Asamblarea, instalarea, testele supermodulelor TRD si masuratorii de raze cosmice

Proiect Capacitati, Modulul 3
Stari exotice ale materiei, efecte in - mediu si dinamica
Outline

- The ALICE – TRD Detector
- ALICE TRD Working Principle
- Last 22 TRD Chambers Construction and Testing
- ALICE TRD Database
- Sealing and grounding of SM08 and SM09 chambers
- SM Implementation in the Experiment
- Conclusions
ALICE A Large Ion Collider Experiment

The dedicated heavy ion experiment at LHC

Designed to address the physics of strongly interacting matter and quark gluon plasma at extreme values of energy density and temperature in nucleus-nucleus collisions.

The ALICE detector is built by a collaboration including over 1000 physicists and engineers from 109 Institutes in 31 countries.

Transition Radiation Detector (TRD)

Electron identification @ $p_t \geq 1\text{GeV}/c$:

- 1% pion efficiency at 90% electron efficiency

Tracking of all charged particles:

- position resolution = 400 µm

Fast trigger for high momentum charged particles.
ALICE TRD Working Principle

- Use different energy deposit and TR signature to identify electrons
- Transition Radiation (TR) photons (<30keV, only for electrons) are absorbed by high Z gas mixture (Xe, CO₂)

Peak at small drift time: amplification region
ALICE TRD Working Principle

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Peak at small drift time: amplification region
Peak at large drift time for electrons: TR
Transition Radiation Detector (TRD)

- 540 individual readout detector modules
- 18 super modules (each: 6 layers x 5 sections)
- total sensitive area: ~ 700 m²
- No. of readout channels: 1.18 x 10⁶
- Chamber construction sites:
  IFIN-HH, Bucharest
  JINR, Dubna
  GSI, Darmstadt
  PI, Heidelberg
  IK Frankfurt

- Readout chamber = radiator + drift chamber + MWPC
- Largest/smallest module: 113 x 145 cm² / 91x122 cm²
TRD Chamber Construction

- Frame assembly
- Pad plane assembly
- Alignment and gluing of multiwire electrodes
- Glue field cage strips
- Fill the cut outs of the panel
- Connect anode/cathode HV wires
- Cover pad plane with glue
- Multiwire electrodes on the winding machine
- Finally gluing of the chamber

Mariana Petris, seminar DFH, 27 iulie 2009
**TRD chamber testing during construction**

- pad connectivity
- checking of the current through the drift HV divider
- the drift HV electrode connection
- wire tension measuring
- electrical connections of the anode and cathode wires
- dark current before chamber gluing
**Final TRD chamber testing**

- Dark current
- Oxygen content
- Gain uniformity
- $^{55}$Fe spectral measurement
- Fine gain scanning uniformity
- Absolute gas gain

L2C1 - 46

Temperature $= 23.3^\circ$C
Humidity $= 30$

Oxygen $= 15$ ppm
$\text{I}_{\text{dark}} = 1-2 \, \text{nA}$
$70\% \text{Ar} + 30\% \text{CO}_2$

$U_D = -1600 \, \text{V}$
$U_A = +1550 \, \text{V}$

$U_D = -1600 \, \text{V}$
$U_A = +1600 \, \text{V}$

Gain $= 10^4$

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Chamber leak rate test

- Measurement of the $O_2$ content in gas mixture @ 2 mbar under pressure, 20 l/h gas flow
- The average leak rate for the last 22 chambers was 1.8 l/h (< 3 l/h - maximum accepted value)
Chamber Transport

Delivery date:
- May 2005 - 7 chambers
- March 2006 - 25 chambers
- November 2006 - 25 chambers
- November 2007 - 20 chambers
- May 2008 - 28 chambers
- November 2008 - 25 chambers

TOTAL: 130 chambers sent to GSI, Darmstadt

Mariana Petris, seminar DFH, 27 iulie 2009
ALICE TRD @ DFH IFIN-HH

MoU: 20% of 540 chambers = 108 chambers (finished March 2008)

Over-task = 22 chambers (finished October 2008)

Total: 24% of 540 chambers = 130 chambers

Components
delivery delay

Dark current
(araldite problem)

Broken down
oxygen meter
A Common Web Interface to Alice TRD Databases

(*) Please use with the Mozilla Firefox or Internet Explorer browsers (Safari and Konqueror have problems displaying it, other browsers like Opera or Chrome have not been tested).

