Measurement of neutral mesons in pp and Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with the PHOS detector in ALICE
Daiki Sekihata for the ALICE collaboration (Hiroshima University, Japan)

**Physics motivation**

- Neutral mesons such as $\pi^0$ are suitable to study parton energy loss in the strongly interacting matter, called Quark-Gluon Plasma, produced in heavy-ion collisions at the LHC.
- They can be identified via their decay channel into photons ($\pi^0 \rightarrow 2\gamma$, $\eta \rightarrow 3\pi^0$, $\omega \rightarrow \pi^0\eta'$), using a finely segmented electromagnetic calorimeter in a wide range of transverse momenta.
- When focusing on parton energy loss, high $p_T$ particles are suitable because such particles are produced by hard scattering with large momentum transfer in the initial stage of the collision.
- The nuclear modification $R_{AA}$ with identified particles can provide quark mass dependence of parton energy loss.
- $\pi^0$ decays are the main background source for the direct photon measurement and should be measured with high precision.

**PHOS detector in ALICE**

PHOton S spectrometer (PHOS) is an electromagnetic calorimeter with fine granularity and good energy resolution installed in ALICE.

Features of the PHOS detector
- Consists of 12,544 channels, each with a $2.2 \times 2.2 \times 18$ cm$^3$ PbWO$_4$ crystal read out by an APD.
- Located at 4.6 m from the interaction point.
- $250^\circ < \varphi < 320^\circ$, $|\eta| < 0.12$ (since 2015)
- Wide dynamic range 5 MeV - 80 GeV
- Very good energy resolution $\sigma_E/E = 3\%$ at $E = 1$ GeV
- Excellent granularity
- Provide high energy photon/electron triggers (L0 + L1 with 3 different thresholds) based on the sliding windows method (sum of $4 \times 4$ APDs).

Additionally, during Long Shutdown 1 (2013 - 2015), one CPV (Charged Particle Veto) module has been installed in front of one of the PHOS modules to improve veto capabilities for charged tracks.

**Data set in Run2**

-2 nb$^{-1}$ of minimum bias events and 70 nb$^{-1}$ of high energy photon trigger by PHOS in pp collisions at $\sqrt{s} = 5.02$ TeV
-12 mb$^{-1}$ of minimum bias events in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV in centrality 0-90%

**Results in pp and Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV**

- $\pi^0$ spectra and nuclear modification factor $R_{AA}$ have been measured between $p_T = 0.4$ and 30 GeV/c in central and semi-central collisions, and up to $p_T = 12$ GeV/c in peripheral collisions.
- $\eta/\pi^0$ ratio reaches plateau at high $p_T$.
- The strongest suppression is observed at $p_T = 5-6$ GeV/c.

**Summary and outlook**

- $\pi^0$ and $\eta$ mesons have been measured in a wide $p_T$ range in pp and Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with the PHOS detector in ALICE.
- This measurement of neutral mesons measurement will give us hints to disentangle mechanisms of parton energy loss in Quark-Gluon Plasma, and provide precise estimations of the background source for the direct photon measurement.
- Higher statistics in pp collisions at $\sqrt{s} = 5.02$ TeV taken in 2017 with rare triggers will extend the measurement to much higher $p_T$ and can significantly reduce statistical uncertainty.

LHCC student poster session at CERN, 28.February 2018