1.2 Investigations in Light to Reveal Empirical Evidence

1.2.1 The Preparations for any Laboratory Investigations

1. Identify precisely one, or more, of the **Observed,** and High Level of, **SEEING Photonics Solutions**.
2. Develop an **awareness** of all the **Inherent Laser/LED Photon Beam Characteristics** and **Treatments**.
3. Establish an appropriate **Investigation Workstation Zone** in which to operate.
4. Establish a **Laboratory Investigation Book** for recording details of all of the **empirical investigations**.
5. Become familiar with the use of all available **Display** and **Measurement Instrumentation**.
6. Ensure the availability of a **Digital Camera** for recording daily progress, and some of the **Empirical Evidence**.
7. Ensure the availability of any anticipated **Optoelectronics Circuit Diagrams**, and **Electronic Components**.
8. Create a **Tool Outline Card** for all of the necessary tools, so tools can be regularly checked in their position.
9. Prepare an **Oscilloscope** and a **Continuity Test Multimeter** as almost essential instruments to have available.
10. Plan a daily Investigation Programme prior to starting each Investigation.
11. Predict the Investigation Outcome, and use the Empirical Evidence to confirm the correctness, or otherwise, of the prediction.
12. **If the Empirical Evidence does not agree with the predicted outcome - change the prediction ! ! !**

The Empirical Evidence cannot be wrong – the theoretical prediction has to agree with the Empirical Evidence.

1.2.2 The Performance of any Laboratory Investigations

1. Identify the specific and precise **Investigation Purpose** and the appropriate **Investigation Parameters**.
2. Plan, and Record, the Investigative Plan in advance of starting the Investigation.
3. Exhaustively examine the entire **Investigative Range** of possible variations – **"What happens if . . . ?"**
4. Repeat the **Observations**, **Observations**, and more **Observations** of what is really happening.
5. Important Question - does **Sensor Input = Sensor Output**. **Does that Input actually produce that Output ?**
6. Acquire and **Record Repeatable** and **Repetitive Empirical Numerical Evidence**.
7. Establish the **True Interpretation** of the **Empirical Evidence**.
8. Designate, and Record, the **Specific**, **Precise**, **Accurate**, and **Useful Explanation of the Empirical Evidence**.
9. Establish the **Link** between the **Empirical Evidence** and the **Mathematical Theory** – the "**Universal Tool**".
   Remember: Every Equation is either
   - 9.1 **A Law**, or
   - 9.2 **A Definition**, or
   - 9.3 **Follows from the previous Line**.
10. Consider how the **Empirical Evidence**, and the **Mathematics**, may indicate a **potential Innovative Solution**.
11. Carefully analyse the **interpretation** of the **Empirical Evidence**, and search for important **Implications.**
12. Propose the basic **Design Specification** for the **Potential Photonics Prototype Design Solution.**

1.2.3 The Presentation of a Design Specification for a Potential Photonics Prototype Design Solution

1. Create a **Flow Diagram** of the entire **Prototype Design Solution**.
2. Create **Diagrams to illustrate** the main features of the **Prototype Design Solution**.
3. Designate all the **Optoelectronic Circuit** requirements.
4. Design the **Signal Logic Control Circuit**.
5. Consider the construction of a 3-**D Model** of the Final Design Solution - to gain **spatial structural awareness**.
6. Include any requirements for a **Motor Control System**.