

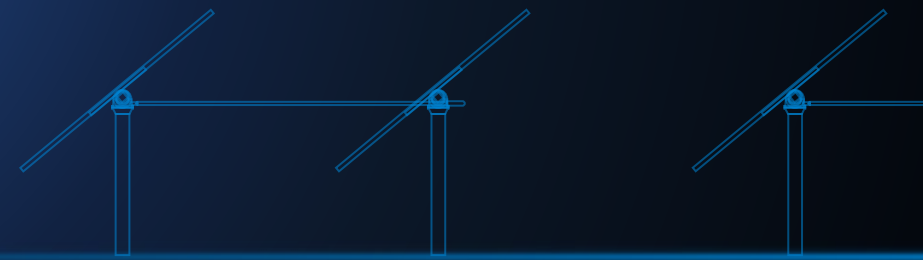


# WEBINAR NEW PRODUCT **AGILE 1P** GLOBAL LAUNCH

Date: April 15<sup>th</sup> 2021 Time: 4-5pm CET



# CONTENTS

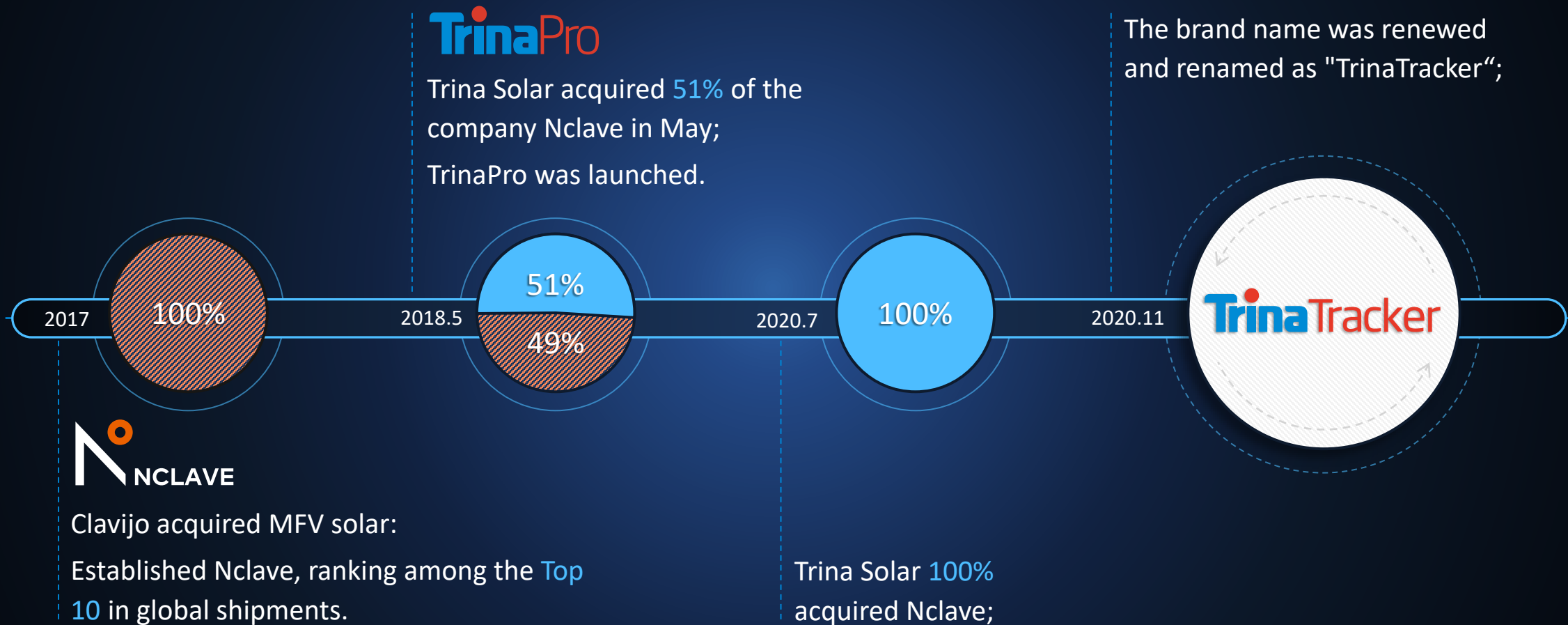
- TRINATRACKER OVERVIEW
  - AGILE INTRODUCTION
  - AGILE SYSTEM FEATURES
  - OUTLOOK
- 

# CONTENTS

- TRINATRACKER OVERVIEW

- AGILE INTRODUCTION
- AGILE SYSTEM FEATURES
- OUTLOOK

# COMPANY DEVELOPMENT



# ACHIEVEMENTS

Over **12** Years  
Experience

**40** COUNTRIES  
Across 5 continents

**5GW<sup>+</sup>**  
GLOBAL INSTALLATIONS

● Offices & Branches

Spain / France / United States / Mexico / Brazil / Chile / Argentina / Japan / Australia / China

