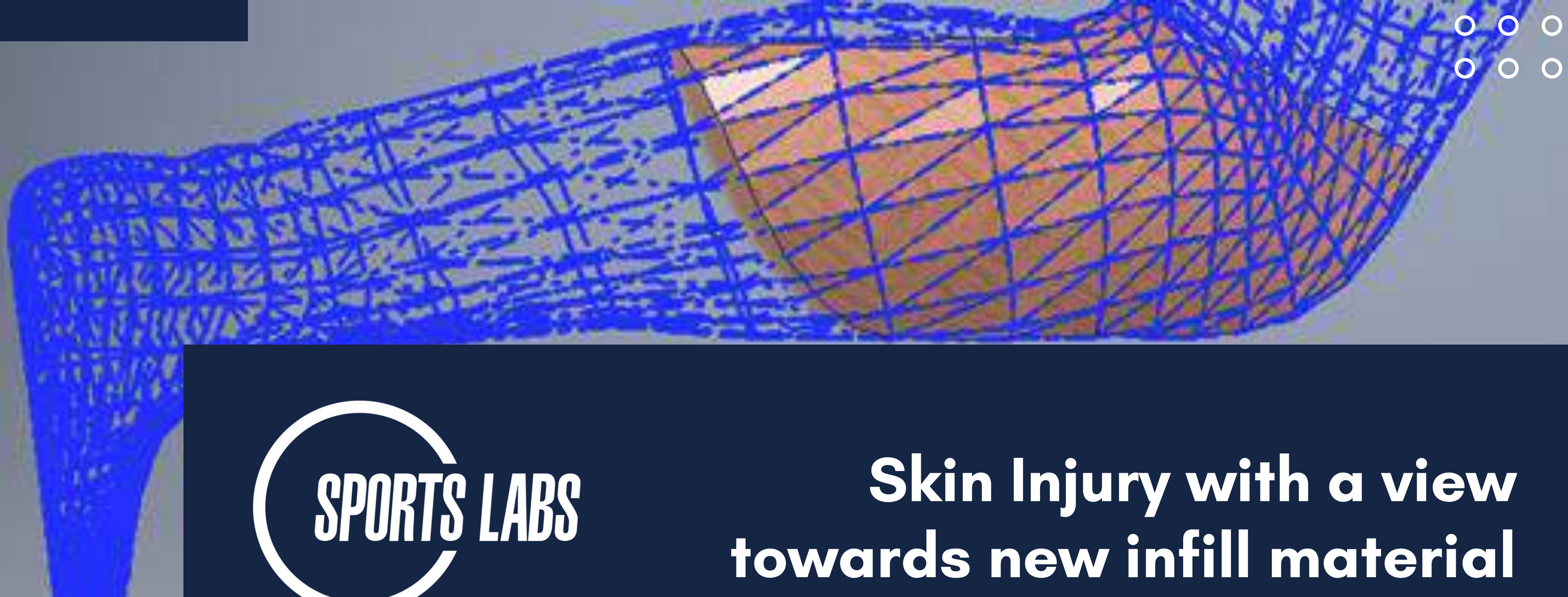




TESTING TECHNOLOGY FOR SPORT

John McLuckie
Innovation + Development Manager

Skin Injury with a view towards new infill material

Simulating realistic player/surface interactions to
assess skin injury possibility on artificial turf.



COVERING TOPICS

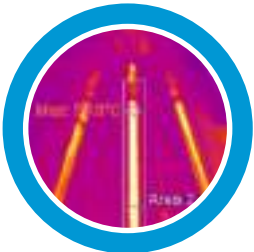
The problem
and the research



The solution –
test apparatus



Test variables & Infills



System infill performance



Impact & mitigation





Risk of Skin Injury?



THE PROBLEM



- Artificial surfaces offer multiple benefits, but possess a skin injury risk for multiple sports
- Skin injuries cause:
 - Pain + discomfort
 - Loss of confidence in playing surfaces
 - Recovery periods
- Skin injury risk potentially alters the way you play the game.

THE PROBLEM



- Existing test apparatus does not represent typical player interactions, isn't dynamic.
- A testing solution was therefore required which:
 - Simulates a more realistic interaction i.e. forces, surface interaction
 - Differentiates between systems + infills
 - Provides repeatable and consistent testing which enables fair comparison and benchmarking.



THE INJURY

TRUE EXTENT OF SKIN INJURY PROBLEM



Literature

Natural - 15/1000 player hours

Artificial - 119/1000 player hours

$$\text{Injury Rate} = \frac{\text{Number of Injuries}}{\text{Exposure}} \times 1000$$

$$\text{Exposure} = \text{Matches} \times \text{Players} \times \text{Duration}$$

Men's

Injuries - 81

Matches - 23 games

Exposure – 75.13 hours

Injury Rate – 1078/1000 player hours

Women's

Injuries - 6

Matches - 3 games

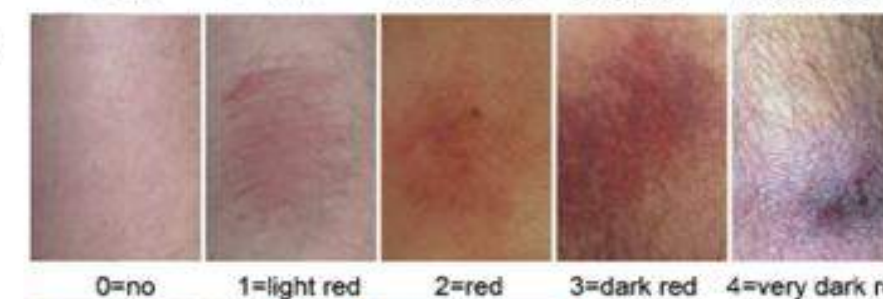
Exposure – 9.8 hours

Injury Rate – 612/1000 player hours

a. Abrasion (A)



b. Erythema (E)



c. Type of exudation (TE)



SDASI

SKIN DAMAGE AND SEVERITY INDEX (SDASI)



0=no 1=mild 2=moderate 3=severe 4=very severe



0=no 1=light red 2=red 3=dark red 4=very dark red

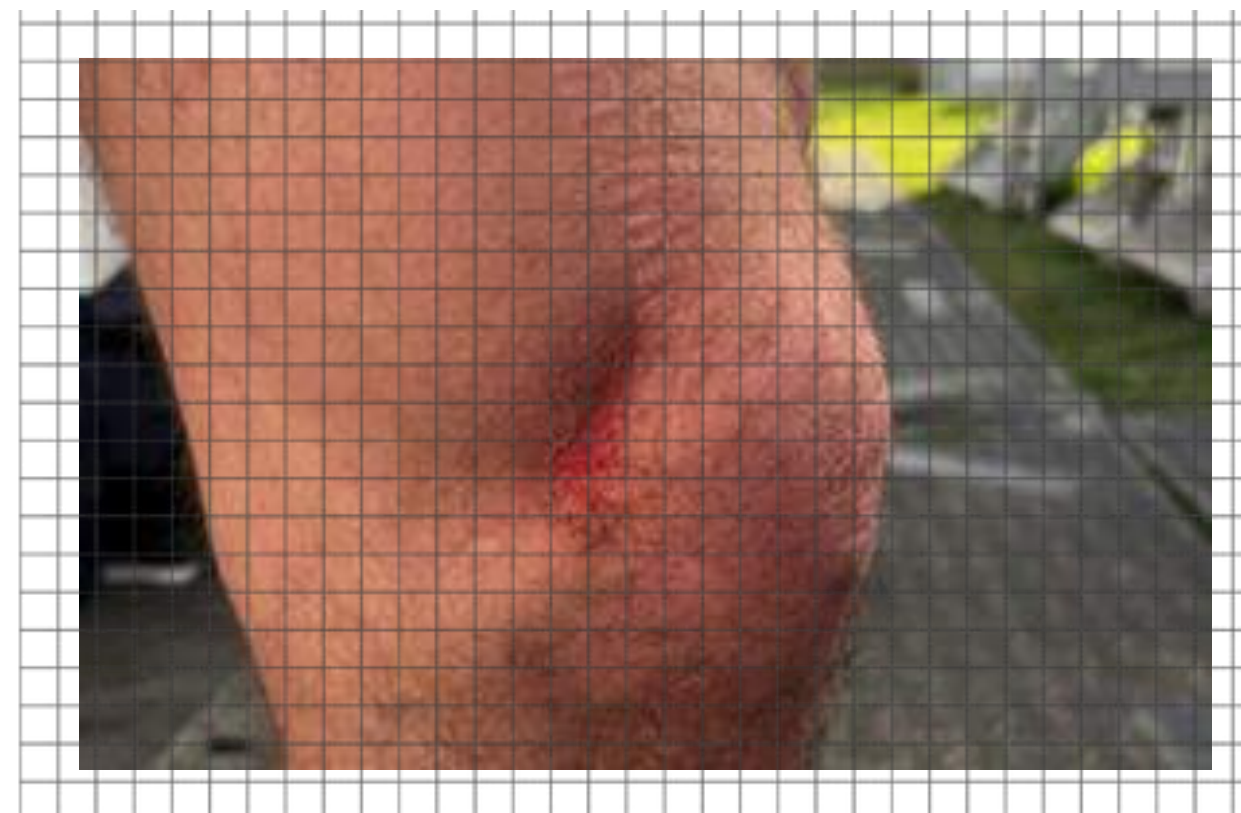


0=dry 1=transparent fluid 2=blood

Psychosensorial assessment of skin damage caused by a sliding on artificial turf: The development and validation of a skin damage area and severity index

Wilbert van den Eijnde^a, Malou Peppelman^b, Martin Olde Weghuis^c, Piet E.J. van Erp^{b,*}

