#	Sensor Description	Quantity &	Comments	Cryomodule Feed-Through	Responsible/
	2000.190.011			Flange	Person
1	Piezo Actuators (Fast Tuners)	<u>32 Piezos</u> – 4 piezos / fast- tuner x 1 fast- tuner/cavity x 8 cavities = 32 piezos	New tuner design similar to Saclay-1 lever tuner Voltage = -32V to +120V The fast tuner can be replaced through an access port. Each fast tuner comes wired with 60cm long Kapton insulated wires but	Flange <u>Flange A</u> Feed-through: One 12-pin DT02H-14-12PN	Person Yuriy Pischalnikov
			connectors will need to be installed (CM internal pigtail connection): One 4-pin Hypertronic connector part number D01PB406MSUTH will be installed on each half-tuner for easy replacement. 2 wires/piezo x 2 piezos/half- tuner.		
			The two mating 4-pin Hypertronic connectors part number D01PB406FSUTH (2 half- tuners) are terminated on the feed-through side with one 4-pair, 28 AWG stranded, shielded, Kapton insulated vacuum wire from Accu-Glass Products, Inc., Model: TYP3-8TW Note: Detoronics 12-pin		
			connectors are hermetic glass to metal feed-through connectors with 304 SS shell. Note O-ring material must be radiation resistant. Two pins will be shorted on the vacuum side to provide		

 Table 1: LCLS 1.3GHz Prototype Cryomodule Instrumentation List

			an interlock for the niezo		
			nower supply		
2	Stenner	8 Platinum RTDs	Will be used as an interlock	Flange A	Vuriv
-	Motor	One RTD/stenner	to prevent the motor from	Feed-through	Pischalnikov
	Platinum RTD	motor x 8 tuners	overheating	One-third 19-nin	1 ISCHUIRING V
		motor x o tuners	overneuting.	Detoronics	
			The stepper motors come	connector.	
			with embedded	DT02H-1/-19PN	
			thermocouples installed by	(Shared with Main	
			the manufacturer	Counter Platinum	
				Interlock RTDs)	
			It is proposed that	Interiock (TDS)	
			Platinum PTDs are installed		
			on the motor housing for		
			consistency with the other		
			Platinum RTD interlocks		
			and readout electronics		
			and readout electronics.		
			One Platinum 100 Ohm		
			BTD installed on the motor		
			housing: European		
			Standard DIN/IEC 60751		
			Standard Divite 00751.		
			Use guad-twisted		
			Manganin wires with		
			Polvimide ML insulation		
			and Tefzel jacket.		
3	Main Coupler	16 Main Coupler	These RTDs are used as	Flange A	Timergali
	Platinum RTDs	RTDs – 2 RTDs at	interlocks so there is no	Feed-through:	Khabiboulline,
		each cavity x 8	need to read lower	Two-thirds 19-pin	Nikolay Solyak
		cavities (1 at 12	temperatures.	Detoronics	
		o'clock & 1 at 10		connector:	
		o'clock).	Use platinum 100 Ohm,	DT02H-14-19PN	
			European Standard DIN/IEC	(Shared with Stepper	
			60751.	Motor Platinum RTD)	
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
			Share a 19-pin feed-		
			through connector with 1		
			stepper motor		
-		46.0 5==	thermocouple.		-
4	Helium Vessel	<u>16 Cernox RTDs</u> –	Not required for cryogenic	Flange A	Iom Peterson
	Cernox RTDs	2 sensors on	control but provides	Feed-through:	
		each helium	additional monitoring.		

