

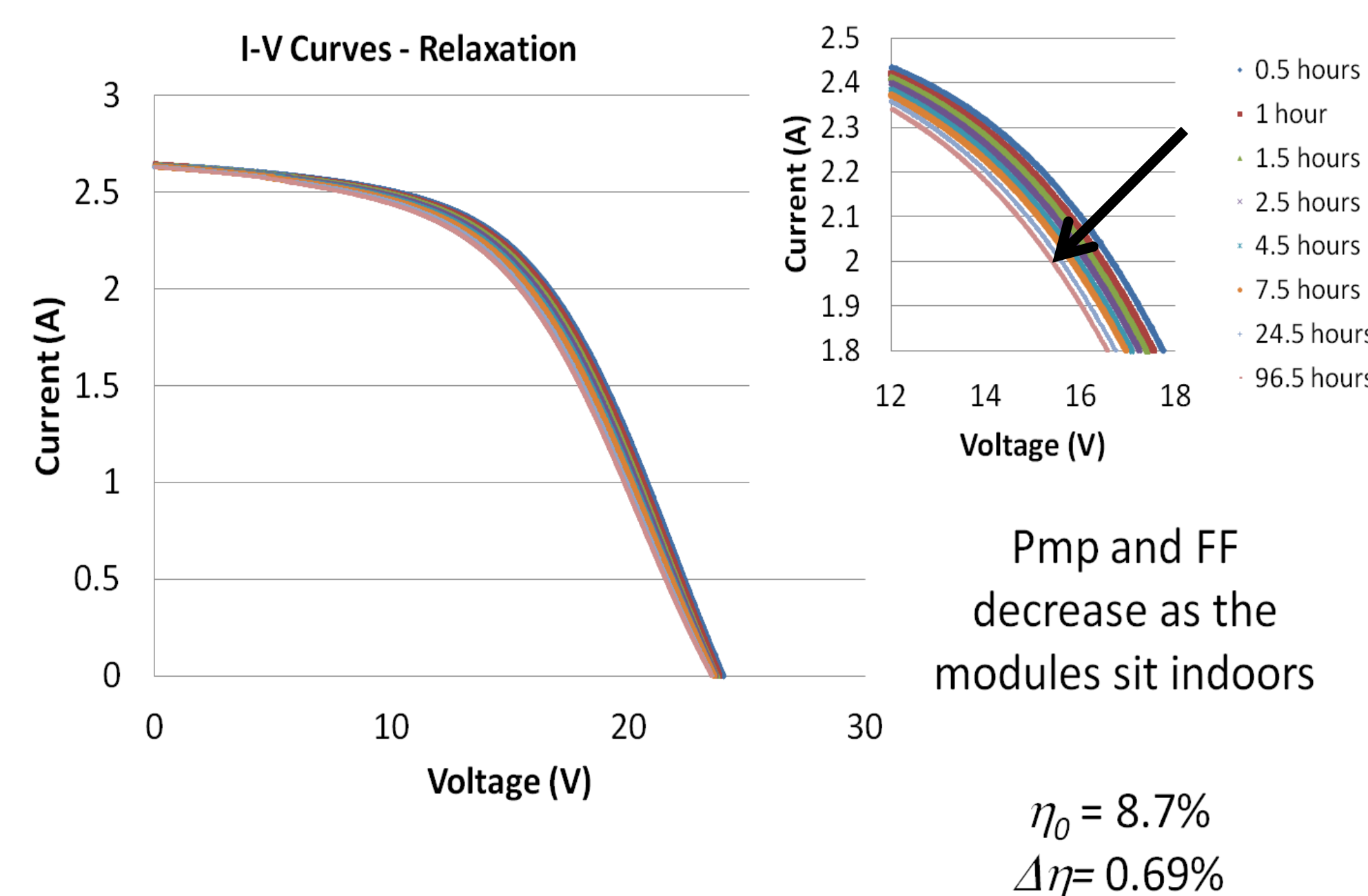
Light soaking behavior and an alternate stabilization method for CIGS modules

Adam Stokes, Chris Deline, John Wohlgemuth, Sarah Kurtz, Steve Rummel, Allan Anderberg, and Matt Weber

