

Kinematic characteristics of the snatch techniques of the top weightlifters in 2018 IWF World Championships

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1. Introduction

We analyzed the biomechanical activity observed while performing the snatch technique during the International Weightlifting Federation (IWF) 2018 World Championships in Ashgabat, Turkmenistan. This study reports one of the outcomes of our research and provides the kinematic characteristics of the snatch techniques of world class top lifters.

2. Methods

The target lifters in this report were the top lifters of each category. Snatch attempts were recorded using a digital video camera operating at 60 Hz with a shutter speed of 1/500 sec. To obtain the real-space two-dimensional position coordinates of the barbell trajectory in the sagittal plane, the left end of the barbell was digitized to obtain the position coordinates in the camera space. The Speedede-Up Robust Features method was used for automatic digitizing. The barbell plate diameter (0.45 m) was used as the reference to calibrate the barbell's real-space position coordinates from the camera-space position coordinates.

The following kinematic parameters were analyzed for the barbell motion: maximum vertical height ($Dy+$), drop distance ($Dy-$), backward displacement ($Dx+$), forward displacement ($Dx-$) (See Image 1), peak vertical velocity ($pVy+$), peak backward velocity ($pVy+$), and peak forward velocity ($pVy-$). The snatch lift events were defined according to the barbell trajectory. *A* was defined as the time when the barbell height was 0.225 m or more. *B* was defined as the time when the barbell height was 0.4 m or more. *C* was defined as the time when the barbell vertical velocity was maximum. *D* was defined as the time when the barbell vertical height was maximum. *E* was defined as the time when the barbell vertical velocity was minimum. *F* was defined as the time when the barbell vertical velocity was zero.

3. Results

Tables 1 and 2 list the kinematic parameters for the women's and men's shaft motion, respectively. Figures 1 to 10 show barbell trajectories, an image of each event, and barbell displacement and velocity.

4. Summary

The barbell trajectory pattern and other kinematic variables were useful for lower/junior lifters as target values for training. Without authorization and guidance from IWF, our research would not have been possible. We profusely thank the IWF.

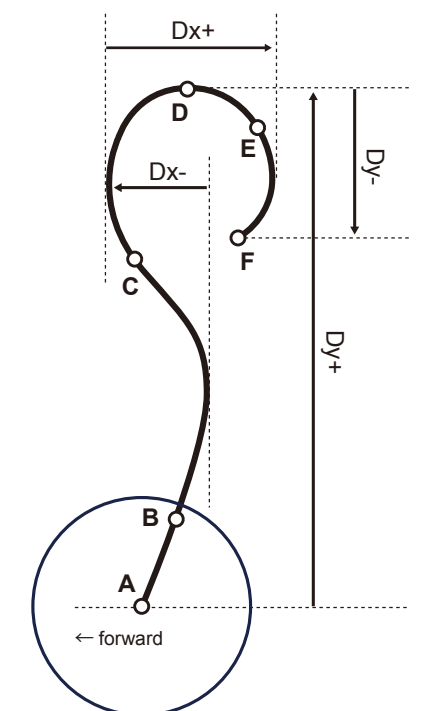


Image 1 Image of barbell Kinematics parameters

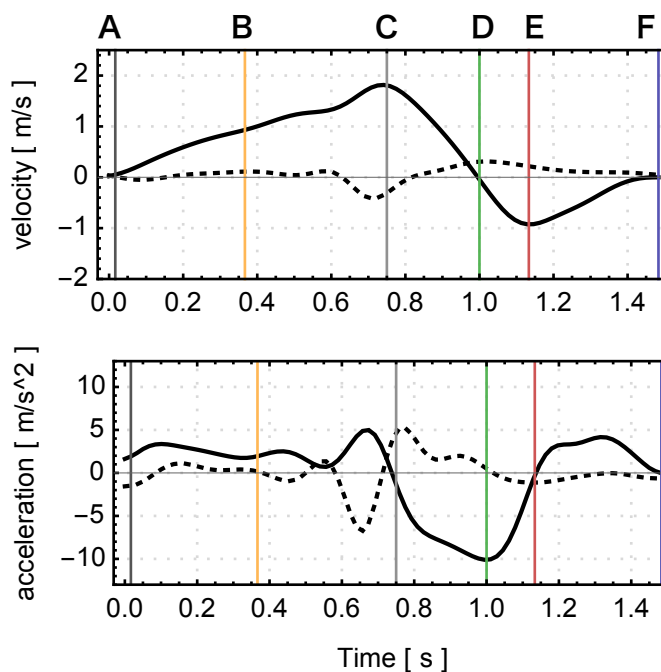
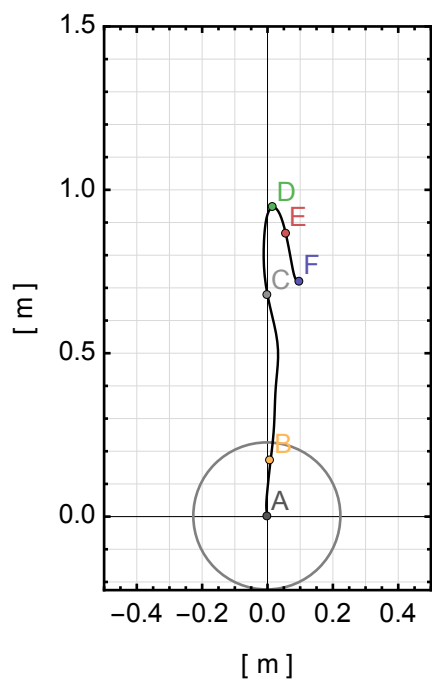
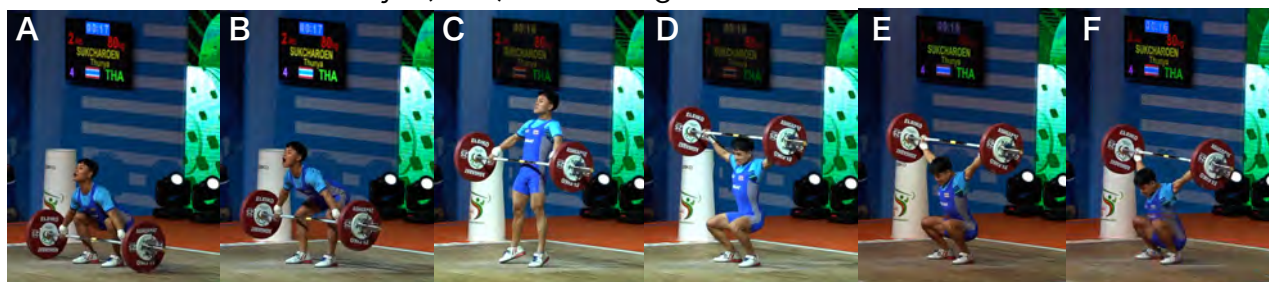
Table 1 Kinematics parameters for women

			Result	Dy+	Dy-	Dx+	Dx-	pVy+	pVx+	pVx-
			[kg]	[m]	[m]	[m]	[m]	[m/s]	[m/s]	[m/s]
W45	SUKCHAROEN	(THA)	82	0.95	0.23	0.11	0.04	1.82	0.31	0.41
W49	TANASAN	(THA)	93	0.92	0.15	0.13	0.03	1.75	0.44	0.33
W55	SRISURAT	(THA)	105	0.98	0.12	0.11	0.05	2.03	0.35	0.48
W59	KUO	(TPE)	105	0.96	0.14	0.06	0.08	1.90	0.26	0.63
W64	DENG	(CHN)	112	0.91	0.17	0.12	0.06	1.73	0.48	0.53
W71	ZHANG	(CHN)	115	0.95	0.14	0.18	0.02	1.83	0.58	0.29
W76	RIM	(PRK)	119	0.99	0.21	0.09	0.05	1.86	0.28	0.50
W81	VALENTIN-PEREZ	(ESP)	113	1.06	0.09	0.12	0.04	1.98	0.39	0.37
W87	AO	(CHN)	117	1.02	0.14	0.16	0.07	1.93	0.54	0.61
W+87	KASHIRINA	(RUS)	145	1.04	0.12	0.13	0.07	1.86	0.47	0.72