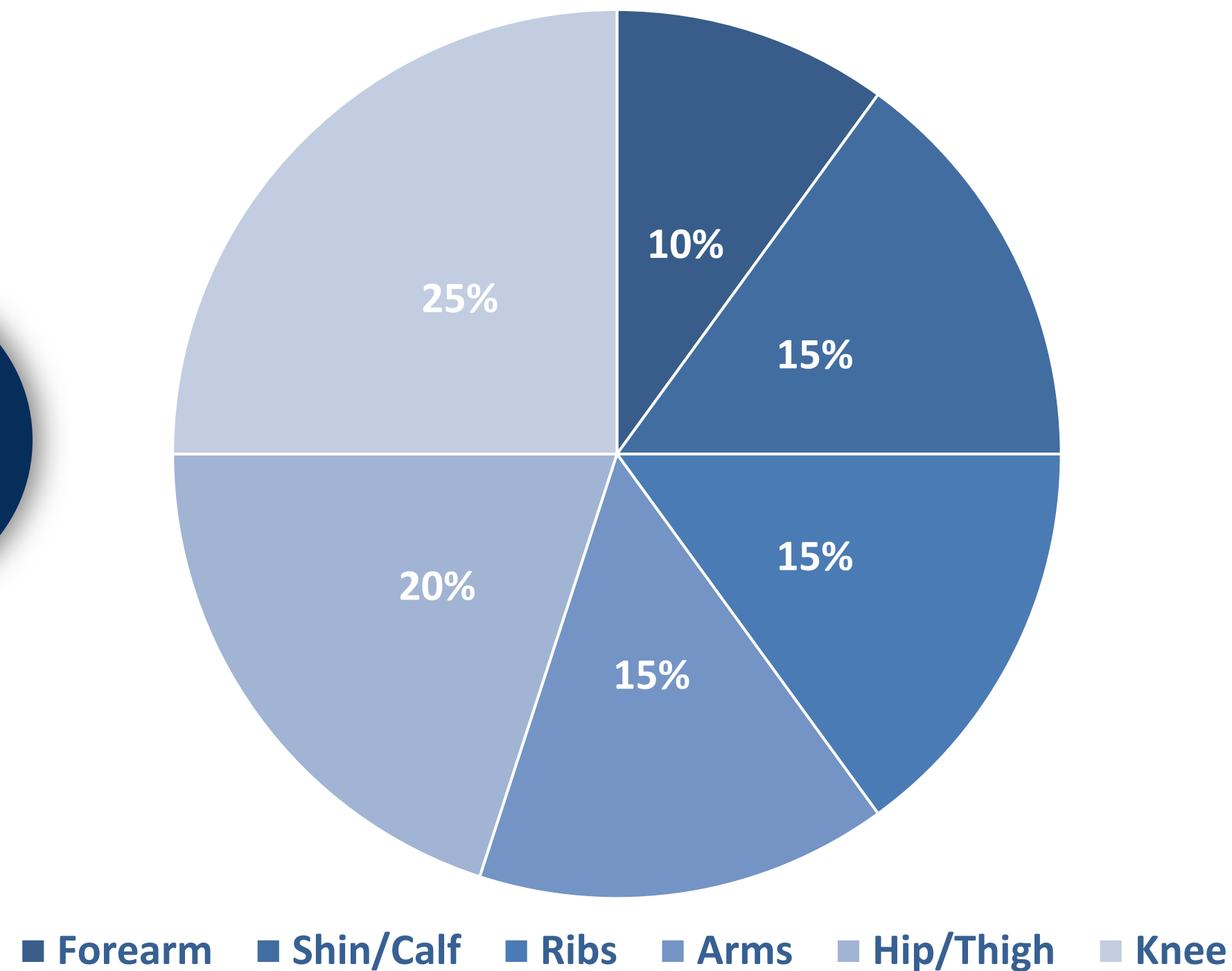
$$SDASI = (A + E + TE) \times I_A$$



*not to scale



INJURY INCIDENCE



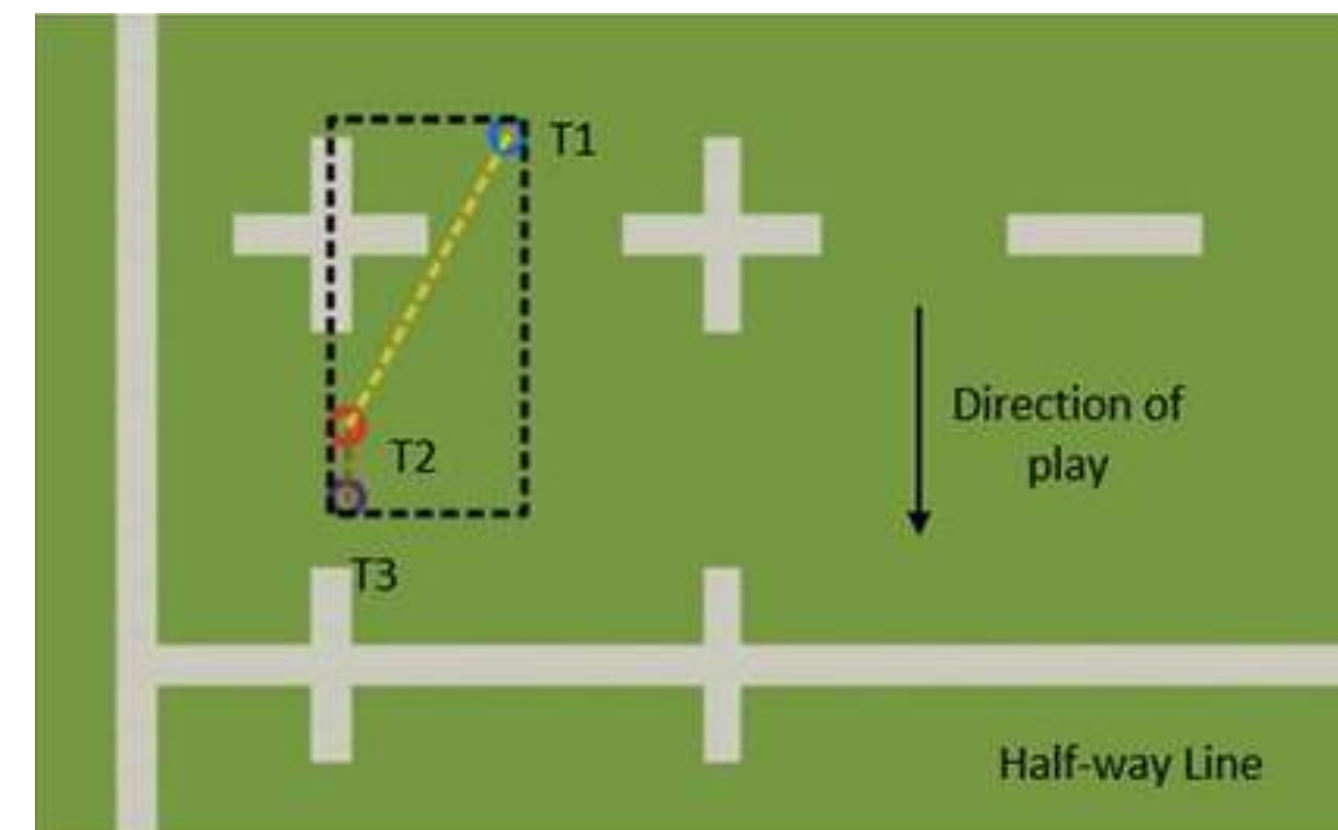


ASI – Abrasion Severity Index

Number of Boxes	Involved Area	Abrasion	Erythema	Type of Exudation	SDAS I
68	6	4	2	1	42

Interaction parameters

Time (s) [T1 - T2]	Distance (m) [T1 - T2]	Speed (m/s) [T1 - T2]	Distance (m) [T2 - T3]	Abrupt or Smooth	Centre of Mass	Body Weight
1.23	8.3	6.7	0.8	Abrupt	Above	100 %

