

2021 Men's 400m Hurdles World Record Season

Karsten Warholm (NOR) - 45.94

Hurdle Touchdown Times



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2025.01.05



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Todd Henson

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Meetings Overview:

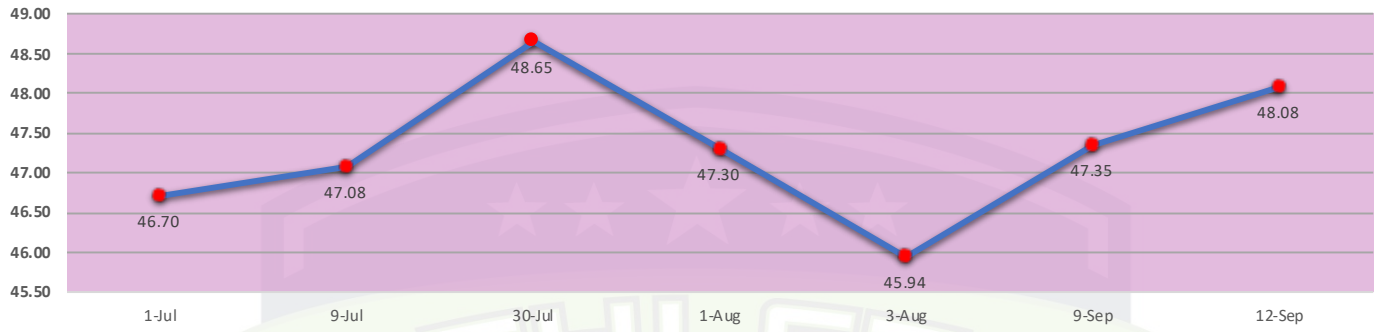
Karsten Warholm Season Overview		3
ISTAF (Berlin, GER) (TV Analysis) — Final		5
Weltklasse (Zürich, SUI) (TV Analysis) — Final		6
2020 Olympic Games (Tokyo, JPN) (TV Analysis) — Final		7
2020 Olympic Games (Tokyo, JPN) (TV Analysis) — Semi-Final 2	NEW	8
2020 Olympic Games (Tokyo, JPN) (TV Analysis) — Heat 3	NEW	9
Herculis Meeting International d'Athletisme (Monaco, MON) (TV Analysis) — Final		10
Bislett Games (Oslo, NOR) (TV Analysis) — Final		11
Bislett Night of Highlights (Oslo, NOR) (300m Hurdles) (TV Analysis) — Final		12



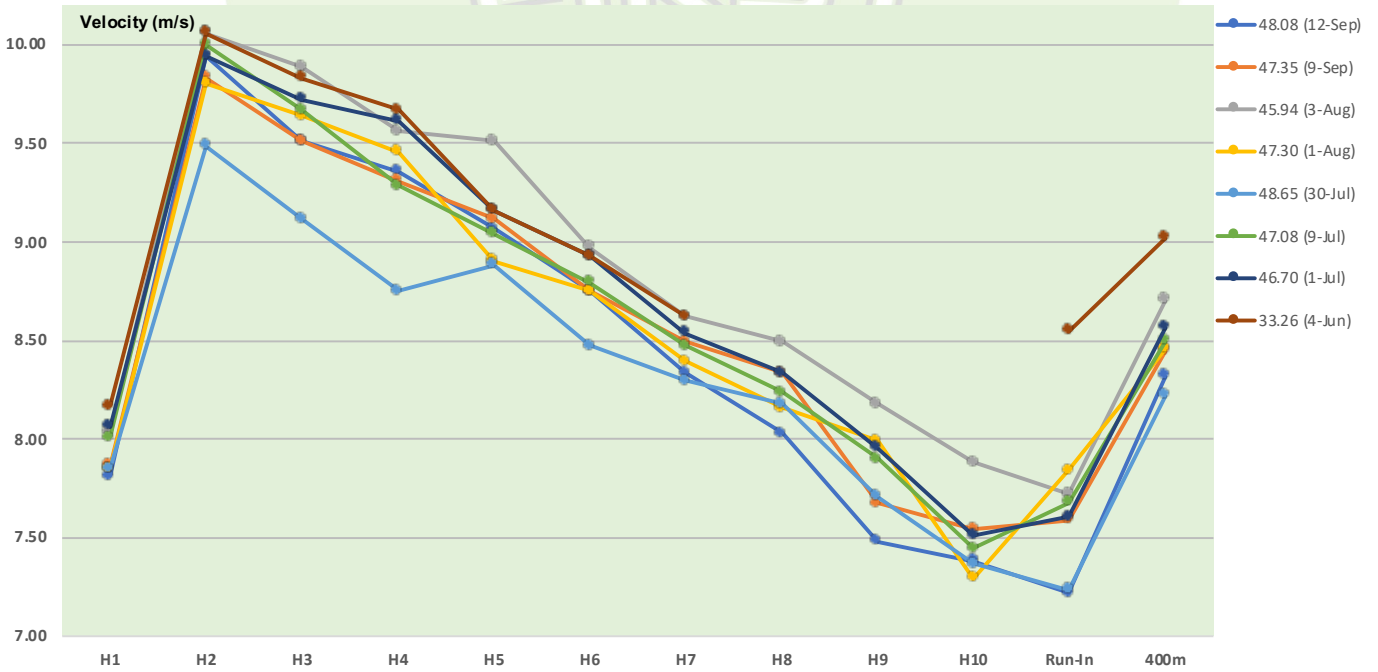
Notes:

- The times listed as TV Analysis are taken from [youtube.com](https://www.youtube.com) videos and generally coming from Television broadcasts. These are not always the best angles or coverage for getting times. They are often trying to tell a story by focusing on one athlete, and sometimes while shifting camera angles an extra frame can get added or removed.
- Where times are taken from the first movement, instead of the gun, there is at least a ± 0.12 second difference/error. This will show up from the start to the first hurdle and then from hurdle 10 to the finish. The between hurdle intervals should be fairly consistent, but there is still the usual ± 0.03 second
- Data errors, missing data, spelling mistakes, anything that need correction - please let me know. As always, I try to put together the most complete and accurate report possible.
- I have done the best I could, I hope people find it useful or at least interesting.

Karsten Warholm 2021

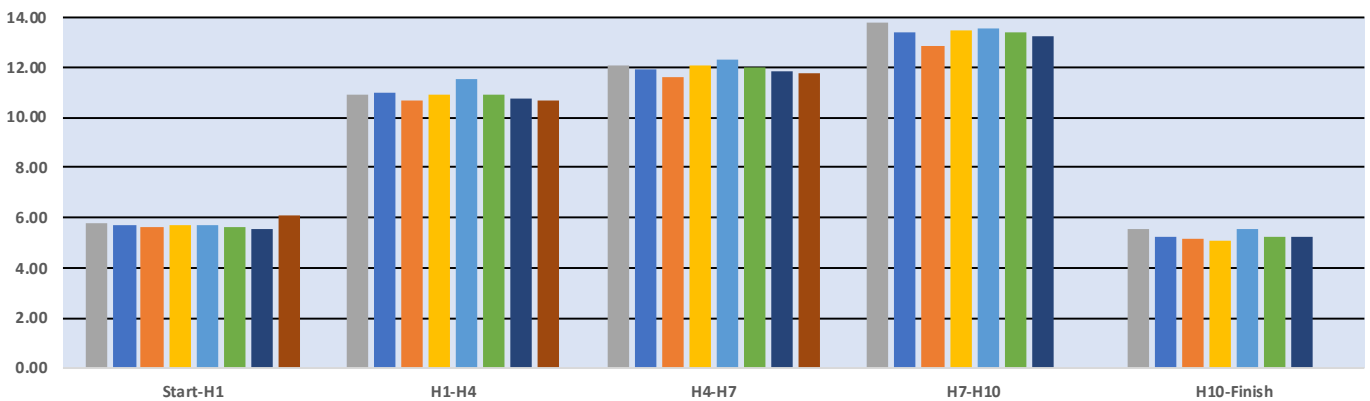


Hurdle Rhythmic Units



Time Intervals (s)

