

Secondary Circuit Model Generation Using Limited PV Measurements and Parameter Estimation

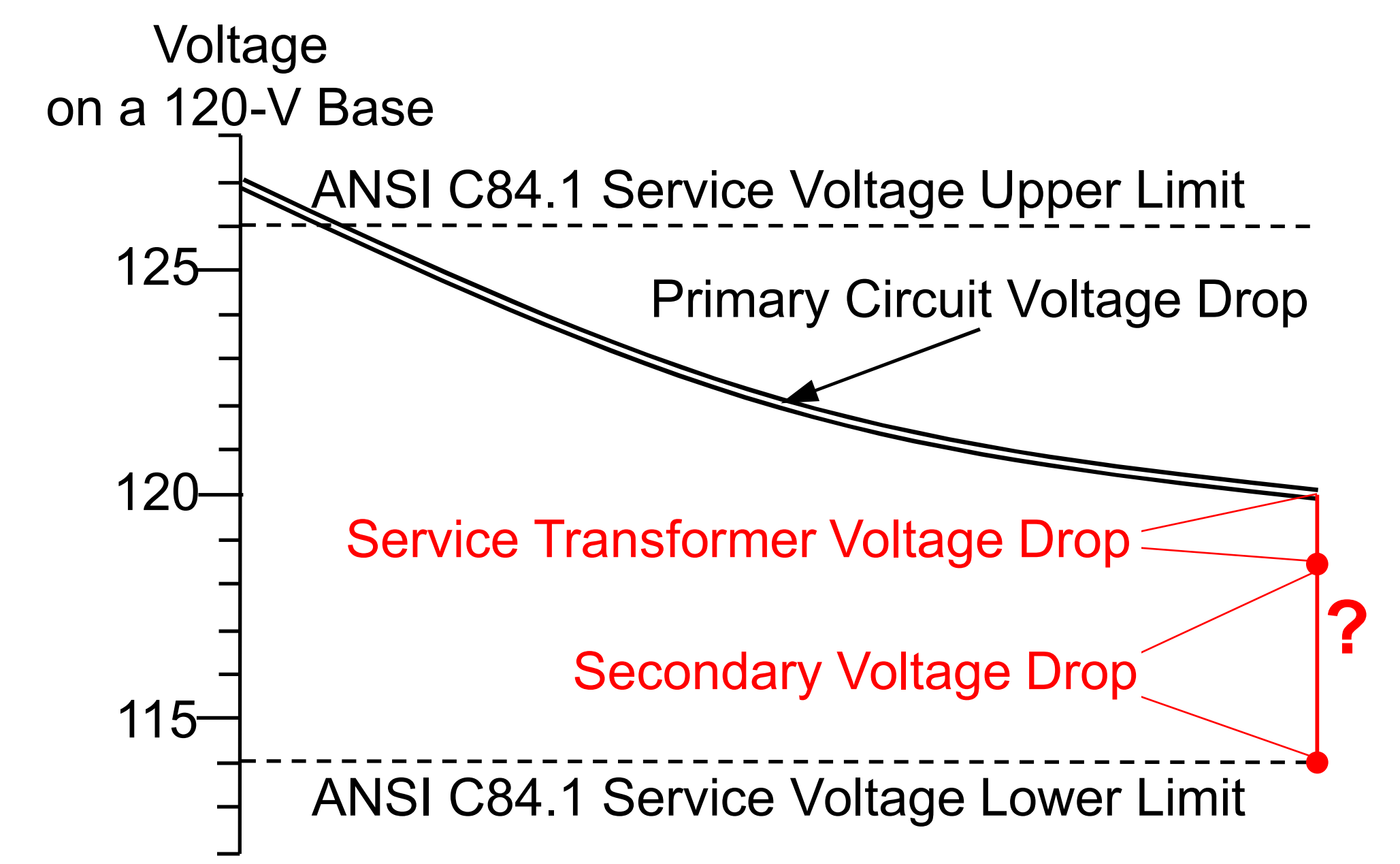
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Motivation

Operating distribution systems with a growing number of distributed energy resources (DERs) requires accurate feeder models down to the point of interconnection.

