PERFORMANCE & PRODUCTION
BIFACIAL VS. MONO-FACIAL PV TECHNOLOGIES

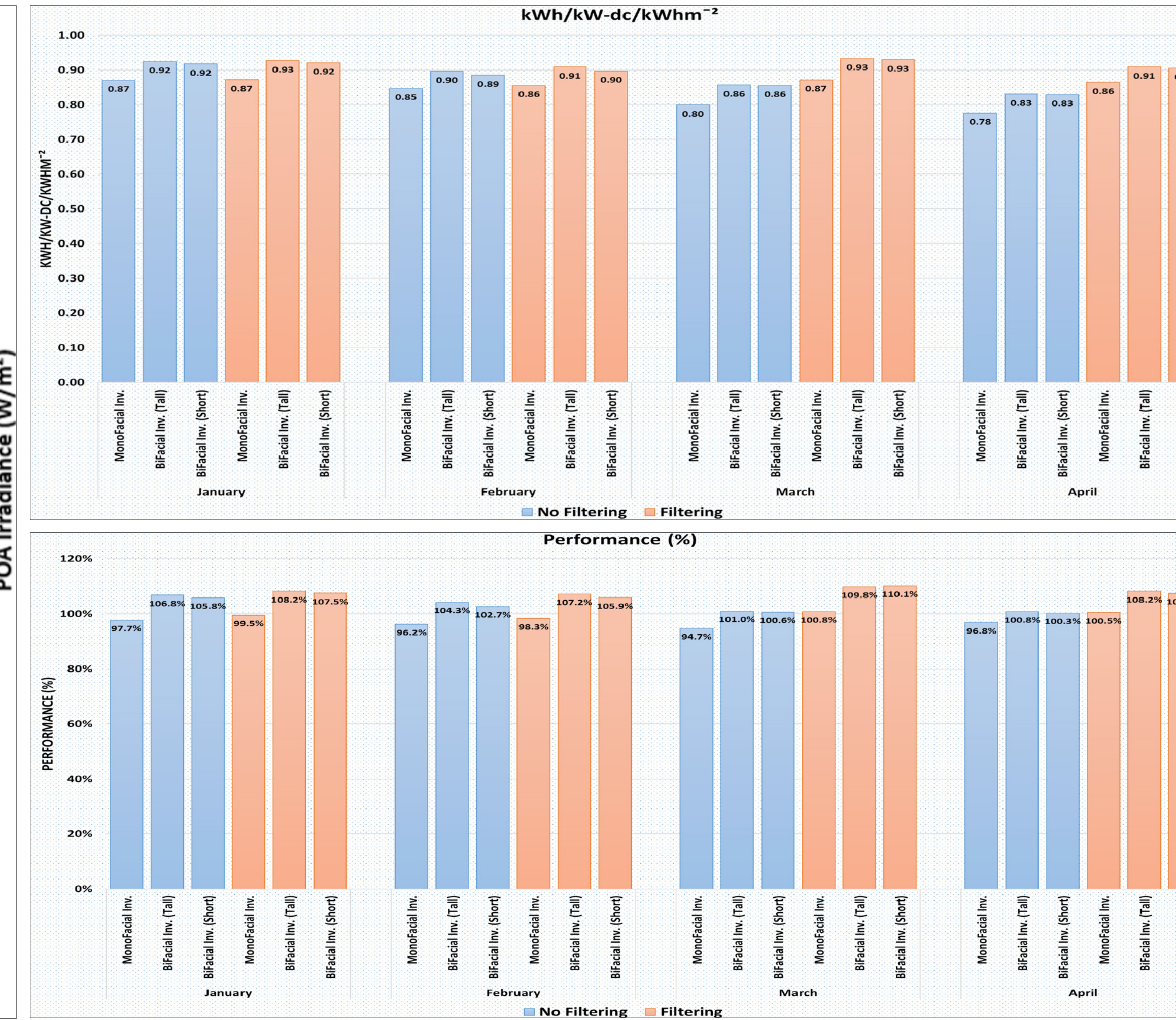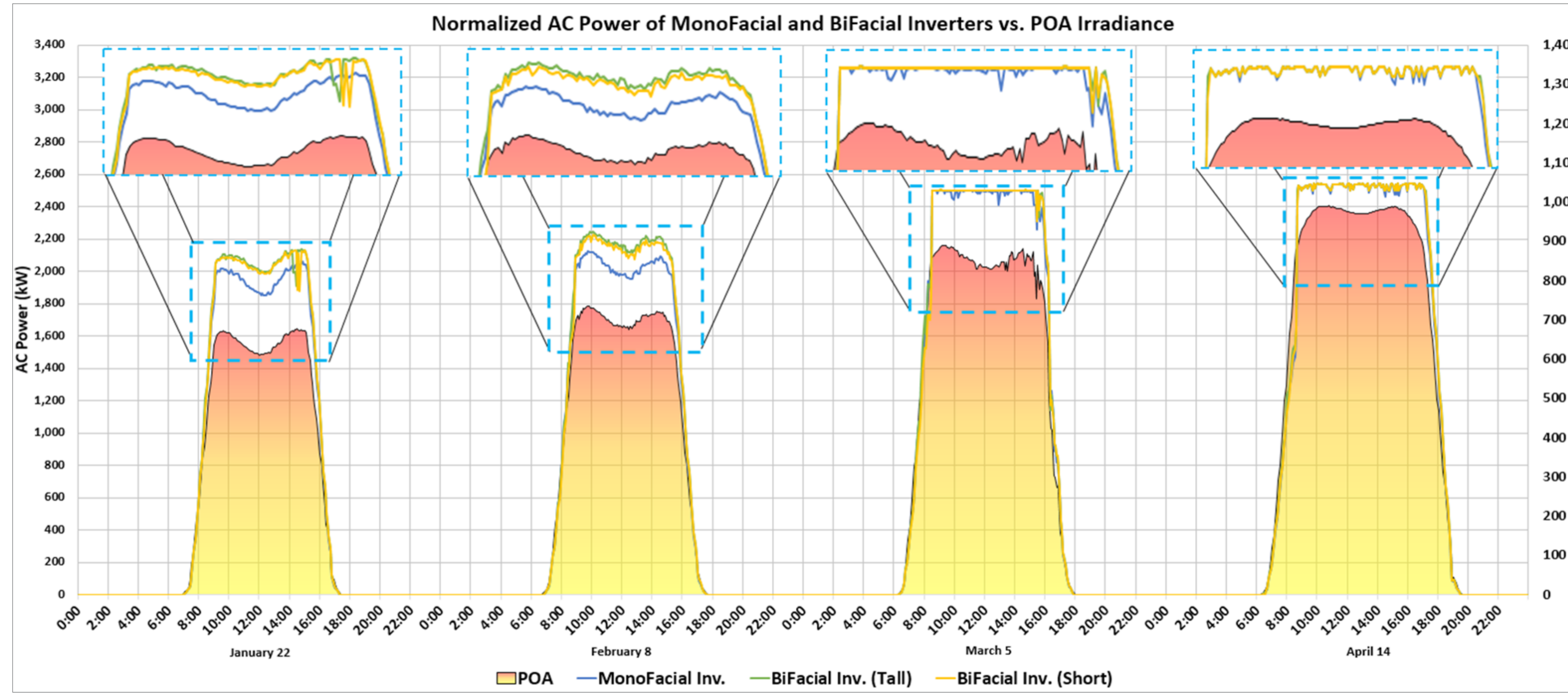Presented by Jaya Mallineni & Chris Raupp

