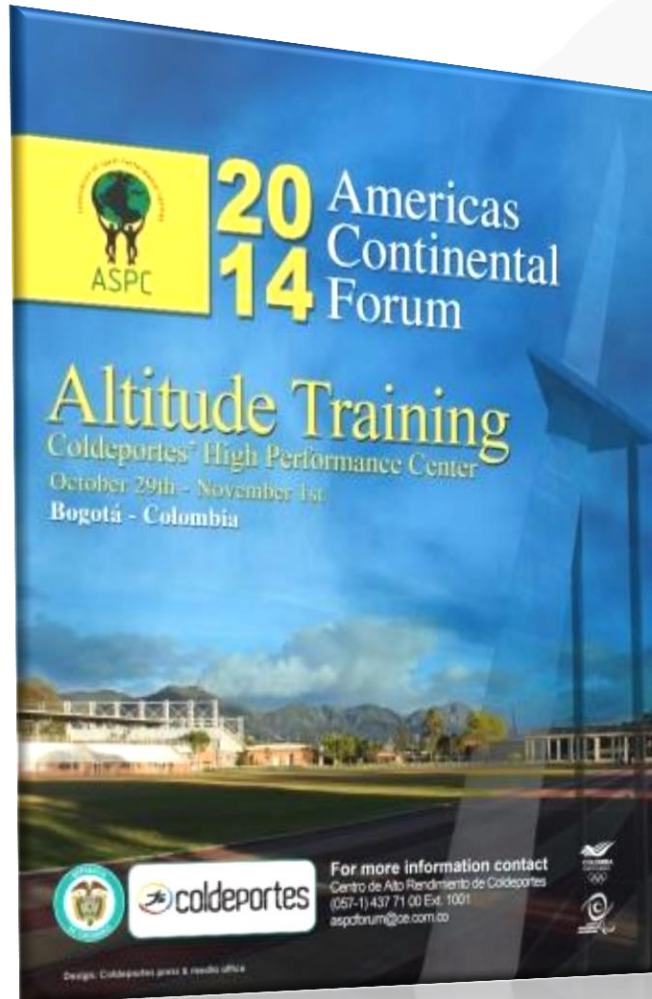




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# Biomechanical evaluation: The Sports Science Center Experience

**Natalia Rodríguez Zárate**

Biomedical Engineer  
Sport Science Center-Coldeportes  
Biomechanics Laboratory Coordinator

[Nrodriguez@coldeportes.gov.co](mailto:Nrodriguez@coldeportes.gov.co)

**Bogotá, October 31, 2014**

Coldeportes' High Performance Center - Bogotá, Colombia - October 29th to 31st, 2014



**20** Americas  
**14** Continental  
Forum



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**COORDINATOR**



**Natalia Rodríguez Zárate**  
**Biomedical Engineer**  
**Nrodriguez@coldeportes.gov.co**

**BIOMECHANICS ANALYST**



**Alfredo Restrepo Marín**  
**Degree in Physical Education**  
**Alrestrepo@coldeportes.gov.co**



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## MULTIDISCIPLINARY STAFF



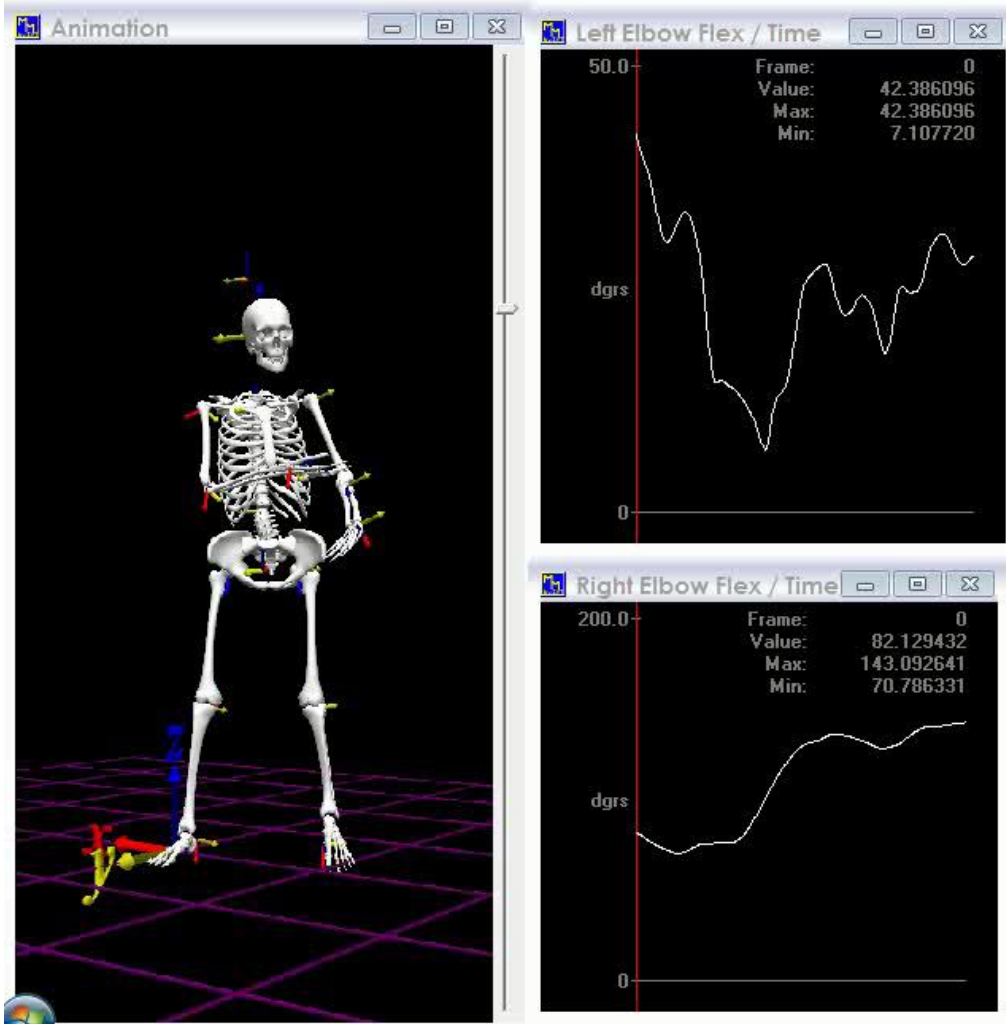
“Talent wins games, but **teamwork** and intelligence wins championships”. — *Michael Jordan*



