Altnative way to Calibrate Light Field inside Drawers

Email： zhaor25@mail2.sysu.edu.cn

School of Physics

Outline

about the container system

Currently, we calculate the PDE results of container by linearly mapping its internal PDE values to scanning station, which means the container is unable to give independent PDE values.

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

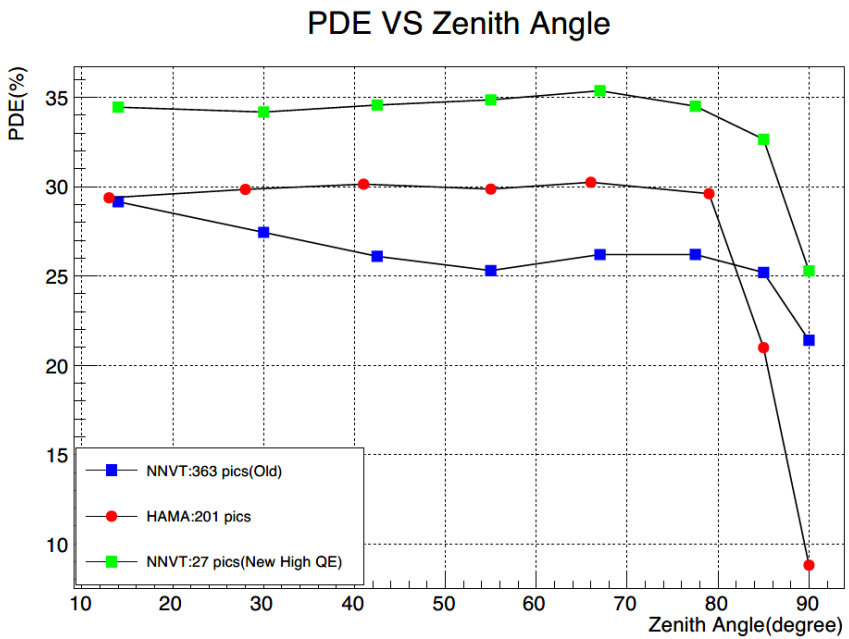
On the other hand, if we can measure the light field inside one drawer, it will become a powerful light source to evaluate PDE of PMTs. Suppose we know the incident photon numbers n_i of one small area in the PMT surface ds, from scanning station could get the normalized PDE factor P_i of this small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

$$\Sigma_i n_i \times PDE \times P_i = n_{pe} \tag{1}$$

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 results[1]



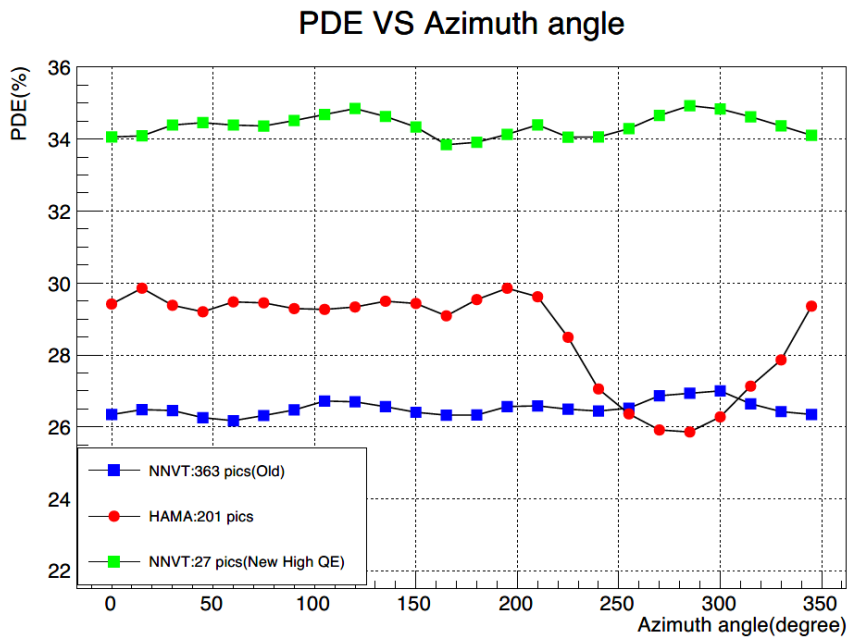


图: average PDE on cathod from SS

[1] hang hu
→ *https://juno.ihep.ac.cn/cgi-bin/Dev_DocDB/ShowDocument?docid* = 3665

calibration methods

From equation1 we have:

$$PDE = \frac{n_{pe}}{\Sigma_i n_i \times P_i} \tag{2}$$

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

The item $\Sigma_i n_i \times P_i$ is exactly the $drawer_{factor}$, the advantage of this method is that we know what the light filed 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 cathod 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 distribution[2].

