GDC

March 21-25, 2022
San Francisco, CA

FIFA 22's Hypermotion

Full Match Capture Driving Machine Learning Technology

#GDC22

EA SPORTS
HYPERMOTION
TECHNOLOGY
01. ADVANCED 11V11 MATCH CAPTURE
02. MACHINE LEARNING
*Exclusive To PlayStation© 5, Xbox Series X|S & Stadia

Agenda

- Full Match Motion Capture
- Workflow and Animation Data Comparison
- Augmenting Motion Data With 3D Ball Data
- Machine Learning: ML FLow

Full Match XSens Capture

The Inspiration

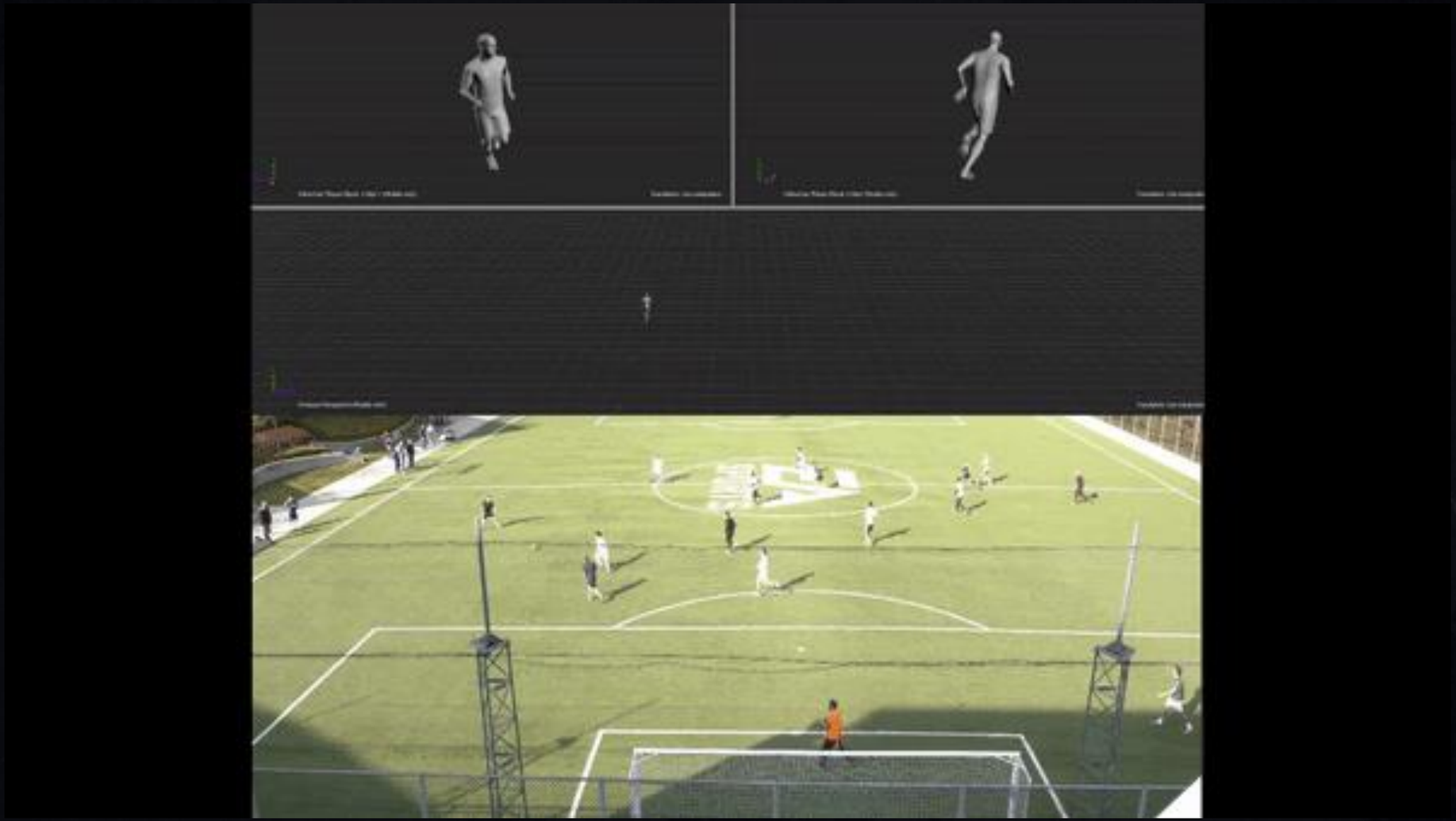
The Problem

Optical Motion Capture:

- Physical space too small for organic match capture
- Local talent pool is limited
- Competitive atmosphere is missing

Optical Motion Capture

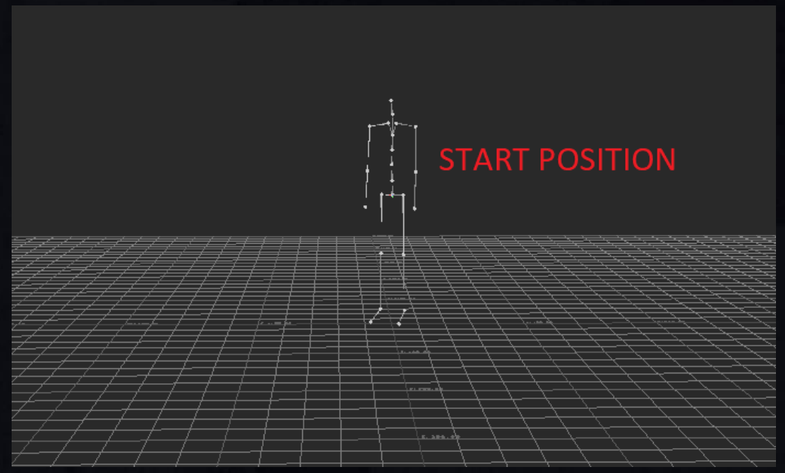
XSens - Prototype



Problems to Solve

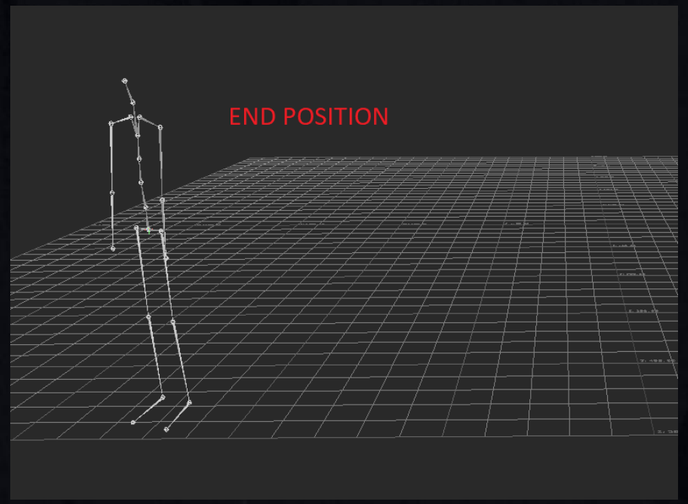
Player Drift:

Sensor based capture solutions experience drift on root. Upwards of 12 feet over 10-minute take.



