Scintillator Tiles Studies

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**CLIC detector concept**

**Tracking system**: records the paths taken by charged particles.

**Electromagnetic calorimeter (ECAL)**: measures energy of photons and electrons as well as the early parts of showers initiated by hadrons.

The Hadron Calorimeter (HCAL) measures the energy of hadrons.

**4-5T Solinod**

**Muon system**: Return yoke: is type of iron used for confining the magnetic field that’s why it’s compact detector.
ECAL for Linear Collider (LC)
Scintillator calorimeter for LC

- Photons: Pair production
- Absorber
- Scintillator
- Tile
- Strip
- SiPM: Photoelectric effect
- Readout system
- Electronics
- Acquisition

Electrons: Bremsstrahlung
Before building, we need testing

The first step in building calorimeter with millions of cells, is building one cell. And to build this unit cell, we made test to get answers on that these questions

- What is the best cell size?
- How much light do we collect?
- Does it have a uniform response?
The Task

Do lab test on different plastic scintillators tiles to answer these questions
Procedures

✓ Experimental setup
✓ Calibration
✓ Measurements (Scan)
✓ Data Analysis
✓ Results (Answers)
A. Experimental setup

Electron gun

Device Under Test (DUT)

Translation axes

Feedthrough to lab next door
The system Ingredients

- **Electron gun**
  - It's sr90 source.
  - double beta emission.
**The system Ingredients**

**Triggering system**

*Goal: trigger on particles that went through scintillator*

- Crossed scintillating fibers (20x1x1 mm³) as trigger, fixed underneath DUT
- Each fiber is read out by a SiPM
- Both SiPM signals are put in coincidence
Scintillator is direct coupling with SiPM using optical grease.
Calibration

With the gun off, perform self-triggered run to measure gain at reference temperature

Measurements

Place selected DUT in setup
Switch electron gun ON
Start automated scan

At each scan step (~60 sec):
• define position(x, y)
• Recording integration of SiPM signals for each trigger.
• Measure temperature
Data acquisition

- Feedthrough to dark room
- High voltage power supply for SiPM bias
- Low voltage for amplifier
- Current source for electron gun coil
- Coincidence circuit for triggering system (NIM)
- Scalers
Data Analysis:

- Each scintillator is divided into number of positions; each position is 1 x 1 mm².
- Get average light yield of each position.
- Create light-yield map for the whole scintillator.

30 x30 scintillator
Data Analysis:

- Every scanned position is affected by two main factors:
  - The position of SiPM
  - Temperature variation.
# Uniformity Study

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<th>+/- 10%</th>
<th>+/- 20%</th>
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<td>92.5</td>
<td>98.9</td>
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</table>
Full scan for 20x20x1 mm³ wrapped scintillator
Thank you
Back up
The Task

Before building the whole scintillator, we need first built one cell. So we do lap test on different plastic scintillator cells to answer that questions.

- What is the best cell size?
- How much can cell collect light?
- Is it have uniform response?
Calorimeter for Linear Collider (LC)
A. Experimental setup
Experimental Setup

Devise Under test

Triggering system

Triggering system

Devise Under test

Triggering system

Triggering system
Backup
CLIC: The Basis

Goal: Lepton energy frontier

Drive Beam Generation Complex

CLIC at 3TeV shown

Drive Beam

Main Beam Generation Complex

D. Schulte, Future Collider Technologies, CERN