● Production center

Spain / Brazil / Argentina / China

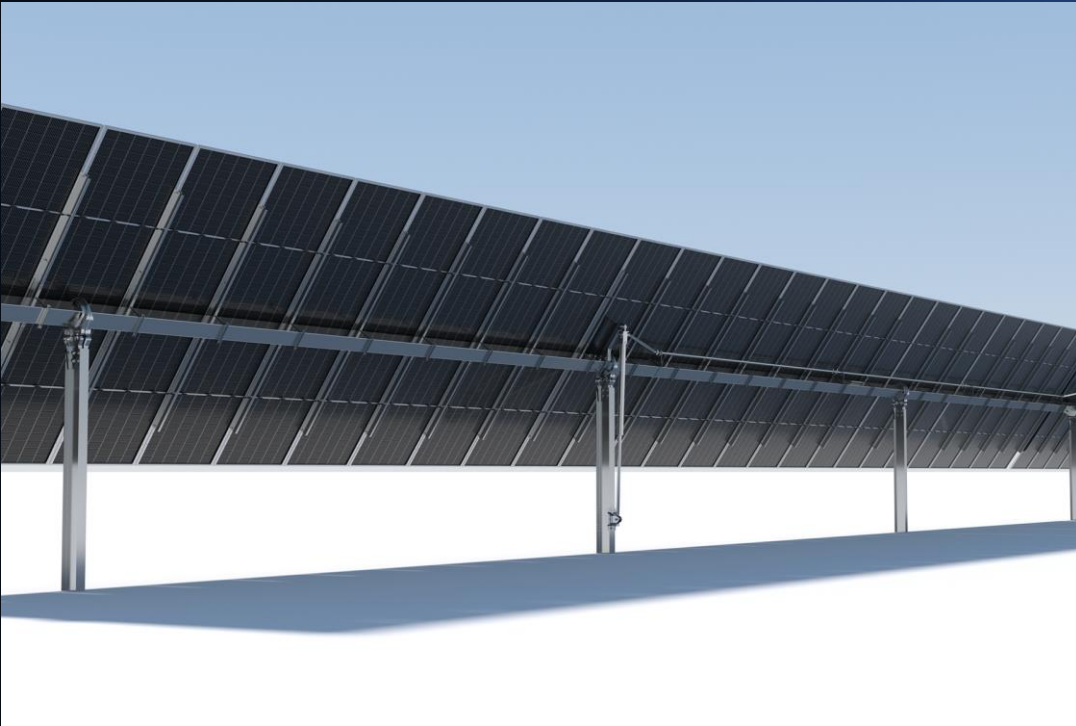


# TRINATRACKER PORTFOLIO



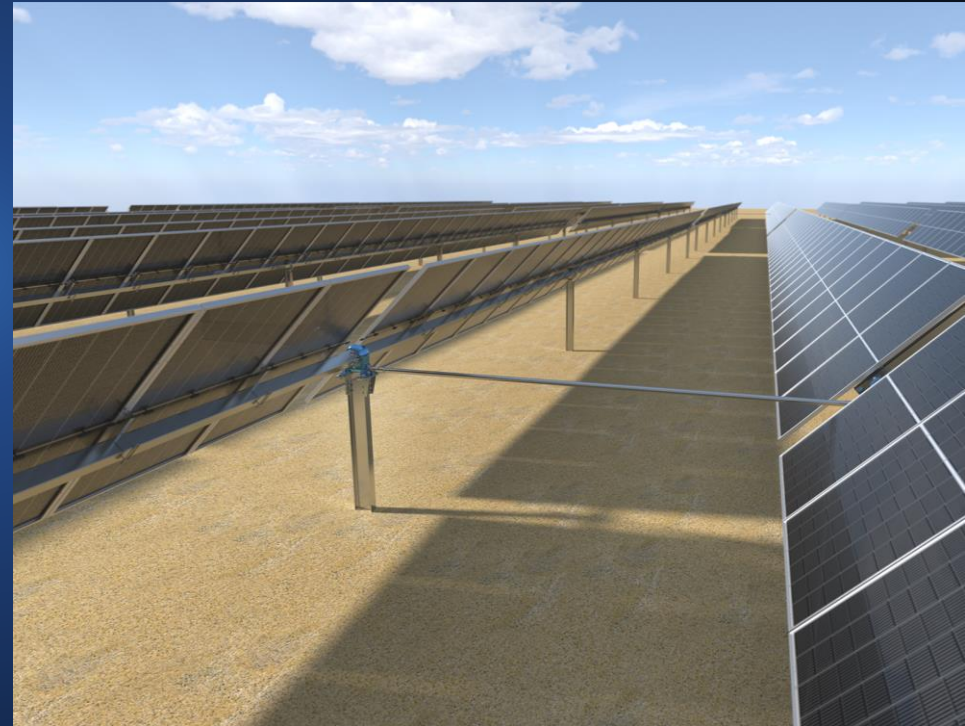
## Vanguard<sup>TM</sup>

Independent row 2P  
configuration



## Agile<sup>TM</sup>

Dual row 1P configuration



# CONTENTS

- TRINATRACKER OVERVIEW
- **AGILE INTRODUCTION**
- AGILE SYSTEM FEATURES
- OUTLOOK

## Agile<sup>TM</sup>

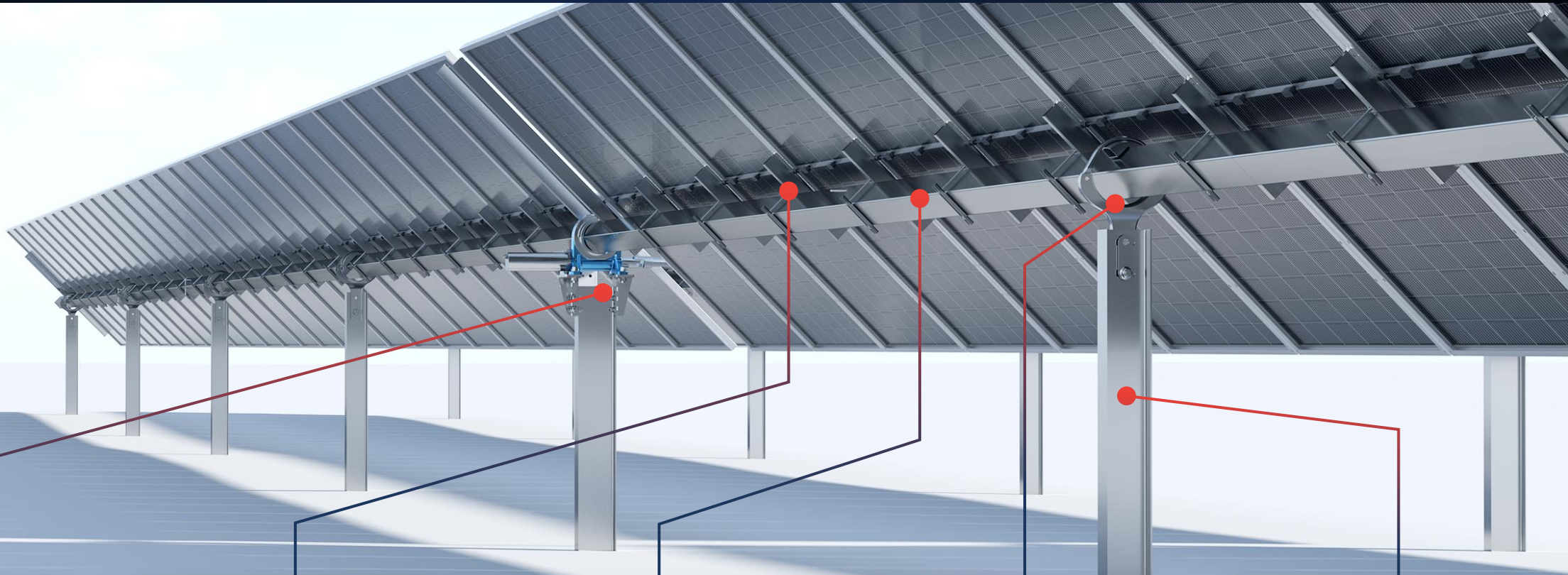
Dual-Axis  
-Row Single  
1P  
configuration

