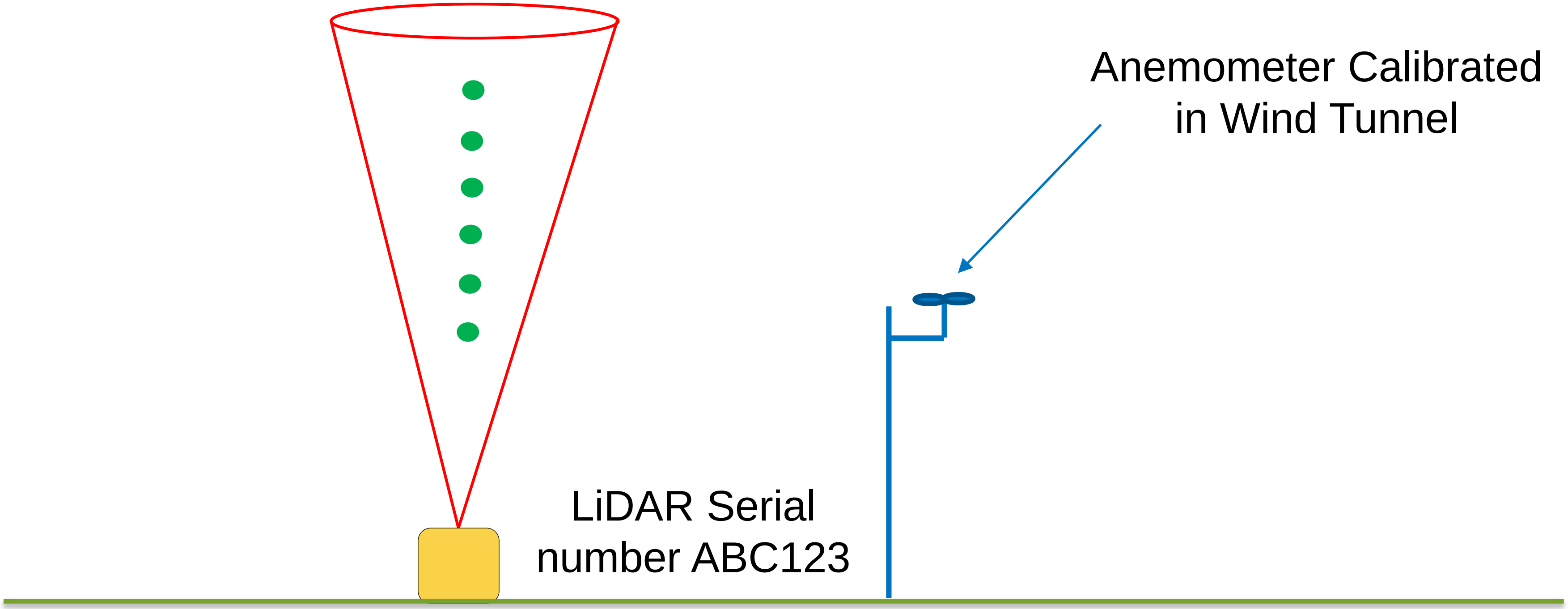
Calibrate to Power

Peter Stuart

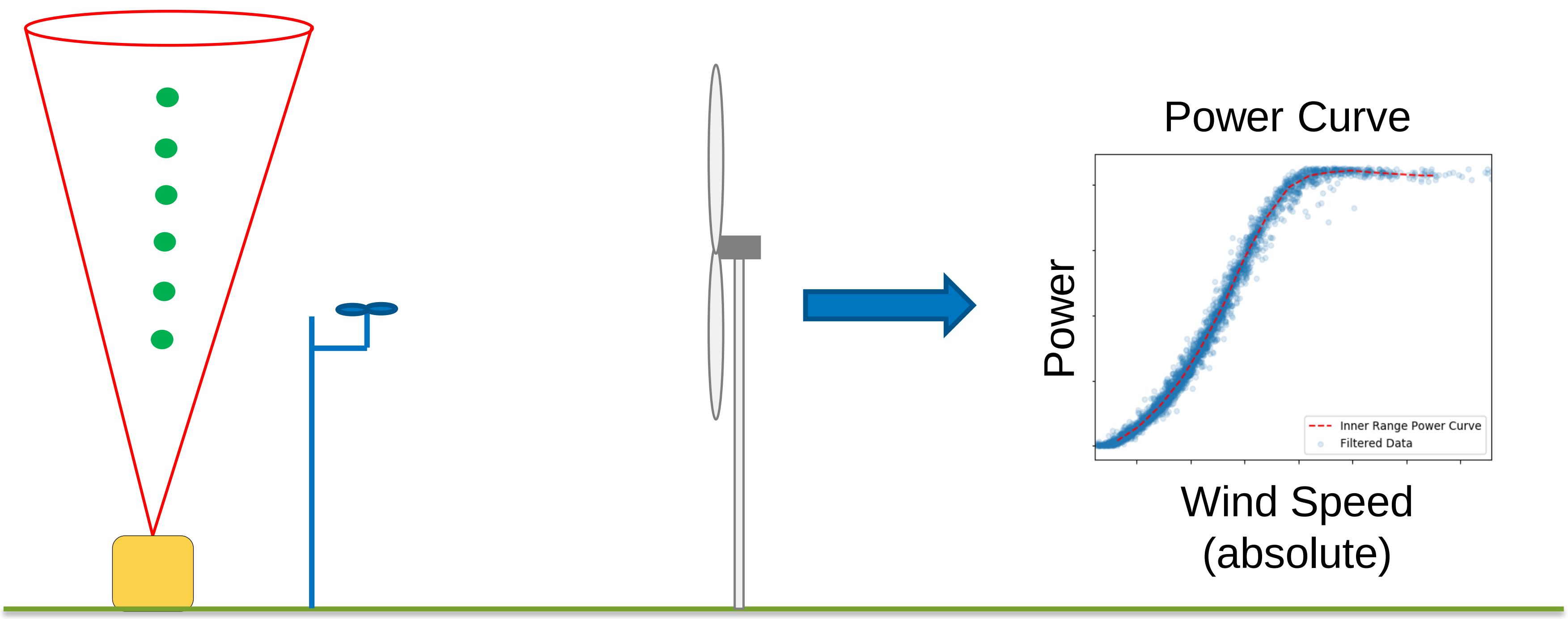
Traditional Resource Assessment Approach

Calibrate (validate) LiDAR to Met Mast Anemometer.