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# BIOMECHANICS LABORATORY



National Archery Team; Software Motion Monitor- Biomechanics Lab. Coldeportes





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## BIOMECHANICS LABORATORY



*Paralympic Powerlifting; Labs Biomechanics, Neuroscience and Physiology Coldeportes*

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# POSITIONING AND LEADERSHIP

Technology  
optimizing

Self-sufficient

Research

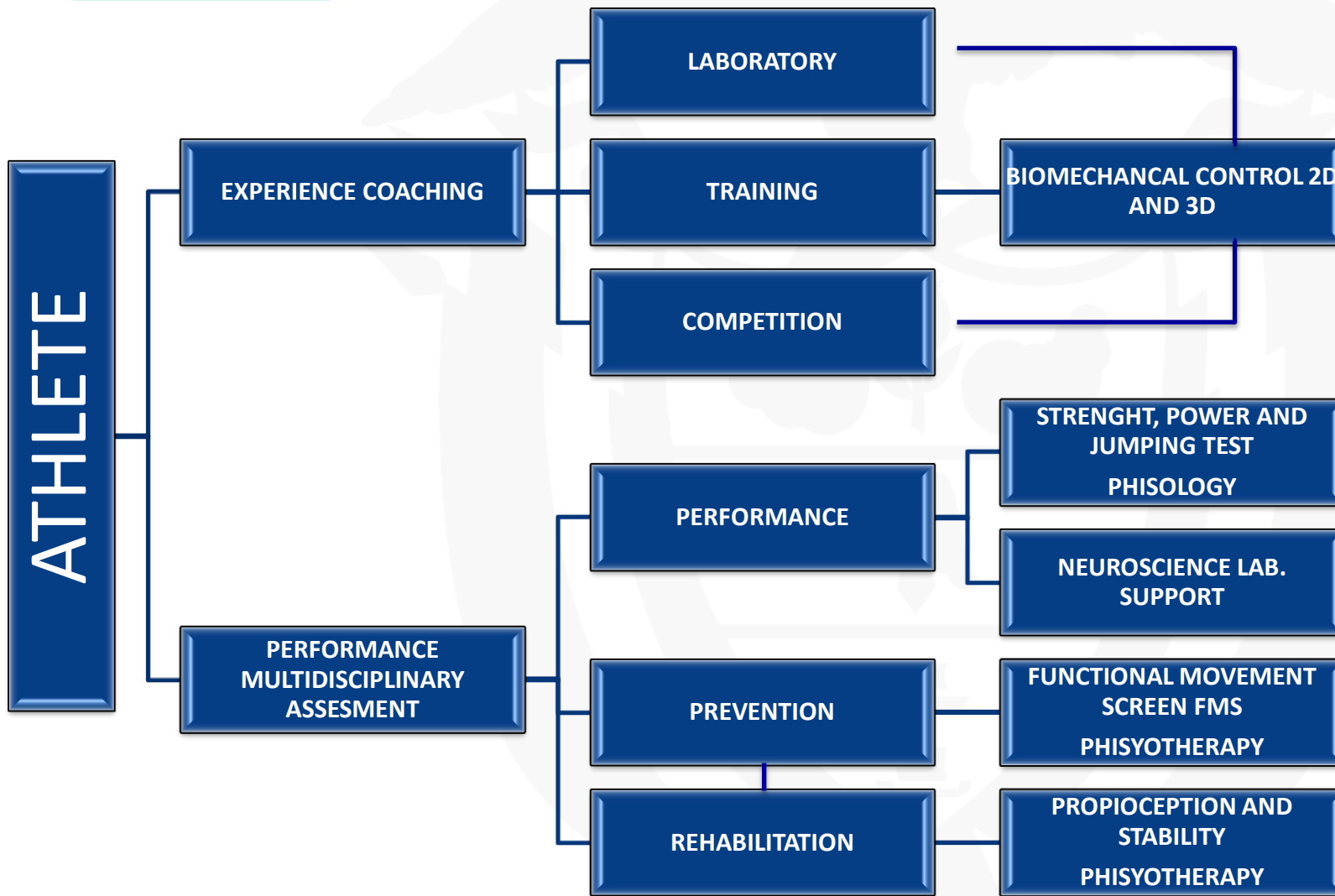
Partnerships and  
Covenants

Kinetics  
Phase #3

Kinematics outdoor  
Phase #2

Kinematics indoor  
Phase #1

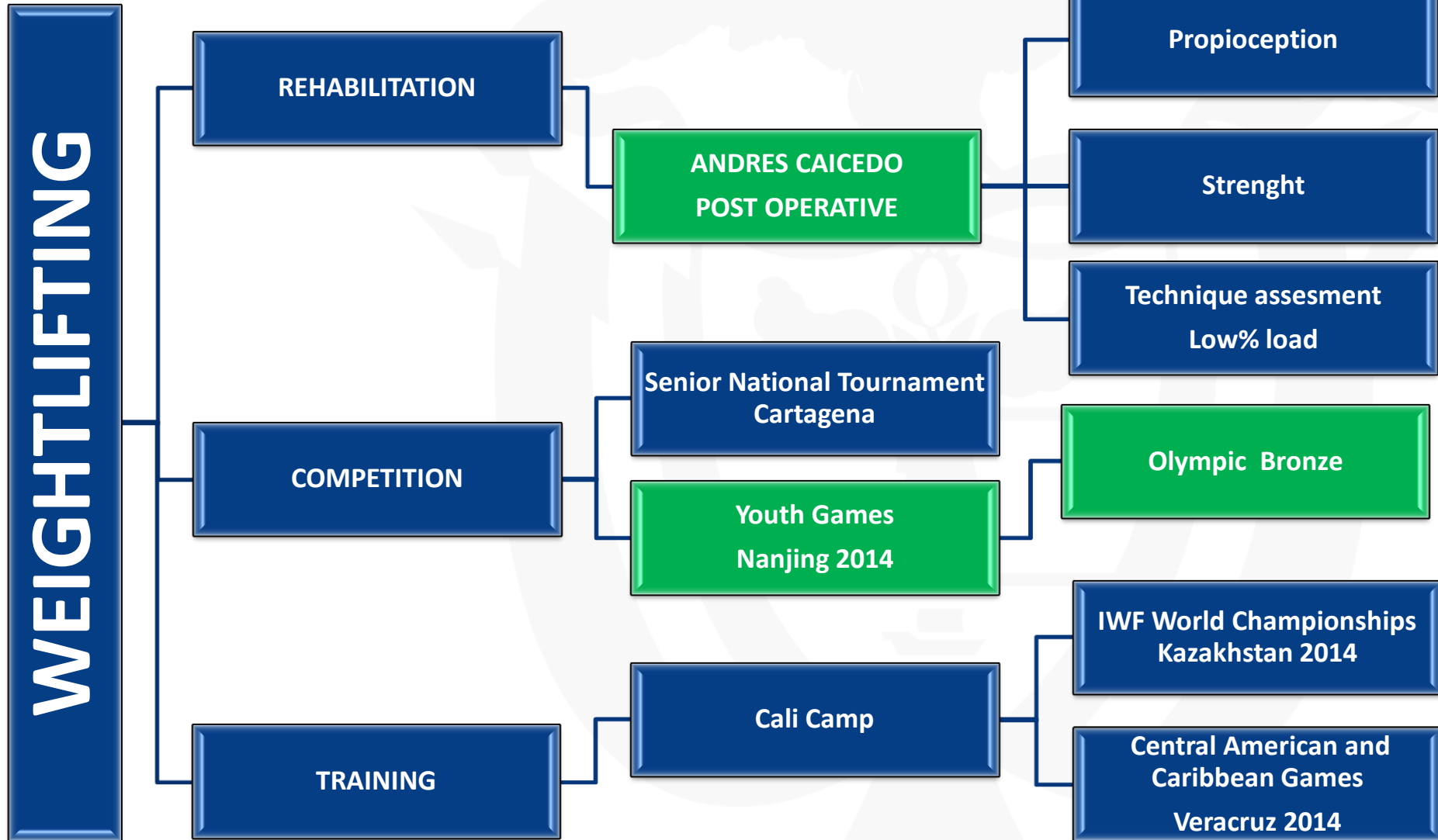