No Ball Data:

Need to reconstruct ball data from video.



Solving Drift

Local Positioning (LPS)

- WIMU Pro
- Accurate within 5cm

Reconstructing Ball Data

Generate from Video

- Multiple Static Cameras
- Computer Vision
- Distinctly Colored Ball

The Shoot

Shoot Requirements

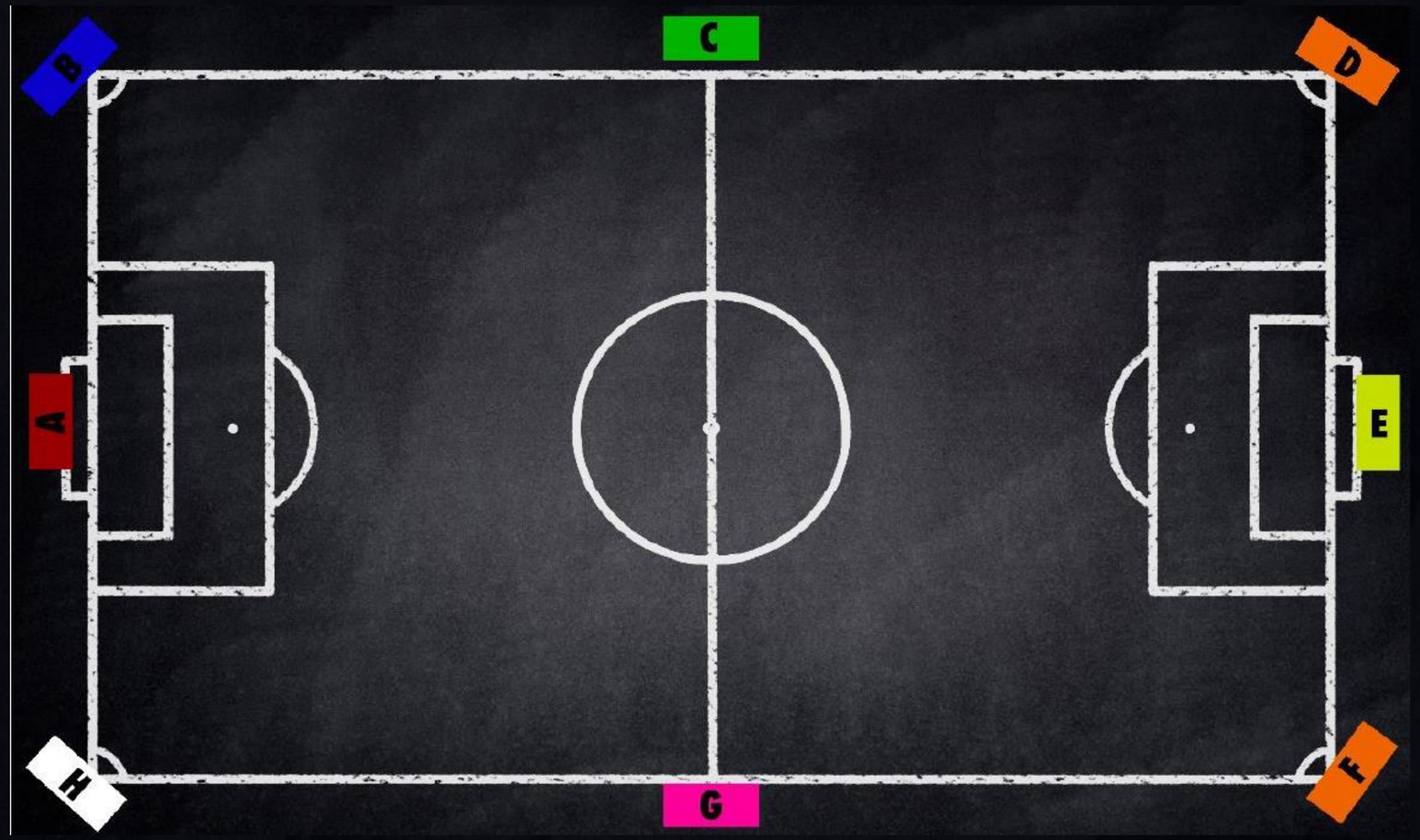
XSens Setup

- Mark Start points and facing for each take.
- Clap at beginning of take to help sync video and XSens data.