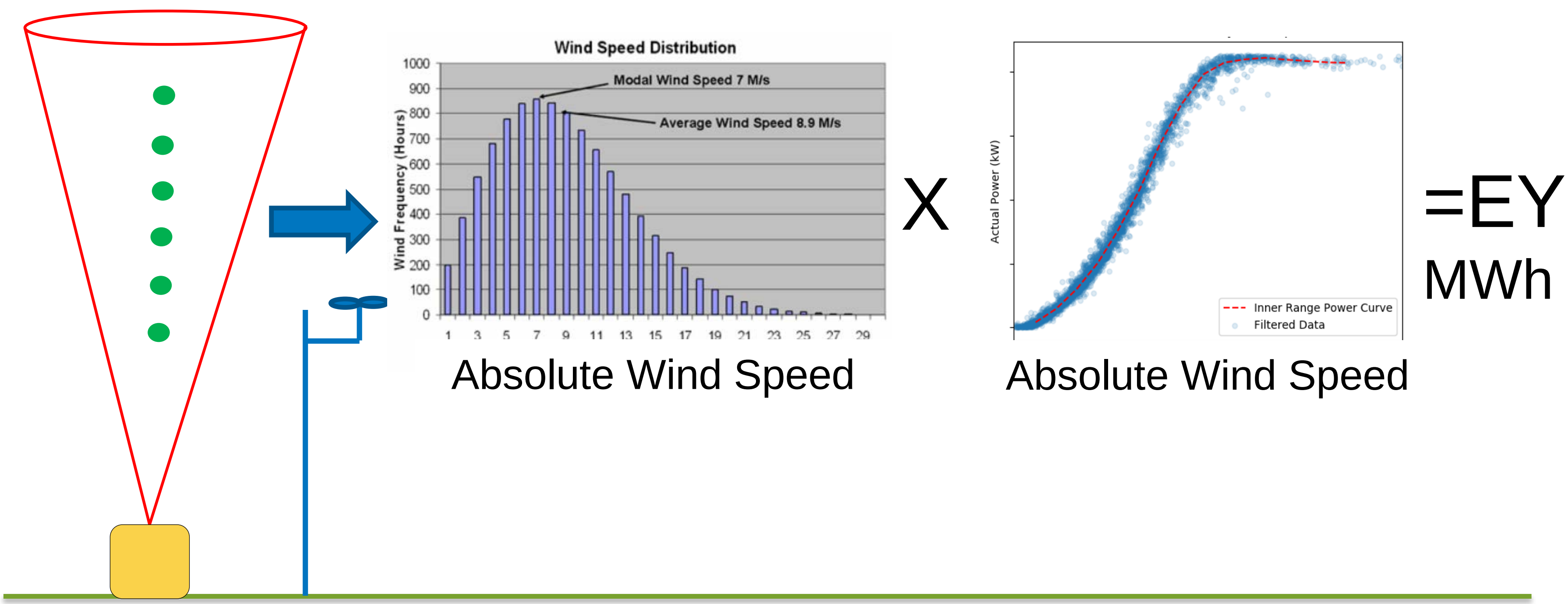


Traditional Approach: Step 2

Measure Power Curve on test site



Measurement on target site (pre-construction)

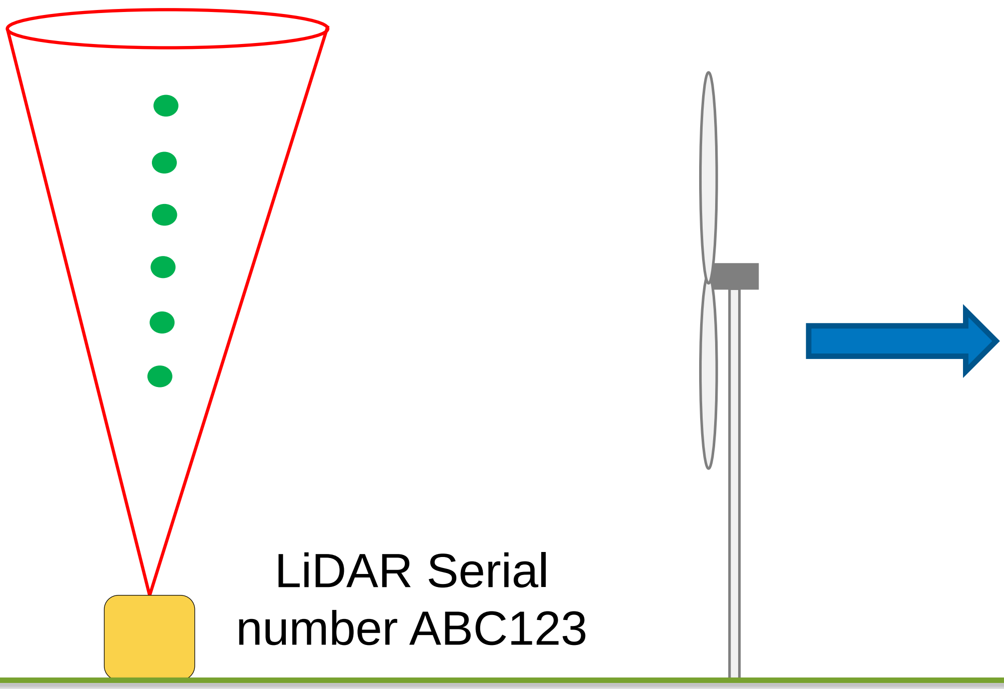


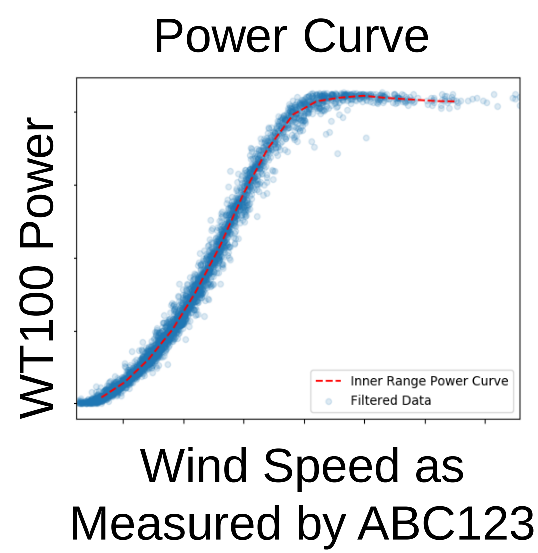
Calibrate to Power Resource Assessment

Calibrate to Power: LiDAR Specific Power Curve Measurement

Measurement on Site A (Training):