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## BIOMECHANICS CONTROL

### ÁNDRES MAURICIO CAICEDO

**AGE:**

17 years old

**SPORT:**

Weightlifting

**DISCIPLINE:**

69 kg

**COACH:**

Oswaldo Pinilla Rueda- National coach

**ACHIEVEMENTS:**

- Youth Games Nanjing 2014  
Bronze Medal 69 kg-290 kg.  
132 kg. Jerk and 158kg. Clean and Jerk





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BIOMECHANICS CONTROL

## PHYSIOTHERAPY MANAGEMENT



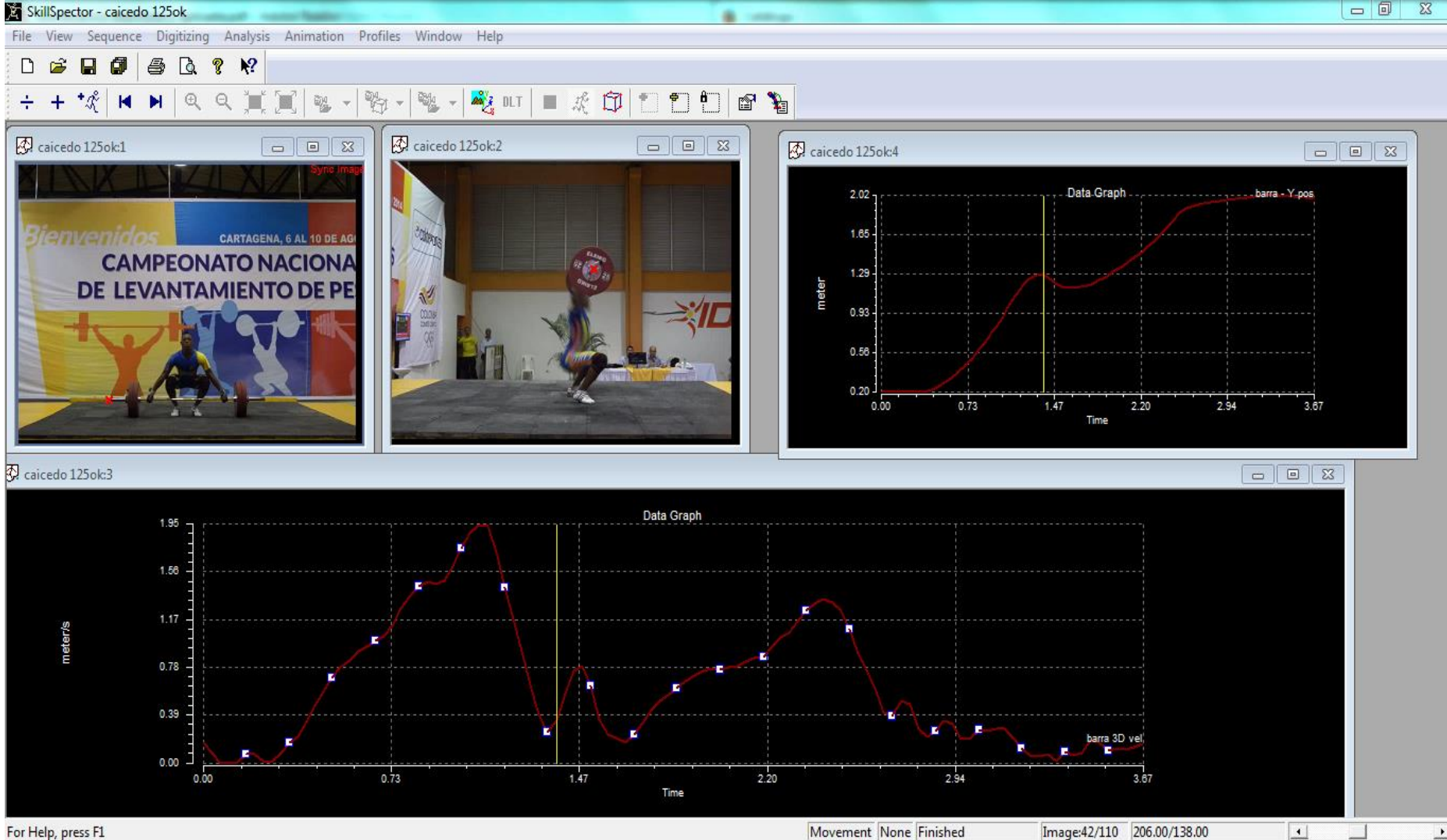
TECHNIQUE ASSESMENT LOW% LOAD



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# SENIOR NATIONAL TOURNAMENT CARTAGENA AUGUST 5th 2014

