Arctech Solar

Performance model of bifacial module and solar tracker

双面光伏及跟踪器性能的建模方法和工具

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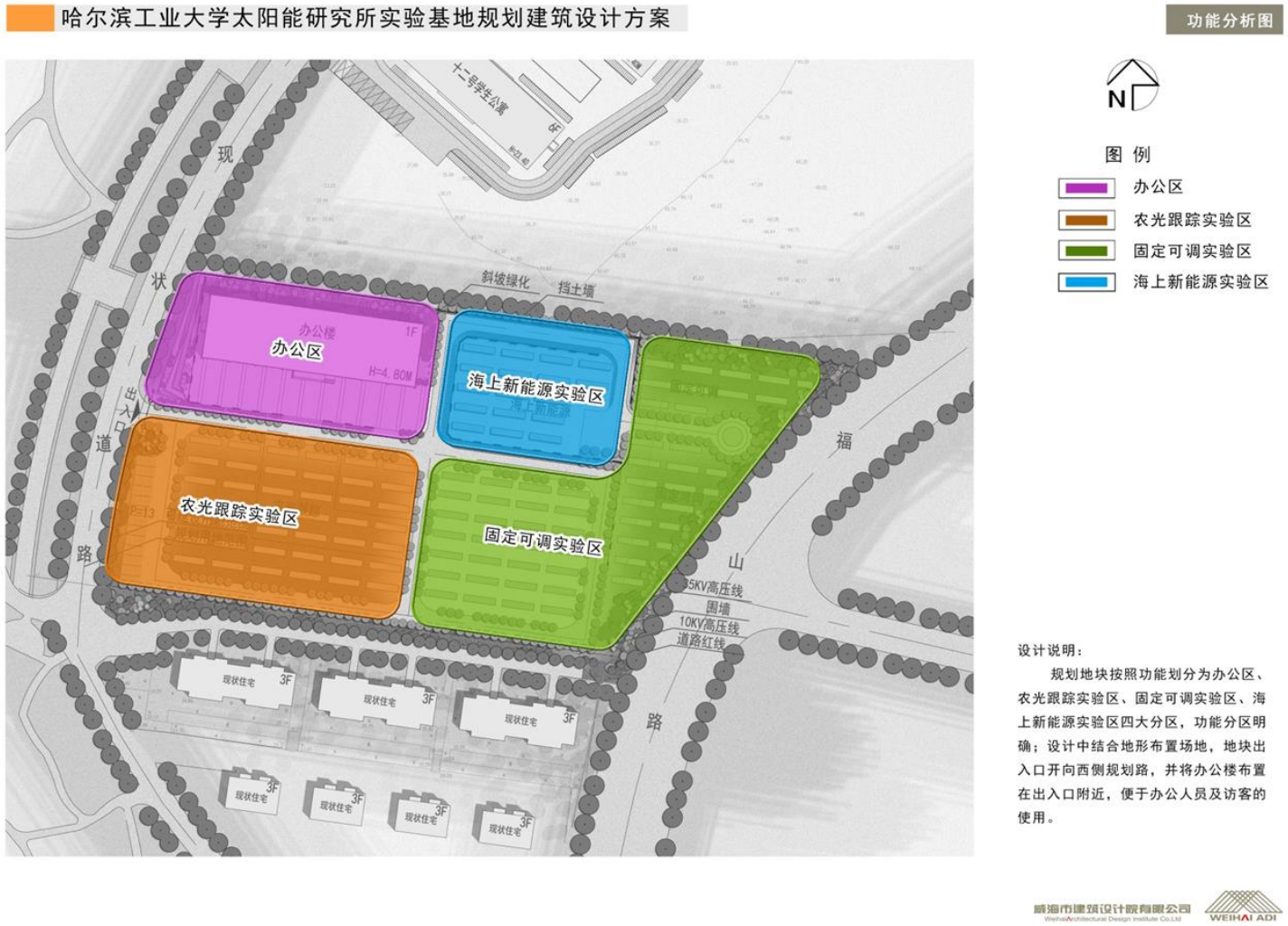
5/12/2017