UP TO 120  
modules per tracker

New Drive system  
-Dual Slewing drive



# KEY MECHANICAL COMPONENTS



## Drive System

Slewing drive &  
cardan design-  
simple assembly  
process

## Trina Clamp

Robust and easy to  
assemble

## Torque Tube

Standard shape for  
supply chain  
efficiency

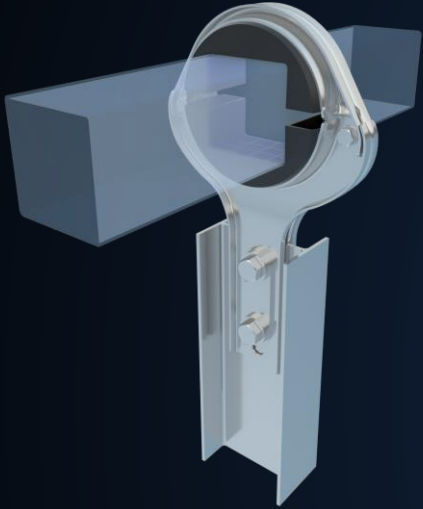
## Spherical Bearing

Self-alignment, easy  
to assemble

## Piles

W/H pile option for  
difficult ground  
conditions

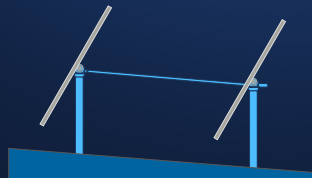
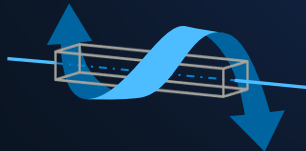
# PATENTED SPHERICAL BEARING AND TRINA-CLAMP



## Spherical Bearing

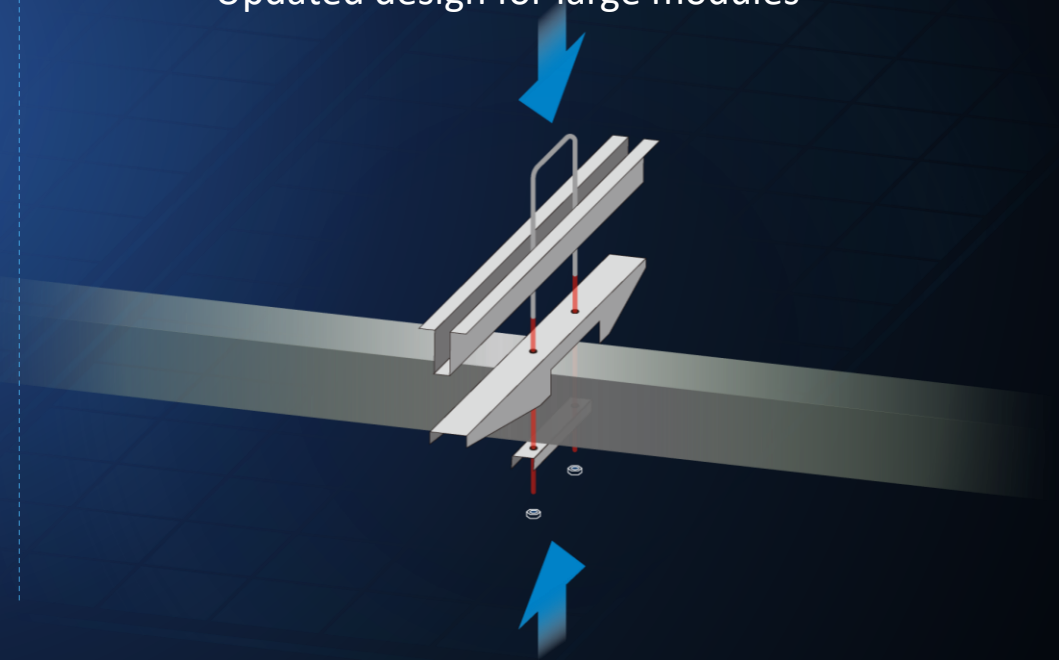
- Self-lubricating plastic
- Resistance to solar degradation (accelerated life cycle tested)
- 12 years proven in harsh environments

- Avoids the need for calibration during the installation process
- Minimizes structure stress and deformation
- Enables increase of racking tolerances



## Trina-Clamp

- Innovative Trina Clamp installation
- Save 50% installation time
- Updated design for large modules



# CONTENTS

- TRINATRACKER OVERVIEW
- AGILE INTRODUCTION
- **AGILE SYSTEM FEATURES**
- OUTLOOK





## DESIGN

- Module & Tracker Compatibility
- Advanced Wind design
- Integrated Alarm Strategy



## HARDWARE

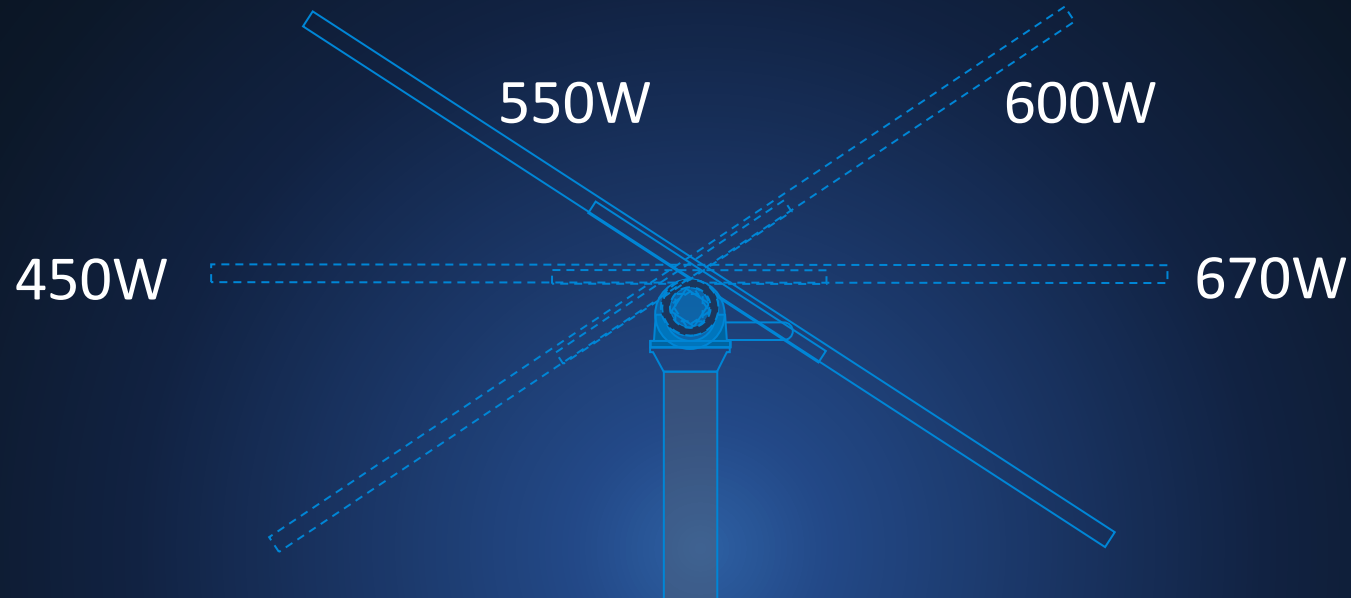
- Multi-drive system
- Length of the tracker