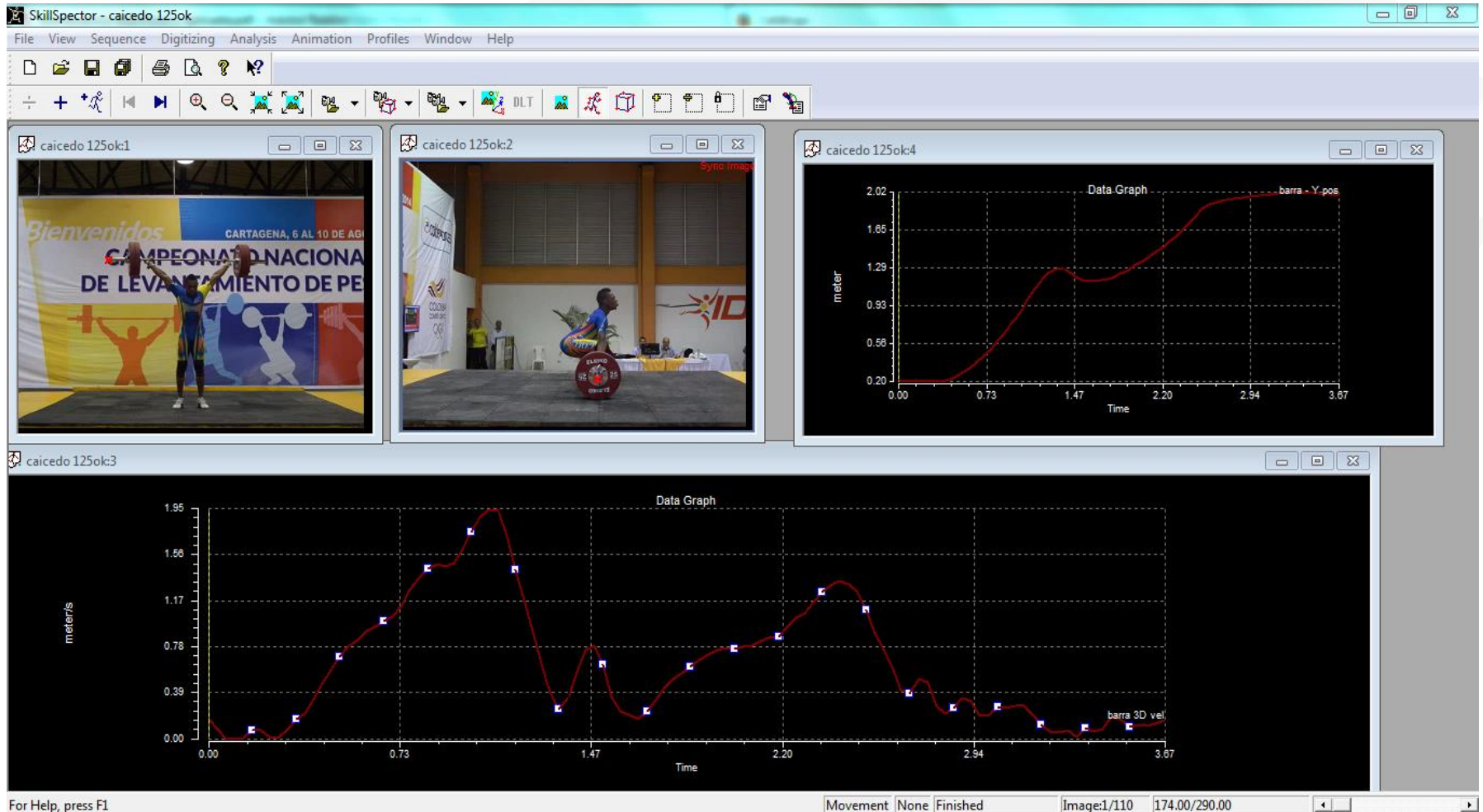




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# SENIOR NATIONAL TOURNAMENT CARTAGENA AUGUST 5th 2014



