Planning of Beam Request at ProtoDUNE VD
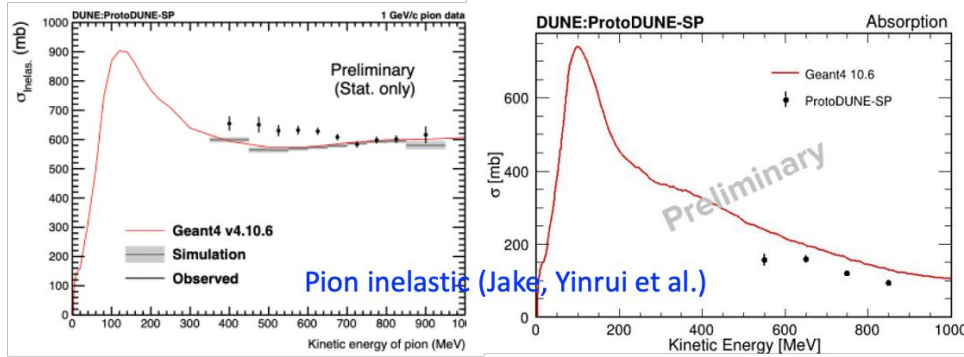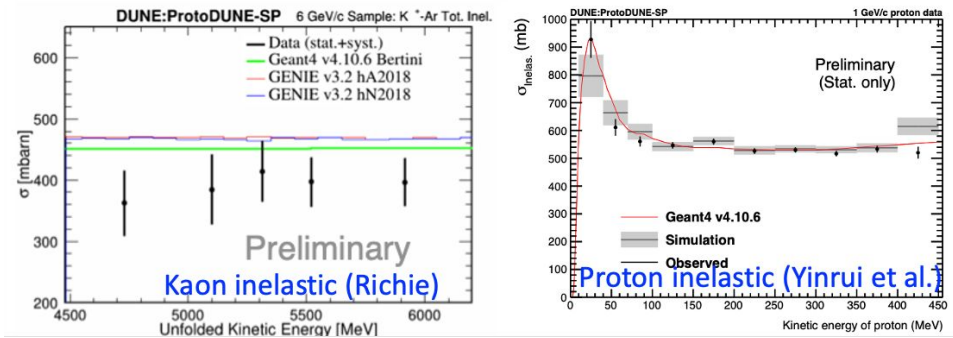
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Status of hadron analysis in ProtoDUNE SP

Pion inelastic (Jake, Yinrui et al.)

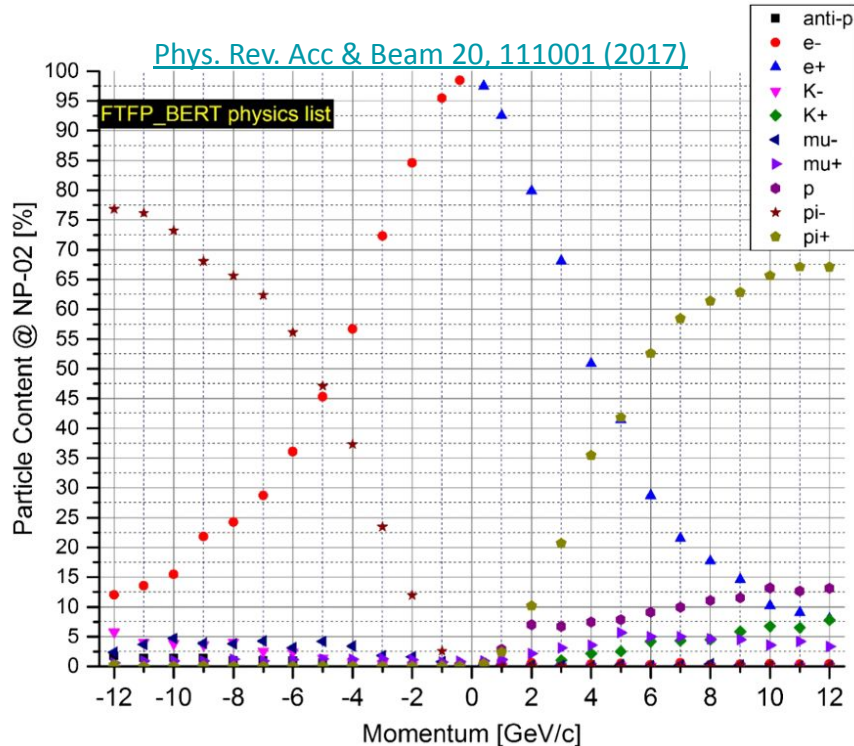Kaon inelastic (Richie)

Proton inelastic (Yinrui et al.)

- Except proton inelastic scattering, other analyses have limited sensitivity around the resonance region (low energy)

What can we add at ProtoDUNE VD?

- Hadron-argon xsec at lower energy
  - Beam data with lower momentum would be helpful, however, how much triggers can we have? ProtoDUNE-SP does not have sufficient triggers at 0.5GeV/c
  - Redesign the beam trigger logic for low-momentum kaon, say 3GeV/c
- Negative polarity
  - Electron vs. positron: same calorimetry performance?
  - How difficult to switch between negative and positive polarity?

- Tune the charged particle fraction with different target? (Niko et al.)

Beam particle fraction @ NP02

Phys. Rev. Acc & Beam 20, 111001 (2017)

- Although no obvious improvement in hadron fractions for negative polarity, it can still be interesting to understand the systematic difference between electron and position, pi- and pi+ etc.
  - Tag stopping pi- via mu- capture with PDS

Beam line instrumentation logic @ NP04

		Momentum (GeV/c)			
		1	2	3	6–7
e	TOF (ns)	0, 105	0, 105	—	—
	XCET-L	1	1	1	1
	XCET-H	—	—	1	1
μ / π	TOF (ns)	0, 110	0, 103	—	—
	XCET-L	0	0	0	1
	XCET-H	—	—	1	1
K	TOF (ns)	—	—	—	—
	XCET-L	—	—	0	0
	XCET-H	—	—	0	1
p	TOF (ns)	110, 160	103, 160	—	—
	XCET-L	0	0	0	0
	XCET-H	—	—	0	0

- In ProtoDUNE SP, we did not separate kaon and proton triggers in the 3GeV/c beam data
  - Can we redesign the beam instrumentation logic for kaon at 3GeV/c?
  - Almost no kaon below 3GeV/c

Plan Idea

ProtoDUNE-HD :

Priority: 1 GeV beam at both polarities to have statistics to perform exclusive cross section studies and probe the delta resonance

Bonus: 3 GeV beam (for kaon cross section analysis) ? -> MC studies for feasibility

ProtoDUNE-VD :

1-? GeV negative beam (with pion and K or p tagging)

- Linearity and calibration studies
- Compare SP and VD measurements with different polarities
- Compare HD and VD results at 1 GeV

1 GeV positive beam

- Pion tagging and cross sections, comparisons with HD and SP

-> Discuss the priorities with the different WG