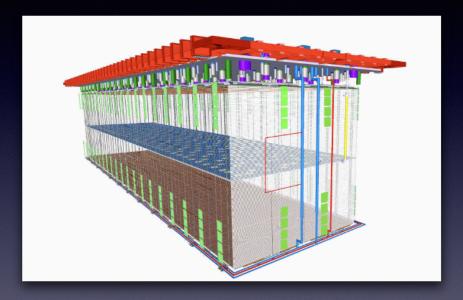
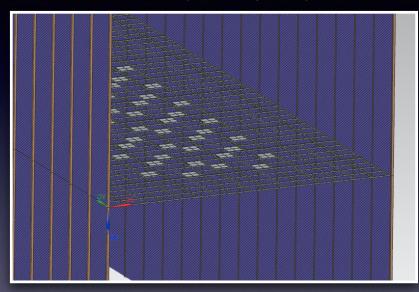
Jun 26 – 28, 2023 Stony Brook University Physics Building

From this (FD2 - VD)



To this (FD3 - VD Optimized)



## "VD Optimized FD3" w/ enhanced PDS Summary and Outlook

SBU WS focused on Optimized VD FD3 with enhanced LArPDS (large area PD-FC integrated system - APEX)

APEX integration with VD LArTPC existing CRP well established, viable option for FD3 based on FD2 demonstrated performance achievements, low risk and cost/schedule control.

Opportunity for integration w/ other options (solutions at MoO) were discussed and found favorable.

The large area PD-FC integrated system - APEX - solution for FD3 stands upon a mature, demonstrated technology for FD2.

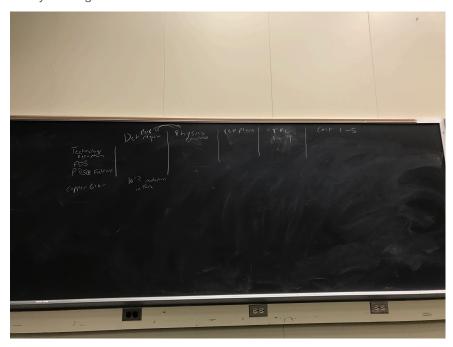
New/Novel Technical Elements for FD3 are being identified (outcome of this WS) Only Few of these are CRITICAL for FD3
(the other are optional/incremental wrt to FD2 demonstrated solutions)

Technical Readiness assessment for the Critical Elements (among the New/Novel Elements) under evaluation

Path toward Technical Readiness defined based on a realistic Prototyping Staged program (Assuming availability of funds both from EU and US sources)

Perspectives for DUNE Physics Scope Expansion well identified (LowEn UG Physics [5 MeV-500 MeV] and anticipated Background Rejection (to be demonstrated)

