

DZero Run IIb Risk Analysis

A qualitative process of risk assessment was used, based on a method described in “A Guide to the Project Management Body of Knowledge”¹. For each WBS Level 4 element, the potential impacts of the element’s risk to the cost, schedule, scope, and technical concerns of the project were assessed by Level 2 project managers and assigned a numeric value according to the severity of the potential impact. Table 1 summarizes the criteria used for this “severity of impact” assessment. The numeric values and the definitions assumed for each level of impact are shown.

Once the severity of impact was determined, then a probability of that impact occurring was assigned and a “risk score” was determined for each “project objective” (cost, schedule, scope, and technical). This risk score was the product of the impact severity and the probability. The resulting risk score was used to categorize the risk as low, medium or high for each WBS Level 4 element and project objective. Table 2 shows this probability-impact matrix and the risk score “cuts” used to define low, medium, or high risk.

For any “high-risk” elements, possible risk mitigation measures were considered and described under the “risk mitigation” heading of the WBS Dictionary entry for that WBS element. The following pages taken from the project schedule show the results at WBS level 4 for these risk assessments, with color-coded indicators denoting the level of risk that was determined.

Table 1 – Risk Impact Table

Project Objective	Very Low Impact .05	Low Impact .1	Moderate Impact .2	High Impact .4	Very High Impact .8	Comments
Cost	Insignificant cost increase	<5% cost increase	5-10% cost increase	10-20% cost increase	>20% cost increase	
Schedule	Insignificant schedule slippage	Schedule slippage <5%	Overall project slippage 5-10%	Overall project slippage 10-20%	Overall project schedule slips>20%	20% slippage ~ 8 months
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Project scope reduction unacceptable for physics objectives	Scope of project effectively useless for physics objectives	
Technical	Technical degradation of project barely noticeable	Technical performance of final product minimally affected	Technical performance of final product moderately affected	Degradation of technical performance of final product unacceptable for physics objectives	Technical performance of project end item effectively useless for physics objectives	

Table 2- Probability-Impact Matrix (green=low, yellow=medium, red=high)

Probability	Risk Score = Probability × Impact				
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.10	0.20	0.40
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
	Impact on Objectives				

¹ A Guide to the Project Management Body of Knowledge, 2000 Edition, Project Management Institute, Four Campus Boulevard, Newton Square, PA.

