Light readout update

ND-LAr management board
December 15, 2021

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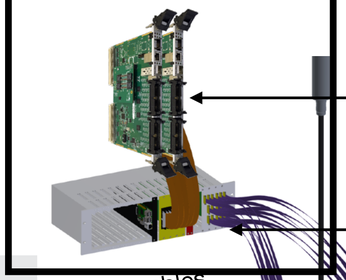
Light R/O Scope

Put everything to a single 6U crate to fulfil the PRISM option

AFI JINR ADC

VGA, SiPM PS, controller

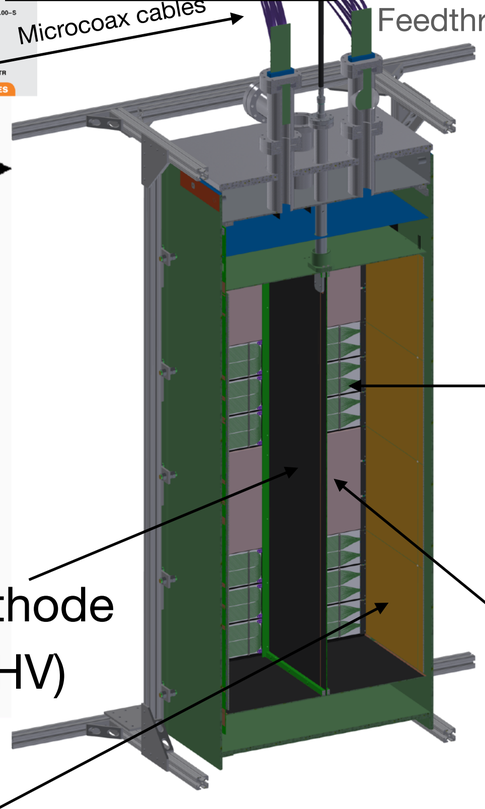


Microcoax cables

Feedthrough

DUNE ND LArTPC
7 x 5 Modules

Neutrino beam

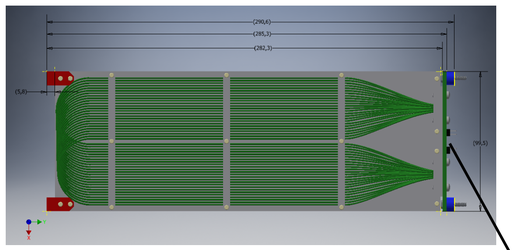


Cathode
(HV)

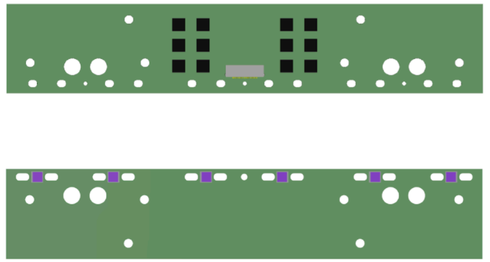
Charge R/O

Light collection modules

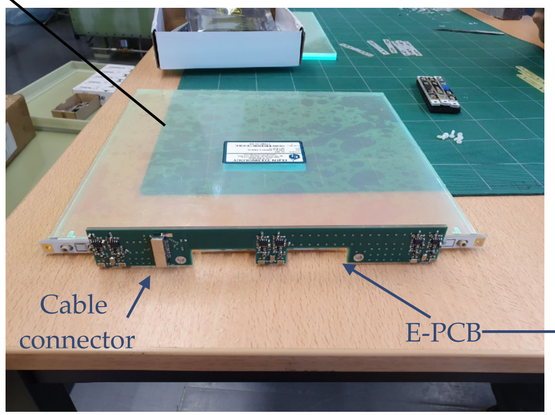
LCM



E-PCB with SiPMs

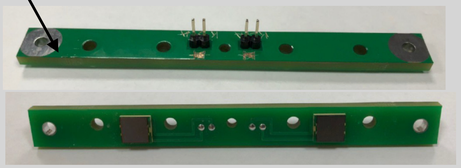


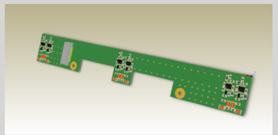
ArcLight



R/O Chain (current)

SiPM Boards





E-PCB/Cold
PreAmps

02.05: Light Readout: Scope/MOU Details

Файл Правка Вид Вставка Формат Данные Инструменты Расширения Справка Последнее изменение: 38 минут назад

