

# KOPIO WBS Dictionary

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## 1.2.3

<b>WBS Number</b>	<b>Descriptio</b>
<b>1.2.3</b>	<b>Calorimeter System</b> Calorimeter System includes: Mockup of Calorimeter System (matrix of 16*8 modules), Photon Calorimeter (2740 APD-instrumented modules & Calorimeter mechanics), Calorimeter Cooling System, Calorimeter High Voltage System, Calorimeter "Cosmic-ray" Pre-calibration System, Calorimeter Monitoring/Calibration System and Calorimeter Readout System.
<b>1.2.3.1</b>	<b>System Prototype</b> Mockup of the Calorimeter System to study the performance parameters of System and to develop the pattern recognition algorithms
<b>1.2.3.1.1</b>	<b>Modules</b> Fabrication of 100 "mass-production" Calorimeter modules
<b>1.2.3.1.1.3</b>	<b>Prototype</b>
<b>1.2.3.1.2</b>	<b>APD Instrumentation</b> APD instrumentation of 100 Calorimeter modules (APD, APD-preamplifier, APD HV-supply)
<b>1.2.3.1.2.3</b>	<b>Prototype</b>
<b>1.2.3.1.3</b>	<b>Mechanics</b> Production of the Mockup Mechanics (Frame & Rotating lift-platform)
<b>1.2.3.1.3.3</b>	<b>Prototype</b>
<b>1.2.3.1.4</b>	<b>Cooling System</b> Prototype of the Calorimeter Cooling System (Refrigerating-circulator & Heat-exchanger)

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<b>WBS Number</b>	<b>Descriptio</b>
1.2.3.1.4.3	<b>Prototype</b>
1.2.3.1.5	<b>HV Control System</b> Prototype of the APD HV-Control System (128 channels of a programmable D-A converters for control of APD HV-supply)
1.2.3.1.5.3	<b>Prototype</b>
1.2.3.1.6	<b>Cosmic Ray Pre-Callib System</b> Prototype of the “Cosmic-ray” Pre-calibration Calorimeter system (32 channels of LTD & Trigger logic)
1.2.3.1.6.3	<b>Prototype</b>
1.2.3.1.7	<b>Monitoring &amp; Calibration</b> Prototype of the Monitoring/Calibration system (LED-flash system & Fiber optics, to service 128 Calorimeter)
1.2.3.1.7.3	<b>Prototype</b>
1.2.3.1.8	<b>Readout</b> Production of the Readout System prototype (128 channels of a 10-bit & 250 MHz Wave-Form-Digitizer)
1.2.3.1.8.3	<b>Prototype</b>
1.2.3.1.9	<b>Shipping</b> Shipping of the Calorimeter Mockup (modules, frame, platform, the cooling unit, etc.)
1.2.3.1.9.3	<b>Prototype</b>
1.2.3.1.10	<b>Test</b> Test & Study of Mockup performance (performance parameters, algorithms, etc.)
1.2.3.1.10.3	<b>Prototype</b>
1.2.3.2	<b>Photon Calorimeter</b> 2740 APD-instrumented modules & Calorimeter mechanics

WBS	Descriptio
Number	Descriptio
1.2.3.2.1	<b>Design</b> Design of Photon Calorimeter (Conceptual design & Detailed drawings)
1.2.3.2.1.1	<b>Conceptual Design</b> Conceptual design of Photon Calorimeter
1.2.3.2.1.2	<b>Technical Design</b> Detailed drawings of Photon Calorimeter
1.2.3.2.2	<b>Tools &amp; Test Equipment Modification</b> The upgrading of the production-tool & test-equipment during of the production cycle
1.2.3.2.2.1	<b>Cosmic Ray Setup</b> Upgrading of a “cosmic ray” setup for a complex test of the APD-instrumented “mass-production” modules
1.2.3.2.2.2	<b>Molding Forms and Stamps</b> Upgrading of molding-forms and stamps during of the production cycle of modules
1.2.3.2.3	<b>Module -Regular</b> Fabrication of 2672 “regular” Calorimeter modules
1.2.3.2.3.1	<b>Scintillator Tiles</b> Fabrication of 850,000 “regular” Scintillator Tiles
1.2.3.2.3.1.3	<b>Fabrication/Procurement</b>
1.2.3.2.3.2	<b>Lead Tiles</b> Fabrication of 850,000 “regular” Lead Tiles
1.2.3.2.3.2.3	<b>Fabrication/Procurement</b>
1.2.3.2.3.3	<b>WLS Fiber</b>