## SOFTWARE

- SuperTrack
- SCADA System

# DESIGN: TRACKER & MODULE COMPATIBILITY



Agile™

MODULE TYPE	POWER	MODULE WIDTH	MODULE LENGTH	MODULE PER STRING (20°C)	No. MODULE	MAX STRING PER ROW	TRACKER LENGTH
DE17 DEG17C.20	450 W	1046mm	2111mm	30	120	2	62.76 m
DE19 DEG19C.20	550W	1096 mm	2384mm	38	114	1.5	63.81 m
DE20 DEG20C.20	600W	1303 mm	2172mm	33	99	1.5	65.70 m
DE21 DEG21C.20	670W	1303 mm	2384mm	32	96	1.5	63.75 m



Trackers are flexible structures even with frequencies higher than 1 Hz

### STRUCTURAL VERIFICATION

STATIC ANALYSIS

DYNAMIC  
ANALYSIS

AEROELASTIC  
ANALYSIS

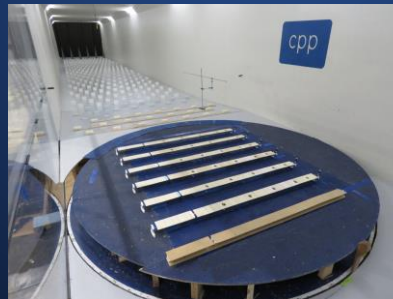
### WIND ENGINEERING

Wind tunnel pressure model test



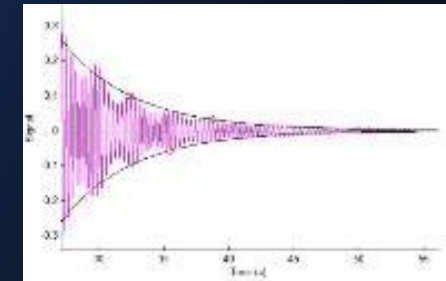
Pressure coefficient  
definition. Rigid  
structure

3D Full aeroelastic test



Critical wind speed  
definition. Flexible  
structure

On-site Pluck Test



Dynamic parameter  
measurement: Frequency  
and Damping

# ADVANCED WIND DESIGN

## WIND MITIGATION STRATEGY

### Wind stow strategy

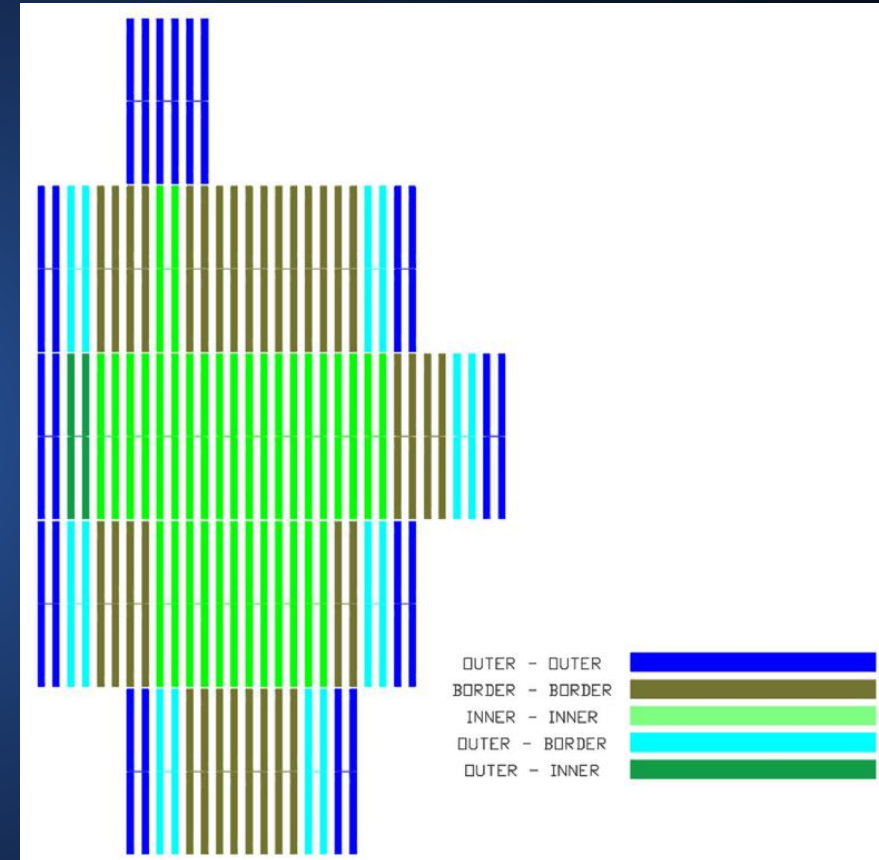
### High tilt angles

Considers critical, maximum structural and design wind speed limits

Configure per tracker and project

No risk for each location and weather conditions

### Tailored Tracker Lay-out



Different types of tracker depending on the location on the plant to enhance efficiency.

# DESIGN: INTEGRATED ALARM STRATEGY

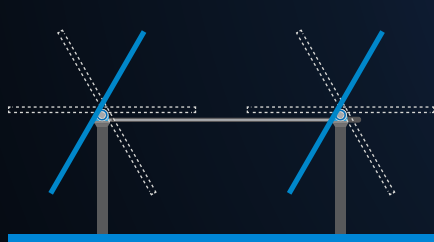
	 LOW BATTERY	 COMMS ALARM	 MANUAL STOW ALARM	 HAIL STOW	 WIND ALARM	 SNOW ALARM
Description	Stow position is command if the battery energy is not enough to stay tracking	Stow position is command if no communications with NCU are available	Stow position is command by the plant operator in case of any extreme risk	Hail Stow position is command in case of hails storms	Wind Stow position is command in case of wind alarms	Snow Stow position is command in case of wind alarms
Activation / deactivation	Automatically by the TCU SOC* estimation	Automatically by the TCU	Manually by the operator	Manually by the operator	Automatically by the weather station	Automatically by the weather station
Priority	1	2	3	4	5	6