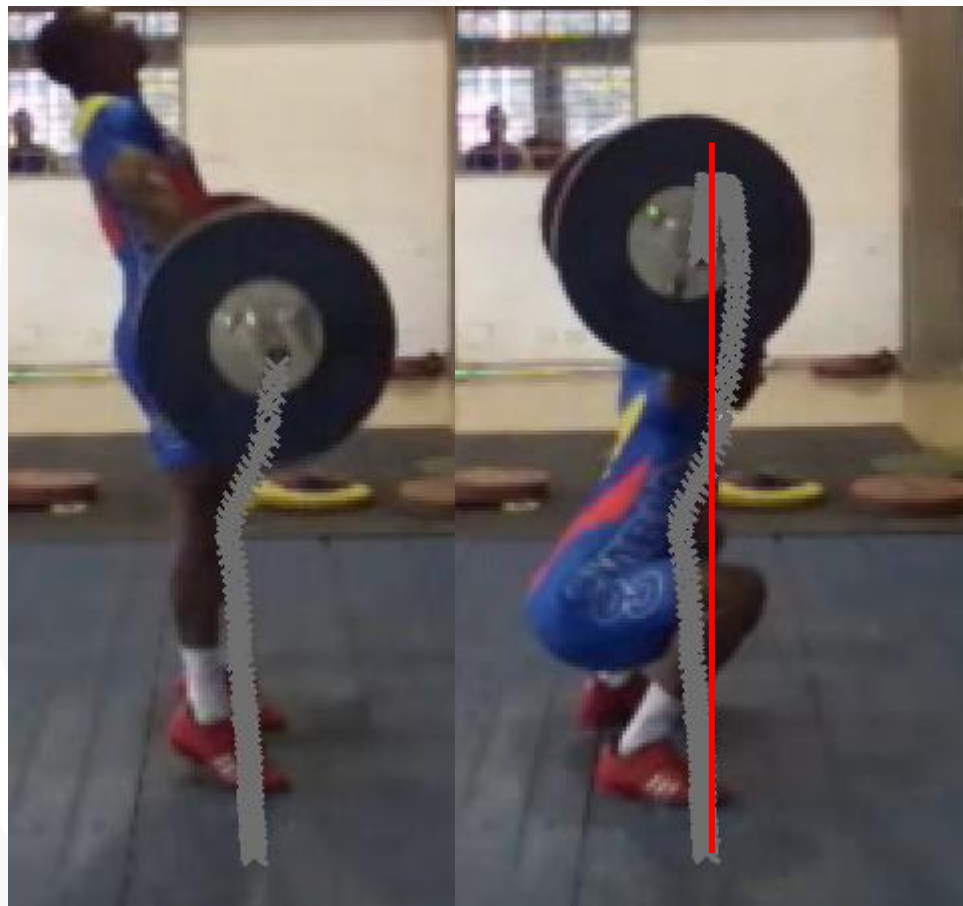
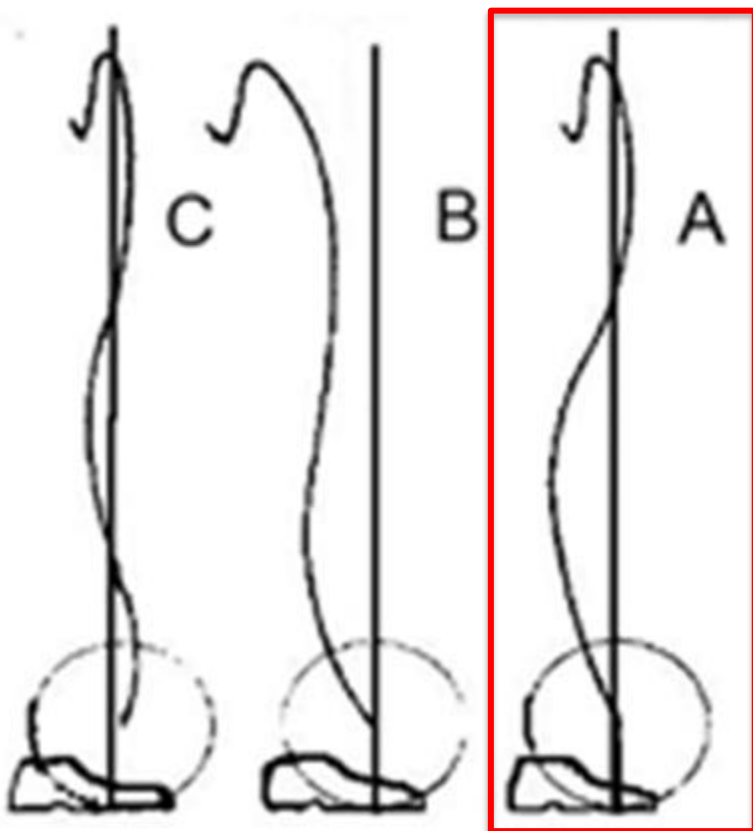


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IWF WORLD CHAMPIONSHIPS KAZAKHSTAN 2014  
CALI CAMP

### BASIC TRAJECTORIES TYPES



OSCAR FIGUEROA



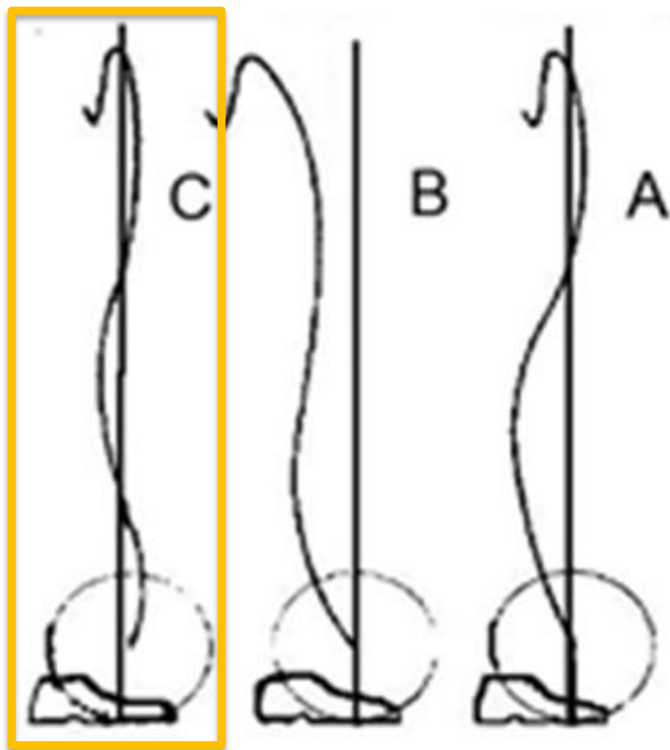


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# IWF WORLD CHAMPIONSHIPS KAZAKHSTAN 2014 CALI CAMP

## BASIC TRAJECTORIES TYPES





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## BIOMECHANICS CONTROL CONVENTIONAL SPORTS

# ATLHETICS

COMPETITION

Throw

Hammer

Shot put

Javalin

TRIPLE JUMP

CATHERINE  
IBARGÜEN

TRAINING

Throw Hammer

MAYRA ALEXANDRA  
GAVIRIA



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## BIOMECHANICS CONTROL



### CATHERINE IBARGÜEN

BIRTH DATE:

February 12th of 1984

SPORT:

Athletics

DISCIPLINE:

Triple Jump

COACH:

Ubaldo Duany

ACHIEVEMENTS:

▪ Diamond league:

2014

Monaco 15,31 mts.

