

## Asamblarea, instalarea, testele supermodulelor TRD si masuratori 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* (*a*)  $p_{t} \ge 1 GeV/c$ : 1% pion efficiency at 90% electron efficiency Tracking of all charged particles: position resolution =  $400 \ \mu m$ *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  $(Xe,CO_2)$



Mariana Petris, seminar DFH, 27 iulie 2009







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# **Transition Radiation Detector** (TRD)



- 540 individual readout detector modules
- 18 super modules (each: 6 layers x 5 sections)
- total sensitive area:  $\sim 700 \text{ m}^2$
- No. of readout channels:  $1.18 \times 10^6$
- Chamber construction sites: IFIN-HH, Bucharest

JINR, Dubna GSI, Darmstadt PI, Heidelberg **IK Frankfurt** 



- Readout chamber = radiator + drift chamber + MWPC
- Largest/smallest module:  $113 \times 145 \text{ cm}^2 / 91 \times 122 \text{ cm}^2$





## **TRD Chamber Construction**





Frame assembly



Cover pad plane with glue



Pad plane assembly

Fill the

of the

panel

cut outs





Multiwire electrodes on the winding machine



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Alignment and gluing of multiwire electrodes



## Connect anode /cathode HV wires



Finally gluing of the chamber



## 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

8

6

(bad (nA)

- Dark current
- Oxygen content
- Gain uniformity
- <sup>55</sup>Fe spectral measurement
- Fine gain scanning uniformity
- Absolute gas gain











## Chamber leak rate test

- Measurement of the O<sub>2</sub> 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 (< 3l/h - maximum accepted value)</li>







## **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







## ALICE TRD (a) 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







# ALICE TRD Database

💐 Alice TRD Database	es Interface - Mozilla Firefox
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Menu:	general       gateDB       tests       voltage       production       TRD         A Common Web Interface to Alice TRD Datab
● <u>info</u>	(*)Please use with the Mozilla Firefox or Internet Explorer browsers (Safari and Konqueror have problems displaying it not been tested).
<ul> <li>gateDB</li> <li>FEE tests</li> <li>ROC tests</li> <li>Voltage</li> <li>production</li> <li>contact</li> <li>internal</li> </ul>	<ul> <li>This web page is intended as a common web interface for all TRD databases in Alice. It accesses information from:</li> <li>gateDB: a complex PostgreSQL DB by Thomas Dietel and others with the full information on the location, history it resides on the alice host at the Physikalisches Institut (Heidelberg).</li> <li>FEE tests: formerly a MySQL DB by Venelin Angelov with test results for mcm, wafer and ori chips that has mo reasons, rob tests are accessed through the gateDB link.</li> <li>ROC tests: recently added tables in gate DB with TRD chamber test results: gas leak, corditioning, gain uniformit measurements.</li> <li>Voltage: new tables in gate DB that describe the TRD low voltage and high voltage systems.</li> <li>production: a MySQL DB by Peter Glassel with the current production status of the TRD chambers; it resides on (Heidelberg).</li> </ul>
Use with (*): Firefox or Explorer Administrator: Paul Constantin	Click on the corresponding <b>link</b> in the left menu panel for access or or the corresponding <b>tab</b> above for detailed informat Note that this interface keeps the same presentation layers as previously used by the individual interfaces and accessed the "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





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the www host at the Physikalisches Institut

tion.

rough the "gateDB", "FEE tests", and

accessed (scripts). However, interfaces will

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Menu:		KOC Test Results
Release Notes     Fe	edora Proj	Individual results: enter ROC type, ROC number, and test type.
Monue	gei • <u>info</u>	Example: "L1C1", "25", "gas leak rate" displays gas leak rate test results for chamber L1C1#025.         L2C1 •       25         all tests       •         Display
	• <u>gateDB</u> • <u>FEE tests</u> • <u>POC tests</u>	Note: use the "Upload" link on the top of the page for instructions on how to upload your chamber test files. Ch to be directed to an upload page that allows you to set the leak conductance for that ROC.
● <u>info</u>	• <u>Voltage</u> (*)F not	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.         all types I all tests I Display
• <u>gateDB</u>	This • <u>contact</u>	
• FEE tests	• <u>internal</u>	List of chambers currently in gateDB. View the <u>numbers by test type</u> .
• <u>ROC tests</u>		L0C0: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 17 19 20
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8 39 40 41 42 43 44 45 46 47 48 49

terfaces will



# GSI – November 2008 SM08 & SM09 chambers

## Chambers sealing



Leak test

## Chambers grounding



## Chamber opening









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## Chambers recovering

## Chambers testing



# TRD Supermodule Installing in the Experiment



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

Present – six TRD super modules installed in the experiment









# **TRD Supermodule Installing** in the Experiment







# **TRD Supermodule Installing** in the Experiment









# Cosmic Ray Tests









# Conclusions

- In total, 6 SMs were installed in ALICE in present; four of them participated in the cosmic ray data tacking 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 1<sup>st</sup> 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)

