

Match Athlete Readiness to a Variety of Endurance Demands



USTFCCCA Convention 2022

Athlete Readiness is on a Timeline of Development

1. Physiological Readiness

- Aerobic (Capacity and Power)
- Anaerobic (H^+ habituation)
- Economy of movement

2. Biomechanical Readiness

- Efficiency of movement
- Optimal force production
- Minimize ground contact time

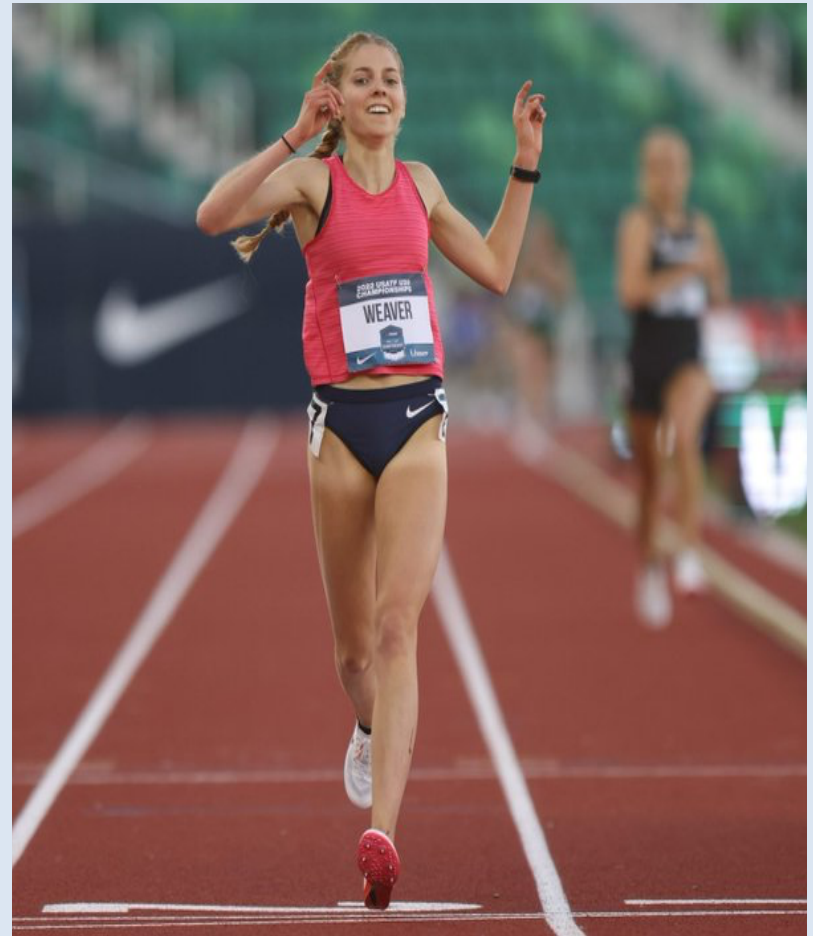
3. Psychological Readiness

4. Tactical Readiness



Race Specific Segments That Every Distance Event Contains

- Start
- Comfort Zone
- Critical Zone
- Finish



Physiological Training Dilemma

- Single training session mitochondrial damage from hydrogen →
- Yes, successful distance racing mainly requires a well developed aerobic energy system.
- But, successful distance racing also requires a *High Lactate Response* (HLR)

Lactate present mmol/L	% damage of mitochondrial numbers
5 mmol/L	1-2%
7 mmol/L	3-4%
8-15 mmol/L	5-7%
16-25 mmol/L	8-9%

400 Meter Repeat Day @ 5-7% Mitochondrial Damage

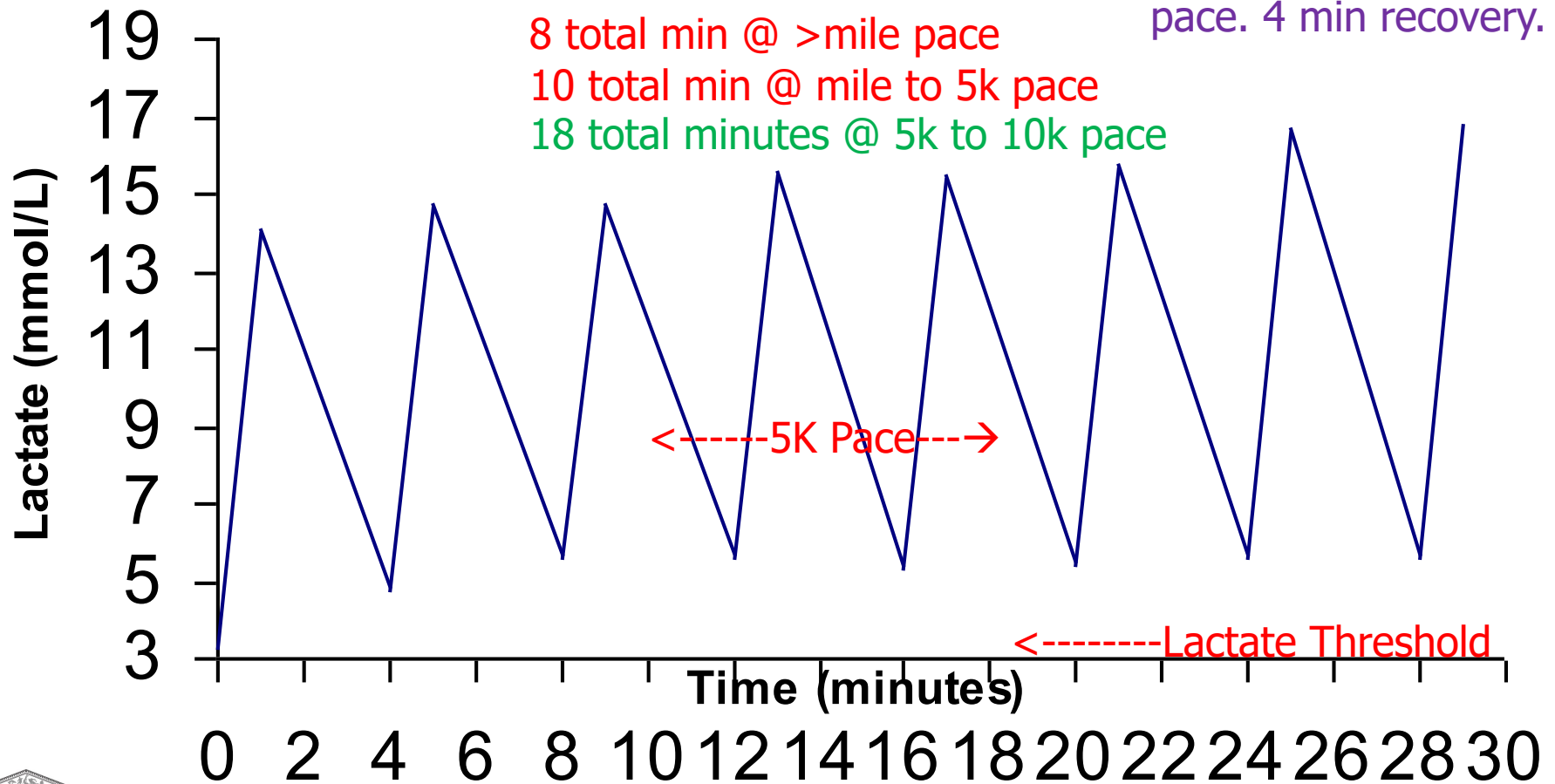
Tested Lactate Values

8 x 400 @ 2 seconds faster than DP race pace. 4 min recovery.

8 total min @ > mile pace

10 total min @ mile to 5k pace

18 total minutes @ 5k to 10k pace



Mile Repeats @ 2% Mitochondrial Damage

	Pre-Lactate (mmol/L)	Post-Lactate (mmol/L)	Velocity (m/s)
1600 #1	3.3	4.4	5.38
1600 #2	3.6	4.8	5.42
1600 #3	3.7	4.8	5.41
1600 #4	4.2	5.3	5.27
1600 #5	4.9	5.4	5.34