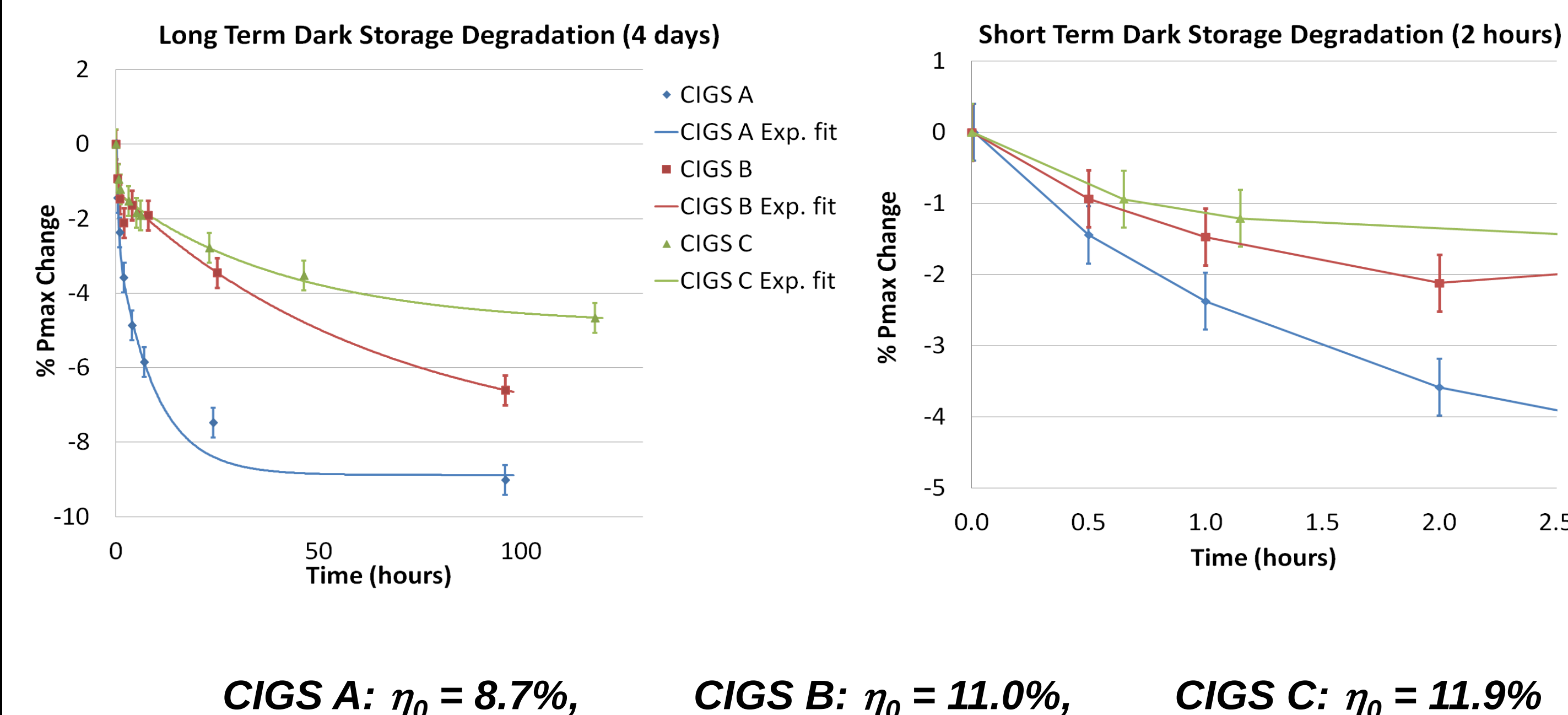
Motivation

- Stabilize CIGS modules for accurate electrical measurements
- Gain insight on variability of metastabilities associated with light soaking and forward bias of different CIGS products
- Determine whether forward bias is a useful substitute to light soaking

I-V curves, dark storage progression (Typical CIGS Module)

