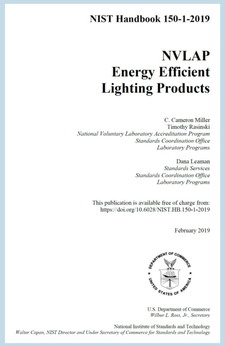
Solid-state lighting measurement assurance program (2)

Cameron Miller, Benjamin Tsai, Yuqin Zong & Maria Nadal
National Institute of Standards & Technology

SSL Standards & Accreditation History

- IES Publishes LM-79-2008 -> LM-79-2019
- 2009 NVLAP Laboratory Accreditation Program
- Measurement assurance program (MAP 1)
  - Jan 2010 – Dec 2014
- Measurement assurance program (MAP 2)
  - Jan 2015 – Dec 2020



Measurement Assurance Program Results

118 laboratories participated

United States (49)		China (45)	Taiwan (9)
Korea (4)	Canada (3)	Netherlands	
Brazil	Singapore	India	
Malaysia	Hungary	Italy	Germany

LEUKOS
The journal of the Illuminating Engineering Society of North America

- MAP 1 results paper published 2016:
C.C. Miller, H. Hastings, and M.E. Nadal (2016): A Snapshot of 118 Solid State Lighting Testing Laboratories' Capabilities, LEUKOS, DOI:10.1080/15502724.2016.1189834.

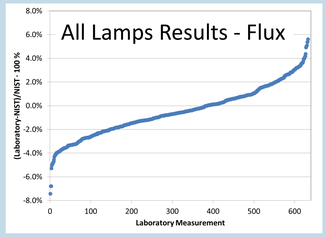
MAP Artifacts & Quantities

128 laboratories

Core Lamps

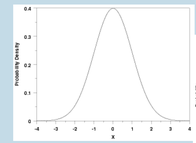
Measured Properties of Lamps	
RMS Voltage and Current	Chromaticity Coordinates (x,y)
Luminous Flux	Color Rendering Index
Power	Correlated Color Temperature
Efficacy	

Normal Probability Plot

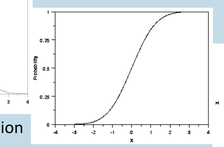


Vertical axis: Ordered response values
Horizontal axis: Normal order statistic medians $N_i = G(U_i)$
where U_i are the uniform order statistic medians; G is the percent point function of the normal distribution
$U_i = 1 - U_n$ for $i = 1$
$U_i = (i - 0.3175)/(n + 0.365)$ for $i = 2, 3, ..., n-1$
$U_i = 0.5(1/n)$ for $i = n$

Graphical technique for if data is approximately normally distributed. (Chambers, 1983)

