REALITY 102

HOW DOES IT WORK?
WHY SHOULD I CARE?

OCTOBER 29 AND 30, 2016

LA, CALIFORNIA

www.MBTevents **www.MyBigTOE.com**

Reality 102

- How Does It Work – VR Mechanics
  - Saturday – Big TOE Science -- The Implications Of Virtual Reality
    - VR…….6 slides
    - Action at a Distance…….2 slides
    - Physics experiments…… 35 of 45 slides
    - Chaos……..2 slides
    - Q&A
- Why should I care? What Does VR Have To Do With Me?
  - Sunday – Life And Love In The Bigger Picture
    - Applications of MBT to everyday life
    - Q & A

Virtual Reality

Our virtual reality -- what we call the physical universe -- is generated by an intelligent probability-based simulation, NOT a deterministic, mater-based, bottoms up process

Today I will show you several easily achievable QM experiments that can verify or falsify this thesis

(EV) → experimentally verifiable

Intro: VR And The Consciousness Connection

- **Consciousness is fundamental -- all else is virtual**
  - Start with the **assumption** that primordial (the potential for) consciousness exists…. then, it evolved to become what it is today.
  - **Conjecture:** The Larger Consciousness System (LCS) evolved through **emergent complexity** operating on simple, initially **random,** recursive processes → stable rule-set → **cellular automata** → process fractal)
  - Its continued evolution (lower entropy) is the driving force – the purpose.
  - The needs of LCS evolution eventually leads to the **evolution** of the PMR VR entropy-reduction-trainer (our universe) BDB. The evolving VR simulation eventually transitions from mostly deterministic with random functions (initial ruleset calculations) to mostly probabilistic.
  - Summary: First we start with the **assumption** of fundamental consciousness emerging from random process and allow the process of evolution to step by step logically derive all the rest

Virtual Reality – Overview

- Consciousness creates (evolves) and computes the VR and populates the VR with Individuated Units of Consciousness (IUOC) "players"
- VR Facts (3 components, 2 are interactive) –IUOC player, computer, VR game map
  - The IUOC player and Computer trade data -- both are subsets of the LCS
  - Consciousness provides an input to the computer (initiates a choice) and asks for consequence data (makes a measurement). The computer probabilistically computes the requested result data within the constraints of **history** **(dynamic continuity)** and the **rule-set** **(a constraint on what can be)**
  - The computer (VRRE) generates PMR through random draws from probability distributions of the possibilities constrained by the rule-set and history. It passes these results in data-streams to all directly involved FWAUs (partitioned part of IUOC immersed in the PMR VR) **(look away --No Man's Sky)**

Virtual Reality Mechanics – Overview

- The VR must be predominately probabilistic
  - The **rule-set** is mostly **deterministic** but sometimes **probabilistic** since uncertainty (modeling random process) is part of the ruleset.
  - The evolving VR simulation quickly evolves from **mostly deterministic to mostly probabilistic** (depending on the accuracy required, each instance may **require a mostly deterministic sim to generate the needed distributions to support the probability model**)
    Cannon example
  - History is maintained in the historical database
  - The future is anticipated in the probable future database

Virtual Reality And Physics – a few examples

- That a measurement in PMR is created by a random draw from a probability distribution explains why every **measurement of a spin state** is a random up or down spin value – a simple random draw from a binary distribution.
  - This same attribute of VR is also the root cause of **chaos**, as in chaos theory.
- The explanation of the so called **Zeno effect** wherein a quantum state with an average decay time of T will remain in the same state if one measures it once every t seconds where t << T → a random draw from a single valued distribution. Decay time resets after each draw
- **Entanglement** is simply modeled with an "IF, Then" statement.
- **Space, time, mass, charge, gravitation, and spin** represent the **fundamentals** of "physical" reality -- but their causal source is entirely unknown…this is a **signature characteristic** of a VR

Virtual Reality And Physics
More Signature Characteristics of a VR

- C (light speed) is constant because time and space are discrete not continuous and a "pixel" of space divided by a "pixel" of time (both constants fixing VR processing and memory requirements) is as fast as any material object can smoothly move within the quantum grid. A "**max speed**" is a signature characteristic of a VR
- There are no fields -- only a ruleset that calculates how things (e.g. electromagnetic of gravitational forces) change and interact as a function of space and time. Force is an effect, it is real, a force field is not physical. **Action at a distance** (with no apparent **physical** cause) is a signature characteristic of a VR
- In a VR there are **initial conditions** without a cause – e.g., Big Digital Bang. **Initial conditions and ruleset definitions appear causeless within the VR --** These are a signature characteristic of VRs
- **Chaos** is a signature characteristic of VR mechanics **(EV)**
- **Quantum Mechanics** (DSE) is a signature characteristic of our VR's mechanics **(EV)**

Virtual Reality And Science

- An explanation of the Anthropic Principle
- A solution to the Fermi Paradox – where are they?
- Virtual brains remember, process, think, and analyze nothing -- all those functions are accomplished by consciousness
  - Virtual brains, like all other virtual things that appear physical to us from inside the VR, define the constraints of the rule-set, and the evolutionary state of the PMR.
    - Brain scans from a 2007 study in The Lancet that looked at a French man missing 90% of his brain. (Feuillet et al/The Lancet)
    - In 1980, Roger Lewin published an article in Science, "Is Your Brain Really Necessary?". He reports the case of a Sheffield University student who had a measured IQ of 126 and acquired a Mathematics Degree but who had hardly any discernible brain matter at all
    - "…of the last group, which had less than 5% of normal brain tissue, half were profoundly retarded. The remaining half had IQs greater than 100.
  - **Donald D. Hoffman is Professor of Cognitive Science, University of California, Irvine** PhD from the Massachusetts Institute of Technology in Computational Psychology. He studies perception, artificial intelligence, evolutionary game theory and the brain. He likens our so called "physical reality" to the GUI of a computer – all symbolic and metaphorical - not the "real", more fundamental, reality which lies underneath. Math model of Consciousness.

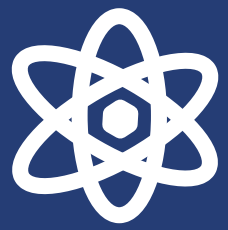
The "Physical" World

- We don't directly measure fundamental particles like electrons, We measure effects and then make up electrons (and all other particles) to explain our measurements in terms of a physical causality because we **believe** in materialism
- Effects and interactions are presented to us in a data stream that we interpret.
- What is not required in someone's data-stream is not directly calculated. Probability distributions model all functions not objectively rendered in PMR to an IUOC taking a "measurement"
  - The double slit experiment's **observer** is critical to the definition of **objective** "which-way" data **(EV)**
  - 1) Walkie talkie or CB radio 2) Cell phone example
- Understanding quantum physics has been too far out of the box for us to recognize the solution for almost 100 years. The solution will be both simple and sound completely bizarre. If it didn't sound bizarre, it couldn't possibly be a correct solution.

Action At A Distance

Predicting VS Causing

- Fields compute effects at a distance. A wave equation does not logically imply a physical process – that is our belief (interpretation)
- The **effects** are real from the view **inside** the VR, the fields are not.
- The fields simply **predict** effects by emulating some portion of our VR's ruleset . E&M waves and particles are both conceptual models -- **as if** there were a physical wave – waves that have none of the properties of being physical.
- **Predicting an effect is much different than causing an effect**
  - Eclipse, force on a charge, change in gravitational force
  - We imagine that fields are causal because we **believe** in materialism
- The **actual cause** is the VRs rule-set and the VRRE's calculation which ends up in your data-stream
- The purpose of science is to better understand the VRs rule-set



QUANTUM PHYSICS EXPERIMENTS (DOUBLE SLIT)

AS SEEN FROM THE PERSPECTIVE OF VIRTUAL REALITY

The Problem: Particles Are Not Physical

- The double slit experiment clearly tells us that particles are **not** physical
- They are also **no physical probability waves** – that is another "physical" interpretation of mathematical (wave function) logic -- only a metaphor
- All particles, big and small, are virtual because our reality is virtual
- The same concepts that explain QM apply to everything: Macro and Micro. Example: astronomer (uncertainty is the key, not size) CB static
- There is no special science just for very small things

The Logic of Virtual Reality

- Claiming that our **physical** reality is based upon the collective interaction of **physical** particles is **logical** but **experimentally proven incorrect –** This is still the standard belief of scientists

- Claiming that our **physical** reality is based upon the collective interaction of **non physical** or **virtual** particles is **illogical and incorrect**

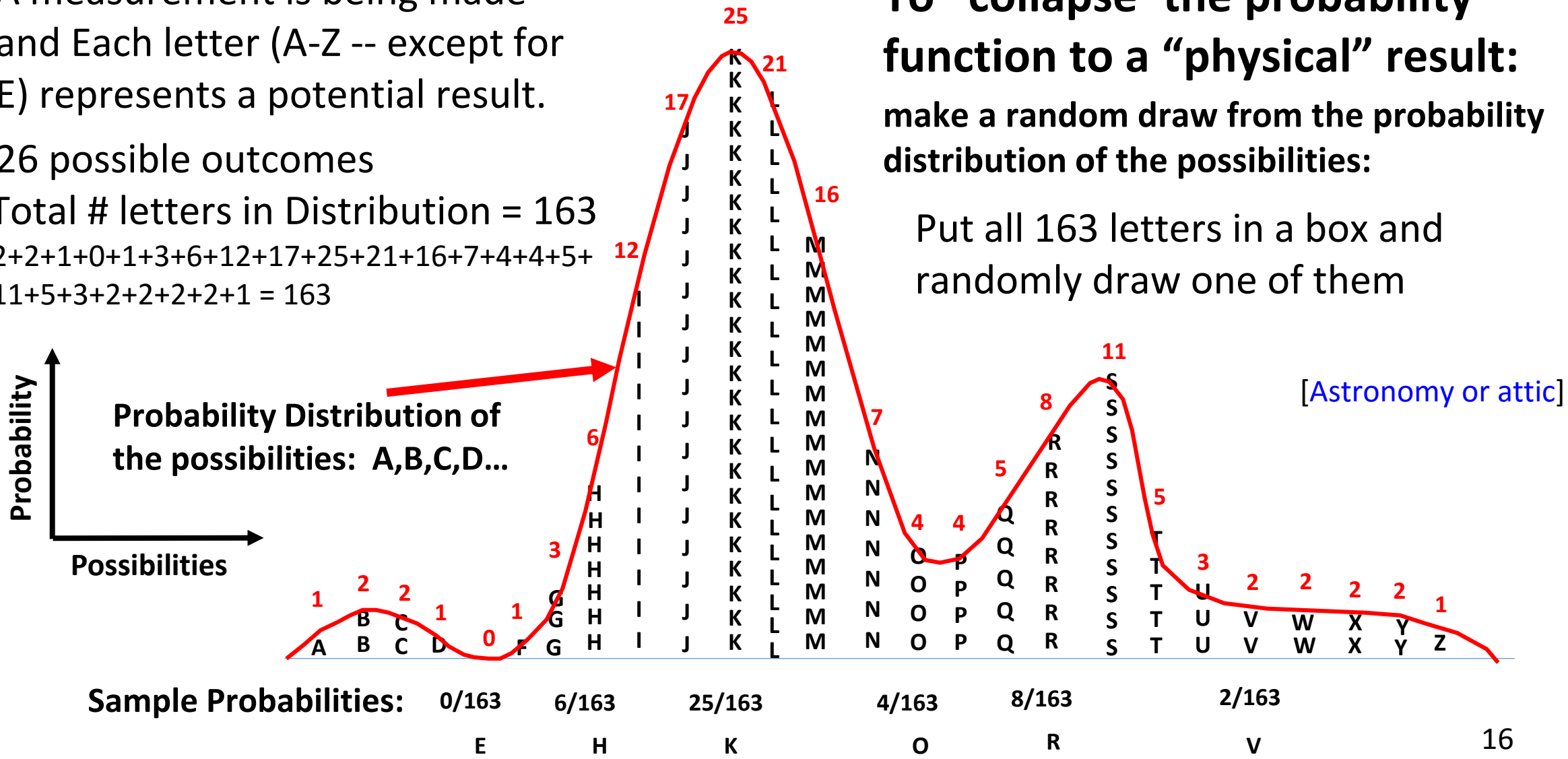
- Claiming that our reality is a **virtual** reality based upon a ruleset that defines the collective interaction of **virtual** "particles" is **logical and correct** – how could it be any other way? What else could one build out of virtual building blocks other than a virtual structure?