Table 2 Kinematics parameters for men

			Result	Dy+	Dy-	Dx+	Dx-	pVy+	pVx+	pVx-
			[kg]	[m]	[m]	[m]	[m]	[m/s]	[m/s]	[m/s]
M55	OM	(PRK)	120	0.87	0.12	0.10	0.05	1.71	0.32	0.39
M61	IRAWAN	(INA)	143	0.89	0.17	0.18	0.01	1.77	0.46	0.11
M67	HUANG	(CHN)	152	0.99	0.10	0.20	0.01	1.98	0.58	0.13
M73	SHI	(CHN)	164	1.00	0.11	0.11	0.05	1.91	0.39	0.43
M81	MAHMOUD	(EGY)	173	0.95	0.17	0.13	0.08	1.67	0.41	0.59
M89	MENDEZ-PEREZ	(CHI)	169	1.07	0.17	0.10	0.05	1.90	0.42	0.44
M96	MORADI	(IRI)	186	1.02	0.11	0.15	0.03	1.98	0.42	0.34
M102	DJURAEV	(UZB)	180	1.14	0.17	0.05	0.09	1.81	0.20	0.74
M109	MARTIROSYAN	(ARM)	197	1.08	0.19	0.12	0.04	1.85	0.34	0.42
M+109	TALAKHADZE	(GEO)	217	1.29	0.13	0.10	0.10	1.98	0.49	0.83

W45A SUKCHAROEN-Thunya (THA) 3Att. 82kg



W49A TANASAN-Sopita (THA) 3Att. 93kg

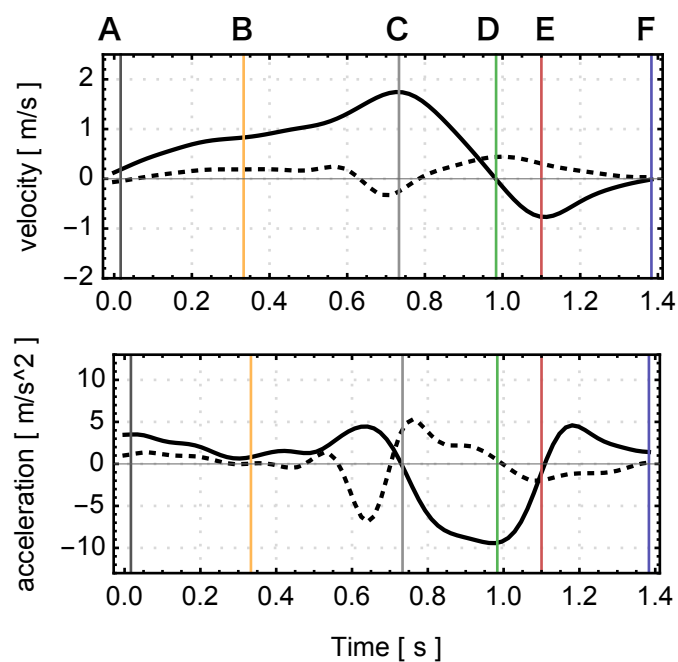
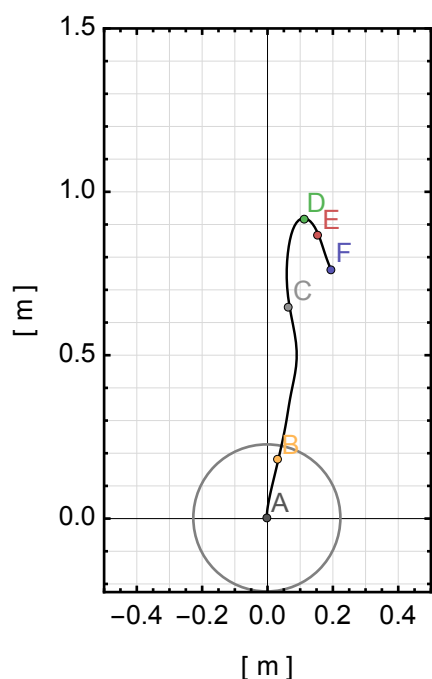
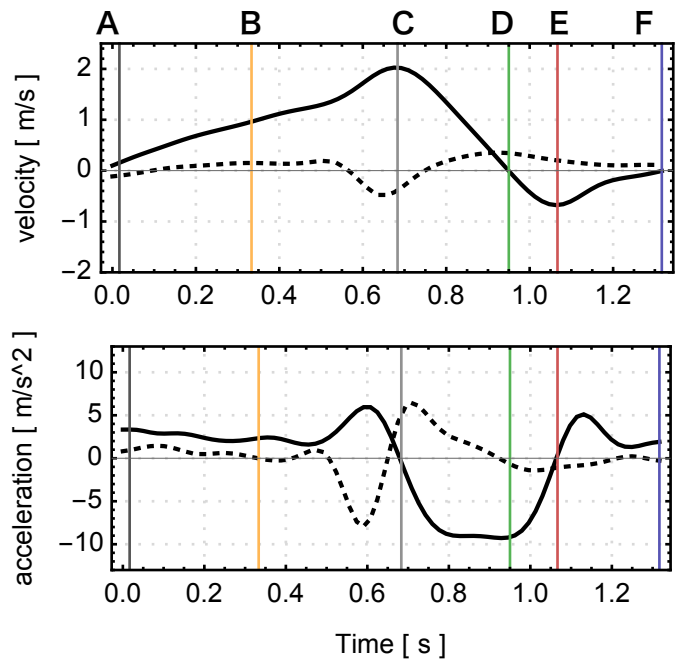
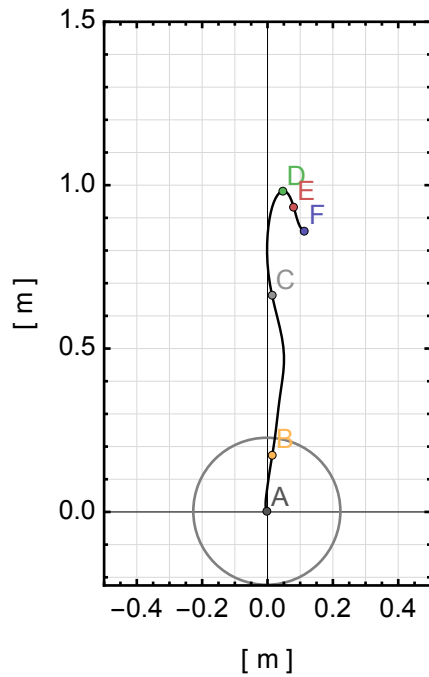


Figure 1 Barbell trajectory, image of each events and barbell position and velocity