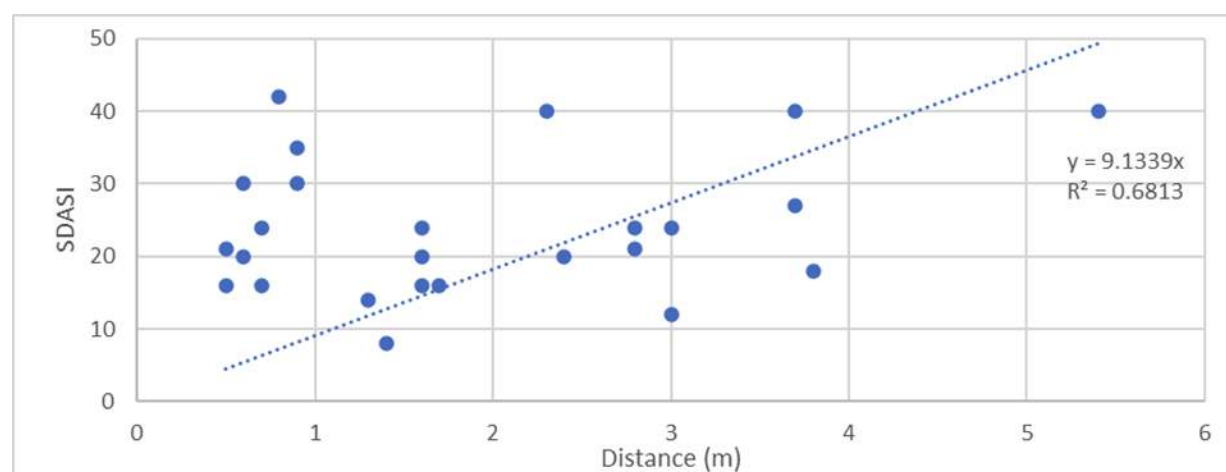




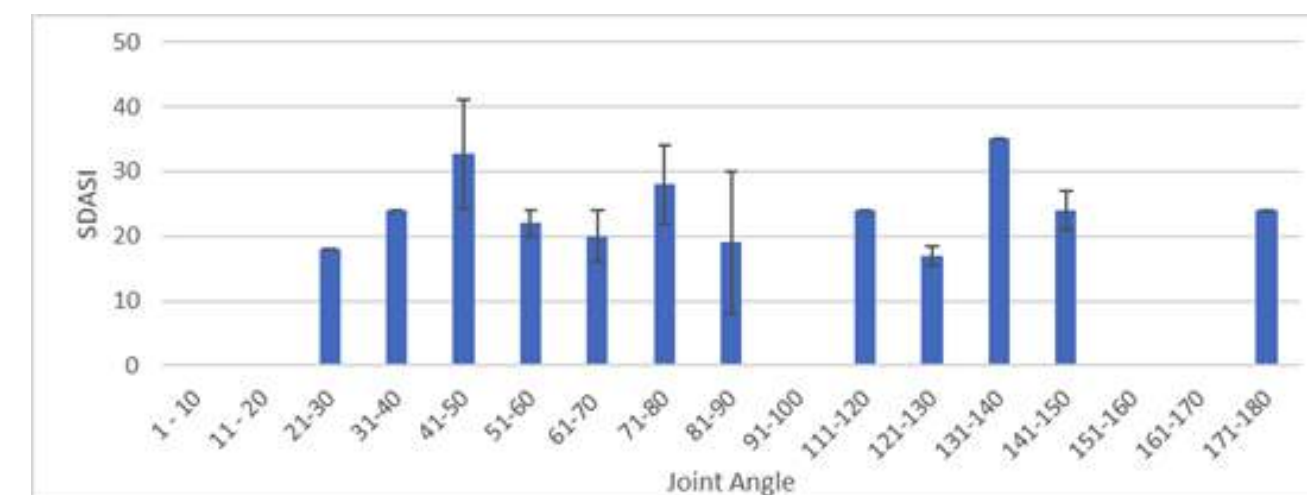
Test Variables



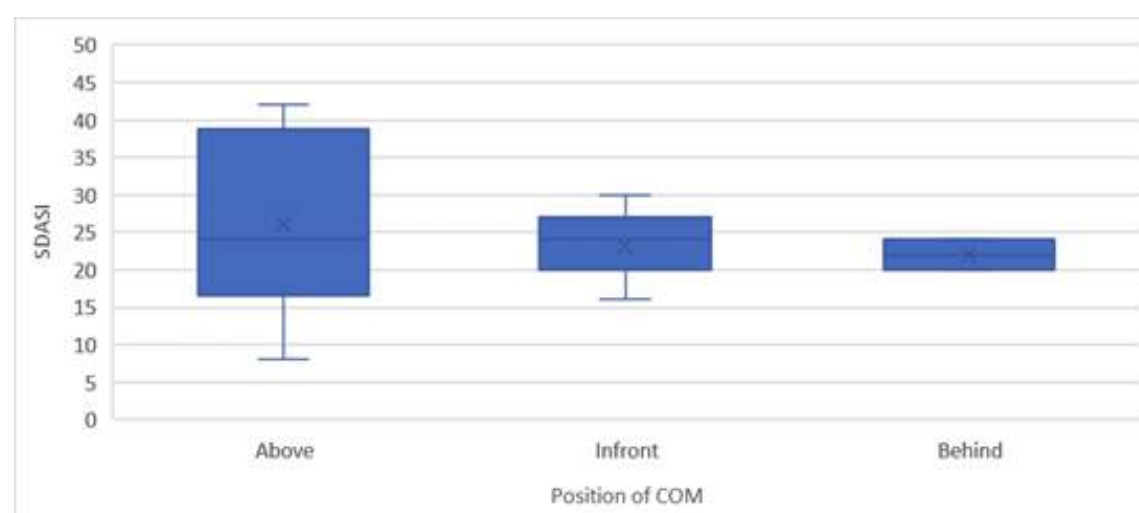
IMPACT OR SLIDING



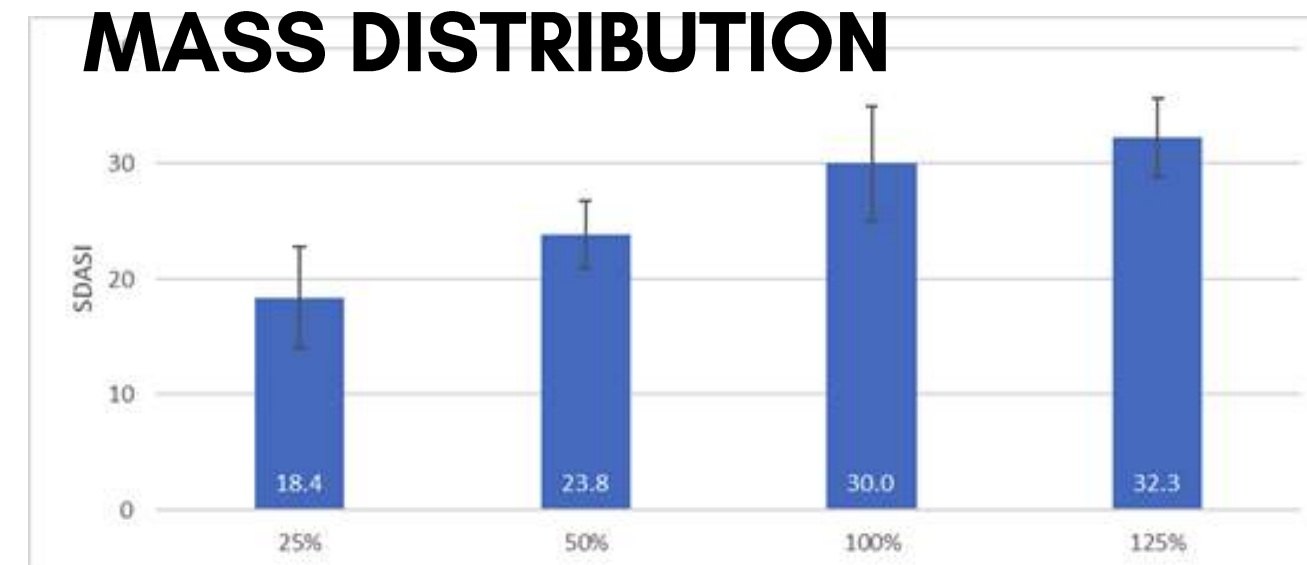
JOINT ANGLE



CENTRE OF MASS



MASS DISTRIBUTION

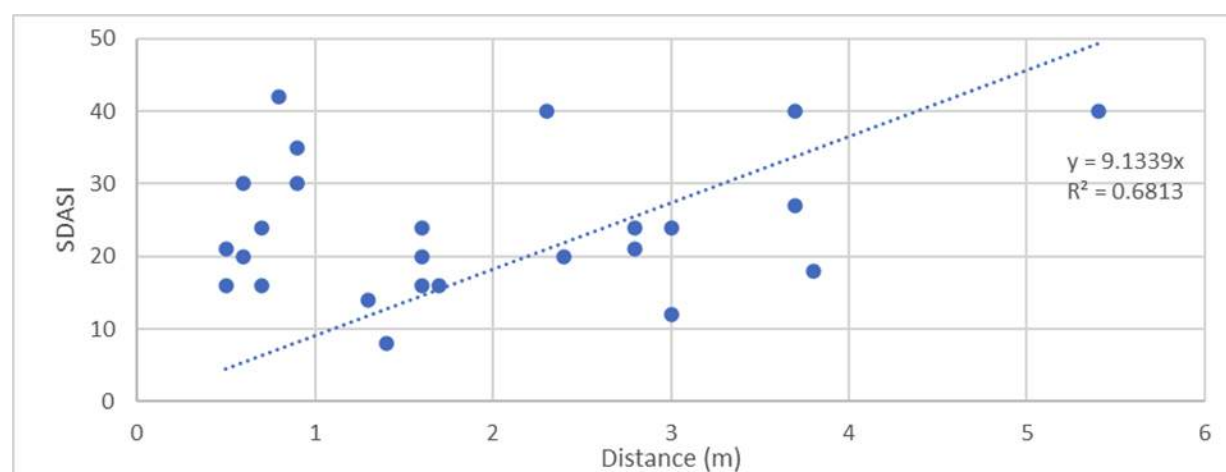




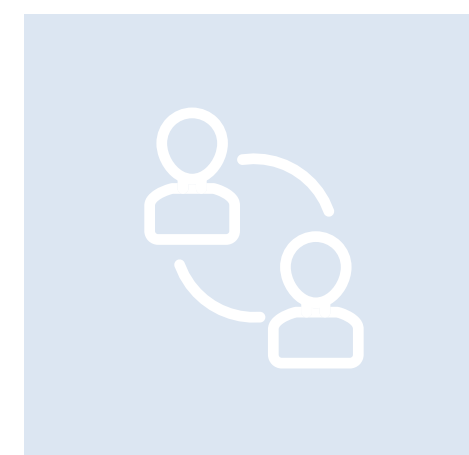
Test Variables



IMPACT OR SLIDING



JOINT ANGLE



CENTRE OF MASS

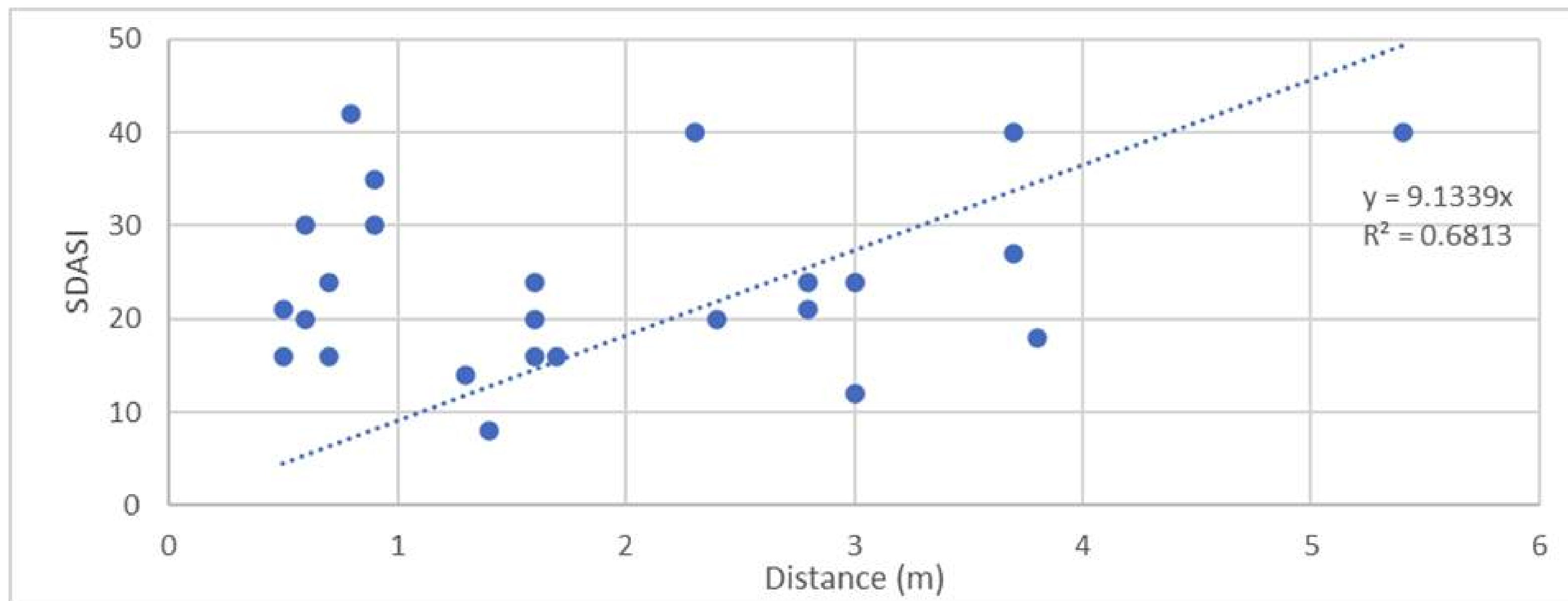


MASS DISTRIBUTION



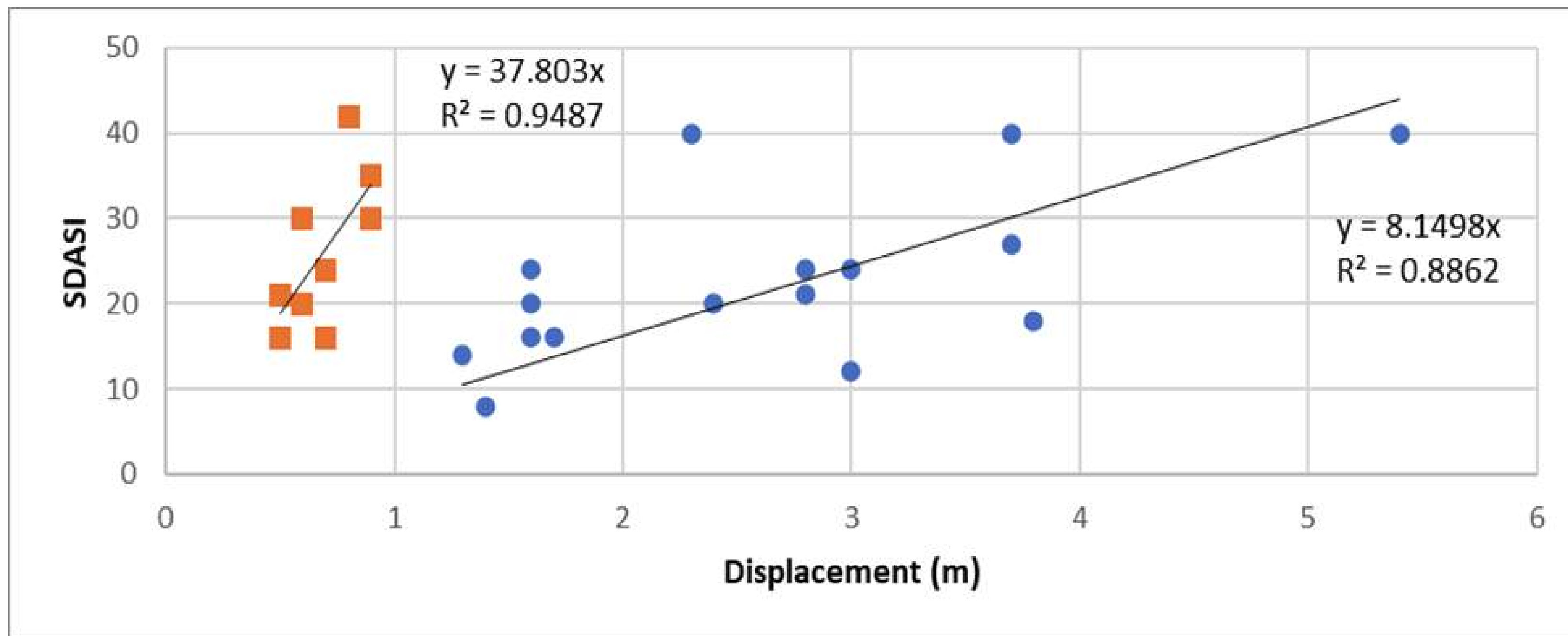


Influence of Sliding Distance





Abrupt vs Smooth