Camera Setup

Considerations

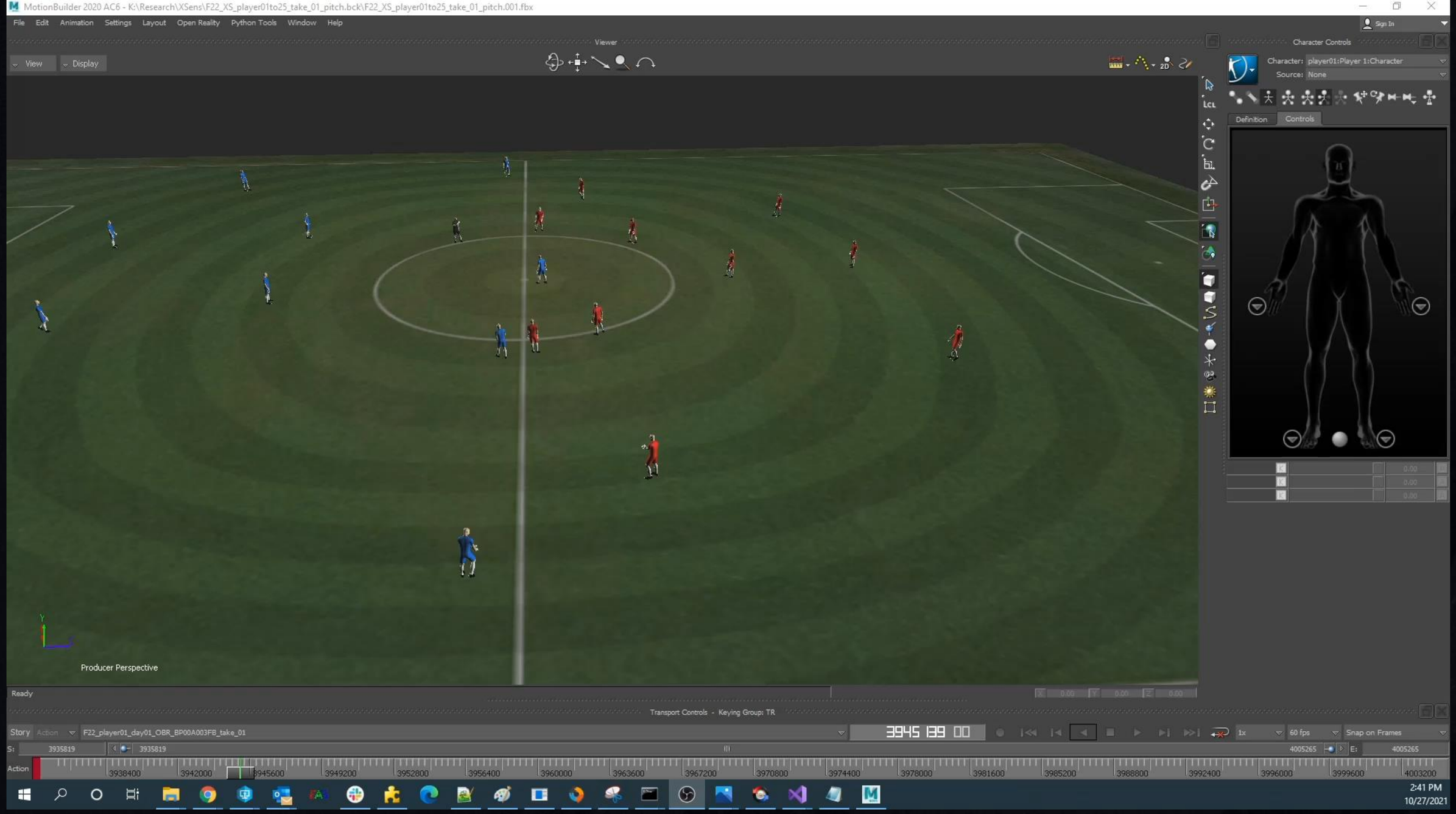
- 8 static 8K cameras (8K @50fps)
- 270MB per second – lots of SD cards!
- Video watermarked with absolute timecode to sync XSens/video



During the Shoot

Takes

- 10-15 minute takes
- Referee responsible for ending take
- High intensity and fidelity


MotionBuilder 2020 AC6 - K:\Research\XSens\F22_XS_player01to25_take_01_pitch.bck\F22_XS_player01to25_take_01_pitch.001.fbx
File Edit Animation Settings Layout Open Reality Python Tools Window Help
Viewer
View
Display
Character Controls
Character: player01:Player 1:Character
Source: None
Definition
Controls
Producer Perspective
Ready
Transport Controls - Keying Group: TR
Story
F22_player01_day01_OBR_BP00A003FB_take_01
Action
60 fps
Snap on Frames
2:41 PM
10/27/2021

Animation Workflow

Uncategorized Motion

New Animator Workflow

- Optical Mocap Workflow:
  - Order takes from shot list.
  - Work on short specific animations.

- Full Match Capture: Giant blob of data with no context or way to search.

- Need to build a shot list.

Workflow – Finding Animation

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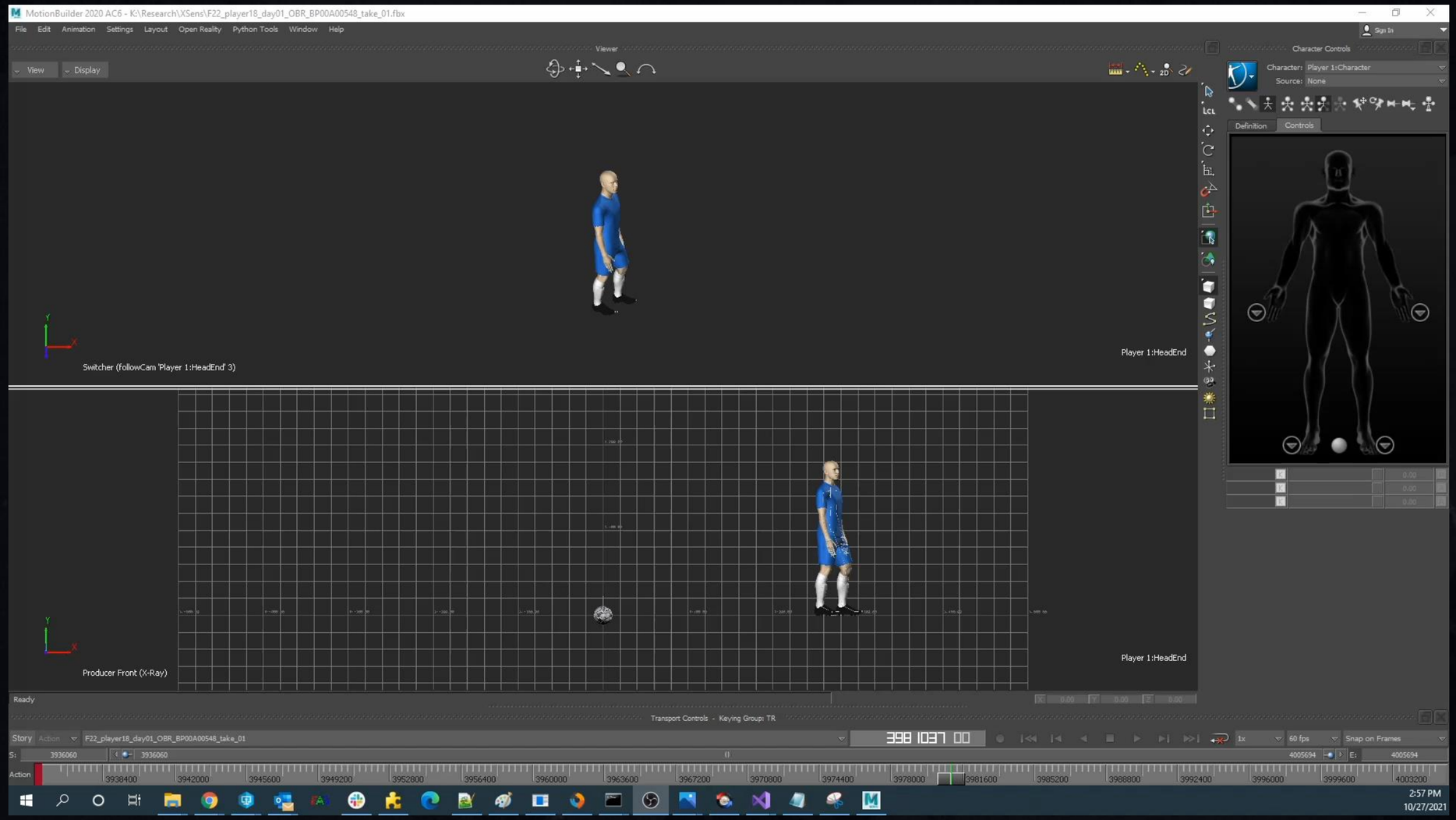
Workflow – Finding Animation