8:55 3200 Runner @ CV Pace

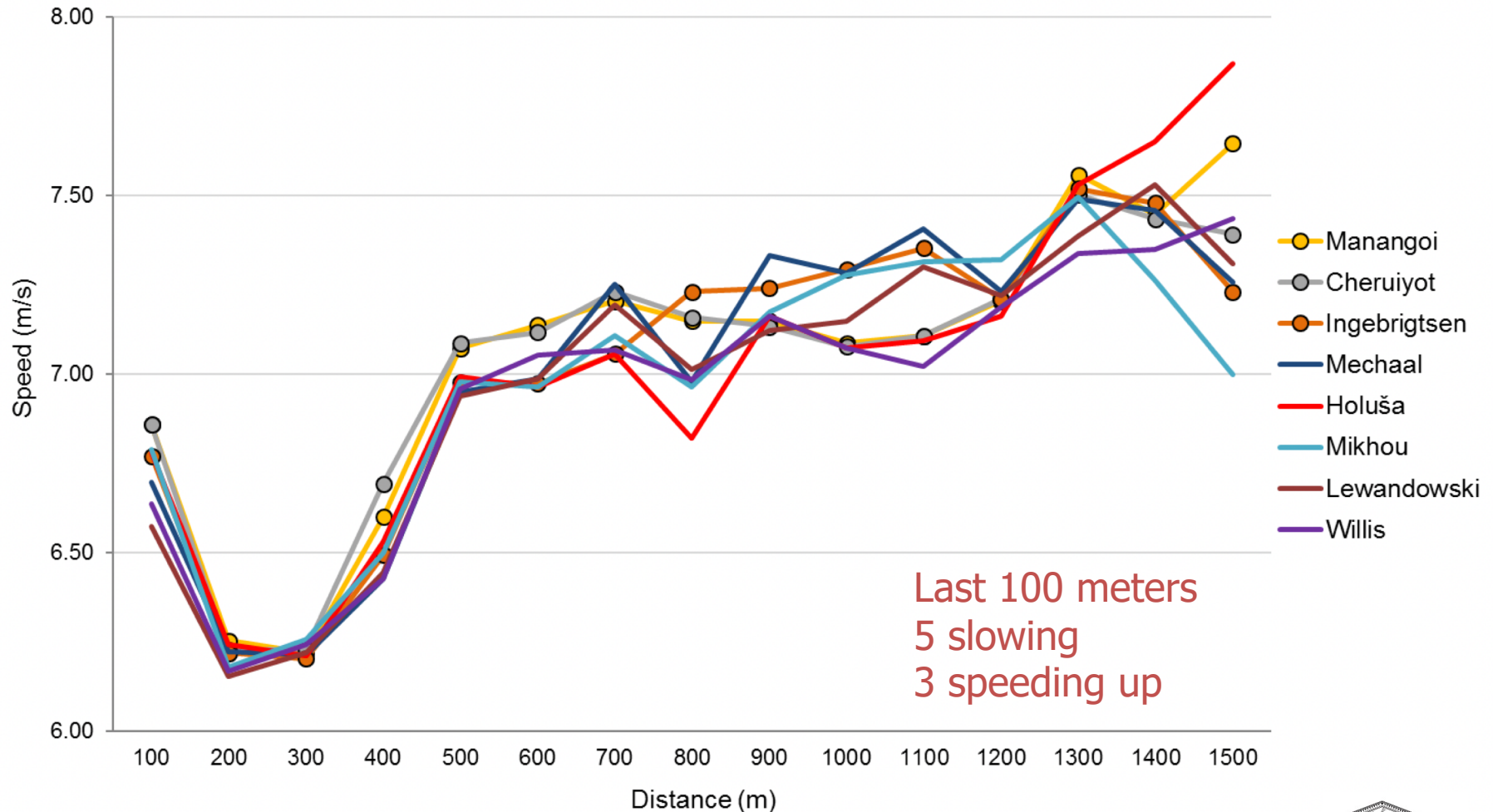
5.35 m/s=5:00/mile



Habituation to Hydrogen Ions

- *Some H⁺ Produced:* 2.9 mmol/L to 4.0 mmol/L. 15 k pace to 10 k pace. Releasing less H⁺ is main adaptation.
- *Moderate H⁺ Produced:* 4.0 mmol/L to 12.0 mmol/L, 10 k pace to 3 k pace. Draining more H⁺ is main adaptation.
- *High H⁺ Produced:* 12.0 mmol/L to 23 mmol/L. 3 k pace to 400 meter pace. Buffering more H⁺ is main adaptation.

2017 WC 1500 Men's Final



Last 8 x 100 Splits

2016 Olympic Trials 1500 Meter Finals

	Centrowitz	Andrews	Blankenship	Manzano
800	15.0	15.2	15.0	15.0
700	14.2	13.9	14.2	14.2
600	14.1	14.3	14.1	14.3
500	13.9	13.6	14.0	13.8
400	13.9	14.0	13.9	14.0
300	13.3	13.5	13.7	13.6
200	13.4	13.4	14.2	14.0
100	13.3	13.4	14.4	14.7