Many DERs are located in the secondary low-voltage distribution circuits that typically are not modeled or modeled with low level of detail.

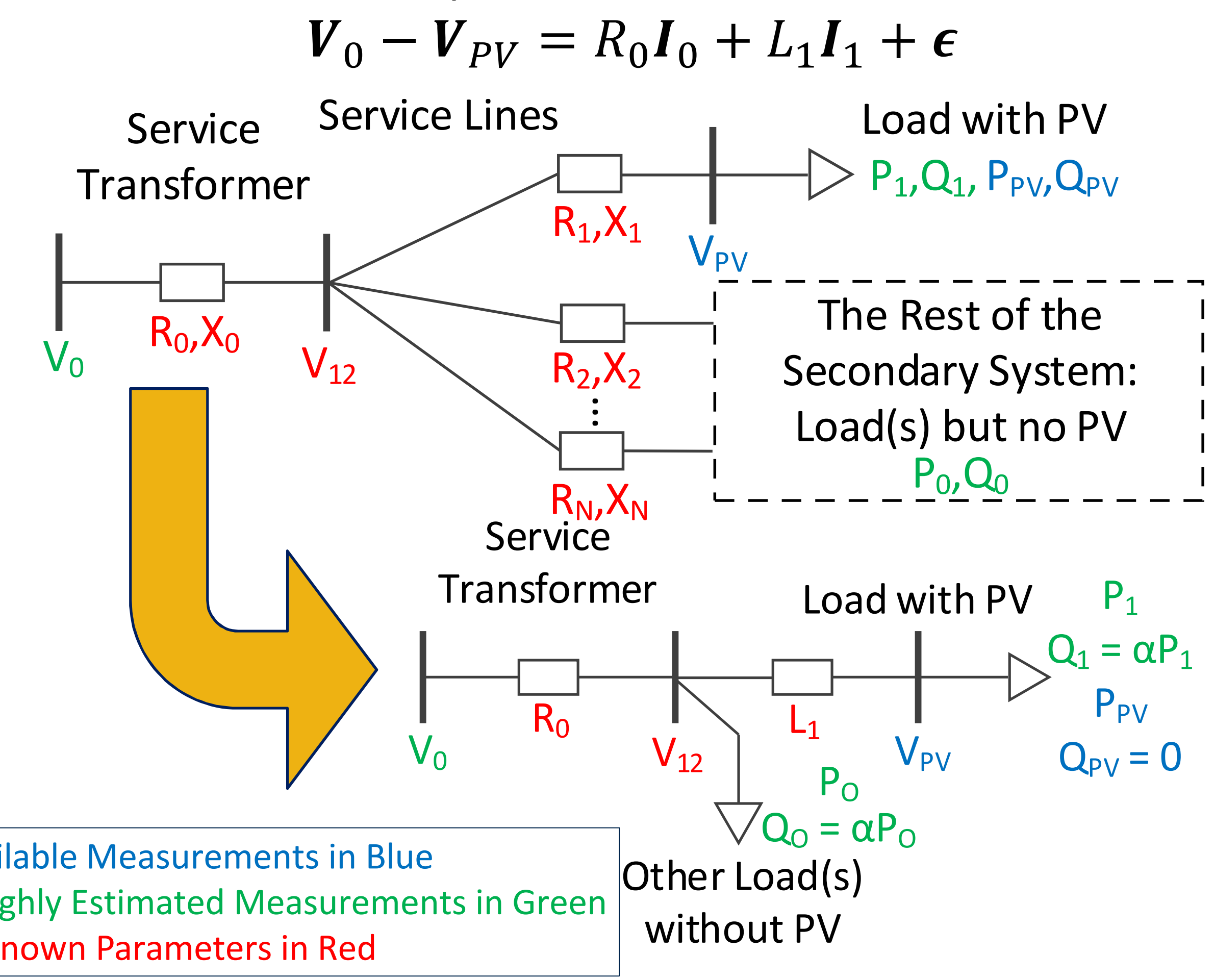


Simplified Secondary Modeling

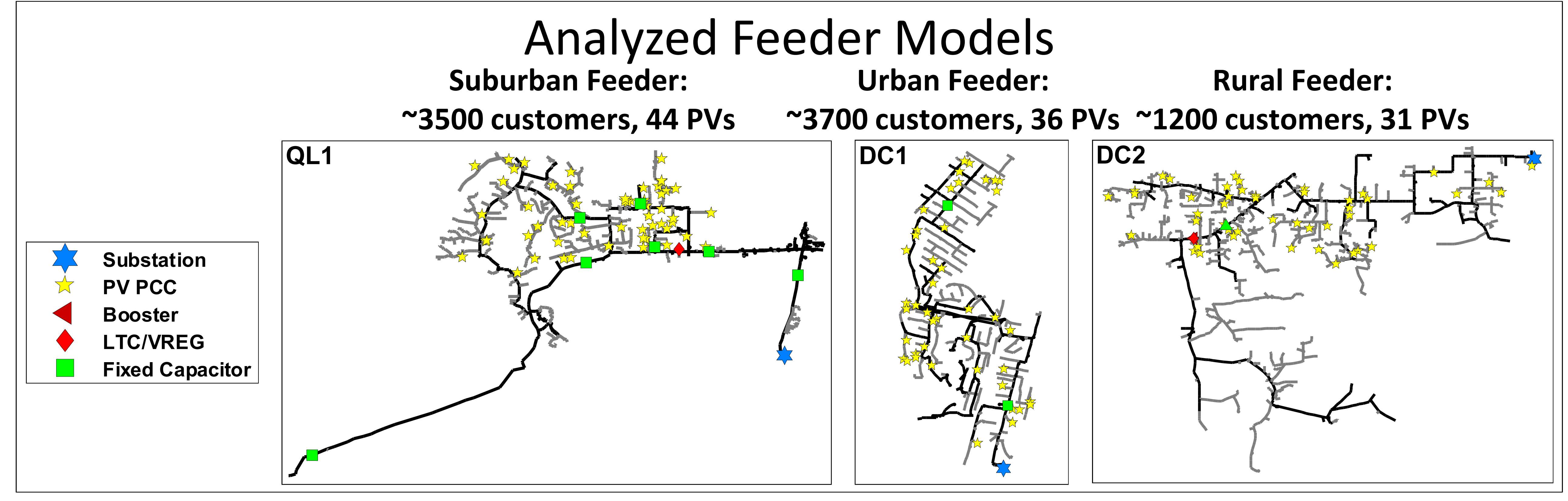
Objective: Improve the voltage simulation accuracy at metered points in the secondary circuits

Limitation: All loads are not metered and some older meters may not transmit voltage measurements

Remedy: Create simplified secondary circuit models and estimate their parameters with



Available Measurements in Blue
 Roughly Estimated Measurements in Green
 Unknown Parameters in Red