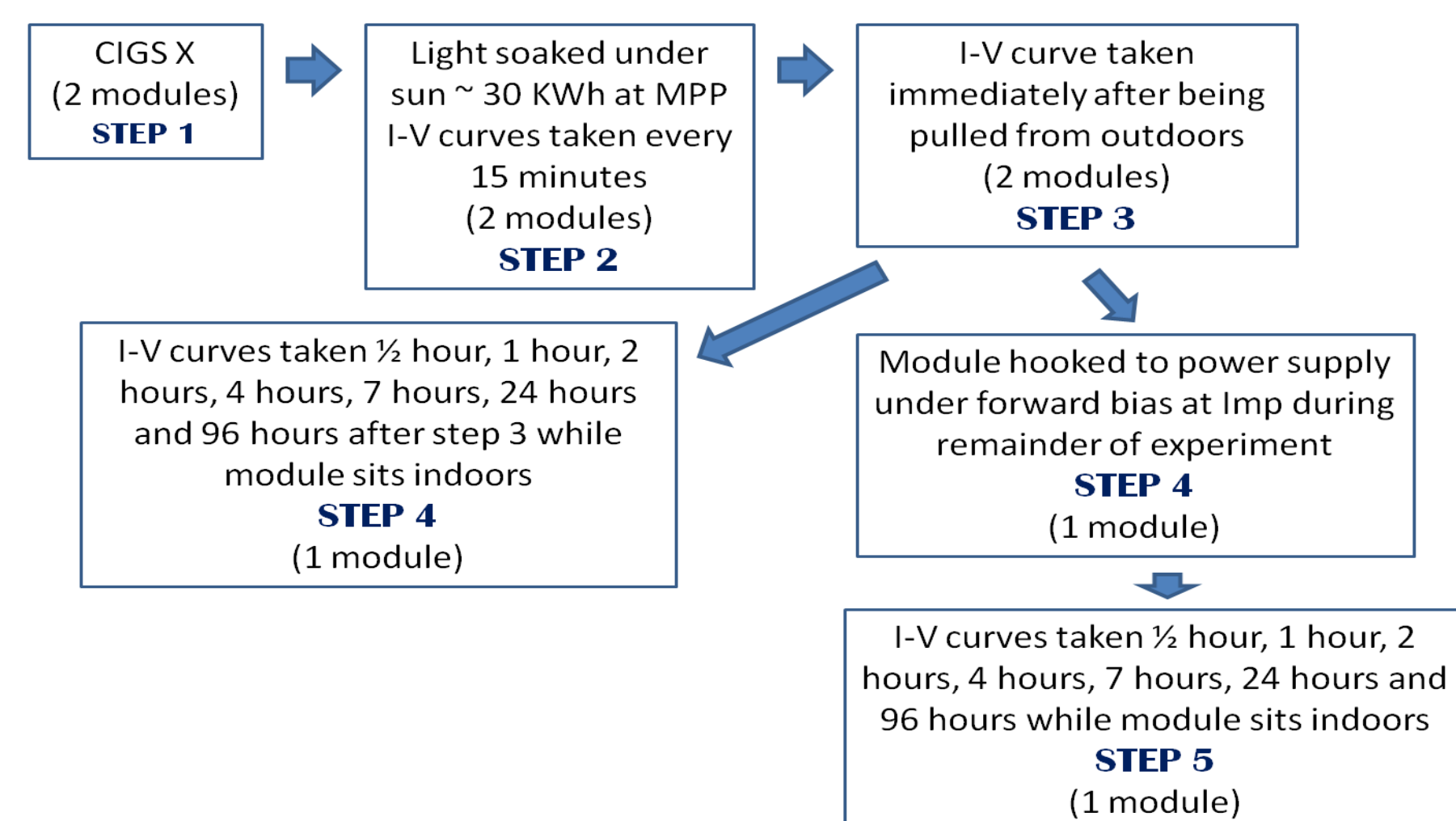


Dark Storage Degradation