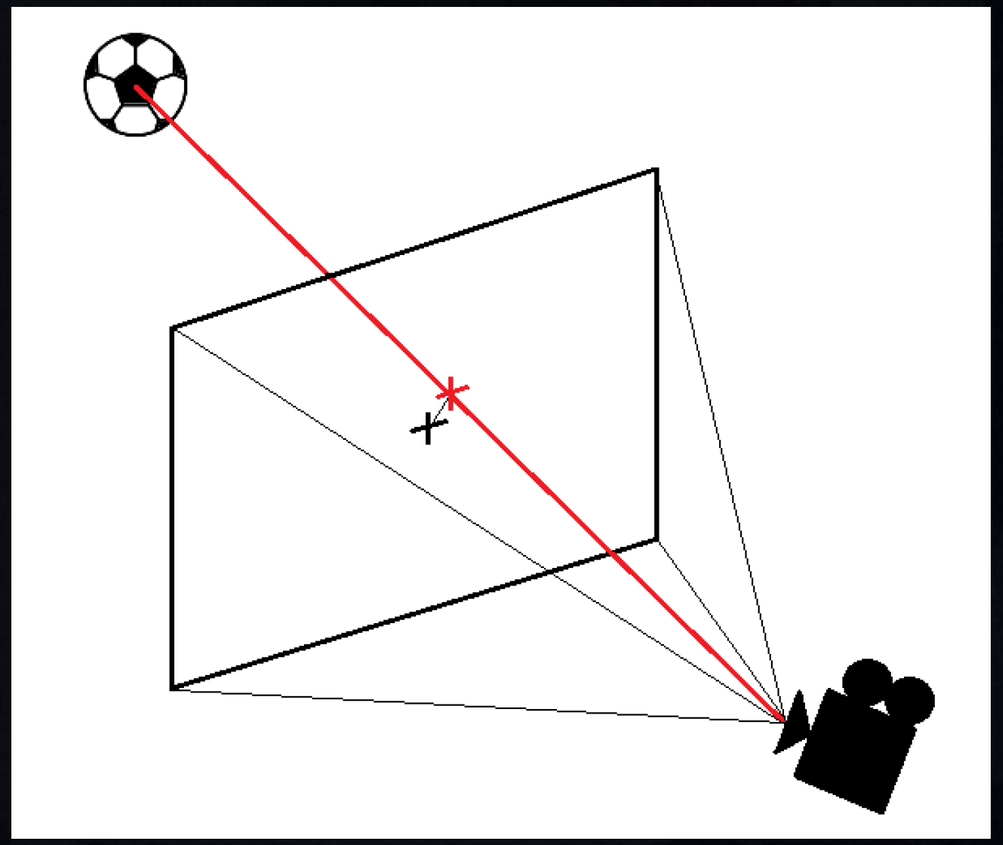


Xsens Match

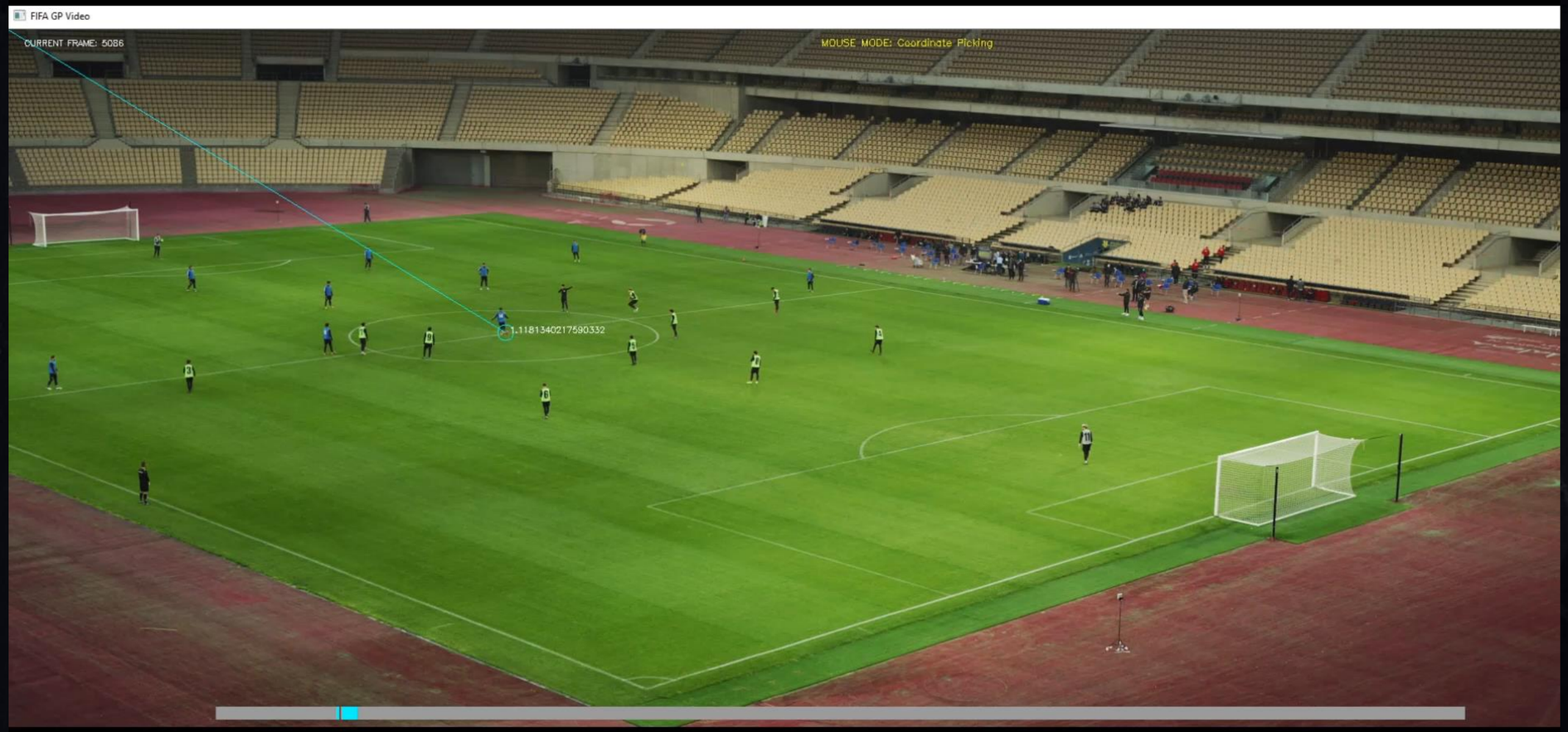
Generating Ball Data from Video

Projection

Projection matrix: 3D -> 2D, but also 2D -> 3D



Ball Tracking



Tracking Pipeline

Camera Calibration

Viewer
View
Display
Switcher (followCam 'Player25:Ball02:TrajectoryEnd') (X-Ray)
Ready
Transport Controls - Keying Group: TR
Story
F22_Madrid_ALL_CHAR_take_01
60 fps
Snap on Frames
Action

Ball Physics

Tuning Physics

Iteration Loop

- Launch game ball side-by-side real trajectory
- Compare and live-tune physics parameters
- Repeat

LIV
0 - 0
MCI
25:33
47 FODEN
66EXANDER-ARNOL