B61 | 2

	A	B	C	D	E	F	G	H	I
7	**Task/Item**	**Qty**	**Spares**	**Institutions**	**Funding Source**	**Funding Status**	**Detailed description**		
8	LCMs	2100	420	JINR	JINR budget	waiting for approval	Design, production, and assembly	*If LCM/ArCLight = 50/50*	
9	ArCLights	700	140	Bern	Swiss	waiting for approval	Design, production, and assembly	*If LCM/ArCLight = 50/50*	
10	SiPMs	8400	1680	JINR	JINR budget	waiting for approval	Specification and procurement		
11	E-PCBs	2800	560	JINR/Marathon	JINR budget	waiting for approval	Design, production, and assembly		
12	Light Readout Feedthroughs	70	14	JINR/Marathon	JINR budget	waiting for approval	Design, production, and assembly	2 per module	
13	SiPM boards	4200	840	JINR/Marathon	JINR budget	waiting for approval	Design, production, and assembly		
14	Microcoax Cables (diff lenghts)	1400	280	JINR	JINR budget	waiting for approval	Design, production, and assembly		
15	SiPM PS (Biasing) modules	70	14	JINR/Marathon	JINR budget	waiting for approval	Design, production, and assembly		
16	SiPM PS & VGA control units	35	7	JINR/Marathon	JINR budget	waiting for approval	Design, production, and assembly	*4 ADC per module + 1 Sum ADC*	
17	VGA unit	280	56	JINR/Marathon	JINR budget	waiting for approval	Design, production, and assembly		
18	ADCs (readout)	175	35	JINR/AFI	JINR budget	waiting for approval	Specification and procurement		
19	ADC sync and trigger units	35	7	JINR/AFI	JINR budget	waiting for approval	Specification and procurement		
20	WR switch	2	1	JINR	JINR budget	waiting for approval	Specification and procurement		
21	VXS crates	35	7	JINR	JINR budget	waiting for approval	Specification and procurement		
22	HV power units	35	7	JINR	JINR budget	waiting for approval	Specification and procurement		
23	Optical cables	245	49	JINR	JINR budget	waiting for approval	Specification and procurement		
24	LV power units	35	7	JINR	JINR budget	waiting for approval	Specification and procurement		
25	Power&Signal Adapter boards	280	56	JINR	JINR budget	waiting for approval	Design, production, and assembly		
26	LRO Slow control software	-	-	JINR	JINR budget	waiting for approval	Devloping within DAQ consortium		
27	LRO DAQ software	-	-	JINR	JINR budget	waiting for approval	Devloping within DAQ consortium		
28	GPS grandmaster (DOWR or similar)	1 port	1 port	Fermilab/?	DUNE-US Project	?	Support at Fermilab testing facilities		
29	LRO DAQ Networking 10Gbps			Fermilab/?	DUNE-US Project	?	Specification, procurement and installation		
30	DAQ computers, disks and tapes			Fermilab/?	DUNE-US Project	?	Specification, procurement and installation		
31	Support during ND A&T	-	-	JINR/Bern/Fermilab/NDLAr	JINR budget/ DUNE-US Project/ Swiss	waiting for approval	Technical/scientific support during TPC Module assembly and test program at the MATF, including travel.		
32	Support during ND I&I	-	-	JINR/Bern/Fermilab/NDLAr	JINR budget/ DUNE-US Project/ Swiss	waiting for approval	Technical/scientific support during TPC Module installation and integration at the DUNE Near Detector Site, including travel.		
33									
34	**QA/QC and characterization**								
35	LCM Light Yield test			JINR/Marathon	JINR budget	waiting for approval	bench qualification test		
36	LCM coating			JINR/Marathon	JINR budget	waiting for approval	bench qualification test		
37	ArCLight LY test			Bern	Swiss	?	bench qualification test		
38	ArCLight coating			Bern	Swiss	?	bench qualification test		
39	LCM assembly: QA/QC			JINR/Marathon	JINR budget	waiting for approval	Mechanical+cryo tests after assembly. Sample test of coating		
40									
41	ArCLight assembly: QA/QC			Bern	Swiss	?	Mechanical+cryo tests after assembly. Sample test of coating		
42	Microcoaxial cable assembly: QA/QC			JINR/Marathon	JINR budget	waiting for approval	bench-testing for contact/signal propagation		
43	Cold electronics: QA/QC			JINR	JINR budget	waiting for approval	bench-testing at warm/cold		
44	VGA: QA/QC			JINR/Marathon	JINR budget	waiting for approval	bench qualification test		
45	SiPM PS: QA/QC			JINR/Marathon	JINR budget	waiting for approval	bench qualification test		
46	ADC and WR synchronization: QA/QC			JINR	JINR budget	waiting for approval	bench qualification test		
47	Ribbon twisted pair cable: QA/QC			JINR/Marathon	JINR budget	waiting for approval	bench-testing for contact/signal propagation		