Hurdle Phases



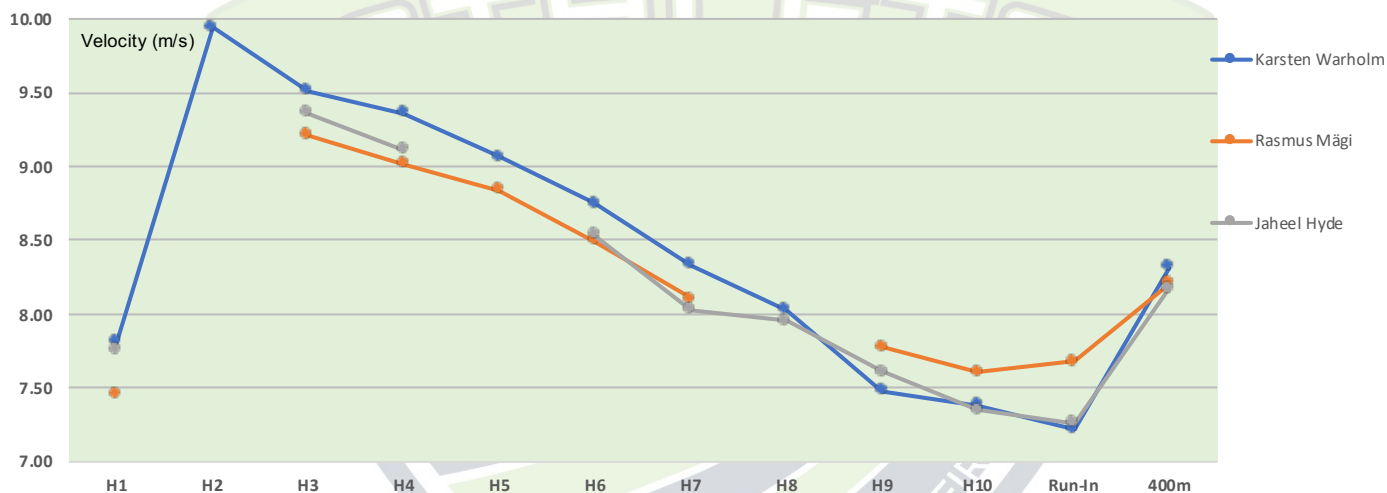
2021 ISTAF (Berlin, GER) (TV Analysis)

Men's 400m Hurdles

Date 2021.09.12

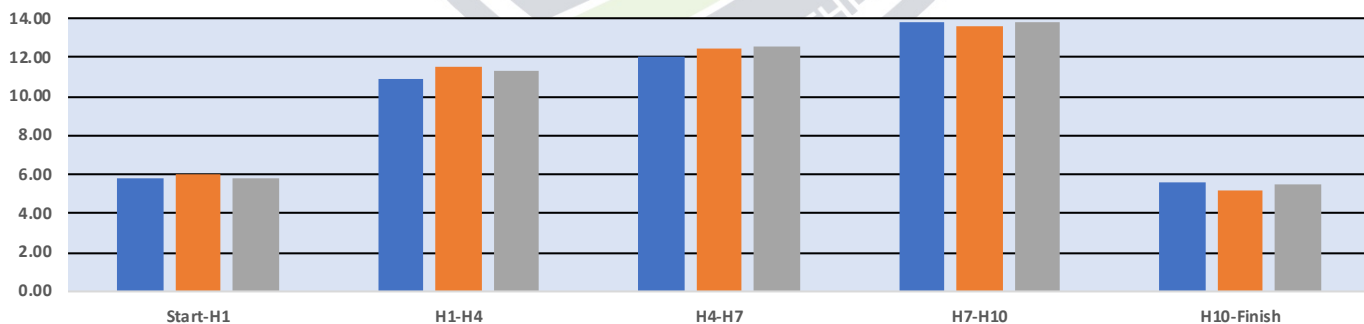
FINAL

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.76	9.28	12.96	16.70	20.56	24.56	28.76	33.12	37.80	42.54		48.08	7 / 1			
	reaction time	0.189															
	interval		3.52	3.68	3.74	3.86	4.00	4.20	4.36	4.68	4.74	5.54			10.94	12.06	13.78
	velocity		7.81	9.94	9.51	9.36	9.07	8.75	8.33	8.03	7.48	7.38	7.22	8.32		9.60	8.71
H1 lead leg	L																
	strides		20	13	13	13	13	13	13	15	15	18.5	159.5				
Mägi, Rasmus (EST) (1992)	time	6.04		13.64	17.52	21.48	25.60	29.92		38.92	43.52		48.73	6 / 2			
	reaction time	0.191															
	interval			7.60	3.88	3.96	4.12	4.32		9.00	4.60	5.21			11.48	12.40	13.60
	velocity			7.45	9.21	9.02	8.84	8.50	8.10		7.78	7.61	7.68	8.21		9.15	8.47
H1 lead leg	R																
	strides				20		13	13	14		14	17	104				
Hyde, Jaheel (JAM) (1997)	time	5.80		13.28	17.12		25.32	29.68	34.08	38.68	43.44		48.95	4 / 3			
	reaction time	0.180															
	interval			7.48	3.84		8.20	4.36	4.40	4.60	4.76	5.51			11.32	12.56	13.76
	velocity			7.76	9.36	9.11		8.54	8.03	7.95	7.61	7.35	7.26	8.17		9.28	8.36
H1 lead leg	L																
	strides				21		13		14	14	15	18	95				



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 25fps

Timing From: First Movement

Source: <https://www.youtube.com/watch?v=WnwlXqMzib0&t=8s>

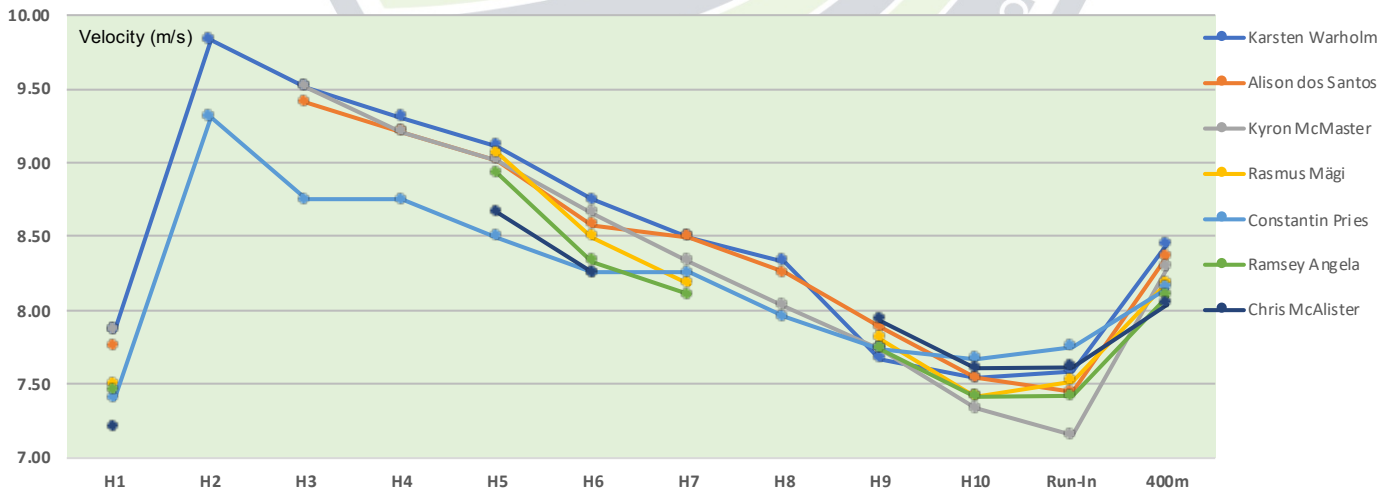
2021 Weltklasse (Zürich, SUI) (TV Analysis)