W55A SRISURAT-Sukanya (THA) 3Att. 105kg



W59A KUO-Hsing-Chun (TPE) 3Att. 105kg

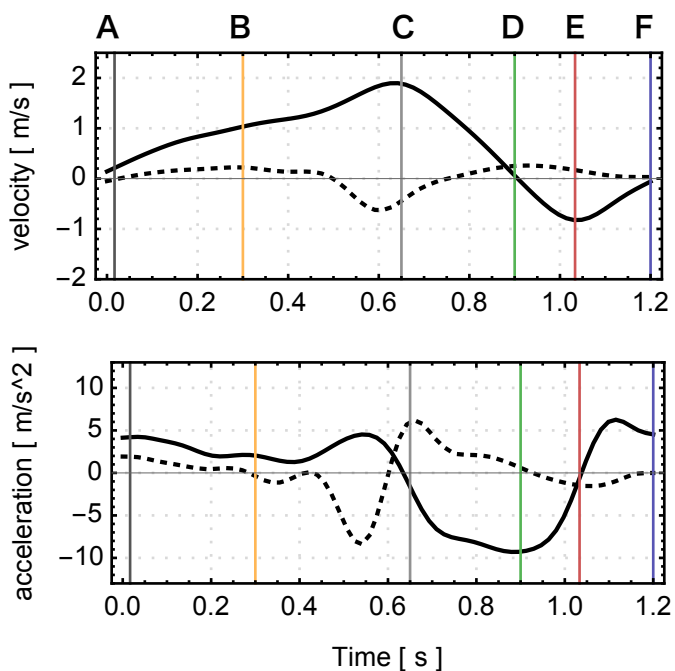
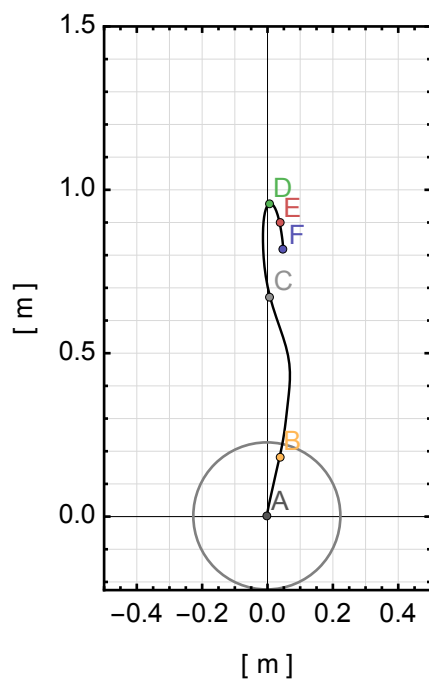
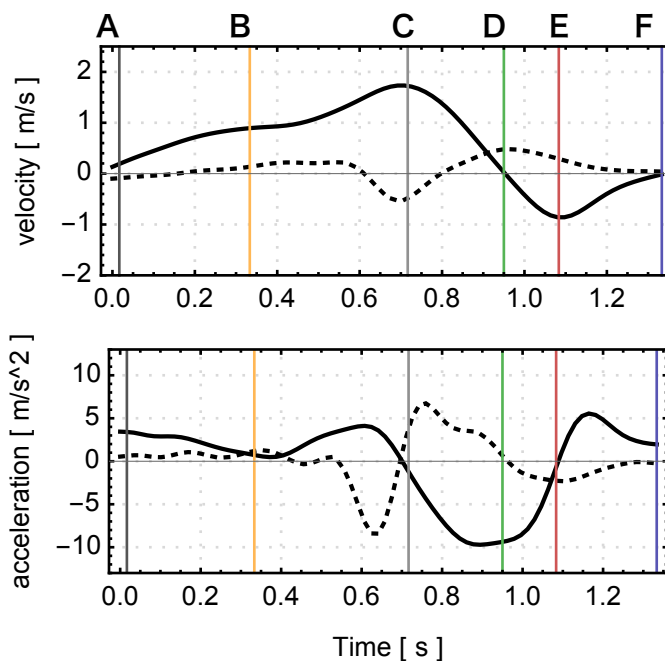
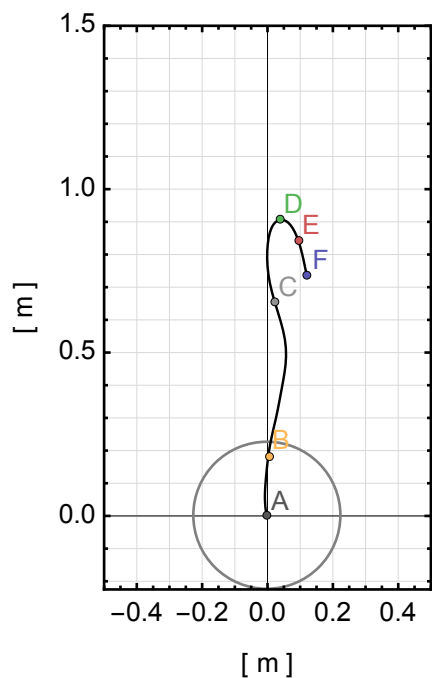


Figure 2 Barbell trajectory, image of each events and barbell position and velocity

W64A DENG-Wei (CHN) 3Att. 112kg



W71A ZHANG-Wangli (CHN) 3Att. 115kg

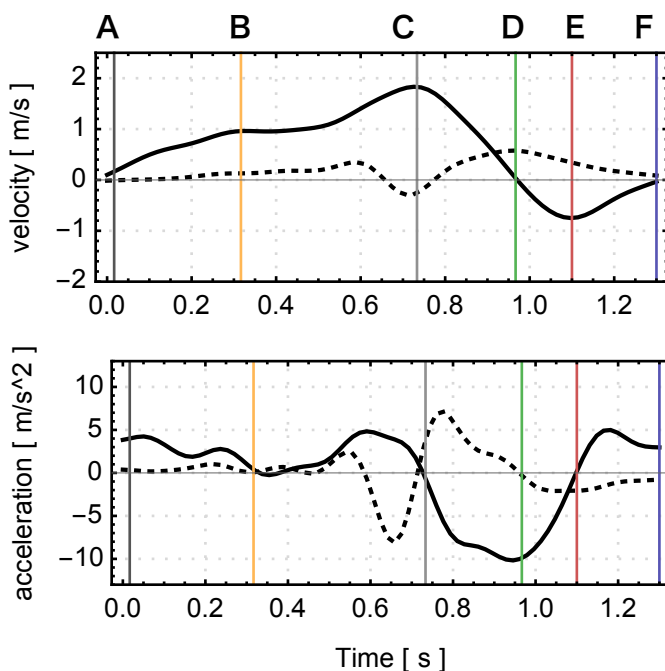
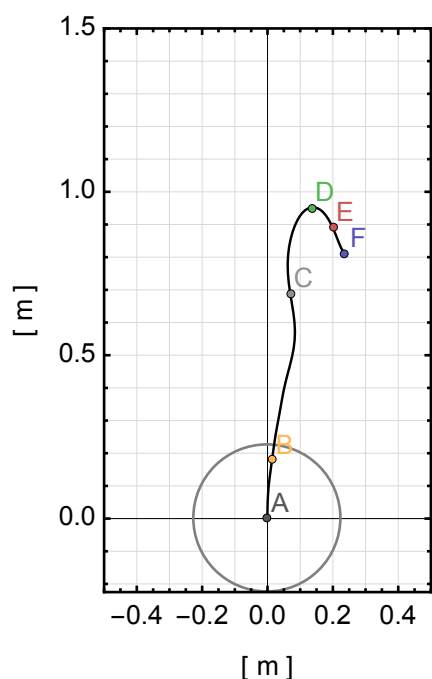
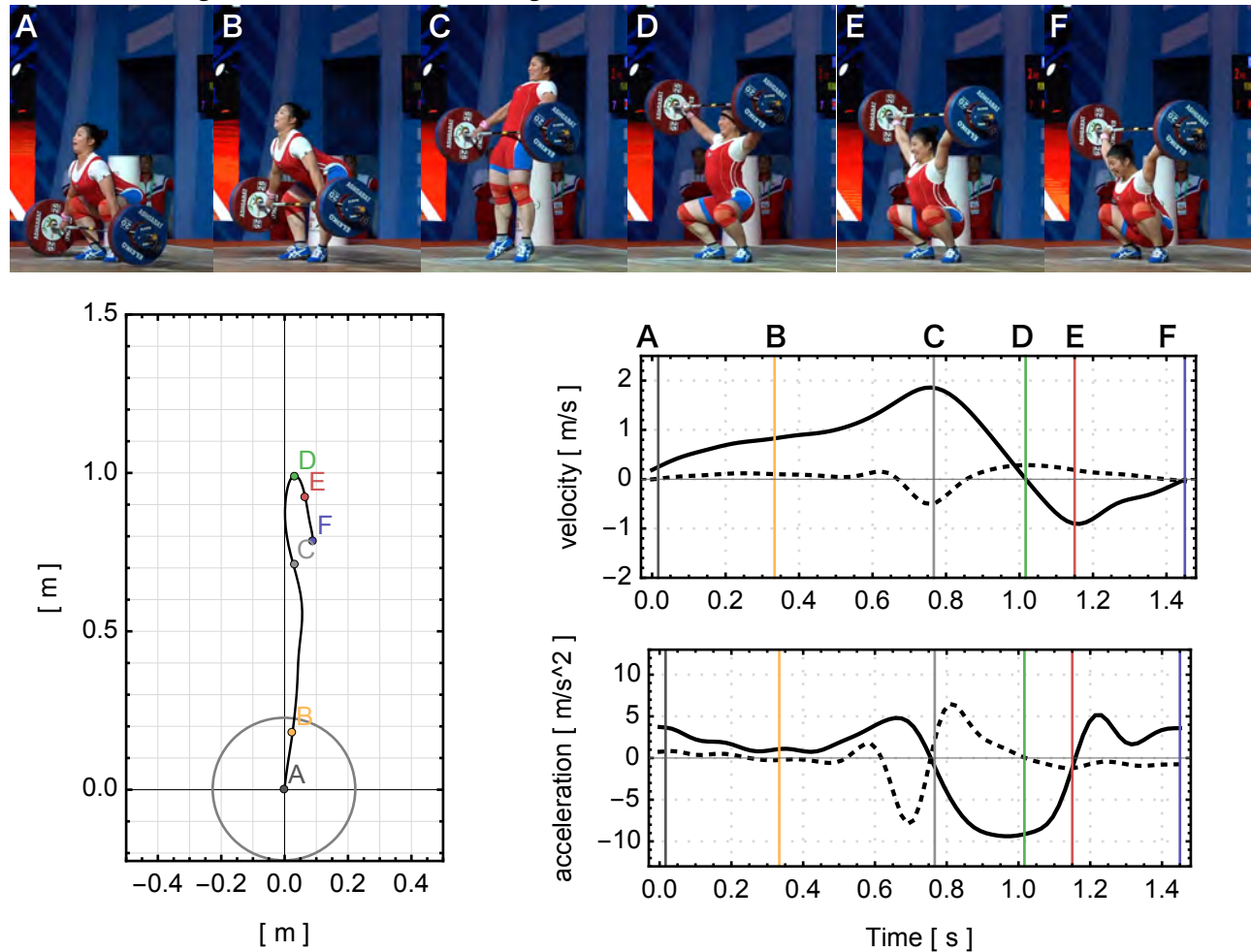


