

Typical Performance of PMT based on the testing data

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Outline

- ① Introduction
- ② possible methods to achieve the calibration
- ③ summary

about this document

I have collected

The main reason is that we know little about the light field around the PMT surface.

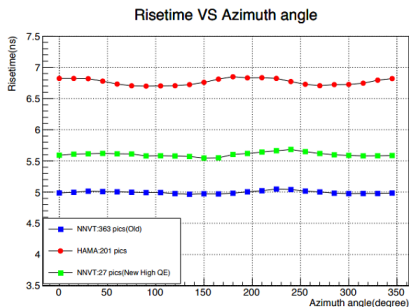
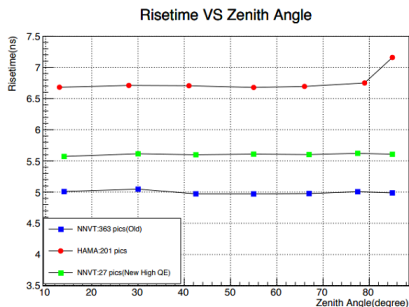
On the other hand, if we can measure the light field inside one drawer, it will become a powerful light source to evaluate PDE of PMTs. Suppose we know the incident photon numbers n_i of one small area in the PMT surface ds , from scanning station could get the normalized PDE factor P_i of this small area. Then we have


$$\sum_i n_i \times PDE \times P_i = n_{pe} \quad (1)$$

where n_{pe} is the total output photon-electron number of PMT.

The average PDE distribution

The factor P_i is from the average PDE map of PMT cathod, which is based on scanning station's results¹



: average PDE on cathod from SS

¹hang hu

→ https://juno.ihep.ac.cn/cgi-bin/Dev_DocDB/ShowDocument?docid=3665

calibration methods

From equation 1 we have:

$$PDE = \frac{n_{pe}}{\sum_i n_i \times P_i} \quad (2)$$

The PMT cathode is divided into 8×24 parts in the SS system, so it is reasonable to apply the same scheme when measure light field.

The item $\sum_i n_i \times P_i$ is exactly the *drawn factor*, the advantage of this method is that we know what the light field is and how PMT response to it.

Apart from this discrete scheme, we can also perform finer light field calibration by measuring more points on the cathode and interpolating the PDE average map.

possible calibration methods

Below are the possible method to achieve the measurement:

- small semiconductor photo detector(like PD).
- use HAMAMATSU 20" PMT with only small part(depend on the PDE map we have) exposed to the light, use the PDE map to determine light field.
- Set a strong light source and measure the saturation current as a relative light field distribution².

²suppose QE is uniform along the cathod

summary and conclusions

- This light field measurement is a finer version of drawer calibration, when combined with the PDE map from SS, we could know more about the PDE of one PMT.
- If the container and scanning station use similar method to evaluate PDE of PMTs we could expect better consistency between these two testing systems.

THANKS

BACULIP