▪ Olympic Games

London 2012

Silver Medal







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**BIOMECHANICS CONTROL**

## PERFORMANCE MULTIDISCIPLINARY ASSESMENT

**CATHERINE IBARGÜEN**

### CONTROL

**Sports Science Center**

**May 28th/2014**

### COMPETITION

**Senior National tournament**

**Medellín June 27th/2014**

**Strenght and  
Power**

**MD. Jaime Albarracín**

**Physyotherapy**

**Ft. Oriana González**

**Biomechanical control  
Best jump 14.98mts**

**Alfredo Restrepo**

## DIAMOND LEAGUE

**MÓNACO 15.31 MTS.**





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BIOMECHANICS CONTROL

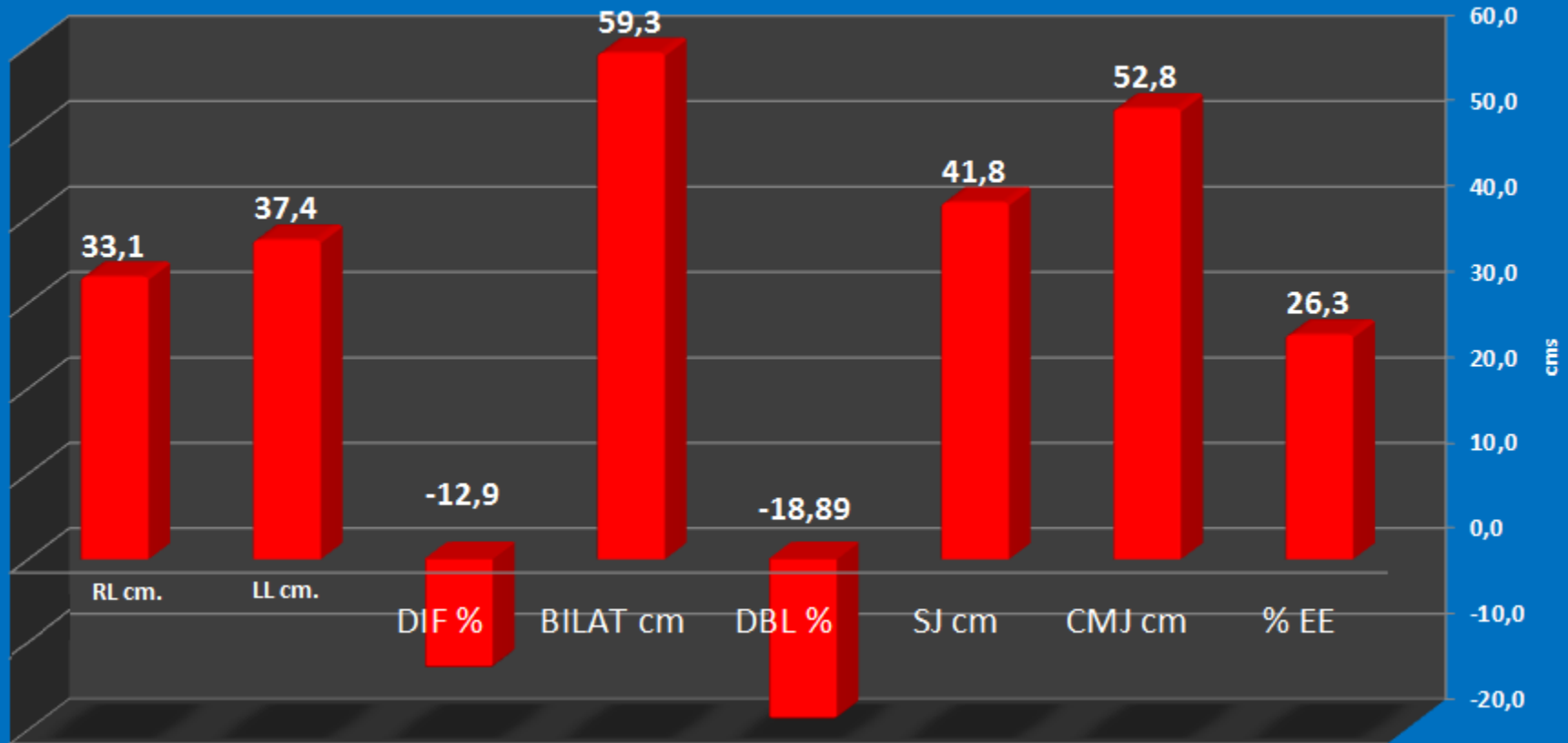


kinetics analysis with force plataform  
CATHERINE IBARGÜEN



# Jumping test

Catherine Ibargüen May 28th 2014



Jumping Test Results with contact plataform - Axon Jump.contact



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## ISOKINETIC STRENGTH



## PHYSIOTHERAPY MANAGEMENT



SENIOR NATIONAL TOURNAMENT MEDELLÍN JUNE 27TH/2014  
5th Attempt=14.98mts.



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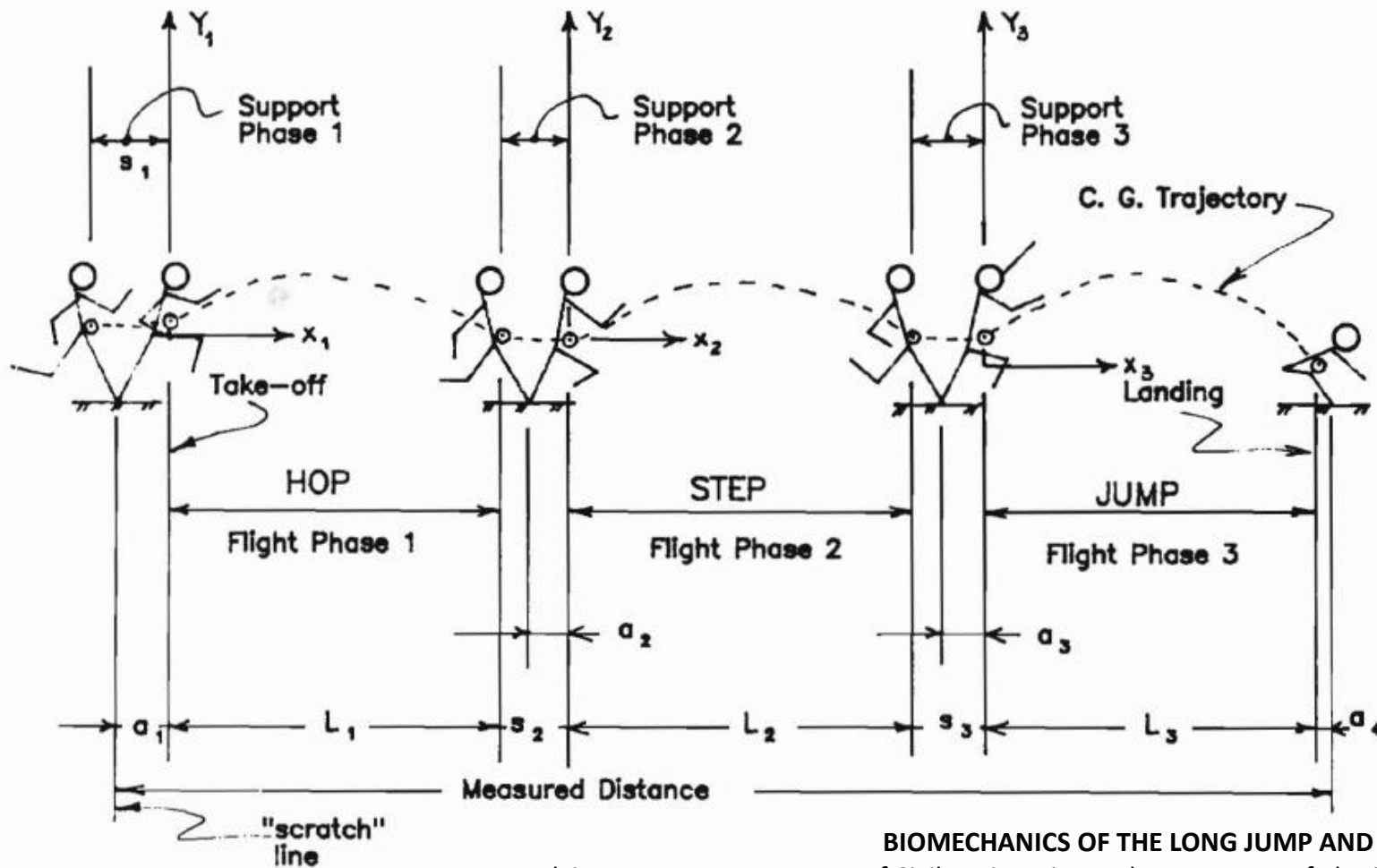