SWINERTON RENEWABLE ENERGY   solv

Bifacial Module Tracker Array

Mono-Facial Module Tracker Array

Normalized AC Power of MonoFacial and BiFacial Inverters vs. POA Irradiance

POA — MonoFacial Inv. — BiFacial Inv. (Tall) — BiFacial Inv. (Short)


kWh/kW-dc/kWhm⁻²

Performance (%)

PRODUCTION:
Increased production from bifacial gain on single axis trackers can be seen during times of non clipping intervals, but once inverters reach max AC capacity, there is no additional gain.

PERFORMANCE:
Each inverter was compared to their respective models to view how well they were operating.

BiFacial Gain- (% Energy Gain, % Power Gain,% Imp Gain)

Energy Gain Power Gain Imp Gain
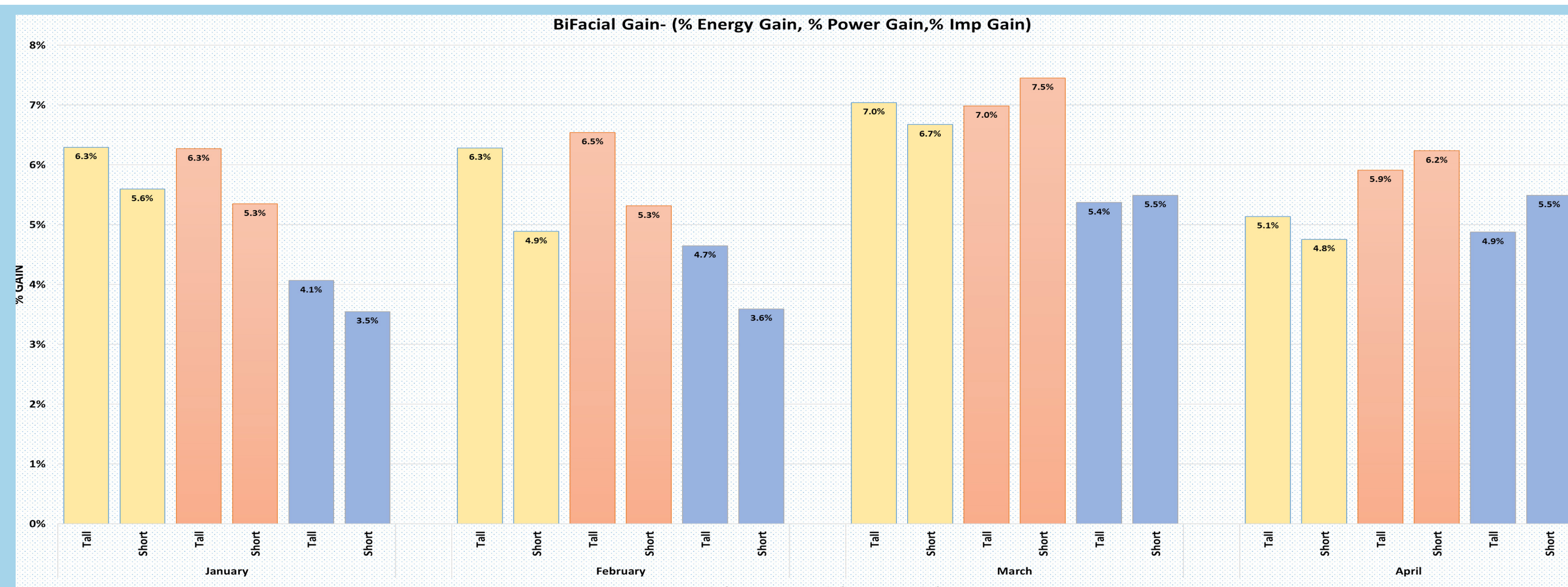
+ BIFACIAL GAIN OBSERVED FROM ENERGY, POWER & OPERATING CURRENT (IMP) IN COMPARISON WITH MONOFACIAL MODULE
+ BIFACIAL GAIN OBSERVED FOR THE MONTHS OF JANUARY TO APRIL WAS BETWEEN 3.5% TO 7.5% AND THE AVERAGE BIFACIAL GAIN DERIVED FROM ALL THREE GAINS WAS 5.8%

OBSERVATIONS:

- Production and performance were derived using both no filtering and filtered data sets, and shows us how good filtering aids to see the true performance.
- Bifacial modules on tall tracker has shown more production and performance than the bifacial modules on short tracker.
- Instantaneous bifacial gains are higher at lower irradiance levels.
- Instantaneous bifacial gains are observed to be higher at noon and during the start of the day and end of the day the bifacial gains are lower.
- Instantaneous bifacial gains are higher when there is unstable irradiance due to higher diffused light.
- A complete year data would give more insight into the complete bifacial gain trend and the factors affecting.

