Probing the Quark-Gluon Plasma (QGP)

Essential, but rare probes involve electrons e.g. from:
- Open heavy-flavour hadron decays
- Virtual photons and Drell-Yan production
- Decays of the \( \eta \) and \( \Upsilon \) families

Study of p-Pb Collisions

Dissasemblable (QGP-related) and cold nuclear matter effects in p-Pb collisions

Requirements:
- Excellent electron identification
- Trigger to enhance events with electrons

**ALICE TRD**
- Transition radiation (TR) produced by ultra-relativistic particles
- \( |p| > 500 \) crossing the border between materials with different dielectric constants
- About 1 TR photon per electron with \( p > 0.5 \text{ GeV/c} \)
- Each of the 522 read-out chambers comprises a radiator and a \( \text{Xe-CO}_2 \) filled wirewire proportional chamber with pad read-out preceded by a drift section
- Fully customised front-end electronics directly mounted on top of the read-out chambers

**Electron Identification Performance**

- Recording of the temporal evolution of the signal allows the contributions of the TR photon and the specific ionisation energy loss of the charged particle to be separated
- TR photons preferentially absorbed at entrance of the chamber, characteristic peak at large drift times
- Pion rejection factor (inverse of the efficiency) of up to 410 achieved at a momentum of 1 GeV/c in p-Pb collisions when using the temporal evolution of the signal
- Clear measurement of the onset of the TR production, both for electrons (\( |p| > 500 \)) and high-energy Tevatron cosmic-ray muons

**Electron Trigger Performance**

- Electron candidate selection
  - Selection of tracks with good quality
  - Cut on electron hypothesis in TdV: removing possible pions with \( p < 1.5 \text{ GeV/c} \)
  - Cut on electron hypothesis in TPC: 0 to 3 m
- Trigger efficiency and acceptance
  - Evaluated in a minimum bias data sample
  - Counted how many events were also tagged by the TRD electron trigger
- Trigger enhancement factor
  - Improvement of the number of electrons passing the cut on transverse momentum threshold of 2 GeV/c
  - Invariant mass distribution in the TRD-triggered data compared to the minimum bias data sample

**Offline Analysis - Invariant Mass Distribution of J/\( \psi \) mesons**

- Electron/positron candidate selection
- Extracted J/\( \psi \) mesons estimated via peak fit and subtracted
- Problem: conversion in detector material at large radii; creating true electrons fulfilling trigger condition
- Removal via online sagitta cut

**TRD Trigger**

- Trigger to enhance quarkonia, heavy-flavour decays and jets at high transverse momenta as well as light nuclei
- Trigger decision within 8\( \mu \)s after the collision
- Chamber-wise tracking (tracklets): detector-mounted front-end electronics, processing in multi-chip modules, including pedestal and gain correction
- Track-wise tracking in Global Tracking Unit (FGPA based): tracklet matching and track reconstruction through linear fit
- Derive Level 1 trigger based on transverse momentum and PID of individual tracks
- Problem: conversion in detector material at large radii; creating true electrons fulfilling trigger condition
- Removal via online sagitta cut