

## Case Study C3-003

### Terminological Instability (The "Drift" Effect)

The "HEIB Target" Oscillation (In-Context Inconsistency)

Cédric Stéphany — Technical Translation & AI Alignment Specialist

#### Case Study Metadata

**Dataset ID:** C3-003

**Category:** Structural Compliance — Constraint 3

**Focus:** Genitive Drift / Consistency

**Model:** Generic NMT

**Domain:** High Energy Physics (Ion Beams)

## 1 The Context: Monolithic Labels in Physics

In the provided text (EP3804475), the term **"HEIB target"** (High Energy Ion Beam target) appears repeatedly as a specific system component. As an acronym-based compound, "HEIB" functions as a **Proper Noun Label** (State 3). Therefore, the French translation should consistently use the **Zero-Marker** (Juxtaposition): *Cible HEIB*.

## 2 The Glitch: Terminological Oscillation

The generic NMT model fails to maintain a stable rule. Within a span of 5 lines, it oscillates between two different grammatical structures for the exact same source term.

### Critical Failure: Terminological Drift

#### The Drift Failure:

- **Line 11:** ...ladite cible HEIB est configurée...  
**(Correct)** The model correctly identifies "HEIB" as a label (Zero-Marker).
- **Line 16:** ...ladite cible DE HEIB a une épaisseur...  
**(Incorrect)** Just 5 lines later, the model succumbs to "Fluency Bias" and inserts the preposition *de*, treating "HEIB" as a possessor or quality.

**Legal Consequence:** In patent law, different words are presumed to mean different things. Using *Cible HEIB* and *Cible de HEIB* in the same claim implies the existence of two distinct components, potentially rendering the claim indefinite.

## 3 The Alignment Challenge

### 3.1 Why It Happens

Generic models process text sequentially and probabilistically.

- In Line 11, the statistical weight favored the technical label (Juxtaposition).
- In Line 16, possibly influenced by the surrounding sentence rhythm ("...a une épaisseur..."), the model prioritized grammatical smoothness and inserted the "smoothing preposition" *de*.

This proves the model lacks **Terminological Memory**—it solves each sentence as an isolated puzzle rather than adhering to a document-wide glossary.

## 4 Alignment Methodology: Global Term-Locking

To resolve "Drift," we must move beyond sentence-level translation to **Document-Level Constraints**.

### Alignment Methodology

#### The Consistency Protocol:

1. **First-Pass Detection:** The Agent scans the document for acronym-based compounds (e.g., [Acronym] + [Noun] or [Noun] + [Acronym]).
2. **State Determination:** "HEIB" is identified as a **Monolithic Label** (State 3).
3. **Global Lock:** The system freezes the translation pair:

HEIB Target → Cible HEIB (Priority: Critical)

4. **Propagation:** This frozen term is forced onto every subsequent occurrence (Line 16, Line 25, etc.), overriding any local fluency probability that might trigger a "de" insertion.

## 5 Key Insights

### Technical Concept

#### What This Case Study Demonstrates:

1. **Correctness is not enough; Consistency is King.** Even if the model gets it right 50% of the time (Line 11), the inconsistency itself (Line 16) destroys the legal integrity of the document.
2. **Fluency is the Enemy of Stability.** The urge to make the text "flow" (by adding prepositions) directly competes with the need for rigid standardization.
3. **Memory Modules are Required.** A stateless NMT model cannot solve this; an external "Memory Agent" (Refiner) must enforce the choice made in Line 11 onto Line 16.

**Portfolio:** Patent Translation AI Alignment Framework  
**Author:** Cédric Stéphany  
**Specialization:** Structural Compliance in Intellectual Property  
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