Men's 400m Hurdles

Date 2021.09.09

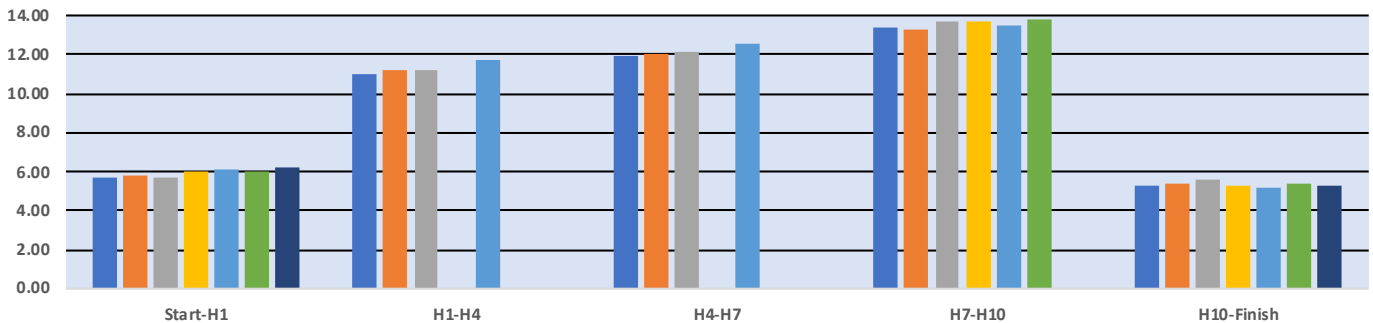
FINAL

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.72	9.28	12.96	16.72	20.56	24.56	28.68	32.88	37.44	42.08		47.35	7 / 1			
	reaction time	0.150															
	interval		3.56	3.68	3.76	3.84	4.00	4.12	4.20	4.56	4.64	5.27			11.00	11.96	13.40
	velocity	7.87	9.83	9.51	9.31	9.11	8.75	8.50	8.33	7.68	7.54	7.59	8.45		9.55	8.78	7.84
H1 lead leg	L																
dos Santos, Alison (BRA) (2000)	time	5.80		13.24	17.04	20.92	25.00	29.12	33.36	37.80	42.44		47.81	6 / 2			
	reaction time	0.181															
	interval		7.44	3.80	3.88	4.08	4.12	4.24	4.44	4.64	5.37				11.24	12.08	13.32
	velocity	7.76	9.41	9.21	9.02	8.58	8.50	8.25	7.88	7.54	7.45	8.37			9.34	8.69	7.88
H1 lead leg	L																
McMaster, Kyron (IVB) (1997)	time	5.72		13.08	16.88	20.76	24.80	29.00	33.36	37.88	42.65		48.24	5 / 3			
	reaction time	0.160															
	interval		7.36	3.80	3.88	4.04	4.20	4.36	4.52	4.77	5.59				11.16	12.12	13.65
	velocity	7.87	9.51	9.21	9.02	8.66	8.33	8.03	7.74	7.34	7.16	8.29			9.41	8.66	7.69
H1 lead leg	L																
Mägi, Rasmus (EST) (1992)	time	6.00				21.44	25.56	29.84		38.80	43.52		48.84	3 / 4			
	reaction time	0.158				15.44	4.12	4.28		8.96	4.72	5.32					
	interval					9.07	8.50	8.18		7.81	7.42	7.52	8.19				13.68
	velocity	7.50				13	13	13		14	14	17	77				7.68
H1 lead leg	R																
Preis, Constantin (GER) (1998)	time	6.08	9.84	13.84	17.84	21.96	26.20	30.44	34.84	39.36	43.92		49.08	8 / 5			
	reaction time	0.259															
	interval		3.76	4.00	4.00	4.12	4.24	4.24	4.40	4.52	4.56	5.16			11.76	12.60	13.48
	velocity	7.40	9.31	8.75	8.75	8.50	8.25	8.25	7.95	7.74	7.68	7.75	8.15		8.93	8.33	7.79
H1 lead leg	L																
Angela, Ramsey (NED) (1999)	time	6.04				21.72	25.92	30.24		39.28	44.00		49.39	2 / 6			
	reaction time	0.167				15.68	4.20	4.32		9.04	4.72	5.39					
	interval					8.93	8.33	8.10		7.74	7.42	7.42	8.10				13.76
	velocity	7.45				15	15			18	70						7.63
H1 lead leg	R																
McAlister, Chris (GBR) (1995)	time	6.24				22.40	26.64			39.88	44.48		49.73	1 / 7			
	reaction time	0.168				16.16	4.24			13.24	4.60	5.25					
	interval					8.66	8.25			7.93	7.61	7.62	8.04				
	velocity	7.21				14				15							
H1 lead leg	R																



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo
 Quality & Frame Rate: 1920 x 1080 @ 25fps
 Timing From: First Movement

Source: <https://www.youtube.com/watch?v=dzq9ik8r4kA>

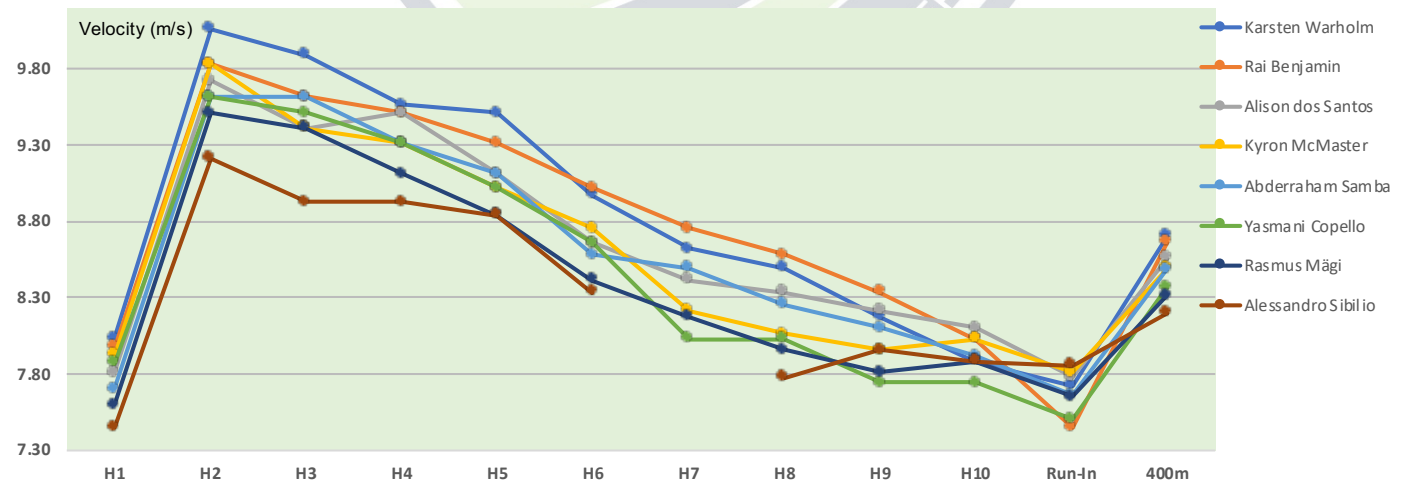
2020 Olympic Games (Tokyo, JPN) (TV Analysis)