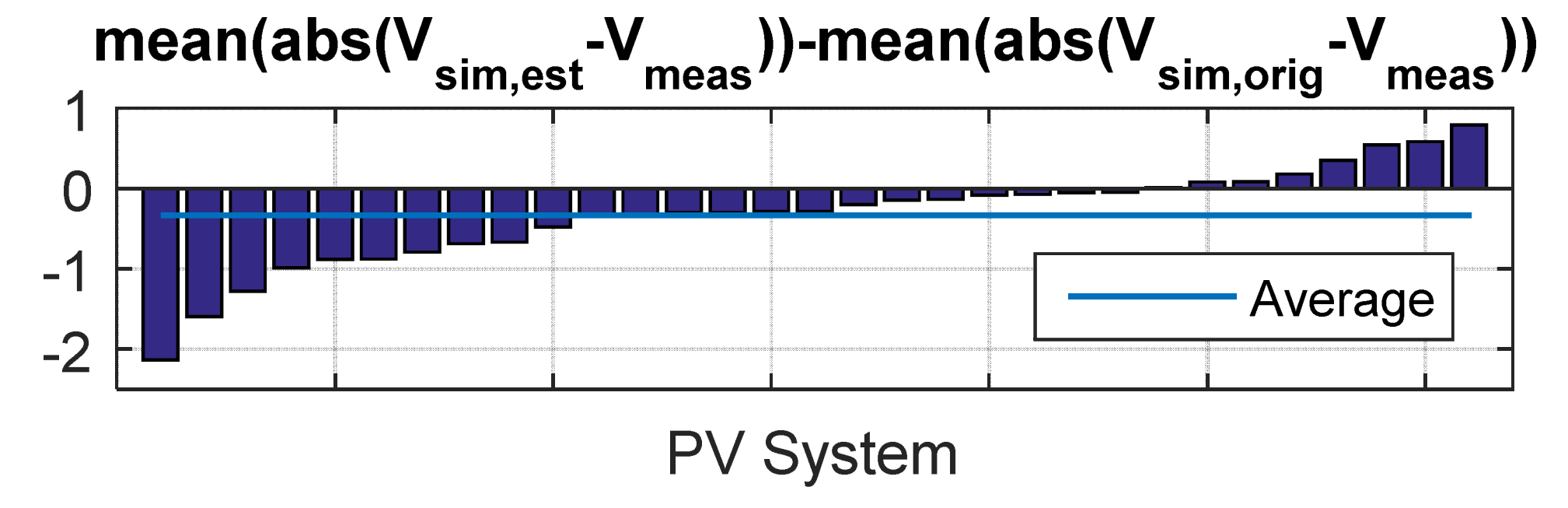


Practical Feeder Model Limitations

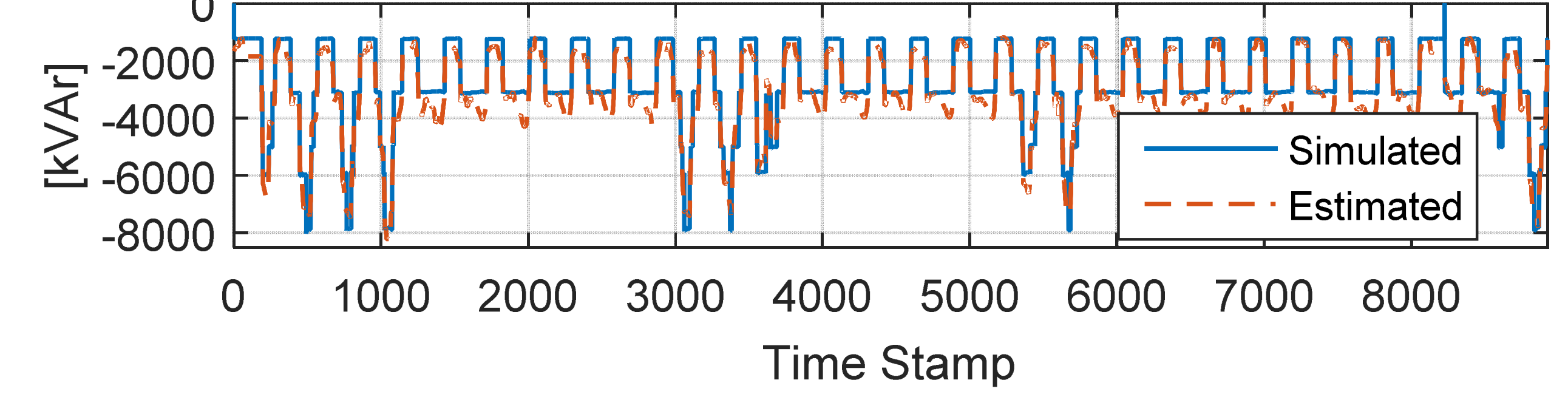
Substation load allocation does **not** provide sufficient detail for secondary model generation.

