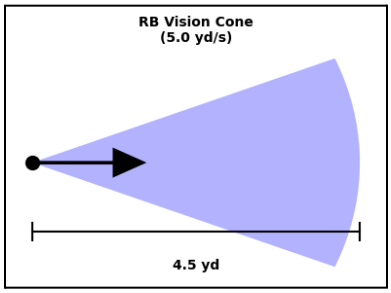
Technical Documentation: Field Control Added (FCA)

Conceptual Foundation

The **Field Control Added (FCA)** metric is designed to isolate the run-blocking contribution of individual offensive linemen by quantifying their impact on spatial control within the intended running lane. The concept draws Madden 06's vision cone (used in the "Pull the Plug" Kaggle submission) to reflect ball carrier intent and lane perception. Our adaptation focuses on measuring how much *field control* an offensive lineman creates in the running back's field of vision during the critical moments of a run play.

Methodology

1. Vision Cone Definition



The running back's **vision cone** is defined as a 45° angle originating from the back's direction of movement. The cone extends a **minimum of 3 yards** ahead of the ball carrier, and scales with their speed using a linear factor of **0.3 yards per yard/second**.

2. Field Control Calculation

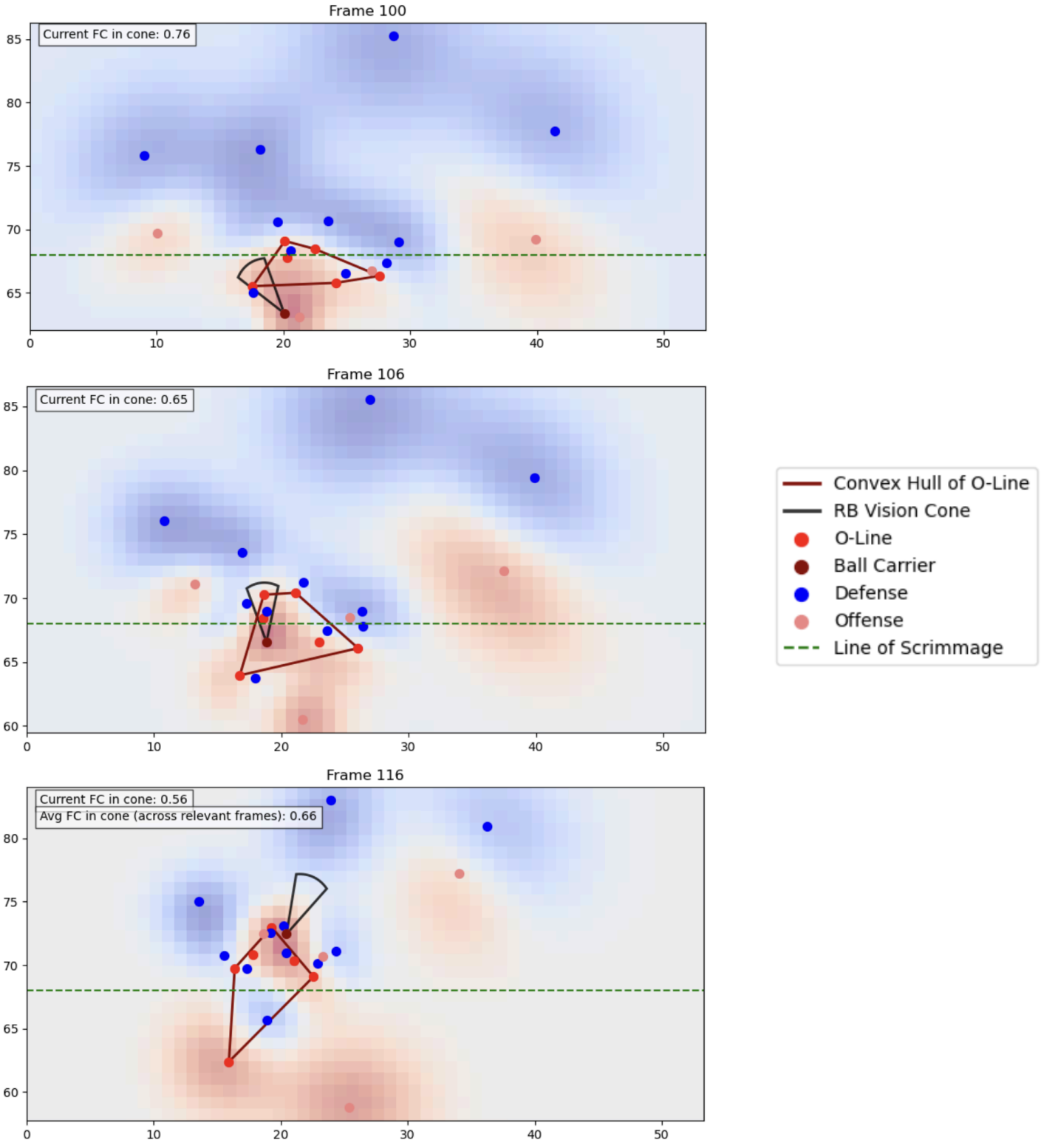
Field control is computed using a variant of the **pitch control model** introduced in the soccer analytics paper *"Wide Open Spaces: A Statistical Technique for Measuring Space Creation in Professional Soccer"* (2018). The influence of each player at a given field point is modeled using **multivariate normal distributions**, adjusted by distance and orientation. The primary modification made to this model is a **parabolic radius function** based on distance from the ball carrier:

- Radius ranges from **4 to 10 yards** for distances from **0 to 18 yards**, increasing parabolically.
- Beyond 18 yards, radius is held constant at 10 yards.

This approach allows players to exert more distributed influence when they are farther from the play, better reflecting pursuit angles and real-world football movement.

For each frame, **offensive field control minus defensive field control** is computed at every point in the RB's vision cone. These values are passed through a **sigmoid normalization function**, yielding a 0.0–1.0 scale, where 1.0 indicates full offensive control, 0.0 full defensive control, and 0.5 contested space. We average these field control values **within the vision cone** per frame, then aggregate across selected frames of the play to generate a single *field control value* for that play.

Below is a visualization of field control across the field (red = offensive control, blue = defensive). The play begins with strong offensive line blocking, yielding an average field control of 0.66 in the RB's vision cone—above the neutral 0.5—during the offensive line blocking window. The result was a 13-yard rush by D'Andre Swift.



3. Frame Filtering

To focus on meaningful blocking interactions, we restrict the analysis to frames from:

- **1 second after the snap** (to allow the play to develop),
- Until the RB either:

- Breaks through the **convex hull** of the offensive line (i.e., crosses the front wall of the OL), or
- **Exits laterally** outside the bounds of the offensive line structure.

This ensures we only measure the lineman's impact on the intended run lane, excluding breakaway yards or bounce-out scenarios.

4. Offensive Lineman Attribution (FCA)

To isolate each lineman's contribution, we employ a **Leave-One-Out (LOO) approach**:

- For each run play, we simulate the field control value **with and without** each individual offensive lineman.
- The difference is the **Field Control Added (FCA)** by that lineman on that play.
- FCA is then **averaged across all qualifying plays** for each player (minimum 80 run plays required for inclusion).

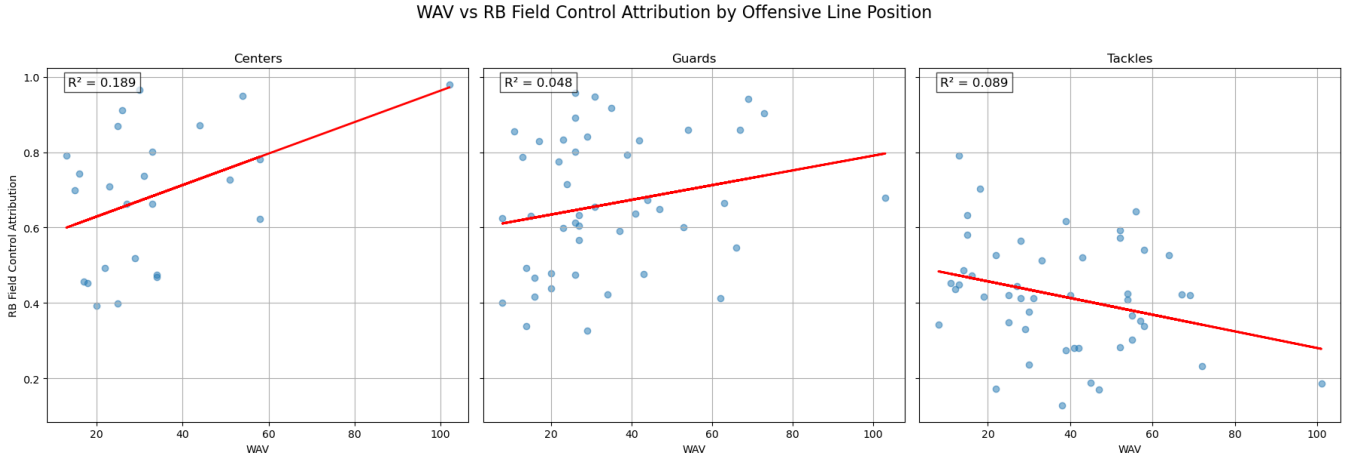
5. Angle-Based Modifier (Experimental)