- So, let's see how it works:

Random Draw From the Probability Distribution of the Possibilities

- A measurement is being made and Each letter (A-Z -- except for E) represents a potential result.
- 26 possible outcomes
- Total # letters in Distribution = 163

1+2+2+1+0+1+3+6+12+17+25+21+16+7+4+4+5+
8+11+5+3+2+2+2+2+1 = 163



To "collapse' the probability function to a "physical" result:

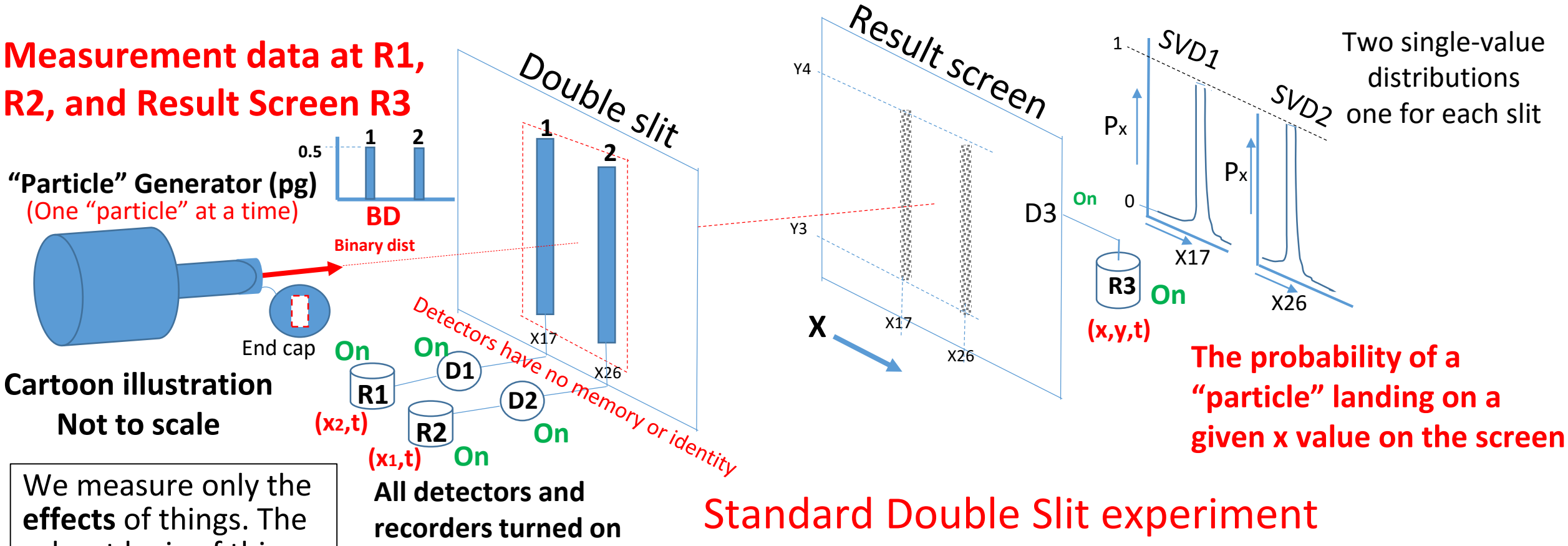
make a random draw from the probability distribution of the possibilities:

Put all 163 letters in a box and randomly draw one of them

[Astronomy or attic]

Review: Double Slit --Detectors (D1,D2) and Recorders (R1,R2) Turned On

Measurement data at R1, R2, and Result Screen R3



We measure only the **effects** of things. The ruleset logic of this virtual "particle" generator causes the LCS to calculate the **effect** of an ejected virtual particle within the VR containing the generator (R1, R2, R3)

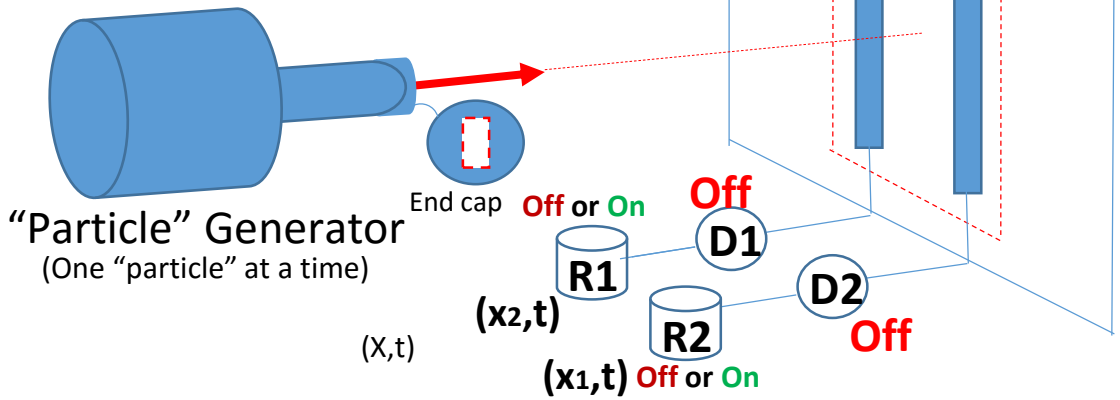
Standard Double Slit experiment with "which-way" information

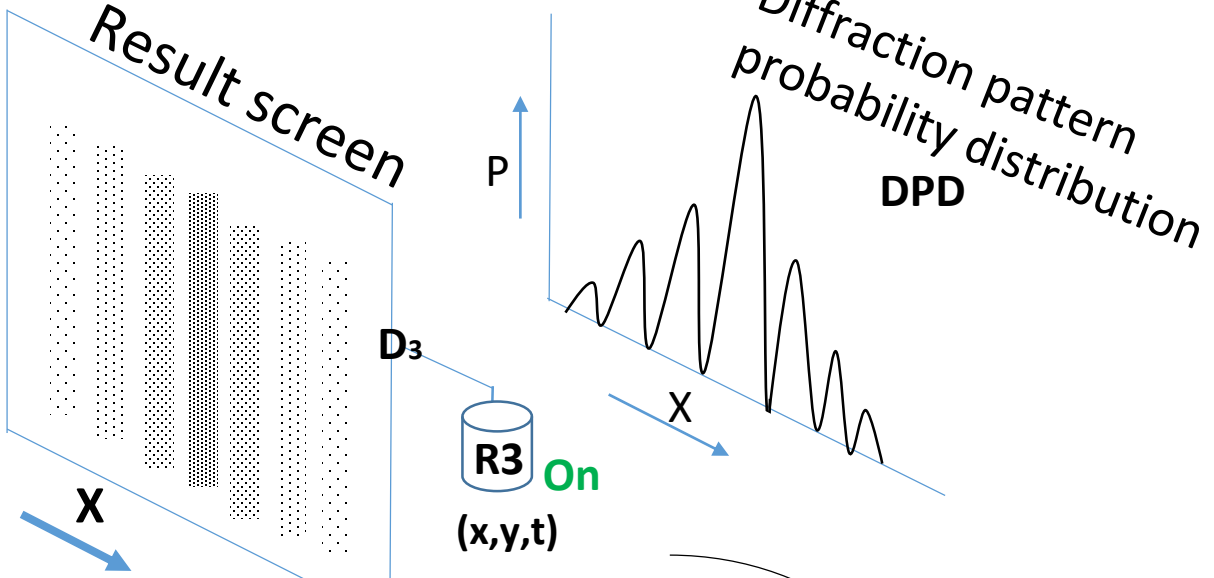
The probability distributions are shaped as shown above because of the prior recorded measurements of R1 and R2 provide the available "which-way" information (time and position)

Review: Double Slit Experiment With Detectors Off

Measurement at screen (R3) only

Let the LCS/VRRE run a large number of particles through this experiment logic to generate the distribution on the next slide -- capture all quirks specific to this experiment

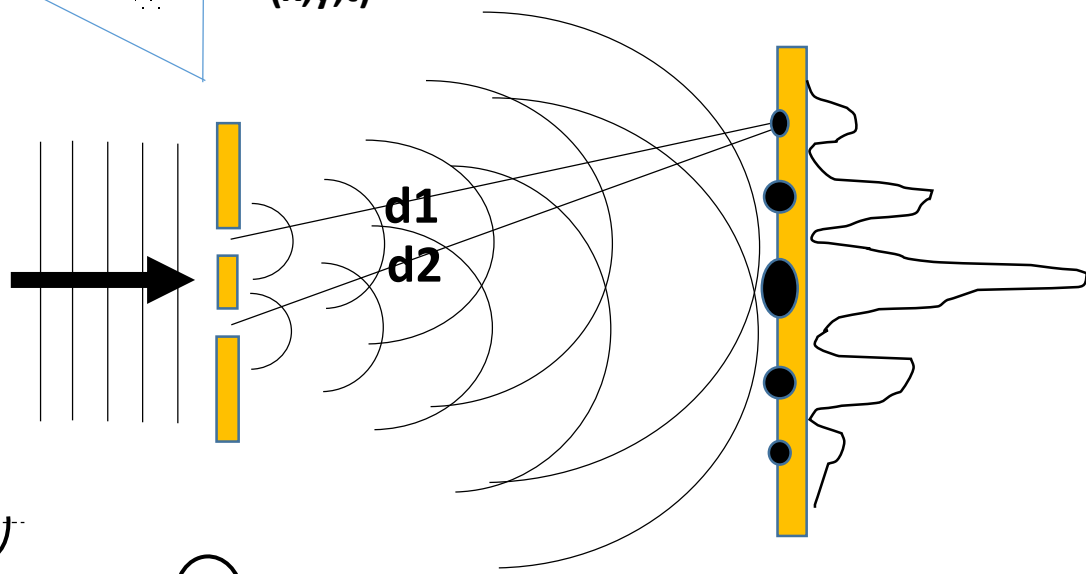




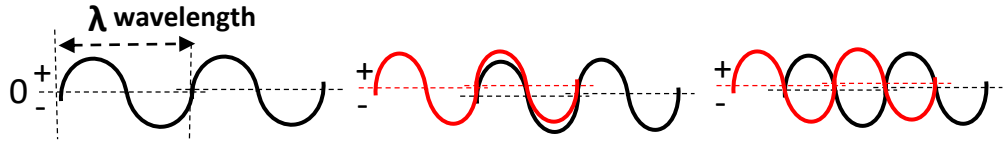
A consistency constraint:

A few "particles" must act the same as many "particles." Thus, "probability waves" and "which way" data are necessary. No objective inconsistencies are allowed

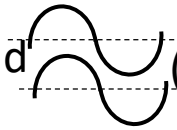
Light as a wave: (many "particles")



Superposition:

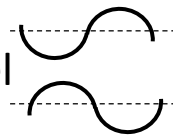


d2-d1 = If path difference = integer number of wavelengths: wave amplitudes add



(waves are In phase)

d2-d1 = If path difference = odd integer number of half wavelengths: wave amplitudes cancel



(waves are Out of phase)

Random Draw From A Diffraction Pattern Probability Distribution (DPD) Computed at the Result Screen

Our avatar can appear to build a "physical" experiment because the LCS builds a computer model of that experiment according to the ruleset logic the avatar imparts to the design and construction.