Silicon Run IIb Risk Analysis Summary

ID	WBS	Name	Cost Risk Score	Schedule Risk Score	Scope Risk Score	Technical Risk Score
1	1.1	Run IIb Silicon				
2	1.1.1	Sensors				
3	1.1.1.1	Probing Equipment Setup	●	●	●	●
16	1.1.1.2	L0 Sensors	●	●	●	●
43	1.1.1.3	L1 Sensors	●	●	●	●
73	1.1.1.4	L2-L5 Sensors	●	●	●	●
105	1.1.2	Readout System				
106	1.1.2.1	SVX4 Chips	●	●	●	●
140	1.1.2.2	L0 Hybrids	●	●	●	●
165	1.1.2.3	L1 Hybrids	●	●	●	●
197	1.1.2.4	L2-L5 Hybrids	●	●	●	●
229	1.1.2.5	L0 Analog Flex Cables	●	●	●	●
241	1.1.2.6	L0-L1 Digital Jumper Cables (KSU)	●	●	●	●
254	1.1.2.7	L2-L5 Digital Jumper Cables (KSU)	●	●	●	●
267	1.1.2.9	Testing of Cables (LA Tech)	●	●	●	●
275	1.1.2.10	L0-L1 Junction Cards	●	●	●	●
285	1.1.2.11	L2-5 Junction Cards	●	●	●	●
295	1.1.2.12	Twisted-pair Cables	●	●	●	●
313	1.1.2.13	Adapter Cards	●	●	●	●
328	1.1.2.14	SASEQ Test Stands	●	●	●	●
359	1.1.2.16	Interface Boards and Backplanes	●	●	●	●
373	1.1.2.17	Low Voltage System	●	●	●	●
392	1.1.2.18	High-mass Cables	●	●	●	●
396	1.1.2.19	High Voltage System	●	●	●	●
412	1.1.2.21	Support of Downstream Electronics at Fermilab	●	●	●	●
431	1.1.2.22	Stand-alone System Integration Test	●	●	●	●
436	1.1.2.23	Vertical Slice Integration Tests	●	●	●	●
456	1.1.3	Mechanical Design and Fabrication				
457	1.1.3.1	Machining through MRI grant	●	●	●	●
458	1.1.3.2	L0 Structures Design	●	●	●	●
468	1.1.3.3	L1 Structures Design	●	●	●	●
477	1.1.3.4	L0 Fabrication Tooling	●	●	●	●
482	1.1.3.5	L1 Fabrication Tooling	●	●	●	●
487	1.1.3.6	Quality Assurance Tooling	●	●	●	●
492	1.1.3.8	L0 Structures Production	●	●	●	●
504	1.1.3.9	L1 Structures Production	●	●	●	●
516	1.1.3.10	Integration Layer 0 and Layer 1 (Fermilab)	●	●	●	●
537	1.1.3.11	Stave Design	●	●	●	●
556	1.1.3.12	Finalize stave design and Readiness Review	●	●	●	●
557	1.1.3.13	Stave Core Production	●	●	●	●
568	1.1.3.14	Stave Shell Production	●	●	●	●
579	1.1.4	Detector Production and Testing				
580	1.1.4.1	Develop Module	●	●	●	●
584	1.1.4.2	Develop module burn-in stands (Fermilab)	●	●	●	●
585	1.1.4.3	Module R&D Tasks	●	●	●	●
592	1.1.4.4	L0 Readout Module Fixtures	●	●	●	●
605	1.1.4.5	L1 Readout Module Fixtures	●	●	●	●
618	1.1.4.6	L2-L5 Readout Module Fixtures	●	●	●	●
630	1.1.4.7	L0 Modules	●	●	●	●
648	1.1.4.8	L1 Modules	●	●	●	●
662	1.1.4.9	Fabricate 20cm Gangs	●	●	●	●
680	1.1.4.14	10/10 Axial Modules	●	●	●	●
704	1.1.4.16	20/20 Axial Modules	●	●	●	●
726	1.1.4.17	10/10 Stereo Modules	●	●	●	●
749	1.1.4.19	20/20 Stereo Modules	●	●	●	●
771	1.1.4.20	Stave Assembly Prototyping	●	●	●	●
777	1.1.4.21	Stave Assembly Fixtures	●	●	●	●
781	1.1.4.22	Assemble Modules Onto Staves	●	●	●	●
816	1.1.5	Silicon Barrel Assembly				
817	1.1.5.1	Machining through MRI grant funding	●	●	●	●
818	1.1.5.2	Cylinders	●	●	●	●
865	1.1.5.3	South Silicon Barrel Assembly	●	●	●	●
890	1.1.5.5	North Silicon Barrel Assembly	●	●	●	●
916	1.1.5.8	Prepare for shipment	●	●	●	●
918	1.1.5.10	Support Structures Within CFT Barrel 3	●	●	●	●
921	1.1.5.11	Coolant Distribution System	●	●	●	●
927	1.1.5.12	Dry-gas Distribution System	●	●	●	●
932	1.1.6	Monitoring				
933	1.1.6.1	Modify monitoring and control system	●	●	●	●
934	1.1.6.2	Radiation Monitors	●	●	●	●
949	1.1.6.3	Temperature Monitors	●	●	●	●
957	1.1.7	Software and Simulation				
958	1.1.7.1	Simulation of Run 2b SMT Response	●	●	●	●
964	1.1.7.2	Cluster Reconstruction	●	●	●	●
968	1.1.7.3	Standalone Track Reconstruction	●	●	●	●
974	1.1.7.4	Software Development for Run2b Commissioning	●	●	●	●
993	1.1.7.5	Support for Packages	●	●	●	●
994	1.1.7.6	Calibration	●	●	●	●
1004	1.1.7.7	Monitoring	●	●	●	●
1010	1.1.7.8	Production Database Work	●	●	●	●
1017	1.1.8	Administration				
1018	1.1.8.1	Administration for the R&D Phase	●	●	●	●
1024	1.1.8.2	Administration for the Project Phase	●	●	●	●