The primary circuit model accuracy of the analyzed feeders was found uncertain in the following three ways:

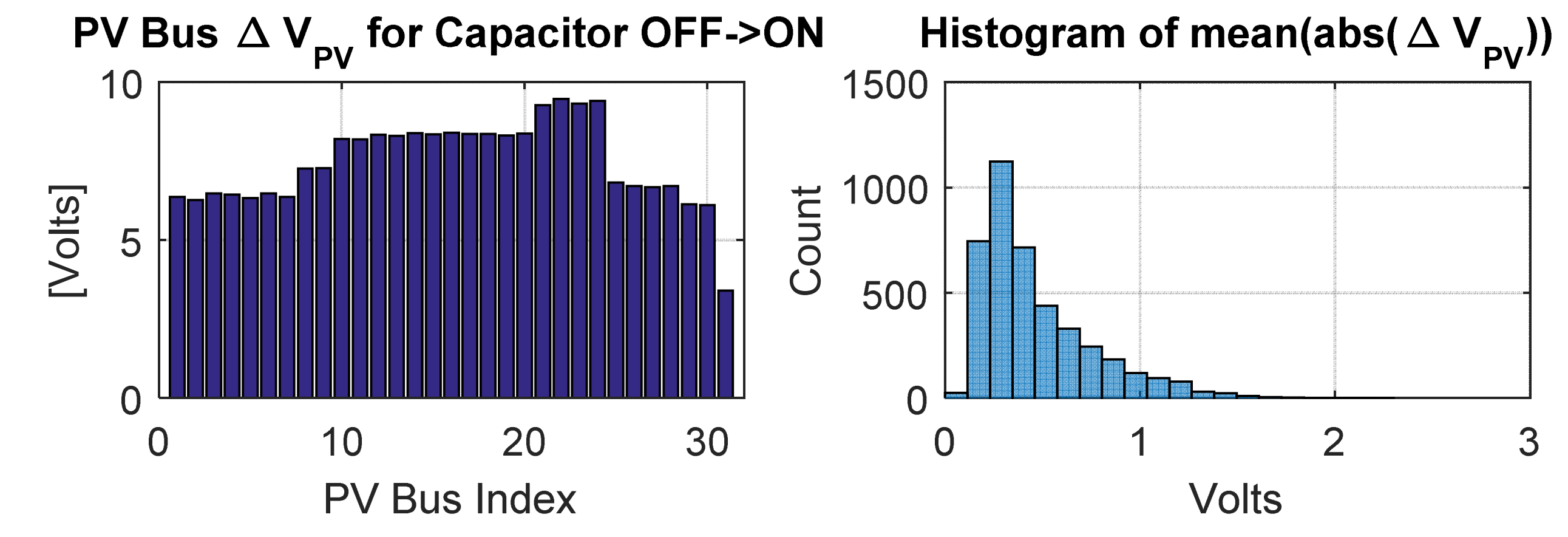
1. All three feeders had uncertain LTC set points



