

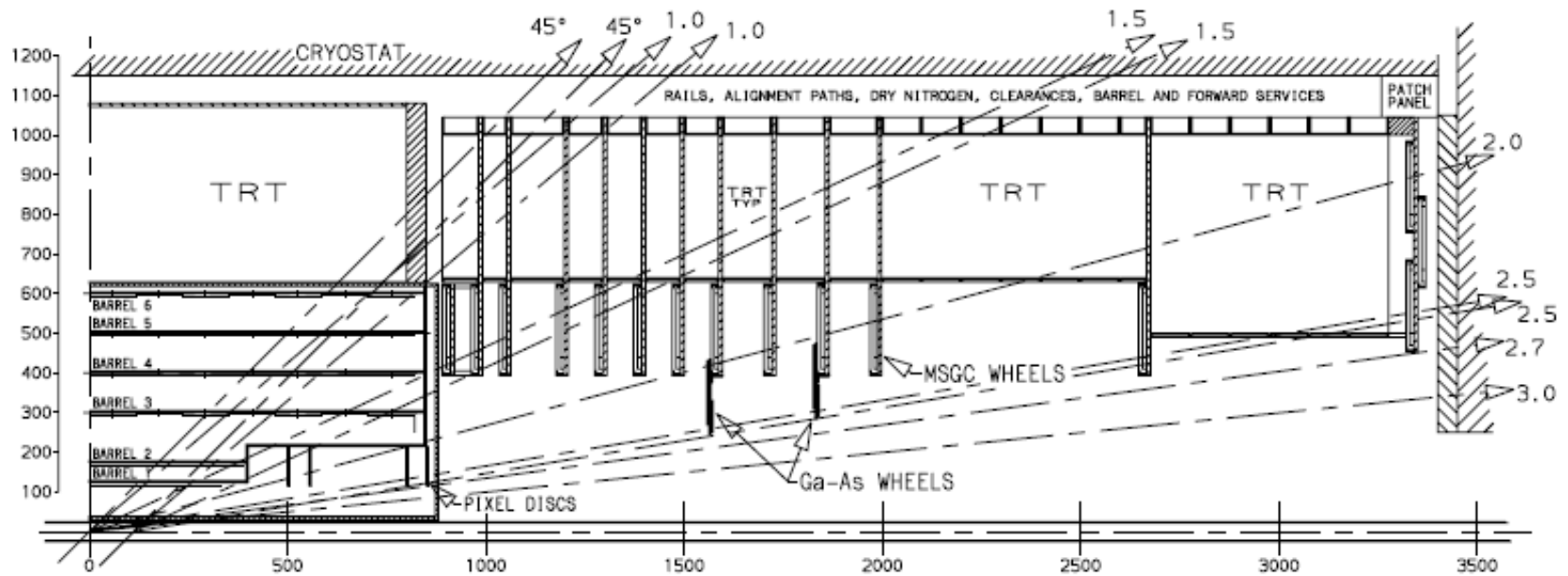
Main requirements for tracking (ATLAS)

High Momentum and vertex resolution

(efficient tracking for lepton momentum measurements, for enhanced electron and photon identification, for tau and heavy-flavour vertexing, and reconstruction capability of some B decay final states.)

1. Hermetic coverage up to $|\eta| < 2.5$.
2. Good momentum resolution (< 0.3) at high p_T (500 GeV).
3. Very good tracking efficiency.
4. Very good resolution of primary vertex.
5. Good efficiency for electron identification
6. Photon identification capabilities
7. V^0 identification
8. Ability to reconstruct secondary vertices from b-decays.
9. B-tagging capability
10. Need to operate up to an integrated dose between 10 and 60 Mrad.