Gold

Silver

Bronze

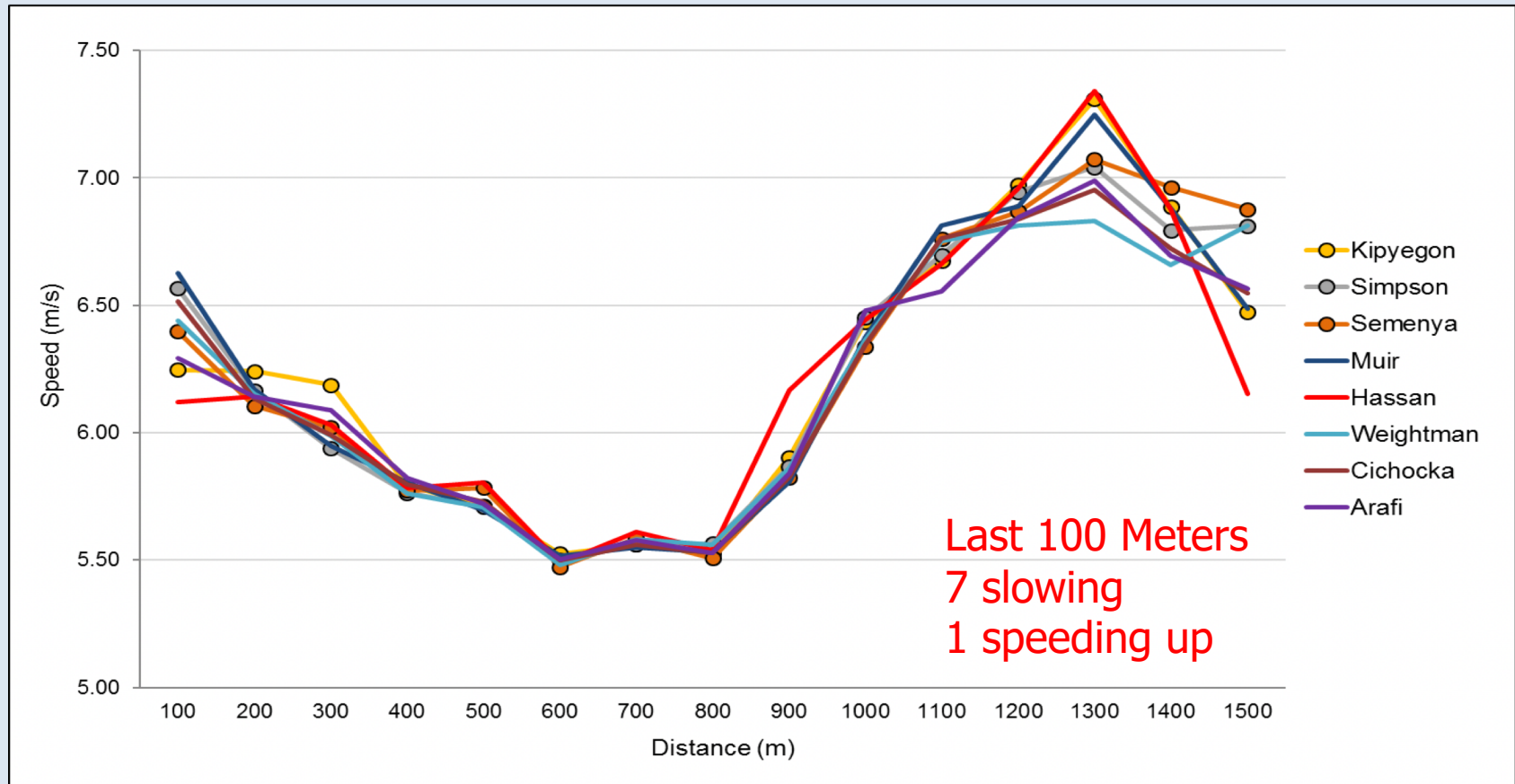


Last 8 x 100 Splits

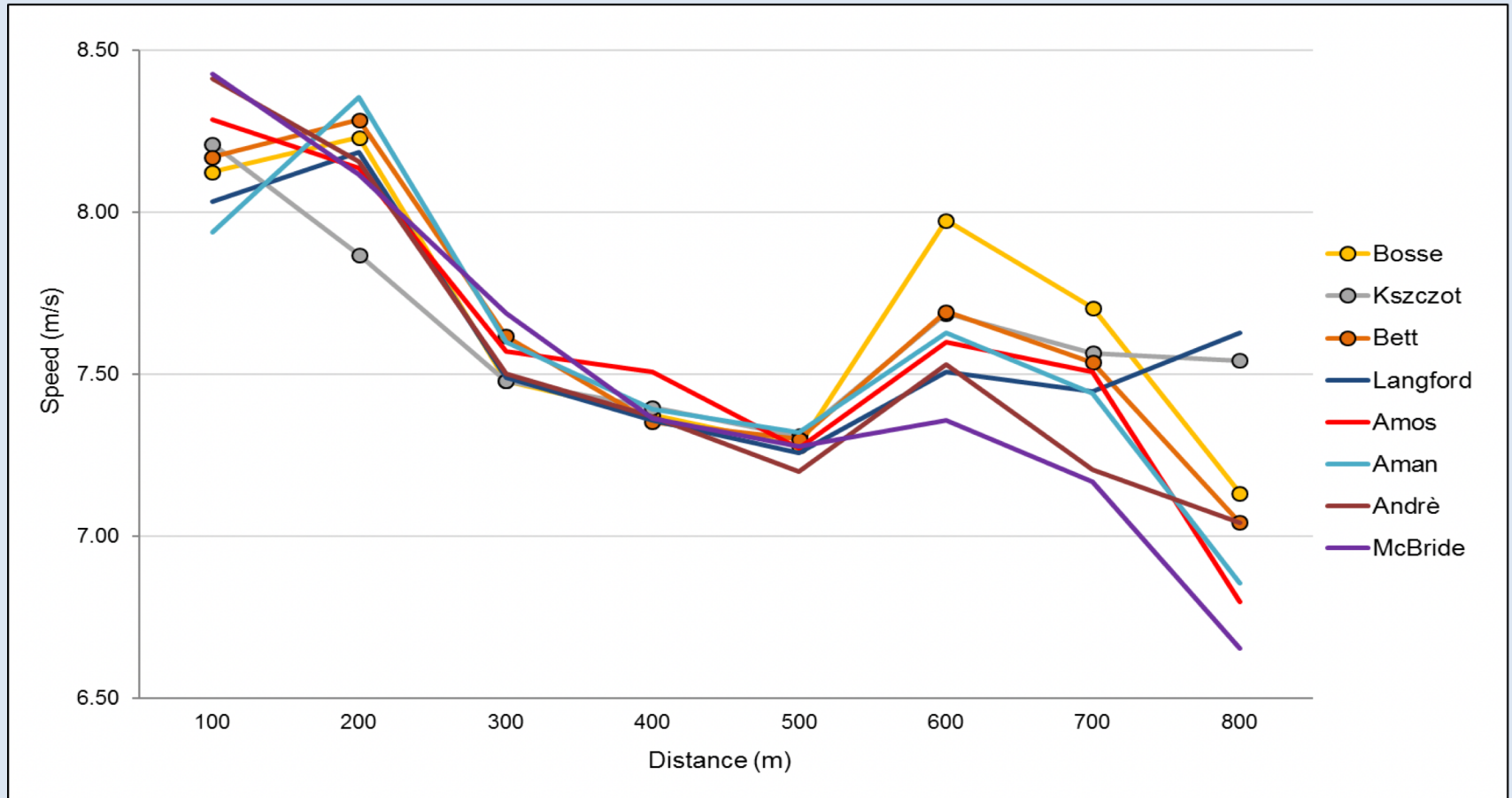
Ben Blankenship 2007 & 2016

	2007 Juniors	2016 OT	% Change
800	16.9	15.0	-12%
700	16.8	14.2	-15%
600	16.6	14.1	-15%
500	15.9	14.0	-12%
400	14.6	13.9	-4%
300	14.3	13.7	-4%
200	14.4	14.2	-1%
100	14.3	14.4	+1%

2017 WC 1500 Women's Final



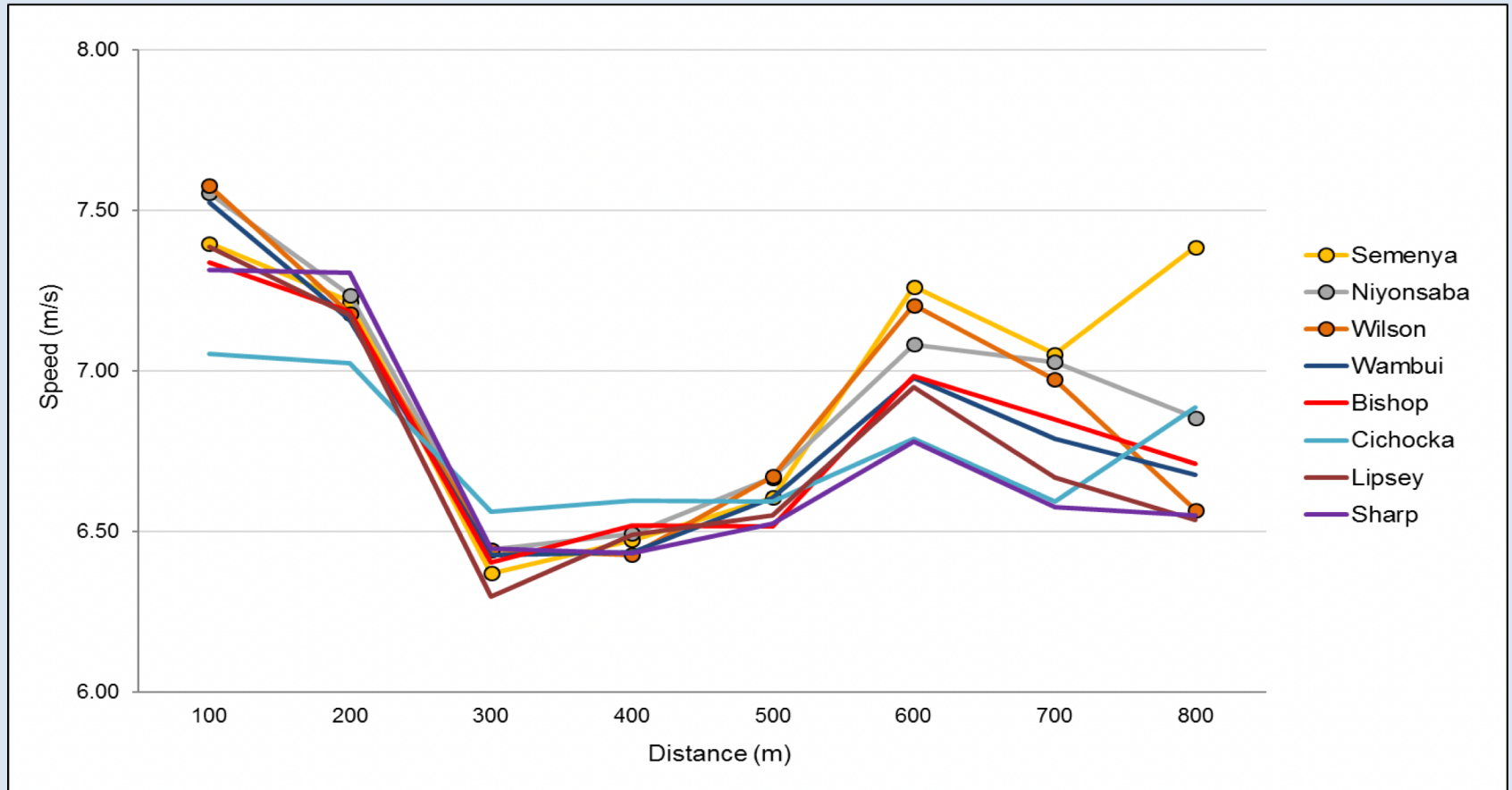
2017 WC 800 Men's Final



Top Ten 800 Men of All Time

Name	Time	Quarter 1	Quarter 2	Difference	
Cruz 81	1:41.77	49.6	52.2	2.6	95%
