

2018 Test Beam Plan for HERD Prototype at CERN SPS

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Objective of 3rd beam test at 2018

- ▶ Solve the problems found at 2nd beam test
 - ▶ upgrade the IsCMOS
 - ▶ upgrade the encapsulation method of crystals
- ▶ Upgrade CALO prototype from 250 to 500 LYSO crystals, 5*5*20(5*10*10) array, corresponding 52(26) X0 longitudinal, 2.8(1.4) λ longitudinal
 - ▶ proton response up to 400 GeV under longitudinal full scale geometry
- ▶ TRD response
 - ▶ by charged pion beam from 20-200 GeV/c
 - ▶ verify the feasibility and performance

Preliminary beam time schedule

Beam time TBD, probably re-arranged soon

1. Current individual proton and ion run
 - 26th Sep. to 3rd Oct., H2, proton run
 - 19th Nov. to 25th Nov. H4, ion run
2. Expected continuous run
 - 05th Nov. to 12th Nov. H2, proton run
 - 12th Nov. to 19th Nov. H2, ion run
 - NA61 is also competing for this time slot

Beam requirement

- ▶ Particle type: electron, proton, charged pion; fragmented ions
- ▶ Particle momentum: several grid from 20 to 400 GeV
 - ▶ proton: primary proton 400, 200 GeV/c
 - ▶ electron: 250, 200, 150, 100, 50, 20 GeV/c
 - ▶ charged pion: 180, 120, 100, 60, 40 GeV/c
- ▶ Beam intensity: ~ 2000 particles / spill
- ▶ Beam size: 1cm * 1cm

Hardware requirement



- ▶ same as what we did in the 2017 test
- ▶ PSD system for beam trigger
- ▶ Silicon/Fiber system for tracking
- ▶ CALO system for energy measurement
- ▶ Veto system for efficiency study and charge measurement
- ▶ Electronics of Silicon ladder(Wenxi)
- ▶ TRD performance test
- ▶ Scissor/Goliath table will be used

Transformation of CALO prototype

- ▶ Two identical $5*5*10$ prototype
- ▶ “Stacked” layout from beam direction($5*5*20$) at the first few(3-4) days
 - ▶ MIP Calibration
 - ▶ response with primary proton beam
- ▶ Then transformed to “Parallel” layout ($5*10*10$) manually
 - ▶ scan with electron beam

Trigger and Synchronization

- ▶ Global trigger provided by Scintillators
- ▶ Prompt veto signal feedback by IsCMOS
- ▶ All systems synchronized by the event number
 - ▶ **electromagnetic interference from scissor table!**

Summary

- ▶ The 2018 test beam will be the last chance for the functional and performance verification of HERD prototype
 - ▶ 2 years long shutdown of beam facilities starting from 2019 (LHC LS2)
 - ▶ LHC LS3, 30 months starting from 2024
 - ▶ Next beam window for us is between 2021 and 2023, and might be last chance before launching

We have pleasant collaboration in the past two beam tests, and I wish we'll make the 2018 test success again