



# Surface Pace

*Vienna 2004*



# Surface Pace

- **Tennis**
  - International Tennis Federation (ITF)
  - EN 13865
  - Alternative methods
- **Football**
  - UEFA & FIFA
- **Rugby**
  - International Rugby Board (IRB)

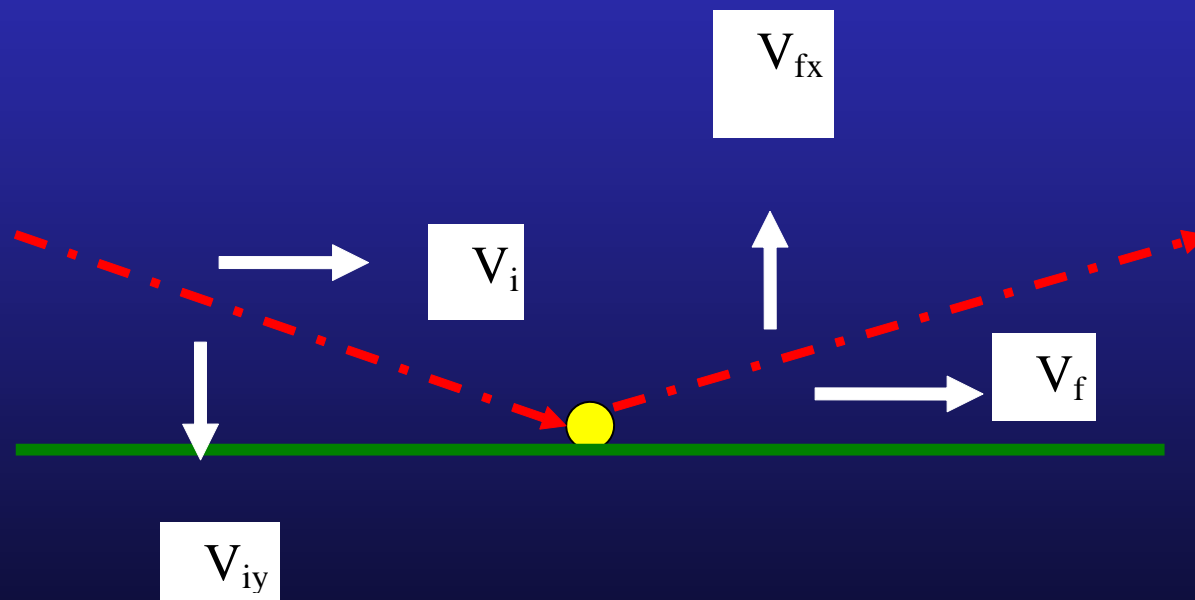


# Tennis Pace



Vienna 2004

# Tennis Pace



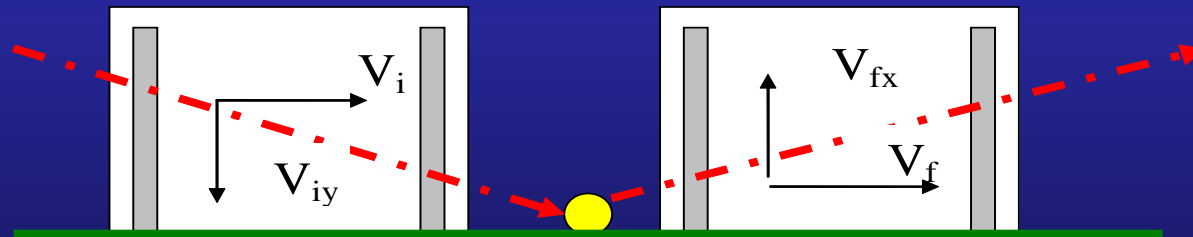