Men's 400m Hurdles

Date 2021.08.03

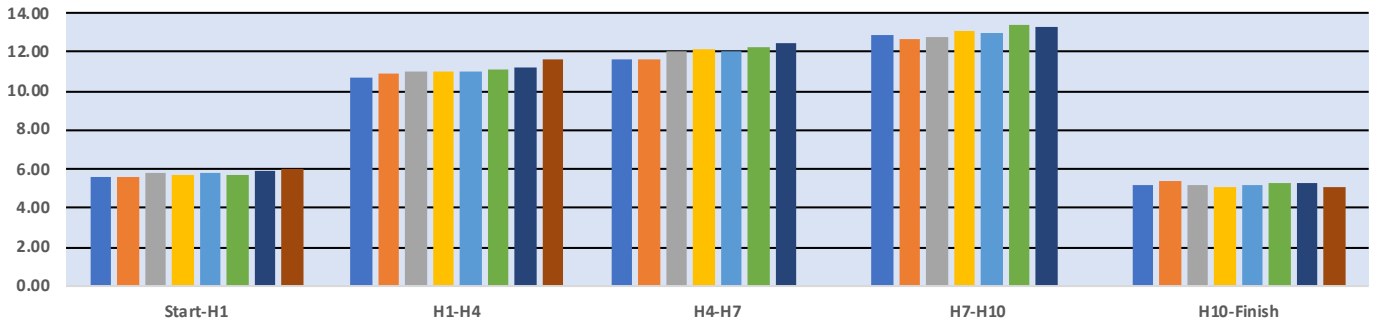
FINAL

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.60	9.08	12.62	16.28	19.96	23.86	27.92	32.04	36.32	40.76		45.94	6 / 1			
	reaction time	0.145															
	interval		3.48	3.54	3.66	3.68	3.90	4.06	4.12	4.28	4.44	5.18	WR		10.68	11.64	12.84
	velocity	8.04	10.06	9.89	9.56	9.51	8.97	8.62	8.50	8.18	7.88	7.72	8.71		9.83	9.02	8.18
H1 lead leg	L																
Benjamin, Rai (USA) (1997)	time	5.64	9.20	12.84	16.52	20.28	24.16	28.16	32.24	36.44	40.80		46.17	5 / 2			
	reaction time	0.168															
	interval		3.56	3.64	3.68	3.76	3.88	4.00	4.08	4.20	4.36	5.37	AR		10.88	11.64	12.64
	velocity	7.98	9.83	9.62	9.51	9.31	9.02	8.75	8.58	8.33	8.03	7.45	8.66		9.65	9.02	8.31
H1 lead leg	R																
dos Santos, Alison (BRA) (2000)	time	5.76	9.36	13.08	16.76	20.60	24.64	28.80	33.00	37.26	41.58		46.72	7 / 3			
	reaction time	0.156															
	interval		3.60	3.72	3.68	3.84	4.04	4.16	4.20	4.26	4.32	5.14	AR		11.00	12.04	12.78
	velocity	7.81	9.72	9.41	9.51	9.11	8.66	8.41	8.33	8.22	8.10	7.78	8.56		9.55	8.72	8.22
H1 lead leg	L																
McMaster, Kyron (IVB) (1997)	time	5.68	9.24	12.96	16.72	20.60	24.60	28.86	33.20	37.60	41.96		47.08	4 / 4			
	reaction time	0.157															
	interval		3.56	3.72	3.76	3.88	4.00	4.26	4.34	4.40	4.36	5.12	NR PB		11.04	12.14	13.10
	velocity	7.92	9.83	9.41	9.31	9.02	8.75	8.22	8.06	7.95	8.03	7.81	8.50		9.51	8.65	8.02
H1 lead leg	R																
Samba, Abderrahman (QAT) (1995)	time	5.84	9.48	13.12	16.88	20.72	24.80	28.92	33.16	37.48	41.90		47.12	8 / 5			
	reaction time	0.186															
	interval		3.64	3.64	3.76	3.84	4.04	4.12	4.24	4.32	4.42	5.22			11.04	12.04	12.98
	velocity	7.71	9.62	9.62	9.31	9.11	8.58	8.50	8.25	8.10	7.92	7.66	8.49		9.51	8.72	8.09
H1 lead leg	R																
Copello, Yasmani (TUR) (1987)	time	5.72	9.36	13.04	16.80	20.68	24.72	29.08	33.44	37.96	42.48		47.81	3 / 6			
	reaction time	0.166															
	interval		3.64	3.68	3.76	3.88	4.04	4.36	4.36	4.52	4.52	5.33	NR = PB		11.08	12.28	13.40
	velocity	7.87	9.62	9.51	9.31	9.02	8.66	8.03	8.03	7.74	7.74	7.50	8.37		9.48	8.55	7.84
H1 lead leg	R																
Mägi, Rasmus (EST) (1992)	time	5.92	9.60	13.32	17.16	21.12	25.28	29.56	33.96	38.44	42.88		48.11	9 / 7			
	reaction time	0.167															
	interval		3.68	3.72	3.84	3.96	4.16	4.28	4.40	4.48	4.44	5.23	NR PB		11.24	12.40	13.32
	velocity	7.60	9.51	9.41	9.11	8.84	8.41	8.18	7.95	7.81	7.88	7.65	8.31		9.34	8.47	7.88
H1 lead leg	L																
Sibilio, Alessandro (ITA) (1999)	time	6.04	9.84	13.76	17.68	21.64	25.84		34.84	39.24	43.68		48.77	2 / 8			
	reaction time	0.144															
	interval		3.80	3.92	3.92	3.96	4.20		9.00	4.40	4.44	5.09			11.64		
	velocity	7.45	9.21	8.93	8.93	8.84	8.33		7.78	7.95	7.88	7.86	8.20		9.02		
H1 lead leg	R																



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 25fps

Timing From: First Movement

Source: <https://www.youtube.com/watch?v=mGzBtclnfyw>

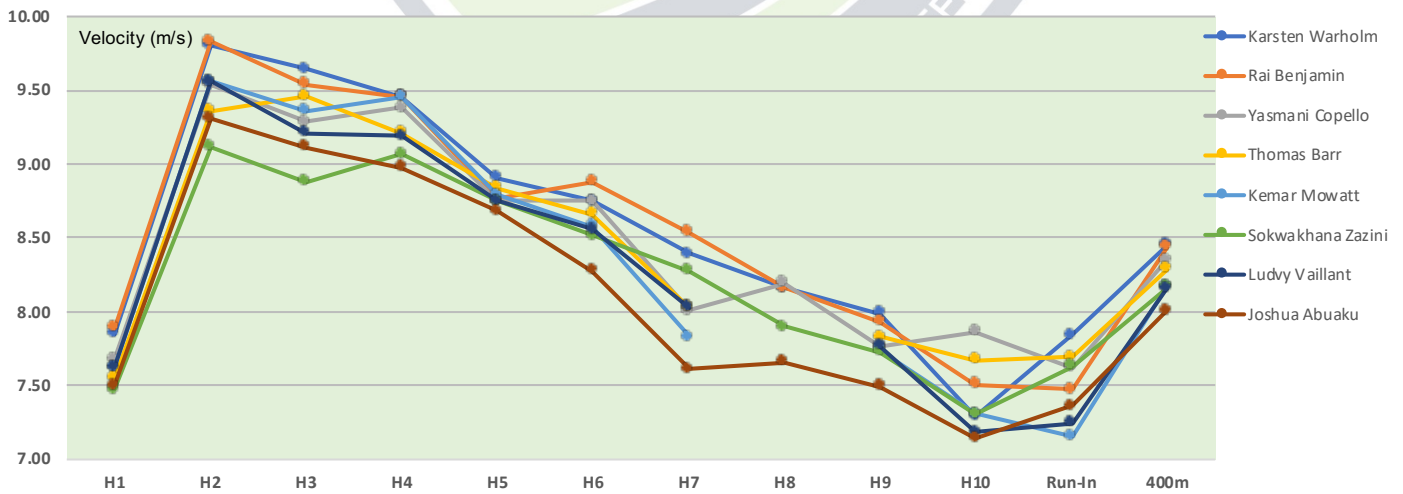
2020 Olympic Games (Tokyo, JPN) (TV Analysis)

