Physics Motivation
- Direct photons at forward rapidity are a key to investigate the high-density parton distribution functions and to understand the initial state of nuclear collisions.
- Gluon density at very small x (< 10^-4) may reach saturation of the phase space.
- The Color Glass Condensate (CGC) is a theoretical framework that describes the coherent dynamics of this saturated regime of QCD.
- Goal: measure direct photons at forward rapidity; background comes mainly from π0 decays into two photons.

Beam Tests at PS and SPS in 2018
- Prepare the new FoCal prototype, Mini-FoCal composed of 20 LGL layers and W in 2018.
- Performance Evaluation of Mini-FoCal
  - PS Test Beam at CERN
    Measurement of ADC corresponding to MIP signal
  - SPS Test Beam at CERN
    Measurement of energy resolution

Analysis
Method of analysis
1. Subtract Pedestal
2. Subtract CMN
3. Clusterise
4. Select positron events
Common Mode Noise (CMN)
CMN shows same time period in one LGL

Results of SPS test beam
MIP peak distribution with single hadron beam
- Beam injected onto one cell
- $<\text{ADC}_{\text{MIP}}>$: 117.2 ± 2.1
- $C_F$: conversion factor
- $C_F = \frac{<\text{Energy deposited in MIP in Si with 320 μm}>}{<\text{ADC}_{\text{MIP}}>}$
  - $= 0.009$ MeV/117.2 $= 7.5 \times 10^{-3}$ GeV/ADC
- $SF$: simulated sampling fraction
- $SF = \frac{<\text{energy deposited in Si}>}{<\text{incident energy}>}$
  - $= 1.7 / 150$ GeV (2.8 / 250 GeV)

Summary
- FoCal is a proposed ALICE upgrade project to study coherent dynamics of the saturated regime of QCD, CGC.
- Mini-FoCal is tested with PS and SPS at CERN to evaluate the FoCal performance.
- Method of CMN subtraction is established.
- ADC corresponding to MIP is evaluated in PS beam test.
- Positron energy is reconstructed with $<\text{ADC}_{\text{MIP}}>$ and energy resolution is evaluated.