# Tennis Pace

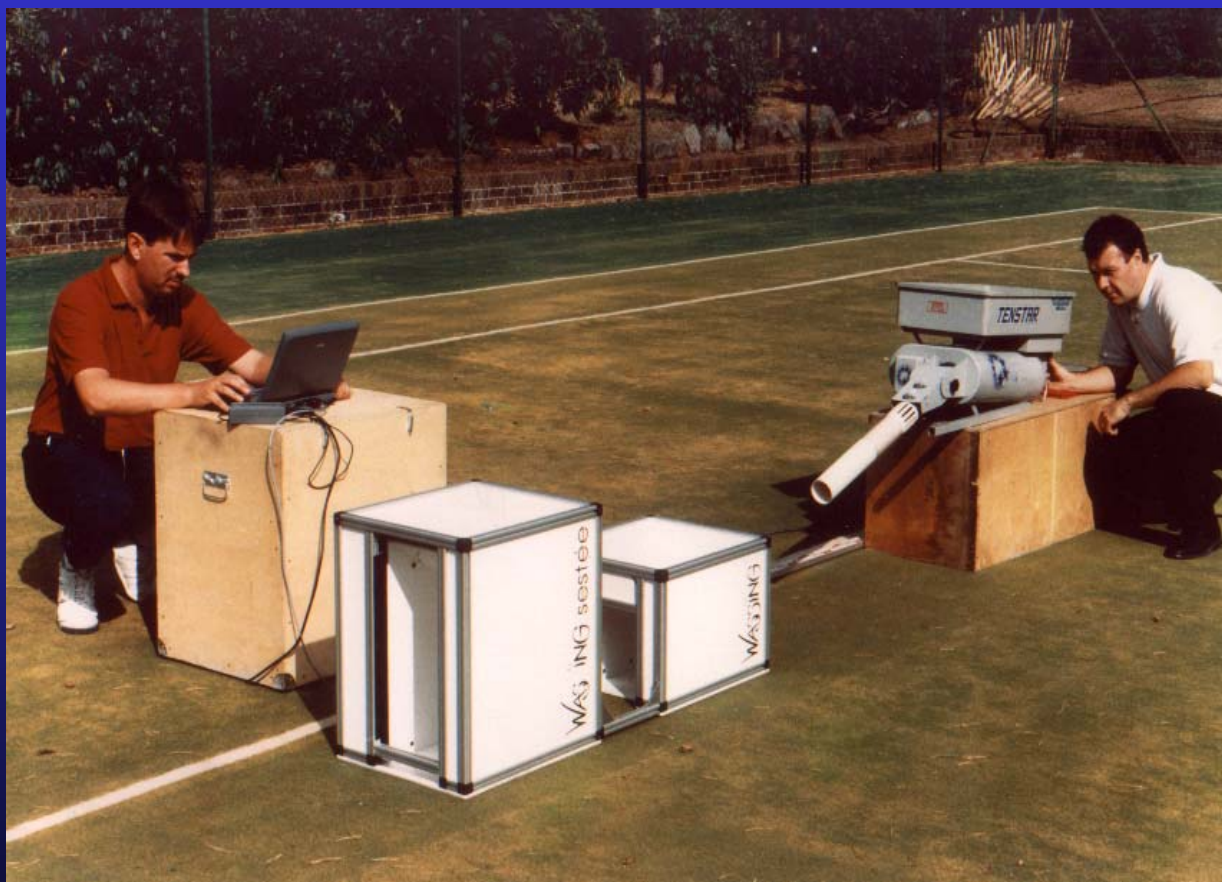
$$\mu = \frac{V_{ix} - V_{fx}}{(1 + e) V_{iy}}$$

Brody, H., Tennis Science for Tennis Players (1987), University of Pennsylvania Press

# Tennis Pace



# Ball / Surface Pace



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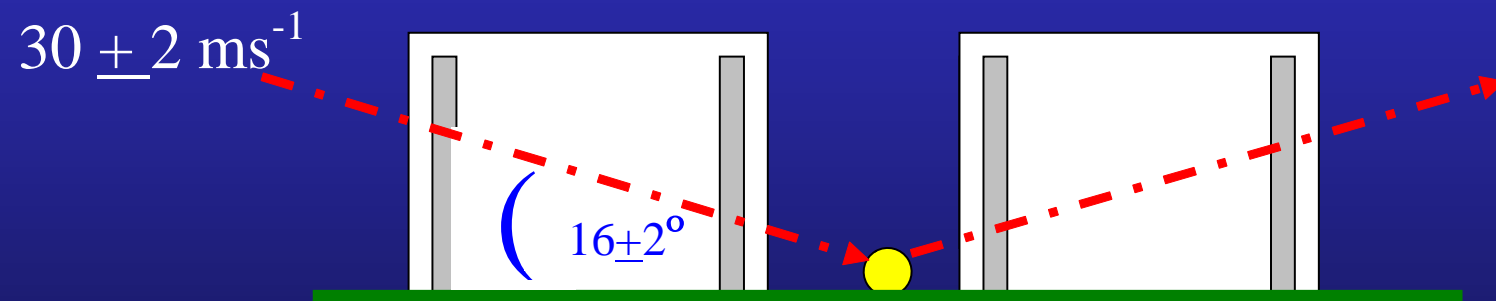
# Tennis Pace