Men's 400m Hurdles

Date 2021.08.01

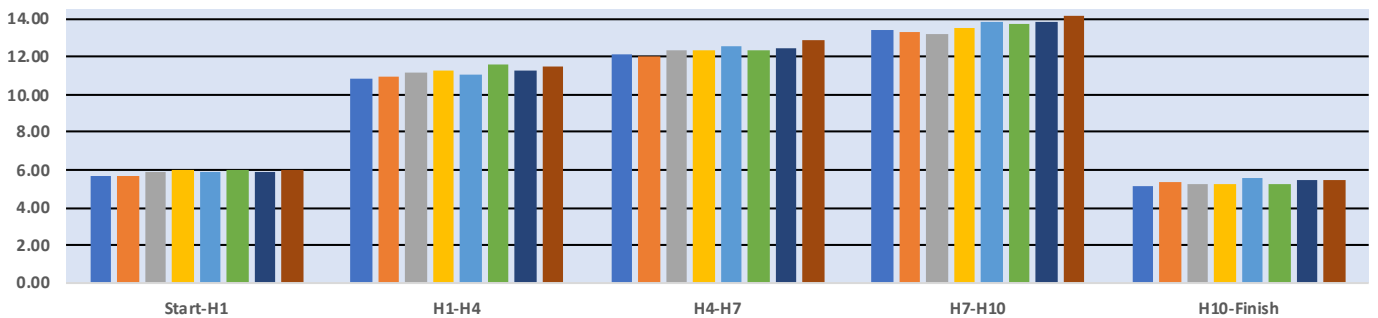
Semi-Final 1

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.73	9.30	12.93	16.63	20.56	24.56	28.73	33.02	37.40	42.20		47.30	7 / 1			
	reaction time	0.156															
	interval		3.57	3.63	3.70	3.93	4.00	4.17	4.29	4.38	4.80	5.10			10.90	12.10	13.47
	velocity	7.85	9.80	9.64	9.46	8.91	8.75	8.39	8.16	7.99	7.29	7.84	8.46		9.63	8.68	7.80
H1 lead leg	L												156.5				
Benjamin, Rai (USA) (1997)	time	5.70	9.26	12.93	16.63	20.62	24.56	28.66	32.95	37.36	42.02		47.37	5 / 2			
	reaction time	0.184															
	interval		3.56	3.67	3.70	3.99	3.94	4.10	4.29	4.41	4.66	5.35			10.93	12.03	13.36
	velocity	7.89	9.83	9.54	9.46	8.77	8.88	8.54	8.16	7.94	7.51	7.48	8.44		9.61	8.73	7.86
H1 lead leg	R												153.7				
Copello, Yasmani (TUR) (1987)	time	5.86	9.53	13.30	17.03	21.03	25.03	29.40	33.67	38.18	42.63		47.88	4 / 3			
	reaction time	0.183															
	interval		3.67	3.77	3.73	4.00	4.00	4.37	4.27	4.51	4.45	5.25			11.17	12.37	13.23
	velocity	7.68	9.54	9.28	9.38	8.75	8.75	8.01	8.20	7.76	7.87	7.62	8.35		9.40	8.49	7.94
H1 lead leg	R												158.2				
Barr, Thomas (IRL) (1992)	time	5.96	9.70	13.40	17.20	21.16	25.20	29.56		38.50	43.06		48.26	6 / 4			
	reaction time	0.151															
	interval		3.74	3.70	3.80	3.96	4.04	4.36		8.94	4.56	5.20			11.24	12.36	13.50
	velocity	7.55	9.36	9.46	9.21	8.84	8.66	8.03		7.83	7.68	7.69	8.29		9.34	8.50	7.78
H1 lead leg	L												159				
Mowatt, Kemar (JAM) (1995)	time	5.90	9.56	13.30	17.00	20.98	25.06	29.53		38.57	43.36		48.95	9 / 5			
	reaction time	0.166															
	interval		3.66	3.74	3.70	3.98	4.08	4.47		9.04	4.79	5.59			11.10	12.53	13.83
	velocity	7.63	9.56	9.36	9.46	8.79	8.58	7.83		7.74	7.31	7.16	8.17		9.46	8.38	7.59
H1 lead leg	L												133				
Zazini, Sokwakhana (RSA) (2000)	time	6.02	9.86	13.80	17.66	21.66	25.77	30.00	34.43	38.96	43.75		48.99	8 / 6			
	reaction time	0.150															
	interval		3.84	3.94	3.86	4.00	4.11	4.23	4.43	4.53	4.79	5.24			11.64	12.34	13.75
	velocity	7.48	9.11	8.88	9.07	8.75	8.52	8.27	7.90	7.73	7.31	7.63	8.16		9.02	8.51	7.64
H1 lead leg	L												164				
Vaillant, Ludvy (FRA) (1995)	time	5.90	9.56	13.36	17.17	21.17	25.26	29.62		38.63	43.50		49.02	3 / 7			
	reaction time	0.162															
	interval		3.66	3.80	3.81	4.00	4.09	4.36		9.01	4.87	5.52			11.27	12.45	13.88
	velocity	7.63	9.56	9.21	9.19	8.75	8.56	8.03		7.77	7.19	7.25	8.16		9.32	8.43	7.56
H1 lead leg	R												145.7				
Abuaku, Joshua (GER) (1996)	time	6.00	9.76	13.60	17.50	21.53	25.76	30.36	34.93	39.60	44.50		49.93	2 / 8			
	reaction time	0.179															
	interval		3.76	3.84	3.90	4.03	4.23	4.60	4.57	4.67	4.90	5.43			11.50	12.86	14.14
	velocity	7.50	9.31	9.11	8.97	8.68	8.27	7.61	7.66	7.49	7.14	7.37	8.01		9.13	8.16	7.43
H1 lead leg	L												143				



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 30fps

Timing From: First Movement

Source: <https://www.olympics.com/en/video/track-and-field/day-9-evening-session-athletics-tokyo-2020-replays>

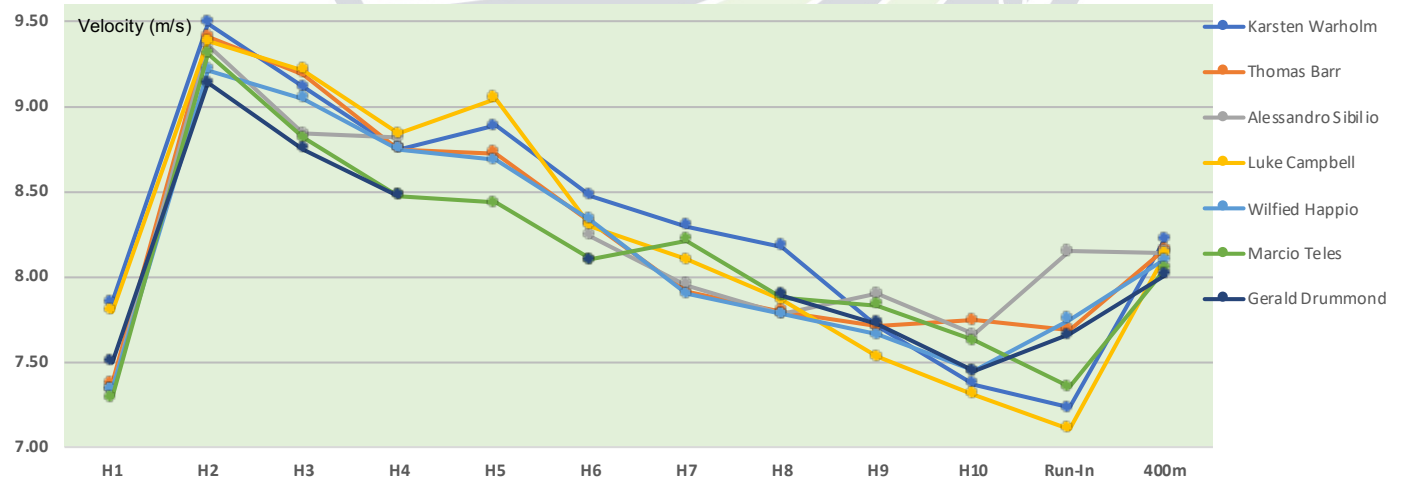
2020 Olympic Games (Tokyo, JPN) (TV Analysis)

