



The ALICE Electromagnetic Calorimeter Project

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The Large Hadron Collider at CERN

- Will collide beams of:
 - protons at an energy of 14 TeV (2008)
 - lead nuclei at 5.5 TeV/nucleon-pair (test: 2010, production: 2011)
- LHC will probe deeper into matter than ever before:
 - Higgs, SUSY, Quark Gluon Plasma (ALICE)



The ALICE Detector



Jets

jet: bundle of hadrons collimated on the boost of the parent parton







Jet Reconstruction





Full Jet Reconstruction (ALICE augmented w/ EMCAL)

- measure the original parton 4-momentum and the jet structure (longitudinal and transverse). A higher sensitivity to the medium parameters (transport coefficient) is expected.
 - Jet as an entity (parton hadron duality) stays unchanged
 - Map out observables as a function of parton energy

EMCAL: Location into ALICE and Characteristics





- scintillator \rightarrow shower sampler / light output
- paper \rightarrow lead/scintillator optical isolation and friction

MODULE PRODUCTION



MODULE PRODUCTION LINE 1 stacking fixture + 3 compression stations



- Initial compression load: 350 Kg
- Compression time: 3 days
- Nominal production rate: 1 module/day

FIBER PROCESSING cut quality check with visual profiler



FIBER PROCESSING *sputtering chamber*





FIBER PROCESSING *final result: aluminum mirror*



FIBER PROCESSING

36-fiber tower bundle



The EMCAL Readout



MODULE ASSEMBLY *fiber insertion*



MODULE ASSEMBLY *alignment into strips*



Strong Backs and Strip Modules





Finished EMCAL Module (contains 4 towers)



The EMCAL Modular Structure



Super Modules: the EMCAL Modular Structure

The Super Module in the crate and full electronics integration



CAL-Frame: the EMCal Support Structure

Full detector:

11 Super Modules, total weight ~ 86 tons

- 1 Module = 26.7 kg
- 1 Strip Module = 324 kg
- 1 Super-Module = 288 modules ~ 7.7 tons

CAL-FRAME capacity: 110 ton (1.3xEMCAL)

Empty CAL-Frame into ALICE



EMCal Insertion Tool



SuperModule Cradle

Rotates and Slides

Dummy EMCal Super Module successfully inserted into the CALFrame in the ALICE cavern (SUBATECH Nantes).

Insertion into the CAL-Frame



APD test station in Catania



APD Test @ Catania

Gain vs T

Gain vs HV



The EMCAL Prototypes Test Beams

- FNAL, November 2005 (I generation prototype)
- SPS + PS, September October 07 (II generation)



Test beam setup



Test beam setup & operation



LED reference signal (GMS)

pulser → monitor stability of gain

• single event signal



time

Position scan (beam)

80 GeV beam → measure uniformity of gain

• single event signal



Test Beam @ CERN:

16 modules (64 counters) assembled: 8 @ LNF + 8 @ WSU APDs tested at INFN-Catania

Test at the CERN SPS and PS during September-October 2007



Upgrading ALICE with the EMCAL

- Extended kinematic and statistical reach (PHOS=12%EMCAL)
- High p_T trigger for γ and e^-
- Jet trigger via large ΣE
- $\gamma/\pi^0/\eta$ discrimination

Combined with ALICE tracking

 Complete measurement of jet energy and characterization of jet fragments

Combined with PHOS

Exploit back to back γ-jet correlation



EMCAL has a key role in ALICE

 Jet quenching: is the ultimate tool (see RHIC results) to probe the QCD dense matter

- RHIC studies: very promising but **not final** (only leading particle, QGP phase still far from deconfinement=liquid)

to go further we need to :

- measure jet-structure modifications in a huge kinematic range
- efficient triggering and robust tracking
- **detailed PID down to low p_T** (physics is in soft fragments)

only ALICE augmented with the EMCAL can meet the above requirements

What's going on:

- EMCAL Technical Proposal published in '06
- Technical Design Report *in progress*
- First supermodule ready for LHC beam (JAN '09)
- half EMCAL installed for LHC shutdown (end of '09), to be ready for Pb-Pb runs in '10.