WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1	Run 2b Silicon Project	$10,101,364	0	0

Notes

Table summarises the number of parts needed to the project:

Layer	Type	Φ-seg.	Z-seg.	Length	Width	Pitch	Total
5	A	30	6	96.4	40.5	75/37.5	360
5	A	30	6	96.4	40.5	75/37.5	360
4	A	24	6	96.4	40.5	75/37.5	288
4	2.5°	24	6	96.4	43.1	80/40	288
3	A	18	6	96.4	40.5	75/37.5	216
3	2.5°	18	6	96.4	43.1	80/40	216
2	A	12	6	96.4	40.5	75/37.5	144
2	2.5°	12	6	96.4	43.1	80/40	144
1	A	6	6	96.4	40.5	75/37.5	72
1	A	6	6	96.4	40.5	75/37.5	72
0	A	12	6	96.4	14.8	50/25	144

	Sensors	Modules	Staves	4-chips hybrids	2-chips hybrids	MPC	JPC
Outer Axials	1512	756	180	1080	0	180	40
Outer Stereo	648	324					
L0	144	72	0	0	72	0	16
TOTAL	2304	1152	180	1080	72	180	56

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1	DAQ	$4,742,979	0	0
1.1.1.1	SVX4 Chips	$802,925	0	0

Notes

Runs:
1. Prototype (Hybrid #1)
2. Contingency (Hybrid #2)
3. Production (Preproduction and Production hybrids)

Need **4,464** chips for the project

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.2	Transceiver Chips	$52,107	0	0

Notes

A new transceiver chip in 0.25um technology (same as the SVX4) is needed in order to minimise the power consumption at the mini-portcard level and the number of indipendent power supply lines needed for the porject (we completely drop the 5V supply line for the mini-PC).
The new transceiver chip is only 2.52x2.88 mm^2.
The backup solution is to re-use the old Honeywell 0.85um rad-hard transceiver chip. These old chips are available in quantity sufficient to cover the needs of this project.
The mini-portcard prototype#1 uses the old chip. The new chip should be available for the 2nd mini-portcard round and for all the L0 hybrids.

WBS	Name	Cost	M&S Cont.	Labor Cont.

"Transceiver Chips" continued

Notes

The mini-portcard needs 4 new transceiver chip (or 5 old ones). The L0 hybrid needs 1 transceiver chip (either old or new).
Total number of transceiver chips needed (new) is 180*4+72 = **792**.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.3	**Hybrids**	**$1,656,392**	**0**	**0**

Notes

The Hybrid is a BeO substrate (2cmx3.9cm).
Included in the bydrids are:
1. 4 SVX4 chips.
2. miscellanea components (capacitors,resistors, thermistor).
3. pitch adapters
4. testing boards

Runs (4 chips hybrids):
1. Prototype#1 (milestone #1 "electrical stave test")
2. Protoype#2-Contingency (milestone #2 "contingency electrical stave test")
3. Preproduction (milestone #3 "preproduction electrical stave test")
4. Production (milestone #4 "Production electrical stave test")

Need **1,080** 4-chips hybrids and **72** 2-chips hybrid for the project

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.4	**Bus Cables**	**$41,001**	**0**	**0**

Notes

Outer layer Bus cable is a Kapton based cable with signal and power traces to electrically connect the mini-PC to the hybrids. It also provides a ground shield plate to minimise noise pick-up from the sensors and the sensor bias connection.

Runs:
1. Prototype (milestone #1 "electrical stave test")
2. Preproduction (milestone #3 "Preproduction electrical stave test")
3. Production (milestone #4 "Production electrical stave test")

Need **360** bus cables for the 180 staves installed.
We will construct 200 Staves to include 20 spares and thus will need 400 Bus cables

Labor:
All LBL labor. No FNAL efforts for the Bus Cable

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.5	**Mini Port Card**	**$506,042**	**0**	**0**

Notes

The MPC is a BeO hybrid (2"x1.55"). Included in the miniportcards are:
1. components (including tranciever chips), connectors etc.
2. short kapton cables (2 cables, one for power and one for data)
3. cable wing (one kapton cable that connects the top MPC to the bottom stave bus cable)

Runs:
1. Prototype (milestone #1 "electrical stave test")
2. Contingency (milestone #2 "contingency electrical stave test")

WBS	Name	Cost	M&S Cont.	Labor Cont.