FIFA 22 STILL IN DEVELOPMENT. CAPTURED IN-GAME.

Machine Learning: ML Flow

Prior ML Work

Generic ML Runtime

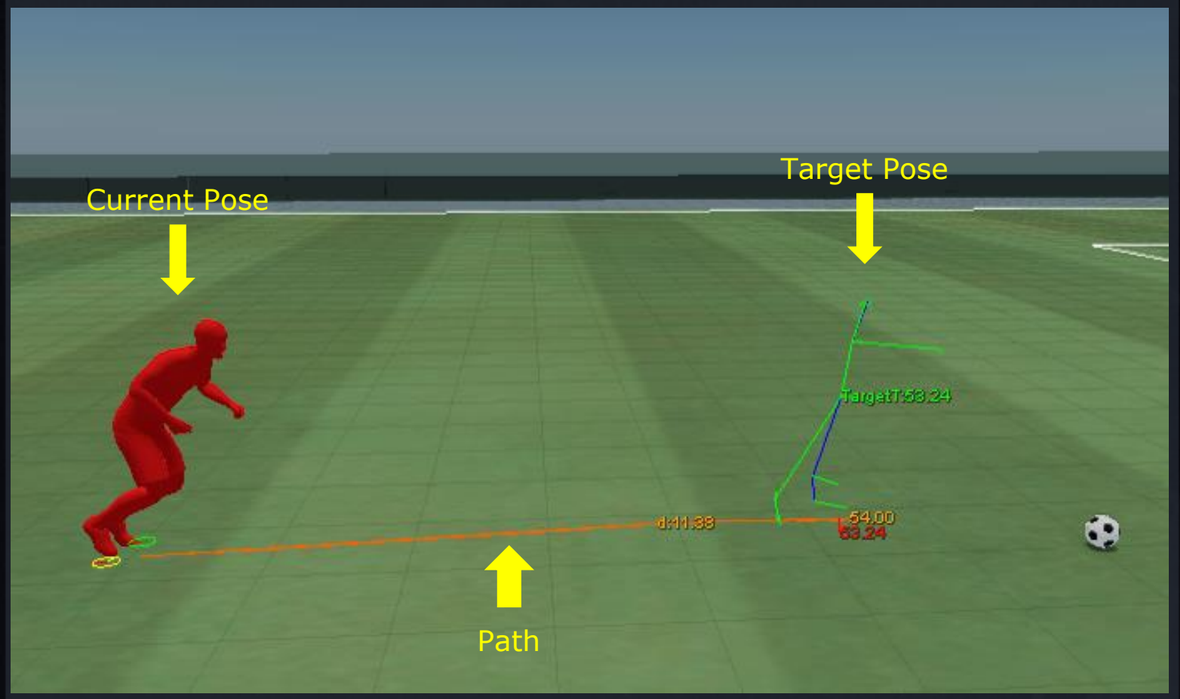
Why do we need a generic runtime?

- Supports many more operators in the DNN
- Allows more experimentation

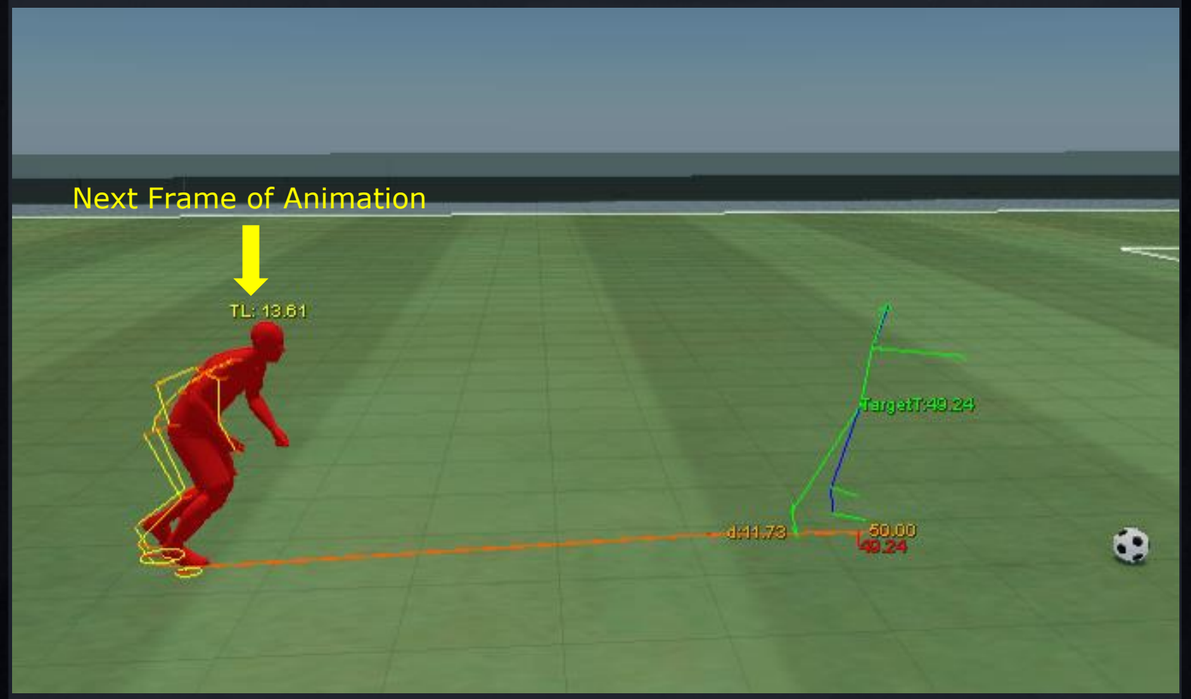
Seed: 2031021101 GameTick: 9394, Clock[00:43] Home [1] 0 - 0 [17] Away at Stadium[100]
Saved Input: Single [RECORD]
GameType_TestingGame
camera: orbitcambehavior target: ball(0),y:0
[PAUSED] Replay Frame: 9328.97
AiClock: tick[226]
fps/ms
cpu 55/18.1
sim 30/ 2.6
gpu0 135/ 7.4
np/s 323.2
NO GDA
FIFAData/FIFAGame - Source 4578055 - Build 4578055 - samuelr - 2020.0 - Release