WBS	Descriptio
Number	
1.2.3.2.3.3.3	Mechanical, thermal and optical treatment of 193,000 (310 km) Wave-Length-Shifting fibers
1.2.3.2.3.4	<b>Fabrication/Procurement</b>
1.2.3.2.3.4.3	<b>Assembly</b>
1.2.3.2.3.5	Assembling of 2672 Calorimeter modules (300 Scintillator tiles, 300 Lead tiles and 72 WLS fibers per module)
1.2.3.2.3.6	<b>Fabrication/Procurement</b>
1.2.3.2.4	<b>Test</b>
1.2.3.2.4.1	Mechanical & optical test of the assembled Calorimeter modules
1.2.3.2.4.1.3	<b>Packing</b>
1.2.3.2.4.2	Packing and warehousing of Calorimeter modules before a complex "cosmic-ray" test of APD-instrumented
1.2.3.2.4.2.3	<b>Module Instrumentation</b>
1.2.3.2.4.3	APD instrumentation of 2672 Calorimeter modules (APD, APD-preamplifier, APD HV-supply, APD mechanics)
1.2.3.2.4.3.3	<b>APD</b>
1.2.3.2.4.4	Procurement & test of APD, development of APD data-base
1.2.3.2.4.1.3	<b>Fabrication/Procurement</b>
1.2.3.2.4.2	<b>Preamplifier</b>
1.2.3.2.4.2.3	Production, test & selection of 2672 APD-preamplifiers
1.2.3.2.4.3	<b>Fabrication/Procurement</b>
1.2.3.2.4.3.3	<b>LV-HV Converter</b>
1.2.3.2.4.4	Procurement of LV-HV converters, production & test of HV-supply units, development of the HV-supply data-base
1.2.3.2.4.3.3	<b>Fabrication/Procurement</b>
1.2.3.2.4.4	<b>Mechanics</b>

WBS	Descriptio
Number	
1.2.3.2.4.4.3	Production of the APD mechanics: APD-housing, mechanical support for preamplifier & HV-unit, panel for <b>Fabrication/Procurement</b>
1.2.3.2.4.5	<b>Assembly</b>
1.2.3.2.4.5.3	Assembling of the APD-units: APD, preamplifier & HV-supply unit, the connector panel, APD housing
1.2.3.2.4.6	<b>APD</b>
1.2.3.2.4.6.3	<b>Test</b>
1.2.3.2.4.7	A complex test of the assembled APD-units, development of APD-unit data-base
1.2.3.2.4.7.3	<b>APD</b>
1.2.3.2.5	<b>Packing</b>
1.2.3.2.6	Packing and warehousing of APD-units before a complex "cosmic-ray" test of APD-instrumented modules
1.2.3.2.6.3	<b>APD</b>
1.2.3.2.7	<b>Cosmic Ray Test of Module/APD</b>
1.2.3.2.7.1	Installation of 2672 APD-units on Calorimeter modules, a complex "cosmic-ray" test of APD-instrumented modules, development of data-base for APD-instrumented Calorimeter modules
1.2.3.2.7.1.1	<b>Beam Line Modules</b>
	Production & test of "special" Beam-Liner modules (68 APD-instrumented modules)
	<b>Fabrication/Procurement</b>
	<b>Photon Calorimeter Mechanics</b>
	Production of the Calorimeter mechanics (Frame, Cooling & Railway systems, Assembling & Service tools)
	<b>Design</b>
	<b>Support Frame</b>
	The production drawings of Calorimeter's frame