TIME OF DAY

Instantaneous BiFacial Gain vs. Time of Day
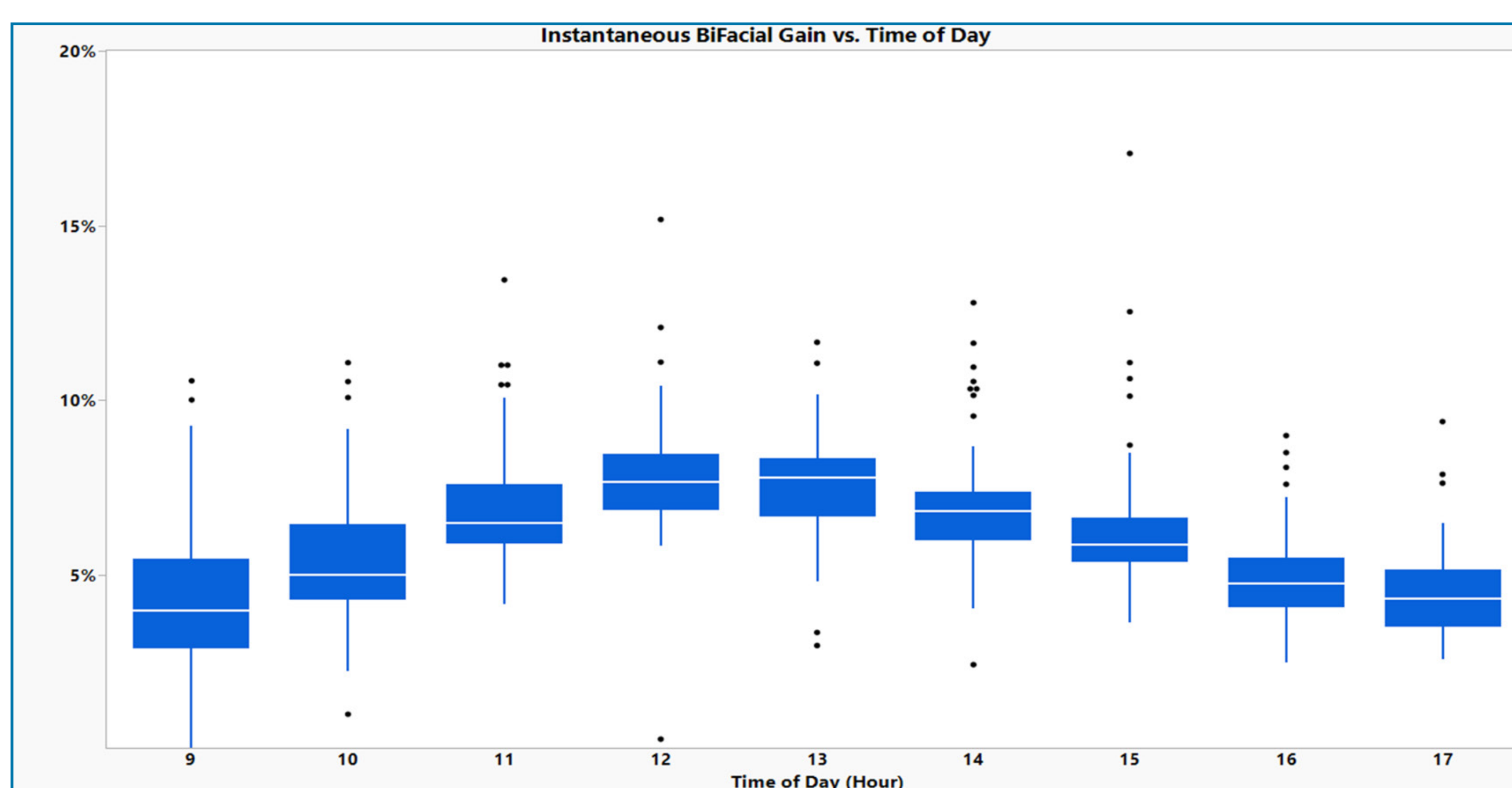
Instantaneous bifacial gains show that the time of most observed gain is during solar noon period (12pm – 1pm) when the one axis trackers are flat.


