Two main aims of the SHiP (Search for Hidden Particles) experiment are the observation of hidden particles and high-statistics study of tau neutrino events. These particles can be produced from the decay of charm particles in the SHiP hybrid target which is composed of a totally 58-cm long series of TZM slabs followed by tungsten slabs of the same total length. A major concern for the experimental design is the precise knowledge of the muon flux and the associated charm production cross section. To achieve the physics goals, we plan to carry out a test experiment with SHiP target replica using CERN SPS 400 GeV/c proton beam at H4 area in July 2018. In this test experiment, resistive plates chambers (RPCs) will be used for muon identification and their slope measurements. Recently, we constructed gas gaps and strip panels to build 5 trigger RPC modules. A RPC module is composed of a 2-mm gas gap and two orthogonal strips of a 10.625-mm pitch. In addition, we constructed a small prototype RPC of a size of 100 x 130 cm2 with the same strip pitch to study the fundamental detector performance using cosmic rays. The current construction of the RPC modules is also as a pilot production for the future SHiP experiment in synergy with the present RPC production for the CMS experiment. In the presentation, we report the design of the RPCs for the test experiment and cosmic-ray test results for the prototype RPC.

**ABSTRACT**

The current Standard Model fails in explaining
- Dark Matter
- Neutrino oscillation and masses
- Matter/antimatter asymmetry in the Universe

A Hidden Sector (HS) of weakly interacting BSM particles is for the explanation of long-lived weakly interacting particles. Long-lived weakly interacting particles require high intensity beams

Collaboration of ~250 members from 52 institutes, 17 countries

**Technical Proposal:** arXiv:1504.04956

**Motivation of SHiP**

- Tau neutrino detector
- Muon tagger (RPCs)
- ECC (Emulsion Cloud Chamber) target
- Spectrometer (Goliath+DTs) to measure momentum and charge of the muons
- Muon tagger (RPCs) to identify muons

**Measurements in 2018 at CERN SPS**

- Muon flux measurements
- SHIP target replica: TZM 58 cm-thick + tungsten 58 cm-thick
- Spectrometer (Goliath+DTs) to measure momentum and charge of the muons
- Muon tagger (RPCs) to identify muons

**Conclusions**

- The detector components, gaps and strips have been manufactured, tested by the Korean SHiP group, and delivered to CERN for the pilot experiment in July 2018.
- The detector characteristics of the prototype RPC are fairly satisfactory for reliable 2D trigger measurements for the future SHiP.
- WP efficiency requiring both x and y signals exceeds 95%
- Well reconstructed 2D images for cosmic muons → Adjutant particle trackers as well as triggers for muons

---

**HPL Trigger RPCs for SHiP**

- Resistive Plate Chambers for SHiP
  - Gaseous detectors operating with an avalanche mode
  - Fast time response of < 10 ns and a time resolution ~ 1 ns
  - 2 orthogonal strip readouts for 2D trigger measurements (anode strips for x and cathode strips for y)

- Expected position resolution of 3 ~ 4 mm in both directions

**Test Results of a Prototype RPC**

- Digitization thresholds at Front-end electronics
  - Th = 0.8 mV for x (anode strip, negative)
  - Th = 1.0 mV for y (cathode strips, positive)

- Efficiencies for x, y, and xy
- Mean cluster sizes for x and y
- Efficiency for x and y

**Reconstructed 2D images for cosmic muons (tagged by plastic scintillators)**