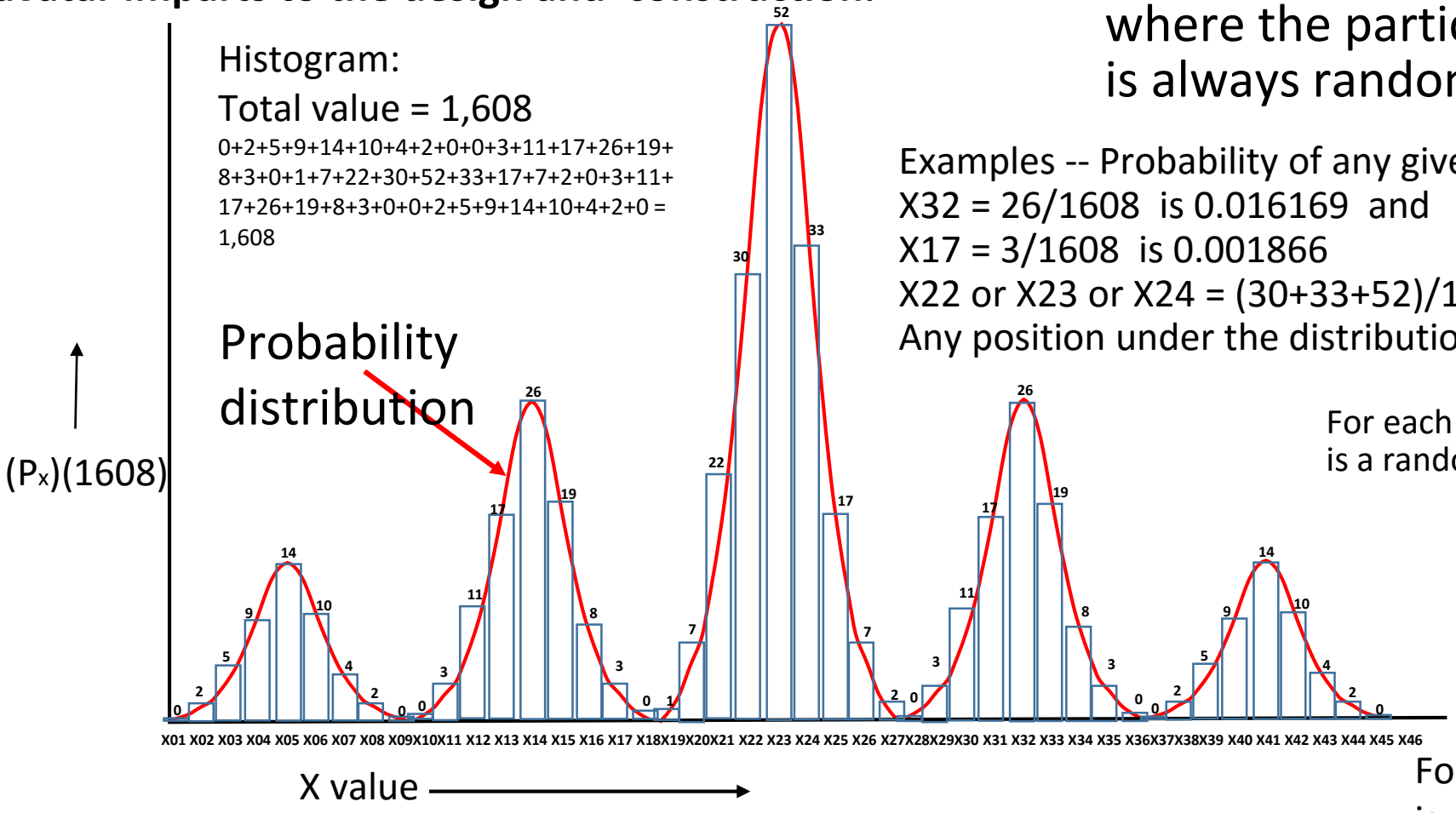
To make a random draw from the probability distribution of the possibilities:

Put all 1,608 X-values (X01 to X45) in a box and randomly draw one of them – that is where the particle goes on the x-axis (y value is always random for any x value)

Histogram:

Total value = 1,608

0+2+5+9+14+10+4+2+0+0+3+11+17+26+19+8+3+0+1+7+22+30+52+33+17+7+2+0+3+11+17+26+19+8+3+0+0+2+5+9+14+10+4+2+0 = 1,608



Examples -- Probability of any given particle landing at position:

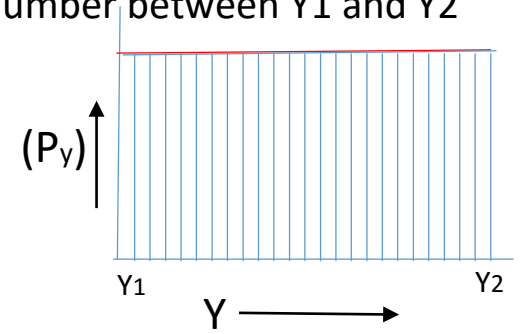
X32 = 26/1608 is 0.016169 and X23 = 52/1608 = 0.032338

X17 = 3/1608 is 0.001866

X22 or X23 or X24 = (30+33+52)/1608 = 0.071517

Any position under the distribution = 1608/1608 = 1.0

For each X value, the corresponding SCREEN Y value is a random number between Y1 and Y2



For each X value, the corresponding Y value is a random number between Y1 and Y2

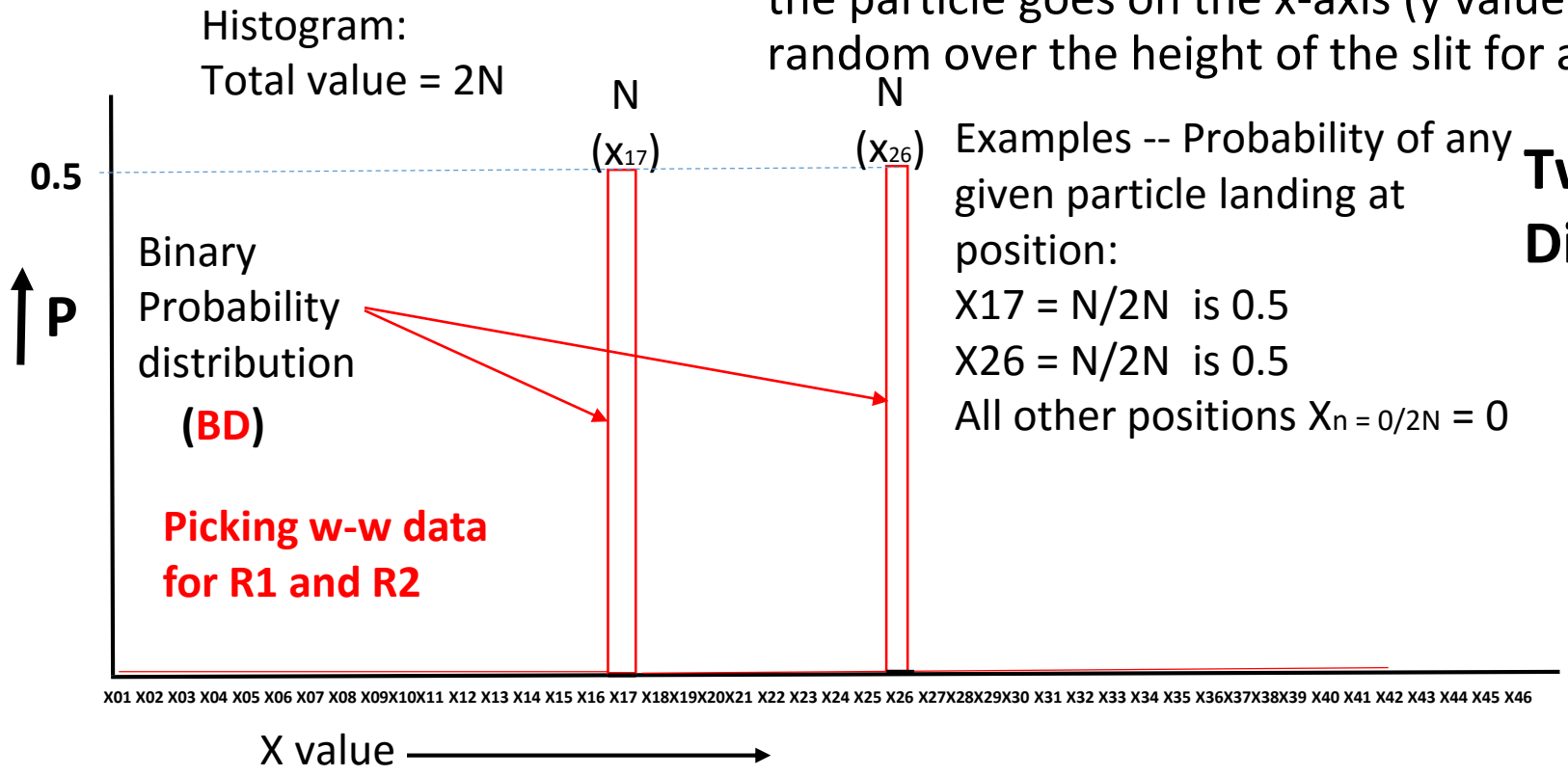
Random Draw From Binary and Single-Value Probability Distributions

To make a random draw from the probability distribution of the possibilities:

All X positions **except** for X_{17} and X_{26}, have zero value (zero probability)

For example, let X1 and X2 be the X coordinate of slit positions in **slide 17**:

Put all 2N of the X-values of (X1=X_{17} and X2=X_{26}) in a box and randomly draw one of them – that is where the particle goes on the x-axis (y value is always random over the height of the slit for any x value)



Examples -- Probability of any given particle landing at position:

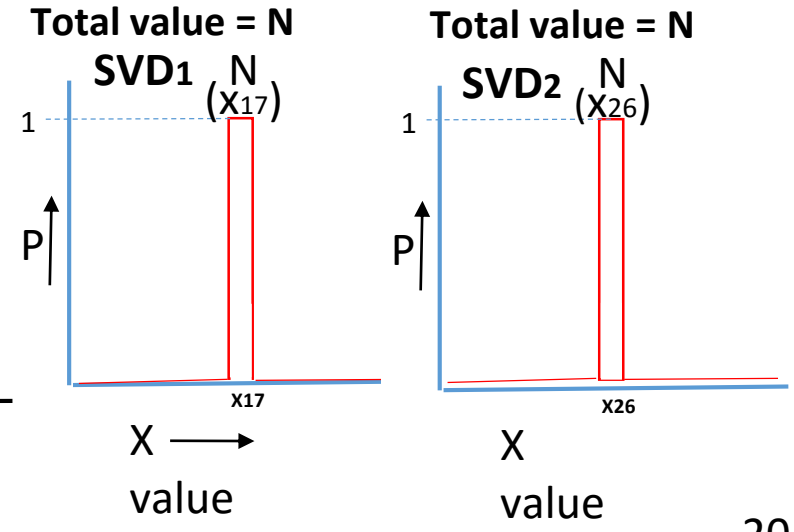
X17 = N/2N is 0.5

X26 = N/2N is 0.5

All other positions $X_{n = 0/2N} = 0$

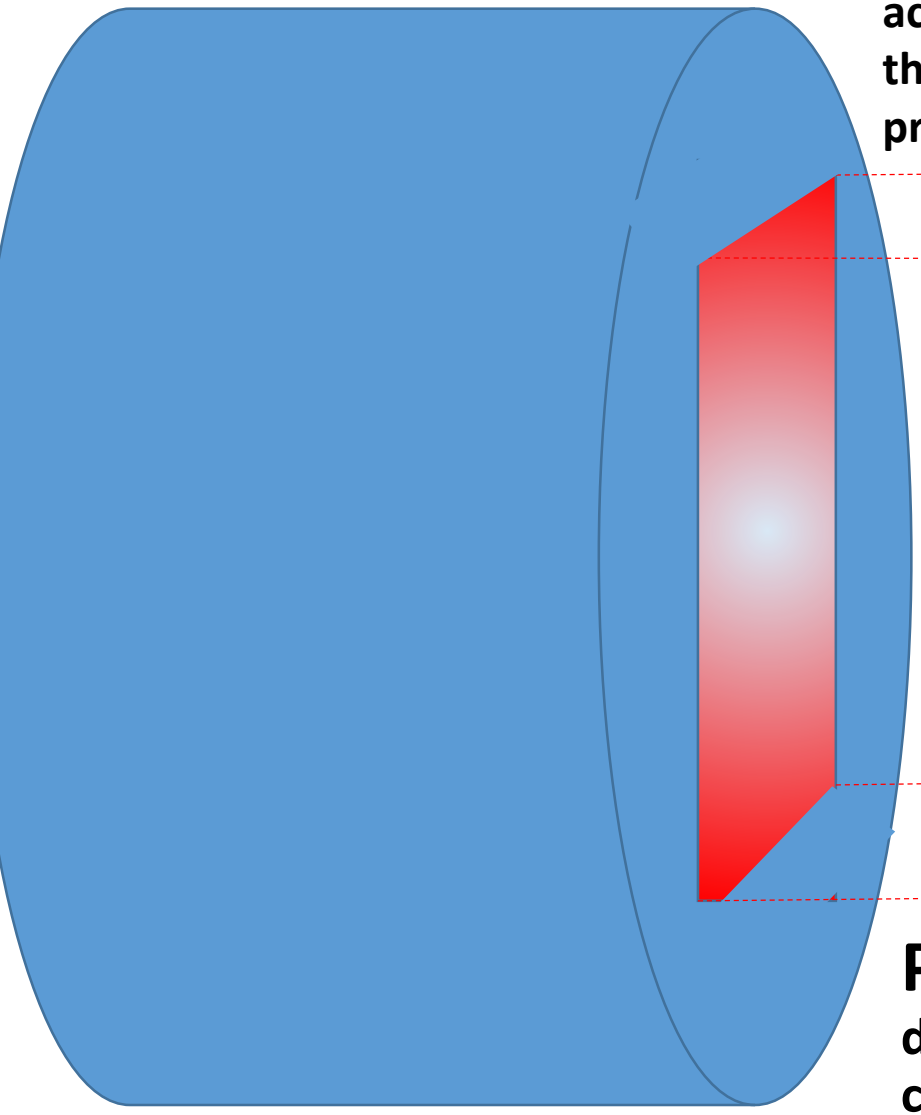
Picking result screen impact point for R3