"Mini Port Card" continued

Notes

3. Preproduction (milestone #3 "preproduction electrical stave test")
4. Production (milestone #4 "Production electrical stave test")

Need **180** Mini Port Cards for the project

1.1.1.6	Junction Port Cards	$231,280	0	0

Notes

The JPC is an FR4 board for signal and power distribution.
JPC includes:
1. components (capacitors, resistors, power filters, FPGA, connectors etc.)

Runs:
1. Prototype#1 (milestone#1 "prototype electrical stave test")
2. Prototype#2 - contingency
2. Preproduction (milestone#3 "preproduction electrical stave test")
3. Production (milestone#4 "production electrical stave test")

Each port card can serve up to 5 mini-PC.
Total number of JPC for the project (inlcuding L0) is **56.**

Junction Port Cards

Layer	Φ-seg.	MPC (each side)	JPC (Total)
5	30	30	12
5	30		
4	24	24	10
4	24		
3	18	18	8
3	18		
2	12	12	6
2	12		
1	6	6	4
1	6		
0	12	0	16
Total JPC			56

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.7	**Cables**	**$322,956**	**0**	**0**

Notes

We will replace all cables going from the silicon detector to the DAQ and Power Supplies racks.
There are 2 sets of these cables:

- from the mini Port Card (end of stave) to the Junction Port Card
- from the Junction Port Card to the racks.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.8	**Fiber Transition Module Replacements**	**$242,578**	**0**	**0**

Notes

New boards are needed to replace the Fiber Transistion Modules (FTMs) because
we are not using optical transmitter/receivers for the data.
Here we estimate the price of making the new cards.
There are 56 JPC's installed the project.
There is one FTM every 2 JPC = 28 FTMs.
We need to have spares and extra boards for test stands: need 37 total FTMs.

Runs:
1. Prototype
3. Production

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.9	**DAQ Testing & Readiness**	**$245,294**	**0**	**0**

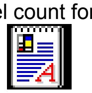
Notes

Cost:
Here is the cost of all electrical testing (M&S) at FNAL. Includes DAQ stands, Burn-in stations, computers, miscellanea PC boards and material, cables, tools and instrument (oscilloscope etc. is needed).
added 50% contingency

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.1.10	**Power Supply system**	**$642,404**	**0**	**0**

Notes

We need a new power supply system in order to provide power to the detector.
The power distribution is per stave (1 AVDD, 1 DVDD and 2 High Voltages).
Channel count for the above scheme is provided in the table.



power_supply.doc

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.2	**Sensors**	**$1,649,138**	**0**	**0**

Notes

The table below summarizes the type and number of sensors needed:

WBS	Name	Cost	M&S Cont.	Labor Cont.

"Sensors" continued

Notes

Silicon Sensors

Layer	Type	Φ-seg.	Z-seg.	Length	Width	Pitch	Total
5	A	30	6	96.4	40.5	75/37.5	360
5	A	30	6	96.4	40.5	75/37.5	360
4	A	24	6	96.4	40.5	75/37.5	288
4	2.5°	24	6	96.4	43.1	80/40	288
3	A	18	6	96.4	40.5	75/37.5	216
3	2.5°	18	6	96.4	43.1	80/40	216
2	A	12	6	96.4	40.5	75/37.5	144
2	2.5°	12	6	96.4	43.1	80/40	144
1	A	6	6	96.4	40.5	75/37.5	72
1	A	6	6	96.4	40.5	75/37.5	72
0	A	12	6	96.4	14.8	50/25	144

	Sensors Quantity	Total (+ 20% spares)
Outer Axials	1512	1814
Outer Stereo	648	778
L0	144	172
TOTAL	2304	2764

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.2.1	Outer layers	$1,558,029	0	0

Notes

We are going to prototype the outer stereo and Axial sensors.
Runs:
1. Prototypes Axials and Small Angle Stereo (30 grade "A"+30 grade "B" each)
2. Production (Axials, SAS and L0)
3. Puchase leftover L00 sensors (same design as used in Run IIa is used for Run IIb)

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.2.2	**layer L0**	**$85,059**	**0**	**0**

Notes
Given the small number of detectors needed and the use of the same technology as for the Outer sensors we order directly the production.
Need **144** for the project.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.2.3	**layer L00 left over**	**$6,050**	**0**	**0**

Notes
These are left over sensors from the L00 production at Hamamatsu. They are identical to those we will use for the current L0 and we want to purchaise them to have a jump start at testing.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.3	**Construction of Modules, Staves and L0**	**$1,770,403**	**0**	**0**