Instantaneous BiFacial Gain vs. Tracker Position and POA Irradiance
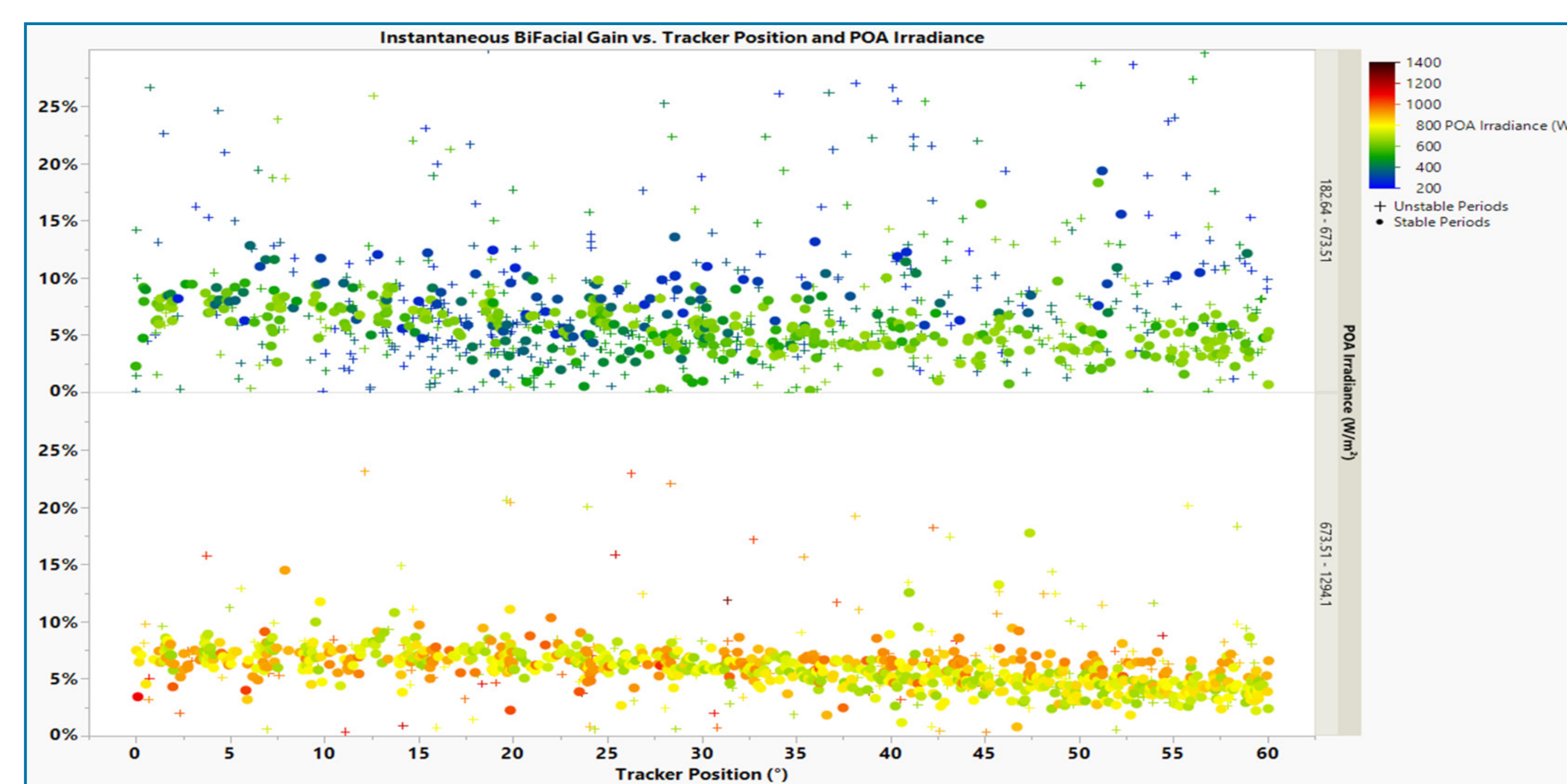
Instantaneous bifacial gains reduces as the tracker moves from flat zero degree position to higher tilt angle.