[2] suppose 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.

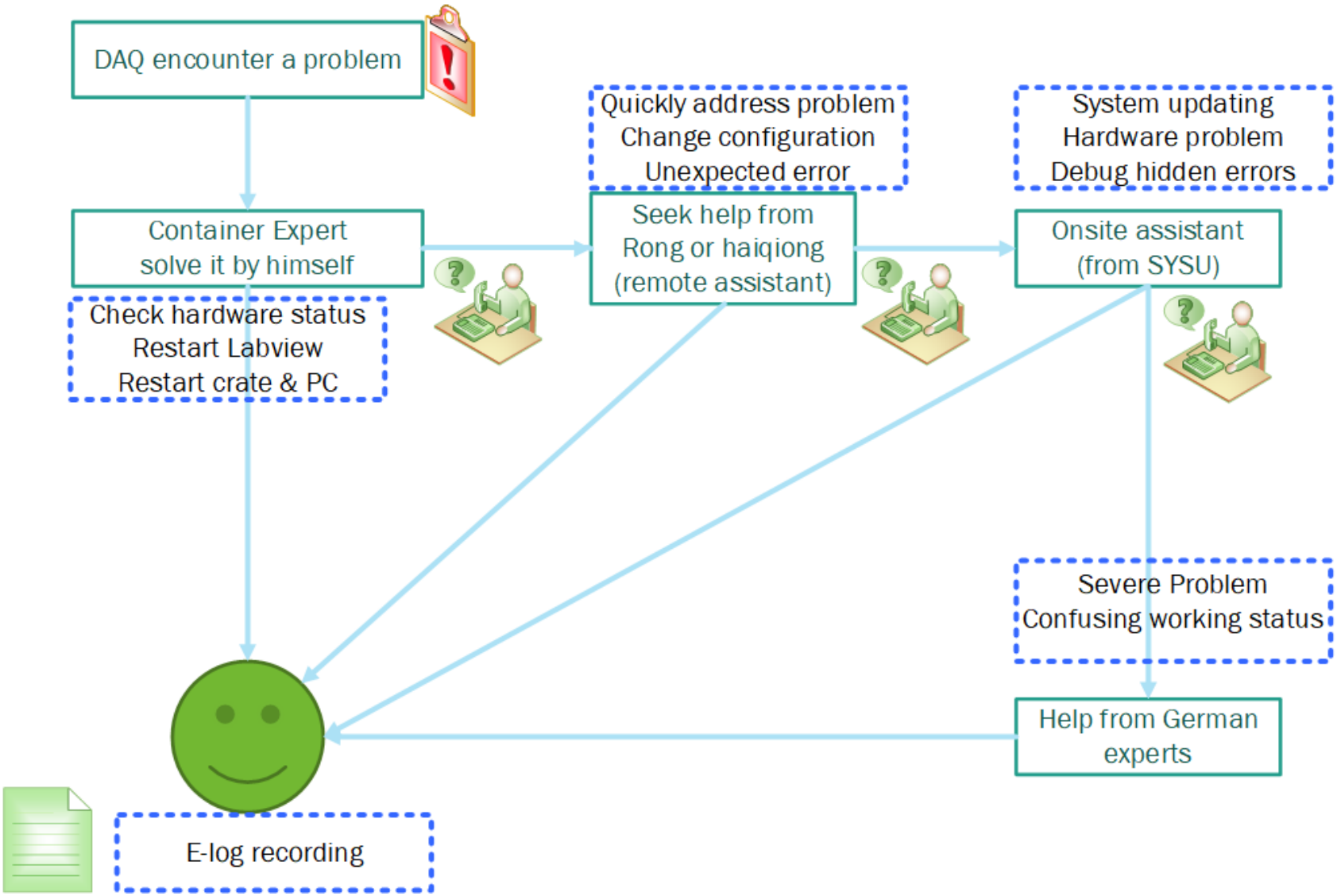
summary about the DAQ learning

I was onsite from Oct 27th - 31th, learning the operation, basic components and trouble shooting of container system.

Now, I am able to

- daily maintenance, such as modifying testing parameters to meet our testing needs.
- update or replace the hardware components.
- remotely help the onsite container expert to try to address the potential problem when system not running properly.
- onsite trouble shooting when severe problem happend.

The flow diagram of handling DAQ problem



BACK-UP