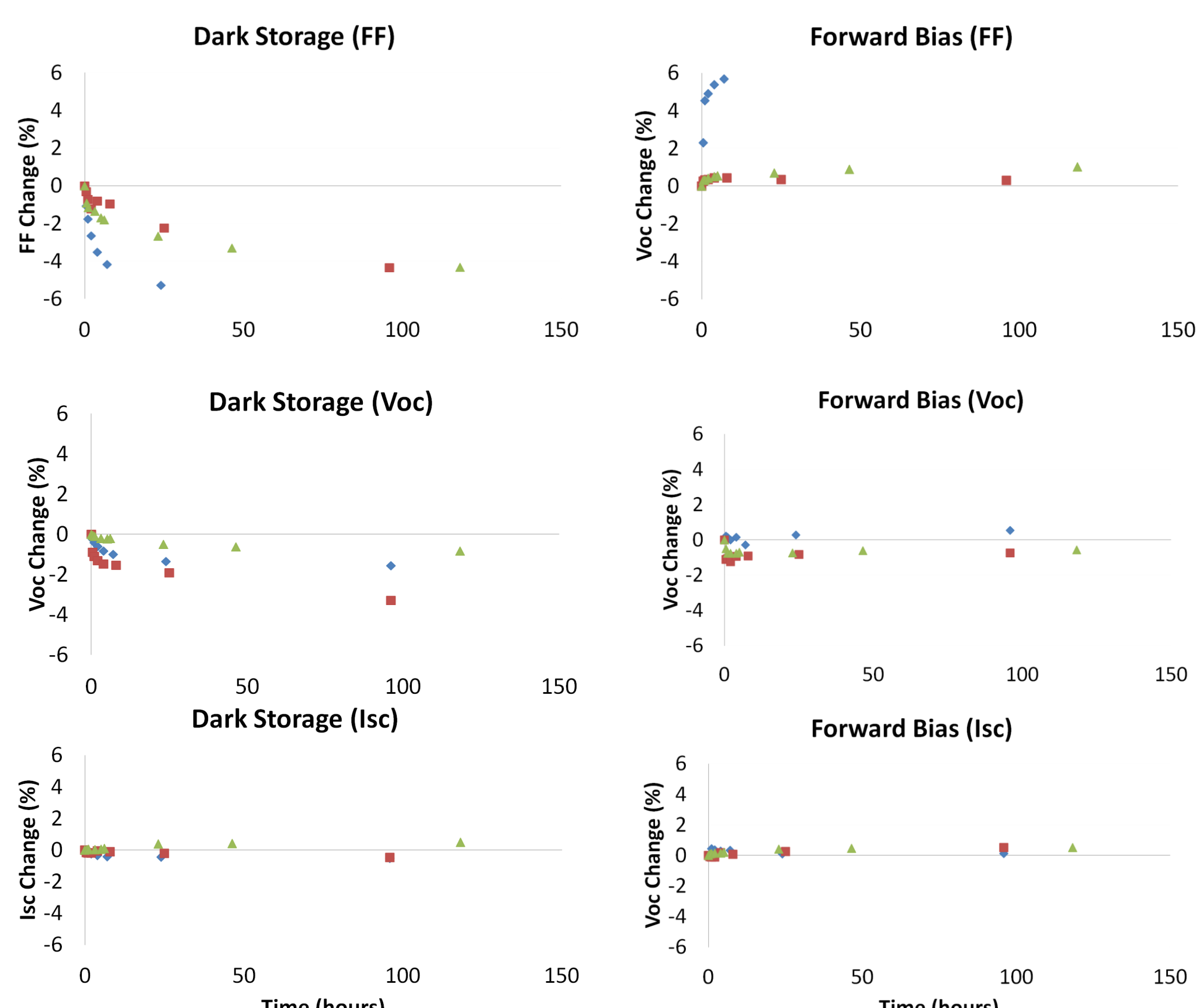
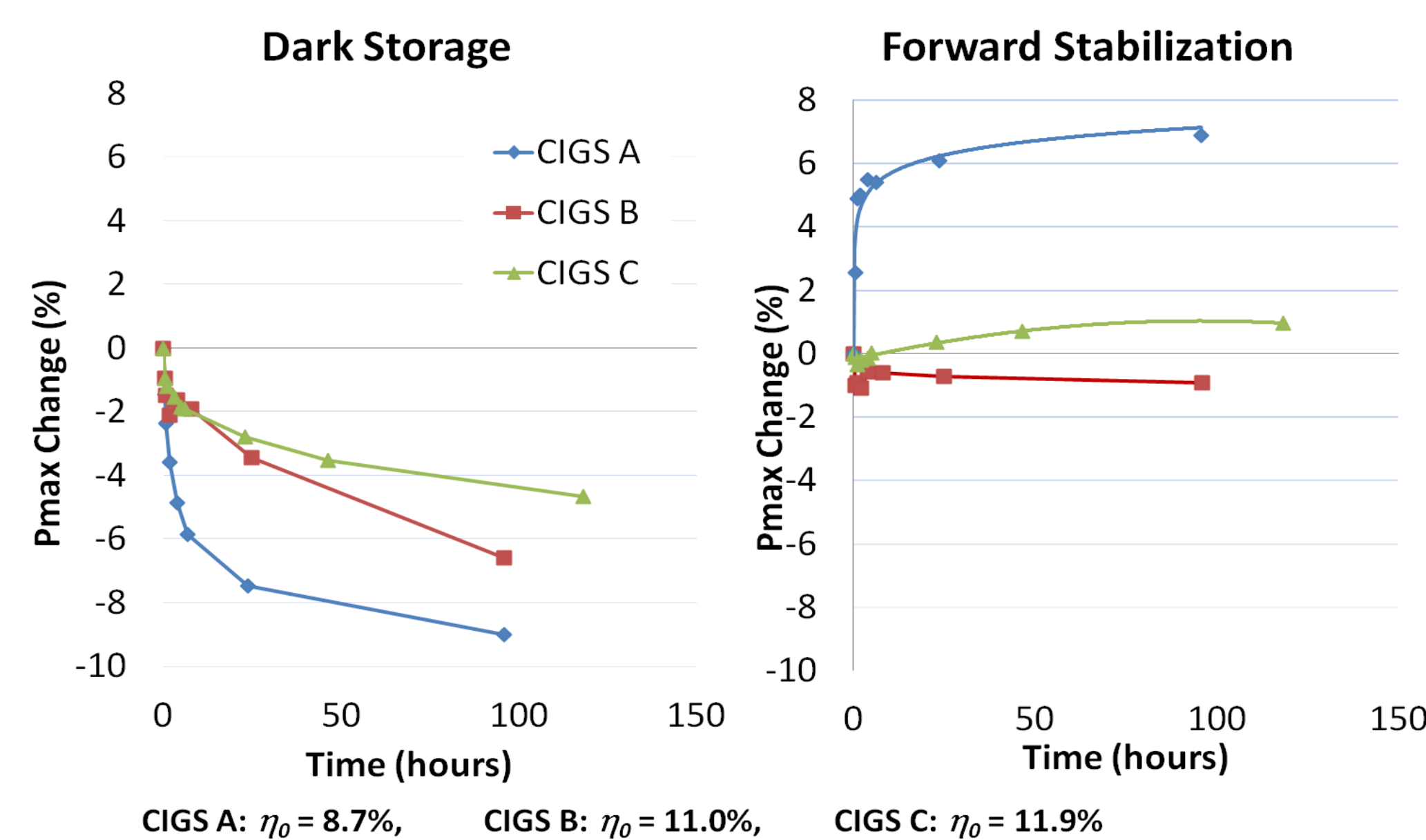