2. Feeder QL1 had 6 temp.-controlled capacitors with unknown states



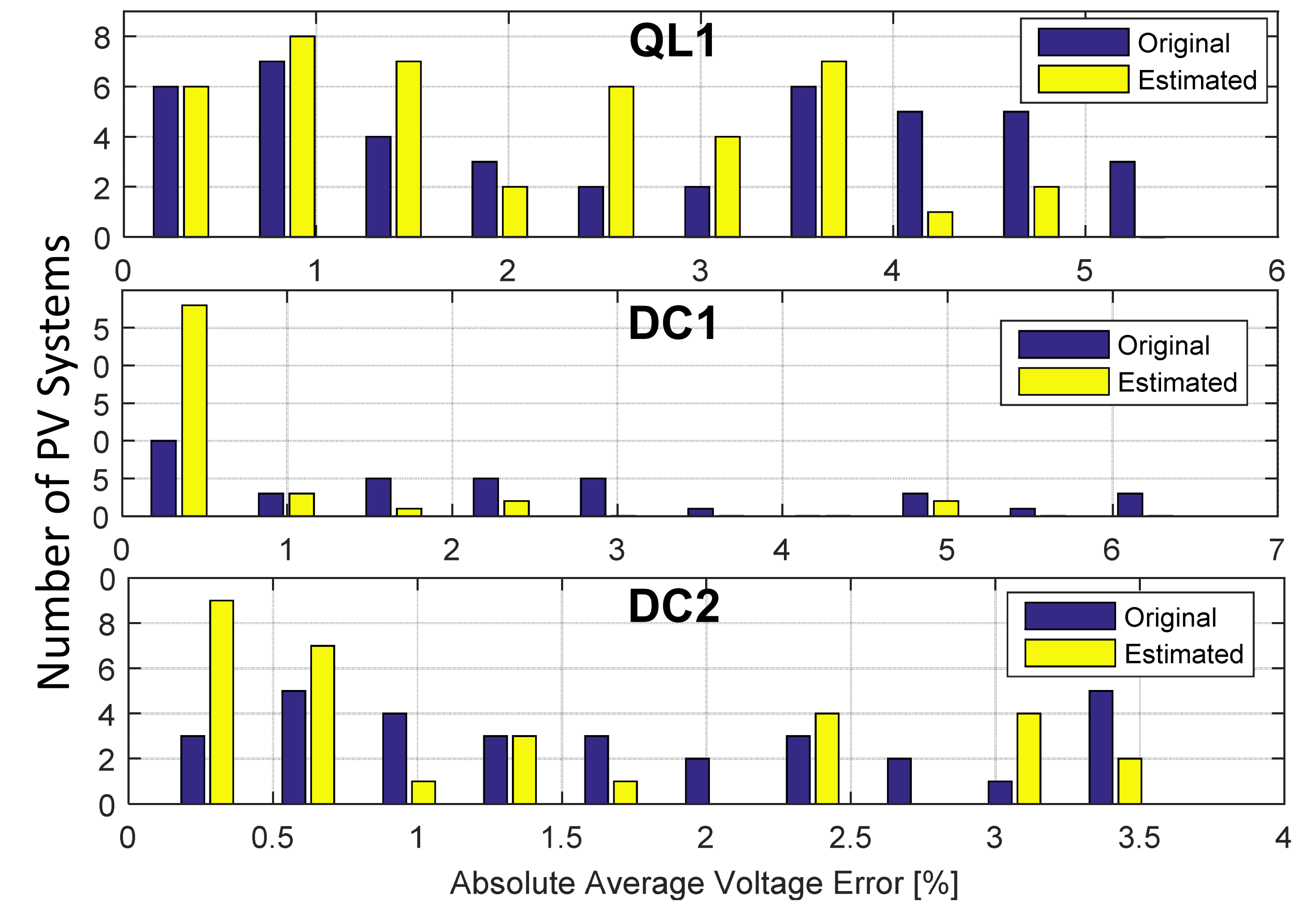
3. Feeder DC2 had a voltage controlled capacitor with unknown states



Results

Average error reductions in simulated PV voltages:

- QL1: 0.57 Volts (19.3% reduction)
- DC1: 1.64 Volts (71.5% reduction)
- DC2: 0.40 Volts (22.5% reduction)



Using estimated parameters changes locational PV hosting capacity significantly ($\pm 90\%$)