Notes
Need 180 staves, 1080 modules for the outer
72 modules for L0

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.3.1	Beginning of Mechanical Project	$0	0	0

Notes
This task marks the end of the conceptual work and the beginning of the specific realization of mechanical parts.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.3.2	**L0 Construction**	**$344,609**	**0**	**0**

Notes
Required quantity for the L0 detector is 72 modules. We should schedule and cost 100 production modules based on the L00 experience

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.3.3	**Outer layer modules**	**$453,456**	**0**	**0**

Notes
It consists of 2 sensors glued together "head-on". On top of one sensor one hybrid and one pitch adapter is also glued. Module is wirebonded and put on a G-10 frame for testing.
Need **882** modules for the project.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.3.4	**Outer layer Staves**	**$972,338**	**0**	**0**
1.1.4	**Beampipe**	**$45,799**	**0**	**0**

Notes
The beampipe is designed to be compatible with the old pipe (it has the same flanges to connect to the Tevatron beampipe). It is constructed from Beryllium for low mass, with short stainless steel sections on the end.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.4.1	Beampipe available	$0	0	0

Notes
This will be put in as a milestone, estimated from the order date (about 15 Jun 02) plus 36 weeks (vender estimate, or was it 32?). pl

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.4.2	**Beampipe Supports**	**$24,371**	**0**	**0**
1.1.4.3	**Beampipe Supports (production)**	**$21,428**	**0**	**0**

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.5	**Support Mechanics**	**$1,040,598**	**0**	**0**

Notes

This section covers infrastucture, the support structures for the staves, barrels, L0, and transportation and installation at B0.
50% cont. is included on all costed items

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.5.1	**Silicon Support Structures**	**$849,032**	**0**	**0**

Notes

This task covers the bulkheads which support the staves, the screens which attach the bulkheads to each other, the tube which supprts the barrels (spacetube in Run IIa) and the support structure for L0.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.5.2	**Transportation Fixtures**	**$69,197**	**0**	**0**

Notes

This is the fixture for transporting ISL+SVXIIa or ISL+SVXIIb from/to the Assembly Hall.
It has to be finished before runiia ends. The fixtures for Run IIa will be reused as much as possible

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.5.3	**Positioning system (inchworms)**	**$41,502**	**0**	**0**

Notes

This system allows adjustment of the position of the entire silicon detector (ISL+SVXIIb+L0+ beampipe) relative the the outer tracker (COT) and the beamline.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.5.4	**Installation of SVXIIb into ISL**	**$80,868**	**0**	**0**

Notes

These are the fixtures that allows for both extracting SVXIIa from ISL and inserting SVXIIb into ISL.
Schedule:
This task needs to be done in time for the removal of SVXIIa from ISL

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.6	**Cooling and Monitoring**	**$275,315**	**0**	**0**

Notes

Thisi task covers the cooling system, the monitoring of the cooling and power to the detectors and the position monitors (RASNIKS)
50% cont. is included on all costed items

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.6.1	**Cooling system Sidet**	**$38,582**	**0**	**0**

Notes

This task covers updating the cooling system at Sidet and B0 and the cost of new manifolds at the detector.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.6.2	**Cooling Manifolds and chiller components**	**$116,733**	**0**	**0**
1.1.6.3	**Interlocks**	**$100,000**	**0**	**0**

Notes

This is the system that montors the power and temperature of the detectors.
It will resue most of the existing system.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.6.4	**Position Monitoring**	**$20,000**	**0**	**0**

Notes

This is to update the esisting position monitoring system (RASNIK).
Cost is based on Run IIa experience and resuing the DAQ already setup.
Labor:
there is no FNAL labor for this task, Toronto is taking on this project

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.7	**Final Assembly (Installation and Integration)**	**$577,126**	**0**	**0**

Notes

This task covers installation of staves into the barrels, installation of L0 modules on the CF supports and the integration of L0 and beampipe with the outer barrel

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.7.1	**Stave Installation (Outer)**	**$281,693**	**0**	**0**

Notes

This covers installation of all layers except for L0.