Coe 81	1:41.73	49.7	52.0	2.3	96%
Kipketer 97	1:41.73	49.6	52.1	2.5	95%
Rudisha 10	1:41.51	49.7	51.8	2.1	96%
Rudisha 11	1:41.33	49.4	52.3	2.9	94%
Kipketer 97	1:41.24	48.3	52.9	4.6	91%
Kipketer 97	1:41.11	48.3	51.8	2.5	94%
Rudisha 10	1:41.09	49.1	52.0	2.9	93%
Rudisha 10	1:41.01	48.9	52.1	3.2	93%
Rudisha 12	1:40.91	48.5	52.4	3.9	93%

2017 WC 800 Women's Final



World Class Critical Zone

(Mean time 400 for last 12 WC)

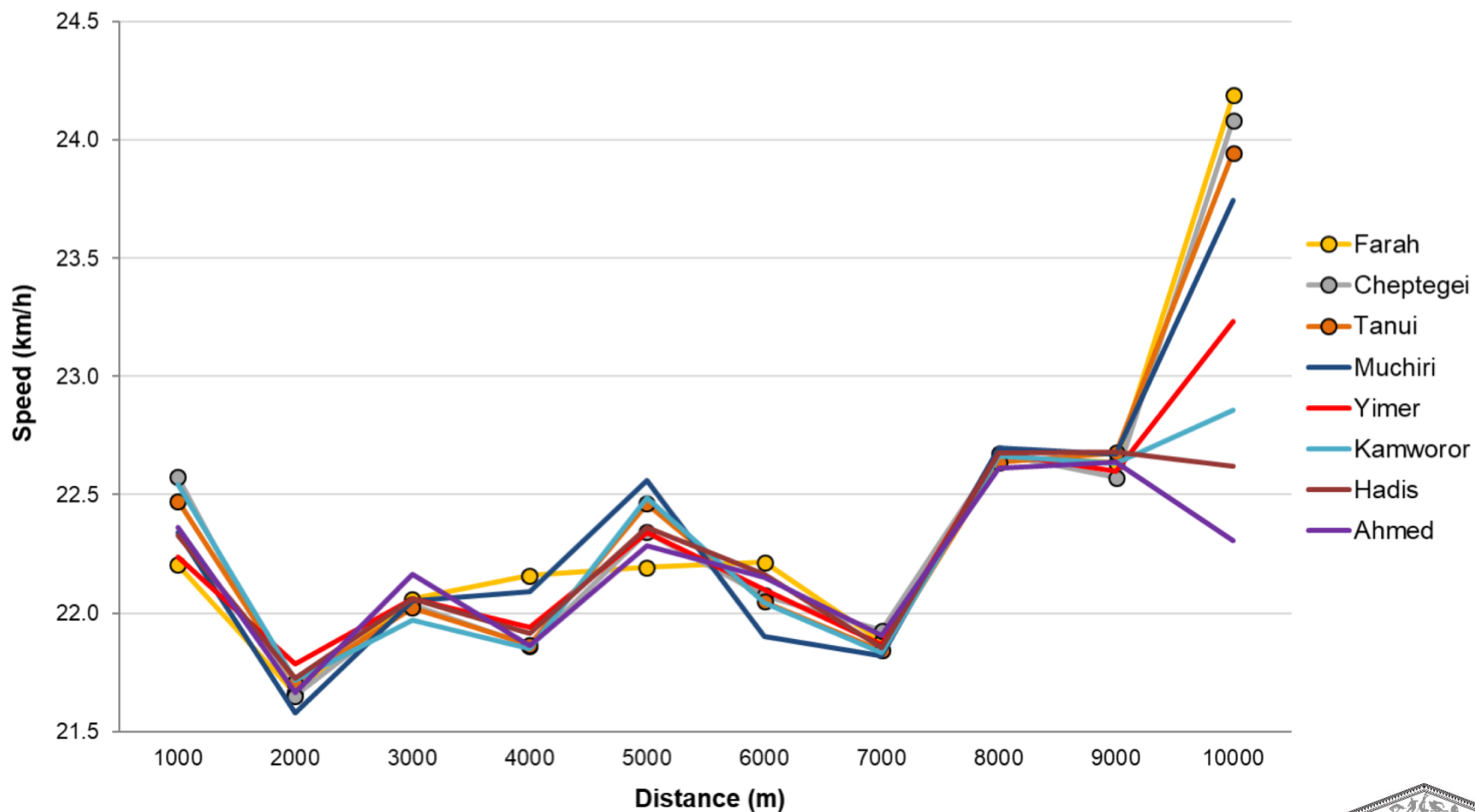
	800	1500	5000	10000
Males	51.99	52.77	53.02	53.85
Females	58.99	60.26	60.31	61.27