Demonstration Base Info. 实证基地信息



Location: Wei ·China
地点：中国·威海

Longitude: 122.1°E
经度：东经122.1°
latitude: 34°N
纬度：34°

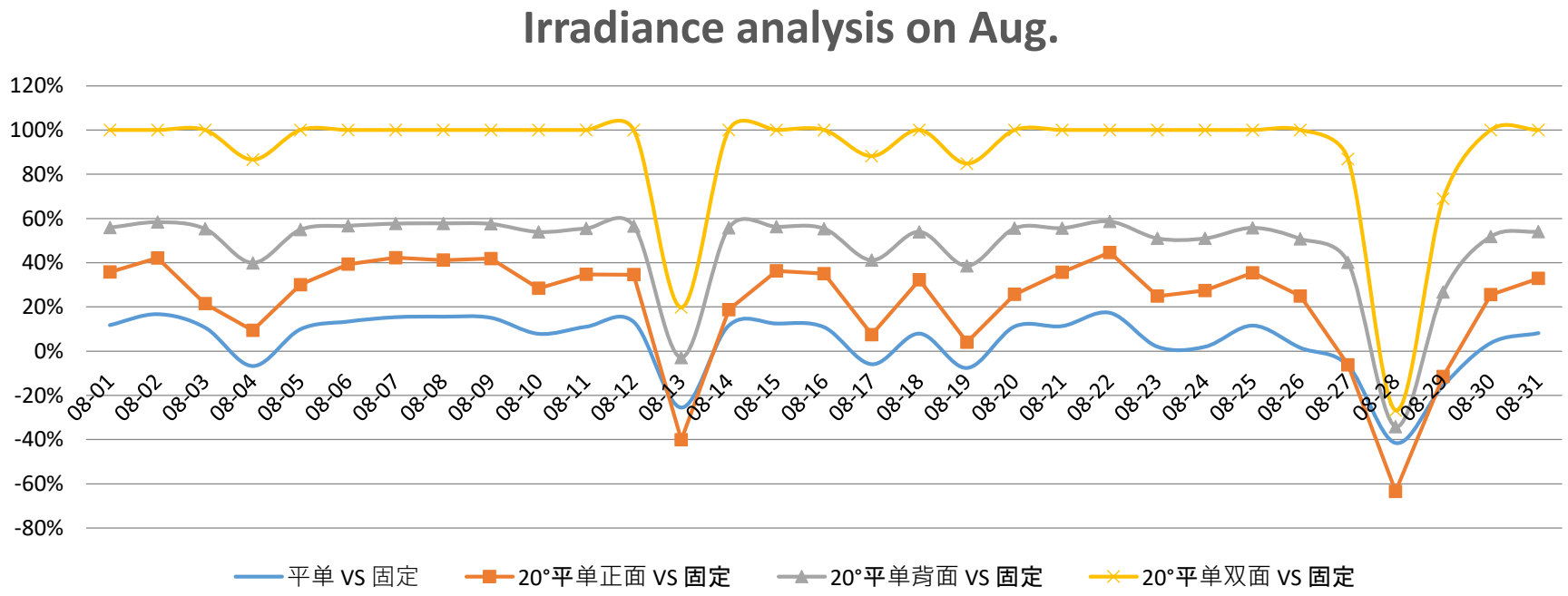
Distribution of ground irradiance monitor system
地面辐照监控系统布局