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# BIOMECHANICAL ANALYSIS OF THE HORIZONTAL JUMPING EVENTS AT THE 2009 IAAF WORLD CHAMPIONSHIPS IN ATHLETICS

BY LUIS MENDOZA AND EBERHARD NIXDORF/ TRANSLATED FROM THE ORIGINAL GERMAN BY JÜRGEN SCHIFFER



## BIOMECHANICS OF THE LONG JUMP AND TRIPLE JUMP

Melvin R. Ramey Department of Civil Engineering and Department of Physical Education  
University of California, Davis, California 95616, U.S.A.





COMPARATIVE ANALYSIS TRIPLE JUMP

Results of the women's triple jump final (m) at the 2009 IAAF World Championships in Athletics (wind readings are shown in parentheses in m/sec)

Pos	Athlete (Country)	Round					
		1	2	3	4	5	6
<b>17 August – 20:00</b>							
1	Yargeris Savigne (CUB)	14.45 (0.5)	14.14 (-0.2)	14.89 (-0.1)	14.85 (0.0)	<b>14.95</b> (1.3)	14.39 (0.0)
2	Mabel Gay (CUB)	13.87 (-0.3)	14.50 (-0.1)	X	<b>14.61</b> (-0.2)	14.48 (0.5)	14.04 (0.1)
3	Anna Pyatykh (RUS)	13.72 (-0.3)	14.23 (-0.1)	13.66 (0.0)	<b>14.58</b> (-0.4)	14.46 (-0.2)	14.53 (0.0)
4	Biljana Topic (SRB)	14.21 (0.1)	14.38 (0.0)	14.27 (-0.5)	<b>14.52</b> (-0.1)	14.43 (0.8)	14.10 (-0.1)
5	Trecia Smith (JAM)	14.31 (0.4)	X	X	14.41 (0.1)	<b>14.48</b> (-0.2)	X
6	Tatyana Lebedeva (RUS)	X	<b>14.37</b> (0.0)	14.23 (0.0)	14.22 (-0.2)	14.26 (0.1)	14.28 (0.0)
7	Cristina Bujin (ROU)	<b>14.26</b> (-0.2)	14.00 (-0.2)	14.03 (0.3)	14.20 (-0.2)	14.16 (-0.2)	14.15 (0.1)
8	Dana Veldáková (SVK)	<b>14.25</b> (-0.2)	X	12.86 (0.1)	14.14 (-0.2)	14.19 (0.0)	14.13 (0.2)
9	Limei Xie (CHN)	<b>14.16</b> (-0.1)	11.46 (0.0)	14.06 (0.3)			
10	Olga Rypakova (KAZ)	X	<b>13.91</b> (-0.2)	13.71 (0.0)			
11	Teresa Nzola Meso (FRA)	13.77 (-0.2)	<b>13.79</b> (0.0)	X			
12	Gisele de Oliveira (BRA)	X	<b>13.19</b> (-0.2)	-			

Catherine Ibargüen - attempt #5 - 14.98 mts (+3.8)





Characteristics of the hop in the individual best jumps in the women's triple jump final at the 2009 IAAF World Championships in Athletics

Name	Studied Attempt	Horizontal Velocity	Loss of Horizontal Velocity	Vertical Velocity	Angle of Projection	Take-off Duration	Inclination Angle	Trunk Angle TD	Trunk Angle TO	Lead-leg Angle TO	Lead-leg Velocity TO
		[m/sec]	[m/sec]	[m/sec]	[°]	[sec]	[°]	[°]	[°]	[°]	[°/sec]
Savigne	5	8.63	0.76	2.49	16	0.107	16	90	87	-17	814
Gay	4	8.12	0.75	2.34	16	0.133	18	89	87	-14	651
Pyatykh	6	8.21	0.80	2.46	17	0.127	22	90	86	-16	702
Topic	4	8.45	0.69	2.30	15	0.127	21	89	89	-11	712
Smith	5	8.34	0.76	2.39	16	0.140	23	89	87	-11	660
Lebedeva	2	8.59	0.53	2.24	15	0.113	18	87	85	-18	663
Bujin	2	8.00	0.83	2.49	17	0.113	19	88	88	-13	778
Veldakova	1	8.48	0.68	2.24	15	0.113	17	91	89	-6	823
	<b>Mean</b>	<b>8.35</b>	<b>0.73</b>	<b>2.37</b>	<b>15.8</b>	<b>0.122</b>	<b>19</b>	<b>89</b>	<b>87</b>	<b>-13</b>	<b>725</b>
	<i>Std. Dev.</i>	<i>0.23</i>	<i>0.09</i>	<i>0.10</i>	<i>0.91</i>	<i>0.012</i>	<i>2</i>	<i>1</i>	<i>1</i>	<i>4</i>	<i>70</i>

Catherine Ibargüen

Velocity, x=7.31m/s; Velocity, y=2.76m/s

projection angle=21.2°







Characteristics of the step in the individual best jumps in the women's triple jump final at the 2009 IAAF World Championships in Athletics