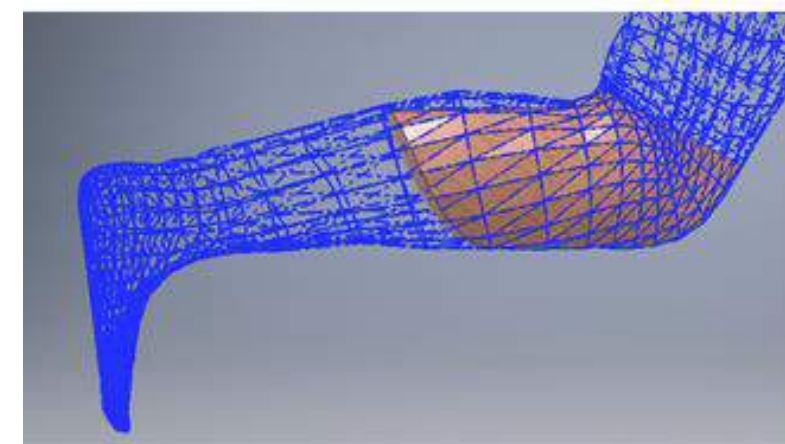




TESTING TECHNOLOGY FOR SPORT

THE TEST IMPACT

INTERACTION CLOSER TO THE PLAYER

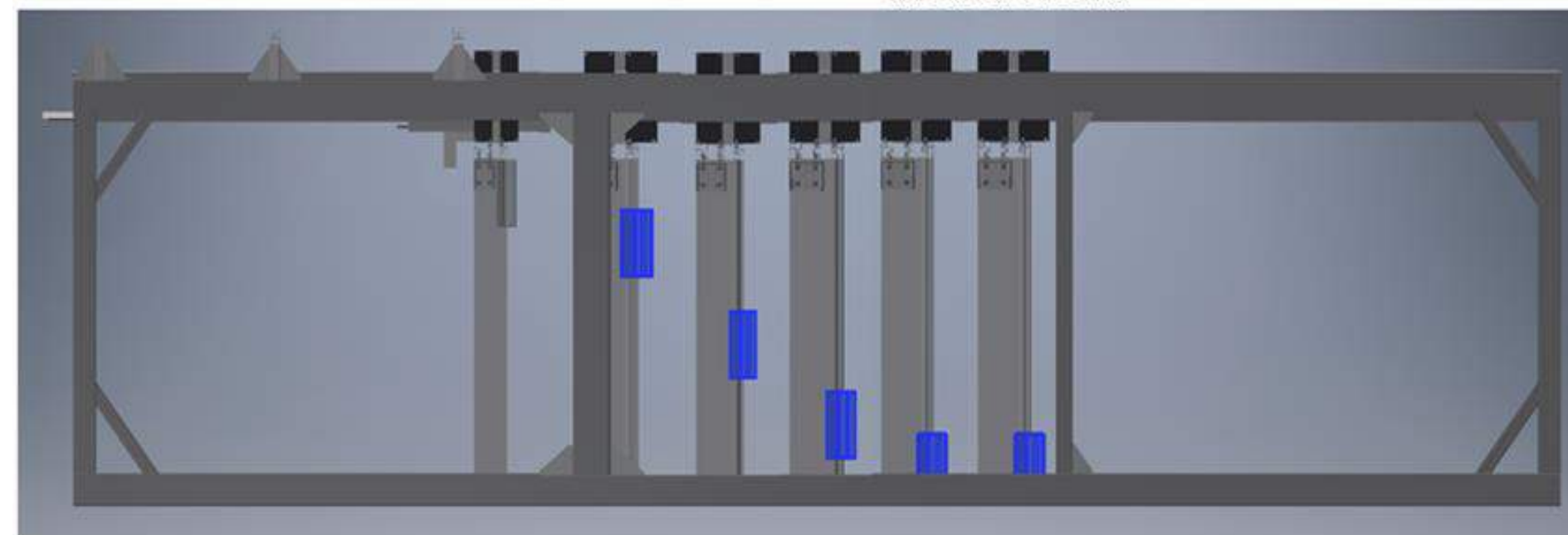


Stage 1
Acceleration

Stage 2
Drop

Stage 3
Impact /
Measurement

Stage 4
Deceleration



**How do we take
research into a test
device?**



TESTING TECHNOLOGY FOR SPORT

Simulated Player

Carriage Mass:	160 kg
Impactor Mass:	36kg
Drop Height:	500 mm
Theoretical Vertical Velocity:	3.13 m/s
Experimental Vertical Velocity:	2.93 ± 0.002 m/s
Horizontal Velocity:	5.01 ± 0.005 m/s

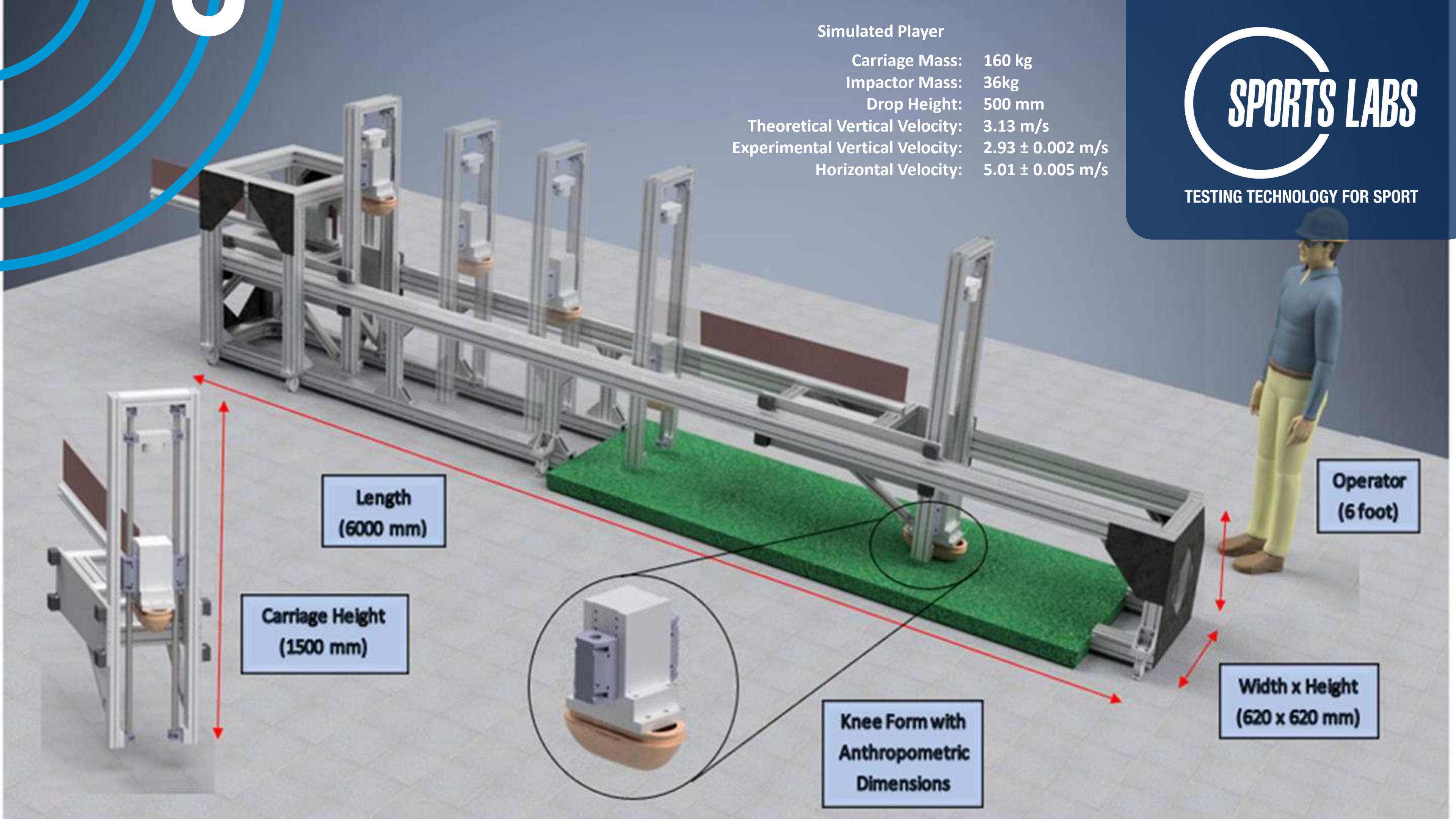
Length
(6000 mm)