Scope table is almost mature

Some obsolete models/pictures

Need to confirm institutions and funding agencies/status for onsite testing

PDR documentation status

Category	Document	Documentaion Maturity	Design/Plan maturity	Notes
Design	PDR chapter	~70% mature	corrections required	
Design	Mechanical CAD	~ 80%	minor changes expected	
Design	Mechanical engineering drawings	~ 80%	minor changes expected	
Design	Mechanical assembly drawings and parts list	~ 50%	feedthrough design not ready	Need help to design FDTR
Design	Electrical schematics and board layouts	~ 50%	Changes expected after 2x2 feedback	SiPM PCB w/ apms need to be designed
Design	Specification of electrical cabling & wiring connections	~ 50%	maybe change from microcoax to flex PCB	
Design	Documentation links for commercial, off-the-shelf items	~ 50 %	not fully finished	

PDR documentation status

Category	Document	Documentaion Maturity	Design/Plan maturity	Notes
Requirements	EB-, TB-, consortium-held requirements	rather mature	validated w/ 2x2,FSD	EDMS # 2612984
Interfaces	Consortium-Consortium/ Installation/Facilities	immature	Interfaces are understood and actively refined	
QA/QC	Preliminary QA/QC plan	mature	validated w/ 2x2, FSD	EDMS # 2587876
QA/QC	Manufacturing plan	mature	minor changes expected	EDMS # 2605604
QA/QC	Procurement plan	mature	changes expected/ semiconductors procurement ???	EDMS # 2605605
Cost/ Schedule	Institutional responsibilities	rather mature	Update some prices	scope table MOU (?)

Top Risks

- **Parts availability for semiconductors (eg. DAC 5535B ~ 90 weeks)**
- Restrictions of JINR fellows presence onsite (Fermilab) - **mitigated**
- Long-term stability @ Cryo (TPB coating, cracks, breaks, films, electronics, etc)
- Fulfillments to the requirements (**Threshold > 5 MeV -> PDE > 0.6%**)
- Integration issues (sync. protocol, DAQ, event building)

Prototyping plan

Production plans for 2x2

- Production of LCMs — Late 2021 - done
- Production of ArCLights — Late 2021 - done
- Readout channels = 384: 64 E-PCB, 16 VGAs(24ch) — Early 2022 (Module 1 - done)
- DAC PS production - 4pcs. + 2 spare - outsource — Late 2021 (waiting for testing soon)
- Microcoaxial cables already purchased
- ADCs ordering & purchasing - 6 pcs. + 1 spare — Late 2021 - done
- Trigger logic ordering & purchasing: 1 ADC -> 64 OR channels + Trigger unit - late 2021 (procurement)
- White Rabbit for Clock sync & Absolute timestamp - Fermilab (onsite preparation). WR switch in Dubna
- Calibration system — late 2021 - (test while module 1)
- Shipment to Bern — early 2022 (Module 1 is in Bern)
- Modules will be instrumented/tested @ Bern and shipped to US
- Module-0 assembled and already been tested

Prototyping plan

Production plans for FSD (1 or 2?)

- LCM/ArCLight production - Late 2022
- Production of E-PCB - Late 2022
- SiPM board production - N/A (integrated on E-PCB) - Late 2022 - Early 2023
- Cables - Late 2022 -Early 2023 (Flex?)
- VGA/Adapter card production - Late 2022 - Early 2023
- DAC PS production - Mid 2022
- ADCs & Logic - Late 2022
- Shipment - Early-Mid 2023
- Testing at Bern or FSD-TF - ??? (Other systems readiness)