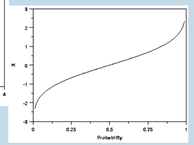


Probability Distribution Function

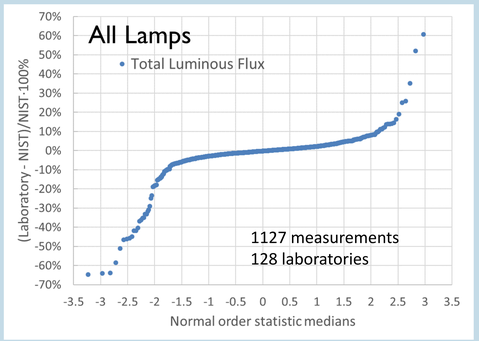


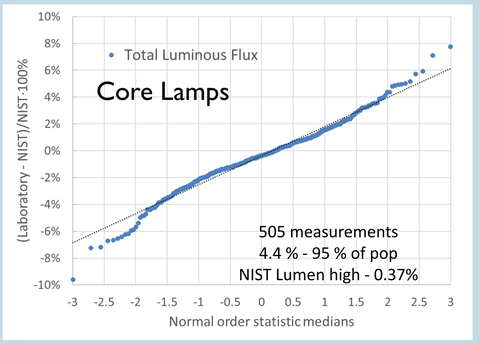
Cumulative Distribution Function

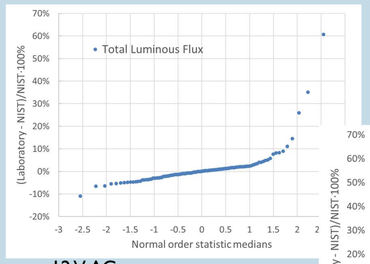
Percent Point Function



http://www.itl.nist.gov/div898/handbook/eda/section3/normprpl.htm



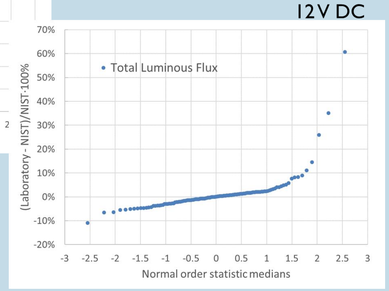


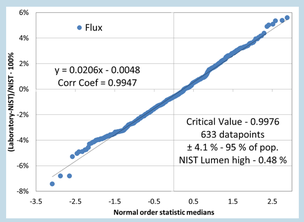


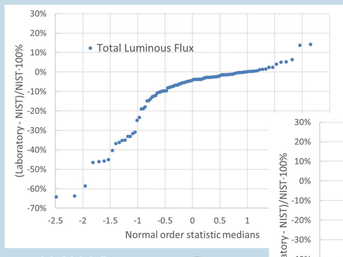
128 measurements

12 V AC

12 V DC



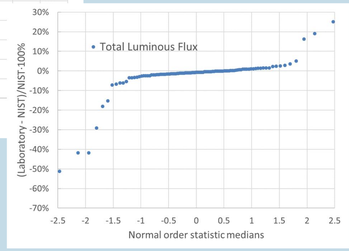


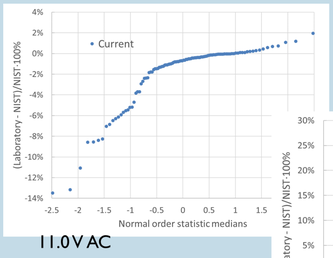


103 measurements

11.0 V AC

4.10 A DC





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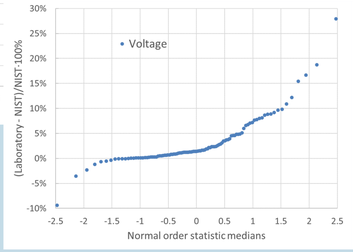
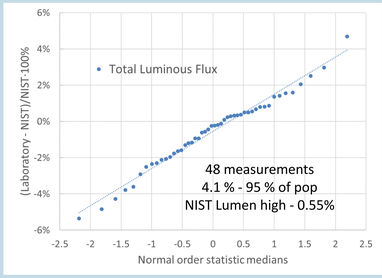
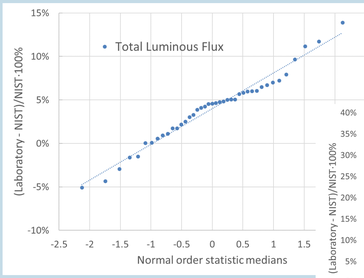
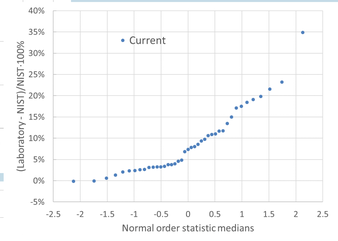
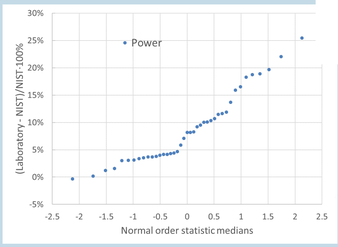






41 measurements
8.2 % - 95 % of pop
NIST Lumen low – 4.0%





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