Figure 3 Barbell trajectory, image of each events and barbell position and velocity

W76A RIM-Jong-Sim (PRK) 2Att. 119kg



W81A VALENTIN-PEREZ-Lidia_(ESP) 3Att. 113kg

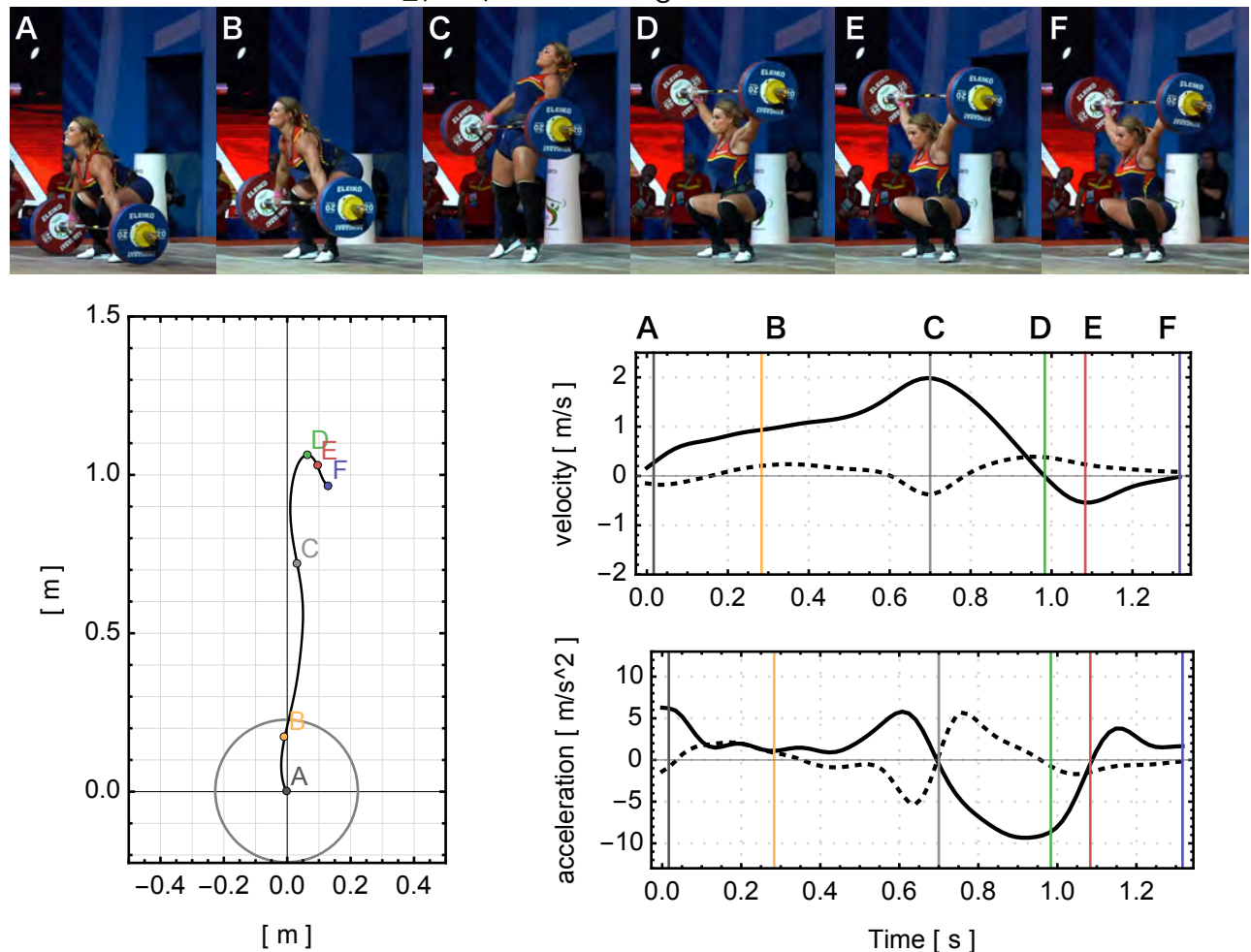
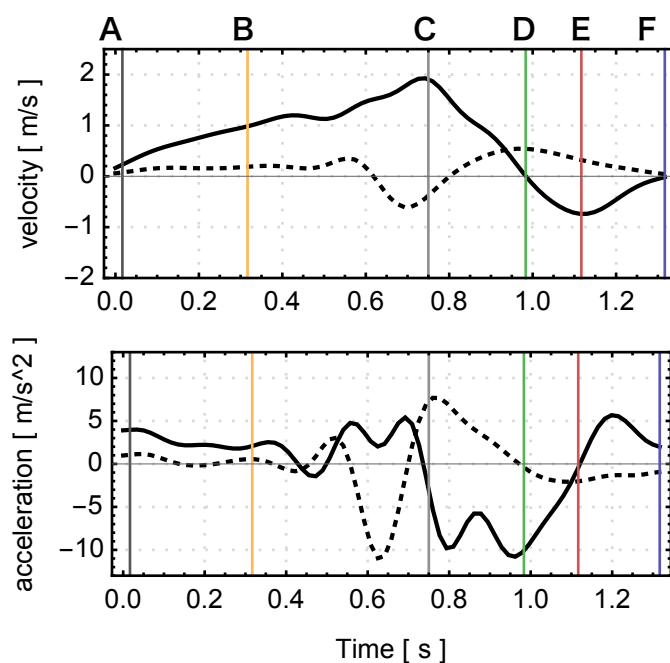
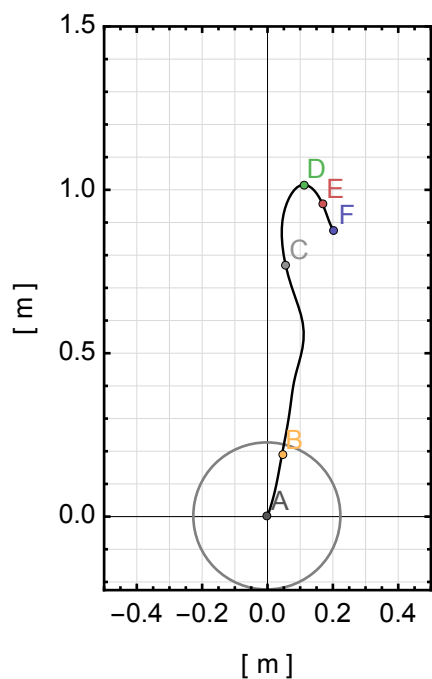


Figure 4 Barbell trajectory, image of each events and barbell position and velocity

