# Chasing & Tool Tracking

Documentation

In standard web guiding, the machine steers the web to align it with a fixed process. However, in "Chasing" or "Tool Tracking" applications, the web is allowed to flow naturally, and the **process mechanism itself** (such as a slitter knife assembly or coating head) physically moves to maintain alignment. This is not just an alternative; it is the **only physical way** to achieve alignment when the web cannot be steered or when the alignment must occur exactly at the point of contact between the tool and the entering web.

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## The Physics of Alignment: Why You *Must* Chase

For applications like slitting to a printed line or aligning a coating head to an electrode edge, standard guiding often fails. The fundamental constraint is the **Feedback Loop**.

### The "Broken Loop" Problem

To control any motion, the system must be able to "see" the result of its own action.

- **Scenario:** You need to align a slitter blade to a wandering printed line on the entering web.
- **The Mistake (Fixed Sensor):** If you mount a sensor on the machine frame looking at the entering web, the sensor sees the web wander. The controller tells the slitter to move. The slitter moves. **However, the sensor does not see the slitter move.** Because the sensor is fixed to the floor and looking upstream, it never sees the *effect* of the corrective action. The error remains, and the control loop remains broken.
- **The Downstream Failure:** If you look at the web *after* the slitter, the damage is already done. You cannot correct a cut that has already happened.

### The Only Solution: The "Relative Position" Loop

- To align a tool with a moving web, you must measure the **relative position** between the tool and the web, not the absolute position of the web on the machine.
- **The Fix:** You must attach the sensor directly to the **moving tool carriage**.
- **The Result:** When the tool moves, the sensor moves with it. This allows the sensor to verify that the tool has successfully chased the web. This is the only way to close the feedback loop and achieve repeatable registration.

## The Roll-2-Roll Solution: Chasing or Dynamic Tool Tracking

We replace complex hydraulic chasing systems with high-precision electromechanical tracking that treats the "Process" as the moving element.

### How It Works

1. **Sensor Mounting:** The sensor is mechanically bracketed to the slitter base, coating carriage, or rewind stand. It moves in tandem with the tool.
2. **The "Null" Principle:** The sensor locks onto the target (printed line, web edge, or pattern).
3. **The Chase:** As the web wanders, the sensor detects the error (in the carriage position based on its measurement). The controller drives the **tool carriage** laterally until the sensor is re-aligned with the web. Because the sensor moves with the tool, the system continuously zeroes out the error, keeping the tool perfectly registered to the web.

### The Roll-2-Roll Advantage

- **Wide-Range Sensing:** Roll-2-Roll® Sensors are available in sensing ranges from 48mm to 960mm—far wider than typical narrow-range sensors. This large capture window maintains lock on the target (edge, line, or pattern) even during significant web wander caused by splices, tension upsets, or roll eccentricity. For example, an ODC 288 sensor tracks targets across a 288mm range, keeping the tool aligned even when the web wanders ±100mm.
- **Lock on Lost Edge Protection:** With older controllers, when an edge exits the sensor's field of view, the actuator can continue driving in one direction—potentially causing equipment damage. The SCU5 and SCU6x controllers include **"Lock on Lost Edge"** protection that inhibits actuator movement if tracking is lost. For line/contrast guiding applications, loss of contrast also inhibits the actuator, preventing runaway conditions.
- **High-Resolution Tracking:** Roll-2-Roll® Sensors achieve 0.0635mm (0.0025 in) hardware resolution and ±0.127 mm (±0.005 in) repeatability, which is critical for coating registration and slit-to-feature applications with tight tolerances. This resolution is maintained across all material types without recalibration.
- **No Recalibration Required:** Unlike legacy sensors requiring calibration when switching between clear films, opaque substrates, and metallic foils, Roll-2-Roll® Sensors detect edges on any material without adjustment. Switch materials mid-run with zero downtime for sensor setup.
- **High Thrust for Heavy Carriages:** Moving a steel slitter base or coating head requires more force than steering a lightweight web. Roll-2-Roll Technologies actuators provide 50–2,000 lbf of nominal thrust. For rewind chasing applications, the RLA-200 moves about 33,333 lb on rolling bearings at ? 0.06 (20,000 lb at ? 0.1); see the RLA load table. Low-friction linear bearings reduce the required thrust while maintaining

precise positioning.