For racking system
固定支架平面

For ground surface
地面背向安装

For bifacial module
双面组件安装

Irradiance analysis of demonstration base—Aug.
威海实证基地辐照分析—8月份辐照对比



Horizontal single system with 20 °tilt angle

20°平单轴系统

+

Bifacial module

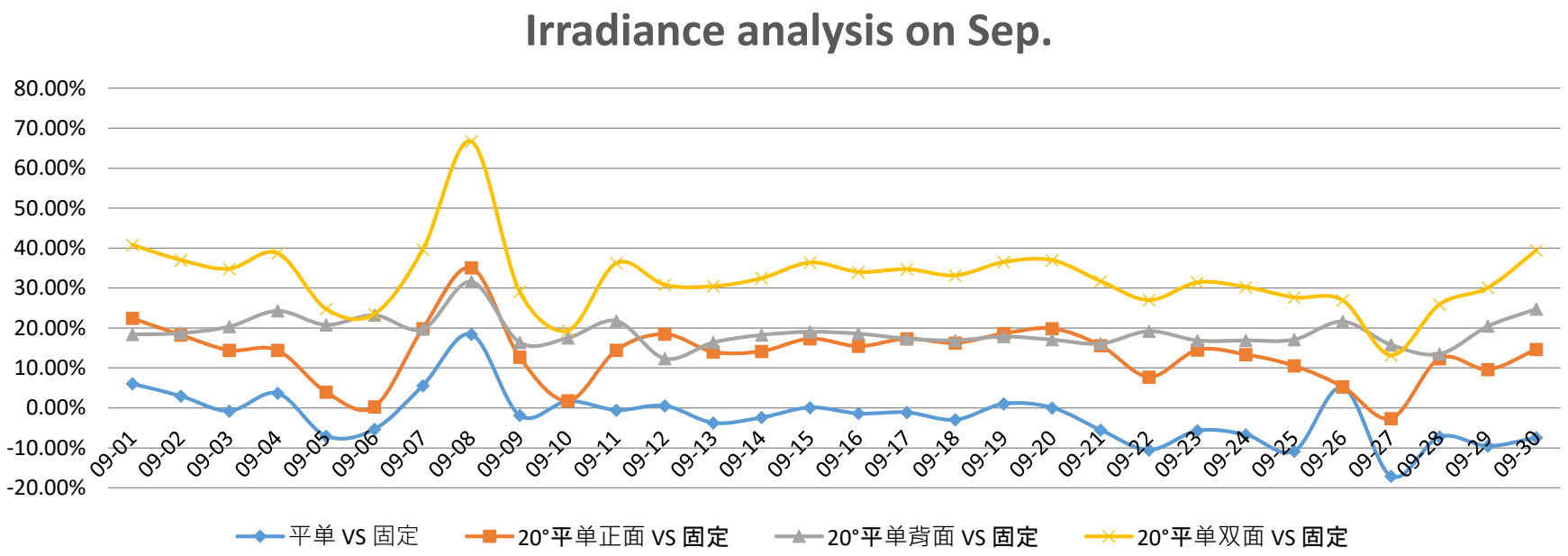
双面组件

=

36.23% more than racking system

高出固定支架 36.23%

Irradiance analysis of demonstration base—Sep.
威海实证基地辐照分析—9月份辐照对比



Horizontal single system with 20 °tilt angle

20°平单轴系统

+

Bifacial module