Two Single-Value Probability Distributions (SVD)

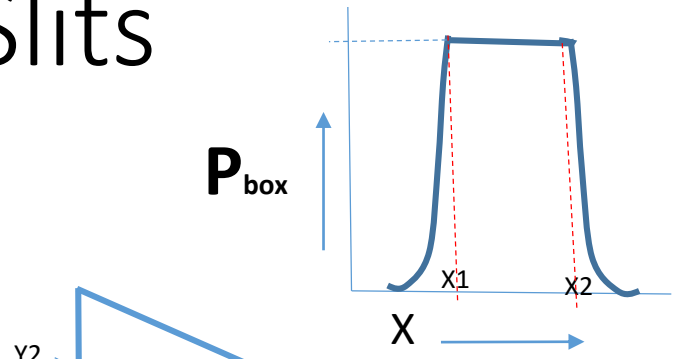


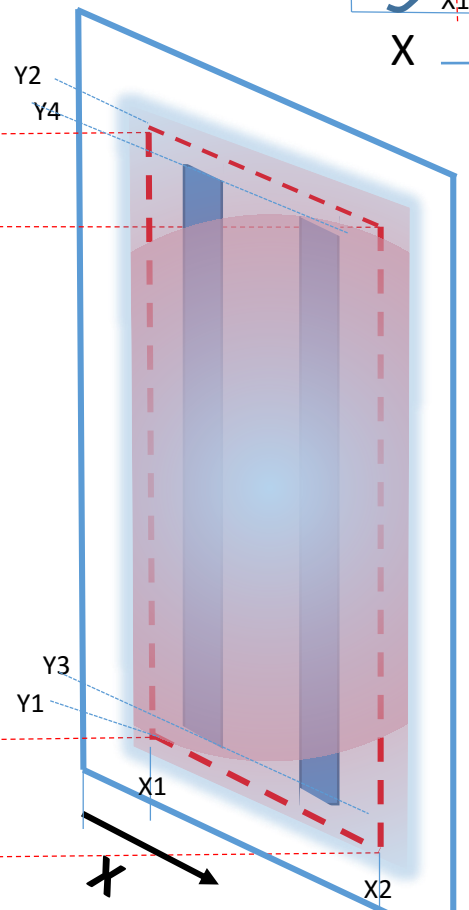
Illuminating the Double Slits

Particle generator
End cap



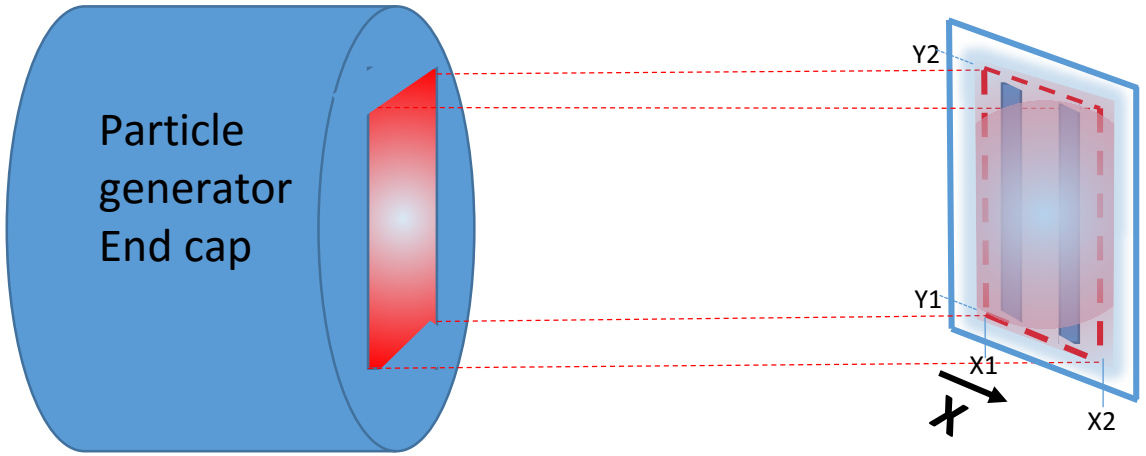
Turn the particle source (e.g., laser light intensity) up and adjust the beam until one achieves a uniform density of particles inside the dashed red line. Fit the line as tightly as practical to the slits

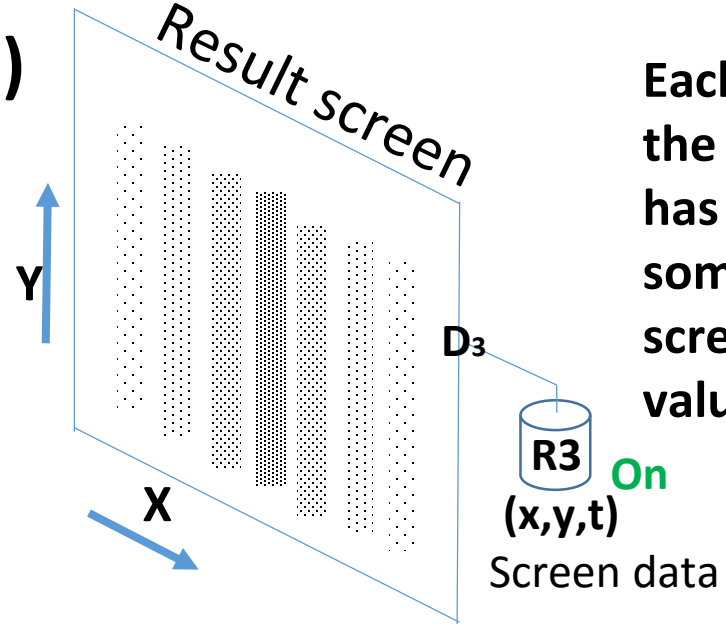




P_{box} = The probability that a generated particle will strike inside the dashed red box (with an x coordinate between X1 and X2 and a Y coordinate between Y1 and Y2)

Placing the particle on the screen R3(x,y,t)





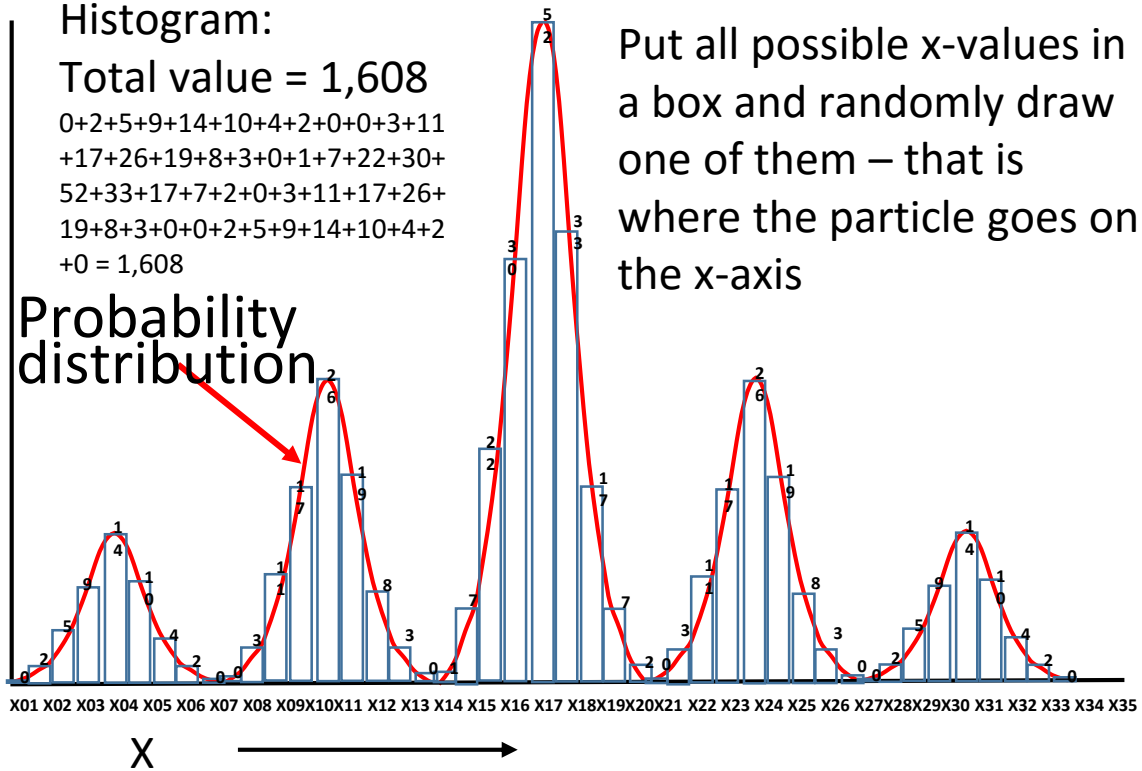
Each particle location on the result screen (X,Y) has a <u>specific</u> X value somewhere on the screen and a <u>random</u> Y value between Y1 and Y2

Histogram:

Total value = 1,608

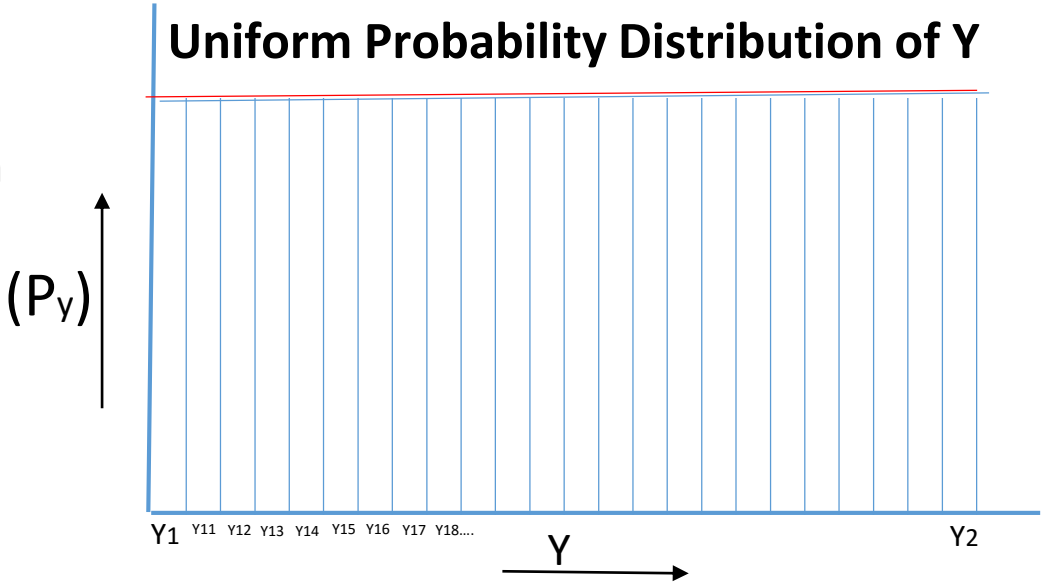
0+2+5+9+14+10+4+2+0+0+3+11
+17+26+19+8+3+0+1+7+22+30+
52+33+17+7+2+0+3+11+17+26+
19+8+3+0+0+2+5+9+14+10+4+2
+0 = 1,608