Movement Efficiency with Increased Racing Distance (mean last 5 WR)

	WR 800 Pace Fall-Off from WR 400	WR 1500 Pace Fall-Off from WR 800
Males	-15.1%	-7.9%
Females	-16.5%	-7.4%

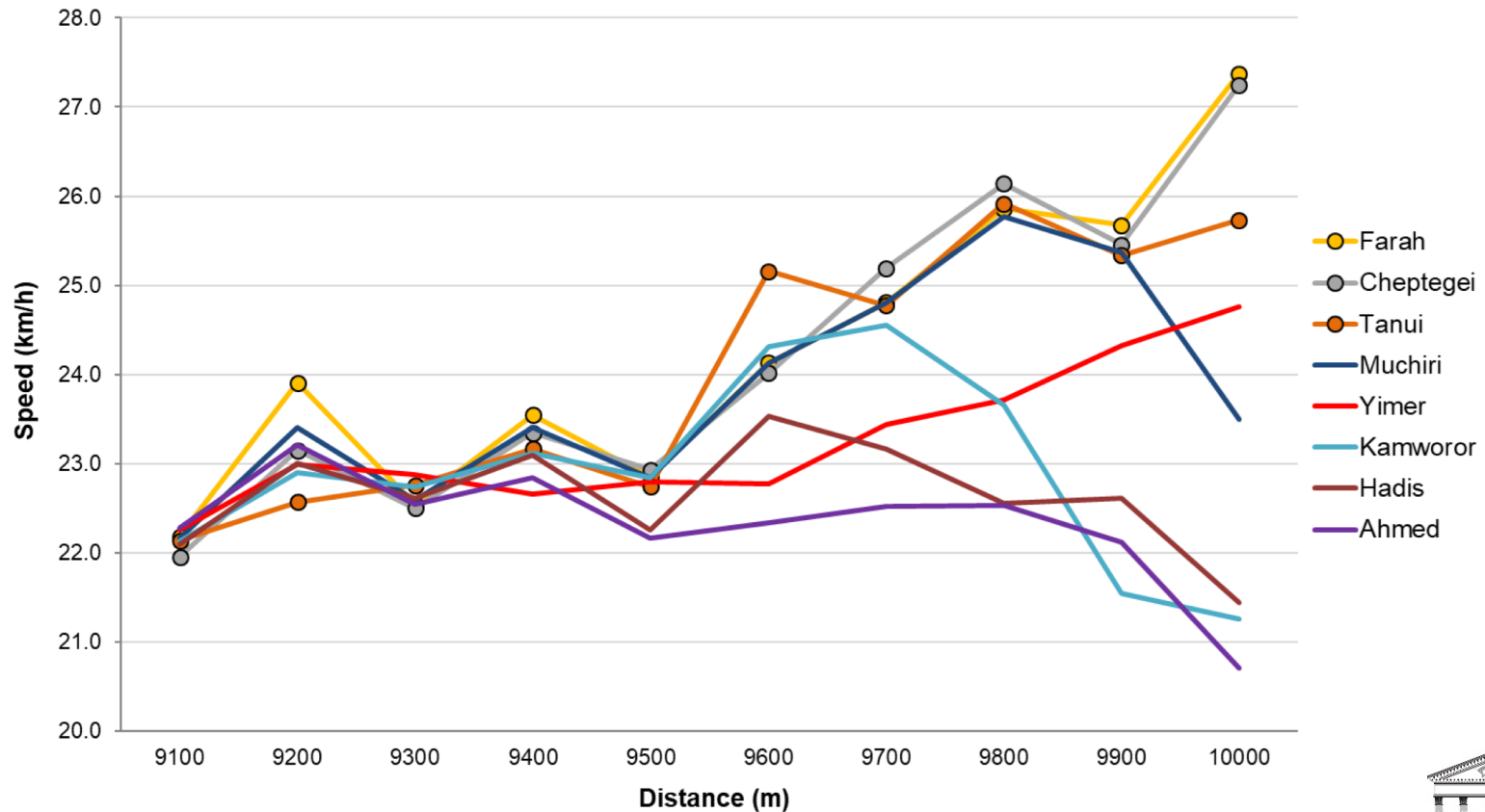
2017 WC 10,000 Men's Final

Mean Speed Per 1000 Meters



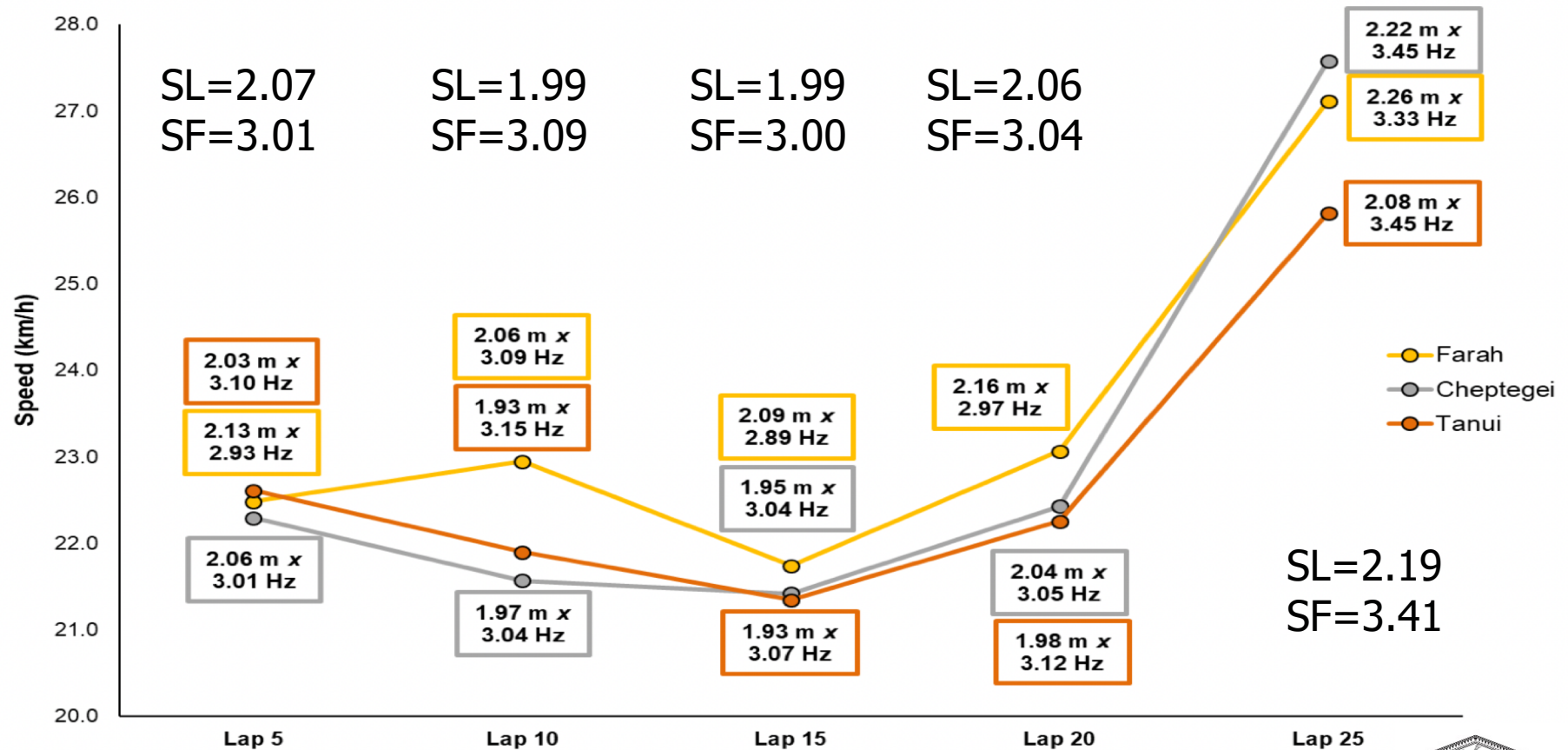
2017 WC 10,000 Men's Final

Last 1000 Meters



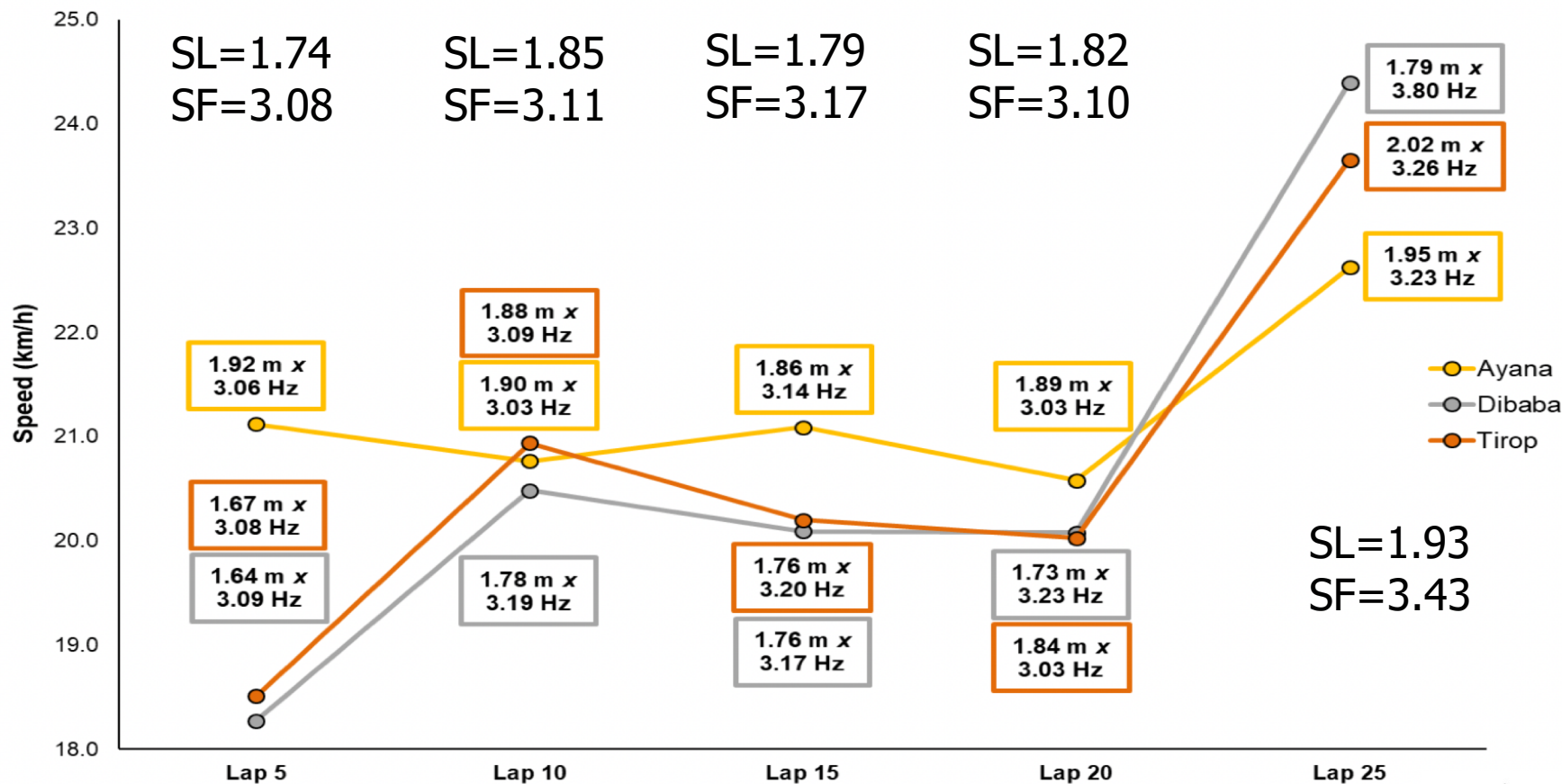
2017 WC 10K Men's Final

Speed, Stride Length, Stride Frequency



2017 WC 10K Women's Final

Speed, Stride Length, Stride Frequency

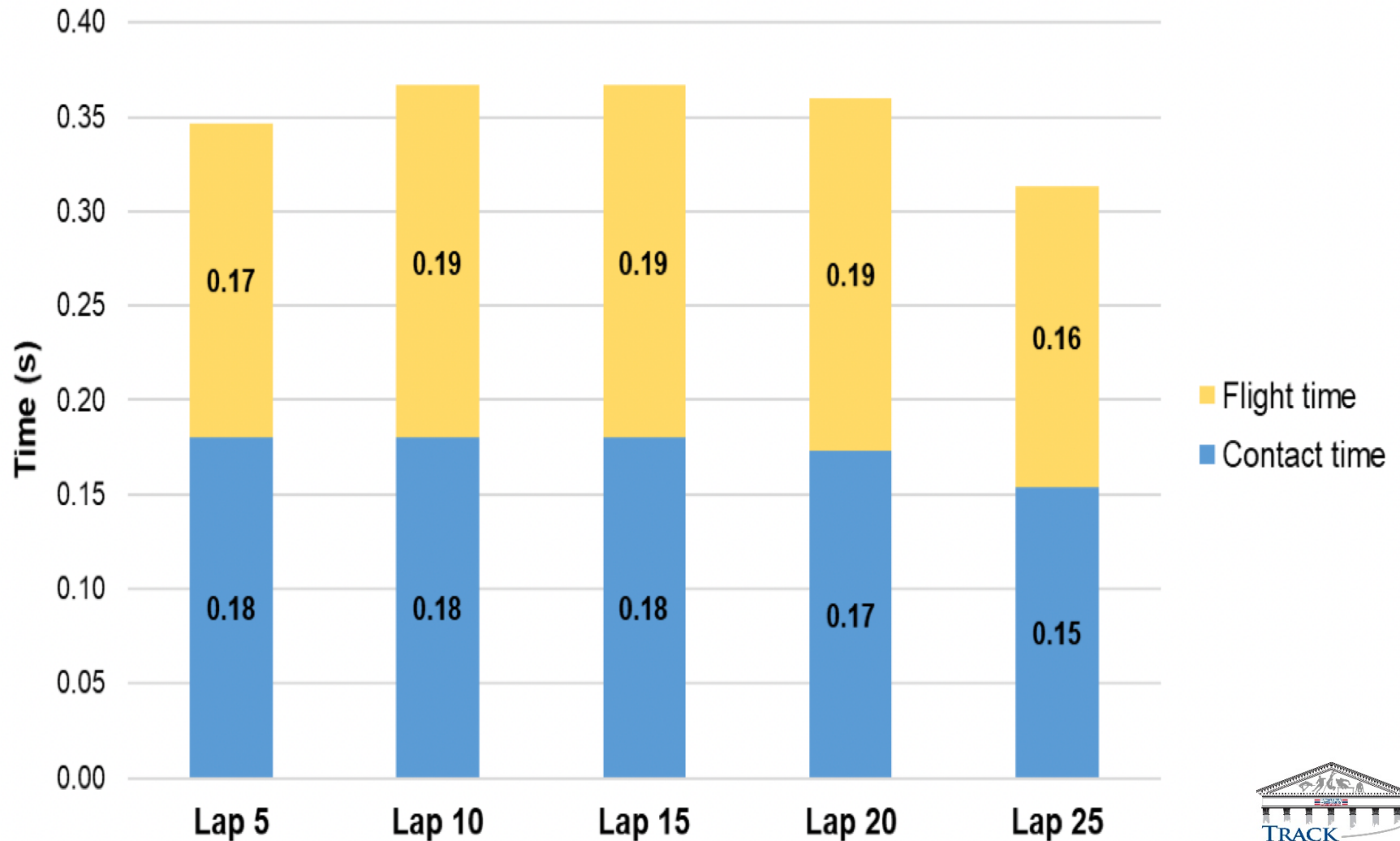


Ground Contact Time (GCT)

Athlete Type	Race Velocity	GCT Per Stride
World-Class sprinter M	12.2 m/s	.083 sec
College sprinter M	11.0 m/s	.095 sec
World-Class 800 M	6.7 m/s	.145 sec
World-Class 10,000 F	5.9 m/s	.170 sec
World-Class 10,000 M	6.2 m/s	.180 sec
College 5000 runner M	6.0 m/s	.175 sec
Elite U20 5000 M	5.7 m/s	.195 sec
Upper-Tier U20 5000 F	4.0 m/s	.250 sec
Upper-Tier U20 5000 M	4.5 m/s	.275 sec