Instantaneous BiFacial Gain vs. Angle of Incidence
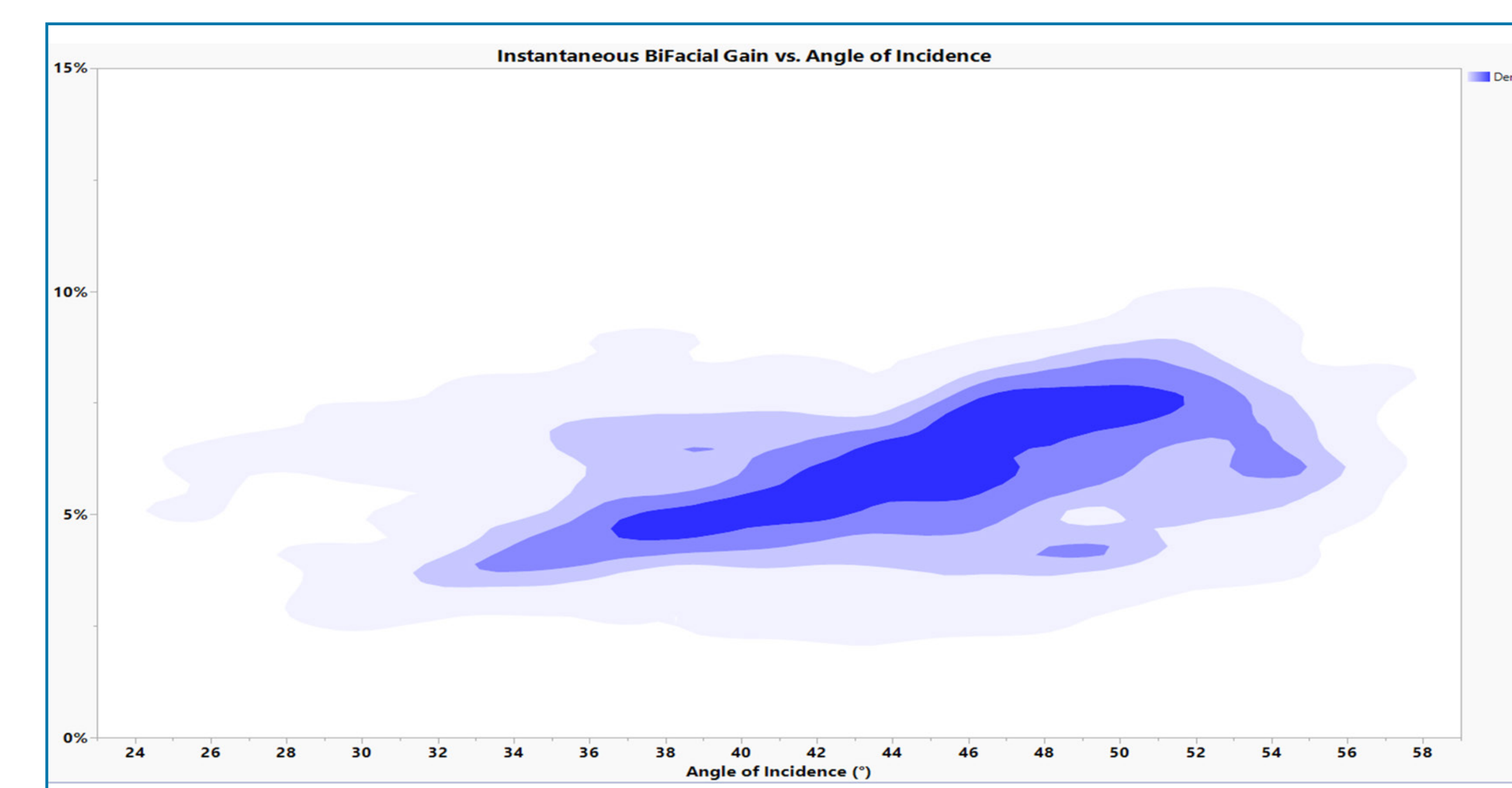
Instantaneous bifacial gains increase as the angle of incidence increases.