Mary & Sergio



SBU WS: >60 Participants, Great organization - Thank you Wei and SBU Team

Detection Technology	Detector Spec's Requirements/Goals	Physics Enable	Critical New/Novel Technical Elements (CTE)	Technical Readiness Level (TRL)	R&D Plan (ECFA& CPAD)	Path/ Timeline for TRL=7	Cost	Combine/ Integrate with LArTPC
Large Area LArPDS (O(2000m²) PD@FC (APEX)	Granularity 0.2-0.3 m²  Energy Resolution (5%@10MeV) Position Resolution (O(20cm³) Time Resolution (O(5ns))  - LY (O(150 PE/MeV) - LY Uniformity (Avg-Min:<20%)  - Light-Energy Calibration (O(5%))  Electronics S/N (O(10))  RadioPurity <xx kg<="" mbq="" td=""><td>LowEn UG Physics [5 MeV-500 MeV]  LowEn Backgd Rejection  Trigger Effic: 100% Solar-nu En. Spectrum SN-nu En.Spectrum, Time Profile, SN sensitivity extension to Magellanic  n-capture identification (and rejection) Alpha decay in LAr bulk PSD and rejection</td><td>⇒PD module framed in FC electrodes (mechanical eng. integration)  ⇒(Non critical) Dichroic on Acrylic (DF+WLS)  ⇒High effic. PoF  ⇒Cold FE+ADC  ⇒(critical ?) LargeBandwidth SoF (Ring Resonator)  ⇒(Non critical) Digital SiPM</td><td><ul> <li>→(Today) TRL=4         (Tech.component integrated and work together)</li> <li>→ (Today) TRL=4-5         (Tech.component integrated and work together)</li> <li>→(Today) TRL=5 (Basic tech. tested at lab.scale and full simul)</li> <li>→(Today) TRL=5-6         (btw lab.scale and pilot-scale prototype validation)</li> <li>→(Today) TRL=3 (Proof of Concept, Active R&amp;D initiated)</li> <li>→(Today) TRL&lt;3</li> </ul></td><td>Staged (3-steps) Prototyping:  Table-top (50lt@CERN) - started/in progress  Iarger sized (m² PD, m³ of LAr) - order of 100- channels SoF read-out and PoF  full-sized, fully PD- instrumented FC of a Vertical Drift LArTPC in the protoDUNE cryostat at CERN</td><td>- 2023-2024 - 2024-2025 - 2025-2027</td><td>Parameter Value  Estimate Fy 23 Prototype FY 26 Module-0 FY 28 Production FY 31 Commissioning FY 34  Average Escalation/ Inflation: 4% Average Procurement Overhead: 10%  FD3 PDS M&amp;S Total \$25,436,884 FD2 PDS Labor Total \$9,392,276 FD2 PDS Grand Total \$34,829,160  Production M&amp;S Total \$20,971,331 Production Labor Total \$4,068,208 Production Grand Total \$25,039,539</td><td>CRP Ariadne Solar Q-Pix LArPix (SloMo)</td></xx>	LowEn UG Physics [5 MeV-500 MeV]  LowEn Backgd Rejection  Trigger Effic: 100% Solar-nu En. Spectrum SN-nu En.Spectrum, Time Profile, SN sensitivity extension to Magellanic  n-capture identification (and rejection) Alpha decay in LAr bulk PSD and rejection	⇒PD module framed in FC electrodes (mechanical eng. integration)  ⇒(Non critical) Dichroic on Acrylic (DF+WLS)  ⇒High effic. PoF  ⇒Cold FE+ADC  ⇒(critical ?) LargeBandwidth SoF (Ring Resonator)  ⇒(Non critical) Digital SiPM	<ul> <li>→(Today) TRL=4         (Tech.component integrated and work together)</li> <li>→ (Today) TRL=4-5         (Tech.component integrated and work together)</li> <li>→(Today) TRL=5 (Basic tech. tested at lab.scale and full simul)</li> <li>→(Today) TRL=5-6         (btw lab.scale and pilot-scale prototype validation)</li> <li>→(Today) TRL=3 (Proof of Concept, Active R&amp;D initiated)</li> <li>→(Today) TRL&lt;3</li> </ul>	Staged (3-steps) Prototyping:  Table-top (50lt@CERN) - started/in progress  Iarger sized (m² PD, m³ of LAr) - order of 100- channels SoF read-out and PoF  full-sized, fully PD- instrumented FC of a Vertical Drift LArTPC in the protoDUNE cryostat at CERN	- 2023-2024 - 2024-2025 - 2025-2027	Parameter Value  Estimate Fy 23 Prototype FY 26 Module-0 FY 28 Production FY 31 Commissioning FY 34  Average Escalation/ Inflation: 4% Average Procurement Overhead: 10%  FD3 PDS M&S Total \$25,436,884 FD2 PDS Labor Total \$9,392,276 FD2 PDS Grand Total \$34,829,160  Production M&S Total \$20,971,331 Production Labor Total \$4,068,208 Production Grand Total \$25,039,539	CRP Ariadne Solar Q-Pix LArPix (SloMo)