Existing Operational Turbine Model WT100





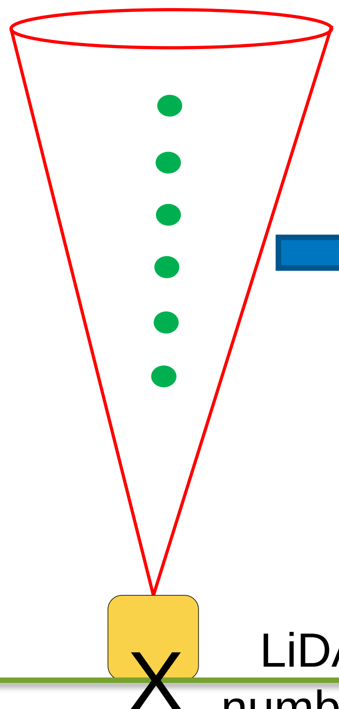
Transport Same Physical LiDAR (Serial ABC123)

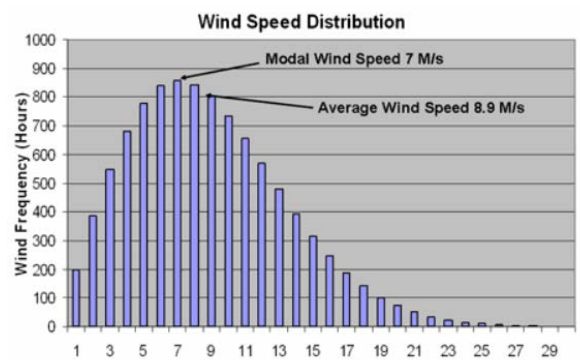
Move LiDAR (same physical device) to site B.

Measurement on Site B (Application):

Pre-construction Site for Model WT100

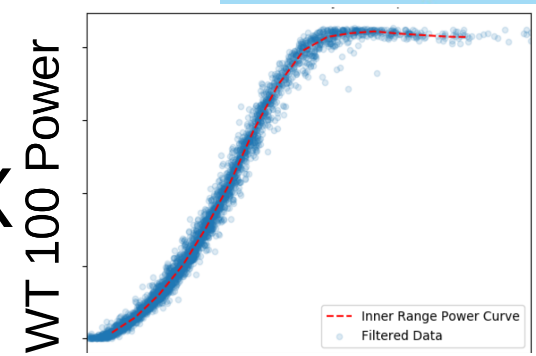
X = planned turbine location





Wind Speed
Measured by ABC123
(on Site B)

X



=EY
MWh

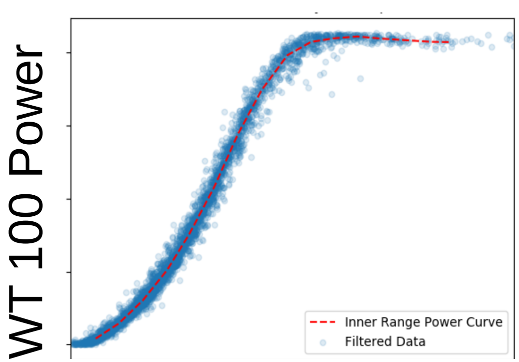
Wind Speed
Measured by ABC123
(on Site A)

LiDAR Serial
number ABC123

Machine Learning

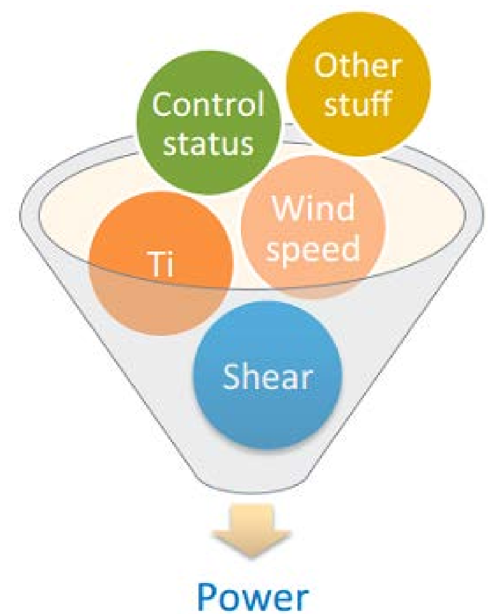
- This approach would like itself to advance statistical modelling approaches e.g. **machine learning**.
- This would mean ‘outer range’ considerations would be inherently addressed (as long as training data sufficient).

