Since your Stage 5 pipeline is running successfully, the next professional steps are about **making it production-ready, robust, and testable**. Here's how I'd prioritize them:

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1. Real Query Testing & Validation

- Run meaningful queries on your full 5,000-document dataset.

- Verify top-K results actually make sense.

- Optional: prepare a small **ground-truth dataset** to check BM25 ranking correctness.

  ✅ This ensures your engine is **functionally correct**.

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2. Snippet Generation (User-Friendly Results)

- Extract **context around matched query terms** from the forward index.

- Highlight query terms in snippets for readability.

- Attach snippets to `SearchResult.snippet`.

  This is standard in professional search engines and makes results interpretable.

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3. Performance & Efficiency Checks

- Measure **query latency** using `std::chrono`.

- Benchmark **memory usage** during query execution.

- Optional: implement **LRU cache** for frequently accessed posting lists.

  Helps ensure your engine is **scalable** for larger datasets.

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4. Unit Tests & Integration Tests

- Write **small unit tests** for BM25 computation, posting retrieval, and top-K selection.

- Integration tests for **full Stage 1–5 pipeline** to ensure no regressions.

    This is what separates a professional project from just working code.

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5. Optional REST API / Query Service

- Expose your query engine via a lightweight **HTTP interface** (C++ Crow/Pistache or Python Flask wrapper).

- Endpoint: `GET /search?q=example&k=10`.

- Return **JSON** with `doc_id`, `score`, and optional snippet.

    Makes your engine **ready for integration with applications**.

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6. Logging & Metrics

- Log queries, execution time, and top-K results.

- Optionally add `/health` endpoint if REST API is implemented.

- Tracks **uptime, query volume, cache hits**.

    Critical for **production monitoring**.

Recommended Professional Order

1. Real query testing & validation

2. Snippet generation

3. Performance checks & optimization

4. Unit & integration tests

5. REST API exposure

6. Logging & monitoring

If you want, I can **prepare a professional snippet generation module next** that plugs directly into your Stage 5 engine, so your queries return **highlighted, readable results**, which is the most visible improvement.

Do you want me to do that next?