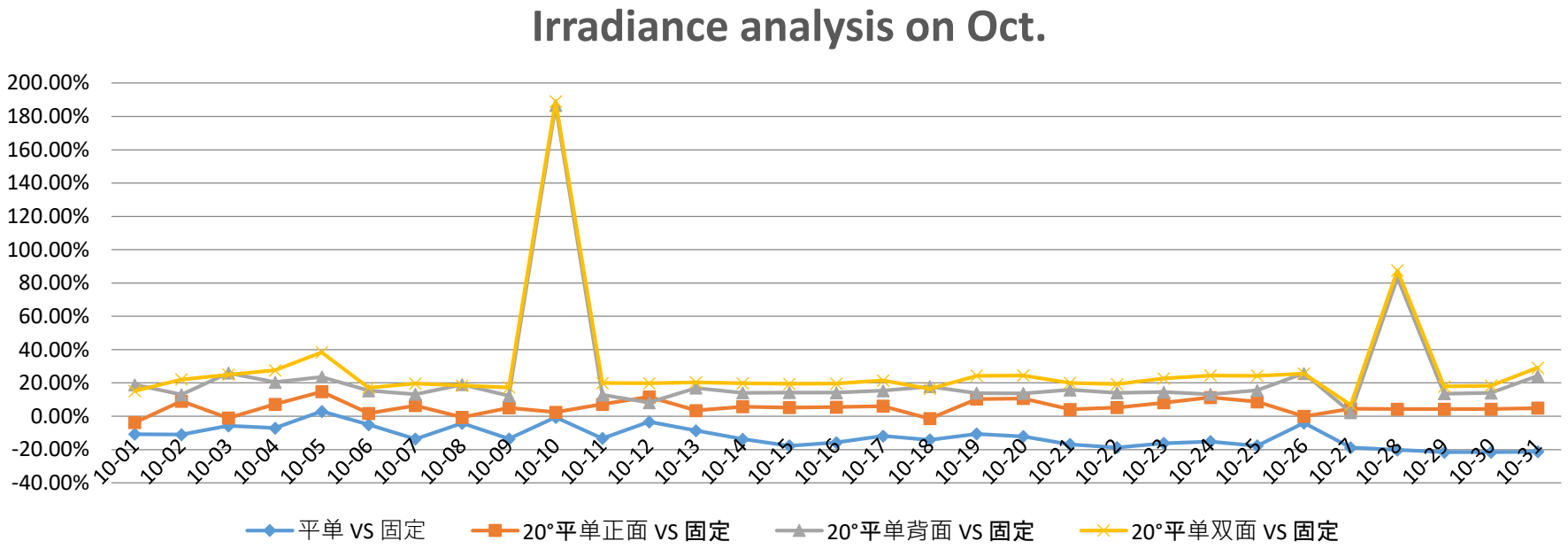
双面组件

=

33.01% more than racking system

高出固定支架 33.01%

Irradiance analysis of demonstration base—Oct.
威海实证基地辐照分析—10月份辐照对比



Horizontal single system with 20 °tilt angle

20°平单轴系统

+

Bifacial module

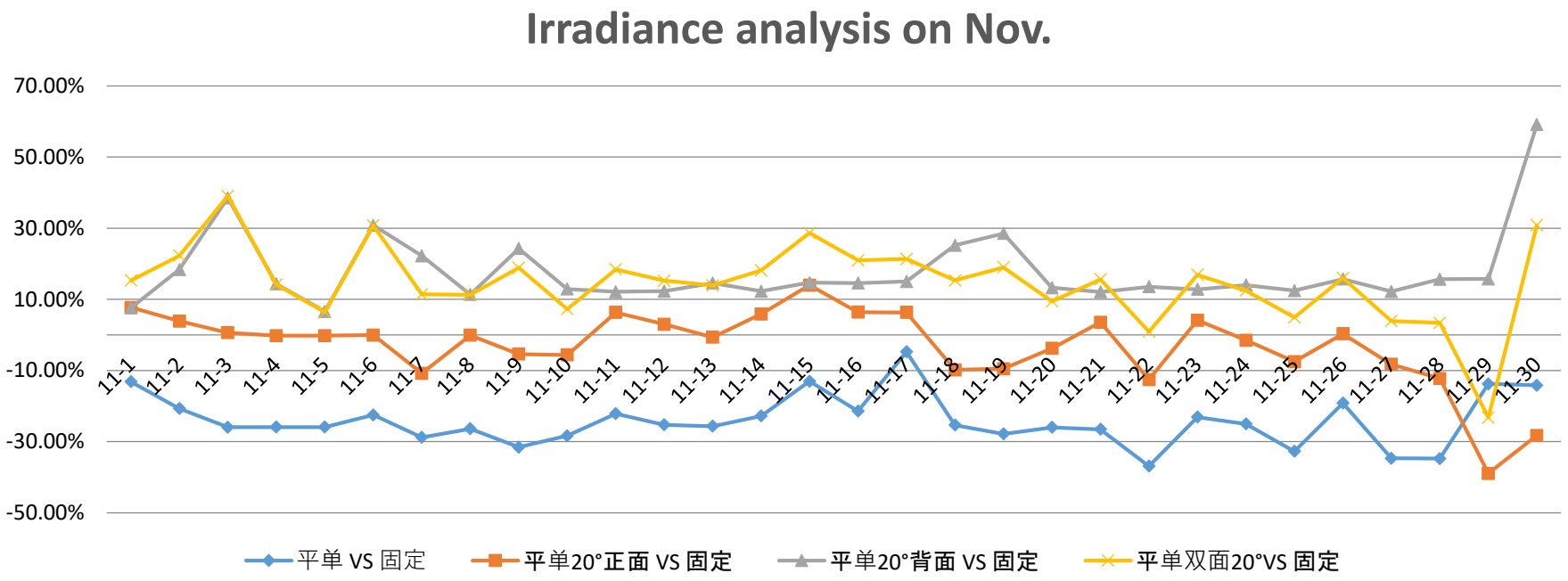
双面组件

=

22.24% more than racking system

高出固定支架 22.24%

Irradiance analysis of demonstration base—Nov.
威海实证基地辐照分析—11月份辐照对比



Horizontal single system with 20 °tilt angle