Inputs/Outputs

Network Inputs

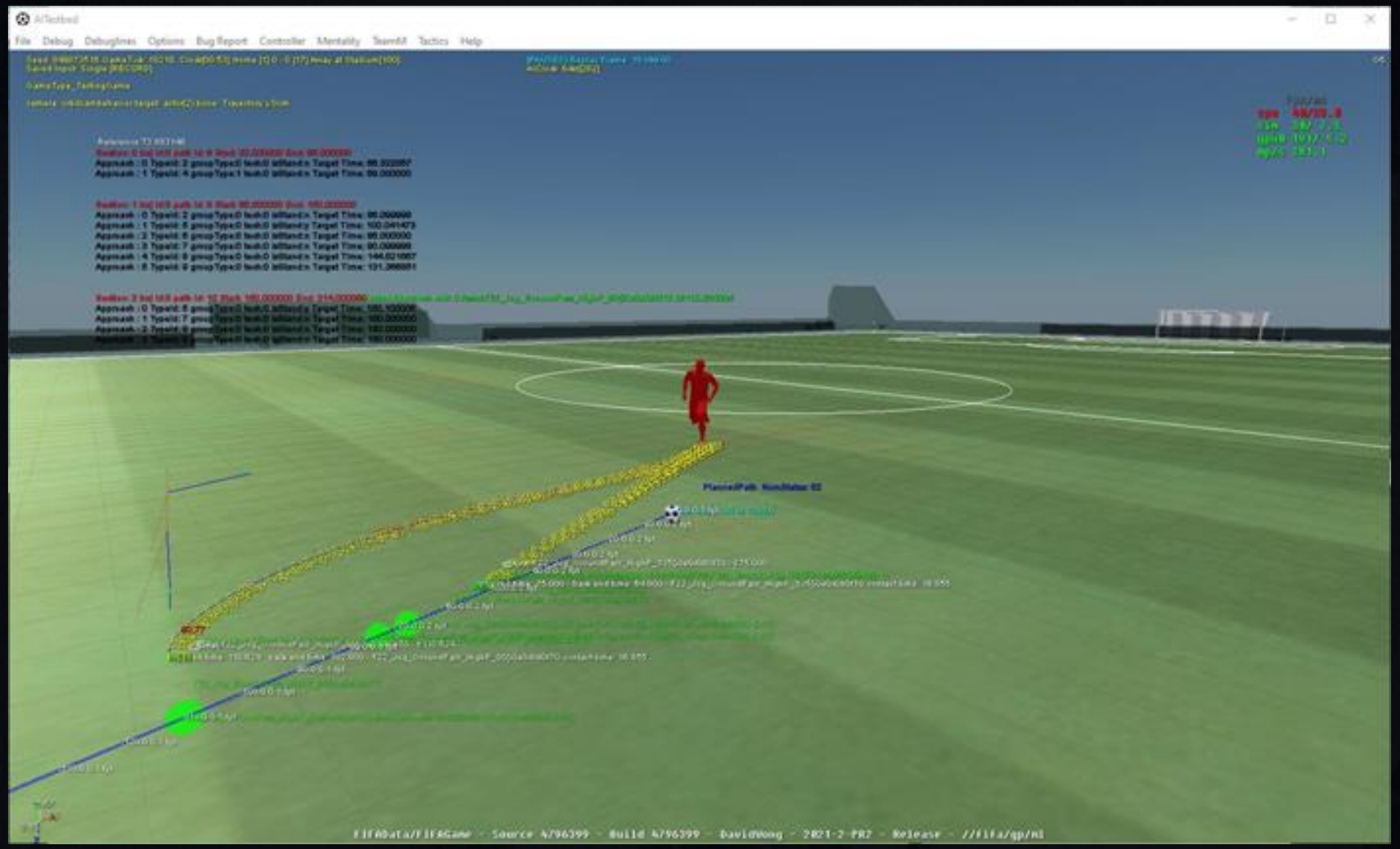


Network Outputs



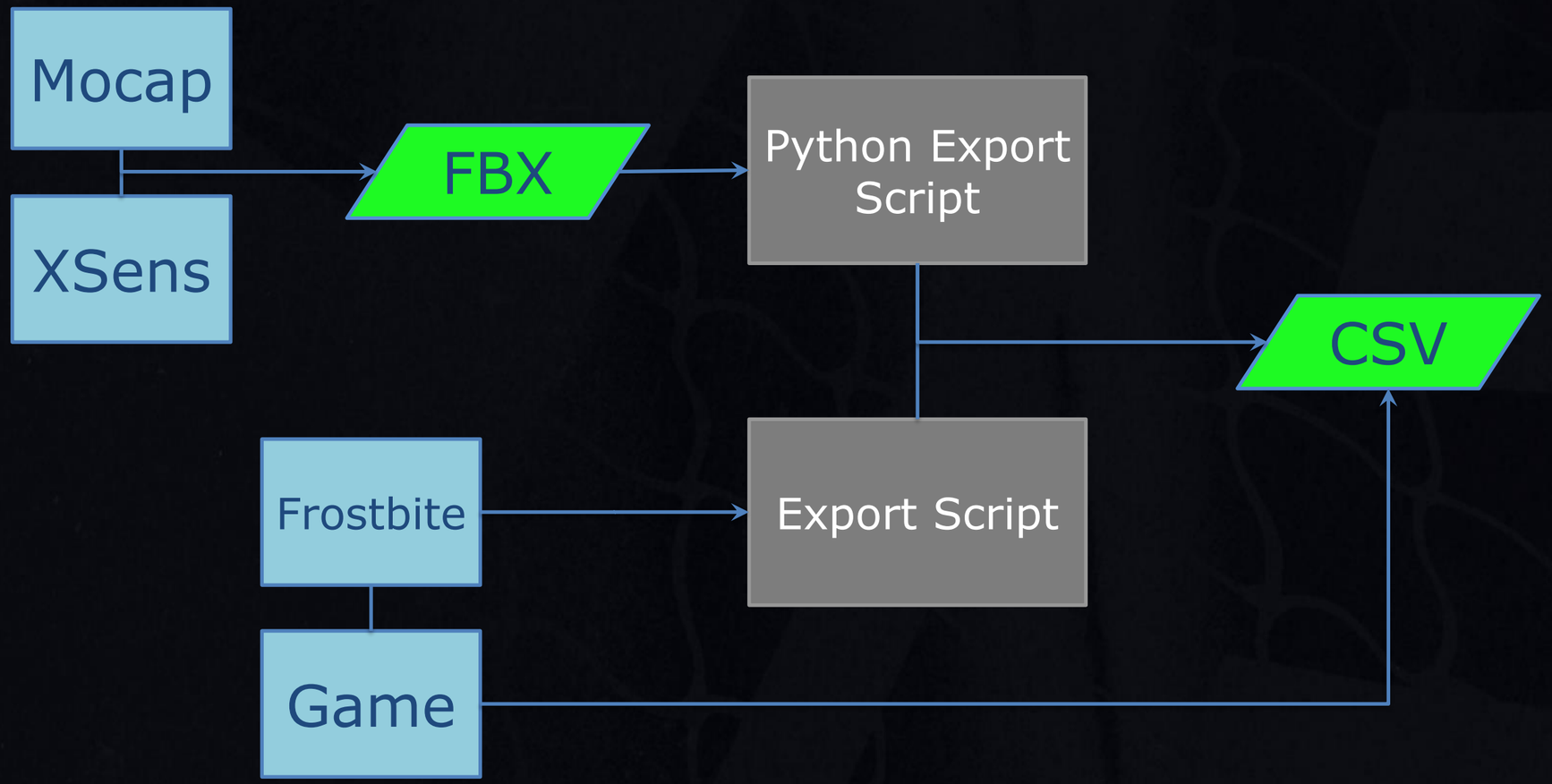
849355387 GameTick: 10330, Clock[00:36] Home [9] 0 - 0 [5] Away at Stadium[100]
Input: Single [RECORD]
Type_TestingGame
a: freecambehavior
[PAUSED] Replay Frame: 10196.00
AiClock: ticks[108]
cpu 55/17.2
sim 30/ 3.4
gpu0 204/ 4.9
mp/s 391.8
10:01