# HARDWARE: MULTIDRIVE SYSTEM

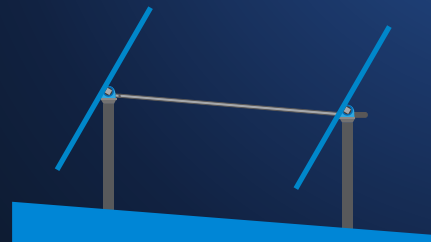
ONE LINEAR ACTUATOR



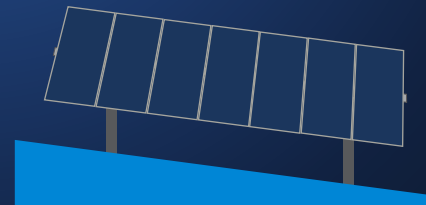
TWO SLEWING DRIVES



$\pm 60^\circ$  Tracking range



10% E-W



20% N-S

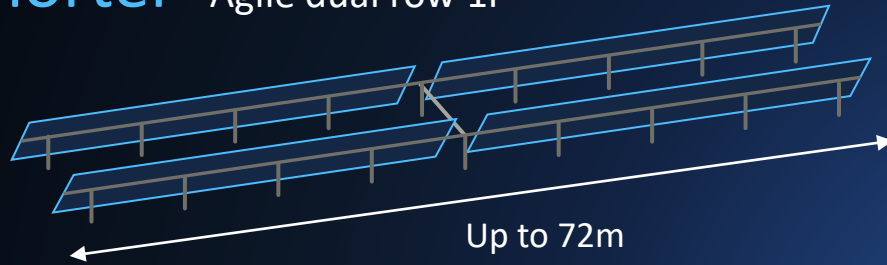


$12^\circ$  Adaptability

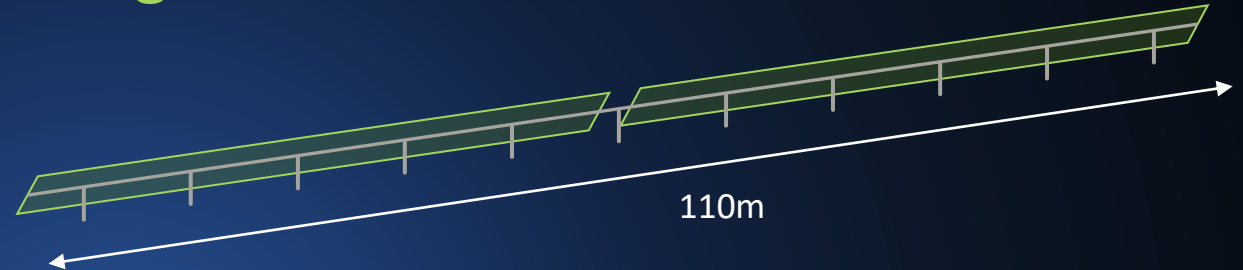


# HARDWARE: TRACKER LENGTH

**Shorter** - Agile dual row 1P



**Longer** - Single row 1P



Per MW

**12.6 trackers**

**-33%**

Trackers per MW

**-45%**

Shorter. Less grading

**-9%**

DC cable

Optimized  
**BOS**



46 trackers

**3036kW**

(46\*60\*2\*550W)



53 trackers

**2625.5kW**

(53\*90\*550W)



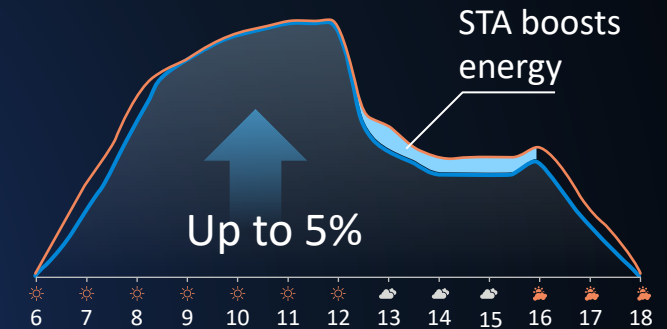
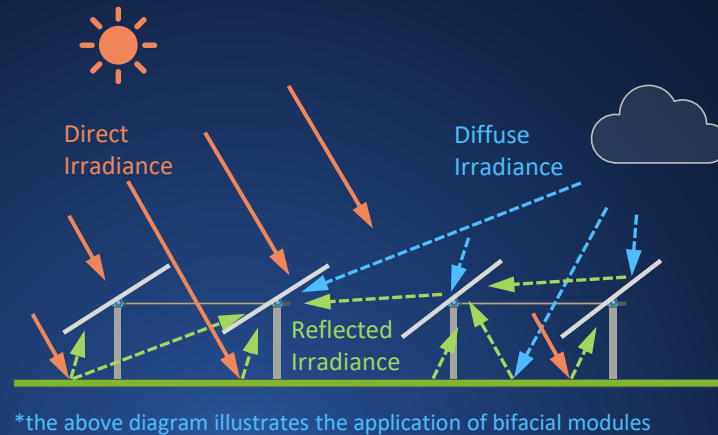
# SOFTWARE: SUPERTRACK ALGORITHM

## STA

### Smart Tracking Algorithm

- Designed for bifacial modules
- Accounting for diffuse and reflected irradiance
- Ensure optimized tracker position for max yield gain at all times
- More effective under cloudy and overcast weather