Dark Storage VS Forward Bias 3 CIGS

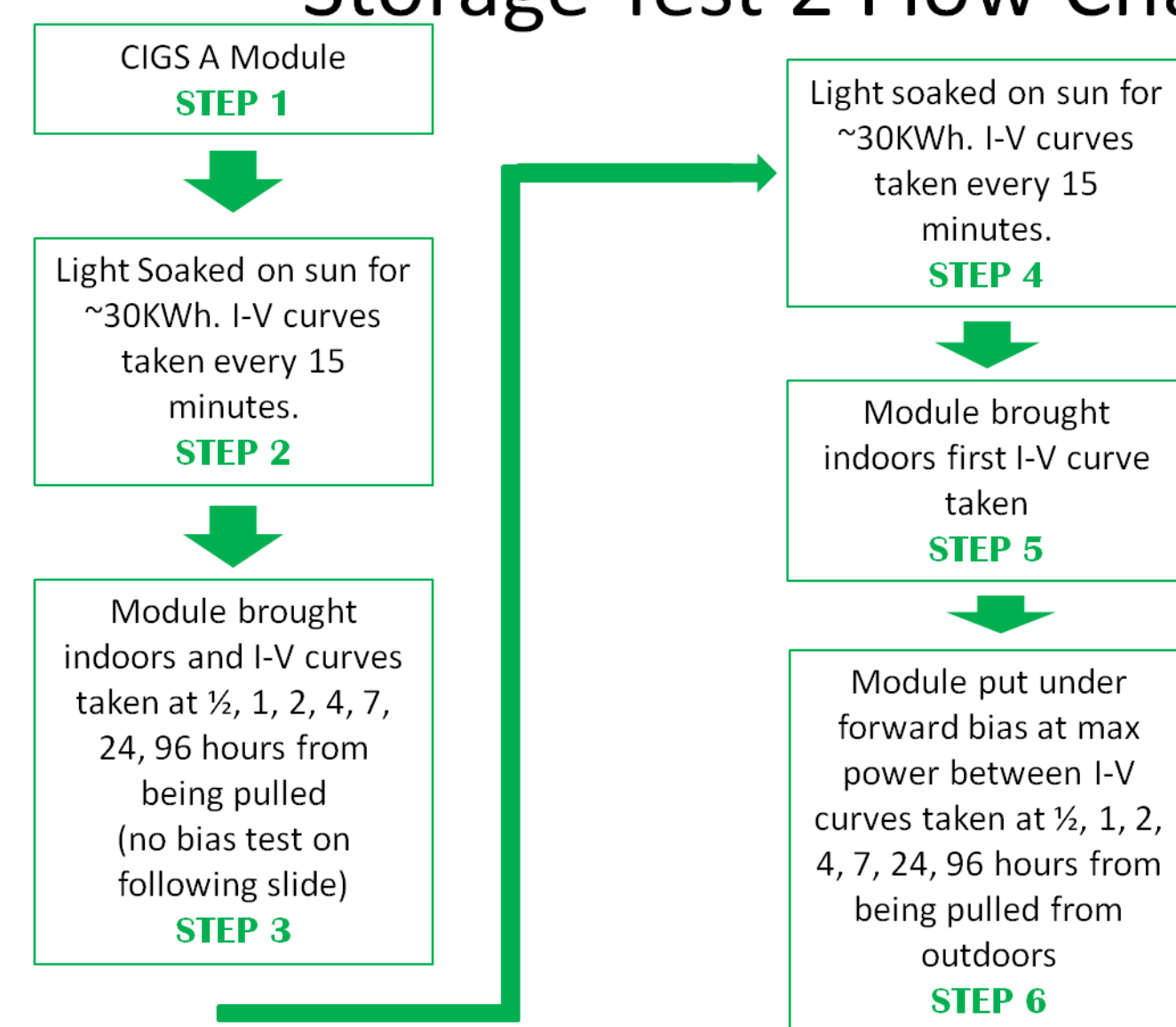
Products Test 1 Flow Chart