$$\text{ITF SPR}^* = 100 (1 - \mu)$$

\* designated in EN 13865 as Tennis Coefficient



# Test parameters



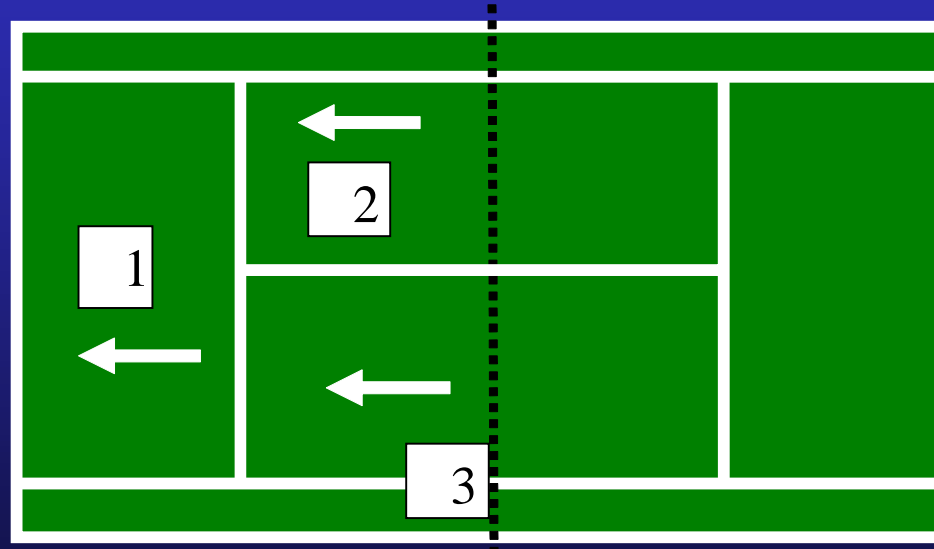


# Test procedure lab tests

- Standard test ball
- Three samples per product
- Nine tests per product
- Calculate mean for each sample
- Calculate mean of three samples

# Site test positions

Three positions per court Nine tests per position



# Test Results - Surface Pace

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# ITF CS/01/01-02-013

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Surface name: 0  
Test date: 3rd December 2002

Temperature: 21°C  
Humidity: 54%

Test laboratory: Centre for Sports Technology  
Laboratory

## PACE TEST 1:

	Shot 1 <sup>(Ball 1)</sup>	Shot 2 <sup>(Ball 2)</sup>	Shot 3 <sup>(Ball 3)</sup>	Shot 4 <sup>(Ball 1)</sup>	Shot 5 <sup>(Ball 2)</sup>	Shot 6 <sup>(Ball 3)</sup>	Shot 7 <sup>(Ball 1)</sup>	Shot 8 <sup>(Ball 2)</sup>	Shot 9 <sup>(Ball 3)</sup>
Vih	28.11	28.23	27.41	27.15	27.58	27.85	28.75	27.77	28.69
Viv	7.88	8.00	7.77	7.67	7.94	7.94	8.06	7.72	8.17
Vrh	18.73	19.01	18.06	18.15	18.53	18.71	19.81	19.20	19.72
Vrv	6.14	6.19	6.01	5.93	6.05	6.17	6.08	5.94	6.10
e	0.78	0.77	0.77	0.77	0.76	0.78	0.75	0.77	0.75
f	0.67	0.65	0.68	0.66	0.65	0.65	0.63	0.63	0.63
Pace	33.1	35.0	32.1	33.8	35.3	35.2	36.8	37.3	37.1