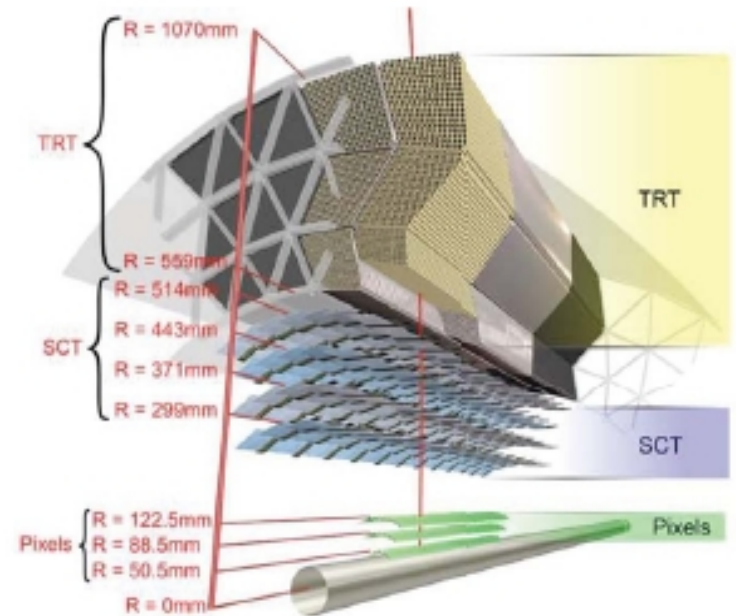
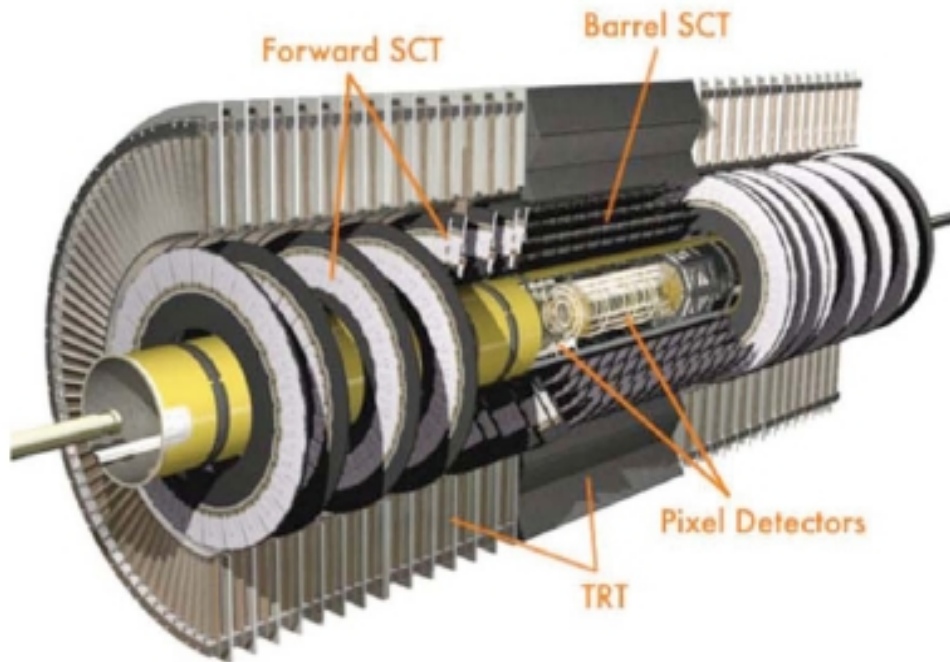
First proposal



System	Barrel radii and half-lengths (cm)	Forward z positions and radial ranges (cm)	Area (m ²)	Element size (μm)	Resolution (μm)	η Coverage
Pixels	R : 11.5, 16.5 $l/2$: 35, 45	z : 50, 55, 80, 85 ΔR : 11.5–21.3	1.38 0.79	50×300	$\sigma_{R\phi} = 14$ $\sigma_z = 87$ $\sigma_R = 87$	± 2.5
Silicon strips	R : 30, 40, 50, 60 $l/2$: ± 82	z : 155.7, ΔR : 20–35	41	75 or 112.5 12 cm length	$\sigma_{R\phi} = 15$ $\sigma_z = 770$	± 1.4
GaAs strips		z : 182.5, ΔR : 29–44	3.3	50 7.6 cm length	$\sigma_{R\phi} = 10$ $\sigma_R = 1200$	2.0–2.5
MSGC		z : 90.0, 97.2, 104.3, 118.7 128.5, 138.2, 148.0, 157.7 171.1, 184.5, 197.8, 265.6 ΔR : 44–60 z : 336.0, ΔR : 50–96	51	200 16 cm length	$\sigma_{R\phi} = 35$ $\sigma_R = 1800$	1.4–2.5
TRT	64 80 cm straws ΔR : 63–107	z : 80–265, ΔR : 64–103 z : 267–327, ΔR : 50–103		4 mm diameter 39, 53 cm length	$\sigma_{R\phi} = 170$ per straw	± 2.5