20°平单轴系统

+

Bifacial module

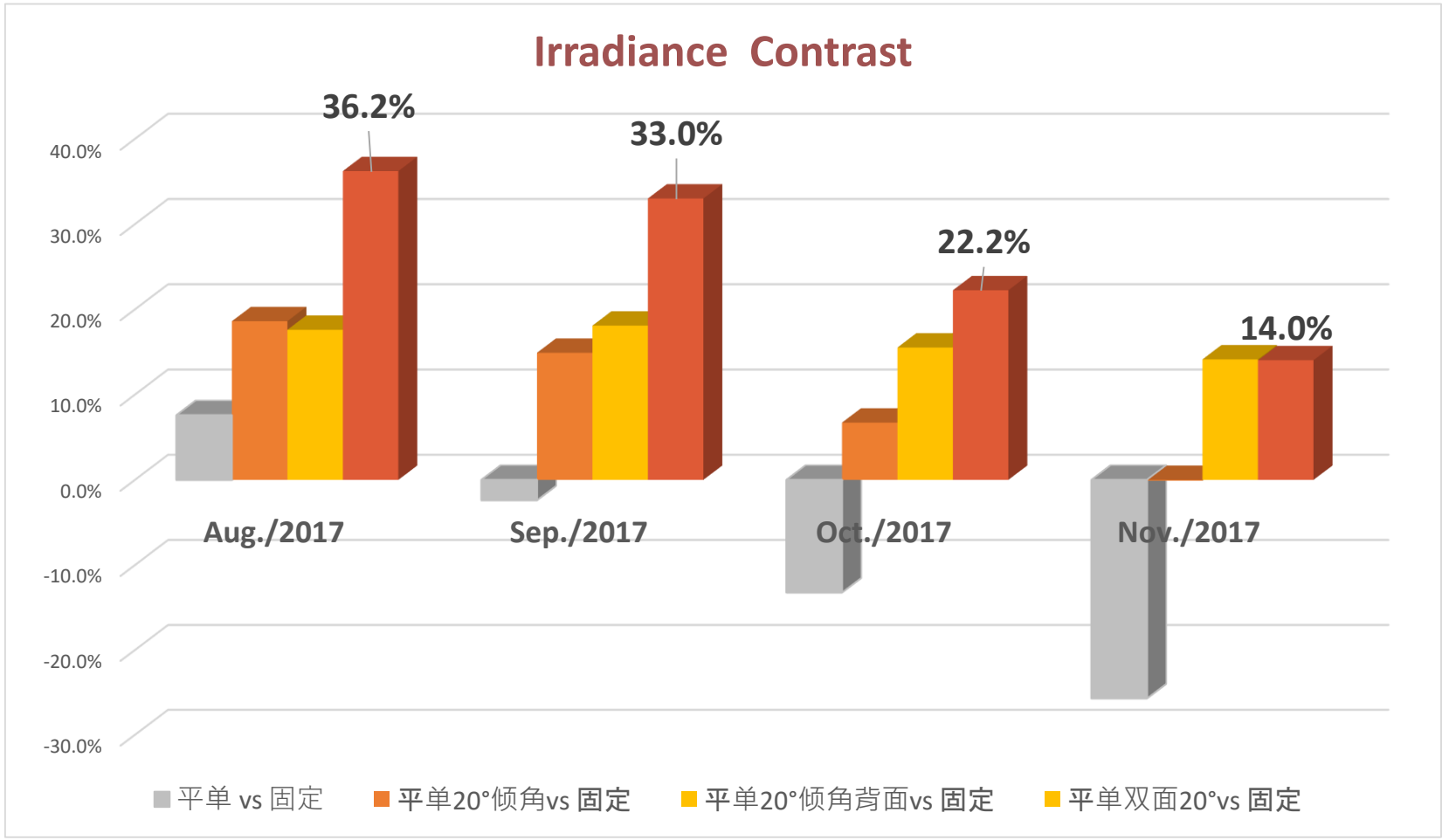
双面组件

=

14.04% more than racking system

高出固定支架 14.04%

Irradiance analysis of demonstration base
威海实证基地辐照分析

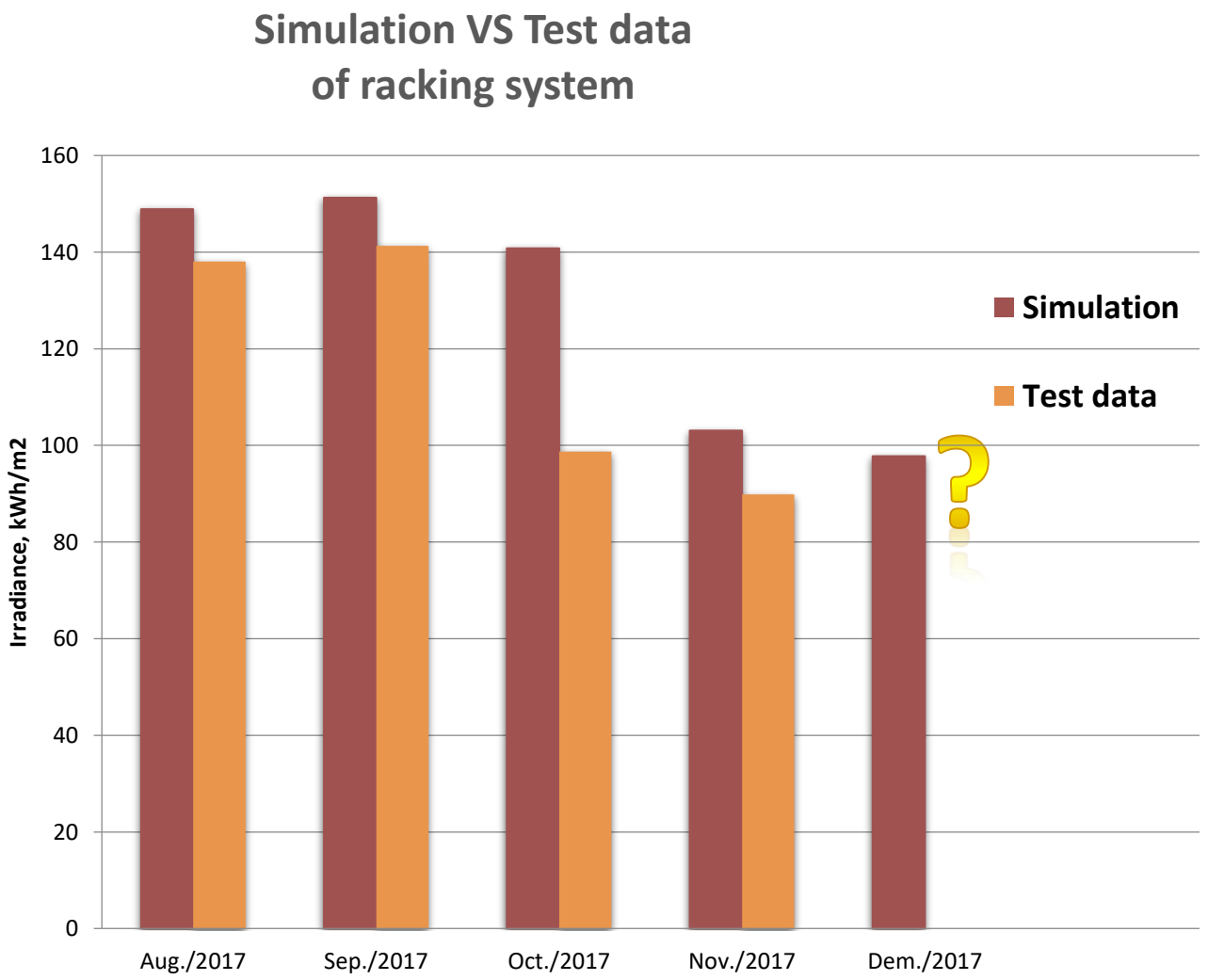


towards winter
进入冬季

Performance of solar tracker 跟踪系统性能

Performance of racking system固定支架性能

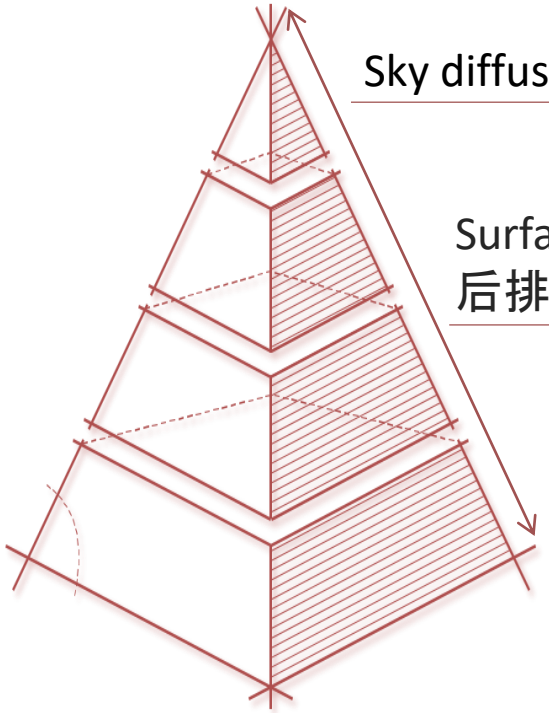
Irradiance forecast for Demonstration base
威海实证基地未来辐照预测



How to obtain the future irradiance?

如何获知未来辐照呢?

