Status of Near Detector Design Study

DUNE Monthly Collaboration Call
16-Mar-2018

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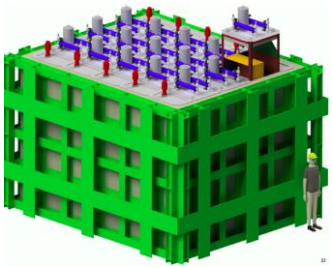
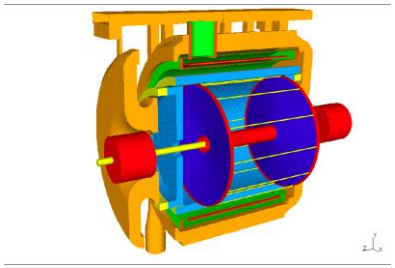
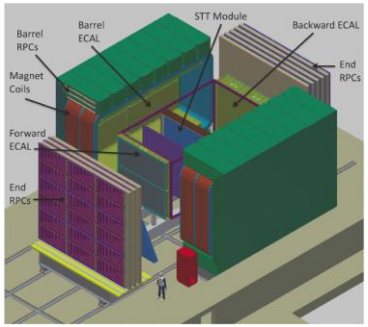
Concepts under study

- LAr TPC with pixel readout
  - Augmented by muon system (MPT or otherwise)

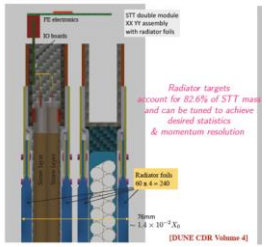


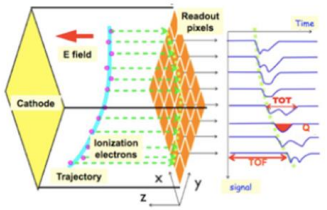


- Multi-purpose tracker (MPT)
  - HP TPC or straw tube tracker
  - Traditional Dipole or KLOE superconducting solenoid
  - Possibly augmented with 3D scintillator



- DUNEPRISM
  - Movable detectors (off-axis 0~30 m)





Outstanding questions

- What kind of magnet for the downstream spectrometer?
  - Re-use KLOE superconducting solenoid or a new-build dipole?
- What kind of tracking technology for the downstream spectrometer?
  - Straw-tube tracker or high-pressure gaseous-argon TPC?
- Should the downstream spectrometer augmented with 3D ST?
- Should we adopt the PRISM concept?
- For LAr TPC
  - Should we use pixelated readout?
  - What are the dimensions?
  - Can it handle pileup?

Timeline

1	Target date	Milestone	Type	Tier	Original date	Complete
40	Jan-17	Launch of expressions of interest in ND Concept Study	ND	2	Jan-17	Feb-17
44	Mar-17	ND Concept Study workshop	ND	2	Mar-17	Mar-17
50	May-17	Define two/three ND concept options for further study	ND	2	May-17	May-17
56	Jun-17	ND Concept Study workshop	ND	2	Jul-17	Jun-17
69	Nov-17	ND Concept Study workshop (CERN)	ND	4	Nov-17	
73	Nov-17	Document criteria/physics processes for ND tracker choice	ND	3	Nov-17	
74	Nov-17	Document criteria for comparison of magnet options	ND	3	Nov-17	
77	Dec-17	Report on cost implications/technical risks of Solenoid option	ND	3	Dec-17	
85	Jan-18	Status report on ND tracker studies - define next steps	ND	3	Jan-18	
86	Jan-18	Recommendattion on whether to purse PRISM concept	ND	2	Jan-18	
87	Jan-18	Report on scientific arguments for magnet to EC	ND	3	Jan-18	
89	Feb-18	Decision on ND Magnet	ND	2	Feb-18	
91	Mar-18	Report on comparison of tracker options and recommendation	ND	3	Mar-18	
92	Mar-18	Report on benefits of PRISM concept and recommendation	ND	3	Mar-18	
93	Mar-18	Report on benefits of 3-D scintillater as part of MPT and recommendation	ND	3	Mar-18	
94	Mar-18	ND Concept Study workshop	ND	4	Mar-18	
97	Apr-18	Decision on PRISM concept	ND	2	Apr-18	
98	Apr-18	Decision on 3-D scintillator	ND	2	Apr-18	
99	Apr-18	Decision on ND Tracker technology	ND	2	Apr-18	
101	May-18	Decision on the conceptual design of the near detector systems	ND	1	Dec-17	
104	Jun-18	Start of ND EoI process	ND	2	Jan-18	
124	Apr-19	Draft of CDR for Near Detector	ND	2	Sep-18	
130	Aug-19	Review of Near Detector CDR	ND	1	Aug-19	
135	Apr-20	TDR for Near Detector	ND	1	Apr-20	
136	Jun-20	LBNC Review of Near Detector TDR	ND	1	Jun-20	
137	Aug-20	CD-3 and LBNC Reviews for near site and Near Detector	ND	1	Aug-20	

Status

- Working groups within the Concept Study have been working hard to find questions to a set of questions agreed in the November 2017 workshop
  - Use common software tools developed within the Concept Study for direct comparison of different proposals
- Based on the scientific findings of the working groups, a draft report on the magnet option is being circulated within Concept Study
  - Plan to submit it to the spokespersons early next week
  - EC will consider the recommendation from Concept Study with the technical and cost impacts of the two options taken into account to reach a decision on the choice of magnet

4th ND Workshop

- The workshop will take place at Fermilab on 22-24 March
  - https://indico.fnal.gov/event/15649/
- Goals of the workshop
  - Decide on the choice of tracking for the downstream spectrometer
  - Decide whether the 3DST should be incorporated into the ND Concept
  - Decide whether the PRISM concept should be implemented
  - Decide whether pixelated readout be used for the LAr TPC and firm up its dimensions
  - Begin to formulate a Concept to be presented to the Collaboration at the May collaboration meeting.

4th DUNE Near Detector Workshop

from Thursday, March 22, 2018 at **09:00** to Saturday, March 24, 2018 at **15:00** (US/Central)
at **Fermilab (Curia II and One West)**

Description In this workshop, we will review and compare the scientific potential of a straw-tube tracker and a high-pressure gaseous argon TPC for the magnetized spectrometer downstream of the liquid-argon TPC, the added value of a 3-D scintillator detector to the scientific capability of the DUNE near-detector complex, and how the PRISM concept would help in measuring the CP-violating phase in DUNE. In addition, we will address some remaining issues that will impact the design of the liquid-argon TPC. Our goal of this workshop is to decide on the mentioned options so that we will converge on a concept of the near detector complex.

Remote Access - https://fnal.zoom.us/j/824322406

Go to day

Thursday, March 22, 2018

09:00 - 09:20 Goals of Workshop *20'*
Speakers: Mike Kordosky (William and Mary), Prof. Steven Manly (University of Rochester), Prof. Kam-Biu Luk (UC Berkeley), Prof. Alfons Weber (University of Oxford and STFC/RAL)

09:20 - 10:30 Liquid-argon TPC
- 09:20 **Issues on LAr TPC** *10'*
- 09:30 **Overview and Status of ArgonCube** *20'*
  Speaker: Dr. James Sinclair (University of Bern)
- 09:50 **PixAr: Status and Results** *20'*
  Speaker: Dr. Jonathan Asaadi (University of Texas Arlington)
- 10:10 **Status of LArPix** *20'*
  Speaker: Dr. Dan Dwyer (LBNL)

10:30 - 11:00 Coffe Break

11:00 - 12:10 Liquid-argon TPC
- 11:00 **Summary of Simulations** *45'*