Probability distribution



Put all possible x-values in a box and randomly draw one of them – that is where the particle goes on the x-axis

Uniform Probability Distribution of Y

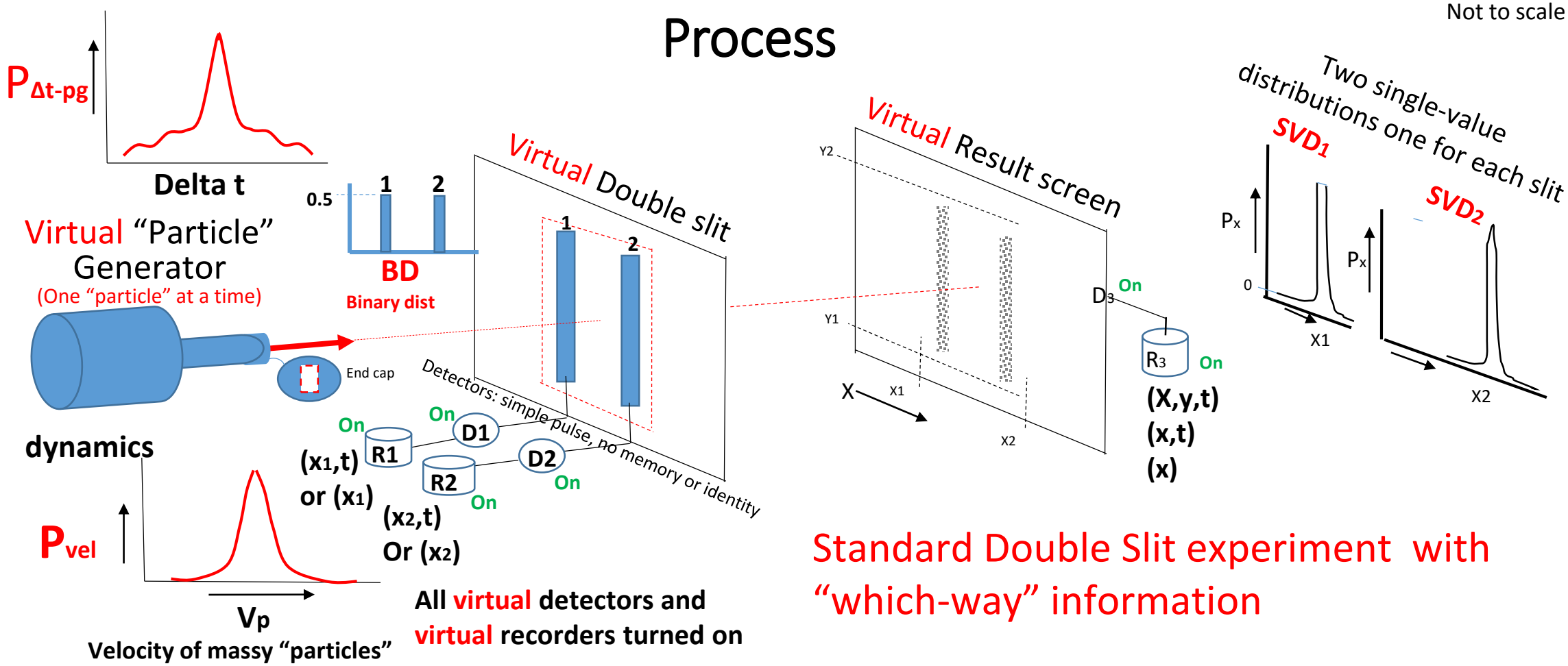


Put each of the possible Y values (between Y1 and Y2) into a box, shake and draw one out. There is an equal probability of getting any particular Y. Thus the Y value you get is random

For each X value, the corresponding Y value is a random number between Y1 and Y2

Inside the Particle Generator – A Statistical Process

Cartoon illustration
Not to scale



Standard Double Slit experiment with "which-way" information

$P_{\Delta t\text{-}pg}$ = probability of the time between consecutive generated "particles

$\overline{f}_{pg}$ = average frequency of particle generation in particles per sec (pps)

[Δt example: If average # of particles/sec, f_{pg} = 30 pps, then Δt=1/30 sec]. Since Δt =1/$\overline{f}$

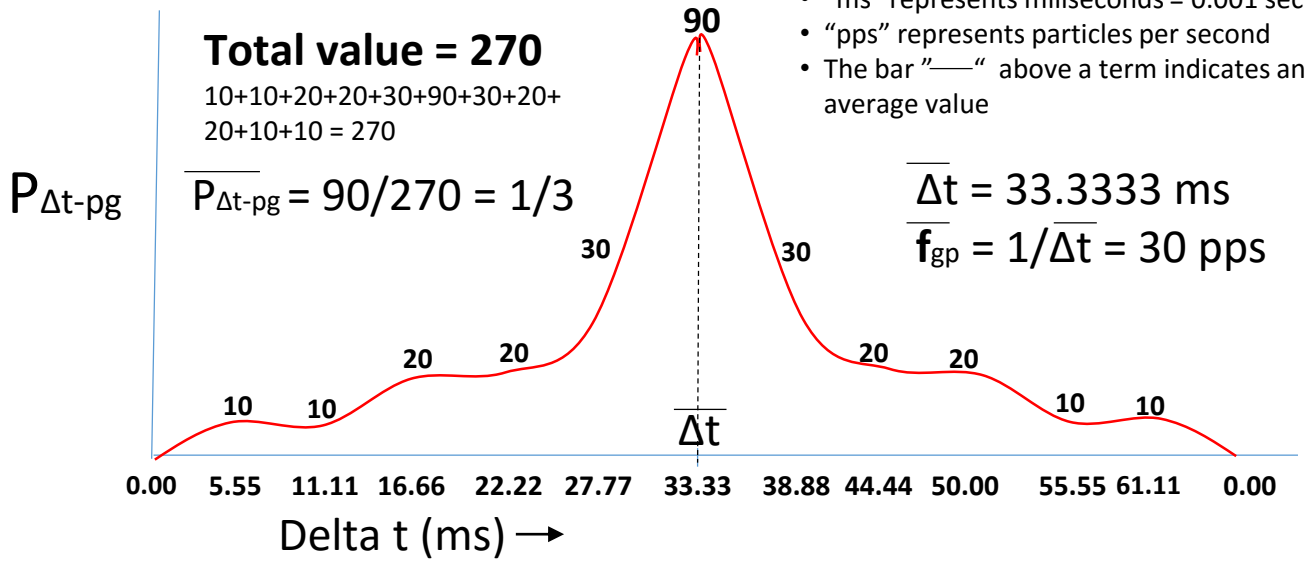
Lets Make Up Some Convenient Example Numbers*

To make a random draw from the probability distribution of the possibilities:

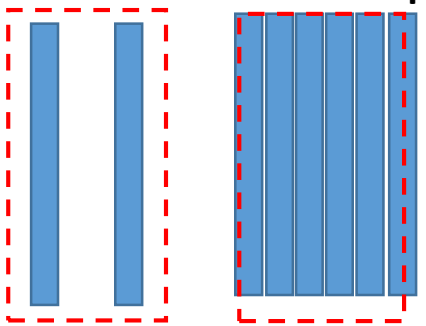
Put all 270 Δt values in a box and randomly draw one of them – that defines the time between the last and next particle. The inverse of that is the rate of particles being generated (pps).

This distribution (along with any dynamics calculations) entirely models the particle generation process for this experiment

The LCS uses the logic and constraints inherent in the particle generator's design, build, environment, initial conditions, settings and the VRs ruleset to compute this distribution:



About 6 slit-areas fill up the box



Given that: A_{1slit}/A_{box} = 1/6
Then, A_{2slits}/A_{box} = 1/3

Given that: P_{box} = .8

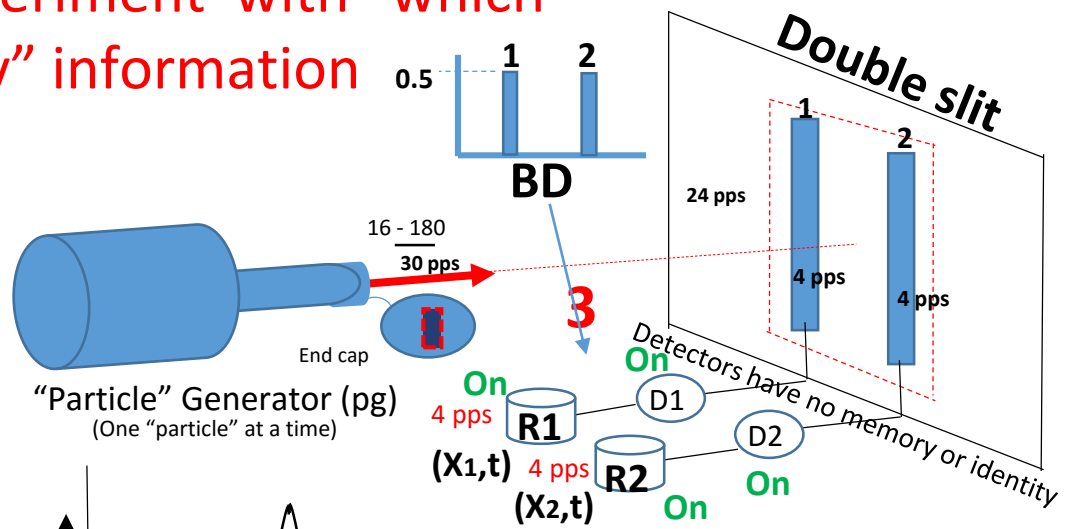
$P_{eitherslit}$ = $(P_{box})(A_{2slit}/A_{box})$ = (.8)1/3 = 0.266667 of all particles generated end up going through a slit

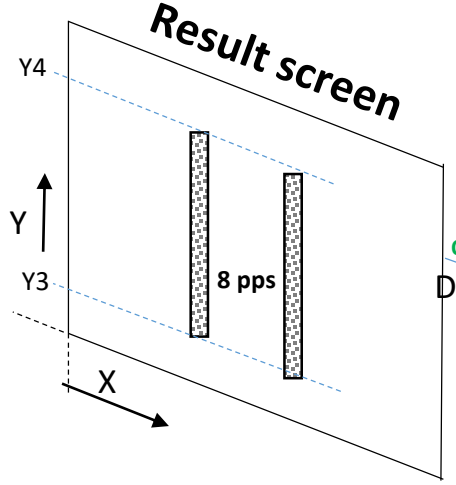
$(\overline{f_{gp}})(P_{eitherslit})$ = (30pps)(1/3)(.8) = on average, **8** particles per second hit the result screen (enter both slits) and 4pps enter each slit. Thus, on average, particles hit he screen every 1/8 of a second.

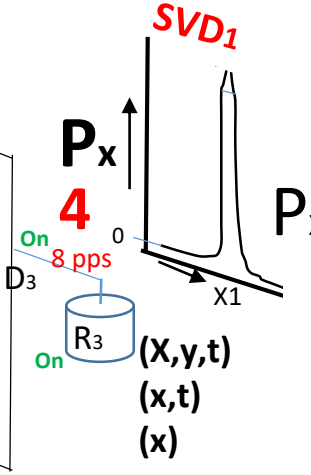
*** This distribution and example numbers are only notional. They have nothing to do with any actual experimental set up**

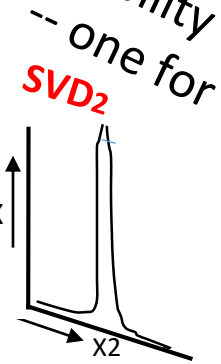
Virtual Double Slit Experiment Reduced To five Random Draws for Each "Virtual Particle"

Standard Double Slit experiment with "which-way" information



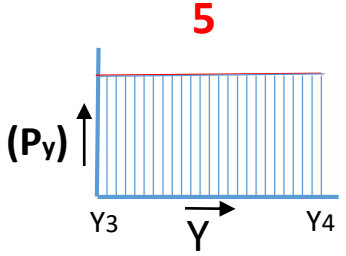




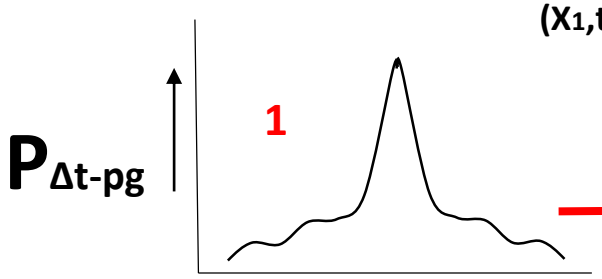


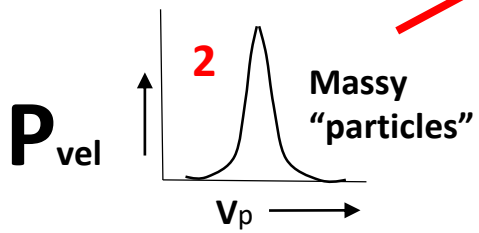
Two **single-value** probability distributions -- one for each slit

On average, 8 pps will impact result screen



For each X value, the corresponding Y value is a random number between Y1 and Y2





When does the next particle arrive? (slit & screen: R1, R2 ,R3)

1) Random draw from $P_{\Delta t\text{-pg}}$
2) Random draw from P_{vel}

Which slit does it go through? Which recorder to write on?