An experimental modification was tested where defenders within **1.5 yards** of an offensive lineman ("engaged" with lineman) had their influence **weighted** based on the angle formed by: `defender → OL → field point`.

- A 180° angle (directly behind the OL) indicated full blockage → lower defensive influence.
- Smaller angles (OL not between defender and field point) increased defender influence. This concept was inspired by the *"Between the Lines"* Big Data Bowl submission on quantifying pass rush pressure. However, incorporating this modifier reduced the correlation of RB field control to rushing yards gained, so it was ultimately excluded from the final FCA implementation.

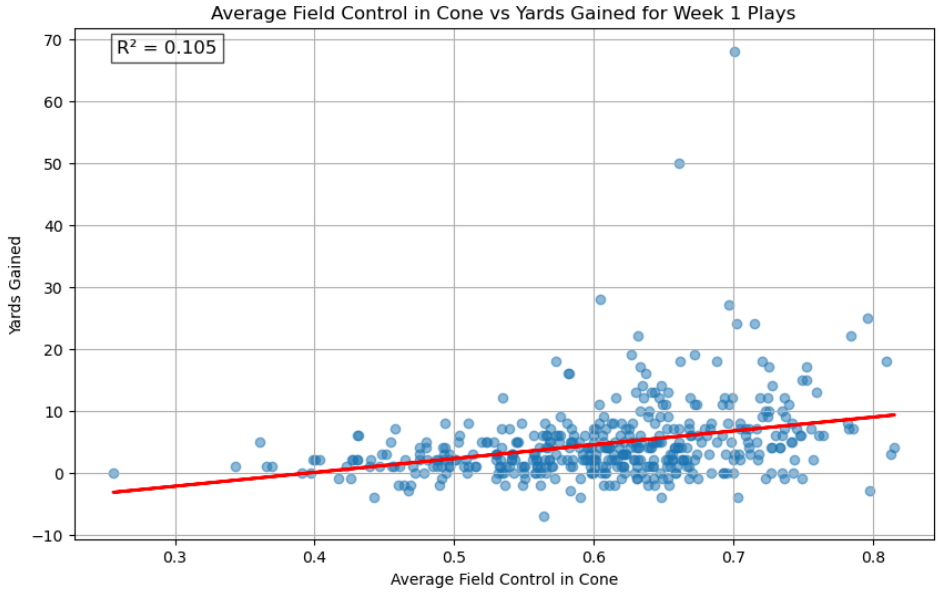
Evaluation of Metric

FCA was evaluated against **Weighted Approximate Value (WAV)**, a composite measure of overall offensive line performance. While WAV is not a pure run-blocking stat, it provides a useful benchmark for player value and performance.



The positive correlation for centers and guards supports the validity of FCA in capturing meaningful run-blocking contributions, particularly for interior linemen. In contrast, the negative correlation for tackles suggests that FCA is not a reliable evaluation metric for them. Tackles often have distinct run-blocking responsibilities—such as setting the edge, climbing to the second level, or sealing backside pursuit—that do not necessarily involve positioning themselves directly between a defender and the RB. As a result, their contributions may not consistently yield increased field control within the RB's vision cone.

Additionally, average field control in the ball carrier's vision cone (from 1 second post-snap to the RB breaking through the O-line) positively correlates with rush yards gained.



Future Considerations

- **Shapley Value Attribution**: A Shapley framework could better account for **inter-lineman interactions** (e.g., double teams, combo blocks). LOO may under-attribute shared responsibilities.

- **Mixed-Effects Modeling**: Considered but deprioritized due to limited player rotation on the offensive line. Less variability in personnel makes the model less stable compared to applications on defensive rotations

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Player Results

Refer to the executive summary.