WBS	Descriptio
Number	Descriptio
1.2.3.2.7.1.2	<p><b>Cooling System</b></p> <p>The production drawings of Calorimeter's cooling system</p>
1.2.3.2.7.1.3	<p><b>Railway System</b></p> <p>The production drawings of Railway system</p>
1.2.3.2.7.1.4	<p><b>Assby. &amp; Service Tools</b></p> <p>The production drawings of Assembling &amp; Service tools</p>
1.2.3.2.7.2	<p><b>Fabrication/Procurement</b></p>
1.2.3.2.7.2.1	<p><b>Support Frame</b></p> <p>Fabrication of Calorimeter Frame, including two movable frame halves with the special supports for the modules over the beam-pipe and the special platforms on the frame-tops for location of racks with electronics and the LV power supplies</p>
1.2.3.2.7.2.2	<p><b>Cooling System</b></p> <p>Fabrication of Calorimeter Cooling units, including the cooling circulators, the heat exchangers &amp; the cooling enclosures for modules</p>
1.2.3.2.7.2.3	<p><b>Railway System</b></p> <p>Fabrication of Railway system, including rails and moving devices</p>
1.2.3.2.7.2.4	<p><b>Assby. &amp; Service Tools</b></p> <p>Fabrication of Assembling &amp; Service tools, including lifts and another specific assembling tooling</p>
1.2.3.3	<p><b>Instrumentation</b></p> <p>Instrumentation of Photon Calorimeter, including the APD HV Control System, "Cosmic-ray" Pre-calibration System, Monitoring/Calibration System and Readout System</p>
1.2.3.3.1	<p><b>HV Control System</b></p> <p>Calorimeter HV control system (2740 programmable D-A VME converters for control of APD HV-supply units)</p>

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1.2.3.3.1.3	<p><b>Fabrication/Procurement</b></p> <p>Procurement, test &amp; software's development of the HV Control System for APDs that is including 176 IP-mezzanine-modules of the 12-bit D-A converters (XIP-5220-016, Xycom, Inc.), 44 VME-carriers for 176 IP-mezzanine-modules (XVME-9660, Xycom, Inc.) &amp; 4 VME /VXI 13-slots mainframes with VME /VXI controller</p>
1.2.3.3.2	<p><b>Self-triggering Pre-calibration</b></p> <p>Calorimeter Self-triggered Pre-calibration System is based on detection and analysis of signals from the "cosmic ray muons" that are vertically traversing Calorimeter modules. Detection of these muons will be selected by a simple trigger, formed from a coincidence between the top and bottom horizontal rows of Calorimeter modules. This system will allow to pre-calibrate 2700 Calorimeter modules with accuracy 2-3% in several hours, even from</p>
1.2.3.3.2.3	<p><b>Fabrication/Procurement</b></p> <p>Procurement, test &amp; software's development of the Self-triggered Pre-calibration System that is including 30 VME-16-channels modules of the programmable Low Threshold Discriminator (V814, CAEN), 6 VME-modules of the programmable trigger logic (V495, CAEN) and 2 VME 20-slots mainframes with VME controller (6021 series,</p>
1.2.3.3.3	<p><b>Monitoring &amp; Calibration System</b></p> <p>Calorimeter monitoring-calibration system is based on the "ultrabright LED-lamps" with an electronic method of stabilization of the LED-lamp light output. This system will include 44 units. Each unit will service 64 Calorimeter modules.</p>
1.2.3.3.3.1	<p><b>Design</b></p> <p>Design of Calorimeter monitoring-calibration system: a LED pulse generator with optical feedback, a 64-channels optical splitter of a LED light</p>
1.2.3.3.3.2	<p><b>Prototype</b></p> <p>Prototyping of Calorimeter monitoring-calibration system (one 64-channels optical splitter &amp; a LED pulse</p>
1.2.3.3.3.3	<p><b>Fabrication/Procurement</b></p> <p>Fabrication of Calorimeter monitoring-calibration system (44 units &amp; a start-up NIM-logic)</p>
1.2.3.3.4	<p><b>Readout Electronics</b></p>