This web page is intended as a common web interface for all TRD databases in Alice. It accesses information from:

- **gateDB**: a complex PostgreSQL DB by Thomas Dietel and others with the full information on the location, history, status, tests, etc. for all TRD components; it resides on the Alice host at the Physikalisches Institut (Heidelberg).
- **FEE tests**: formerly a MySQL DB by Venelin Angelov with test results for mom, water and on chips that has moved now inside gateDB. For historical reasons, rob tests are accessed through the gateDB link.
- **ROC tests**: recently added tables in gateDB with TRD chamber test results: gas leak, conditioning, gain uniformity, absolute gain, spectral and stability measurements.
- **Voltage**: new tables in gateDB that describe the TRD low voltage and high voltage systems.
- **production**: a MySQL DB by Peter Glassel with the current production status of the TRD chambers; it resides on the www host at the Physikalisches Institut (Heidelberg).

Click on the corresponding link in the left menu panel for access or on the corresponding tab above for detailed information.

Note that this interface keeps the same presentation layers as previously used by the individual interfaces and accessed through the "gateDB", "FEE tests", and "production" links in the left menu panel.

Note also that, behind the interfaces, we plan to make changes in the way the above information is stored (databases) and accessed (scripts). However, interfaces will...
ALICE TRD Database

ROC Test Results

**Individual results**: enter ROC type, ROC number, and test type.
Example: "L1C1", "25", "gas leak rate" displays gas leak rate test results for chamber L1C1#025.

Note: use the "Upload" link on the top of the page for instructions on how to upload your chamber test files. Choose "upload conductance" option to be directed to an upload page that allows you to set the leak conductance for that ROC.

**Summary results**: enter ROC type and test type.
Example: "L1C1", "gas leak rate" displays a summary of the gas leak test for all L1C1 chambers.

List of chambers currently in gateDB. View the numbers by test type.
L0C0: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
L0C1: 5 6 7 8 9 10 11 12 13 14 15 16 17 18 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 40 41 42 43 48 51 52 53 54 55 56 59 63 65 68
L1C0: 3 4 5 6 9 10 11 12 13 14 15 16 17 18 20 21
L1C1: 1 3 4 6 7 8 11 18 22 23 25 27 28 29 31 33 35 36 38 40 42 44 47 49 58 69
L2C0: 5 6 7 8 10 11 12 13 14 15 16 17 18 19
L2C1: 1 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
L2C2: 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
L4C0: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
L4C1: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
L4C2: 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
L5C0: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
L5C1: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
L5C2: 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
GSI – November 2008
SM08 & SM09 chambers

Chambers sealing

Chambers grounding

Chambers recovering

Leak test

Chamber opening

Chambers testing

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10 October 2006 – first TRD super module installed in the experiment

Present – six TRD super modules installed in the experiment

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TRD Supermodule Installing in the Experiment

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TRD Supermodule Installing in the Experiment

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Cosmic Ray Tests

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Conclusions

- In total, 6 SMs were installed in ALICE in present; four of them participated in the cosmic ray data taking in 2008.
- Next month the 7th SM will be installed in the ALICE setup.
- The obtained results were presented at:
  - Quark Matter 2009 Conference, 30 March – 4 April, Knoxville, Tennessee, SUA: 
    ALICE TRD Collaboration, “The Transition Radiation Detector for ALICE at LHC”  
    (will be published)
  - The 1st International Conference on Technology and Instrumentation in Particle Physics, 12 – 17 March 2009, Tsukuba, Japan: ALICE TRD Collaboration, “Transition Radiation Detector of ALICE at LHC”  
    (will be published)