W87A AO-Hui (CHN) 3Att. 117kg



W+87A KASHIRINA-Tatiana (RUS) 3Att. 145kg

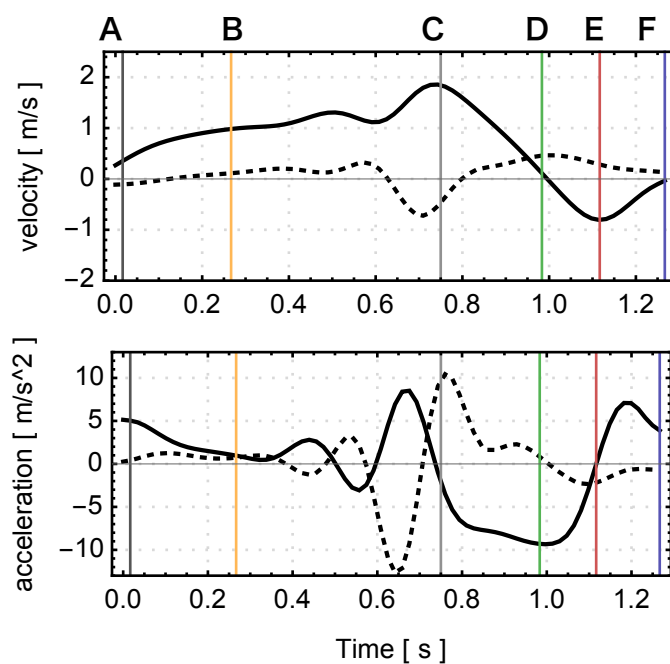
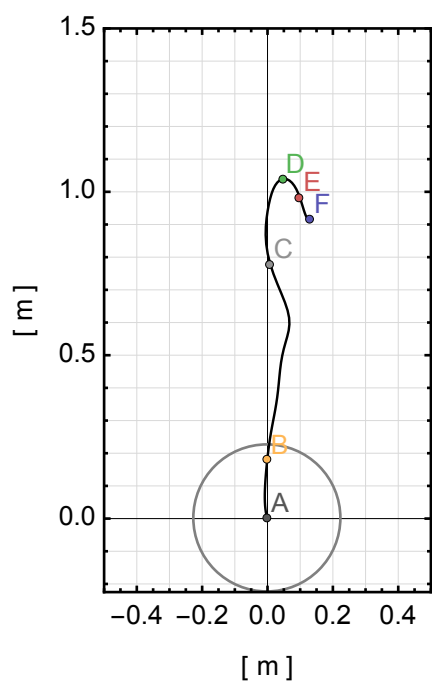
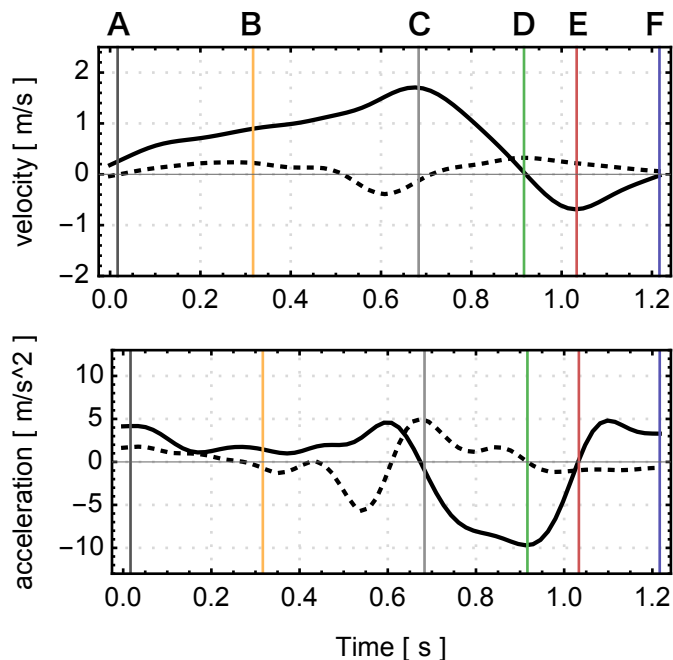
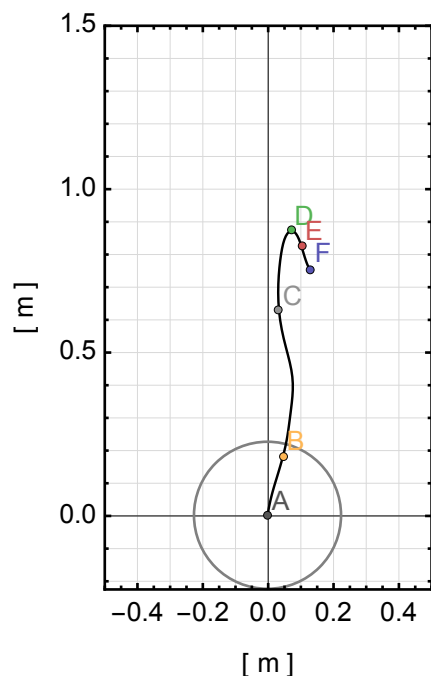
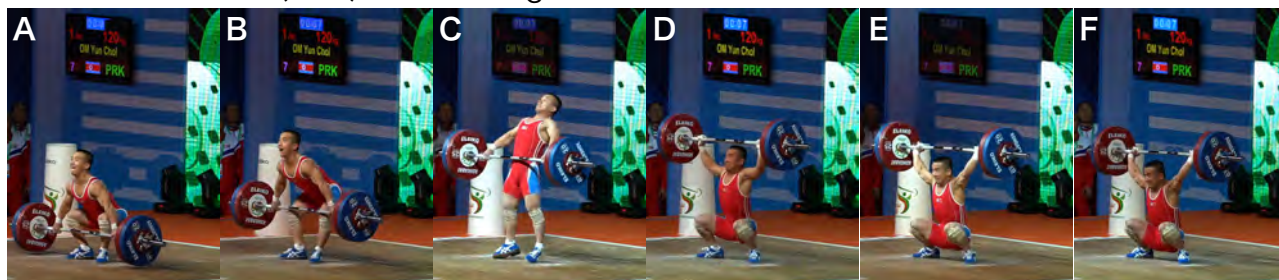


Figure 5 Barbell trajectory, image of each events and barbell position and velocity