STA can boost the energy gain by up to 5% on cloudy and overcast days

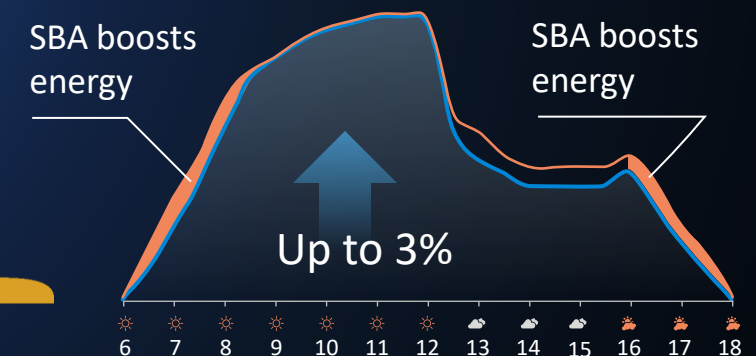


## SBA

### Smart Backtracking Algorithm

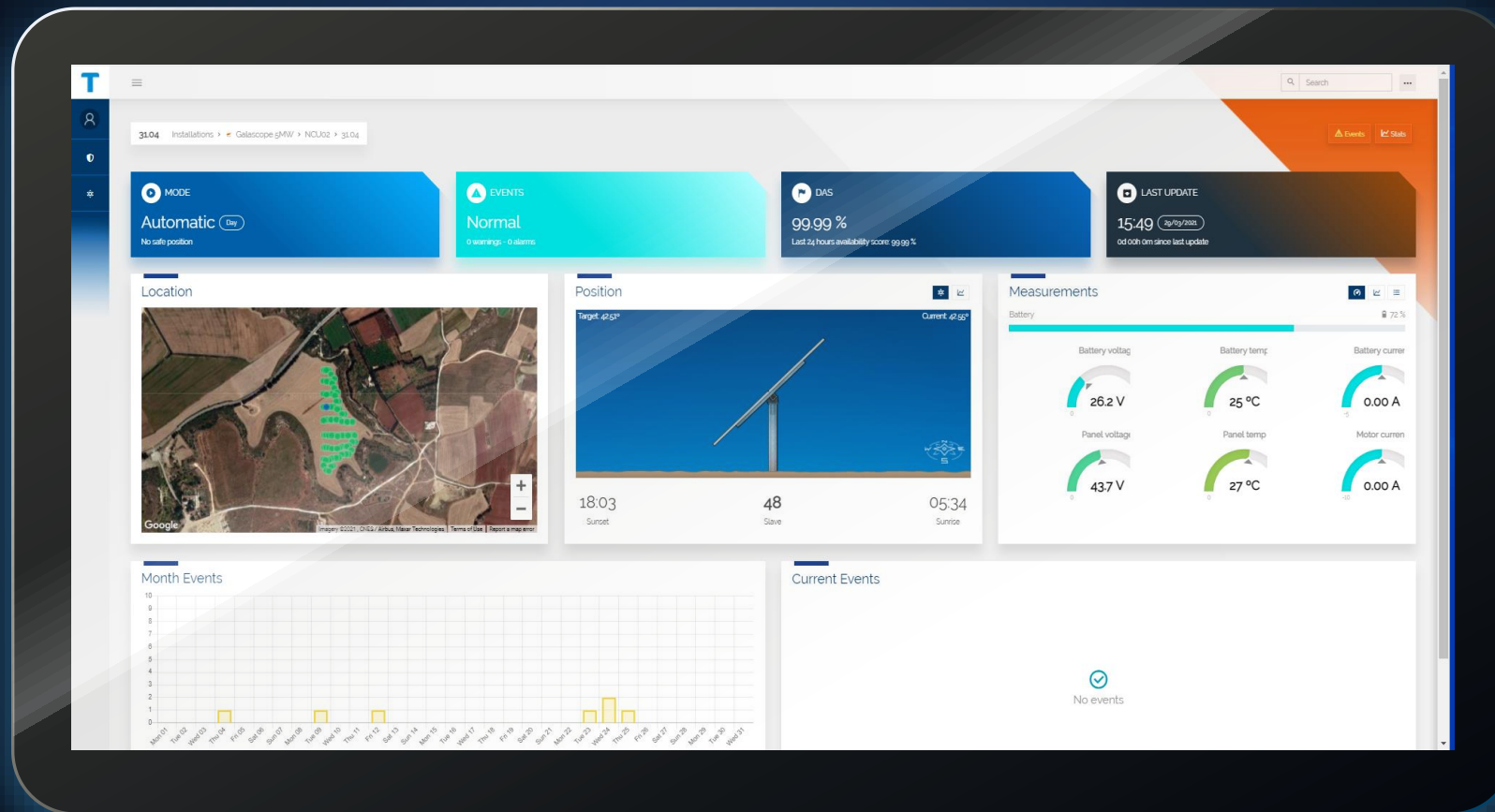
- Accounting for complicated terrain variations
- Ensure module shading avoidance at all times
- Most effective during dawn and evening periods

SBA can boost the energy gain by up to 3% during early morning and late afternoon



# SOFTWARE: SCADA SYSTEM

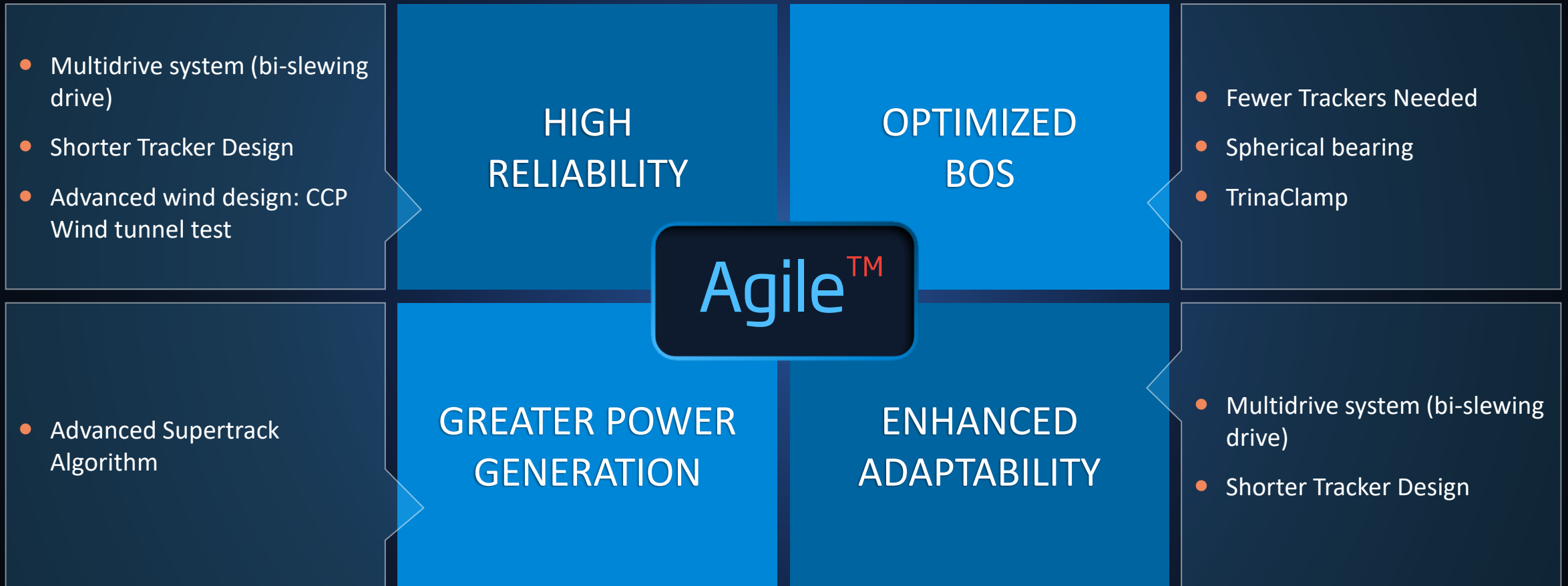
TrinaSCADA = Tracker Monitoring & Alarm + System Diagnosis + Intelligent Control = Easier O&M



Upgrade to SCADA system based on current TrinaTracker Cloud

# TECHNICAL ADVANTAGES

## SUMMARY OF AGILE 1P



# CONTENTS

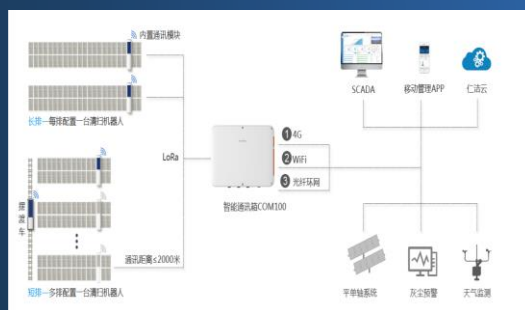
- TRINATRACKER OVERVIEW
- AGILE INTRODUCTION
- AGILE SYSTEM FEATURES
- OUTLOOK

# OUTLOOK FOR TRACKER INDUSTRY DEVELOPMENT



## TECHNIQUES

With the technology development, well-established standards and integration of the whole industry chain, the value of trackers will be greatly improved, which will further increase the global market share of trackers.