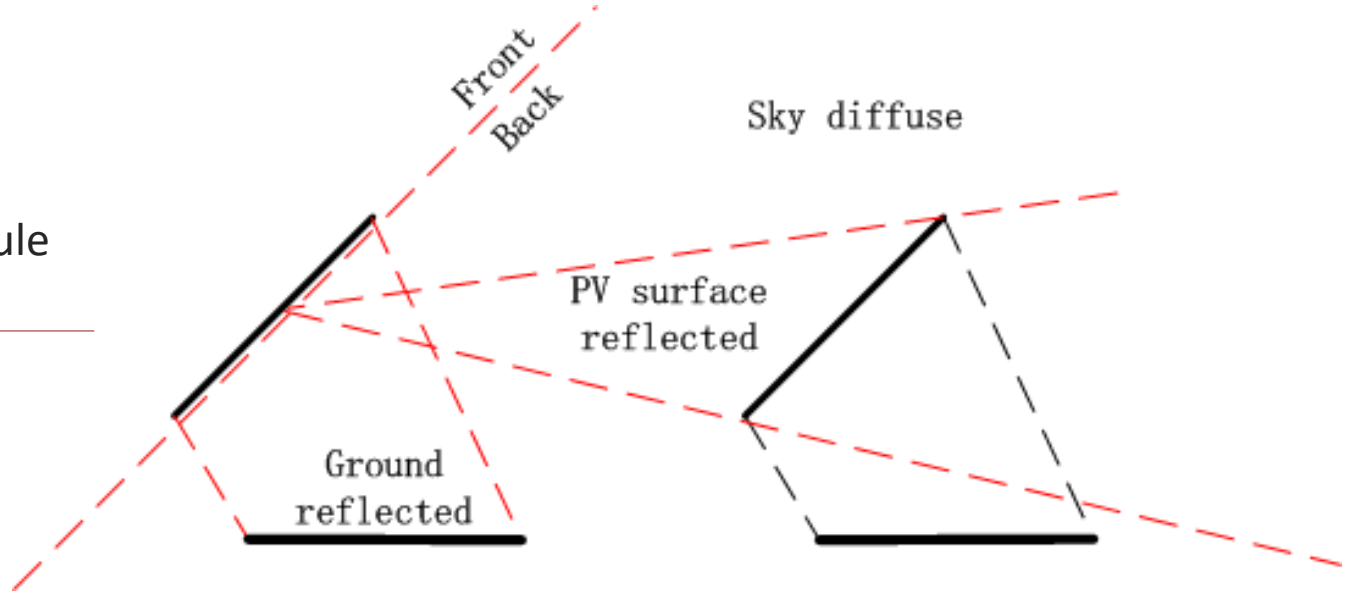
Rear diffuse and reflection model of bifacial module
双面组件的背面散射及反射模型



Sky diffuse/天空散射

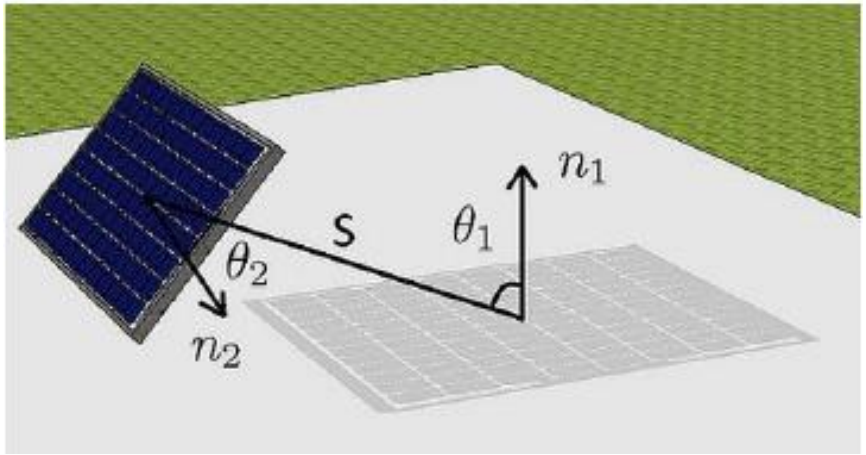
Surface reflect from back module
后排组件表面反射

Ground reflect
地表反射



Reflect irradiance model of bifacial module on racking system
基于固定支架的双面组件的两面辐照模型探讨

Based on Perez model/基于Perez model



Irradiance model 辐照度模型

- Ground reflect model of front irradiance 正面地表反射辐照模型

$$G_f=\rho GHI\frac{1-\cos\beta}{2}$$

- Ground reflect model of rear irradiance 背面地表反射辐照模型

$$G_r=\rho DHI\frac{1-\cos(180-\beta)}{2}+\rho(GHI-DHI)\left(\frac{1-\cos(180-\beta)}{2}-F_V\right)$$

$$=\rho DHI\frac{1+\cos\beta}{2}+\rho(GHI-DHI)\left(\frac{1+\cos\beta}{2}-F_V\right)$$

ρ：地表反射率；β：组件倾斜角度；Fv：视角因子
GHI：水平面总辐照；DHI：散射辐照度

If racking system is not oriented to directly south, the rear irradiance will increase.
调整固定支架为非正南方向，双面组件的背面辐照量将增加。