3) Random draw from a binary distribution **BD** because there are detectors recording thus making the "which way" data available to consciousness with R1 & R2

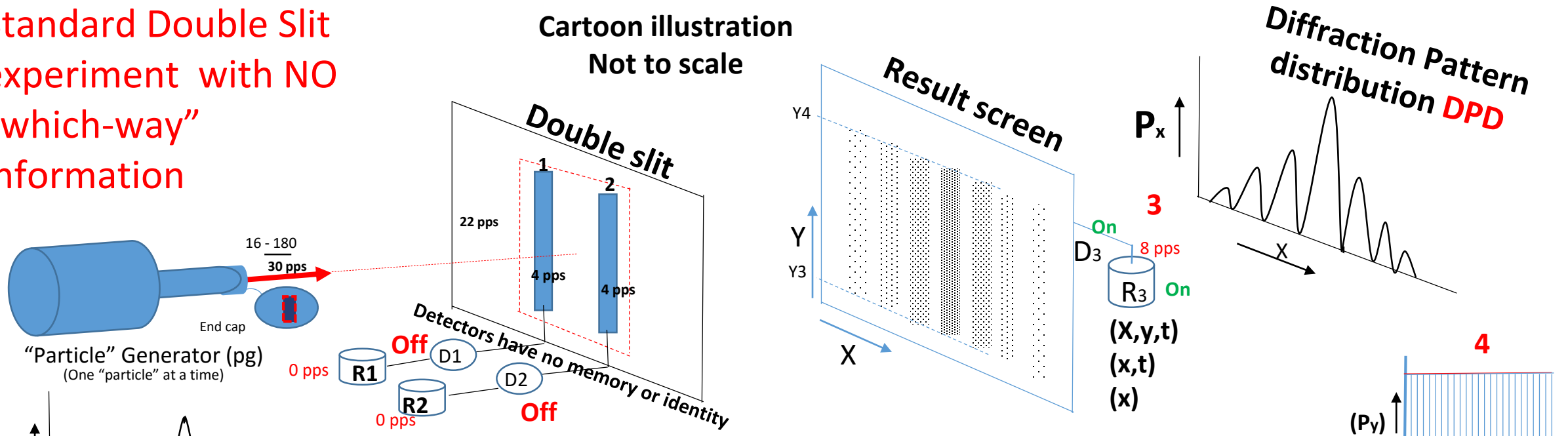
Where does it impact the result screen? Thus making the screen data available to consciousness with R3

4) Random draw from P_X (single value) and P_Y (random number between Y1 and Y2)

Delayed erasure – a future possibility: Random draws will be finalized according to current Objective (deductively logical) conditions (after no future changes are possible).

Double Slit Experiment Reduced To four (three) Random Draws Per Particle

Standard Double Slit experiment with NO "which-way" information



When does the next particle arrive (~~R1~~, ~~R2~~, R3) ?

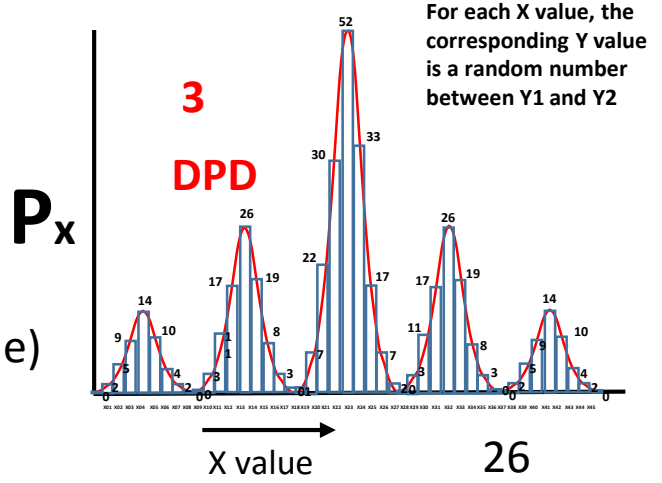
1) Random draw from $P_{\Delta t\text{-}pg}$
2) Random draw from P_{vel}

Where will it impact the result screen (R3)?

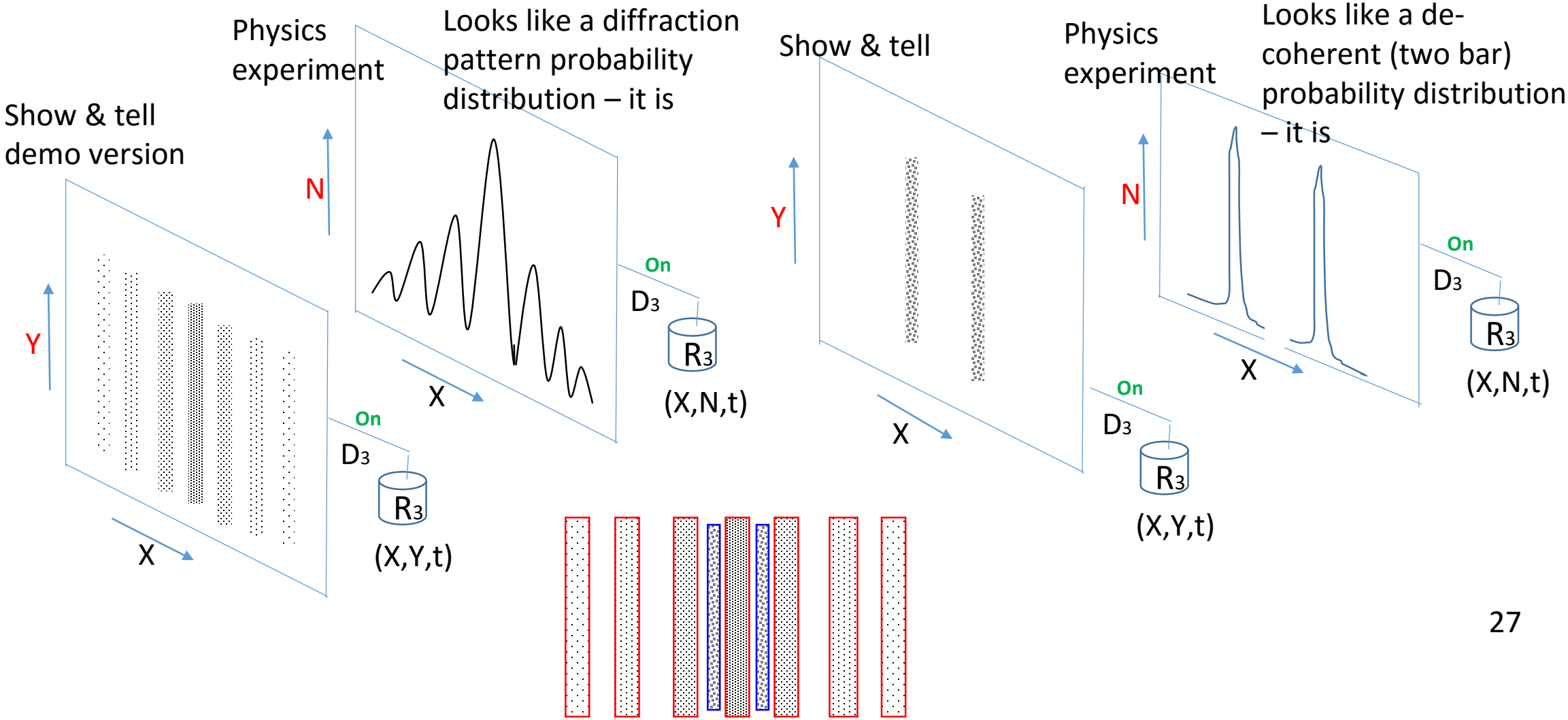
3) Random draw from P_x **DPD** (single X value)

Screen data is made available to consciousness through R3

3) Random draw from P_y (single y value)



Reducing confusion
The Appearance Of Result Screen Data



Introducing The Experiments

- Feynman, discussing the two-slit experiment, noted that this wave-particle dual behavior contains the basic mystery of quantum mechanics. **He is correct**.
- Our virtual reality is generated by an intelligent simulation, not a deterministic material bottoms up process. These experiments can **verify** or **falsify** this claim
- 5 different double slit experiments, with more than a dozen additional sub-experiments (some introductory or conditional), are cast in terms of VR concepts **to test** multiple aspects of MBT VR concepts and **to develop** new information about the rules and choices that determine how our VR is rendered.
  - Simple, inexpensive, easily doable, designed to answer questions and gather information
  - **Logical explanations (rather than calculations) and predictions** are made as to the outcome of each experiment according to current MBT VR understanding.
  - Many incorrect conceptions about the DS in particular and QM in general, are very common. These **simple** experiments should clearly settle many of these issues.
- If MBT VR theory can mature sufficiently, QM may be reduced to an easily understood and explained logic problem without the need for wave functions or advanced mathematics to predict most outcomes.
- **Summary of the experiments (repeated at the end of the presentation on slide 58):**
- Exp 1f2 depends on Exp 2 producing a diffraction pattern but Exp 1c2, Exp 4 and Exp 5 do not – they are completely independent of the outcome of Exp 2 and are also independent of each other. This means that if Exp2 fails, then Exp 1f2 will also fail.
- Exp 1c2 and Exp 1f2 are very similar (almost redundant in function), however, the difference is that Exp 1f2 is considerably easier to implement. Thus, if Exp 2 fails, one can still do Exp 1c2, and if Exp 2 succeeds, one can do the easier, less expensive Exp 1f2
- Exp4 **may seem odd and even unscientific** because of the human interaction in the experiment and because the experiment is done in the macro-world instead of the micro-world, **but that is more the result of prejudice than any real problem of good science**.
- Exp 5 has no off-the-beaten-path strangeness or unusualness, but its set-up and equipment are more complex and difficult to construct.
- Experiments 1c2, 2, 4, and 5 are the core experiments here (all independent), each has the potential to rewrite quantum theory.
- Experiment 3 will initiate the breaking of new ground with a study of the interaction of the PMR VR (our so called physical reality) with consciousness.

Virtual Reality Mechanics -- Basic characteristics

1. The Virtual Reality Rendering Engine (VRRE) must be or represent an intelligent agent (the LCS). Our VR's computer (VRRE) is a subset of the LCS. Expect our VR to be implemented intelligently not mechanistically. Reality is not the output of a deterministic machine – Newton's "clockwork" material universe is not correct.
2. The rendered physical world (PMR) is generated by information passed in a data stream to a consciousness (IUOC) that interprets the information as physical reality – it's a multiplayer game
3. New information must not directly conflict with existing information
   a. No **objective** inconsistencies are allowed. Thus we have a requirement that any existing **objective PMR** information cannot be in conflict with an **objective PMR** measurement result. **The boundary value problem between one and many photons impinging on double slits defines such a potential inconsistency.**
4. In a mature VR, efficiency requires the VRRE to use the ruleset to compute probability distributions that, for the most part, drive the data stream's content. Thus, virtual reality interaction unfolds as the VRRE executes a series of random draws from probability distributions that describe all possible significant PMR outcomes of all significant choices of consciousness.
5. When a "measurement" is made (by an avatar within the VR) , the result is generated by taking a random draw from a distribution of all the possible objective results that are consistent with the rule-set and with all that has gone before within the VR
   a. Random draws will be finalized according to current Objective conditions (when no future changes to the results of that specific measurement are possible – all potential changes/options have been made/taken) – the logic is fixed or static. (EV)
   b. If future changes to the result of that specific measurement are possible (experimental logic isn't fixed yet), then that measurement result remains only a potential result subject to modification until potential for change is eliminated.