Men's 400m Hurdles

Date 2021.07.30

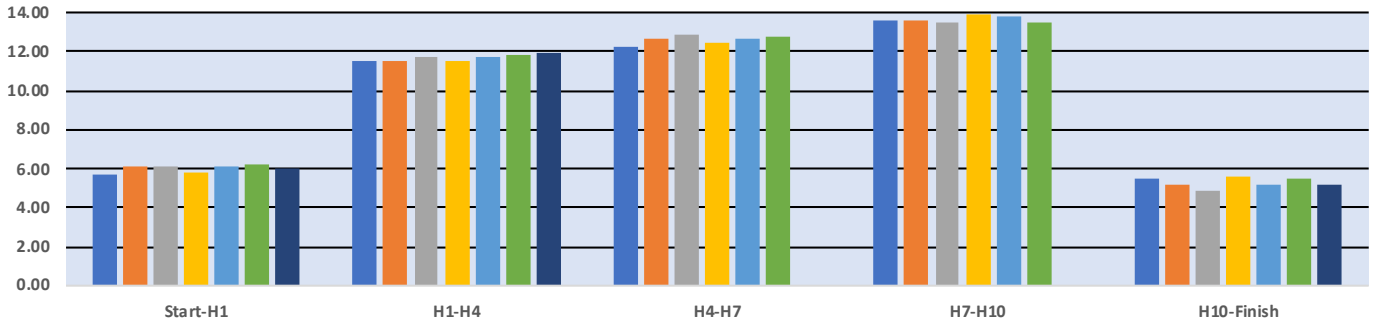
Heat 3

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.73	9.42	13.26	17.26	21.20	25.33	29.55	33.83	38.37	43.12		48.65	8 / 1			
	reaction time	0.157															
	interval		3.69	3.84	4.00	3.94	4.13	4.22	4.28	4.54	4.75	5.53			11.53	12.29	13.57
	velocity	7.85	9.49	9.11	8.75	8.88	8.47	8.29	8.18	7.71	7.37	7.23	8.22		9.11	8.54	7.74
H1 lead leg	L																
Barr, Thomas (IRL) (1992)	time	6.10	9.82	13.63	17.63	21.64	25.85	30.27	34.76	39.30	43.82		49.02	7 / 2			
	reaction time	0.147															
	interval		3.72	3.81	4.00	4.01	4.21	4.42	4.49	4.54	4.52	5.20			11.53	12.64	13.55
	velocity	7.38	9.41	9.19	8.75	8.73	8.31	7.92	7.80	7.71	7.74	7.69	8.16		9.11	8.31	7.75
H1 lead leg	L																
Sibilio, Alessandro (ITA) (1999)	time	6.13	9.87	13.83	17.80		26.30	30.70	35.20	39.63	44.20		49.11	3 / 3			
	reaction time	0.126															
	interval		3.74	3.96	3.97		8.50	4.40	4.50	4.43	4.57	4.91			11.67	12.90	13.50
	velocity	7.34	9.36	8.84	8.82		8.24	7.95	7.78	7.90	7.66	8.15	8.14		9.00	8.14	7.78
H1 lead leg	R																
Campbell, Luke (GER) (1994)	time	5.77	9.50	13.30	17.26	21.13	25.35	29.67	34.12	38.77	43.56		49.19	4 / 4			
	reaction time	0.145															
	interval		3.73	3.80	3.96	3.87	4.22	4.32	4.45	4.65	4.79	5.63			11.49	12.41	13.89
	velocity	7.80	9.38	9.21	8.84	9.04	8.29	8.10	7.87	7.53	7.31	7.10	8.13		9.14	8.46	7.56
H1 lead leg	L																
Happio, Wilfried (FRA) (1998)	time	6.13	9.93	13.80	17.80	21.83	26.03	30.46	34.96	39.53	44.23		49.39	5 / 5			
	reaction time	0.152															
	interval		3.80	3.87	4.00	4.03	4.32	4.26	4.44	4.47	4.59	5.16			11.67	12.66	13.77
	velocity	7.34	9.21	9.04	8.75	8.68	8.33	7.90	7.78	7.66	7.45	7.75	8.10		9.00	8.29	7.63
H1 lead leg	L																
Teles, Marcio (BRA) (1994)	time	6.17	9.93	13.90	18.03	22.18	26.50	30.76	35.20	39.67	44.26		49.70	6 / 6			
	reaction time	0.154															
	interval		3.76	3.97	4.13	4.15	4.32	4.26	4.44	4.47	4.59	5.44			11.86	12.73	13.50
	velocity	7.29	9.31	8.82	8.47	8.43	8.10	8.22	7.88	7.83	7.63	7.35	8.05		8.85	8.25	7.78
H1 lead leg	L																
Drummond, Gerald (CRC) (1994)	time	6.00	9.83	13.83	17.96		26.60		35.47	40.00	44.70		49.92	2 / 7			
	reaction time	0.183															
	interval		3.83	4.00	4.13		8.64		8.87	4.53	4.70	5.22			11.96	-17.96	44.70
	velocity	7.50	9.14	8.75	8.47		8.10		7.89	7.73	7.45	7.66	8.01		8.78	-5.85	2.35
H1 lead leg	L																



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 30fps

Timing From: First Movement

Source: <https://www.olympics.com/en/video/track-and-field/day-7-morning-session-athletics-tokyo-2020-replays>

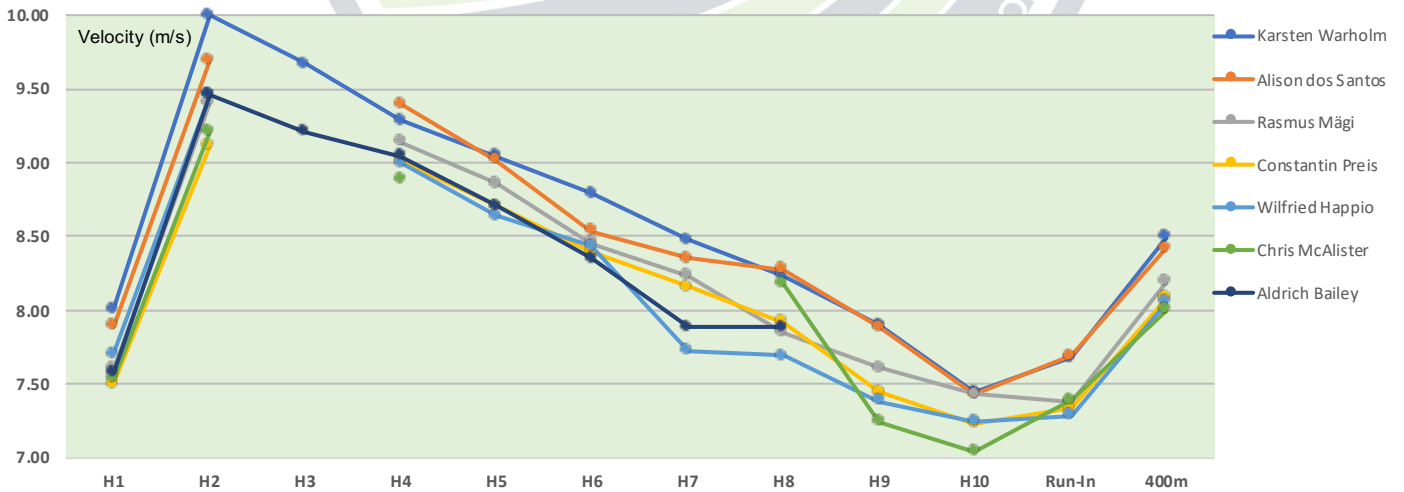
2021 Herculis Meeting International d'Athletisme (Monaco, MON) (TV Analysis)

Men's 400m Hurdles

Date 2021.07.09

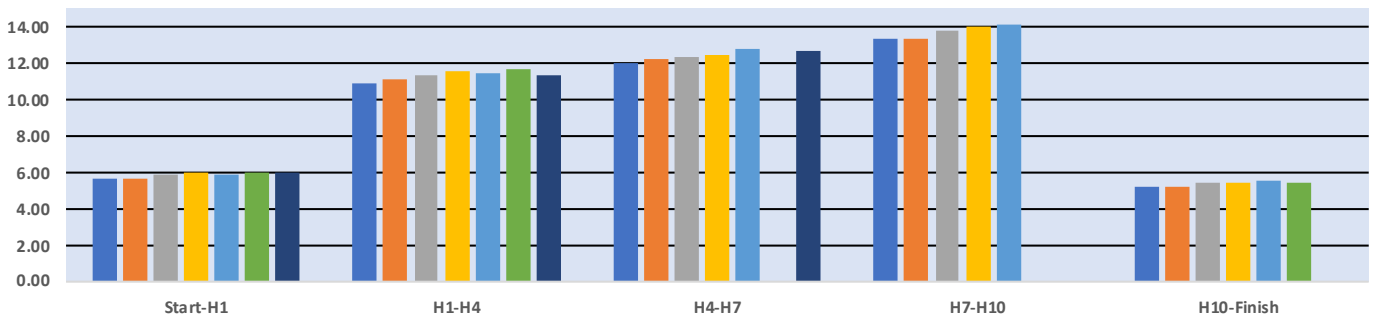
FINAL

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.62	9.12	12.74	16.51	20.38	24.36	28.49	32.74	37.17	41.87		47.08	7 / 1			
	reaction time	0.150															
	interval		3.50	3.62	3.77	3.87	3.98	4.13	4.25	4.43	4.70	5.21			10.89	11.98	13.38
	velocity	8.01	10.00	9.67	9.28	9.04	8.79	8.47	8.24	7.90	7.45	7.68	8.50		9.64	8.76	7.85
H1 lead leg	L																
	strides	20	13	13	13	13	13	13	13	13	15	18	157				
dos Santos, Alison (BRA) (2000)	time	5.70	9.31		16.76	20.64	24.74	28.93	33.16	37.60	42.31		47.51	6 / 2			
	reaction time	0.177															
	interval		3.61		7.45	3.88	4.10	4.19	4.23	4.44	4.71	5.20			11.06	12.17	13.38
	velocity	7.89	9.70		9.40	9.02	8.54	8.35	8.27	7.88	7.43	7.69	8.42		9.49	8.63	7.85
H1 lead leg	L																
	strides	20	13	13		12	13	14		15	15	16.5	131.5				
Mägi, Rasmus (EST) (1992)	time	5.92	9.64		17.30	21.25	25.39	29.64	34.10	38.70	43.41		48.83	5 / 3			
	reaction time	0.152															
	interval		3.72		7.66	3.95	4.14	4.25	4.46	4.60	4.71	5.42			11.38	12.34	13.77
	velocity	7.60	9.41		9.14	8.86	8.45	8.24	7.85	7.61	7.43	7.38	8.19		9.23	8.51	7.63
H1 lead leg	R																
	strides	20	13			13	13	13	14	14	14	114					
Preis, Constantin (GER) (1998)	time	6.00	9.84		17.60	21.62	25.79	30.08	34.50	39.20	44.04		49.49	4 / 4			
	reaction time	0.231															
	interval		3.84		7.76	4.02	4.17	4.29	4.42	4.70	4.84	5.45			11.60	12.48	13.96
	velocity	7.50	9.11		9.02	8.71	8.39	8.16	7.92	7.45	7.23	7.34	8.08		9.05	8.41	7.52
H1 lead leg	L																
	strides	22	14			14	15	15		16	16	112					
Happio, Wilfried (FRA) (1998)	time	5.84	9.54		17.32	21.37	25.52	30.05	34.60	39.34	44.17		49.66	3 / 5			
	reaction time	0.123															
	interval		3.70		7.78	4.05	4.15	4.53	4.55	4.74	4.83	5.49			11.48	12.73	14.12
	velocity	7.71	9.46		9.00	8.64	8.43	7.73	7.69	7.38	7.25	7.29	8.05		9.15	8.25	7.44
H1 lead leg	L																
	strides	20	13			13	13	14		15	15	103					
McAlister, Chris (GBR) (1995)	time	5.97	9.77		17.65				34.77	39.60	44.57		49.98	2 / 6			
	reaction time	0.144															
	interval		3.80		7.88				17.12	4.83	4.97	5.41			11.68		
	velocity	7.54	9.21		8.88				8.18	7.25	7.04	7.39	8.00		8.99		
H1 lead leg	R																
	strides	22	14							16	16	68					
Bailey, Aldrich (USA) (1994)	time	5.94	9.64	13.44	17.31	21.33	25.52	29.96	34.40				dnf	8 / --			
	reaction time	0.225															
	interval		3.70	3.80	3.87	4.02	4.19	4.44	4.44								
	velocity	7.58	9.46	9.21	9.04	8.71	8.35	7.88	7.88								
H1 lead leg	L																
	strides	21	13	13	13	13	13	14	14								



