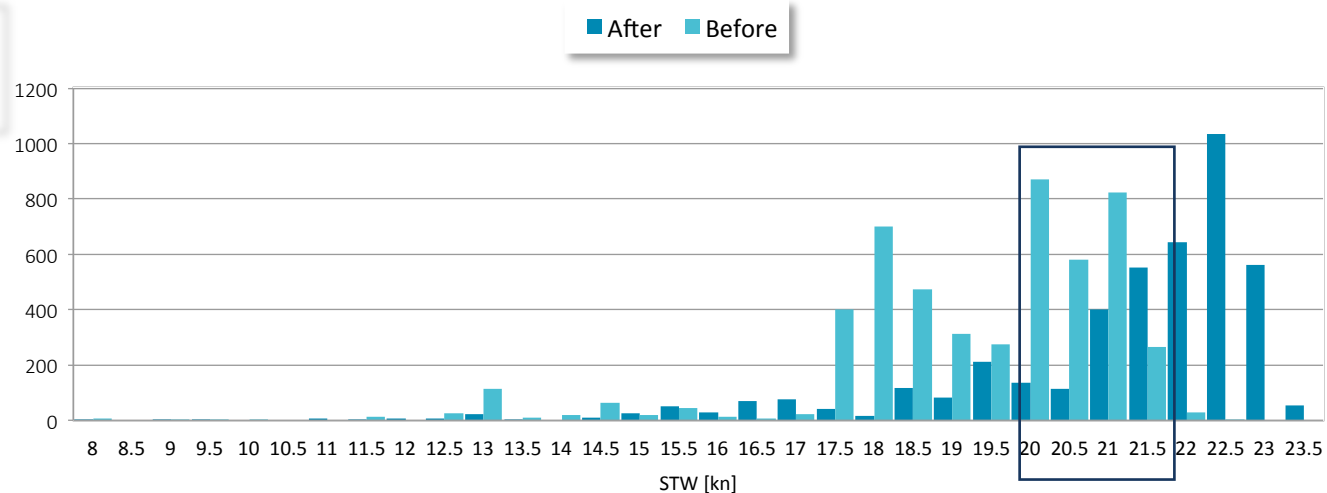


CO₂ SAVING:
78,6 t/Day @ 21 kn



PAYBACK TIME:
90 Days @ 21 kn

(IFO380 price on 31/05/2018: 450 \$/mt)



RINACube - OPTIMUM



SAVINGS? Yes but not only !

2% - Rule editor and alerting;

2% - Trim Optimization;

2% - Route Optimization;

??% - Safety and regulatory compliance;

??% - Data driven technical management;

Thank you for the attention.
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Behind Excellence.