M55A OM-Yun-Chol (PRK) 1Att. 120kg



M61A IRAWAN-Eko-Yuli (INA) 3Att. 143kg

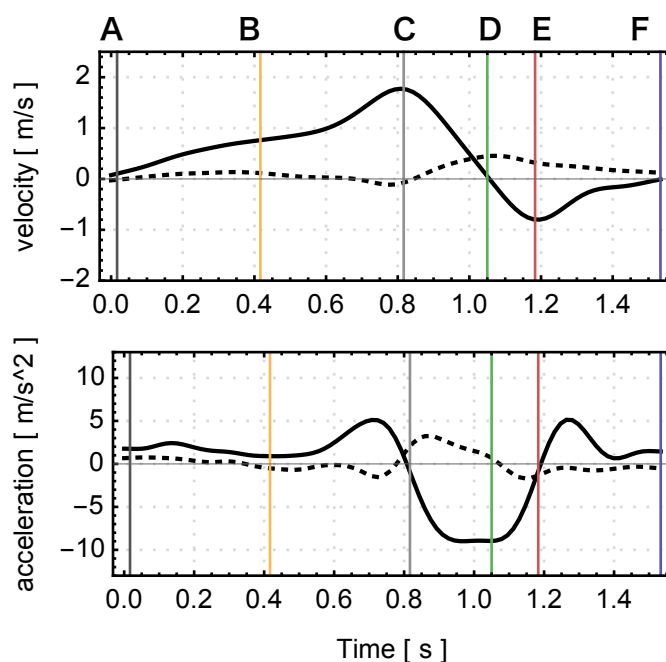
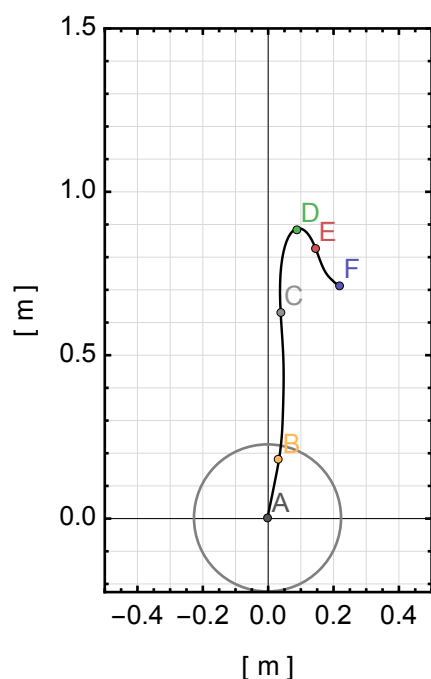
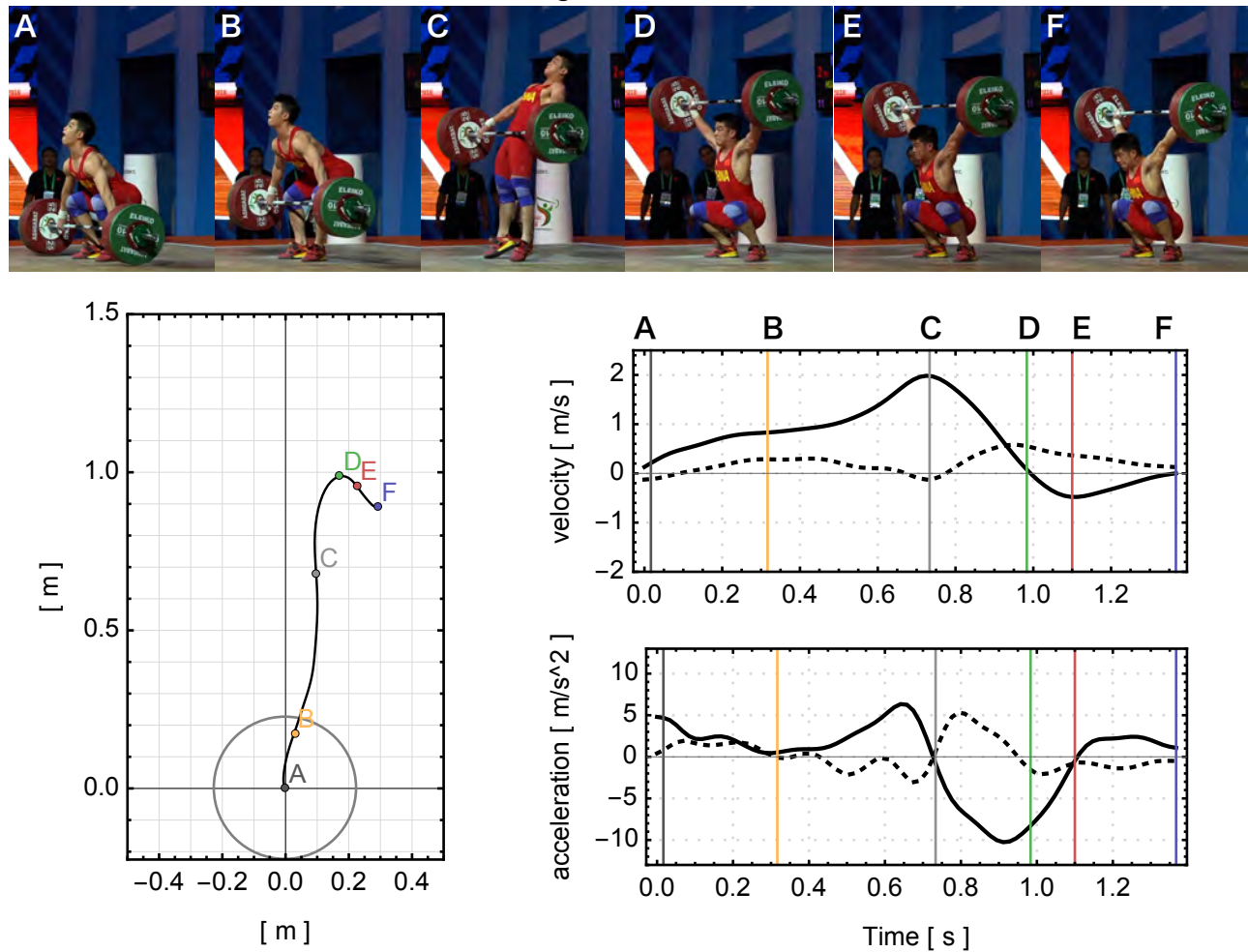


Figure 6 Barbell trajectory, image of each events and barbell position and velocity

M67A HUANG-Minhao (CHN) 2Att. 152kg



M73A SHI-Zhiyong (CHN) 3Att. 164kg

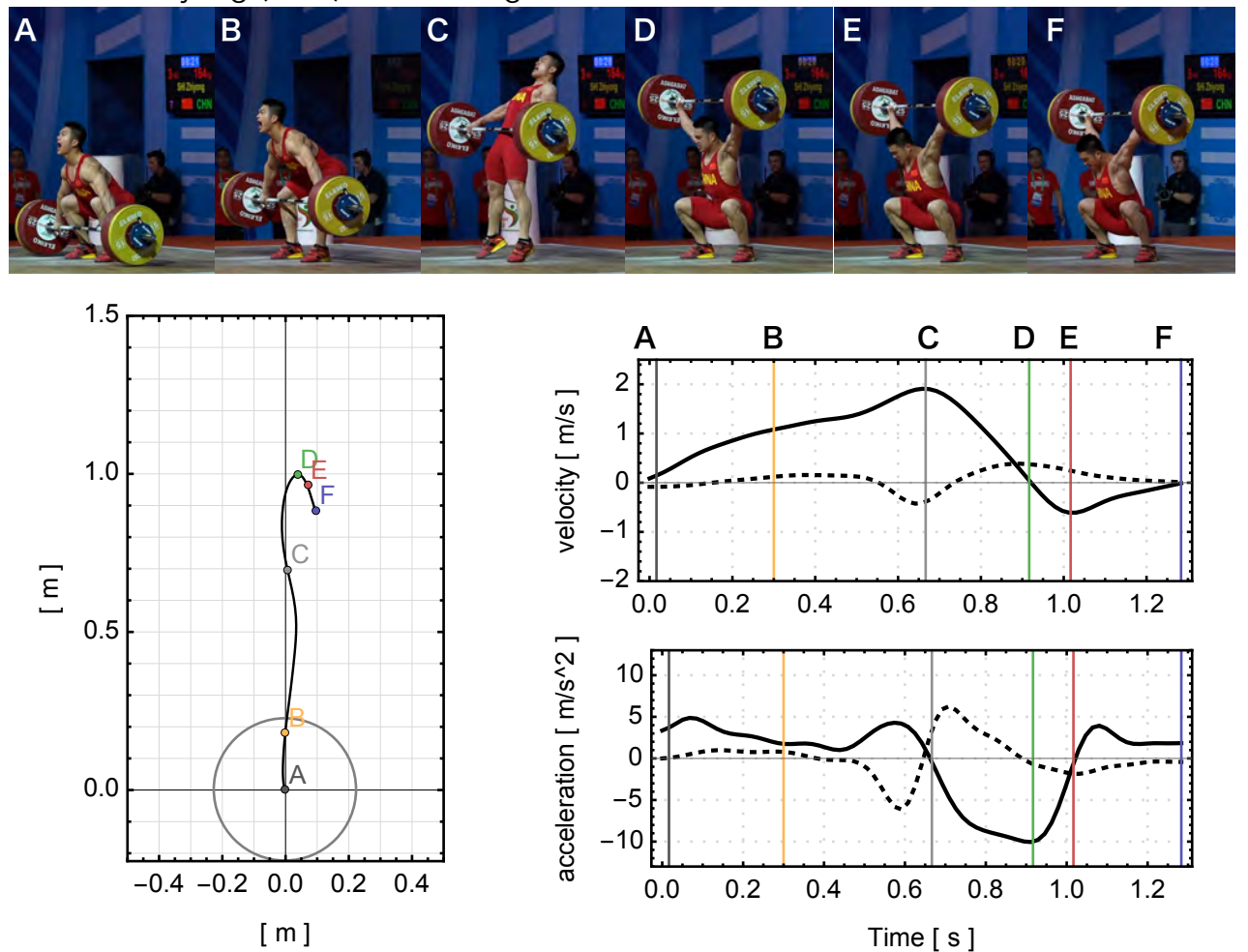


Figure 7 Barbell trajectory, image of each events and barbell position and velocity

