

FDC Design Parameters

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Geometry (each chamber unit)

Active volume inner radius (cm)	5.0
Active volume outer radius (cm)	48.5
Chamber assembly outer radius (cm)	60.0
Number of U cathode strips (25 μm Kapton, 5 μm Cu)	192
Number of W cathode strips (25 μm Kapton, 5 μm Cu)	192
Number of sense wires (20 μm gold-plated W)	96
Number of field wires (80 μm gold-plated CuBe)	97
Cathode pitch (mm)	5
Gap between strips (mm)	1
Half gap (anode-cathode separation) (mm)	5
Positioning accuracy of sense wires in x,y (μm)	50

Package details

Number of chamber units per package	6
Number of cathode cables (50-conductor shield ribbon cables)	96
Number of anode cables (34-conductor shield ribbon cables)	36
Thickness per package (cm)	13.0
Thickness per package (g/cm^2)	0.341
Thickness per package (radiation lengths)	0.01156
Thickness of annulus for wire plane (11.5 cm G10, g/cm^2)	19.55
+ 1 cm cable (0.88 g/cm^2 each) (g/cm^2)	20.43–23.07

Material budget per package						
Material	Thickness (cm)	Number of layers	Density (g/cm ³)	Total thickness (g/cm ²)	Radiation length (X ₀) (g/cm ²)	X/X ₀
Rohacell	0.50000	12	0.032	0.192	41.04	0.00468
Epoxy	0.00200	12	1.08	0.026	40	0.00065
Kapton	0.00250	12	1.42	0.043	40.56	0.00106
Copper	0.00050	12	8.96	0.054	12.86	0.00420
Ground planes (Mylar)	0.00063	7	1.39	0.006	39.95	0.00015
Argon	1.0×0.9	8	1.65×10 ⁻³ †	0.012	19.55	0.00061
CO ₂	1.0×0.1	8	1.83×10 ⁻³ †	0.001	36.20	0.00004
Entrance/exit windows (Mylar)	0.0025	2	1.39	0.007	39.95	0.00017
Total				0.341		0.01156
Total (4 packages)				1.364		0.04624

†70°F, 1 atm

Channel count

Number of cathode channels	9216
Number of anode channels	2304
Total number of channels	11520
Number of channels per preamp board	24
Number of preamp boards	480

Package locations in z

Package #1 (upstream face, cm)	212.0
Package #2 (upstream face, cm)	271.3
Package #3 (upstream face, cm)	330.6
Package #4 (upstream face, cm)	389.8
Positioning accuracy of packages in z (mm)	1

dE/dx capability

Cathode strips	YES
Sense wires	NO

Operation

Nominal operating voltage (sense wires, V)	+1650
Nominal operating voltage (field wires, V)	-300
Gas mixture (1 cm at 1 atm)	Ar/CO ₂ 90/10
Nominal gas gain	10 ⁵
Gas flow, volume changes per day	2-3

Time Characteristics

Maximum drift time (B=0.0 T)	100 ns
Effective drift velocity (B=0.0 T)	50 $\mu\text{m}/\text{ns}$
Maximum drift time (B=2.0 T)	143 ns
Effective drift velocity (B=2.0 T)	35 $\mu\text{m}/\text{ns}$
Cathode timing resolution, σ	<5 ns

Preamplifier parameters

Nominal gain (mV/fC)	2
Maximum range for impulse input (fC)	400
Peaking time (ns)	11
Tail cancellation	YES
Discriminator output (configurable)	YES

Readout

Cathode strips	100 MHz Flash-ADCs
Anode wires	8.3 GHz pipeline TDCs

Calibration

Cathode strips (selected charge)	Electronic pulser
Anode wires (selected charge)	Electronic pulser

Resolution

Position resolution ($\sigma_U, \mu\text{m}$)	200
Position resolution ($\sigma_W, \mu\text{m}$)	200
Position resolution ($\sigma_X, \mu\text{m}$)	200