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 30fps

Timing From: First Movement

Source: <https://www.youtube.com/watch?v=pl5zgnzUj0o>

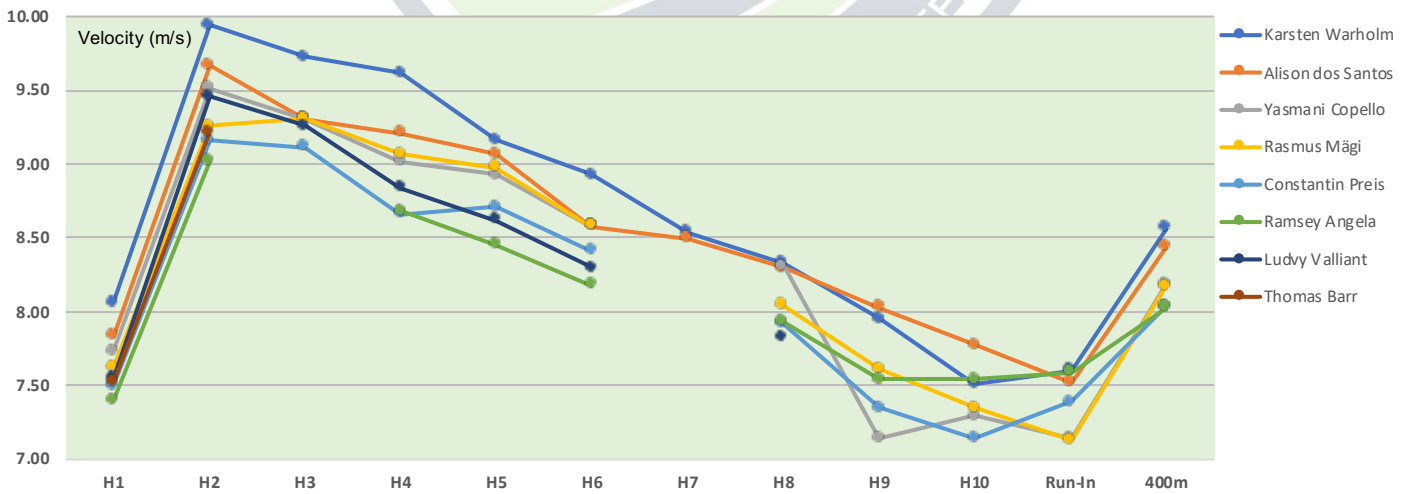
2021 Bislett Games (Oslo, NOR) (TV Analysis)

Men's 400m Hurdles

Date 2021.07.01

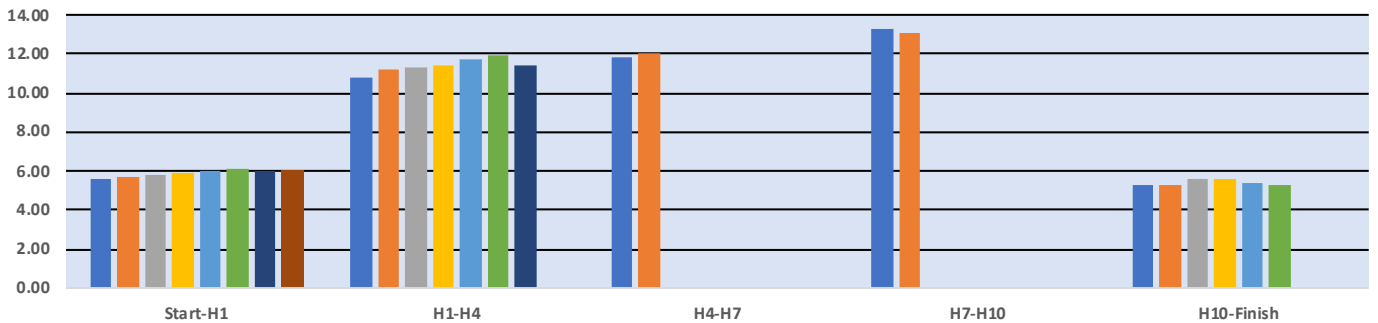
FINAL

		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.58	9.10	12.70	16.34	20.16	24.08	28.18	32.38	36.78	41.44		46.70	7 / 1			
	reaction time	0.163															
	interval		3.52	3.60	3.64	3.82	3.92	4.10	4.20	4.40	4.66	5.26	WR		10.76	11.84	13.26
	velocity	8.06	9.94	9.72	9.62	9.16	8.93	8.54	8.33	7.95	7.51	7.60	8.57		9.76	8.87	7.92
H1 lead leg	L																
	strides	20	13	13	13	13	13	13	13	13	13	18	155				
dos Santos, Alison (BRA) (2000)	time	5.74	9.36	13.12	16.92	20.78	24.86	28.98	33.20	37.56	42.06		47.38	6 / 2			
	reaction time	0.179															
	interval		3.62	3.76	3.80	3.86	4.08	4.12	4.22	4.36	4.50	5.32	AR PB		11.18	12.06	13.08
	velocity	7.84	9.67	9.31	9.21	9.07	8.58	8.50	8.29	8.03	7.78	7.52	8.44		9.39	8.71	8.03
H1 lead leg	L																
	strides	20	13	13	12	12	13	13		13	13	16.5	138.5				
Copello, Yasmani (TUR) (1987)	time	5.82	9.50	13.26	17.14	21.06	25.14		33.56	38.46	43.26		48.86	5 / 3			
	reaction time	0.198															
	interval		3.68	3.76	3.88	3.92	4.08		8.42	4.90	4.80	5.60			11.32		
	velocity	7.73	9.51	9.31	9.02	8.93	8.58		8.31	7.14	7.29	7.14	8.19		9.28		
H1 lead leg	R																
	strides	20	13	13		13	13	13		14	15	114					
Mägi, Rasmus (EST) (1992)	time	5.90	9.68	13.44	17.30	21.20	25.28		33.98	38.58	43.34		48.95	3 / 4			
	reaction time	0.161															
	interval		3.78	3.76	3.86	3.90	4.08		8.70	4.60	4.76	5.61			11.40		
	velocity	7.63	9.26	9.31	9.07	8.97	8.58		8.05	7.61	7.35	7.13	8.17		9.21		
H1 lead leg	R																
	strides	20	13	13		13	13	13		14	14	113					
Preis, Constantin (GER) (1998)	time	6.00	9.82	13.66	17.70	21.72	25.88		34.72	39.48	44.38		49.79	2 / 5			
	reaction time	0.246															
	interval		3.82	3.84	4.04	4.02	4.16		8.84	4.76	4.90	5.41			11.70		
	velocity	7.50	9.16	9.11	8.66	8.71	8.41		7.92	7.35	7.14	7.39	8.03		8.97		
H1 lead leg	L																
	strides	22	14	14		14	15		16	16		111					
Angela, Ramsey (NED) (1999)	time	6.08	9.96		18.02	22.16	26.44		35.26	39.90	44.54		49.81	1 / 6			
	reaction time	0.199															
	interval		3.88		8.06	4.14	4.28		8.82	4.64	4.64	5.27			11.94		
	velocity	7.40	9.02		8.68	8.45	8.18		7.94	7.54	7.54	7.59	8.03		8.79		
H1 lead leg	R																
	strides	22	14			15			15	15		81					
Valliant, Ludvy (FRA) (1995)	time	5.96	9.66	13.44	17.40	21.46	25.68		34.62				dnf	8 / --			
	reaction time	0.245															
	interval		3.70	3.78	3.96	4.06	4.22		8.94								
	velocity	7.55	9.46	9.26	8.84	8.62	8.29		7.83								
H1 lead leg	R																
	strides	21	13	13	13	13	13						86				
Barr, Thomas (IRL) (1992)	time	5.98	9.78										dnf	4 / --			
	reaction time	0.147															
	interval		3.80														
	velocity	7.53	9.21														
H1 lead leg	R																
	strides	21	14										35				



