

# Sports Technology and Athletics Consulting

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#### **DETAILED RESULTS**

The processed results of each scan are shown in the subsequent figures. Fig. 1 depicts a side view of the cyclist, Fig. 2 highlights the centreline velocity of the air over the cyclist, Fig. 3 demonstrates the flow losses through total pressure, and Fig. 4 shows the flow separation, or wake, behind the cyclist.

The centreline velocity, shown in Fig. 2, demonstrates the separation of the flow as it passes over the rider's back. The longer this separation point can be delayed, shown by a sharp reduction in flow velocity, the lower the drag for the rider. This is due to a smaller wake, and less air being "pulled" along with the rider.

Total pressure is effectively a measure of energy loss in the air flow. The smaller the change in total pressure from the inlet, the lower drag the pictured region has experienced. Wake areas undergo a large energy change, while freeflow areas, i.e. far from the cyclist, undergo virtually no change in energy. This is shown in Fig. 3.

Flow separation, Fig. 4, can be thought of as the area where the flow is recirculating behind the cyclist due to flow separation. The transparent red surface indicates the approximate region where flow separation is occurring. The vertical sections of the arms, legs and the backside of the rider are observed to be the largest contributors. Minimizing the size of this zone is one of the most direct ways of reducing the drag impact of the rider and increasing speed.



#### **CONFIGURATION REFERENCE**

Pose Detail	Pose 1	Pose 2	Pose 3			
Helmet	Medium tail aero helmet					
Bike	TT bike					
Front Wheel	90mm					
Rear Wheel	disc					
Clothing	speed suit					
Hyd. and Nut.	none					
Race Distance	40km time trial					
Notes	baseline	+20mm elbow height	Mantis position			

#### TABLE 1: Configurations Tested





(a)



(b)



(c)

FIGURE 1: Side view of the various scans





(a)



(b)

**FIGURE 2:** Centreline Velocity, [m/s]







FIGURE 3: Centreline Total Pressure, [Pa]



(a)





(b)

(c)

FIGURE 4: Flow separation region



### **ANALYSIS - WHAT THIS MEANS FOR YOUR NEXT RACE**

Pose Number	Calculated CdA				
Pose 1	0.203				
Pose 2	0.206				
Pose 3	0.2				

TABLE 2: Tabulated CFD drag results

**TABLE 3:** Estimated Riding Speed

Average Power Output:	150W	200W	250W	300W	350W
Pose 1	34.4km/h	38.7km/h	42.3km/h	45.4km/h	48.1km/h
Pose 2	34.3km/h	38.6km/h	42.1km/h	45.2km/h	47.9km/h
Pose 3	34.6km/h	38.9km/h	42.5km/h	45.6km/h	48.3km/h

TABLE 4: Estimated Time Change, for target race length (-ve represents time reduction)

Average Power Output:	150W	200W	250W	300W	350W
Pose 1	-	-	-	-	-
Pose 2	14s	12s	12s	11s	10s
Pose 3	-18s	-17s	-16s	-15s	-14s

