

# ZPD Production Plan

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This document describes the production plan for the ZPD modules. The production procedure, schedule, deliverable, cost and manpower are presented.

## 1 Overview

The production of the final ZPD modules will take place at Harvard University High Energy Physics Laboratory (HEPL). Much of the production process will be identical to that for the prototype board, which was produced in May 2002.

## 2 Production Procedure

### 2.1 PCB Production

The printed circuit boards (PCBs) will be produced by the same manufacturer that produced the prototype. The PCBs will be 100% tested against the netlist.

### 2.2 Component Procurement

The list of the on-board components is given in Appendix A. All parts are in hand except for the FPGAs, for which a purchase order has been placed. Most parts are identical to those used on the prototype. Exceptions are:

**FPGAs:** The FPGAs on the prototype were engineering samples with various technical limitations, which included:

- the Digital Clock Manager that could not adjust the clock phase on the fly, and
- the 18-by-18-bit Multiplier that was slower than the ones in the newer production version.

**FPGA Configuration:** The prototype used the System ACE MPM for configuring the FPGAs. The production version will use the System ACE CF. See *ZPD Board Modifications*<sup>1</sup> for more details.

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<sup>1</sup> <http://www.slac.stanford.edu/BFROOT/www/Detector/Trigger/upgrade/fdr/zpd/ZPDChangesPCB.pdf>

## 2.3 PCB Assembly

The PCBs will be assembled by the same manufacturer that assembled the prototype. Prior to the production, mechanical sample FPGAs will be placed on a test PCB (which is identical to the production PCB) to determine the optimal temperature-time profile. After the assembly, all FPGAs are X-ray inspected to ensure that the ball-grid arrays (BGAs) have soldered correctly. The prototype had no defect.

## 2.4 Module Testing

The modules will be tested at HEPL prior to shipping to SLAC. The test procedure is described in *ZPD Test Plan*<sup>2</sup>.

## 3 Schedule

The PCB production requires 2 weeks. The FPGAs are available in stock and will be available before the PCBs arrive. The assembly requires 2 more weeks. Including shipping and communication, we expect to have the modules produced in 5–6 weeks. Testing at HEPL should take no longer than 2 weeks.

## 4 Deliverables and Cost

A total of 11 ZPD modules will be produced and delivered to SLAC. The production cost of the ZPD modules is estimated as shown in the table below. Note that the number of PCBs produced is 13, of which 1 will be used for the profiling for the assembly and another will be kept as a spare.

Function	Part	Qty	\$/ea	\$/ea*Qty	Fixed	Total
Data Receiver	XC2V3000	12	631.00	7,572.00		7,572.00
Algorithm Engines	XC2V4000	68	1,239.00	84,252.00		84,252.00
Decision Module	XC2V1000	12	202.70	2,432.40		2,432.40
Other components				4,845.37		4,845.37
PCB fab. + tooling		13	701.23	9,116.00	1,890.00	11,006.00
PCB assy. + tooling		11	65.00	715.00	1,400.00	2,115.00
<b>Total</b>						<b>112,222.77</b>

The cost of the ZPD modules is driven by the FPGAs used for the Algorithm Engines. The Xilinx Virtex II FPGAs have been available in volume since early 2002, and the prices have been stable for the last 6 months.

## 5 Manpower

The following personnel are working at HEPL for the production:

- N. Felt – Engineering
- S. Harder – PCB layout

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<sup>2</sup> <http://www.slac.stanford.edu/BFROOT/www/Detector/Trigger/upgrade/fdr/zpd/ZPDTestPlan.pdf>

- T. Fries – Parts procurement, vendor contact

Testing will be covered mostly by the physicists, S. Bailey, G. Brandenburg, M. Morii, E. Won, and the students.