	[-	
		vessel (vacuum		One-half 19-pin	
		side) x 8 cavities:	Use Lakesnore Cernox	Detoronics	
		1 sensor on top	bobbin mounted RTDS (CX-	Connector:	
		and I sensor on	1030-CU-HT) to provide a	DIUZH-14-19PN	
		the bottom of	the using	(Shared with Beam-	
		each cavity.	the wire.		
			A wires / Cernox PTD Lise	Temperature)	
			ane 19-pip feed-through	remperaturej	
			connector Will have 11		
			snare nins on each		
			connector.		
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
5	Beam-tube	8 Cernox RTDs -	Use Cernox bobbin (CX-	Flange A	Tom Peterson,
	Temperature	1 Cernox RTD on	1030-CU-HT) mounted	Feed-throughs:	Joshua
		each cavity	RIDs to provide a local	One-fourth 19-pin	кајиźny
		beam-tube	thermal anchor for the	Detoronics	
			wire.		
			4 wires / Cernox BTD	D10211-14-19FN	
			+ wires / cemox mp.		
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
6	Magnetic	8 Cernox RTDs -	Use Cernox bobbin (CX-	Flange A	Tom Peterson,
	Shield	1 Cernox RTD on	1030-CU-HT) mounted	Feed-throughs:	Joshua
	Temperature	each magnetic	RTDs to provide a local	One-fourth 19-pin	Kaluzny
		shield	thermal anchor for the	Detoronics	
			wire.	connector:	
			A wines / Company DTD	D102H-14-19PN	
			4 wires / Cernox RTD.		
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
7	HOM Coupler	<u>32 Cernox RTDs</u> –	One RTD is mounted on	Flange A	Timergali
	Cernox RTDs	Install 2 RTDs on	each HOM can, alongside	Feed-through:	Khabiboulline,
		each HOM	the two spots where the	One 19-pin	Nikolay Solyak
		coupier.	legs of the formfell are	Detoronics	
		This number will	welded to the can.		
		he reduced on		DT02H-14-19PN	
1		De reduced Off	1	1	

		the production	A second RTD will be	(split between two	
		CMs	installed on the conner	connectors but	
		Civis.	feed-through via the	taking up one	
			conner clamp	connector total)	
			copper clamp.		
			Lise a total of 4 Corney		
			1030-HT-SD RTDS at each		
			cavity.		
			4 wires / Cernox RTD. Use		
			one 19-pin feed-through		
			connectors.		
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
8	Stepper	8 Stepper Motors	Manufacturer: Phytron	Flange B	Yuriy
	Motors	– 8 slow tuners x	Model #: VSS 52.200.2.5-	Feed-through:	Pischalnikov
		1 stepper motor	4LP-5M-UHVC	One-half 8-pin	
		/ slow tuner	200 Steps / Rev, 2.5A, 4	Detoronics	
			Leads Parallel.	connector:	
				DT02H-16-8PN	
			The slow tuner can be	(Shared with Tuner	
			replaced through an access	limit switches)	
	(port.		
			One 5-pin Hypertac		
			connector part number		
			HBM26E11-05PN will be		
			installed on the slow tuner		
			side (4 wires (stepper		
			side (4 wires/stepper		
			motor).		
			A meeting F win 14 meeters		
			A mating 5-pin Hypertac		
			connector part number		
			HRM24F11-05SN WIII be		
			terminated with four		
			twisted wires, 20 AWG		
			stranded, Kapton insulated		
			wire from Accu-Glass		
			Products, Inc.		
			Model: TYP12		
			One 8-pin Detoronics		
			connector on flange A at		
			each cavity.		

٩	Tuner limit	2 switches per	Limit switches on tuner to	Flange B	Vuriv
5	switches	tunor	prevent damage to cavity	Feed-through	Pischalnikov
	3001001103	tuner	due to excessive tuper	One-half 8-nin	rischannkov
			travel		
			Liso 2 twistod pair 24	connector	
			Ose 2 twisted-pail, 24		
			Awd, Rapton insulated	DIUZH-10-OPN (Sharad with Stannar	
			24AWG-TWIST-5	(Shareu with Stepper	
10	Covity Field	Q Field Drohoe		Flance D	Timonyaali
10	Cavity Field	<u>8 Field Probes</u> –	Ose Times Microwave	Flange B Food throughout	Khabibaulling
	Propes –		Systems Triex-402 RF	Peed-throughs:	Khabibouiine
	Pransmitted	cavity x 8 cavities	cables for the cavity field	One N-Type, H+S	
	Power		probes (see description for	34-N-50-0-3/133NE	
			HOMS below).		
			The RF cable will be used in		
			a vacuum and at 4K. See		
			the technical specification.		
			2		
			3 m long cable terminated		
			with SIVIA male connector		
			on cavity end and N type		
			male connector Flange B		
			end.	Flavor D	
11	HOIVI FIEld	<u>16 Field Probes</u> –	Use Times Microwave	Flange B	Timergali
	Probes –	1 on each HOM x	Systems TFlex-401 RF	Feed-throughs:	Khabiboulline,
	Transmitted	2 HOMs / cavity x	cables: 7-mm thick and	I wo N-Types, H+S	Mohamed
	Power	8 cavities	copper core. Will have	34-N-50-0-3/133NE	Hassan
			lower losses than that used		
			for ILC CM-2.		
			The RF cable will be used in		
			a vacuum and at 4K. See		
			the technical specification.		
			Thermal anchor the RF		
			cables by clamping directly		
			to 5K pipe and 80K (35K)		
			snield. Special semi-loops		
		-	on cables		
			will accommodate relative		
			motion of cryomodule		
			parts up to 20 mm.		
			Note that the second free large		
			Note that the cavity feed-		
			through (Sapphire)		
			connector will also be		
			thermally anchored to the		
			2K, 2-phase.		