Applying Fundamental Virtual Reality characteristics To The Double Slit Experiment And Thus To QM And Physics In General

- In VR theory, our "physical" universe [often referred to as: physical matter reality (PMR)] is generated within the minds of individuated units of consciousness (IUOC) as they process (subjectively interpret) the information they receive in a data stream from the computer generating the VR
  - (Note: "the computer" is variously referred to as: Larger Consciousness System (LCS), Virtual Reality Rendering Engine (VRRE), The Big Computer (TBC) or just The System).
- **In a VR, time is fundamental and always runs forward** (a result of incrementing time in a dynamic simulation). Space is defined by a coordinate system and computed as required.
- The PMR VR is rendered by the VRRE to each IUOC. PMR is an interactive multi-player game played **within a common data-space called the "Physical" universe**. **PMR facts are objective (sharable with all other players) pieces of information that are for at least some period of time available to IUOCs within PMR**. If such a fact is perishable and eventually disappears from the common data-space it remains objective only to those who objectively experienced it or those who were/are objectively impacted by it.
- The data stream defines the **objective** PMR VR to all IUOC as their avatars (body) perception apparatus (5 human senses) requires specific data that resides within PMR.
- Individual **subjective** information is generated internally by the IUOCs by assessing and analyzing its previous knowledge and experience or it is received by the IUOC as an opinion or as physically unverifiable information
- The LCS will not generate (does not allow in its data streams) multiple objective PMR **facts** that are in direct logical conflict with each other (thus avoiding a logically inconsistent VR).

  There can be no conflicting objective PMR facts. To be an objective PMR fact, a piece of information must be **available** to all IUOCs. Subjective information existing only in the mind of a particular individual(s) is not generally available to all and can not be a PMR fact (can only be an individual opinion). Thus, the requirement to avoid logical conflicts in PMR applies **only** to objective PMR "physical" facts. Subjective knowledge and inductively arrived at conclusions do not constitute objective PMR facts since they are individually, internally generated assessments. Conclusion: **"which way" data is considered objective if it is part of the shared public data-space – if it is an objective PMR fact. One way** that **potential** "which way" data that is not directly observable (not yet part of the PMR shared data-space) can become a PMR fact is to be "physically" recorded in PMR and thus made "generally available" as part of PMR's common data-space. (EV)

  Though **recorded** "which way" data is always sufficient to cause decoherence, recording the data may not always be necessary. This leads us to the possibility that if the "which way" data is ever an objective fact available within the shared space of PMR long enough for people to get a good look at it, and if one or more people do get a good look at it, then that instance of "which way" data is enough to cause decoherence (two piles of dots on the result screen). Otherwise the LCS/VRRE would have to make case by case judgement calls on **how long** perishable evidence has to be available in the shared PMR space AND **how many** of what kind of people have to see it before it counts as actionable evidence of a particle passing through a specific slit. Such case by case judgements represent an inefficient computational process compared to one objective rule applies to all cases. The LCS/VRRE seems to prefer efficient computational process. (EV)
- To maintain consistency within the VR, once an objective fact is rendered into PMR (made generally available) it must stay in PMR. Objective PMR facts must behave as "material" objects within the VR. Conclusion for the double slit experiment: **Once a particle is objectively observed in PMR by an IUOC, it must, from that moment on, act and interact like a physical particle within the VR (remain subject to the VRs rule-set). In other words, once the potential particle is observed by a IUOC "player" by making a measurement in the VR (demanding objective data from the VRRE) it must then act like a material particle (move in a straight line to the screen).** On the other hand, **before** it has been observed by any IUOC (available to be put into that IUOCs data stream as an objective fact), it is not a material particle bur rather a potential or possible particle. When an IUOC (actually an IUOCs avatar) makes a measurement in PMR, the result gets defined by a random draw from the probability distribution of all the possibilities and is made available to be placed in the data stream of the IUOC. (EV)

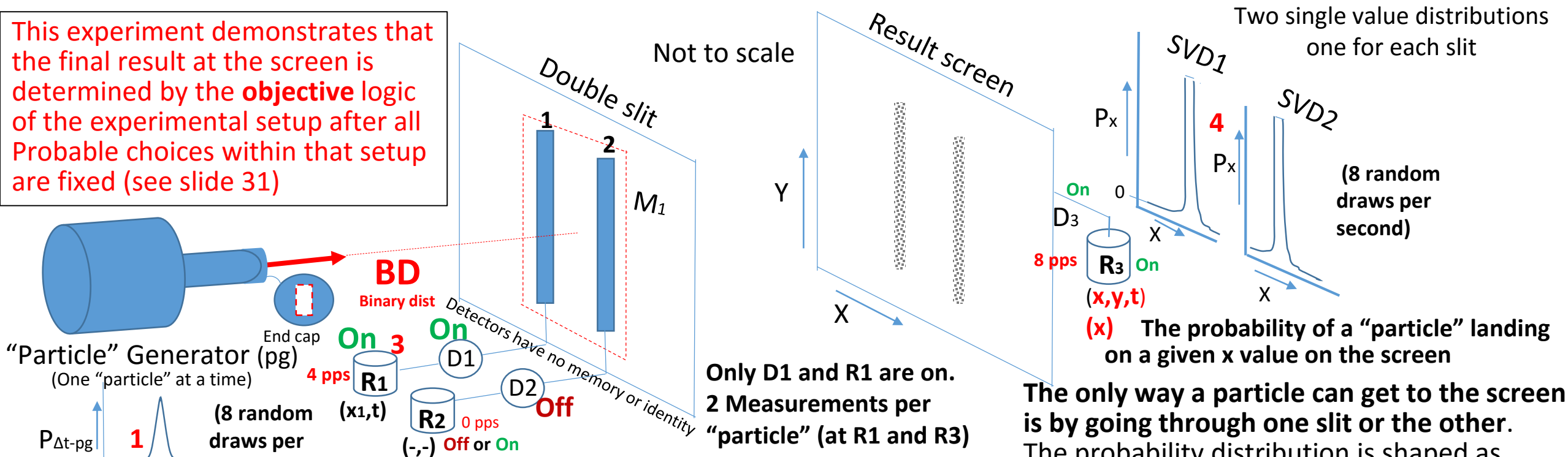
Making a Measurement in PMR

Top only

- At the site of the measurement of an **objective PMR** fact and at the **time** when that measurement result must be delivered to an IUOC, the VRRE calculates the probability distribution of all the **possible objective PMR** results of that measurement, takes a random draw from that distribution, and makes this result available to be placed in the IUOC's data-stream as the measurement result. The measurement result is computed only after no future changes to the probability distribution, from which the result of **that specific measurement** is drawn, are possible. This closure of possibilities **may** occur because the avatar is now "looking" at an object (and queries the VRRE about that object) thus forcing the VRRE to immediately inject "measurement" information describing that object into the IUOCs data-stream. (EV)
  - Thus, objective PMR facts are a logical artifact of the probabilistic measurement process that is implemented by an IUOC interpreting (based on its' quality, knowledge, experience, and belief) the data sent to the IUOC by the VRRE in response to a query (the "looking") sent by the IUOC to the VRRE.
  - The set of what is possible according to the rule-set is constrained by the requirement for consistency within PMR. In other words, any objective measured result must be consistent with (constrained by) the PMR rule-set (what is objectively possible now and in the future) and with all objective information currently residing within PMR (PMR history). No **objective** inconsistencies are allowed in the PMR VR. Thus we have a requirement that any existing **objective** PMR information cannot be in conflict with a new **objective** PMR measurement result. If a given result would create a conflict or inconsistency within the PMR VR, that result is not allowed – thus, it is not included as a possibility within the probability distribution from which the result is randomly drawn.

Double Slit with Only R1, D1 Turned On

This experiment demonstrates that the final result at the screen is determined by the **objective** logic of the experimental setup after all Probable choices within that setup are fixed (see slide 31)



Purpose: Exploring the logical requirements of "which-way" information. The objective value of **deductive** logic.

"which way" information for slit 1 is available before screen data is required. **If** half the particles that get to the screen **must** pile up behind slit 1, then the other half that does not have to pile up behind slit 1 **must** have come through slit 2.

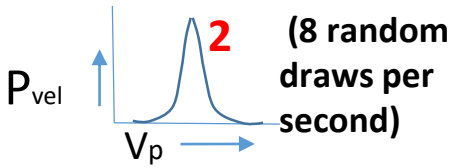
If R3 and R1 record time, then every particle on the screen can be objectively correlated with one slit or the other. If either one or both do not record time, the particles can still be objectively correlated with one slit or another by their position on the screen. R3(x) is sufficient, R3(x,y,t) is not necessary.

The only way a particle can get to the screen is by going through one slit or the other. The probability distribution is shaped as shown above because the prior measurements at R1 only account for half the dots that MUST appear on the screen behind slit 1 – the other half (those not on the line behind slit 1) MUST have come through slit 2.

Thus, the which-way data is **logically** (deductively → objectively) known for **all** "particles" though it is only measured for one. Slit 1 must have a single value **Px** distribution. **Thus we get two bars.**

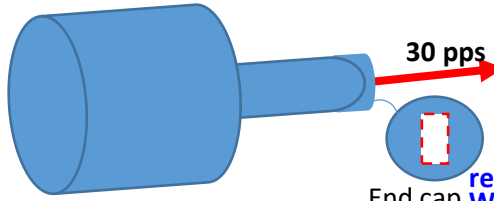
$P_{\Delta t\text{-}pg}$ = probability of the time between consecutive "particles" (Δt) being a particular value of Δt [Δt example: If # particles/sec = 4, then Δt=1/4 sec] F=1/Δt.

$\overline{F}_{pg}$ = average frequency of particle generation in particles per sec (pps)



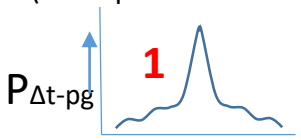
Exp. 1: Double Slit with Detectors (D1,D2) & Recorders (R1,R3) Turned On

These experiments show that detectors detecting at each slit, and the **theoretical** (potentially measurable) availability of "which way" data (1b), are **not** important. Only the **certain** (1d) availability of **objective (measured)** "which way" data (1e) is important.



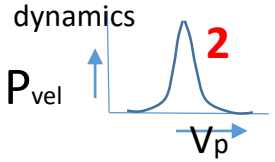
"Particle" Generator (pg)

(One "particle" at a time)



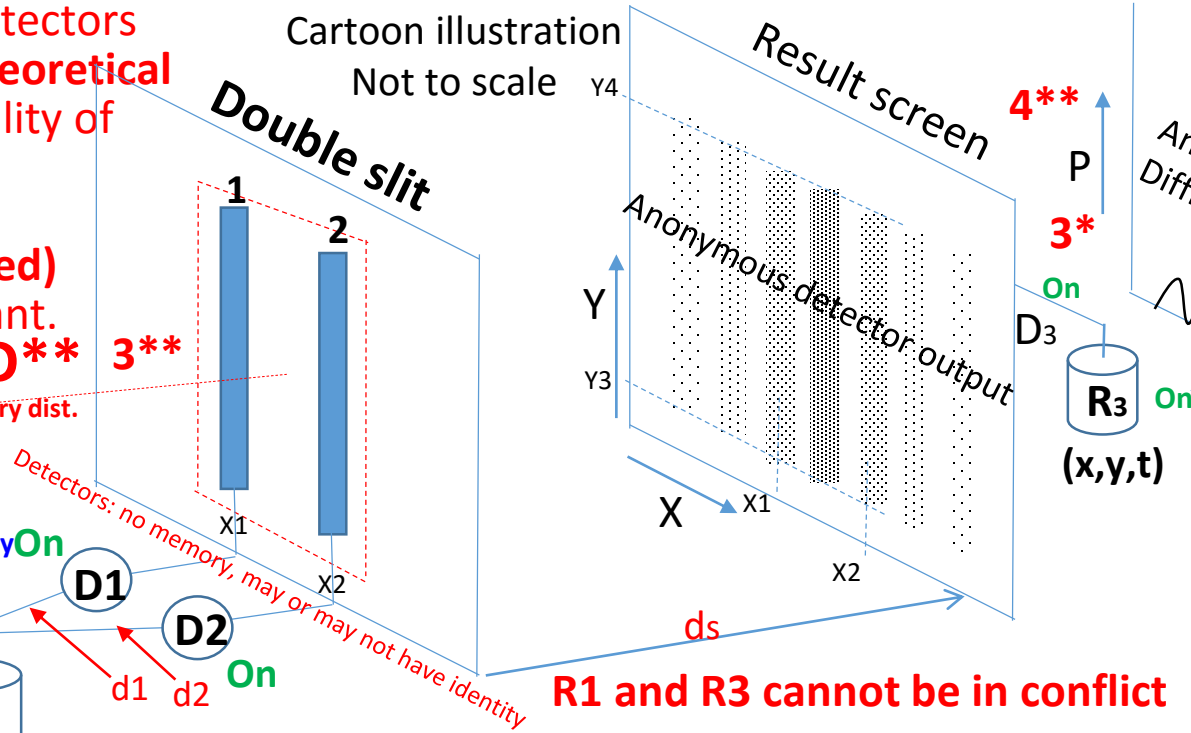
$P_{\Delta t\text{-pg}}$ = probability of the time between consecutive "particles" (Δt) being a particular value of Δt [Δt example: If # particles/sec = 4, then Δt=1/4 sec] F=1/Δt