Source of Inputs

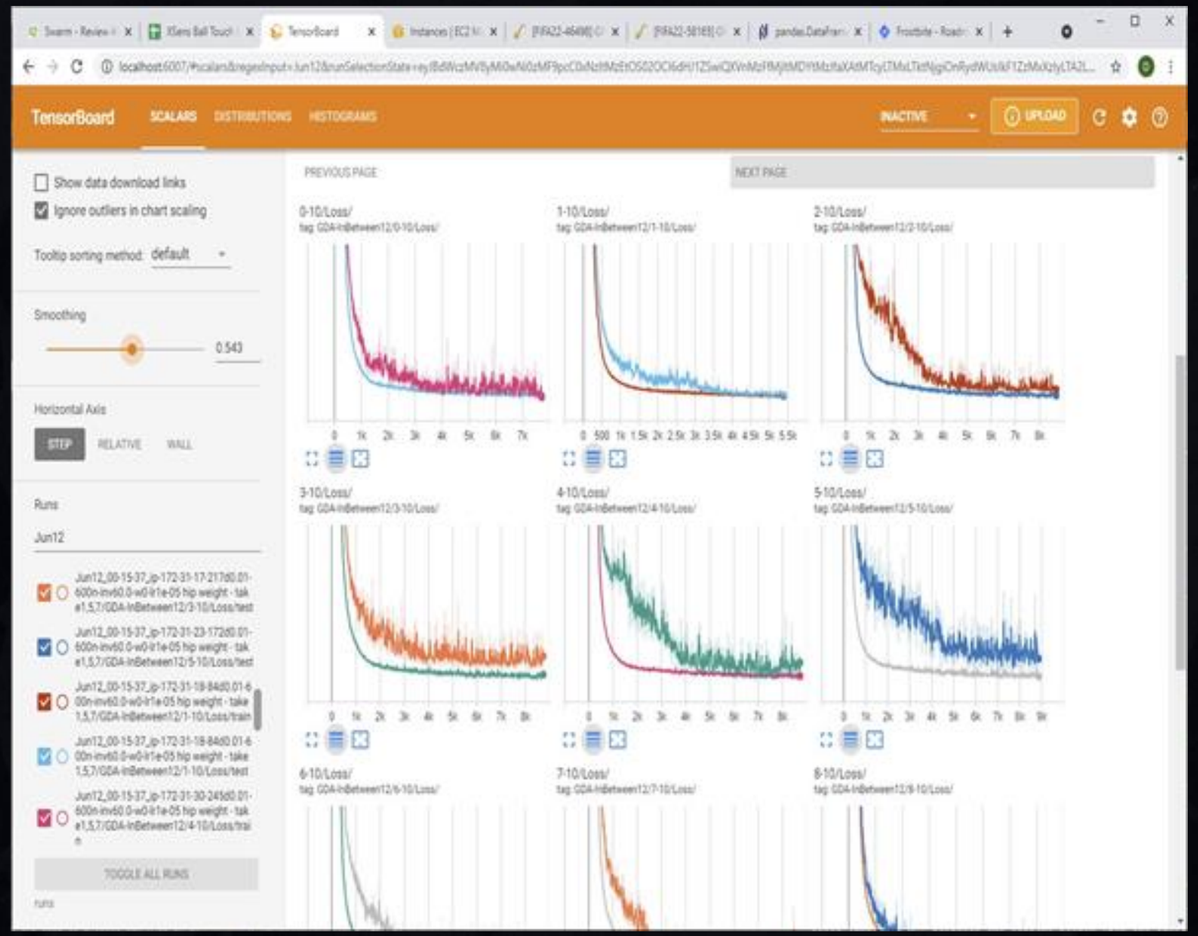


Data Source - XSens

Training Data Pipeline

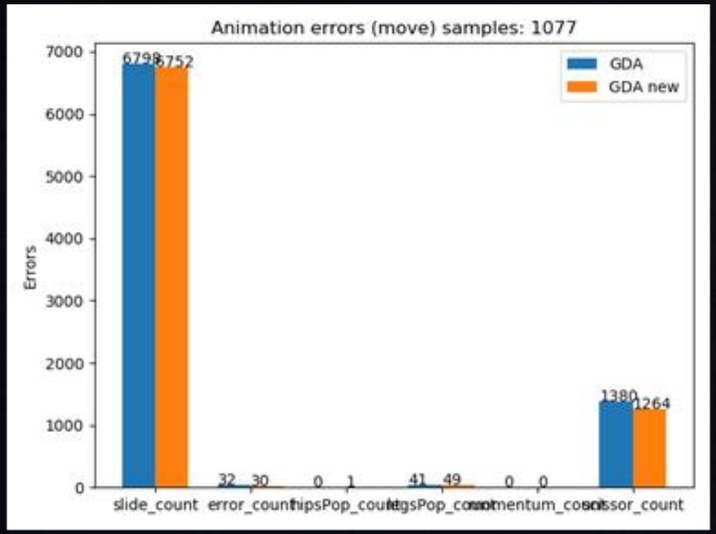


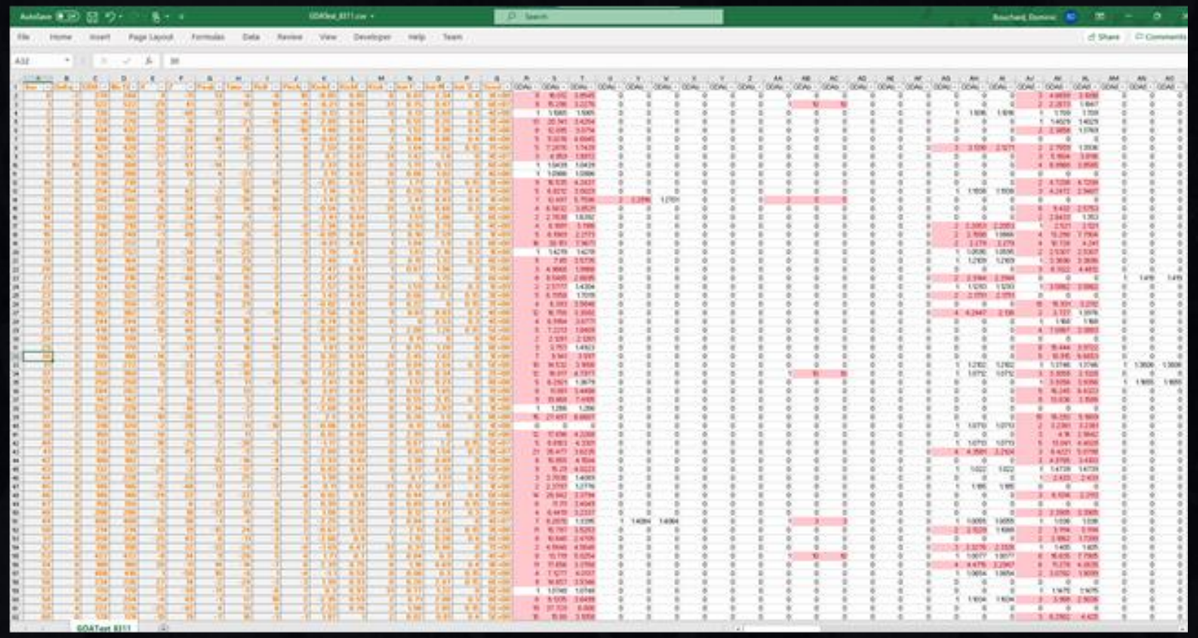
Training Deep Neural Network

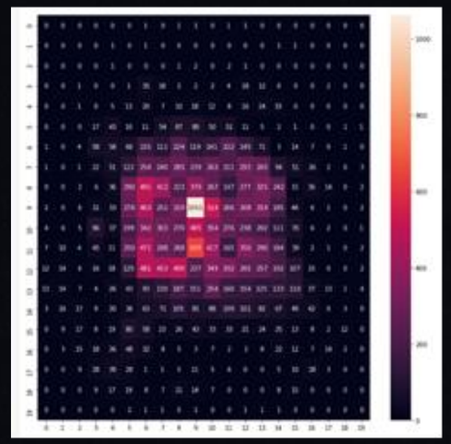


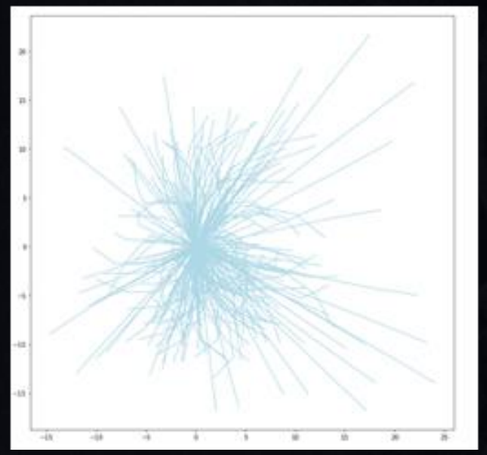
Identifying Problems – Stress Test

Stress Test – Reviewing Results









GDA with Xsens takes
First Iteration

Closing Thoughts

What Worked

Positives

- Highly competitive match captured
- Animation was high quality
- Unique animations
- Ball data successfully generated
- Improved ball physics using real world examples
- Lots of data for training ML networks

What Needs Work

New Challenges:

- Identifying, selecting, exporting animation
- Huge file sizes

In Conclusion

Overall Thoughts

- Proved out new capture technique
- Used real world data to improve game
- Built our first Full Body ML animation system

We’re Hiring

Electronic Arts

http://www.ea.com/careers