Traditional Power Cure

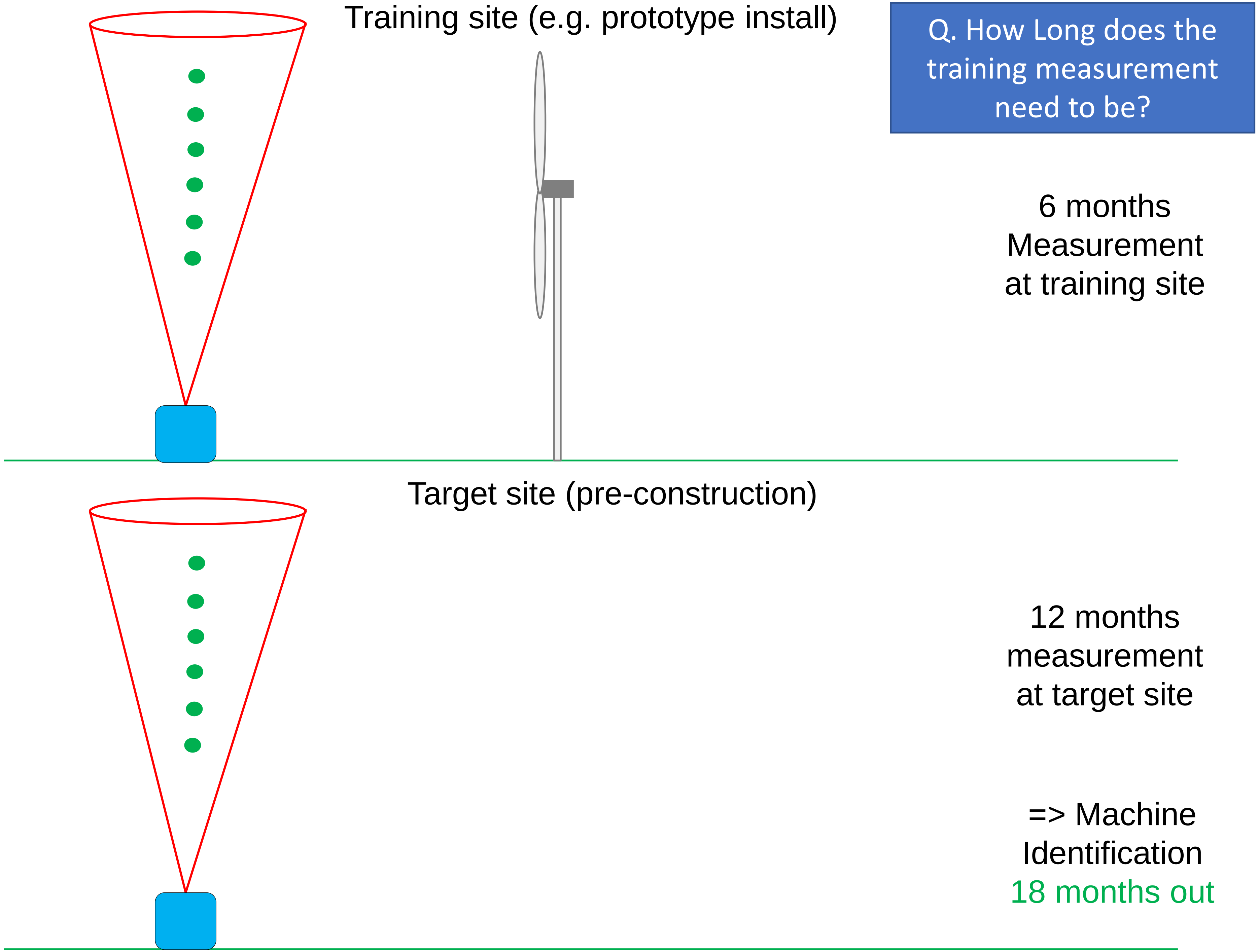


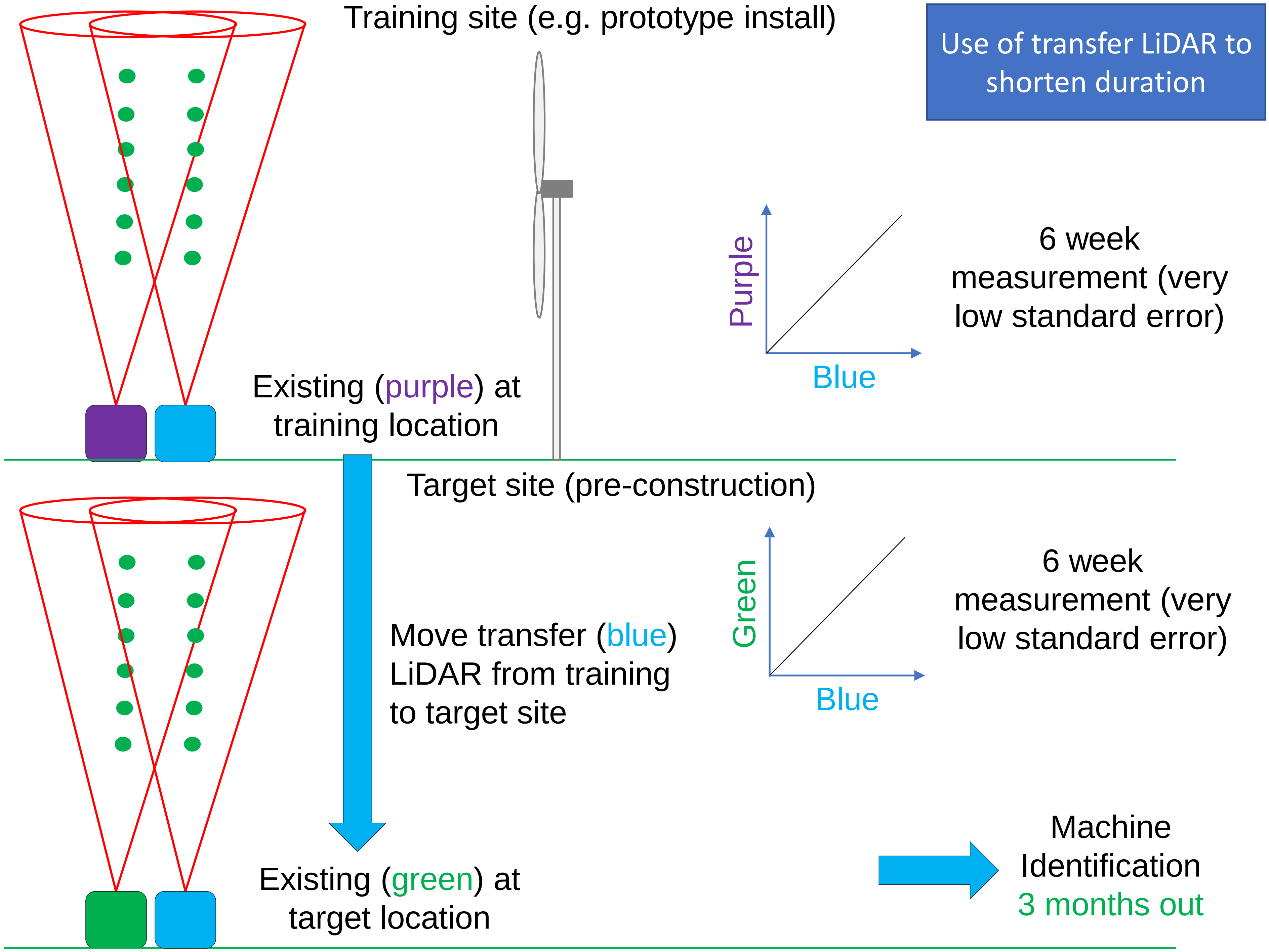
Wind Speed
Power Curve Measured
by ABC123
(from Site A)

Machine Learning



A Clifton http://www.nrel.gov/docs/fy13osti/58314.pdf


Training site (e.g. prototype install)
Q. How Long does the training measurement need to be?
6 months Measurement at training site
Target site (pre-construction)
12 months measurement at target site
=> Machine Identification
18 months out


Training site (e.g. prototype install)
Use of transfer LiDAR to shorten duration
Purple
Blue
6 week measurement (very low standard error)
Existing (purple) at training location
Target site (pre-construction)
Green
Blue
6 week measurement (very low standard error)
Move transfer (blue) LiDAR from training to target site
Existing (green) at target location
Machine Identification
3 months out

Benefits & Next Steps

Benefits

- Site step major measurement uncertainty component (no requirement to reference LiDAR measurement to Anemometer).
- Provide highly specific training dataset to advanced statistical methods (specific to turbine model and specific to physical LiDAR).
- Lower overall yield uncertainty, assist project design and inform turbine selection (lower £/MWh).
- Could be extended to loading analysis if loading sensors on training site.

Next Steps

- RES is planning to trial approach on two operational sites in 2018.
  - Training Site (Site A)
  - Validation Site (Site B)
- RES is open to collaboration with industry stakeholders

Acknowledgements

- This presentation expands upon ideas originally voiced by Matt Smith of ZephIR.