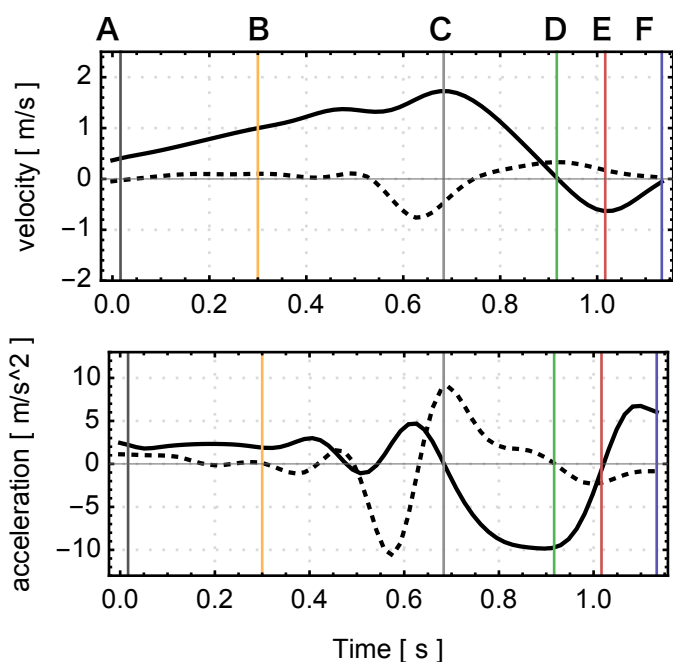
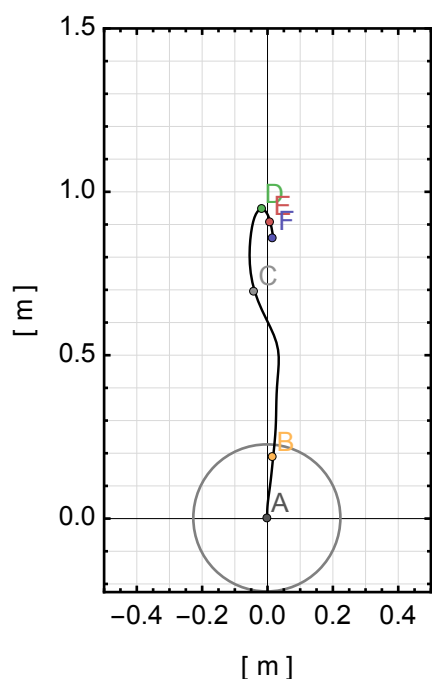
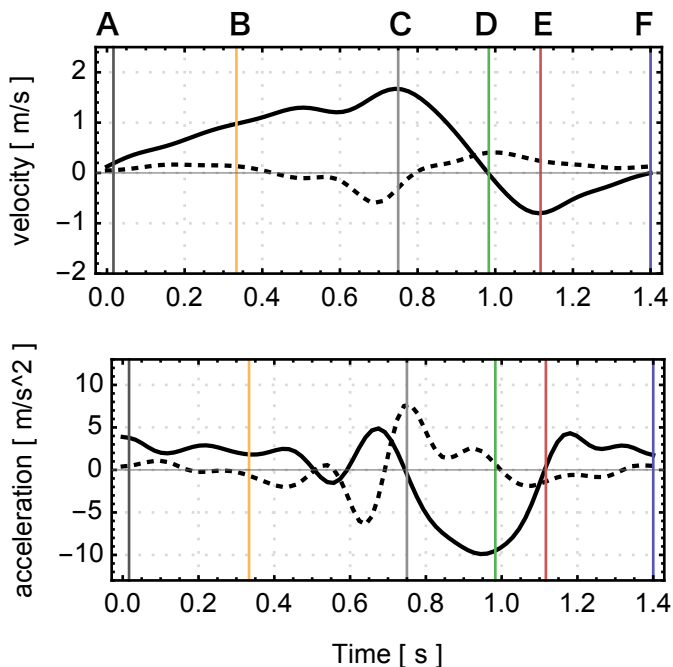
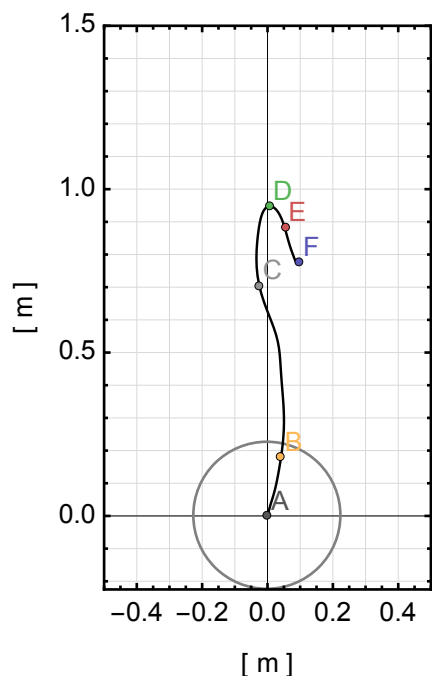
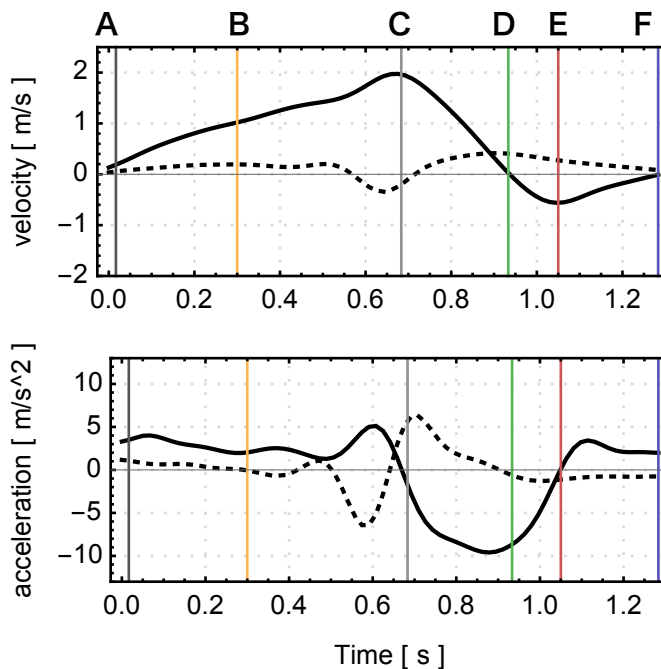
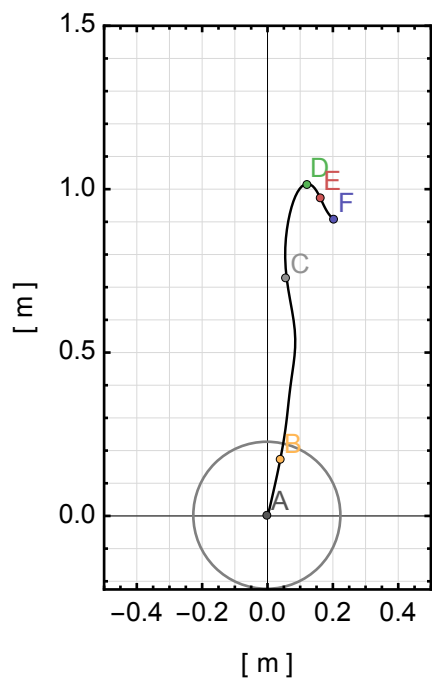


Figure 8 Barbell trajectory, image of each events and barbell position and velocity

