



Design of an Efficient, High-Throughput Photomultiplier Tube Testing Facility for the IceCube Upgrade

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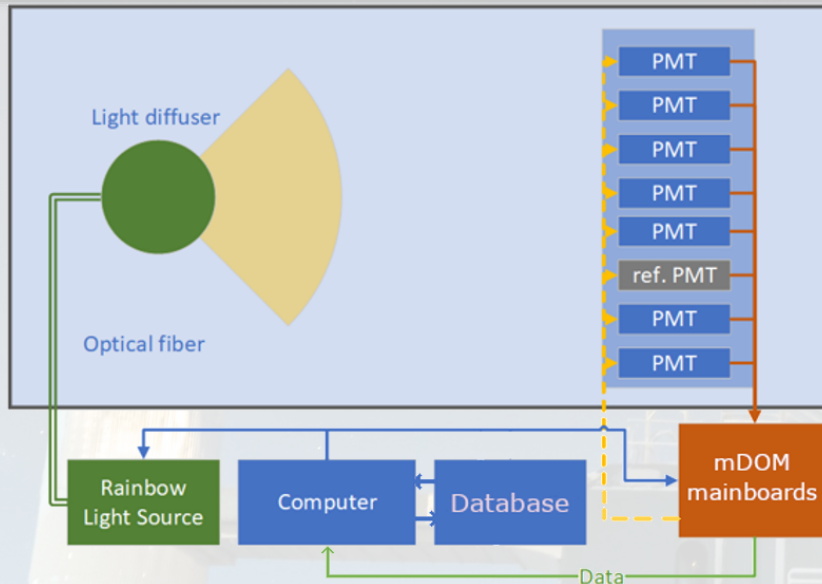
Introduction



mDOM PMTs in the IceCube Upgrade

- IceCube Upgrade: Seven new cable strings
- More than 300 new multi-PMT optical modules [mDOM]
- 24 3-inch PMTs (Hamamatsu) per mDOM
- More than 10,000 PMTs need to be tested and pre-calibrated
- Need high-throughput testing facilities

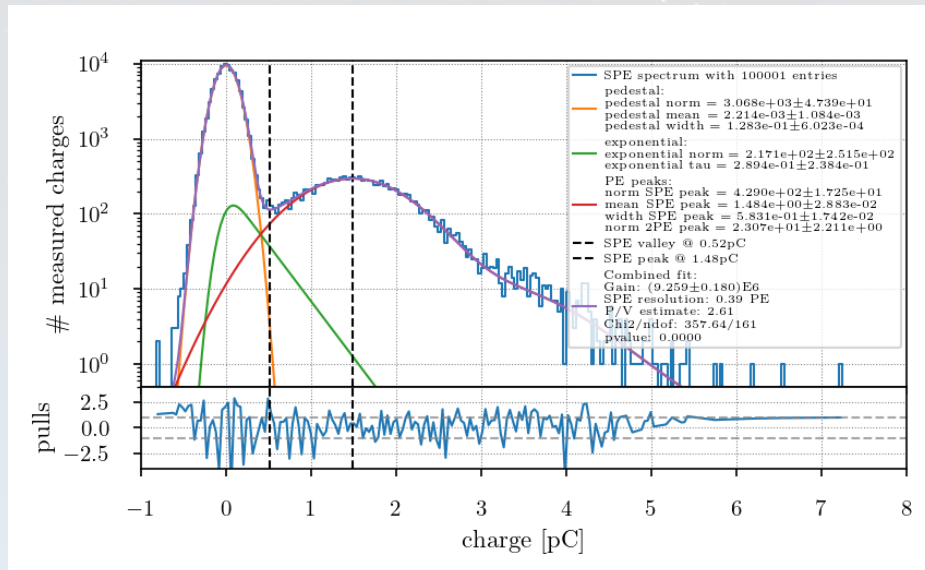
Facility Design



- Light- and Airtight, temperature controlled rooms
- Modular mounting rack for PMTs on slide-in bars
- Custom lightsource systems with fast LEDs
- Readout and slowcontrol with mDOM mainboards
- Fully automated measurements and analyses
- Central data storage in database

Results and outlook

Test campaign with the first 320 PMTs



- Fully automated measurements of Single-Photo-Electron spectra
- Analysis of SPE spectra incl. determination of gain
- Determination of target high voltage for each PMT
- A single PMT was rejected because of a faulty solder joint
- Full test campaign starting in near future
- Facility is easily adaptable for future IceCube Gen2 PMTs