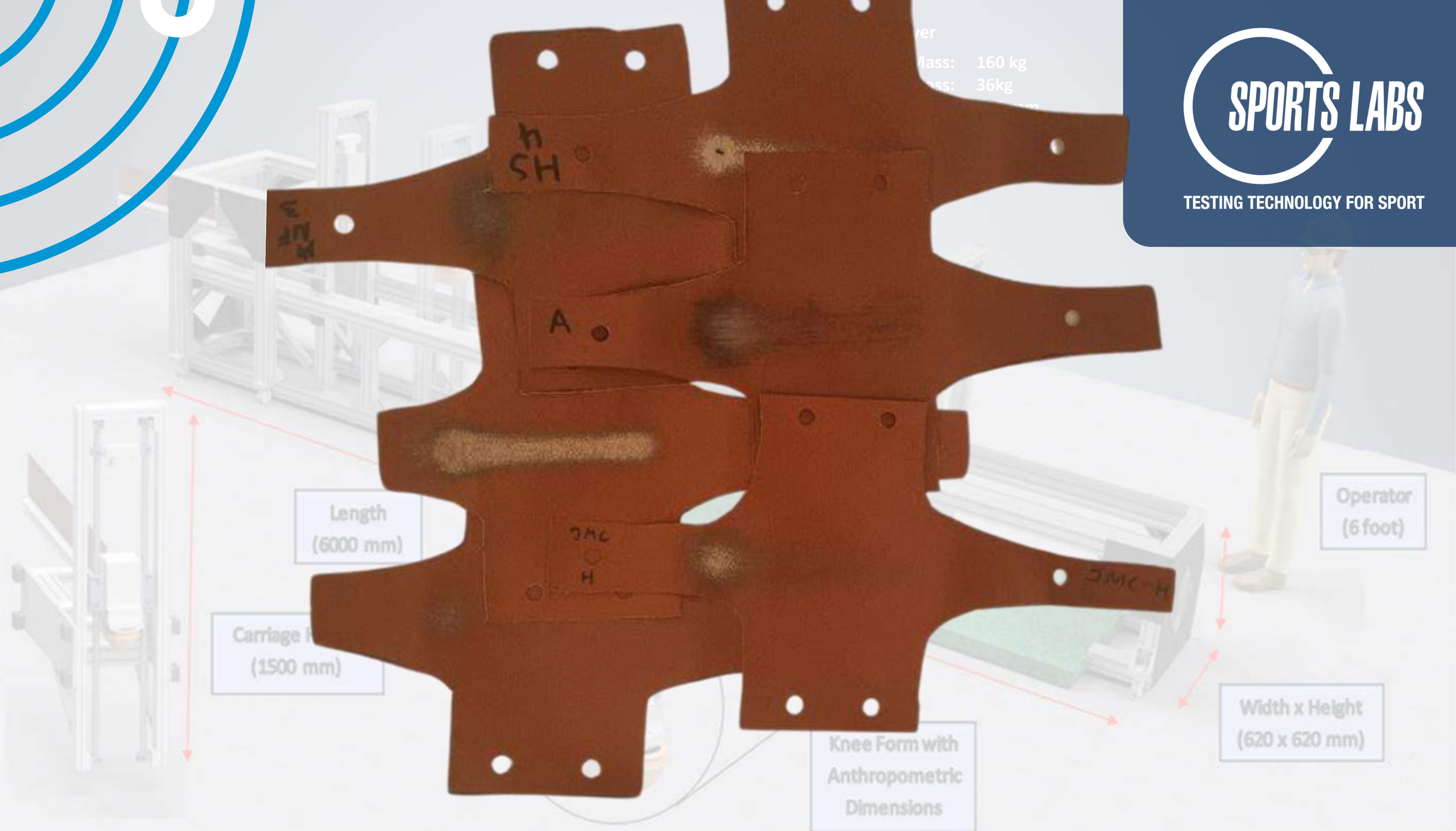
Carriage Height
(1500 mm)

Operator
(6 foot)

Width x Height
(620 x 620 mm)

Knee Form with
Anthropometric
Dimensions





Length
(6000 mm)

Carriage
(1500 mm)

Operator
(6 foot)

Width x Height
(620 x 620 mm)

Knee Form with
Anthropometric
Dimensions

Mass: 160 kg
Mass: 36kg
Mass: 100 kg

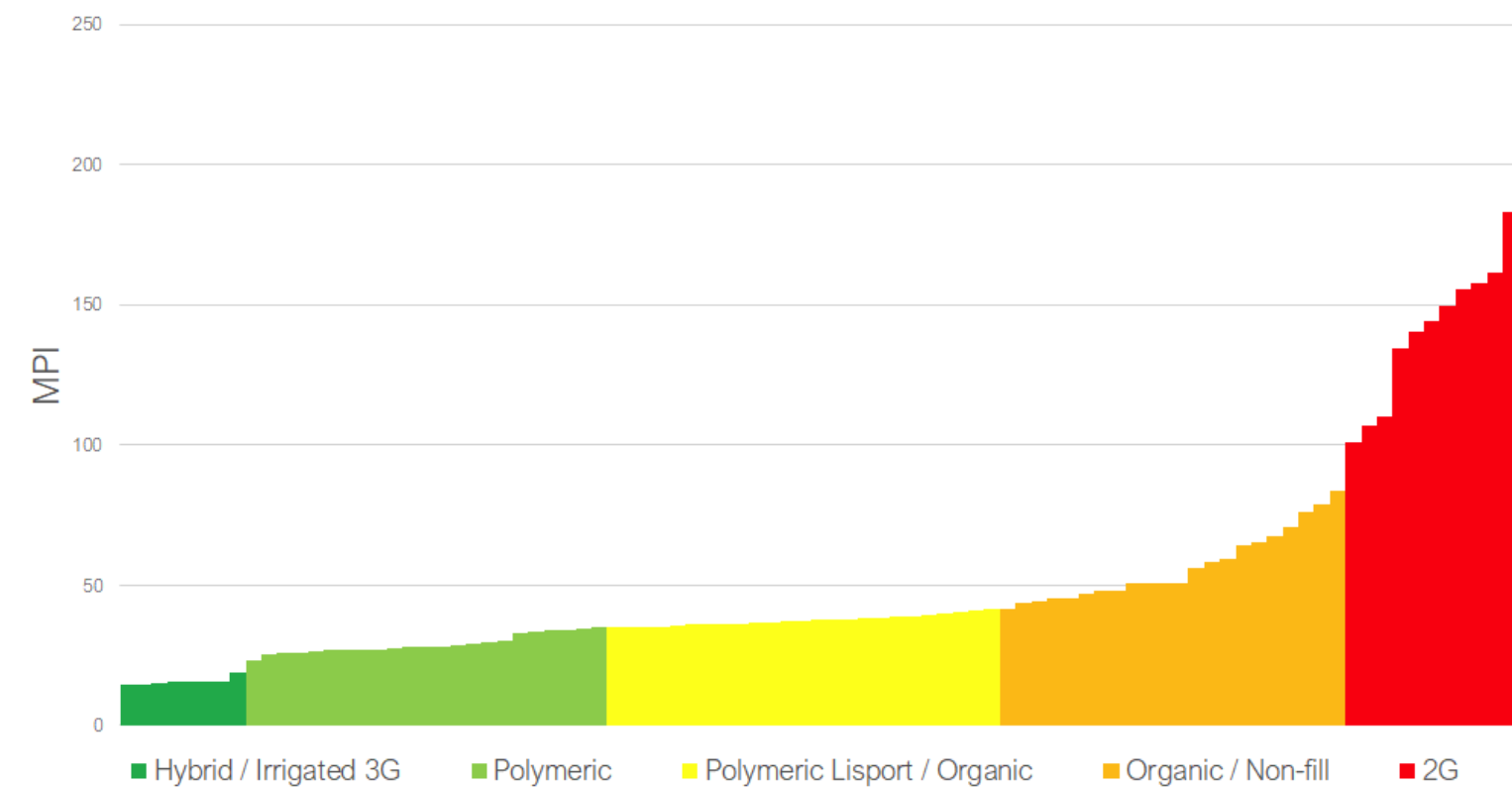


Knee Form With
Anthropometric
Dimensions

(620 x 620 mm)