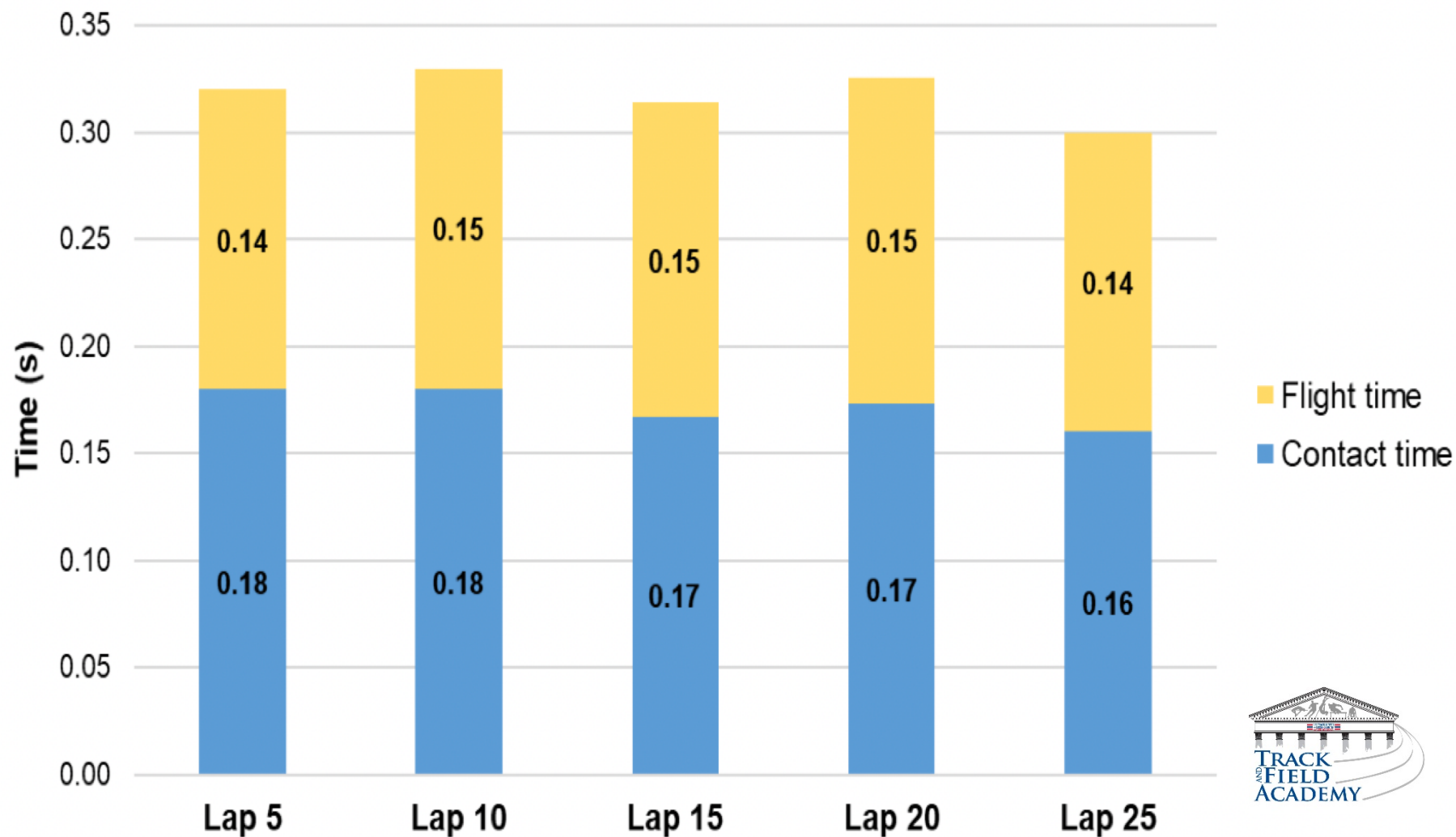
2017 WC 10K Final

Mo Farah



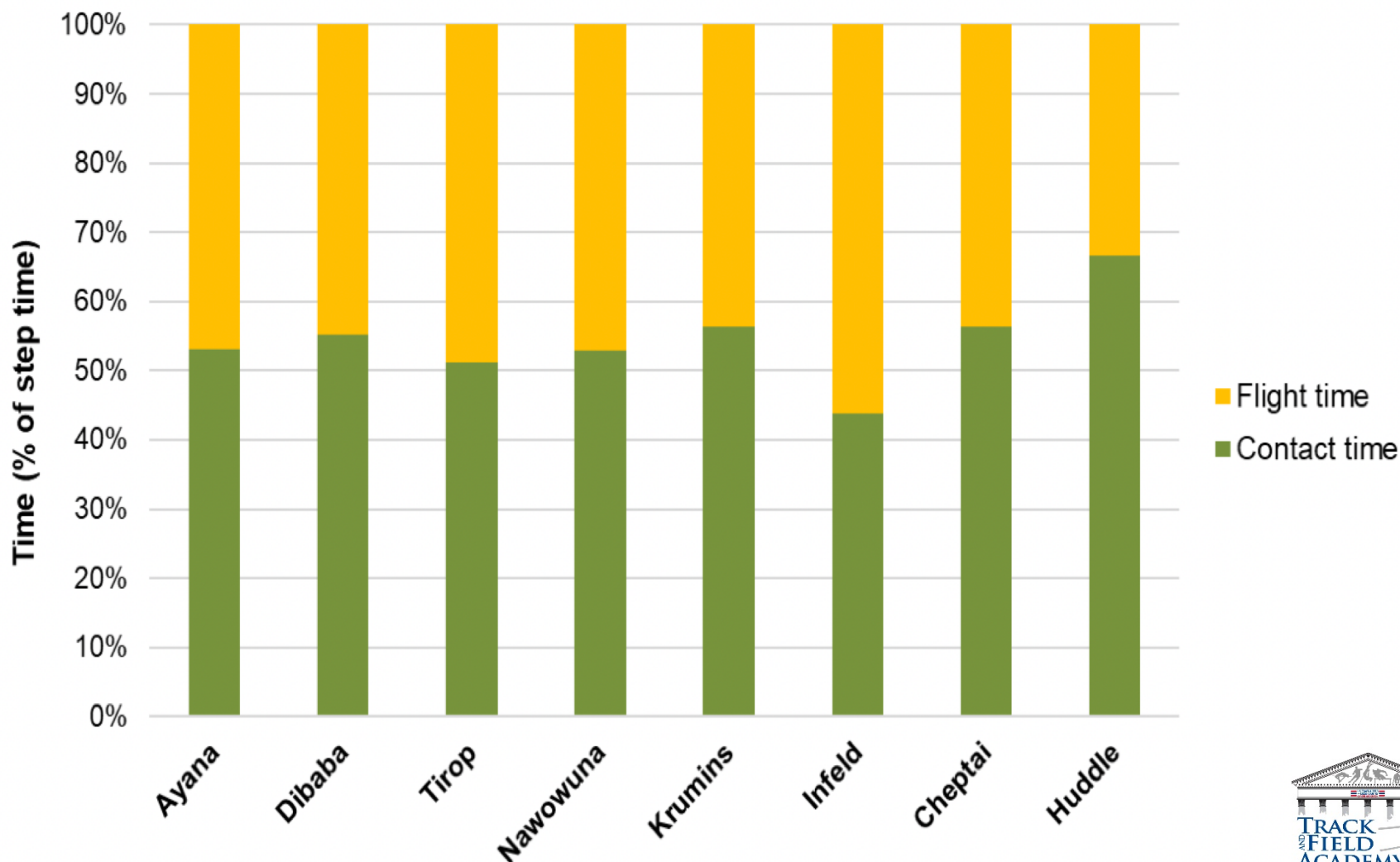
2017 WC 10K Women's Final

Almaz Ayana



2017 WC 10K Women's Final

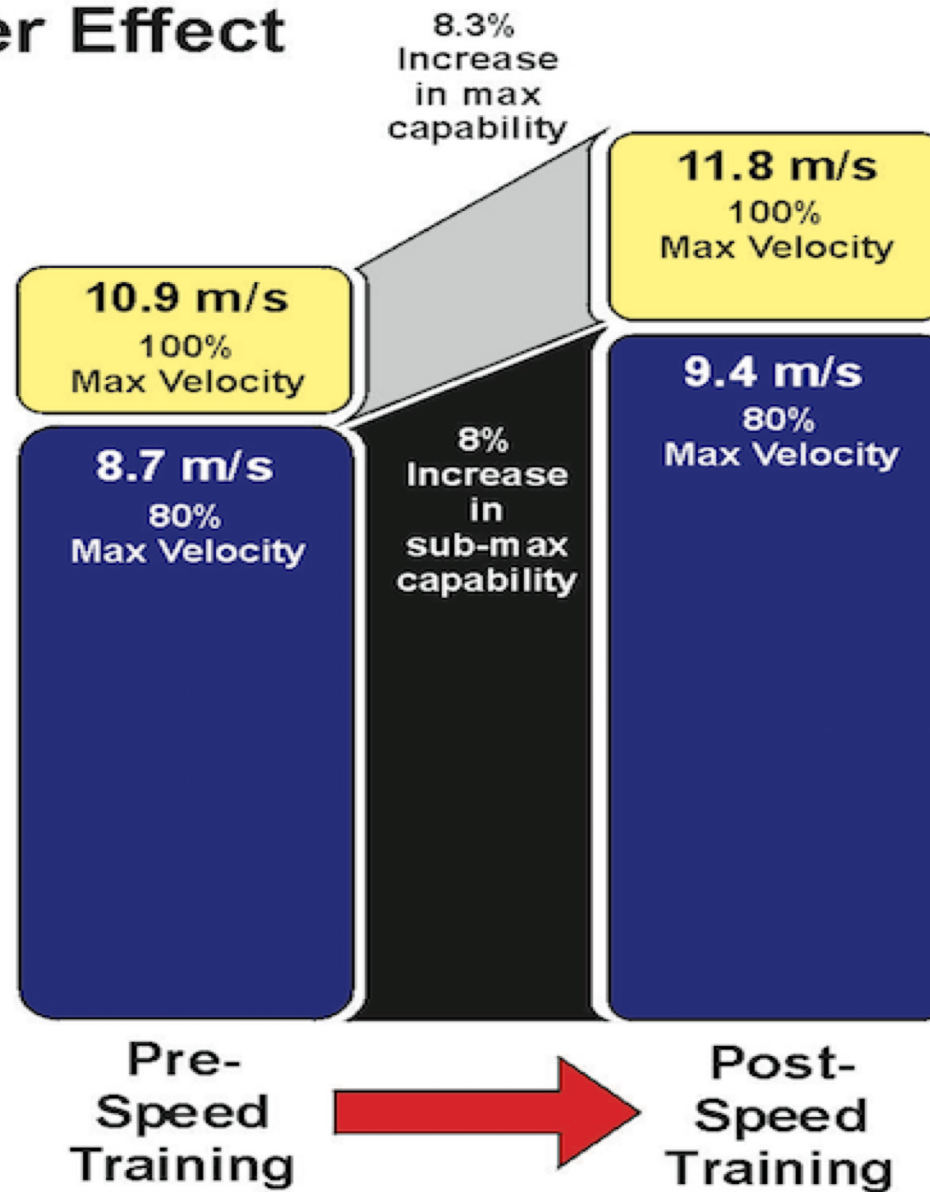
% Distribution of Stride (Lap 15)