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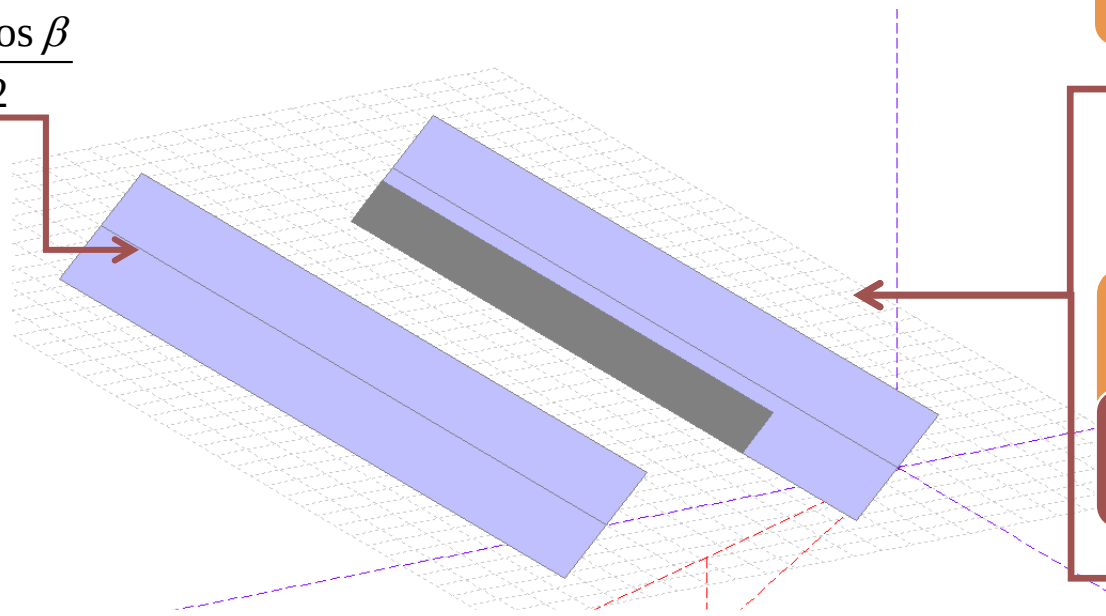
Reflect irradiance model of bifacial module on trackers
基于跟踪系统的双面组件的两面辐照模型探讨

Front ground-reflect model of bifacial
双面组件的正面地表反射辐照模型

$$G_f = \rho GHI \frac{1-\cos\beta}{2}$$



ρ：地表反射率；β：组件倾斜角度；VF：组件区域投射因子，即视角因子，视角因子随观察点与表面的距离减小而增加。
GHI：水平面总辐照；DHI：散射辐照度

Rear ground-reflect model of bifacial module
双面组件的背面地表辐照模型

--1.sky diffuse model of rear side
--1、背面天空散射辐照模型

$$\rho DHI \frac{1-\cos(180-\beta)}{2}$$

Rear ground-reflect model of bifacial module
双面组件的背面地表辐照模型

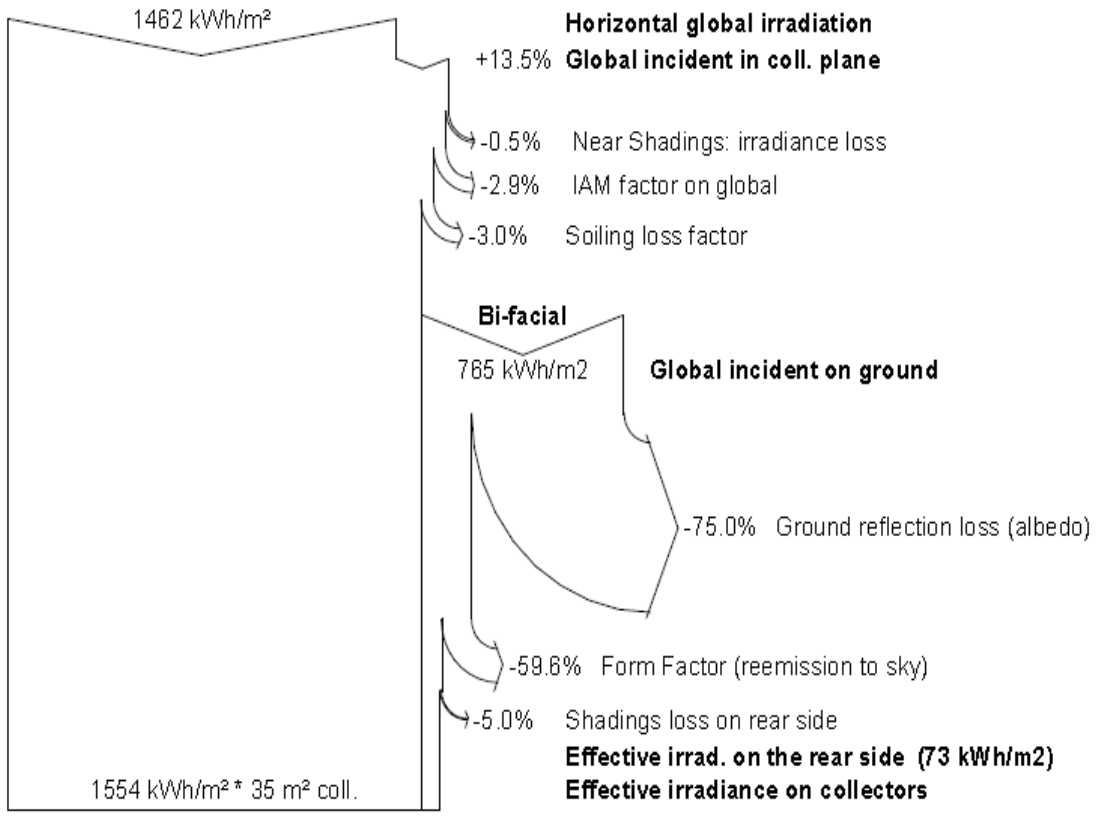
--2.ground reflect model of rear side
--2、背面地表反射辐照模型