POA IRRADIANCE


Instantaneous BiFacial Gain at Various POA Irradiance Bins
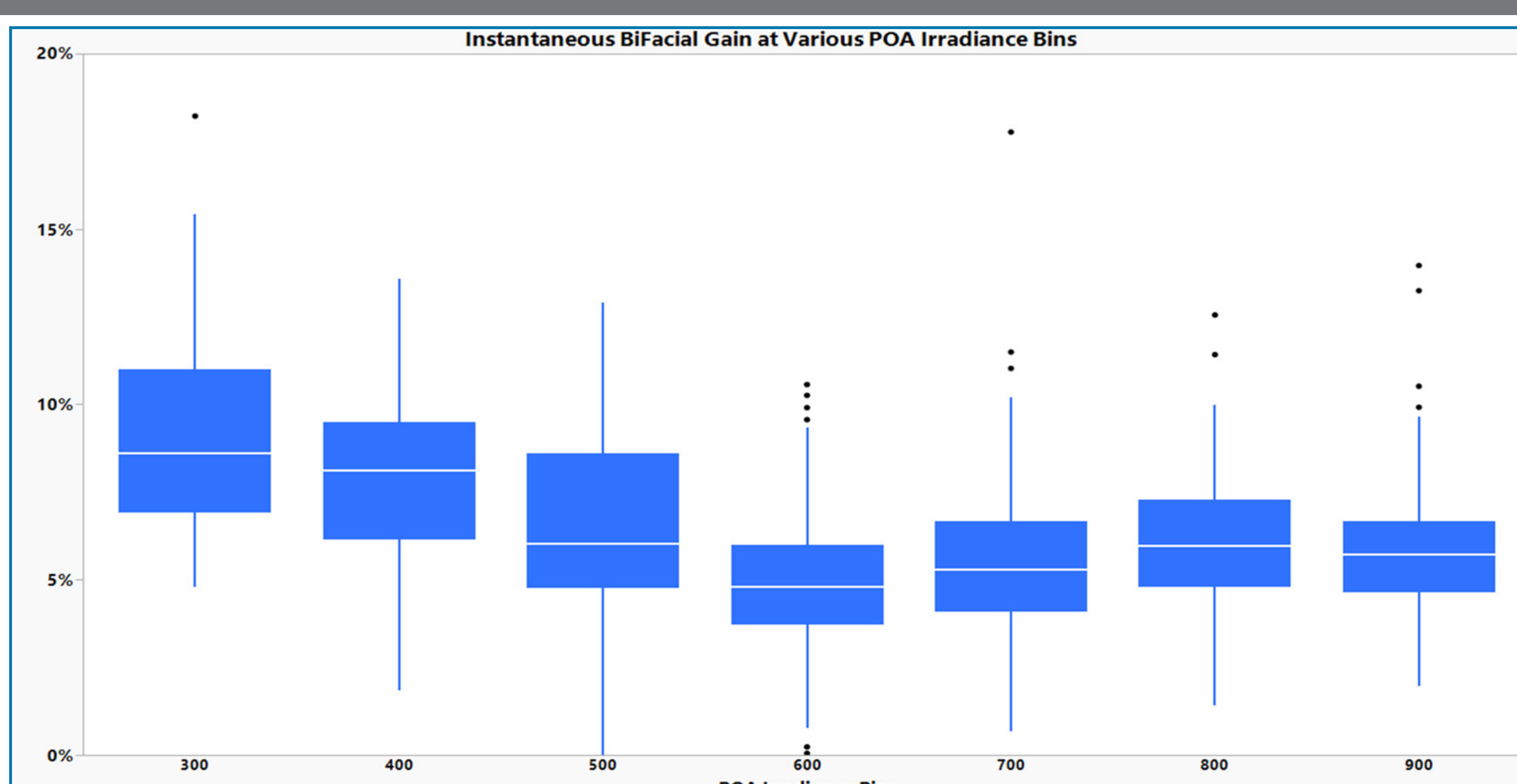
Instantaneous bifacial gains show that during low irradiance days is when the most significant gain can be found.