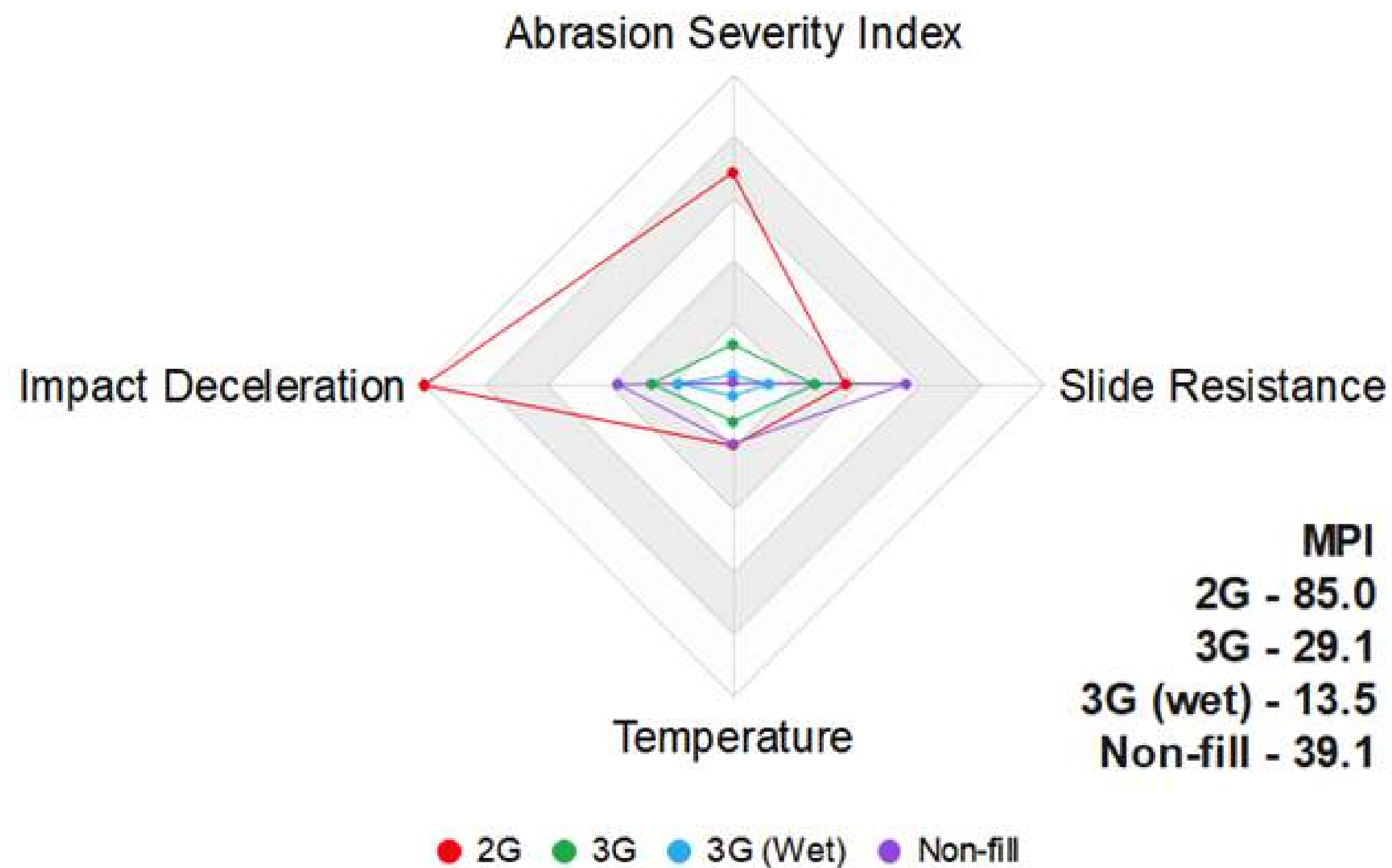


Categorisation



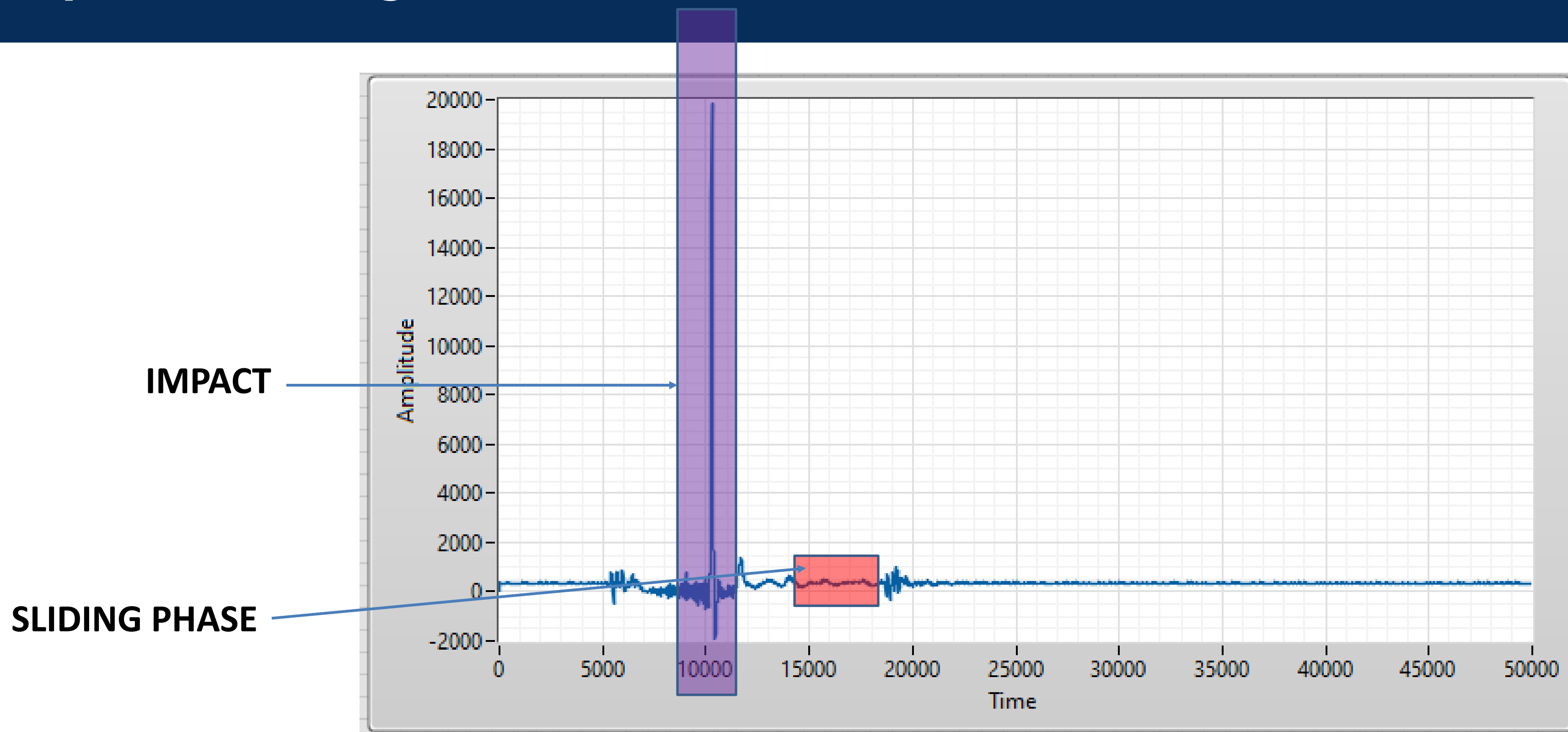


The Maxwell Protection Index



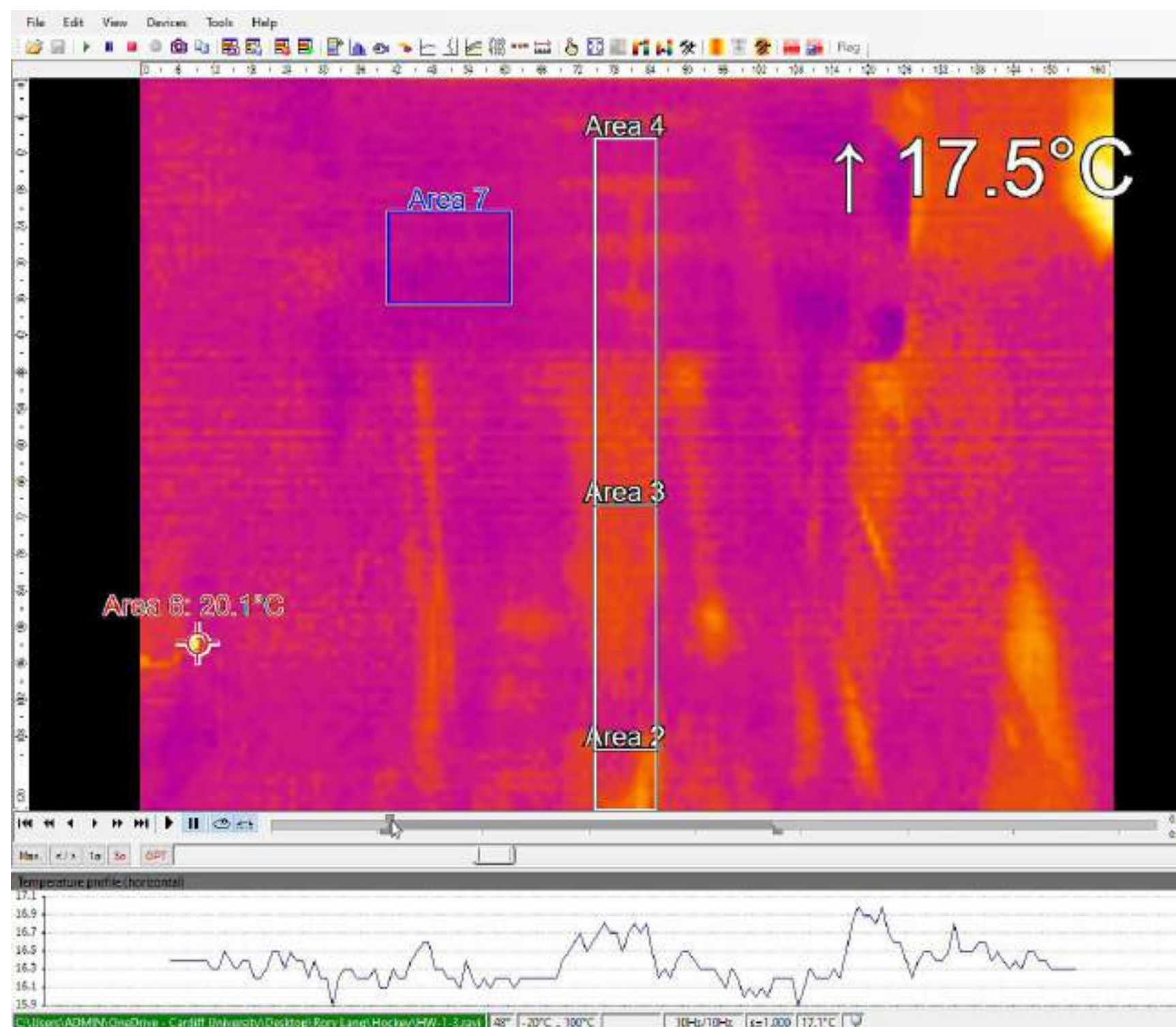


Impact v Sliding Phase

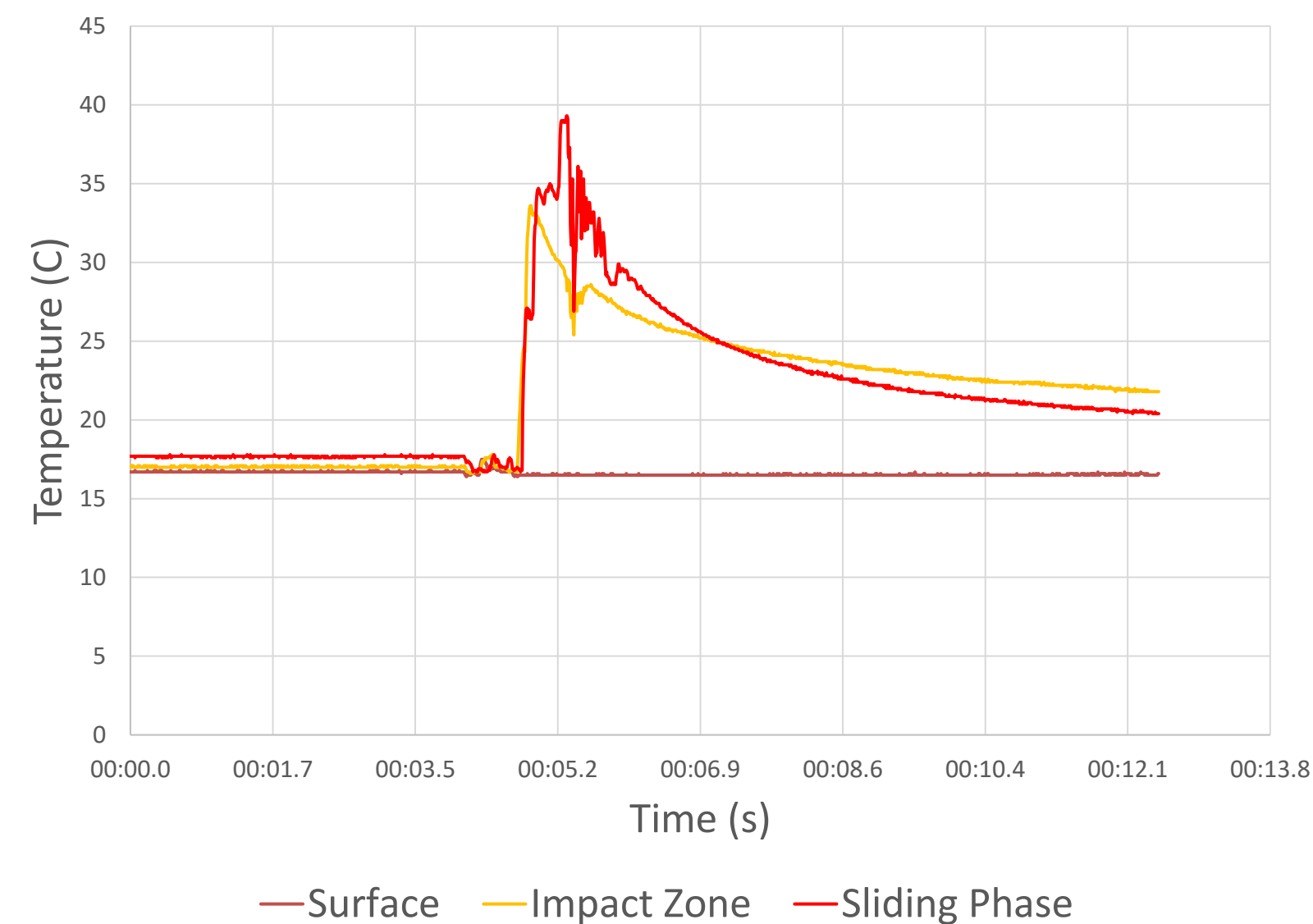




Temperature

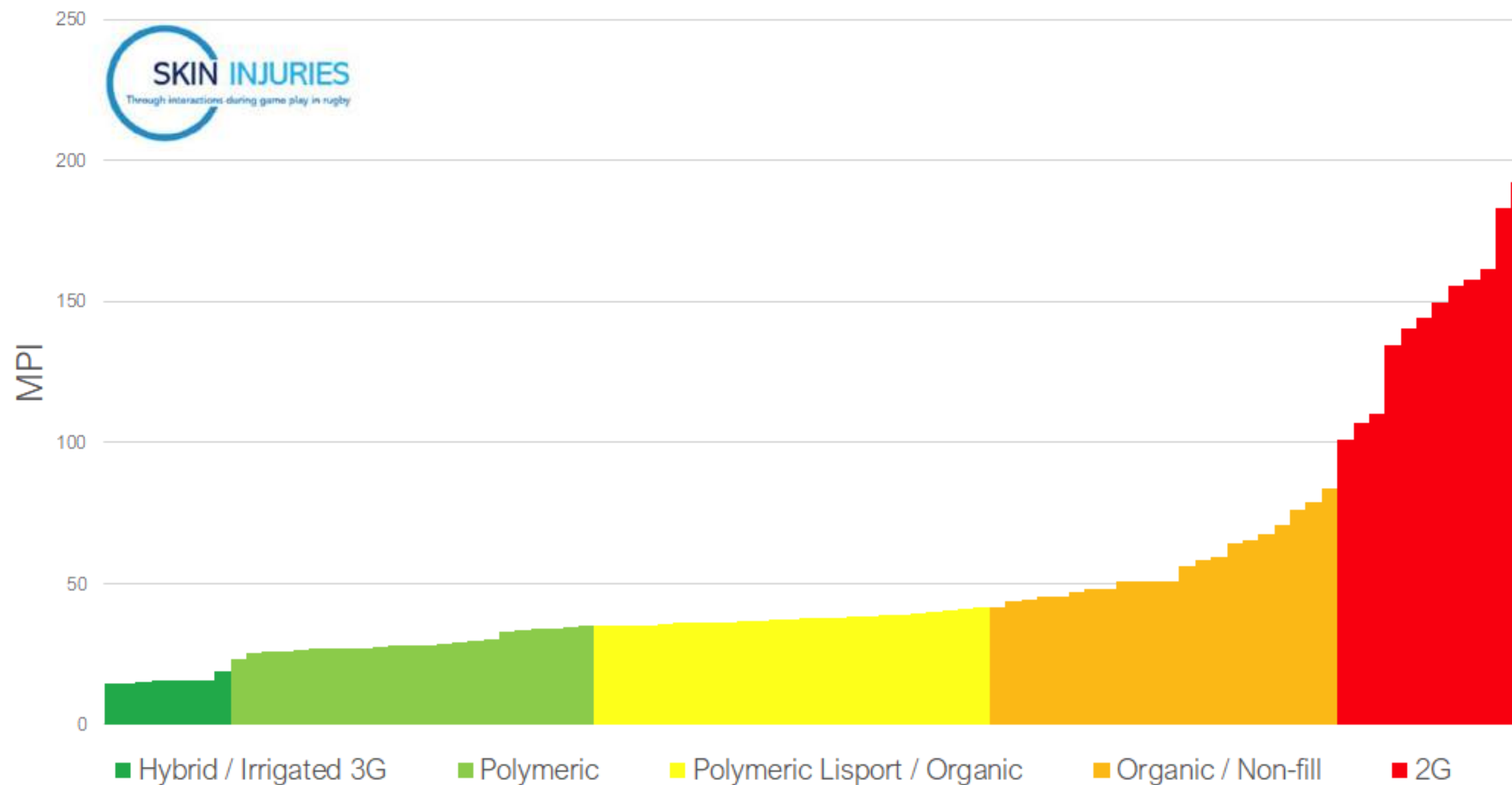


Monitoring Surface Temperature to Assess Skin Injury Risk



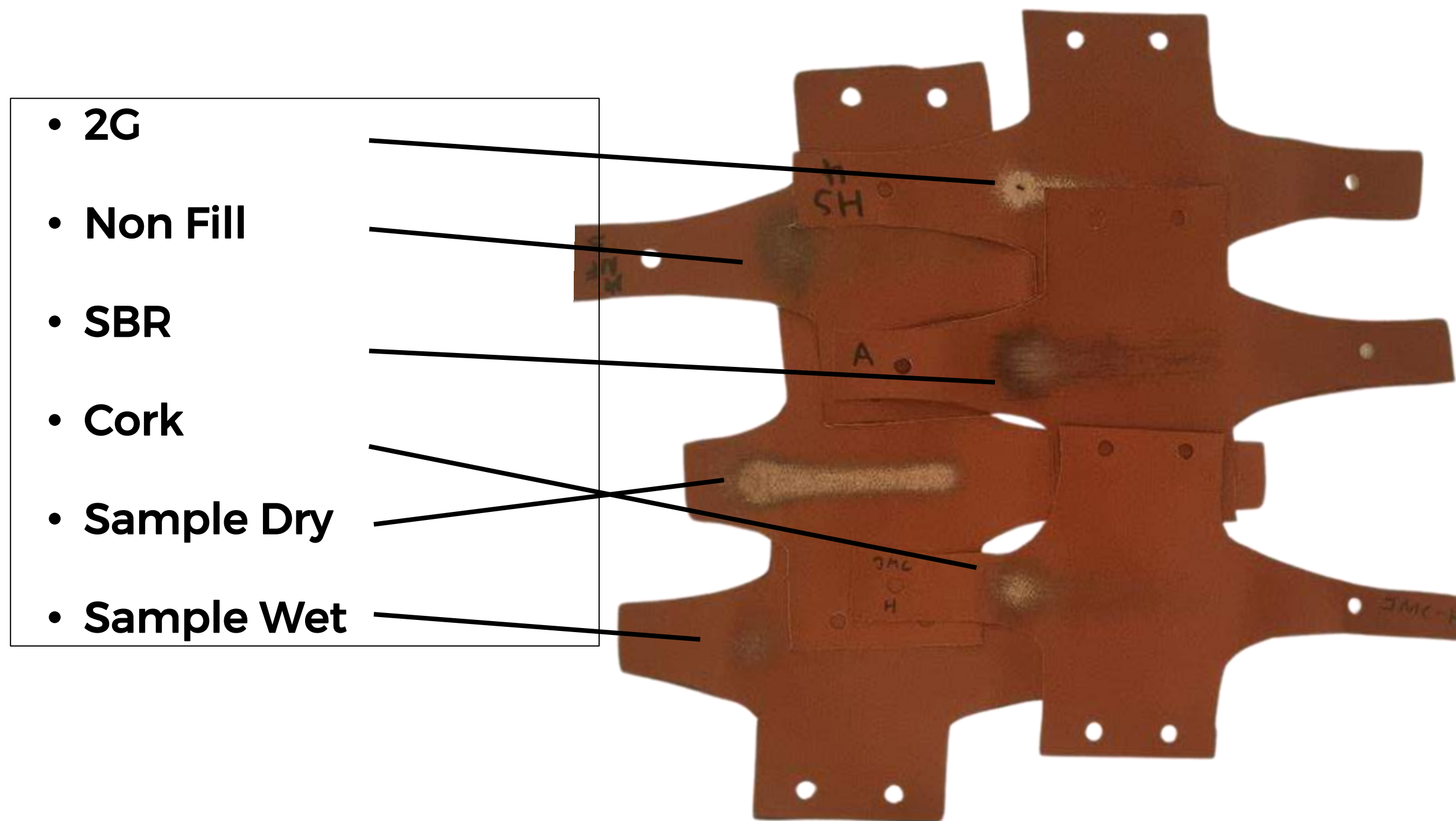


The Maxwell Protection Index





Skin Samples

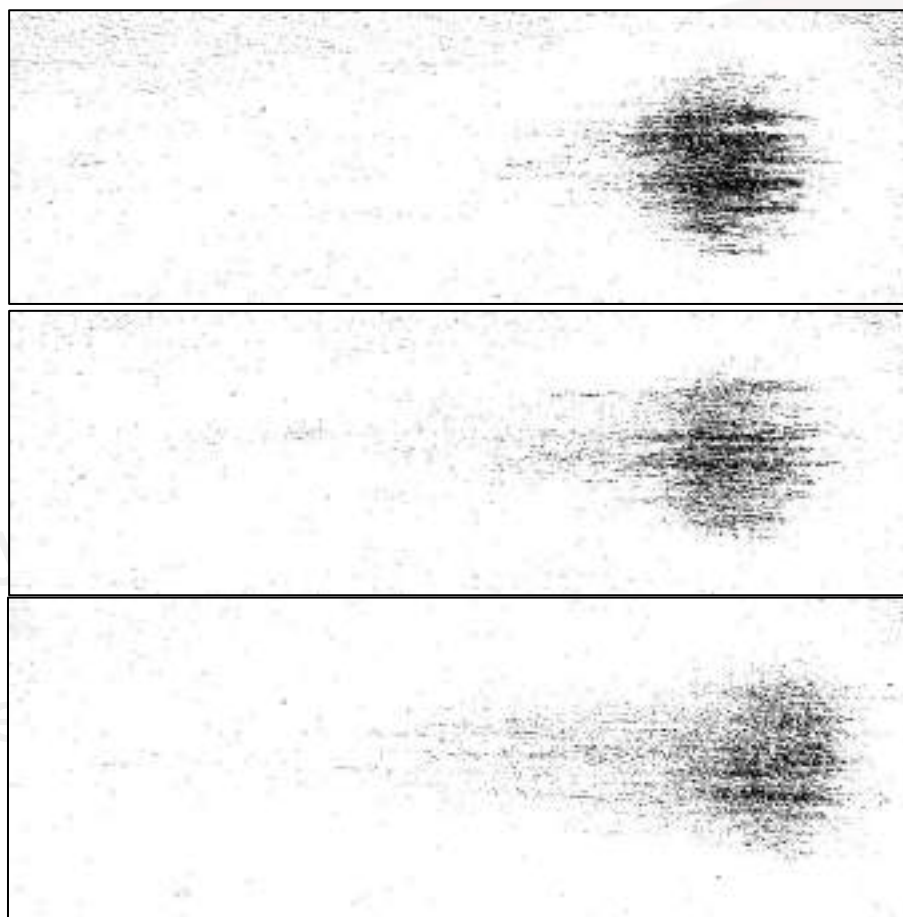




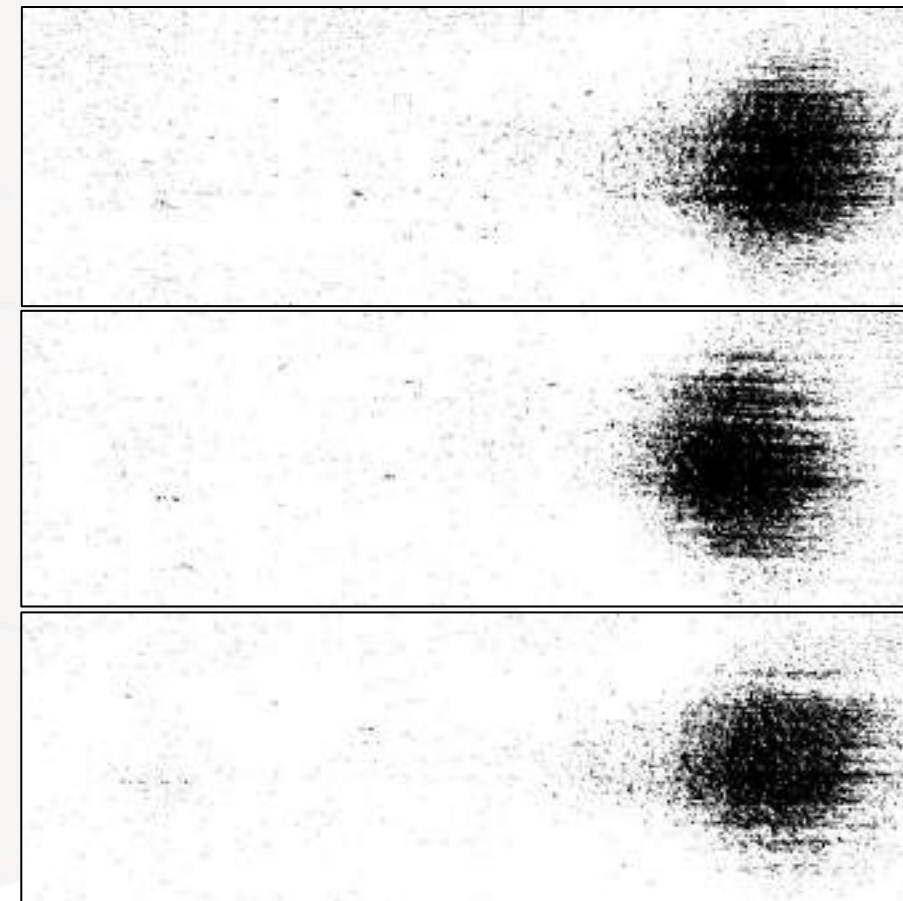
Skin Samples

- 2G
- Non Fill
- SBR
- Cork
- Sample Dr
- Sample We

SBR

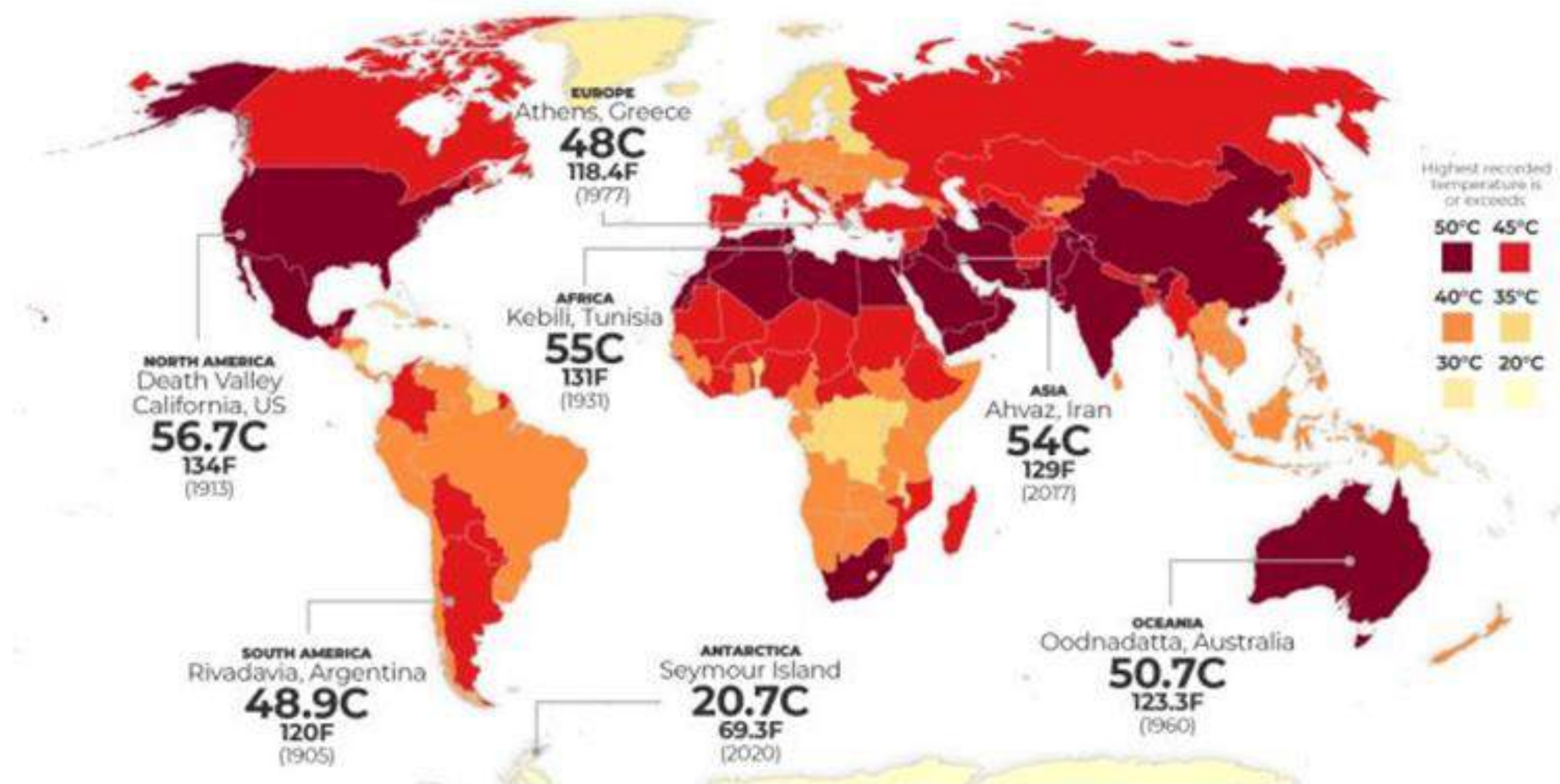


Organic





Geography v Impact

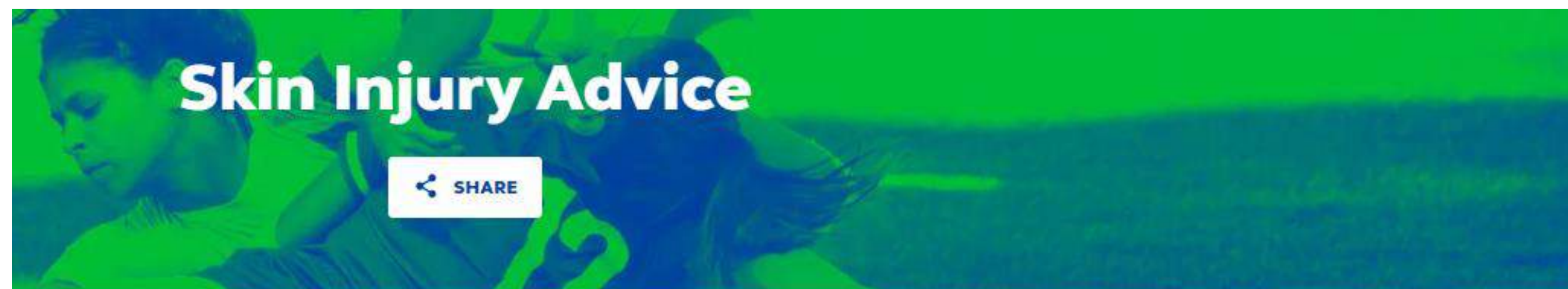