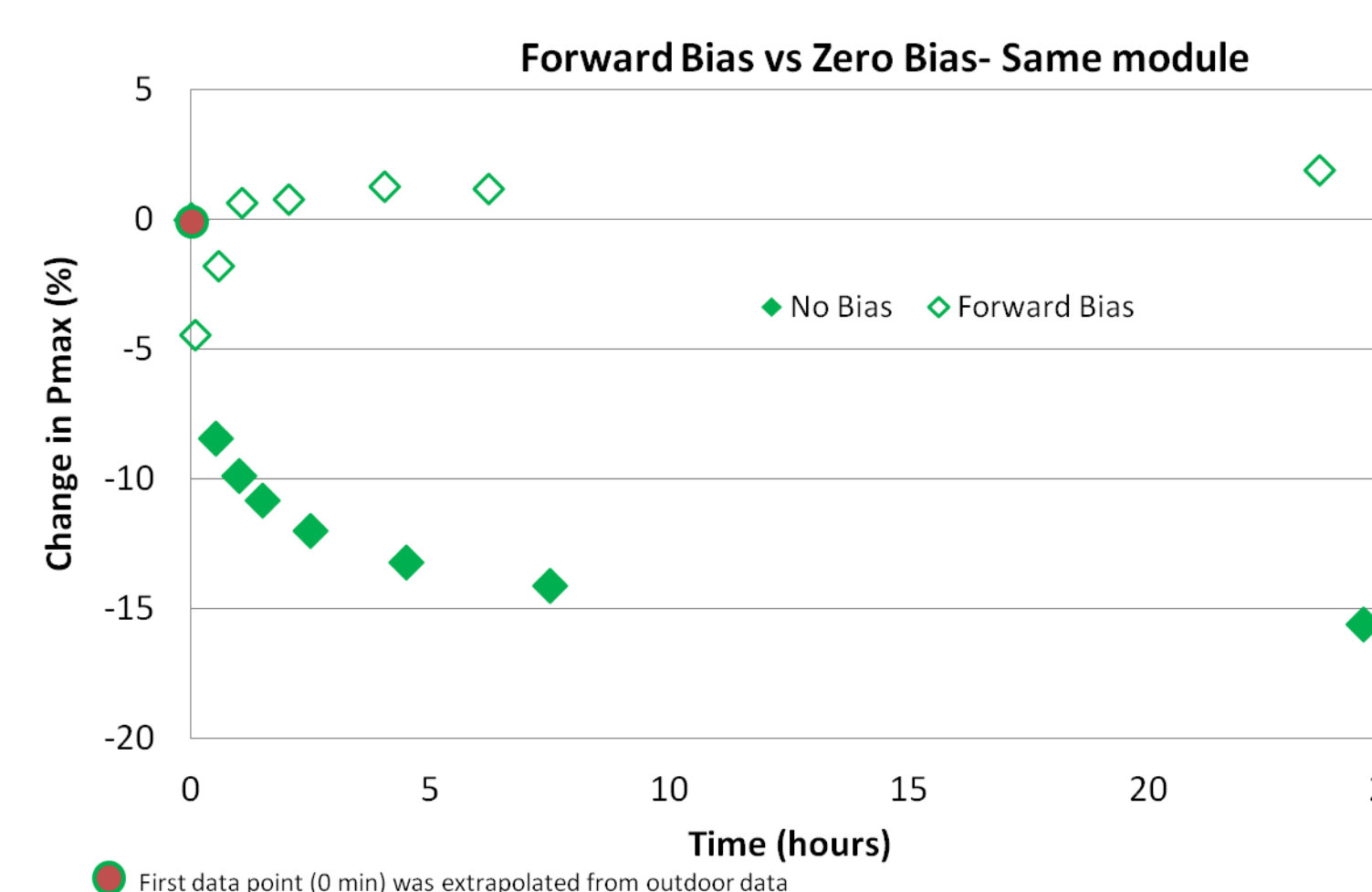
Forward Bias Stabilization VS Dark Storage Relative To First Indoor Point