Instantaneous BiFacial Gain vs. POA Irradiance
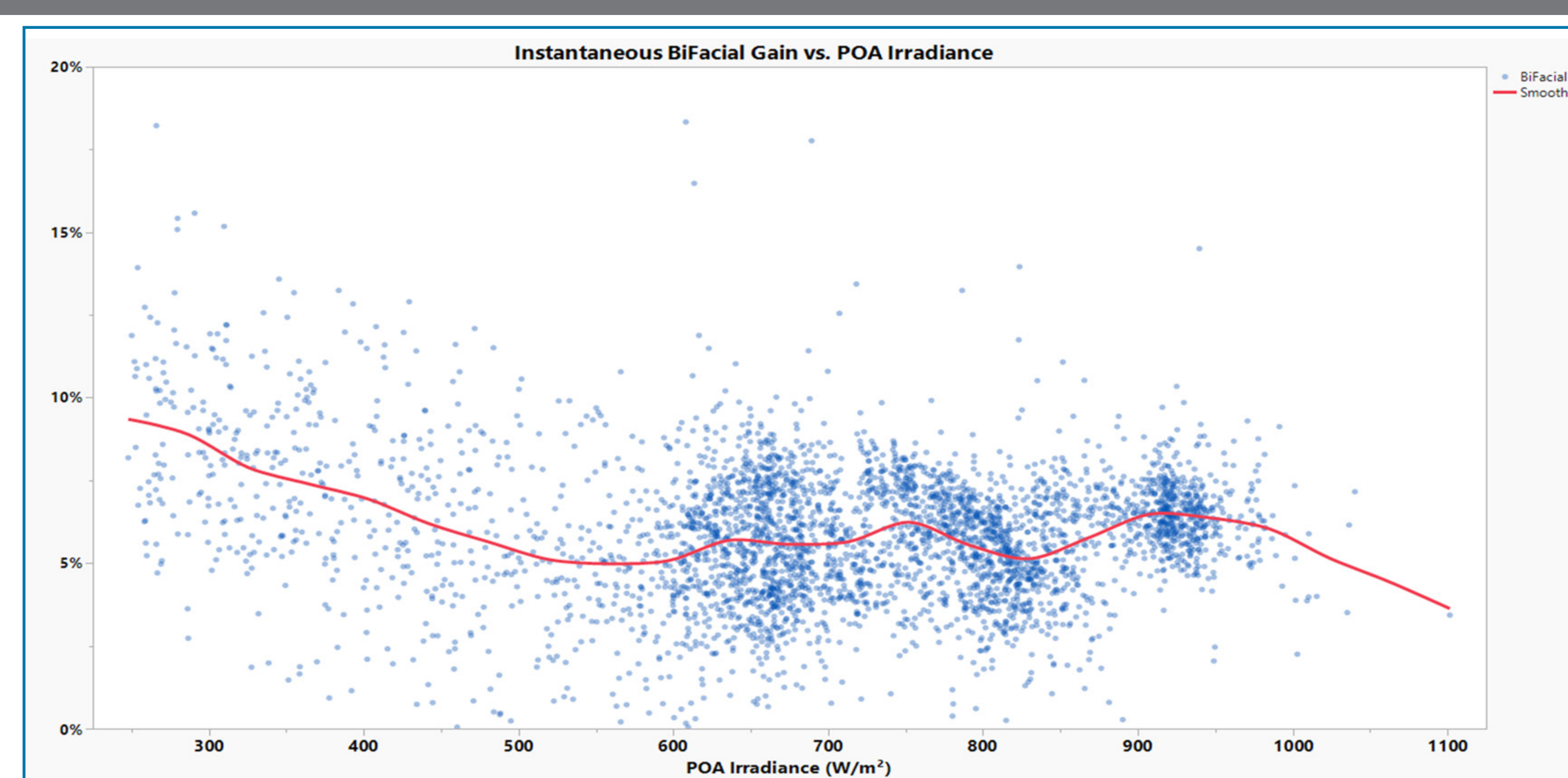
Instantaneous bifacial gains show that at lower irradiance higher gain is observed with large spread in the gain, whereas when the irradiance gets to higher levels the bifacial gain spread reduces with a lower gain.