Name	Studied Attempt	Horizontal Velocity	Loss of Horizontal Velocity	Vertical Velocity	Angle of Projection	Take-off Duration	Inclination Angle	Trunk Angle TD	Trunk Angle TO	Lead-leg Angle TO	Lead-leg Velocity TO
		[m/sec]	[m/sec]	[m/sec]	[°]	[sec]	[°]	[°]	[°]	[°]	[°/sec]
Savigne	5	8.22	0.41	1.24	8.6	0.113	11	89	88	-33	586
Gay	4	7.30	0.82	1.70	13.1	0.160	17	89	82	-25	548
Pyatykh	6	7.46	0.74	1.93	14.5	0.140	15	89	79	-28	592
Topic	4	7.80	0.65	1.72	12.5	0.147	18	94	78	-20	639
Smith	5	7.38	0.96	1.84	14.0	0.160	17	88	75	-11	569
Lebedeva	2	7.80	0.79	1.84	13.3	0.147	19	86	73	-29	639
Bujin	2	7.37	0.63	1.57	12.0	0.147	14	85	75	-19	642
Veldakova	1	7.90	0.58	1.19	8.6	0.147	16	91	85	-25	507
	Mean	7.65	0.70	1.63	12.1	0.145	16	89	79	-24	590
	Std. Dev.	0.33	0.17	0.28	2.29	0.015	3	3	5	7	49

Catherine Ibargüen  $V_x=7.1m/s$ ;  $V_y=1.32m/s$

projection angle= $11.3^\circ$



Characteristics of the jump in the individual best jumps in the women's triple jump final at the 2009 IAAF World Championships in Athletics

Name	Studied Attempt	Horizontal Velocity	Loss of Horizontal Velocity	Vertical Velocity	Angle of Projection	Take-off Duration	Inclination Angle	Trunk Angle TD	Trunk Angle TO	Lead-leg Angle TO	Lead-leg Velocity TO
		[m/sec]	[m/sec]	[m/sec]	[°]	[sec]	[°]	[°]	[°]	[°]	[°/sec]
Savigne	5	6.87	1.35	2.67	21.2	0.147	21	92	87	-18	578
Gay	4	6.07	1.23	2.57	22.9	0.173	19	90	81	-21	476
Pyatykh	6	6.32	1.14	2.48	21.4	0.167	21	86	85	-18	578
Topic	4	6.89	0.91	2.14	17.2	0.153	18	86	75	-16	609
Smith	5	6.00	1.38	1.78	16.5	0.187	22	86	74	-13	542
Lebedeva	2	6.30	1.50	2.32	20.2	0.173	26	80	70	-22	613
Bujin	2	6.11	1.26	2.80	24.6	0.147	18	86	76	-22	555
Veldakova	1	6.70	1.20	2.24	18.5	0.160	21	85	81	-16	584
	Mean	6.41	1.25	2.38	20.3	0.163	21	86	79	-18	567
	Std. Dev.	0.36	0.18	0.33	2.80	0.014	3	4	6	3	44

Catherine Ibargüen  $V_x=5.51\text{m/s}$ ;  $V_y=2.19\text{m/s}$

Projection angle= $24.4^\circ$





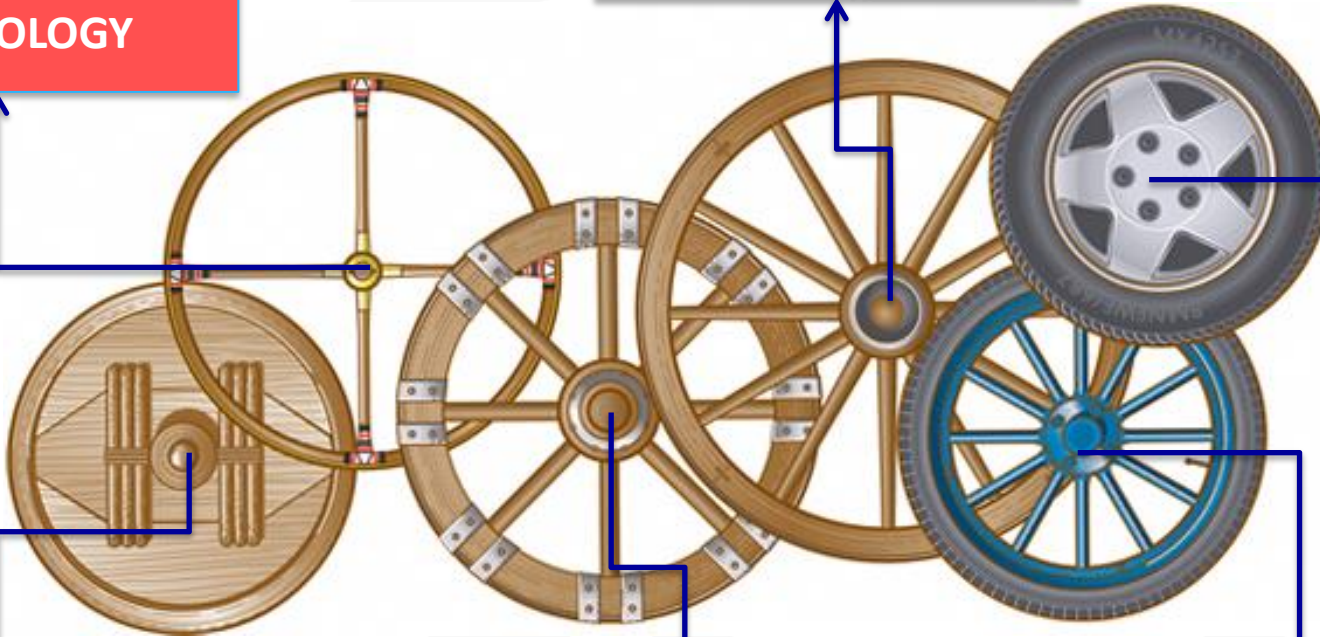
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APPLY THE  
TECHNOLOGY

OPTIMIZING  
TECHNOLOGY

DESIGN AND  
DEVELOPMENT  
TECHNOLOGY



ACQUIRE  
TECHNOLOGY

ACKNOWLEDGE OUR  
TECHNOLOGY LIMITS

NEW IDEAS IN  
TECHNOLOGY



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