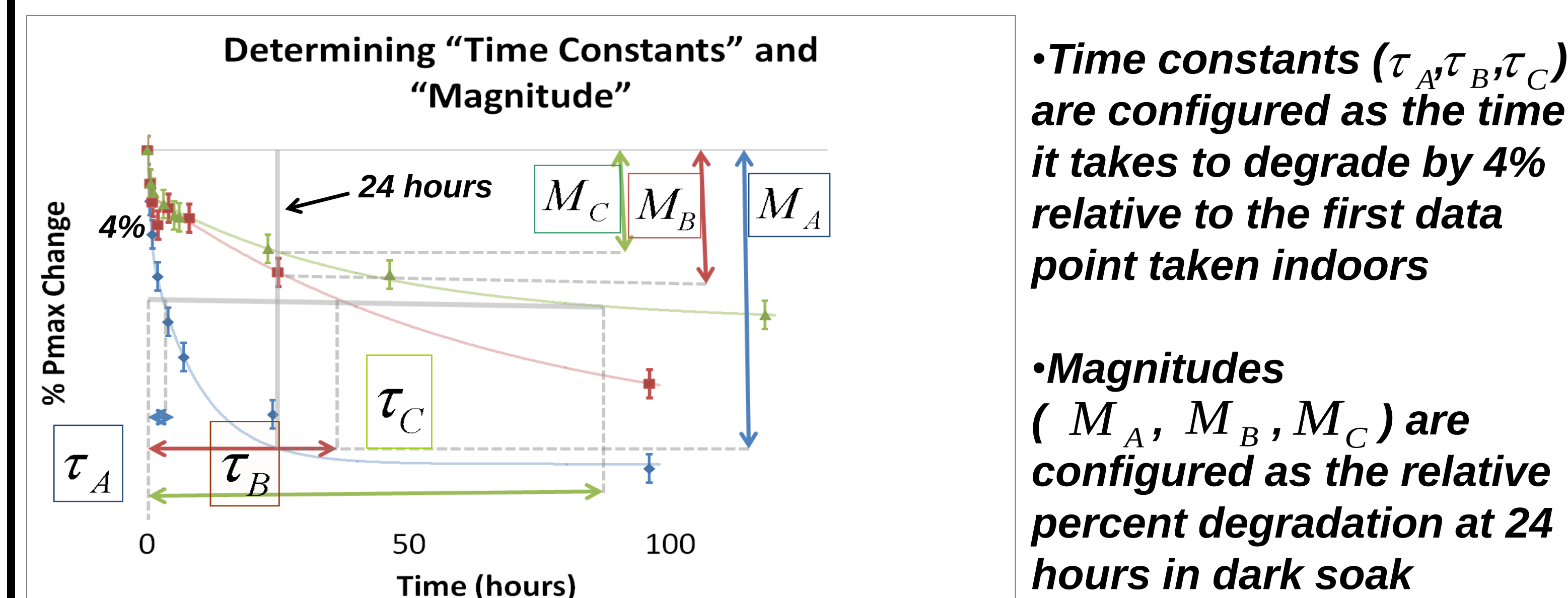
CIGS A Module Forward Bias vs Dark Storage Test 2 Flow Chart



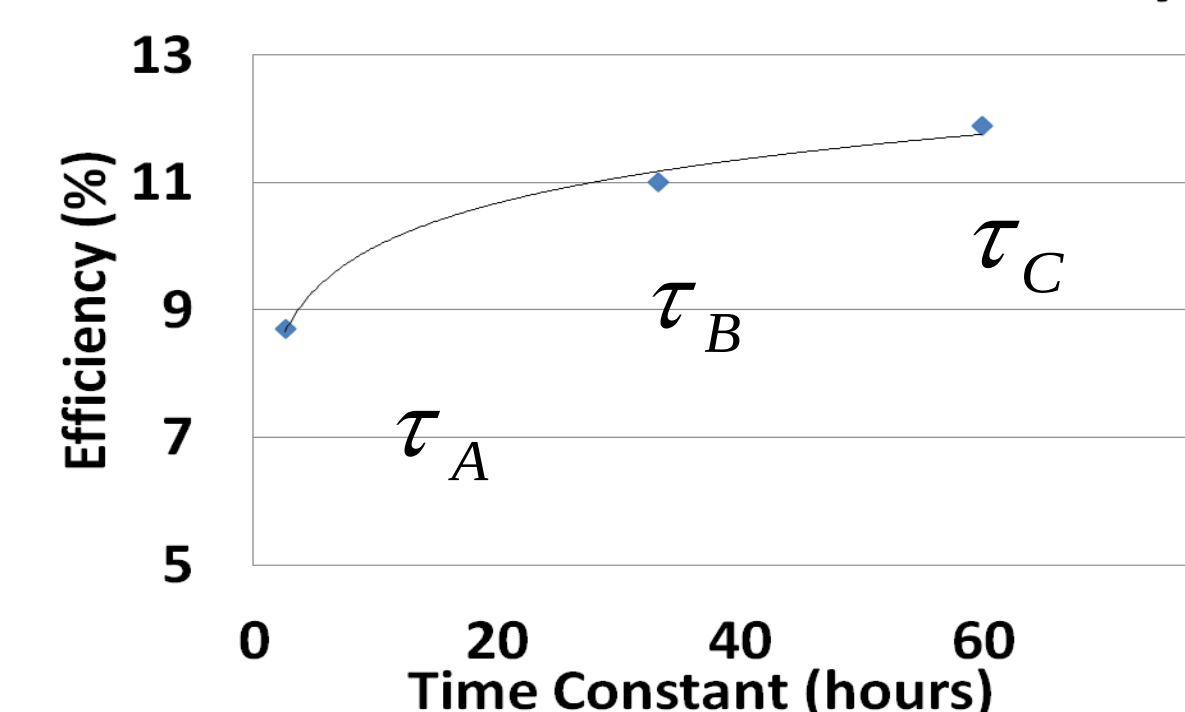
CIGS A module, Forward Bias vs dark storage



