**Data Analysis & Interpretation Plan**

**D.1: Pre-Registered Success Criteria**

A. Minimum Positive Signal:

A successful MBT signal is defined as any statistically significant and repeatable shift in the laser beam’s position, measured on the detector, which:

* Occurs in correlation with the chamber’s rotation and vacuum state.
* Cannot be explained by thermal drift, vibration, or equipment artefact, as verified by control and sham trials.

B. Publication Threshold:

We will consider the experiment publishable if:

* The measured beam deflection exceeds the instrument’s noise floor by >3 standard deviations (3σ).
* The effect is robust across multiple trials and independent operators.
* Sham/control trials (rotation without vacuum, vacuum without rotation, no rotation/no vacuum) show no comparable effect.

C. Breakthrough Criteria:

If the observed shift is robust, reproducible, and cannot be explained by any established classical or GR mechanism, this will constitute a major paradigm shift.

In that case, we will immediately notify outside labs, preregister the result, and invite rapid independent replication.

**D.2: Data Handling & Quantitative Analysis**

* Raw Data Management:
  + All raw images, detector frames, time series, and log files will be archived in open formats (CSV, FITS, video), with full timestamps.
  + Both unprocessed and processed datasets will be available for scrutiny and further analysis.
* Signal Processing:
  + Beam centroid positions will be automatically extracted from each image.
  + Displacement will be plotted as a function of RPM and vacuum state.
  + Statistical tests (Pearson/Spearman correlation, t-tests, ANOVA) will be used to assess significance versus controls.
* Error Control:
  + Systematic drifts (thermal, vibration, alignment) will be modelled and subtracted using calibration and control data.
  + Blind analysis will be conducted where feasible, randomising trial labels to avoid bias.

**D.3: Interpretation Protocol**

* If No Signal Is Detected:
  + Publish a null result—this is valuable for constraining or refining the MBT framework.
  + Review apparatus sensitivity and design potential upgrades if warranted.
* If a Sub-threshold Signal Is Found:
  + Report as an “anomalous but sub-threshold” finding.
  + Propose improvements (e.g., better detectors, higher rotation rates, improved vacuum).
* If a Robust, Significant Signal Is Detected:
  + Draft a manuscript for immediate preprint/arXiv release.
  + Alert the community for independent replication.
  + Pursue scale-up and press outreach if effect is confirmed.

**D.4: Follow-Up Experiment Guidelines**

* Sensitivity Upgrades:
  + Employ higher-power lasers, alternative wavelengths, or cryogenic cooling for enhanced resolution.
* Geometry/Material Variations:
  + Test different chamber geometries, rotation axes, or introduce quantum materials (graphene, superconductors) to probe additional MBT effects.
* Quantum Material Tests:
  + Place a chip of quantum material in the chamber’s path, monitor for coherence effects via photoluminescence or resistance measurements.

**D.5: Outreach and Open Collaboration**

* Prepare outreach materials: summary figures, visualisations, and plain-language explanations.
* Publicly preregister analysis methods and thresholds for positive results.
* Actively invite collaboration and criticism from the scientific community.

**Deliverable**

This plan makes the MBT quantum chip experiment maximally transparent, credible, and replicable—minimising bias and maximising trust for potential funders and the broader physics community.

**E. Scaling & Integration: From Demonstration to Device**

**E.1: From Proof-of-Concept to Prototype**

Once a quantum effect—such as laser beam bending, enhanced coherence, or quantum state trapping—has been observed and replicated using the MBT Particle Forge, the next logical step is to build upon this foundation with systematic, scalable device engineering.

* Reproducibility:

Automate the core process (rotation, vacuum, laser parameters) and repeat measurements to confirm stability and reproducibility.

* Foundry Environment:

Design a controlled “quantum foundry” workflow, allowing for iterative tuning of casting conditions (rotation speed, pressure, material type) and rapid prototyping of chip elements.

**E.2: Quantum Chip Architecture and Fabrication**

Translating the raw MBT-formed material into a functional chip requires careful design:

* Layering Quantum Material:

Deposit or cast the quantum material (e.g., graphene, MBT-diamond, or forged matter) onto a suitable substrate (e.g., silicon, sapphire, or glass).

* Patterning and Circuit Integration:

Use micro-fabrication tools (lithography, etching, additive manufacturing) to define qubit domains, readout circuits, and control electrodes.

* Embedding MBT Domains:

Embed MBT-cast regions as logical elements—qubits, quantum wires, or sensor zones—within the chip, ensuring good electrical and thermal contact.

**E.3: Room Temperature Stability and Longevity Testing**

With the prototype chip assembled, focus turns to validating its unique room-temperature quantum properties:

* Quantum Coherence:

Measure the lifetimes (T1, T2) and error rates of qubits or quantum states at various temperatures (room temp, above, and below).

* Longevity:

Stress test the device for repeated cycling, environmental noise, and aging—critical for practical deployment.

* Thermal and Electrical Performance:

Monitor the chip’s stability, resistance, and power consumption under operational loads.

**E.4: Early Device Demonstrations**

To demonstrate the MBT chip’s quantum power, begin with simple logic operations and memory tests:

* Logic Gates:

Program and measure single- and two-qubit operations (NOT, CNOT, Hadamard, etc.) using the cast domains as logic units.

* Quantum Memory:

Store and retrieve quantum information at room temperature, benchmarking against conventional superconducting or trapped-ion systems.

Simulation note: Many of these operations can be simulated in code alongside experimental work, to guide hardware iterations and interpret results.

**E.5: Feedback Loop and Optimisation**

* Design–Test–Iterate:

Use all measured data to refine device geometry, casting protocols, and materials selection.

* Variable Tracking:

Keep rigorous records of every experimental variable (e.g., vessel rotation rate, vacuum level, laser frequency, casting material) to ensure reproducibility and enable rapid optimisation.

* Scalability Considerations:

Assess the path toward mass-manufacturing—can these chips be scaled up to wafer-scale or stacked arrays? Identify engineering bottlenecks early.

Summary:

This scaling plan transforms a one-off quantum demonstration into a viable, reproducible quantum chip platform, leveraging MBT principles to achieve stability and functionality at room temperature. The combination of experimental iteration, simulation, and rigorous documentation ensures both scientific credibility and engineering progress.