Trigger Run IIb Risk Analysis Summary

ID	WBS	Name	Cost Risk Score	Schedule Risk Score	Scope Risk Score	Technical Risk Score
1	1.2	Run IIb Trigger Upgrade				
2	1.2.1	Level 1 Calorimeter Trigger				
3	1.2.1.1	ADC/Digital Filter (ADF)	●	●	●	●
26	1.2.1.2	ADF Crates	●	●	●	●
35	1.2.1.3	Trigger Algorithm Board	●	●	●	●
52	1.2.1.4	Global Algorithm Board (GAB)	●	●	●	●
64	1.2.1.5	Cables	●	●	●	●
68	1.2.1.6	TAB Crates and Services	●	●	●	●
76	1.2.1.9	Prototype Integration	●	●	●	●
83	1.2.1.10	Pre-Production Integration	●	●	●	●
88	1.2.1.11	L1 Cal Online Software	●	●	●	●
92	1.2.2	Level 1 Calorimeter Track Matching				
98	1.2.2.4	SLDB	●	●	●	●
102	1.2.2.5	MTCxx	●	●	●	●
112	1.2.2.6	MTCM	●	●	●	●
118	1.2.2.7	MT Flavor Board	●	●	●	●
129	1.2.2.8	Infrastructure	●	●	●	●
141	1.2.3	Level 1 Tracking				
143	1.2.3.2	Develop Target CTT Algorithm	●	●	●	●
147	1.2.3.4	Develop Test Procedures	●	●	●	●
150	1.2.3.5	DFEA Prototype I	●	●	●	●
162	1.2.3.6	DFEA Prototype II	●	●	●	●
178	1.2.3.7	DFEA Production	●	●	●	●
200	1.2.4	Level 2 Beta Processor				
201	1.2.4.1	Finalize Targets For Run2b Beta Upgrades		●	●	●
208	1.2.4.2	Develop Prototype	●	●	●	●
221	1.2.4.3	Test Prototype	●	●	●	●
227	1.2.4.4	Assemble Production Processors	●	●	●	●
234	1.2.5	Silicon Track Trigger Upgrade				
239	1.2.5.4	VME Motherboard	●	●	●	●
247	1.2.5.5	STC Module	●	●	●	●
255	1.2.5.6	VTM	●	●	●	●
260	1.2.5.7	Link Transmitter Board	●	●	●	●
268	1.2.5.8	Link Receiver Board	●	●	●	●
276	1.2.5.9	BC Module	●	●	●	●
284	1.2.5.10	TFC Module	●	●	●	●
291	1.2.5.11	Hotlink Repeaters	●	●	●	●
296	1.2.5.12	LVDS Cables	●	●	●	●
300	1.2.5.13	Splitters	●	●	●	●
305	1.2.5.14	Fibers	●	●	●	●
311	1.2.5.16	STC firmware	●	●	●	●
313	1.2.5.17	TFC Code	●	●	●	●
315	1.2.5.18	Downloading & Monitoring	●	●	●	●
319	1.2.6	Trigger Simulation				
328	1.2.6.3	L1CTT Simulation	●	●	●	●
336	1.2.6.4	STT Simulator	●	●	●	●

Online/DAQ Run IIb Risk Analysis Summary

ID	WBS	Name	Cost Risk Score	Schedule Risk Score	Scope Risk Score	Technical Risk Score
1	1.3	Online Systems				
2	1.3.1	Level 3 Systems				
25	1.3.2	Network and Host Systems				
26	1.3.2.1	Online/DAQ Network				
31	1.3.2.2	Control Room Nodes				
44	1.3.2.3	Monitoring Nodes				
57	1.3.2.4	Storage Systems				
83	1.3.2.5	HOST Systems R&D				
89	1.3.2.6	DAQ HOST Systems				
100	1.3.2.7	ORACLE Systems				
112	1.3.2.8	File Servers				
125	1.3.2.9	OS & Software				
130	1.3.3	Control Systems				
147	1.3.4	DAQ/Online Management				