The stave installation fixture will be similar to the fixture used in Run IIa, but it will be larger.
This fixture holds the bulkheads and staves while the staves are installed. It has a precision angular encoder. The staves are supported on long arms which are attached to roller bearings. Precise adjustment cabability is incorporated into the arms.
In Run IIa the prototype + production fixture cost 50k$ (two sets). Here we estimate 30k$ for the prototype and 70k$ for the two production fixtures.
We need two complete production fixtures so that two barrels can be assembed in parallel.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.7.2	**L0 Module Installation (Inner)**	**$131,254**	**0**	**0**

Notes

These are the fixtures for installaing the L0 modules onto the CF structure.

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.7.3	**Integration**	**$164,179**	**0**	**0**

Notes

This task incudes the fixtures and labor associated with installing the inner detector (L0) into the outer barrel. All costs and labor are estimated based on Run IIa experience

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.8	**Italy Buy Backs**	**$3**	**0**	**0**
1.1.8.1	I-BB- on 1st chip layout	$1	0	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*
2	*FNALR&D*	*0%*	*0 hrs*	*0 days*	*Thu 2/7/02*	*Thu 2/7/02*
3	*ItalyEQ*	*0%*	*0 hrs*	*0 days*	*Thu 2/7/02*	*Thu 2/7/02*

ID	*Resource Name*	*Units*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
2	*FNALR&D*	*0%*	*($24,999)*	*$0*	*$0*	*($24,999)*
3	*ItalyEQ*	*0%*	*$25,000*	*$0*	*$0*	*$25,000*

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.8.2	I-BB on Production SVX4 chip manufacturing	$1	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish
1	FNALEQ	0%	0 hrs	0 days	Wed 5/21/03	Wed 5/21/03
3	ItalyEQ	0%	0 hrs	0 days	Wed 5/21/03	Wed 5/21/03

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	FNALEQ	0%	($99,999)	$0	$0	($99,999)
3	ItalyEQ	0%	$100,000	$0	$0	$100,000

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.8.3	I-BB on Power Supplies Procurement	$1	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish
1	FNALEQ	0%	0 hrs	0 days	Wed 1/14/04	Wed 1/14/04
3	ItalyEQ	0%	0 hrs	0 days	Wed 1/14/04	Wed 1/14/04

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	FNALEQ	0%	($131,999)	$0	$0	($131,999)
3	ItalyEQ	0%	$132,000	$0	$0	$132,000

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.9	**Japan Buy Backs**	**$4**	**0**	**0**
1.1.9.1	J-BB on prototype sensors manufacturing	$1	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
2	FNALR&D	0%	0 hrs	0 days	Fri 3/1/02	Fri 3/1/02	($96,672)	$0	$0	($96,672)
5	JapanEQ	0%	0 hrs	0 days	Fri 3/1/02	Fri 3/1/02	$96,673	$0	$0	$96,673

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.9.2	J-BB on production sensors manufacturing I	$1	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish
1	FNALEQ	0%	0 hrs	0 days	Mon 3/3/03	Mon 3/3/03
5	JapanEQ	0%	0 hrs	0 days	Mon 3/3/03	Mon 3/3/03

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	FNALEQ	0%	($378,326)	$0	$0	($378,326)
5	JapanEQ	0%	$378,327	$0	$0	$378,327

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.9.3	J-BB on production sensors manufacturing II	$1	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish
1	FNALEQ	0%	0 hrs	0 days	Mon 3/1/04	Mon 3/1/04
5	JapanEQ	0%	0 hrs	0 days	Mon 3/1/04	Mon 3/1/04

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	FNALEQ	0%	($221,865)	$0	$0	($221,865)
5	JapanEQ	0%	$221,866	$0	$0	$221,866

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.9.4	J-BB on L0 production sensors manufacturing	$1	0	0

ID	Resource Name	Units	Work	Delay	Start	Finish
1	*FNALEQ*	*0%*	*0 hrs*	*0 days*	*Mon 3/1/04*	*Mon 3/1/04*
5	*JapanEQ*	*0%*	*0 hrs*	*0 days*	*Mon 3/1/04*	*Mon 3/1/04*

ID	Resource Name	Units	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	*FNALEQ*	*0%*	*($85,058)*	*$0*	*$0*	*($85,058)*
5	*JapanEQ*	*0%*	*$85,059*	*$0*	*$0*	*$85,059*

WBS	Name	Cost	M&S Cont.	Labor Cont.
1.1.11	**Schedule contingency and reportable milestones**	**$0**	**0**	**0**
1.1.11.9	**Reportable milestones - Level 2**	**$0**	**0**	**0**
1.1.11.12	**Reportable Milestones - Level 1**	**$0**	**0**	**0**