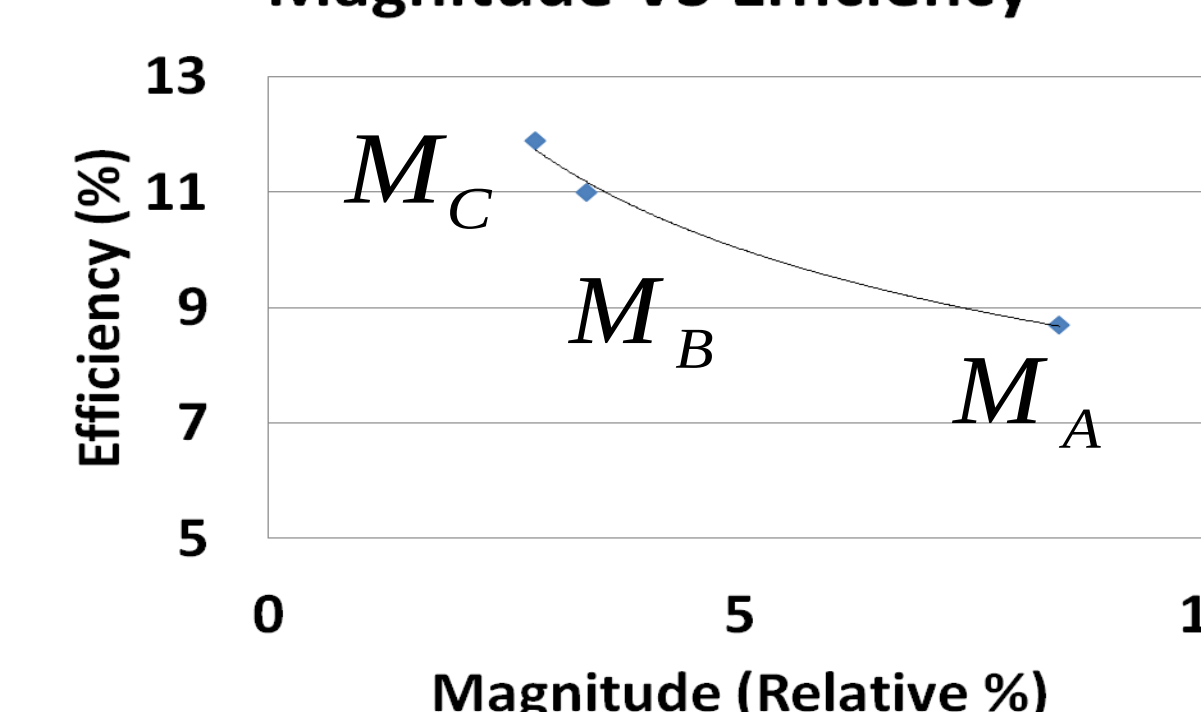
Efficiency and Metastability Correlation



Time Constant VS Efficiency



Magnitude VS Efficiency



Conclusions

- Dark storage after light soak changes the simulator measured efficiency
- Times range from 3-60 hours for a decrease in Pmax by 4% depending on CIGS product
- Forward bias could be useful for stabilizing the simulator measured efficiency close to an outdoor measured value
- Metastability drivers
 - Isc doesn't vary
 - Change in FF dominates
 - Change in Voc varies with sample
- Metastability magnitude tends to decrease as STC efficiency increases

Outdoor Correlation