			HOM1 (fundamental coupler side) length = 2.0 meter (CM-2 L=2.6m – 0.6m), HOM2 length = 3.0 meters (CM-2 L=3.6m – 0.6m). Both ends terminated with N type male connectors.		
12	Coupler Electron Pick- ups	24 e-Pickups – 3 Pick-ups /cavity x 8 cavities (1 is mounted on the cavity side of the Couple, 2nd is mounted on the wave guide side of the Coupler, and 3 rd e-probe in air side of the coupler at each cavity).	Include on the Prototype CMs but may be decreased to 3 electron pick-ups on the production CMs. Use Times Microwave Systems TFlex-402 RF 1m cable. Both ends terminated with SMA male connectors. The cable will be used in a vacuum and at 4K. See technical specification. Alternative: Use H+S, K 03252-D06 RF cable (same as ILC CM-2 but will specify 316 SS). Two feedthroughs – third in air.	Elange B Feed-throughs: Two SMA-Type, H+S 34_SMA-50-0- 3/111NE	Timergali Khabiboulline
13	Helium Vessel Heaters	1 Kapton Insulated Strip heaters on the bottom of each vessel = 8 heaters.	25 watt heater, Omega KH-112/10 (110 ohms, ~50VDC) 2 wires/heater x 1 heaters/vessel. Install 2 voltage sense wires on the air side. Use two 20 AWG twisted wires, Kapton Insulated Wire from Accu-Glass, Model: TYP12	Flange B Feed-through: One 4-pin BTC Electronics connector: 8673-14B-4PN-SP- M121 (FNAL drawing #C124809) Mil-C- 26500	Tom Peterson, Tug Arkan, Josh Kaluzny

			Use one potted 4-pin feed-		
			through connector/helium		
			vessel.		
1/	Split	5 VT's (magnet v	Use three 8-nin "notted"	Flange C	Vladimir
14	Ouadrupole	3 magnets =	feed-through connectors at	Feed-through:	Kashikhin
	and Corrector	15 VT's.	Flange C.	Six potted 8-pin	
	Coil Voltage		5	Detoronics	
	Taps for coil		Use fifteen, 22 AWG,	connectors:	
	quench		stranded, Kapton Insulated	DT02H-16-8PN	
	monitoring.		wires from Accu-Glass,		
			TYP11.		
			Wires to be bundled in		
			groups of five for each		
			magnet.		
			The magnets will use		
			passive quench protection		
			(diodes) with energy		
45	C		extraction resistors.	Flavor C	
15	Split	1 Heater - 1	The heater is used to stop	Flange C	Vladimir Kashikhin
	and Corrector	entire coil	magnet package tests	One notted 4-nin BTC	Nashikhin
	Coil heater	package.	hughet puckage tests.	Electronics	
		Providen	R(300 K) = 278 Ohms, Vmax	connector:	
			= 400 V	8673-14B-4PN-SP-	
				M121 (FNAL drawing	
			Use twisted 20 AWG	#C124809) Mil-C-	
			stranded, Kapton insulated	26500	
			Wire from Accu-Glass,		
			TWIST-5)		
			Use one 4-pin potted feed-		
			through connector.		
16	Power Lead	<u>24 Voltage Taps</u> –	Will use conduction cooled	Flange D	Vladimir
	Voltage Taps	3 voltage taps /	current leads. VT's are	Feed-through:	Kashikhin
	tor resistance	current lead x 2	necessary for protection.	Inree potted 8-pin	
	monitoring.	3 magnets	Fach lead is thermally	connector:	
		Jinagineta	anchored at two	DT02H-16-8PN	
			temperatures. The two		
			pairs of voltage taps per		
			lead are used to measure		
			the two resistive segments		