Correlating ASR Data to GCT Data

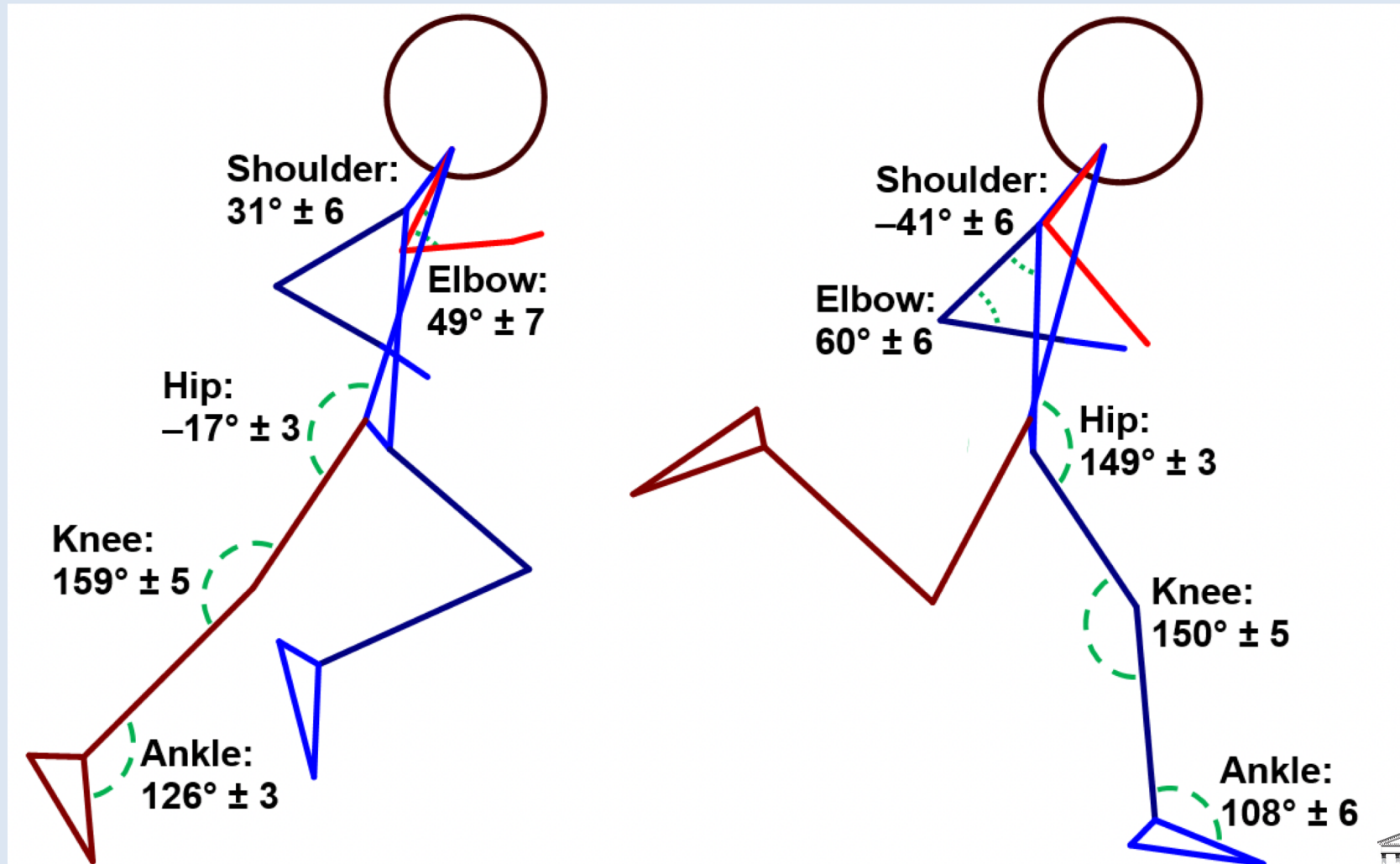
	30 M max 15	30 M m/s 15	30 M max 18	30 M m/s 18	m/s % Change 15-18
Blankenship	4.14s	7.25	3.34s	8.98	-19%
	GCT 15		GCT 18		GCT % Change 15-18
	.278		.198		-29%