- **Fast Response Time:** Standard 20ms response time keeps the tool registered to the web at production speeds. For high-speed applications, 1ms response is available—essential when minimizing web travel per response cycle.

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## Key Applications

### Slitter Positioning

In some inline slitting applications, the cut must align with the artwork or a feature on the web. Since the print position varies relative to the web edge, you cannot guide the web edge. This is mostly in applications where a inline stlittling after a process such as printing or coating is needed with limited space.

- **The Physics:** You must align the entering web feature to the knife.
- **The Execution:** The sensor is mounted to the knife holder. It tracks the web feature like a printed line or a coating edge. As the print wanders, the knives chase it, ensuring the cut is always registered to the image.

### Coating Head Alignment

In battery electrode coating or striping, the coating must align with the metal foil edge or in Li-Ion application the coating on both sides need to align.

- **The Challenge:** Steering the foil creates stress and wrinkles.
- **The Execution:** The coating head moves. The sensor is attached to the coating carriage, looking at the foil edge. If the foil drifts, the coating head chases it, maintaining a perfect bead position without stressing the delicate material.

### Rewind Chasing

Rewinding is a classic chasing application. To prevent a telescoped roll, the winding roll must move to catch the incoming web.

- **The Requirement:** The sensor *must* be mounted on the shifting rewind stand looking at the incoming web. This maintains the relative position between the roll and the web, ensuring a straight-sided roll.

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## Engineering Guide: Critical Design Rules

Designing a chasing system requires strict adherence to mechanical principles to ensure the heavy tool carriage can keep up with the lightweight web.

1. The "Sensor-on-Carriage" Rule
    - **Non-Negotiable:** The sensor must be physically attached to the moving frame. If the sensor is fixed to the floor/machine frame, the control loop is open, and the system will fail to guide.
2. Structural Rigidity: The carriage holding the tool and sensor must be stiff.
    - **Resonance:** Because you are moving a large mass, the natural frequency of the carriage structure must be higher than the control frequency (typically >25-50Hz). If the sensor bracket wobbles as the carriage moves, it induces "false error," causing the system to oscillate.
3. Actuator Sizing (Thrust for Mass) Unlike web guiding (moving a light roller), chasing moves heavy machinery.
    - **Breakaway Force:** The actuator must be sized to overcome the static friction of the linear bearings holding the carriage.
    - **Acceleration:** Speed is less important than acceleration. The actuator must change direction fast enough to match the rate of web error. If the carriage is too heavy or the actuator too weak, the tool will lag behind the web.

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## System Configurations (Select Your Kit)

### Slitter/Tool Tracking Kit

*Best for: Converting lines requiring slit-to-feature registration.*

- **Sensor:** 1x Roll-2-Roll® Sensor (Tracks lines, patterns, or UV features).
- **Actuator:** Low-backlash Roll-2-Roll® Actuator (sized for carriage mass).
- **Controller:** Roll-2-Roll® Controller with "Chasing" logic enabled.
- **Mounting:** Sensor bracket designed to attach directly to the slitter knife holder.

### Coating Alignment Kit

*Best for: Battery electrode coating and precision laminating.*

- **Sensor:** 1x Roll-2-Roll® Sensor (High resolution ±0.0635mm).
- **Actuator:** Low-backlash Roll-2-Roll® Actuator (sized for carriage mass).
- **Controller:** Roll-2-Roll® Controller with "Chasing" logic enabled.
- **Benefit:** Keeps coating aligned to substrate edge without stressing the foil.

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