Project Risk ID	Title	Summary	Mitigation	Post Mitigation
RT-131-ND-077	DR8 Kapton Cost & Delivery	IF the vendor for the DR8 Kapton cannot schedule the custom run, THEN there could be cost and schedule impact OR an alternative solution would need to be investigated	Alternative resistive material investigation	**High 67% 4 mo, $xx Negligible**
RT-131-ND-080	Fluid Flow across the module	If the LAr fluid flow within a module is insufficient to cool the power density of the electronics then there could be impact on electric field, noise or redesign of electronics	1. CFD Fluid flow analysis completed by E. Voirin @ FNAL - shows good thermalization and flow - running final study 2. Test with the 2 x 2 - compare liquid levels, see heat build out near readout. temperature sensors. 3. Could CSU set up a dummy test with field cage mock up and resistors? 4. Test full scale demonstrator	**High 67% 4 mo, $0 Significantly Substandard**
RT-131-ND-081	Simulation Staffing Limitations	IF additional resources for simulation and reconstruction development cannot be identified, then risks SIM-002 and SIM-003 and dependencies will be realized.	Recruit additional developers	**High 60% 6 mo, $0 Significantly Substandard**
RT-131-ND-084	Single module instability	IF a single module has instabilities THEN single module data shall be corrupted	-Robust design avoiding risks for sparking -Full-scale demonstrator testing -MIF Testing	**High 50% 3 mo, $500k Extremely Substandard**

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RT-131-ND-075	Module Components Damaged at MIF	If module components damaged at MIF, then minor delays to module tests at MIF would be incurred due to waiting for component replacement	Ensure testing procedures are fully developed (both cold and warm testing), ask subsystem experts for input on handling/testing of their subsystem's components, ensure training of operators is complete and consistent	Med 50% 6 mo, $100k Negligible
RT-131-ND-079	Large Copper Clad and etching availability	IF copper clad and etched G10/FR4 boards are not readibly availble in the full size, THEN a custom made manufacturing solution or an alternative material or lapped joint could impact cost and schedule and possibly decrease active area	1. Epoxy copper at institutions 2. Etch at a "cleaning vendor" instead of a PCB house 3. Join segments (3-4 panels would be required)	Med 67% 6 mo, $100k Somewhat Substandard
RT-131-ND-082	Lamination process	IF the lamination process is not easily scaled for production, THEN either performance or cost and schedule is impacted	1. Investigate commerical vendors 2. Consider agreements with universities for labor 3. Additional tooling/jigs to improve some of the set-up not proposed: 2 set-ups	Med 50% 1.5 mo, $ 37k Negligible
RT-131-ND-085	Integrated Event Reconstruction	IF a complete event reconstruction framework is delayed or incomplete, THEN design validation will be delayed or incomplete.	Develop alternative reconstruction paths in parallel, including Pandora and simplified parametric models	Med 45% 6 mo, $0k Somewhat Substandard

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RT-131-ND-005	Design Changes from MOD1	IF the MOD0 test results indicate major design changes are needed, THEN there will be an increase in cost and schedule	Plan for some design evolution during the 2x2 program (between module 0 tests and modules 1-4). Plan for some design evolution between the 2x2 and Full-scale ND module demonstration stages.	Med 30% 6 mo, $ 20 k Negligible
RT-131-ND-083	Integrated End-to-end Simulation	IF a complete simulation including the geometry and charge and light response is delayed or incomplete, THEN dependent analysis risks will be realized.	Develop alternative simulation paths in parallel, including simplified parametric models	Low 50% 5 mo, $ 0k Significantly Substandard
RT-131-ND-086	Key Staff/hiring	IF key staff is lost, THEN cost and schedule will increase	1. Documentation and cross training. Understand and mitigate single point failures	Low 36% 3 mo, $90k Negligible
RT-131-ND-087	in-kind labor	If in-kind labor is not realized, THEN costs will increase and schedules could be delayed	Agreements from partners Find additional in-kind staff from other partners or new countries	Low 35% 3 mo, $ 127.2 k Negligible
RT-131-ND-066	uneven lar supply in row of modules	IF LAr flow is inhomogeneous, THEN the electron lifetime may differ between modules changing the energy resolution, and the heat load in a module may increase	Design apertures into the LAr supply to provide equal flow to each module	Low 25% 2 mo, $0k Significantly Substandard
RT-131-ND-063	Bern Resources	IF there are Bern people or funding resource delays, THEN the cost and schedule will be impacted	Investigating resources needed to complete the work versus committed resources by Bern	Low 25% 3 mo, $ k0 Negligible