			There are 8 lead VTs per		
			magnet		
			Use twenty-four, 22 AWG.		
			stranded. Kapton Insulated		
			wires from Accu-Glass		
			TVP11		
			Use three 8-nin "notted"		
			feed-through connectors		
17	Ream Position	1 BPM – 4 pick	Mounting near to split	Flange D	Timorgali
1/	Monitor	$\frac{1}{1} \frac{\text{DFIM}}{\text{PFIM}} = 4 \text{ pick}^2$	auadrupolo magnet?	Food throughs:	Khabiboullino
		ups	quadrupole magnet!	Feed-tilloughs.	Nikolov
	(DPIVI)	Varify that DDM	Liss Times Misroupus	24 N FO O 2/122NF	Nikoldy
		DTDs are not	Systems TElay 402 DE	54-IN-50-0-5/155INE	SUIYAK.
		required (earlier	systems friex-402 KF		
		TK noto)	Cable.		
		TK HOLE)	The cable will be used in a		
			The cable will be used in a		
			tochnical coocification		
			technical specification.		
			The PE cable length is 2m		
			Reth ands terminated with		
			N type male connectors		
			N type male connectors.		
			Alternative: Use H+S K		
			03252-D06 BE cable but		
			will specify 316 SS) (same		
			as e-nickups)		
18	Eluygate	5 Eluvgate	1 outside of shield in region	Flange D	Curtis
10	Sonsors in	Sansors	of cavities 1, 2, 7, 8, and	Feed-through:	Crawford
	Vacuum	Jensors	between 5 & 6	Two 19-nin	Dmitri
	vessel	1ea in vacuum	Setween S & 0.	Detoronics	Sergatskov
	VESSEI	region near	Need to be insure the	connector:	Sergatskov
		c_{2}	magnetic field inside the		
		and 8	dressed cavity is <0 5uT	D10211-14-13110	
			Use Bartington Mag-F		
			single-axis cryogenic sensor		
			rated for vacuum operation		
			= 0.2 mT (full field)		
			Use 2 twisted 24 AWG		
			pairs. Kapton Insulated		
			Wires from Accu-Glass		
			KAP-24AWG-TWIST-5.		

19	Heater on	Kapton insulated	Use two potted 4-pin feed-	<u>Flange D</u>	Tom Peterson,
	Helium Cool	strip heater	through connector.	Feed-through:	Joshua
	Down Circuit			Two 4-pin BTC	Kaluzny
			150 watt total heater	Electronics	
			power, Omega KH-112/10	connector:	
			(110 ohms, 3 in parallel,	8673-14B-4PN-SP-	
			~75VDC)	M121 (FNAL drawing	
			,	#C124809) Mil-C-	
			Install 2 voltage sense	26500	
			wires/heater on the air	20000	
			side		
			side.		
			Liso two 20 AMG wiros		
			twisted Kapton Insulated		
			Wisted, Kapton Insulated		
			Wires from Accu-Glass,		
			Model: TYP12		
20	Split	4 Silicon Diode	Use Lakeshore DI-670	<u>Flange F</u>	Vladimir
	Quadrupole	<u>lemperature</u>	Band A-1 uncalibrated	Feed-through:	Kashikhin
	and Corrector	Sensors – 1	silicon diodes.	One 19-pin	
	Coll cold mass	sensor on the		Detoronics	
	temperature	surface of each	4 wires / Silicone Diodes.	connector:	
	sensors	coil x 4 coils	Use one 19-pin feed-	DT02H-14-19PN	
			through connectors.		
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
21	Split	12 Silicon Diode	Use Lakeshore DT-670	<u>Flange F</u>	Vladimir
	Quadrupole	<u>Temperature</u>	Band A-1 uncalibrated	Feed-through:	Kashikhin
	and Corrector	<u>Sensors</u> – 2/lead	silicon diodes.	Three 19-pin	
	Coil lead	x 6 leads		Detoronics	
	temperature		4 wires / Silicon Diode. Use	connector:	
	sensors		three 19-pin feed-through	DT02H-14-19PN	
			connectors.		
			Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
22	Cool Down	<u>15 Cernox R</u> TDs –	Use Cernox bobbin (CX-	<u>Flange</u> K	Tom Peterson
	Cernox	mounted on:	1030-CU-HT) mounted	Feed-throughs:	
	Temperature		RTDs to provide a local	Four 19-pin	
	Sensors	Line A: 1	thermal anchor for the	Detoronics	
		Line B: 6	wire.	connectors:	
		Line C: 1		DT02H-14-19PN	
		Line D: 1	4 wires / Cernox RTD. Use	-	
		Line E: 1	four 19-pin feed-through		

