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# TMS Calibration

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# Energy Calibration

- Expected calibration target: 6-8% energy resolution
- Planned procedure
  - Attenuation light curves during QA/QC process for scintillation layers
    - Radiation source at various intervals along bars
    - Provides initial baseline calibration for comparison
  - Cosmic muons - Through-going muons as standard candle
- Needed for
  - Accurate energy reconstruction

# SiPM Response

- Expected calibration target: Low photosensor noise, light yield sufficient for MIP (TBD)
- Planned procedure
  - Use known light signals or single photoelectron spectra to measure the detector's gain
  - LED Light injection system
- Needed for
  - Correct conversion of light into electrical signals
  - Reducing energy resolution uncertainty
  - Monitor stability of the signal readout

# Timing resolution

- Expected calibration target: Few-ns to separate muons in different RF buckets
- Planned procedure
  - Use fast pulsed light sources
  - Cosmic ray coincidence signals
- Needed for
  - Determining time offset and jitter between detector modules
  - Particle identification
  - Event reconstruction
  - Background event rejection

# Spatial resolution

- Expected calibration target: X-Y resolution of few-cm. U-V + Y planes to improve Y resolution
- Planned procedure
  - Cosmic muons with known trajectories
  - Movable radioactive source during QA/QC to map the spatial response
- Needed for
  - Track reconstruction
  - Alignment
  - Reducing systematic uncertainties in measurements

# Temperature and Humidity effects

- Really this is Slow Controls\* in collab. with Calibration
- Expected calibration target: Compensate for environmental factors that affect detector performance
- Planned procedure
  - Monitor temperature, humidity, and apply corrections based on their impact on scintillator light yield, photodetector gain, and electronics
- Needed for
  - Improves long-term stability and ensures consistent performance in varying conditions
    - for example, monitor detector ageing combining calibration and SC info.

\*Ensuring the stability, safety, and optimal performance of the detector over longer time scales

# Summary

- Data sources at our disposal are the LED flashers, cosmic muons and beam muons
- Emphasize calibration quantity measurements during QA/QC
  - Radioactive source, baseline calibration
- Magnetic field uniformity: open question under investigation
  - Will have installation field maps
- Alignment
  - Cosmics, cross-detector reco., installation measurements
- Dedicated “test beam” calibration in-situ
  - I.e. during Operations