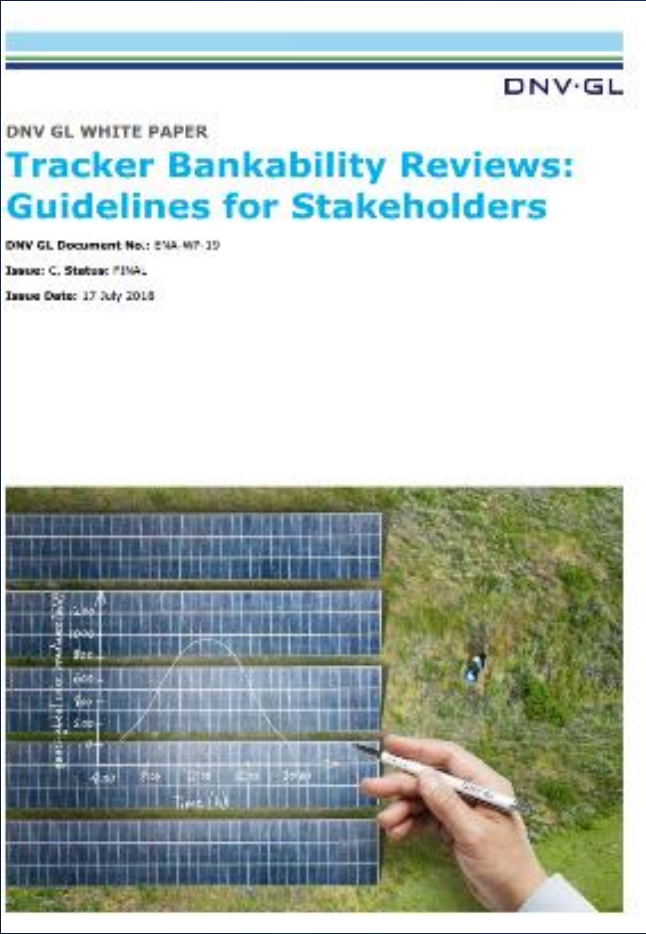
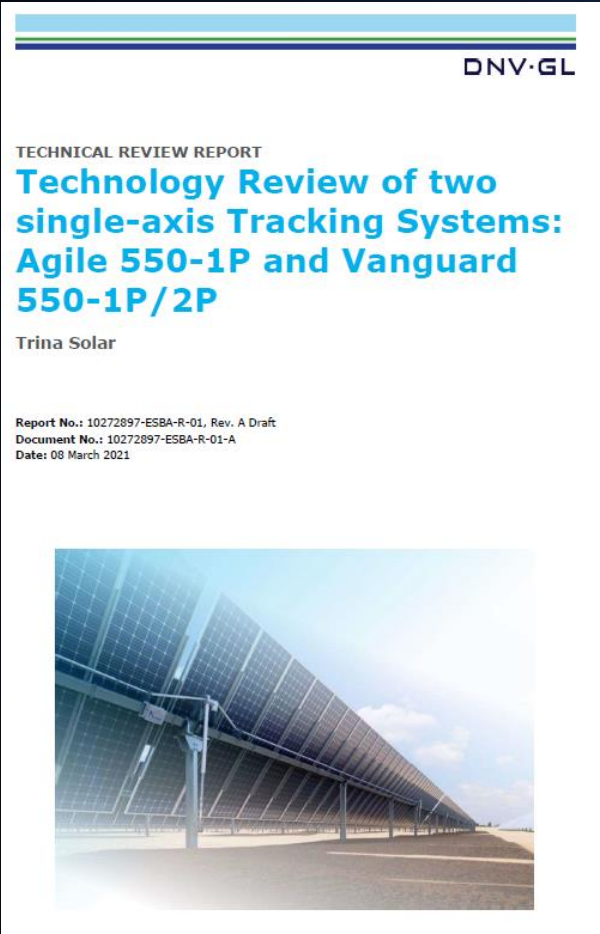


## INTEGRATION

Currently no unified mature standards in the tracker industry which leads to transaction costs increase. Standards needs to be established for the long-run.

## STANDARDS





DNV has continually provided valuable validation to TrinaTracker

# THANK YOU!

For more information, contact us at:

[info.trinatracker@trinasolar.com](mailto:info.trinatracker@trinasolar.com)

# Tracker bankability review

How to mitigate investment risk in tracker technology

César Hidalgo, DNV, Barcelona, Spain

15 April 2021

# Bankability of PV trackers

- DNV
- What is bankability?
- What are the aspects to review?
- Are existing building codes enough for structural calculation of trackers?
- Is necessary to undertake dynamic analysis for trackers?
- Do new backtracking algorithms allow any energy yield increase?
- CONCLUSIONS



# Broad and deep expertise in solar projects



## FEASIBILITY

- › Feasibility studies
- › Utility grid integration
- › Environmental permitting
- › Component technology reviews
- › Component qualification testing
- › Type and component certification of PV inverters

## ENGINEERING & DEVELOPMENT

- › Due diligence / Independent engineering
- › Owner's engineering
- › Energy assessment
- › Pre-construction engineering
- › Interconnection support
- › Project certification

## CONSTRUCTION & COMMISSIONING

- › Due diligence/ Independent engineering
- › Owner's engineering
- › Construction oversight
- › System testing and inspection
- › Project certification and grid code compliance
- › Declaration of conformity
- › Module batch testing
- › Project certification

## OPERATION

- › Performance validation
- › Resource and energy forecasting
- › Existing asset consulting, inspections and decommissioning
- › Refinancing and mergers and acquisitions advisory services
- › Forensic investigations
- › Monitoring, control and asset management
- › Project certification



# DNV Solar: a few figures in Iberia and Latin America







# Bankability

Bankable= stable and secured Cash Flow

*“Bankability means that the bank is convinced to the greatest possible extent that the cash flows are stable and the loan will be repaid.”*

*Credit Risk Manager, Structured Finance, Energy, Major bank*

# Aspects to review in a PV tracker bankability process

A bankable tracker is a good quality tracker

Aspects to consider in the evaluation

Certification

Raw materials

Adequate design for the  
site conditions

Easy operation and  
maintenance

Lifetime expectation

Manufacturing quality control: Quality instructions, traceability, Health and Safety, Bill of Materials, logistics, after sales department