Speed Reserve Transfer Effect

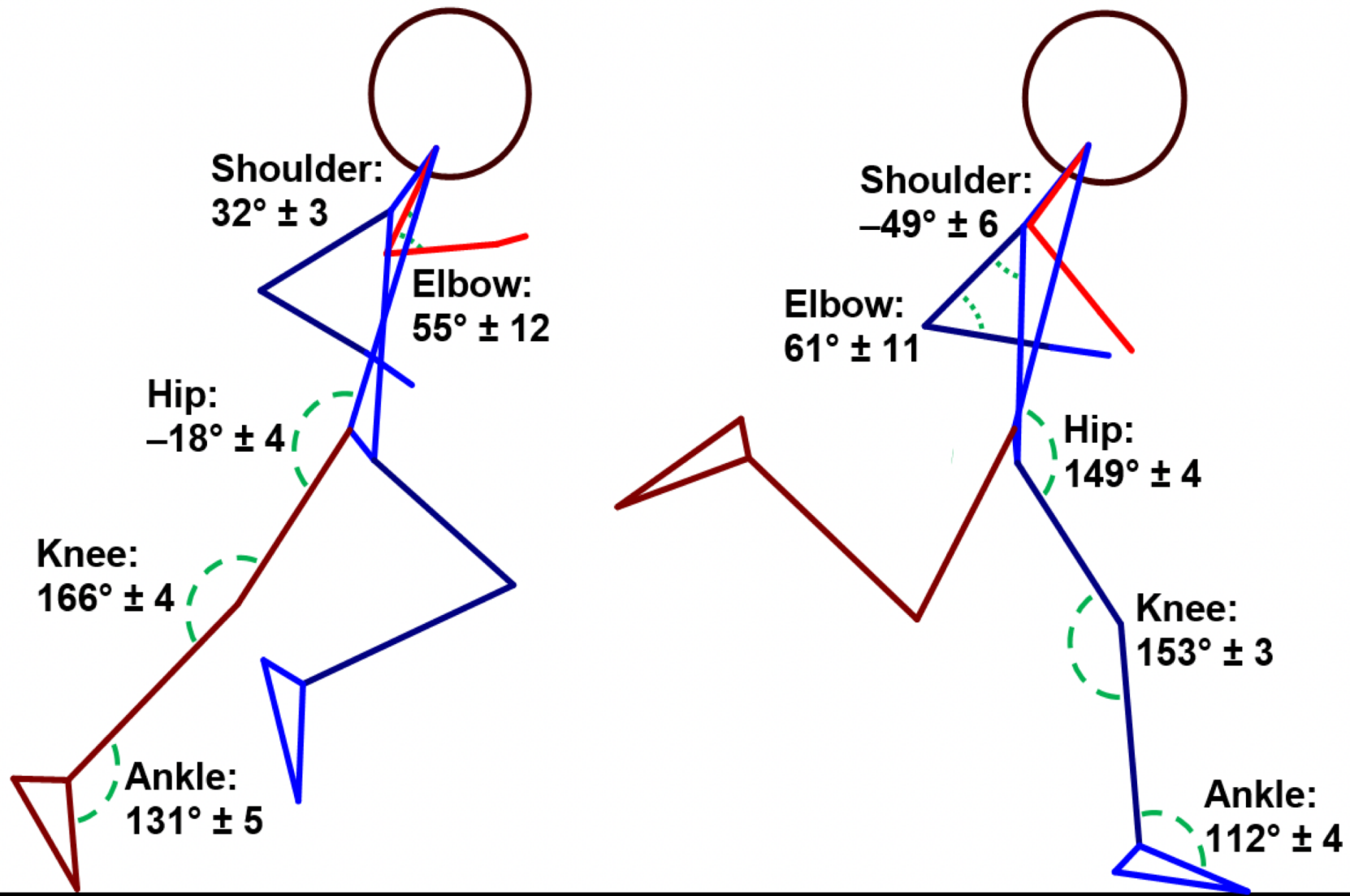


Mean Body Position 10K Men

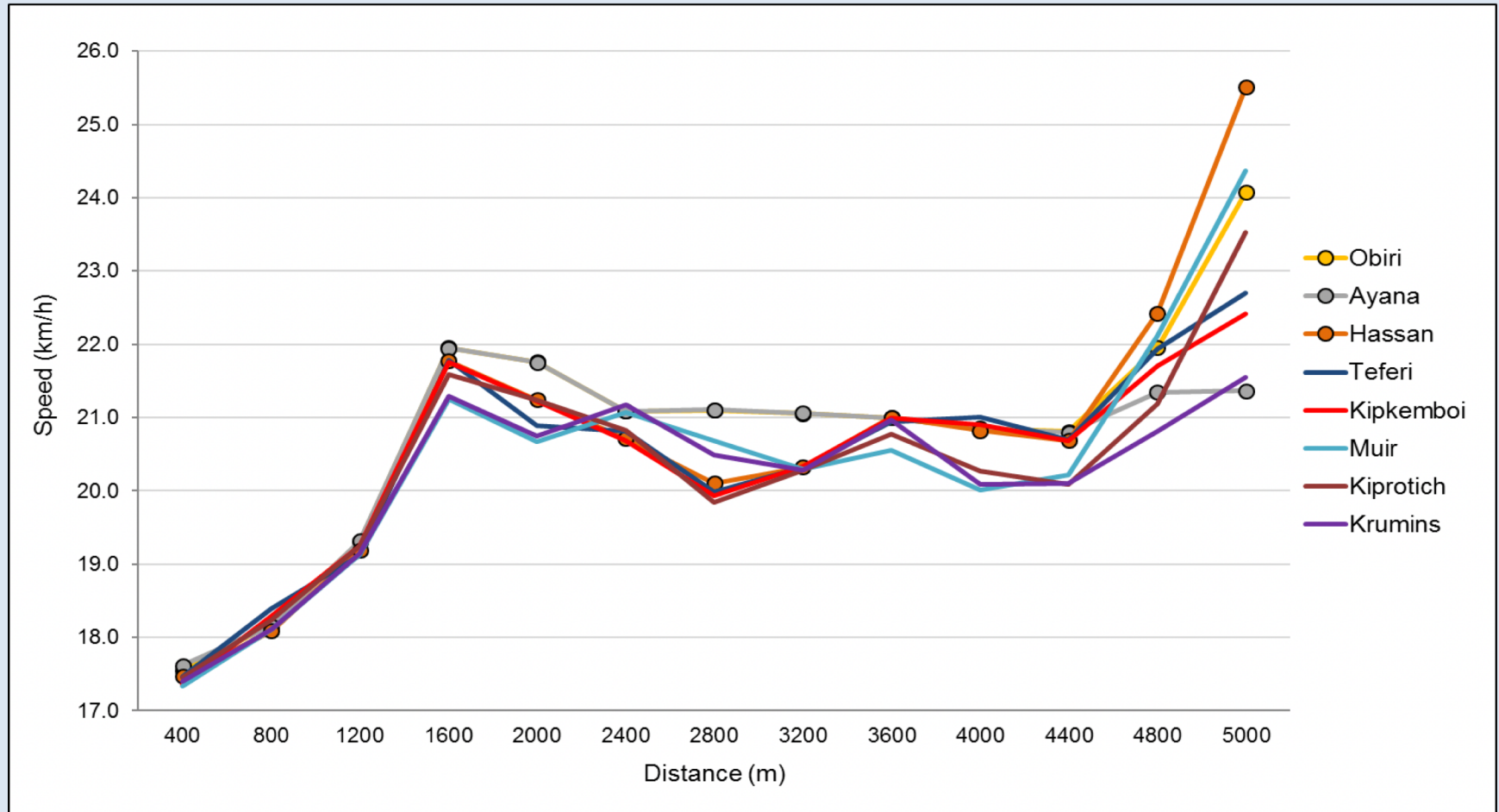
8 Finalists Lap 15 of 25



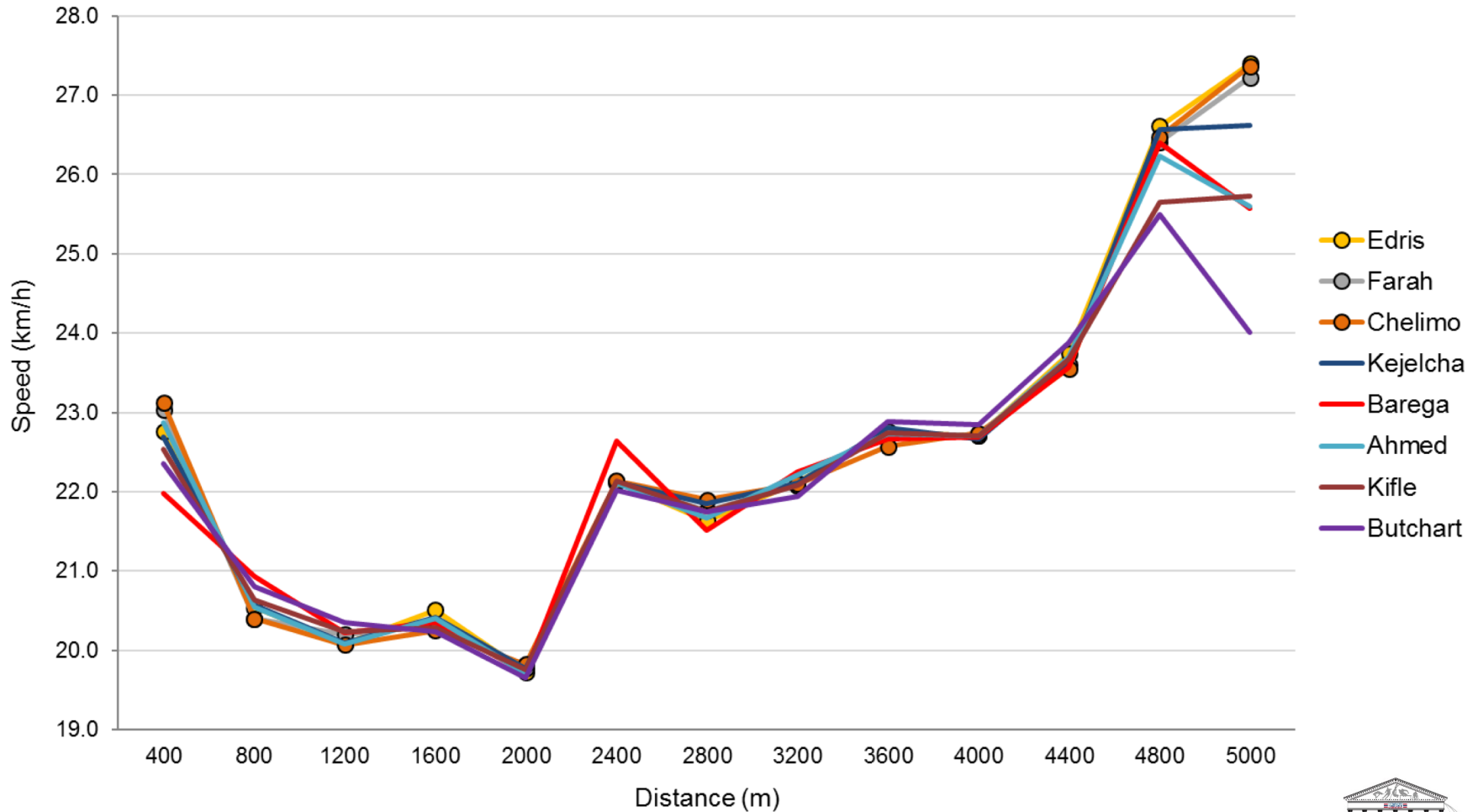
Mean Body Position 10k Women 2017 WC 8 Finalists Lap 15 of 25



2017 WC 5000 Women's Final

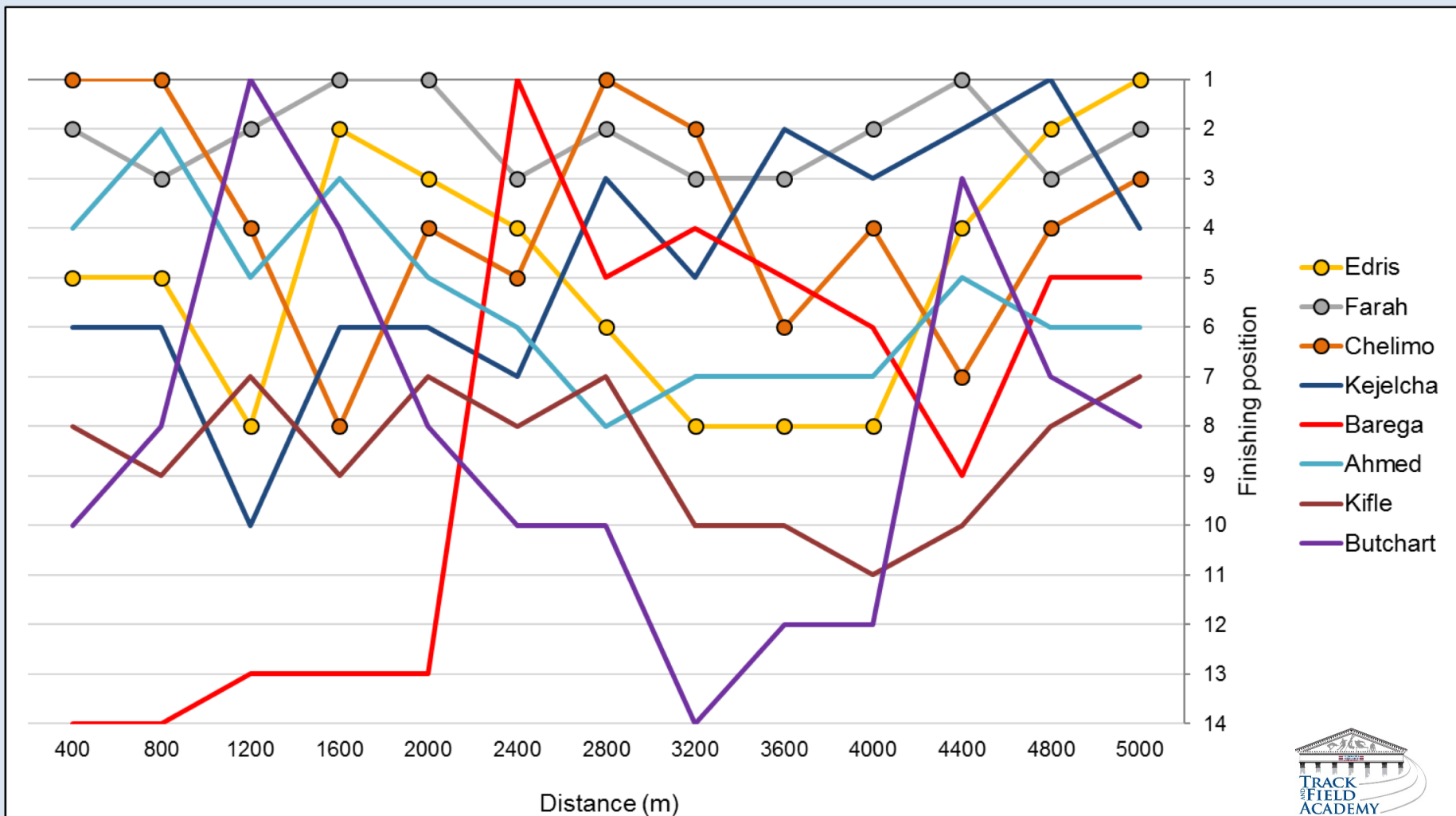


2017 WC 5000 Men's Final



2017 WC Men's 5000

Position Changes



Take-Home Points

1. Does the runner have the specific strength to hold a necessary shape?
2. Does the runner have the coordination and flexibility to transition to the next shape?
3. Does the runner have the speed to transition quickly to the next shape?
4. Does the runner have the ability to economically change shapes over extended periods of time?





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