M96A MORADI-Sohrab (IRI) 3Att. 186kg



M102A DJURAEV-Akbar (UZB) 3Att. 180kg

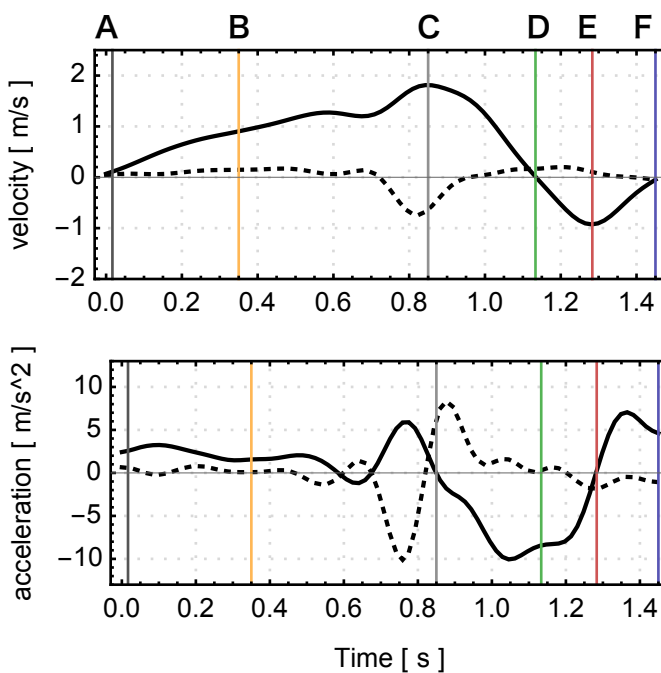
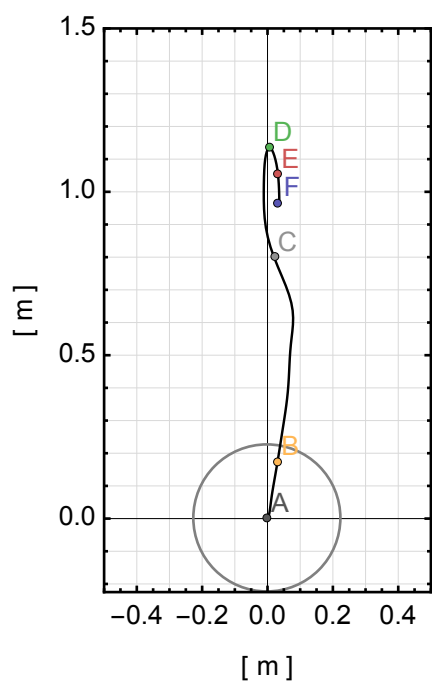
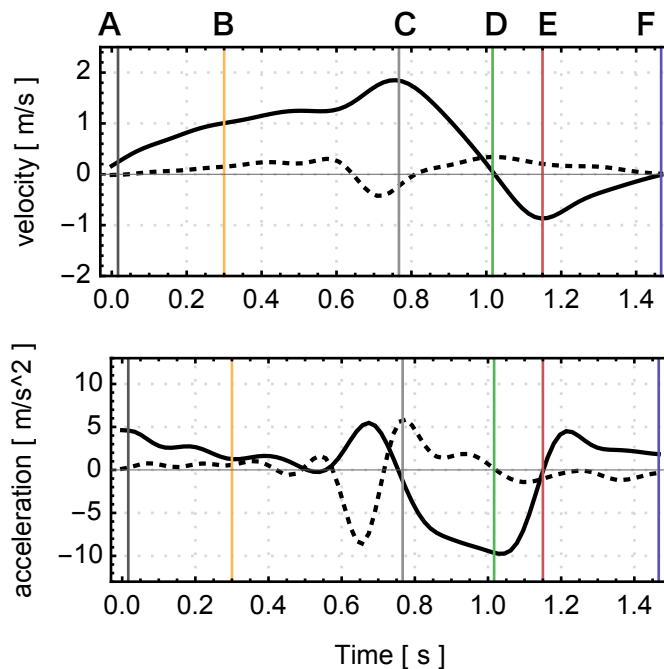
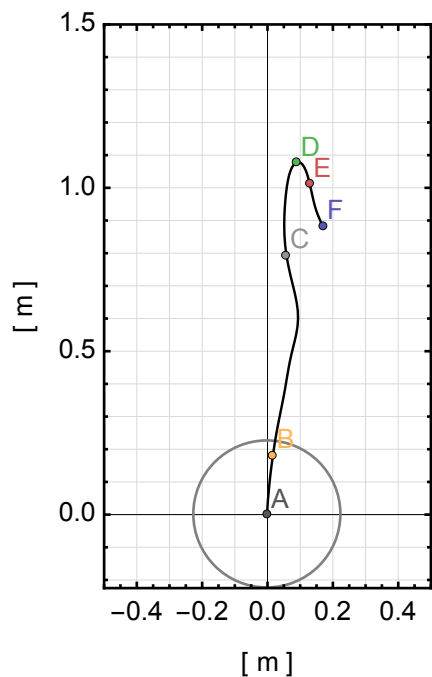
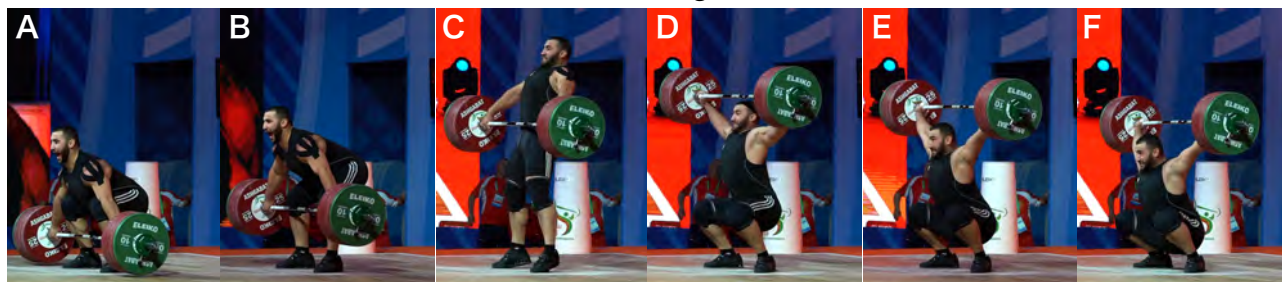


Figure 9 Barbell trajectory, image of each events and barbell position and velocity

M109A MARTIROSYAN-Simon (ARM) 3Att. 197kg



M+109A TALAKHADZE-Lasha (GEO) 3Att. 217kg

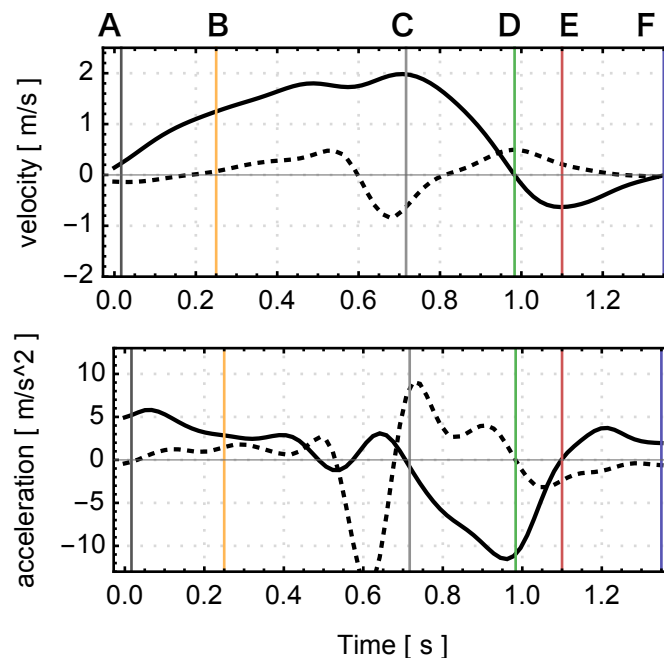
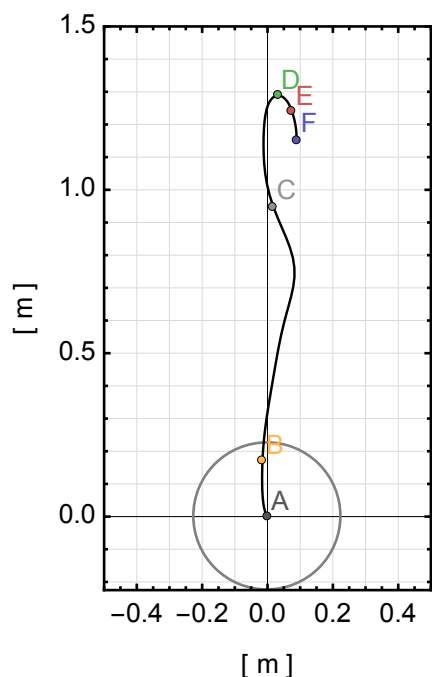


Figure 10 Barbell trajectory, image of each events and barbell position and velocity