1 The Electromagnetic Calorimeter (ECAL)

Description: A sampling calorimeter, consisting of lead sheets and wire chambers, situated inside the solenoid. The barrel and two end-caps each comprise 12 modules and the longitudinal shower development is sampled in 45 layers grouped in three stacks of 10, 23 and 12 layers. The wire chambers are Al extrusion covered with graphite coated mylar. Signals are taken from cathode pads as well as from the anode wires. In each stack the pads form towers pointing to the interaction vertex. Gas: $XeCO_2$ (80% : 20%).

Dimensions:

Thickness of lead plates	2 mm (stack 1+2), 4 mm (stack 3)
Diameter of tungsten wire	25 μ
Wire spacing	5 mm
Radiation length/stack	Barrel: $3.83X_0$, $8.80X_0$, $8.85X_0$
	Endcaps: $3.46X_0$, $8.86X_0$, $8.91X_0$
$8.91X_0$	
Interaction length	1.0 - 1.3 λ_{int} for 5GeV pions

Barrel:

Radius:	R_{outer} = 225 cm	R_{inner} = 185 cm
overall length	477 cm	
Weight per module	11 t (12 modules)	
Pad size at inner radius	3 cm ×3 cm	
Granularity	$\Delta\theta \times \Delta\phi sin\theta$	
	17 mrad ×17 mrad at 90^0	
	12 mrad ×12 mrad at 45^0	

Endcaps:

Radius:	R_{outer} = 235.0 cm	R_{inner} = 54.0 cm
Radius (active layers)	R_{outer} = 227.5 cm	R_{inner} = 56.8 cm
Distance from I.P.	250.5 cm	active layer: 255.0 cm
Overall length (each)	56.25 cm	active layers: 41.10 cm
Weight per module	2.6 t (2 × 12 modules)	
Granularity	$\Delta\theta \times \Delta\phi sin\theta$	
	12 mrad ×14 mrad	for $11^0 < \theta < 16^0$
	11 mrad ×12 mrad	for $16^0 < \theta < 27^0$
	10 mrad ×11 mrad	for $27^0 < \theta < 36^0$
	10 mrad ×10 mrad	for $36^0 < \theta < 42^0$

Readout: Channels:

Tower storeys = $12\times3\times4,096$ (barrel) + $2\times12\times3\times1,024$ (endcap) = 221,184 (total)

Performance:

Energy resolution	$\sigma/E = 0.01 + 0.18/\sqrt{E(GeV)}$
Angular resolution	$\sigma_\phi = \sigma_\theta/\sin\theta = .32 + 2.7/\sqrt{E(GeV)}$ mrad