Ecal status

Construction
Tests
MC simulation

WARSAW
October 2019
Igor Tyapkin
38400 башен
2400 модулей
50 half-sectors ➔ 25 sectors
48 modules/half-sector
50 DAQ stations
Eight Module Types for Projective Geometry of ECAL

8th Module Type
Produced at JINR
Tested at DESY
- Scintillator plates
  *Polypac company (Dubna) and Uniplast company (Vladimir)*
  100% is done

- Lead plates
  *Russia (25%) and China (75%)*
  in progress  under study

- Pressure plates and fiber bonding plates
  *Polypac (Dubna)* –
  100% is done

- WLS fibers. Kuraray (Japan).
  *Russia (25%) and China (75%)*
  100% delivered  under study
Typical measurement results of relative light yield

Number of plates

Relative light yield

Uniplast company

Polipac company
<table>
<thead>
<tr>
<th>Example</th>
<th>2</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destructive load, [H]</td>
<td>3151</td>
<td>3884</td>
<td>3231</td>
<td>918</td>
<td>4400</td>
<td>3565</td>
<td>2763</td>
<td>2271</td>
<td>11094</td>
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<tr>
<td>Displacement, [мм]</td>
<td>0,33</td>
<td>0,33</td>
<td>0,29</td>
<td>0,39</td>
<td>0,39</td>
<td>0,45</td>
<td>0,27</td>
<td>0,21</td>
<td>0,59</td>
</tr>
</tbody>
</table>
Protvino
Production started 2019-2020
440 modules

TEH3OP
Production started 2019-2020
250 modules

China
2016 modules
Contribution of both sides:

China

Modules production
Electronics production analog part

Institutes:

Tsinghua University (60%)
Huzhou University
Shandong University (20%)
Fudan University (10%)
University of South China (10%)

To guarantee quality:

• same material
• same standard
• same procedure
Time line (draft)

- **2019.8-12**  – *Preparation for production*
- **2020.1-2020.6**  – *Preproduction, cosmic test*
- **2020.7-2021.6**  – *Finish production*
- **2020.8**  – *Install on MPD*
- **2021.10**  – *Finish install and detector commission*
- **2021.11**  – *Start commission*
Stand for ECAL Modules Calibration

- Cosmic rays
- Test one load (12 modules) in 10-14 days
- 8 stands for 8 types of modules
- All modules test and calibration in about 1 year
Simplified ECAL Modules Calibration

- Cosmic rays
- Calibrates any number of modules in 10 hours
- Do not need special equipment
100 Tons  Up to 5 mm

8,26 m !!!
Container for the modules (half-sector)

- Total load of about 1.2 tons
- Made from carbon composite
DESY electron beam

Graph showing the relationship between Nph and $E_e$ [GeV].
After corrections

Nph

$E_e [\text{GeV}]$
After corrections

1.6 GeV

DESY test beam

$N_{ph}$

$X$ mm

$N_{ph}$

$X$ mm
\[
\chi^2 = \sum_i \frac{(E_i^{measured} - E_i^{expected})^2}{\sigma_i^2}
\]
linear

1.6 GeV
DESY 2018

$\sigma=5.8 \text{ mm}$

LOG
$W_i=3.1$

$\sigma=5.5 \text{ mm}$
Systematic error in the polar angle measurements due to the not fully projective geometry of ECal
Summary

• All materials are already produced and delivered. Quality of all materials is under careful control
• First modules are produced in all production areas and tested
• China will be ready to start production in the few production areas in beginning of 2020
• Carbon made supporting frame is under design and may be produced in the second half of 2020!
• Moving frame for the electronics is under development.
• **Assembling can start not before autumn 2020 and completed in the second half of 2021**
  • First modules have been tested.
  Sensitivity to the electromagnetic shower is shown on the level of previously constructed devices
  Effect of numerical saturation of the SiPM was studied and found to be well in the agreement with expectations

2. Easy method of the channels calibration by means of cosmic muons have been tested
3. Systematic error in the polar angle measurements due to the not fully projective geometry of ECal was studied and solution proposed
4. More research is needed to study possibility of use in physical analysis the shower shape cuts.
Acknowledgments:
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