Actual choice

The Inner Detector

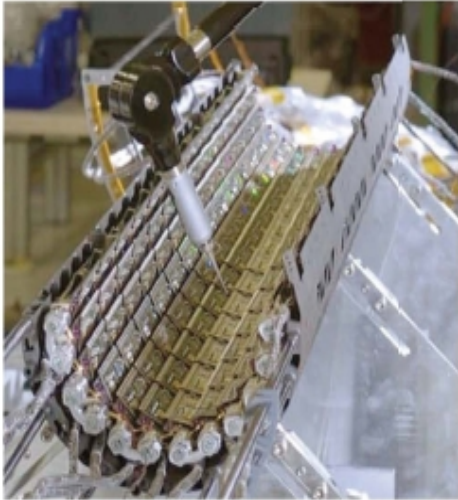


All detector components installed in 4 steps

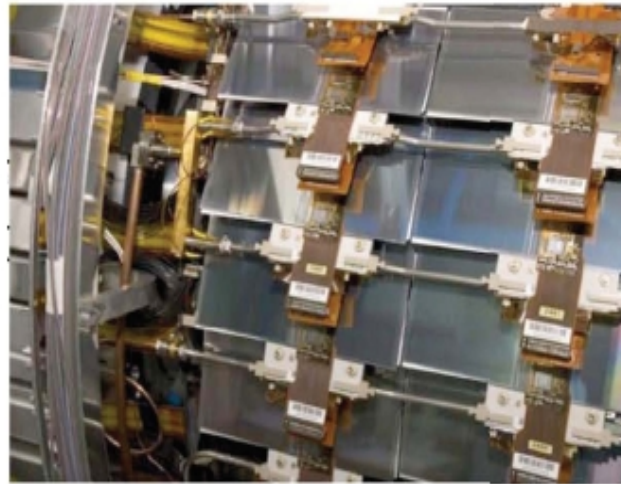
- ✓ Barrel SCT + TRT
- ✓ 2 End-Caps SCT + TRT
- ✓ Full pixel detector + Be beam pipe

Detectors

1744 modules, min $50 \times 400 \mu\text{m}^2$

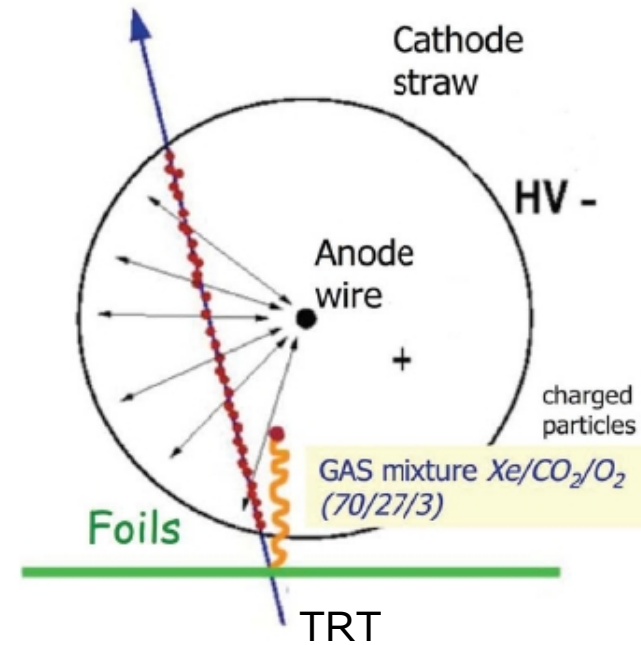


Pixel detector



4088 modules, $80 \mu\text{m}$ micro-strips

SCT detector



Item	Intrinsic accuracy (μm)	Alignment tolerances (μm)		
		Radial	Axial z	Azimuth $R\phi$
Pixel				
Layer 0	10 ($R\phi$) 115 (z)	10	20	7
Layers 1 and 2	10 ($R\phi$) 115 (z)	20	20	7
Disks	10 ($R\phi$) 115 (R)	20	100	7
SCT				
Barrel	17 ($R\phi$) 580 (z) ¹	100	50	12
Disks	17 ($R\phi$) 580 (R) ¹	50	200	12
TRT	130 (drift time)			30^2

Optional solution

We have one proposition for alternative technology for the tracker

- GEM
 - Radiation hard
 - Low material budget
 - Provides the same speed and resolution