Warranty terms: standard terms, exclusions

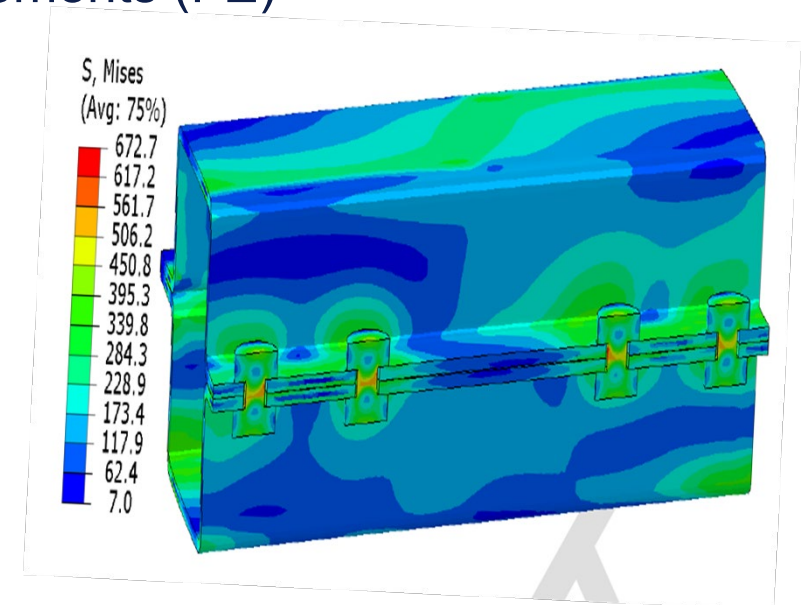
Track record and operating history of product/company



# Existing building codes used for PV trackers

1) Existing building codes like the Eurocode in Europe or ASCE in USA were never intended for solar. Therefore, compliance with those codes is not a total guarantee of lifetime. Natural frequency: buildings at 1Hz  
PV trackers between 1.5 Hz and 3 Hz in most of cases. Finite Elements (FE)

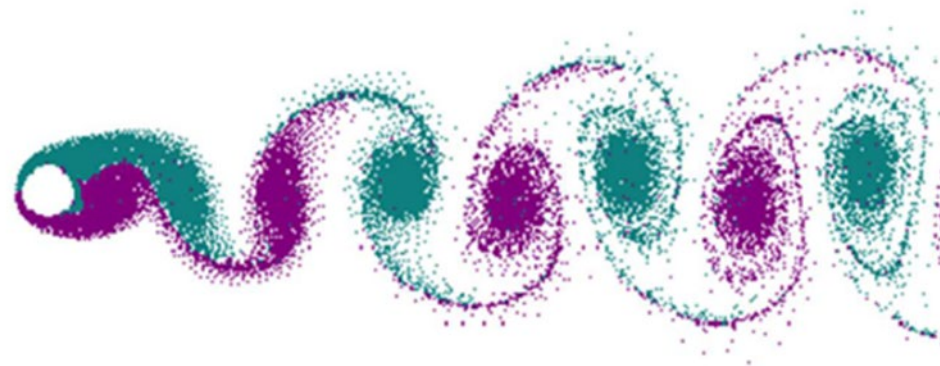
2) Wind tunnels are required for an accurate structural assessment (static and dynamic wind tunnels)



# Aeroelastic instability in PV trackers

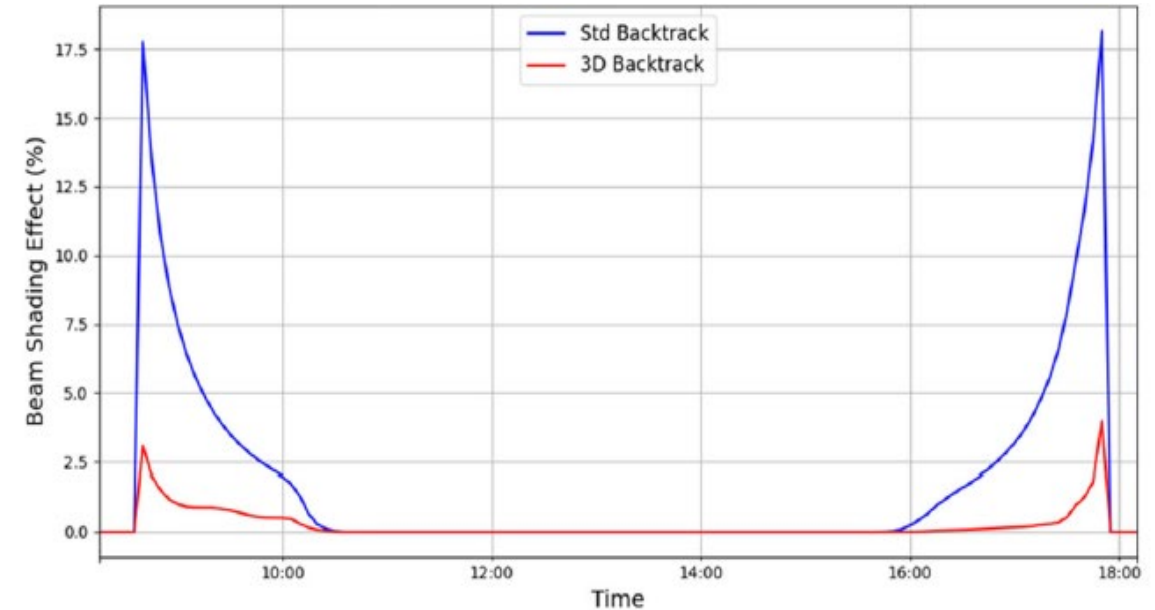
Buffeting, vortex-induced vibrations, aeroelastic deflection, torsional fluttering/galloping, torsional divergence

Catastrophic failures occurred in Spain due to winter storms in 2020 and 2021: many PV plants involved, and several manufacturers affected. Damages have occurred at much lower wind speeds than maximum design wind speeds, so it does demonstrate that the amplification function of these instabilities



: Vortex shedding around a cylinder (courtesy Cesareo de La Rosa Siqueira).

# New 3D Backtracking algorithms



DNV has used SolarFarmer with 5 min data to simulate the shadings of conventional backtracking algorithm compared to new 3D backtracking algorithms

DNV has found net energy gains of 0.4% in relatively benign sites and 1% in site with medium topography complexity (slopes up to 4%-6%).

# Conclusions

- PV tracker industry is lacking of standardization
- Bankable trackers are good quality trackers but this concept involves many parameters
- Hot topics in the today industry of trackers: optimum design for aeroelastic instabilities and the new backtracking algorithms
- DNV has been undertaking PV tracker bankability reports for the last years with a guideline published in 2018
- DNV has technically reviewed Agile and Vanguard trackers from TrinaTracker