		Line F: 1	connectors. Will have 11		
		HT Shield: 2	spare pins on one		
		Cooldown	connector.		
		heater: 2 (1 +			
		redundant)	Use quad-twisted		
			Manganin wires with		
			Polyimide ML insulation		
			and Tefzel jacket.		
23	Liquid Level	2 Liquid Level	Mounted inside each liquid	One on Flange E &	Tom Peterson,
	Sensors	Sensors – 1 at	level can.	<u>one on Flange L</u>	Joshua
		each end of the		Feed-through:	Kaluzny
		cryomodule	American Magnetics 2K	Two 6-pin Detoronics	
			level probe, radiation	connectors:	
			resistant, active	DT02H-10-6PN	
			Length = 12"		
				Two 6-pin Ceramtec	
			Use 2 potted 6-pin	connectors:	
			connector, and 2 Ceramtec	18904-01-CF	
			6-pin connector.		
			2 feed-throughs/flange x 2		
			flanges = 4 feed-throughs		
			Line true truisted pairs 24		
			AWC Kapton Insulated		
			AvvG, Kapton Insulated	-	
			KAD-22AW/G-TW/IST-5		
24	Cavity Helium	2 Pressure	Pressure transducers will	One on Flange F &	Tom Peterson
	Pressure	Transducers	be in air	one on Flange L	Joshua
				No feed-through,	Kaluzny
		1 – 0-100 Torr	0-100 Torr, VCR 8 female	VCR 8 male Pressure	· · · · · · · · · · · · · · · · · · ·
		1 – 0-100 psia	MKS 230EA-00100BB	tap on side of each	
				flange extension	
			0-100 psia, VCR 8 female	-	
			MKS 750C12PCE4GD		
			[Check operation in		
			radiation environment]		
			(not inside vacuum vessel,		
			accessible after		
			installation)		
25	Tomporature	16 Correy	Concorr or installed in	Condition F and 0 ar	Tom Dataman
25	Soncors in	TO CELLOX	Sensors are installed in	Cavilies 5 and 8 on	loopus
		36115015		and 4 on Flange L	Voluzny
	Vasals		One belium to guard	Eacd_througher	rtaluzily
	v C33C13		helium feed-through per	reeu-uniougns.	
1		1	nenum reeu-unough per		

		4 RTDs in helium	flange * 2 flanges = 2 feed-	Four 19-pin	
		vessels 1.4.5. and	throughs	Detoronics	
		8		connector:	
			Two guard helium to air	DT02H-14-19PN	
			feedthroughs ner flange * 2	0102111110111	
			flanges = 1 feed-throughs	Two 32-nin Ceramtec	
			hanges – 4 leeu throughs	connector:	
			Lise augd-twisted	24017-01-CE	
			Manganin wires with	24017-01-01	
			Dolyimido ML insulation		
			and Tofzol jackot		
26	Eluvato	9 Eluvrato	Sonsors are installed in	Covition E and 9 on	Curtic
20	Fluxgale	Soncore	bolium voscols	Elango E & Covition 1	Curus
		Sensors	nenum vessels.	Fidlige E & Cavilles I	Crawioru, Desitri
	Nessels	2 in halium		<u>and 4 on Flange L</u>	Dinitri
	vessels		Use Bartington Mag-F,	Two 10 min	Sergalskov
		vessel 1,4,5, and	Single-axis cryogenic sensor	Two 19-pin	
		8		Detoronics	
			One haling to mond	Connector:	
			One neitum to guard	D102H-14-19PN	
			flemme * 2 flemme 2 feed	Two 10 min Committee	
			through a	Two 19-pin Ceramtec	
			throughs	connector:	
				18906-01-CF	
			One guard helium to air		
			feedthroughs per flange * 2		
			flanges = 2 feed-throughs		
			Use 2 twisted 24 AWG		
			pairs, Kapton Insulated		
			Wires from Accu-Glass,		
			KAP-24AWG-1WIST-5.	-1	
27	Heater in level	1 cartridge	Mounted in well protruding	Flange K	Tom Peterson,
	can	heater	into level can.	Feed-through:	Joshua
				One 4-pin BTC	Kaluzny
			Hotwatt	Electronics	
			HS50-5 (28.8 Ohms)	connector:	
				8673-14B-4PN-SP-	
			Install 2 voltage sense	M121 (FNAL drawing	
			wires on the air side.	#C124809) Mil-C-	
				26500	
			50W, ~40VDC		
			Use two twisted, 20 AWG,		
			Kapton Insulated Wire		
			trom Accu-Glass, TYP12.		<u> </u>
28	Coupler l'uner	<u>& Stepper</u>	Purchase 2 sets (16 stepper	N/A	Timergali
	Wotors	Motors, 16 Limit	motors, etc.) for tests	External to the CM	Khabiboulline,
		<u>Switches, & 8</u>	before shipping the CM to		