## PACE TEST 2:

	Shot 1 <sup>(Ball 4)</sup>	Shot 2 <sup>(Ball 5)</sup>	Shot 3 <sup>(Ball 6)</sup>	Shot 4 <sup>(Ball 4)</sup>	Shot 5 <sup>(Ball 5)</sup>	Shot 6 <sup>(Ball 6)</sup>	Shot 7 <sup>(Ball 4)</sup>	Shot 8 <sup>(Ball 5)</sup>	Shot 9 <sup>(Ball 6)</sup>
Vih	27.60	28.55	28.69	27.30	26.91	28.52	28.11	27.24	28.00
Viv	7.76	7.84	7.89	7.65	7.45	7.92	7.86	7.56	7.91
Vrh	18.56	19.50	19.39	18.61	17.91	19.00	19.42	18.78	18.96
Vrv	6.08	6.23	6.36	5.83	5.86	5.80	5.80	5.67	6.01
e	0.78	0.79	0.81	0.76	0.79	0.73	0.74	0.75	0.76
f	0.65	0.64	0.65	0.64	0.68	0.69	0.64	0.64	0.65
Pace	34.7	35.7	34.7	35.5	32.4	30.6	36.4	36.1	35.1

## PACE TEST 3:

	Shot 1 <sup>(Ball 7)</sup>	Shot 2 <sup>(Ball 8)</sup>	Shot 3 <sup>(Ball 9)</sup>	Shot 4 <sup>(Ball 7)</sup>	Shot 5 <sup>(Ball 8)</sup>	Shot 6 <sup>(Ball 9)</sup>	Shot 7 <sup>(Ball 7)</sup>	Shot 8 <sup>(Ball 8)</sup>	Shot 9 <sup>(Ball 9)</sup>
Vih	28.25	28.88	28.50	26.44	26.68	27.79	28.11	28.19	27.78
Viv	7.92	7.97	7.86	7.38	7.32	7.71	7.91	7.69	7.61
Vrh	19.00	20.06	19.24	17.04	17.87	18.84	18.64	19.43	18.64
Vrv	6.14	6.14	6.28	5.86	5.57	5.82	6.15	5.81	6.17
e	0.78	0.77	0.80	0.79	0.76	0.75	0.78	0.76	0.81
f	0.66	0.63	0.65	0.71	0.68	0.66	0.67	0.65	0.66
Pace	34.2	37.5	34.5	29.0	31.7	33.9	32.6	35.1	33.7



# Classification of SPR values

ITF Surface Pace Rating	ITF Classification
0 - 35	Slow
30 - 45	Medium / Medium Fast
40+	Fast

Court Surface Classification Scheme

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# Alternative tests



Haynes Pendulum

# Alternative tests



**Tortus II**  
**(used by USTA)**



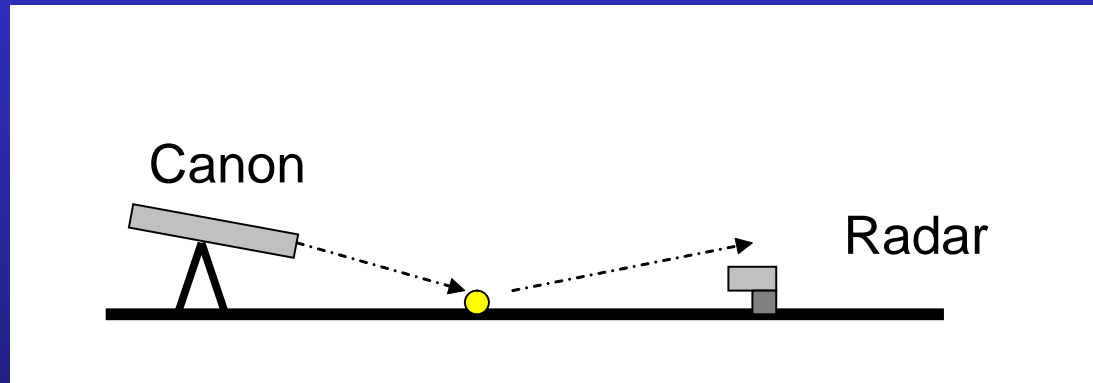
# Football Pace



Vienna 2004



# Football Pace









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# Football Pace

- FIFA & IRB

- Speed = 55kmp
- Angle = 25°

- UEFA

- Speed = 50 kmp
- Angle = 15 °

Result expressed as % lose of speed



# The future?



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