Time Intervals (s)

Hurdle Phases



Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 50fps

Timing From: First Movement

Source: https://www.youtube.com/watch?v=QfHE_FPIDko

Biomechanical Analysis

2021 Bislett Night of Highlights (Oslo, NOR) (TV Analysis) (300m Hurdles)

Men's 300m Hurdles		Date 2021.06.04										FINAL					
		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	6.12	9.60	13.16	16.78	20.60	24.52	28.58					33.26	7 / 1			
	reaction time											4.68	WB PB		10.66	11.80	
	interval		3.48	3.56	3.62	3.82	3.92	4.06									
	velocity	8.17	10.06	9.83	9.67	9.16	8.93	8.62				8.55	9.02		9.85	8.90	
	H1 lead leg	L	strides	23	13	13	13	13	13	13	13	17	118				

2020 Impossible Games (Oslo, NOR) (TV Analysis) (300m Hurdles)

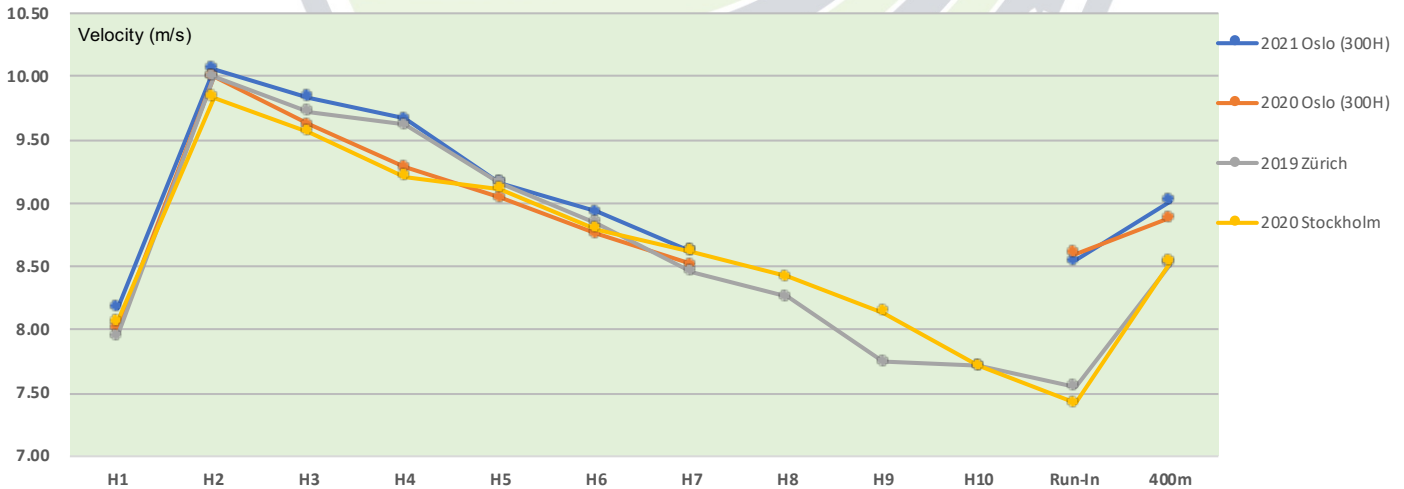
Men's 300m Hurdles		Date 2020.06.11										FINAL					
		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	6.24	9.74	13.38	17.15	21.02	25.02	29.13					46.92	7 / 1			
	reaction time	0.182										4.65	WB PB		10.91	11.98	
	interval		3.50	3.64	3.77	3.87	4.00	4.11									
	velocity	8.01	10.00	9.62	9.28	9.04	8.75	8.52				8.60	8.88		9.62	8.76	
	H1 lead leg	L	strides	20	13	13	13	13	13	13	13	16.5	114.5				

2019 Weltklasse (Zürich, SUI) (TV Analysis)

Men's 400m Hurdles		Date 2019.08.29										FINAL					
		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.66	9.16	12.76	16.40	20.22	24.18	28.32	32.56	37.08	41.62		46.92	7 / 1			
	reaction time	0.140										5.30	AR PB		10.74	11.92	13.30
	interval		3.50	3.60	3.64	3.82	3.96	4.14	4.24	4.52	4.54						
	velocity	7.95	10.00	9.72	9.62	9.16	8.84	8.45	8.25	7.74	7.71	7.55	8.53		9.78	8.81	7.89
	H1 lead leg	L	strides	20	13	13	13	13	13	15	15	18.2	159.2				

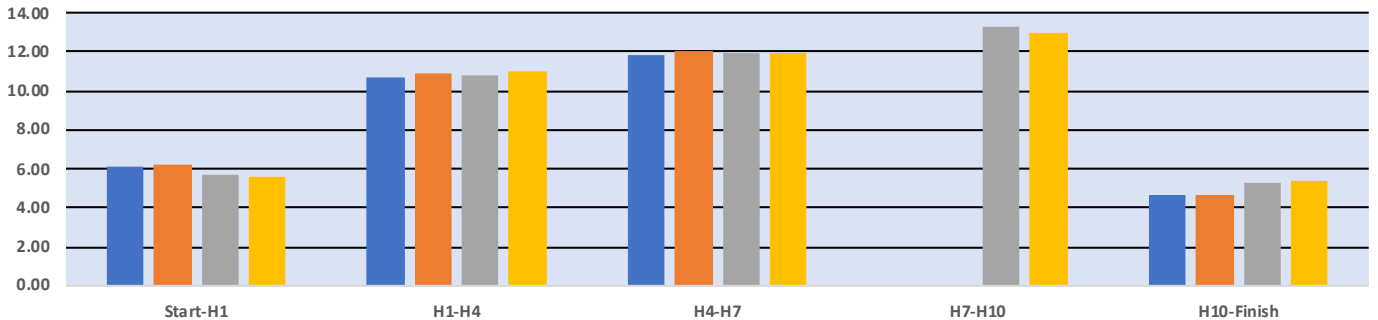
2020 Bauhaus Galan (Stockholm, SWE) (TV Analysis)

Men's 400m Hurdles		Date 2020.08.23										FINAL					
		H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Run-In	400m	Lane / Place	H1-H4	H4-H7	H7-H10
Warholm, Karsten (NOR) (1996)	time	5.58	9.14	12.80	16.60	20.44	24.42	28.48	32.64	36.94	41.48		46.87	8 / 1			
	reaction time	0.161										5.39	AR PB		11.02	11.88	13.00
	interval		3.56	3.66	3.80	3.84	3.98	4.06	4.16	4.30	4.54						
	velocity	8.06	9.83	9.56	9.21	9.11	8.79	8.62	8.41	8.14	7.71	7.42	8.53		9.53	8.84	8.08
	H1 lead leg	L	strides	20	13	13	13	13	13	13	15	18	157				



Time Intervals (s)

Hurdle Phases



2021 Bislett Night of Highlights (Oslo, NOR)

Evaluated with: ObjectusVideo

Quality & Frame Rate: 1280 x 720 @ 25fps

Timing From: First Movement

Source: <https://www.youtube.com/watch?v=NivYikNOI0&t=2s>

2020 Impossible Games (Oslo, NOR)

Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 30fps

Timing From: First Movement

Source: <https://www.youtube.com/watch?v=aYUG74Uzr5M>

2019 Weltklasse (Zürich, SUI)

Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 50fps

Timing From: First Movement

Source: <https://www.youtube.com/watch?v=JdYoaU0-HEc>

2020 Bauhaus Galan (Stockholm, SWE)

Evaluated with: ObjectusVideo

Quality & Frame Rate: 1920 x 1080 @ 30fps

Timing From: First Movement

Source: https://www.youtube.com/watch?v=NNmygWfl_xg