Potentiometers 1 stepper motor, 2 Limit Switches, & 1one set for Fermilab. Remove before shipping to SLAC.Solyak, Tug Arkanpotentiometers for each main coupler x 8 main couplers.12V, 0.54A, 2-Phase, stepper MotorSubstance Tug ArkanExternal to the CM – no feed throughs or internal wiring.External to the CM – no feed throughs or internal wiring.
1 stepper motor, 2 Limit Switches, & 1Remove before shipping to SLAC.Tug Arkan1 stepper motor, 2 Limit Switches, & 112V, 0.54A, 2-Phase, stepper MotorTug Arkanpotentiometers for each main coupler x 8 main couplers.12V, 0.54A, 2-Phase, stepper MotorTug ArkanExternal to the CM – no Purchase 2 sets: One set for FNAL and one for I-LabExternal to the CM – no feed throughs or internal wiring.
2 Limit Switches, SLAC. & 1 potentiometers for each main 12V, 0.54A, 2-Phase, coupler x 8 main stepper Motor couplers. External to the CM – no Purchase 2 sets: feed throughs or internal One set for FNAL wiring.
& 1 potentiometers 12V, 0.54A, 2-Phase, for each main stepper Motor coupler x 8 main External to the CM – no Purchase 2 sets: feed throughs or internal One set for FNAL wiring. and one for I-Lab
octpotentiometers12V, 0.54A, 2-Phase,for each mainstepper Motorcoupler x 8 maincouplers.couplers.External to the CM – noPurchase 2 sets:feed throughs or internalOne set for FNALwiring.and one for I-Lab
for each main coupler x 8 main couplers. Purchase 2 sets: One set for FNAL and one for I-Lab
coupler x 8 main couplers. couplers. External to the CM – no Purchase 2 sets: feed throughs or internal One set for FNAL wiring.
coupler x 8 maincouplers.Purchase 2 sets:One set for FNALand one for I-Lab
Purchase 2 sets: feed throughs or internal One set for FNAL wiring.
One set for FNAL wiring.
and one for I-Lab
29 PMTS & <u>8 PMTS & 8</u> SLAC's vender will install N/A Timergali
Quartz <u>Quartz windows</u> the quartz windows on External to the CM Knabibouiline,
Windows will – Purchase 2 each cryomodule. Nikolay
be used. Solyak,
FNAL and one for Purchase two sets of PMTs Tug Arkan
J-Lab (16 total) for tests before
shipping the CM to SLAC.
One set for J-Lab and one
set for Fermilab. Remove
before shipping to SLAC.
A threaded port on the
waveguide is available for
connection of an infraRed
temperature sensor head,
which monitors the
window temperature.
One set for FNAL and one
set for J-Lab
External to the CM – no
feed throughs or internal
wiring.
30 Infrared 8 IR temp A threaded port on the N/A Nikolay
Temperature sensors waveguide is available for External to the CM Solyak,
Sensors (see connection of an infraRed Tug Arkan
#29) One per temperature sensor head,
threaded port which monitors the
window temperature.
31 Photo diode 8 photo diode Will be installed to N/A Elvin Harms
Temperature sensors compare with the IR sensor External to the CM
Sensors (see for monitoring the window
#29) Outside warm temperature. Need to
window design a support.

32	JT and	One JT and One	WEKA	N/A	Tom Peterson,
	Cooldown valves	cooldown valve per Cryomodule	PM-TEV DN6/PN25 C-Po h=600 PM-TEV DN15/PN25 C-Po h=600	External to the CM	Joshua Kaluzny