Instantaneous BiFacial Gain vs. Albedo
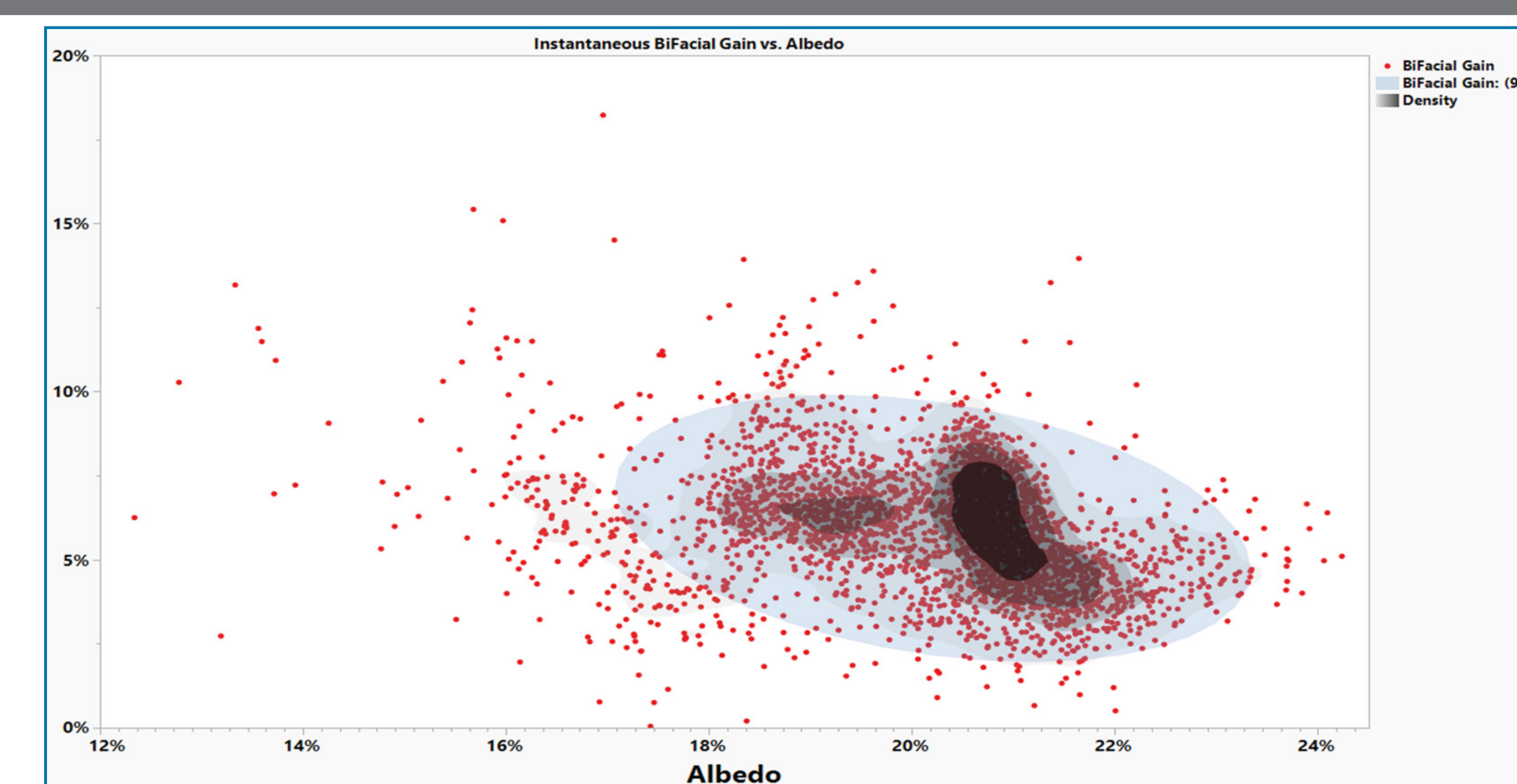
About 90% of the instantaneous bifacial gains were observed when the albedo is between 0.18 to 0.22.