## Appendix A Component List

Qty/Ea	Description	P/N	Mfg
4	Cap, 1000pF 50V Cer. X7R 10% 0603	06032R102K9B20	Polycomp
26	Cap, 10uF 10V Tant. 10% B3528	267E1602106K	Matsuo
240	Cap,0.1uF 16V Cer Y5V +/-20% 0402	S0402Y104Z1CRN	R.G. Allen
15	Cap,0.1uF 16V Cer Y5V +/-20% 0603	06032F104Z8B20D	Yageo America
4	Cap, 150uF 10V Tant. 20% Pkg:D	ECS-T1AD157R	Panasonic
3	SMT fuseholders (or 10 Amp Fuse)	154 000 (or 451 010)	Littlefuse
2	Conn, 96 pin Rt/A Male VME	650947-5	Tyco - AMP
1	Conn, 160 pin Rt/A Male DIN41612	02.01.160.2102	Harting
1	18 Pin vertical, thru-hole,dual - 0.1 pitch	WM7018-ND	Waldom/Digikey
0	Conn, 6 Pin vertical, dual - 0.1 pitch	TSM-103-01-L-DV	Samtec
9	Conn, 38pos. Vert. Recptl. 0.025" Gull Wing	767054-1	Tyco - AMP
9	Conn, 34 pin Vert. Dual 0.1 pitch	TSM-117-01-L-DV	Samtec
1	RJ45 Low Profile (No Shield)	RJ45-8N-S	Corcom
3	Chokes		in stock
8	LED, 2mm 5V vert. Red PC MNT	Dialight 555-3007	in stock
4	2N3904 transistor	MMBT3904	
161	82 ohm resistor 0603 package	RM73B1J820J	KOA Speer
8	4.7K ohm resistor 0603 package	RM73B1J472J	KOA Speer
49	300 ohm resistor 0603 package	RM73B1J301J	KOA Speer
8	200 ohm resistor 0603 package	RM73B1J201J	KOA Speer
2	24K ohm resistor 0603 package	RM73B1J243J	KOA Speer
22	120 ohm resistor 0603 package	RM73B1J121J	KOA Speer
22	160 ohm resistor 0603 package	RM73B1J161J	KOA Speer
2	42.2K ohm resistor 1% 0603 package	RM73H1J4222J	KOA Speer
1	620 ohm resistor 1% 0603 package	RM73H1J6200J	KOA Speer
0	2.20K ohm resistor 1% 0603 package	RM73H1J2200J	
1	1.00K ohm resistor 1% 0603 package	RM73H1J1001J	KOA Speer
1	IC, LM1085IT-ADJ Pos. Reg, TO-220	LM1085IT-ADJ	National Semiconductor
1	Switch, P.B. SPST, Rt/A	EP11SD1ABE	C&K/ITT Cannon
1	IC, Decoder/Driver 1152-pin BGA	XC2V3000-4FF1152CES	Xilinx
6	IC, Tracker/Fitter 1152-pin BGA	XC2V4000-4FF1152C	Xilinx
1	IC, Decision Module 896-pin BGA	XC2V1000-4FF896C	Xilinx
0	IC,System ACE 388-pin BGA	XCCACEM64BG388I	Xilinx
2	IC,Octal Buff./Dvr., 3.3V w/3-State Out SOIC	SN74LVT244B	in stock
1	TIA/EIA-232 3x5 Driver/Receiver	DS14C335MSA	National Semiconductor
2	1.5V DC-DC converter	UNR-1.5/10-D5T	Datel
2	60.0 MHz oscillators	JITO-2-AC3-AE - 60.0 MHz	Fox
4	Ultra Red LED	SML10R6H-TR	LEDtronics , Inc
1	Ultra Blue LED	SML10UB500H-TR	LEDtronics , Inc
21	Super Orange LED	SML10O4H-TR	LEDtronics , Inc
19	Hi-Eff Green LED	SML10G5H-TR	LEDtronics , Inc
33	Lightpipes	LTP003-0CW-101	LEDtronics , Inc