WBS	Descriptio
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	Calorimeter readout electronic has to be include 2740 channels of a 10-bit & 250 MHz WFD, 12 Crate data-collection modules and 12 mainframes
1.2.3.3.4.1	<p data-bbox="539 396 701 420"><b>WFD Boards</b></p> <p data-bbox="539 443 1871 501">WFD-board has to be including 16 channels of a 10-bit/250 MHz WFD, one “trigger” output that is providing signal if any WFD channel exceeds over threshold, and a special fast link to a crate data-collection board.</p>
1.2.3.3.4.1.3	<p data-bbox="560 522 877 547"><b>Fabrication/Procurement</b></p> <p data-bbox="539 570 905 596">Production of 176 WFD boards</p>
1.2.3.3.4.1.5	<p data-bbox="560 615 617 639"><b>Test</b></p> <p data-bbox="539 662 831 688">Test of 176 WFD boards</p>
1.2.3.3.4.2	<p data-bbox="539 708 905 732"><b>Crate Data-Collection Boards</b></p> <p data-bbox="539 755 1871 808">The crate data-collection board has to be collecting data from 16 WFD board (256 WFD channels) thru the special fast links and transfer these collected data to a high level</p>
1.2.3.3.4.2.3	<p data-bbox="560 828 877 852"><b>Fabrication/Procurement</b></p> <p data-bbox="539 875 1073 901">Production of 12 Crate data-collection boards</p>
1.2.3.3.4.2.5	<p data-bbox="560 920 617 945"><b>Test</b></p> <p data-bbox="539 967 999 993">Test of 12 Crate data-collection boards</p>
1.2.3.3.4.3	<p data-bbox="539 1013 898 1037"><b>VXI Mainframes &amp; Controller</b></p> <p data-bbox="539 1060 1598 1086">12 VXI (or PCI) mainframe &amp; controller for 176 WFD boards and 12 data-collection boards</p>
1.2.3.3.4.3.3	<p data-bbox="560 1105 877 1130"><b>Fabrication/Procurement</b></p> <p data-bbox="539 1153 1289 1179">12 VXI (or PCI) 20-slots mainframes with VXI (or PCI) controller</p>
1.2.3.3.5	<p data-bbox="539 1198 1024 1222"><b>Electronic Racks &amp; LV Power Supplies</b></p> <p data-bbox="539 1245 1780 1271">The water-cooling racks for the control/readout electronics, LV power supply for APD preamplifiers &amp; APD</p>
1.2.3.3.5.1	<p data-bbox="539 1291 779 1315"><b>LV Power Supplies</b></p>

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<b>WBS Number</b>	<b>Descriptio</b>
	Low voltage power supply for APD preamplifiers & APD HV-chips, including 10 12-VDC power supplies (RM-50M) and 10 5-VDC power supplies (RM-30M) power supplies, produced by Astron corp.
<b>1.2.3.3.5.1.3</b>	<b>Fabrication/Procurement</b>
<b>1.2.3.3.5.2</b>	<b>Electronic Racks</b> 8 water-cooling racks for the control/readout electronics
<b>1.2.3.3.5.2.3</b>	<b>Fabrication/Procurement</b>
<b>1.2.3.4</b>	<b>Shipping</b> Shipping of Photon Calorimeter according of next shipping formula: 600 modules ´ 3, Mechanics, 940 modules
<b>1.2.3.5</b>	<b>Assembly &amp; Test</b> Assembling, & Testing of the delivered Calorimeter modules
<b>1.2.3.5.1</b>	<b>Delivered Modules</b> Complete assembling, mechanical and optical tests of the delivered modules
<b>1.2.3.5.2</b>	<b>Cosmic Ray Test</b> “Cosmic ray” test & pre-calibration of the delivered modules
<b>1.2.3.5.3</b>	<b>Technical Support</b> ???????
<b>1.2.3.6</b>	<b>Installation</b> Installation of Photon Calorimeter
<b>1.2.3.6.1</b>	<b>Railway &amp; Cabling System</b> Installation of Railway and Cabling systems
<b>1.2.3.6.2</b>	<b>Support Frame</b> Installation of Calorimeter support frame

<b>WBS Number</b>	<b>Descriptio</b>
1.2.3.6.3	<b>Assembly &amp; Service System</b> Installation of Assembling and Service system
1.2.3.6.4	<b>Modules into Frame</b> Assembling of modules into Calorimeter frame
1.2.3.6.5	<b>Monitoring &amp; Calibration System</b> Installation and testing of monitoring and calibration system
1.2.3.6.6	<b>Read-out Boards</b> Installation and testing of readout boards
1.2.3.6.7	<b>Technical Support</b> ????
1.2.3.7	<b>Cabling</b> Cabling of Photon Calorimeter
1.2.3.7.1	<b>LV Power Supply</b> Production of 2704 LV power supply cables with connectors
1.2.3.7.2	<b>HV control System</b> Production of 170 HV-control cables with connectors
1.2.3.7.3	<b>Signal Cables with Connectors</b> Production of 3172 signal cables with connectors
1.2.3.7.4	<b>Assembly and Installation</b> Assembling & Installation of cables
1.2.3.7.5	<b>Technical Support</b>

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WBS Number	Descriptio
1.2.3.8	???? <b>Technical Support</b> Technical Support of Calorimeter during Construction Project
1.2.3.9	<b>Commissioning</b> ????