Guidance



TESTING TECHNOLOGY FOR SPORT



Reducing Abrasion Risk

World Rugby are working to reduce skin abrasion risk on artificial turf via a new field test method which better represents a player-surface interaction in motion.

From this ongoing research, good field maintenance has been identified as a way to reduce the risk of injury. Key practices for facilities owning artificial fields are:

1. Keeping fibres upright.
2. Keeping infill mobile.

Contents

[Reducing Abrasion Risk](#)

[Artificial Turf Field Maintenance Recommendations](#)

[Player Mitigation](#)



Moving Forward + The Mitigation



LAB V FIELD

Where are the differences that we need to consider



PLAYER BEHAVIOUR

Is player behaviour changing and will it affect the game, is this acceptable?



WEATHER

Different climates will suit different products better



INNOVATION

There are many opportunities with component alterations. MPI factors



WEARABLE TECH

Clothing and protection advancements



FOCUS

For innovation how do we focus our attention as an industry. Traction?



THE FUTURE OPPORTUNITY

An industry with solutions

- A trusted metric for comparison
- Lab to field development (Phase 2)
- Knowledge transfer in mitigation
- Infill types by climate
- Increase or decrease traction, material shape
- End user and how do they interact



TESTING TECHNOLOGY FOR SPORT

QUESTIONS

Supporting innovation with the best metrics