$$\rho(GHI-DHI)\left[\frac{1-\cos(180-\beta)}{2} - VF_{A_s \to A_m} - \ldots\right]$$

...includes the influence factors of module height, array spacing and position, sun azimuth
...包含组件高度、阵列间距、组件的位置、太阳方位角的影响因子

Power analysis based on bifacial module and solar trackers
双面组件与跟踪系统结合的发电效果提升分析

Loss analysis of bifacial module and racking system
双面组件与固定支架结合的仿真损失分析



Loss difference of bifacial module and trackers**双面**组件与**跟踪系**统结合，系统损失差异：

Horizontal global irradiation

+25%	**Global incident coll.plane**
-0.5%	Near Shadings：irradiance loss
-2.9%	IAM factor on global
-3.0%	Soiling loss factor

12%

Bi-facial

?	**Global incident on ground**
-75%	Ground reflection loss(albedo)
?	**Form Factor(reemission to sky)**
5%	shading loss on rear side

10%-20%

VF decreases, the rear irradiance increases.
VF下降，**双面**组件背面接收辐照总量上升。

Total increase could be 30-40%.
提升总量将达到30-40%

Solution for bifacial module and solar tracker
双面组件与跟踪系统的解决方案

Artificial intelligence track technology
AI 跟踪

Environment monitor of plants
电站环境监控

Automatic operation
自动运维

Solution for bifacial module and solar tracker
双面组件与跟踪系统的解决方案

Rear irradiance test—recommend setup method of pyranometers
背面辐照检测--推荐辐照仪安装形式

Albedo mounting plate
增加反射安装板

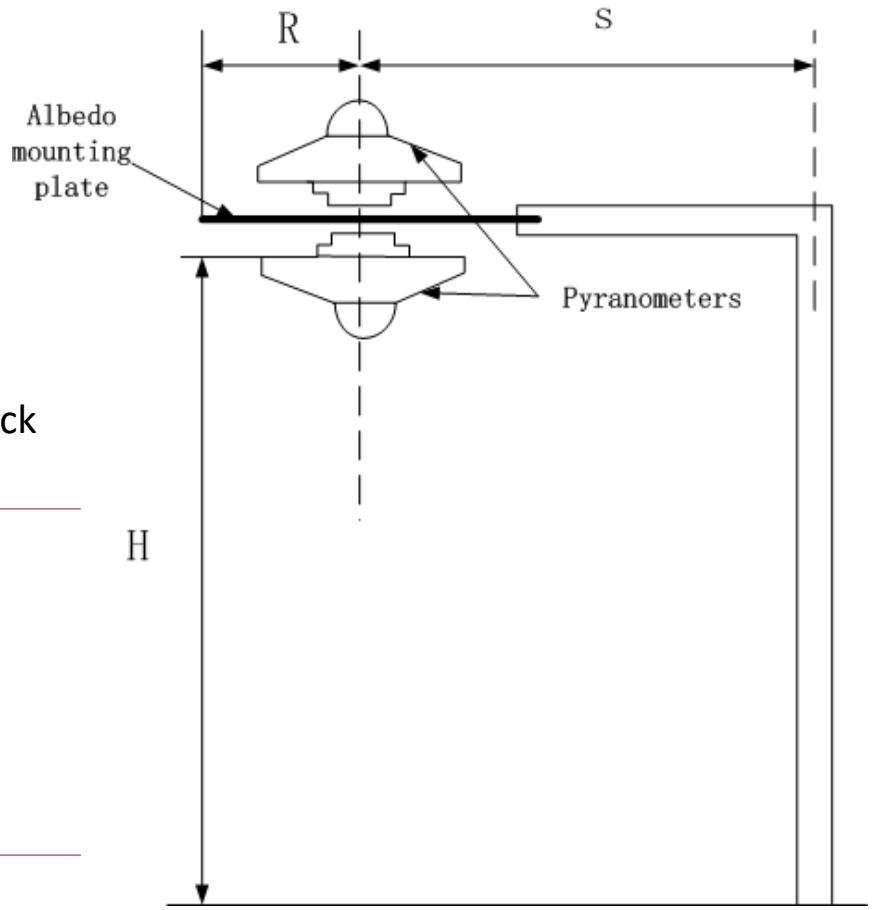
Blacken the plate surface
反射安装板推荐表面加黑处理

Back-to-back setup of dual pyranometers
双辐照仪背向安装

Refer the reverse shade cover for back
背向辐照仪参考反向遮阳罩

Suitable height of mast
高度合适的桅杆

The mast height is recommended as 1-2m for grass.
对于草地，H**推荐**值为1-2m



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THANKS

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