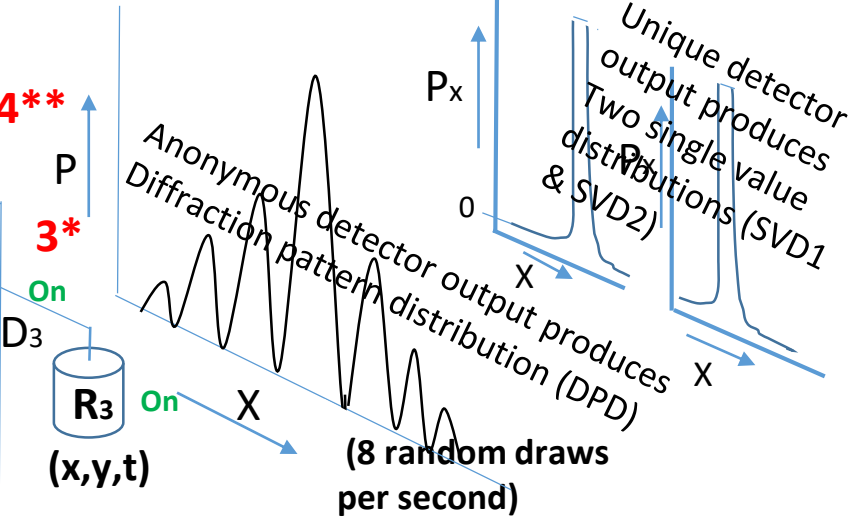
$\overline{F_{pg}}$ = average frequency of particle generation in particles per sec (pps)



(velocity of massive "particles")

Cartoon illustration
Not to scale





The probability of a "particle" landing on a given x value on the screen

R1 and R3 cannot be in conflict

(x_n,t) OR $(-,t)$

(d_{R1} = distance from slits to R1 ; d_s = distance from slits to Screen) ; d0 is very small

$d_1=d_2=d$, $d_{R1}= d+d_0$, $d_{R1} < d_s$ or $d_{R1} > d_s$ [$t_{R1}=d_{R1}/V_p$ $t_s=d_s/V_p$]

(d_{R1} path length can be lengthened or shortened by changing d)

*__Anonymous__ - R1 data from D1,D2: R1(null,t) [t only – pulse at time t]

** __Unique__ – X_1, X_2 data generated by D1, D2: R1(x_n,t) where n={I,2}

*Exp **1a**: D1 and D2 output is anonymous & $t_{R1} < t_s$ (DPD)

*Exp **1b** D1 and D2 output is anonymous & $t_{R1} > t_s$ (DPD)

*Exp **1c1 & 1c2**: like1b except at last moment, just before d_0, a unique w/w path tag is randomly added into path 1

Exp **1d If D1, D2 are unique & $t_{R1} < t_s$: BD, (SVD1 & SVD2)

Exp **1e1: If D1, D2 are unique & $t_{R1} > t_s$ (SVD1, SVD2)

Exp **1f, like 1e except after looking at screen data, recording (x,t), turn off R1 just before the which way data arrives

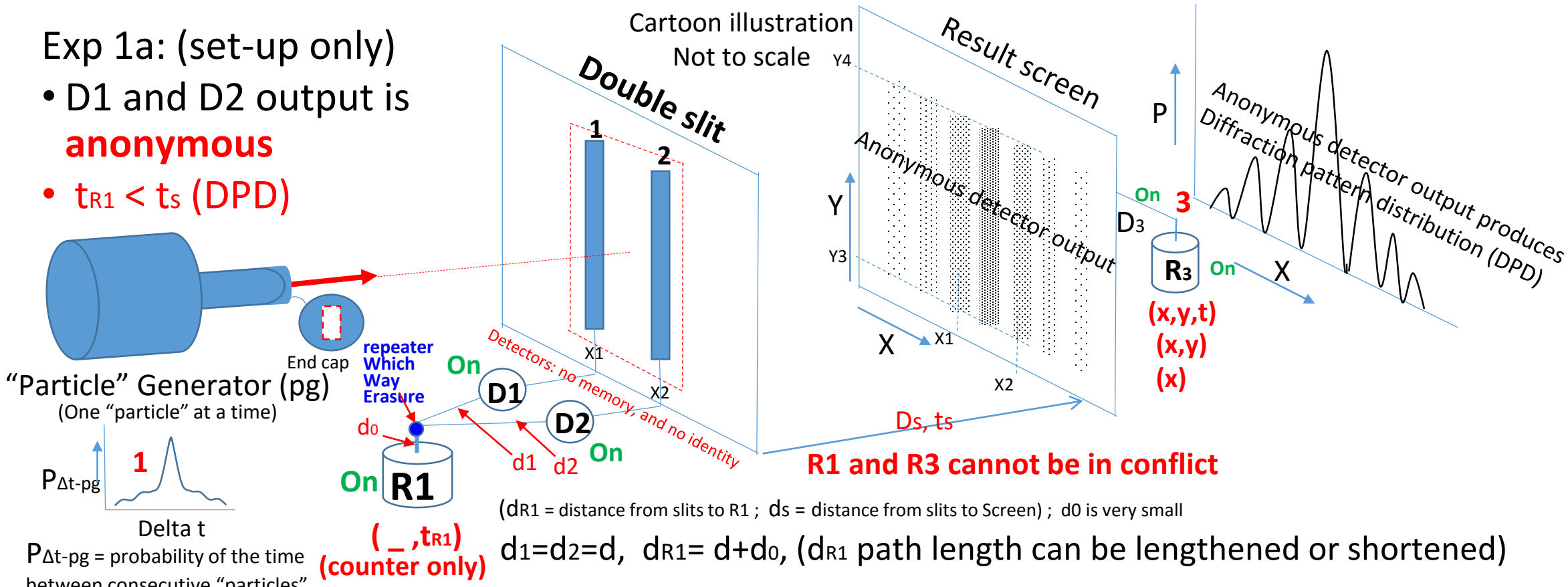
[The probability distribution for Exp 1a and Exp 1b is a diffraction pattern (DPD) because we have assumed that each detectors output is anonymous , thus there is no "which way" data

If each detectors output is unique (Exp 1a and Exp 1b), we would have "which way" data and see two bars drawn from two single value distributions SVD1 and SVD2.

Exp. 1a: Double Slit with Detectors (D1,D2) Recorder (R1,R3) Turned On

Exp 1a: (set-up only)

- D1 and D2 output is **anonymous**
- $t_{R1} < t_s$ (DPD)



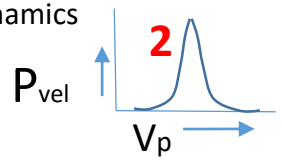
(d_{R1} = distance from slits to R1 ; d_s = distance from slits to Screen) ; d0 is very small

$d_1=d_2=d$, $d_{R1}= d+d_0$, (d_{R1} path length can be lengthened or shortened)

$P_{\Delta t\text{-pg}}$ = probability of the time between consecutive "particles" (Δt) being a particular value of Δt [Δt example: If # particles/sec = 4, then Δt=1/4 sec] F=1/Δt

$\overline{F_{pg}}$ = average frequency of particle generation in particles per sec (pps)

dynamics



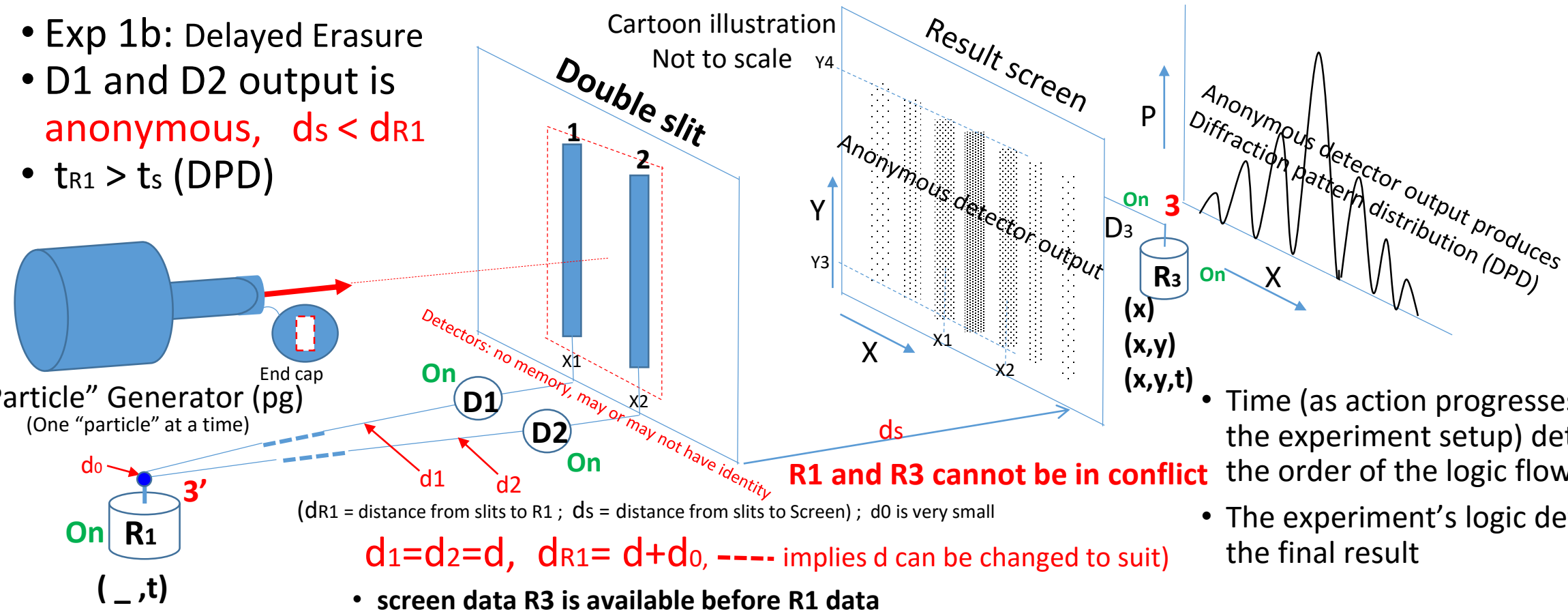
(velocity of massive "particles")

Exp 1a represents a Standard Eraser experiment -- D1 and D2 are anonymous: $t_{R1R1} < t_s$ (as drawn)

- [The setup logic causes R1 to collect data before R3 collects data].
- **The erasure of "which-way" data occurs when the two paths combine just before arriving at d_0 and go through a repeater (blue dot) that eliminates any minute characteristic differences between D1 and D2 signals.** NO binary distribution at slits required.
- **predict diffraction pattern - measurement 3 at R3 is from DPD.** R1 tells a conscious observer only that particles went through slits – something we know from experiment setup logic anyway.

Exp. 1b: Double Slit with Detectors (D1,D2) Recorder (R1,R3) Turned On

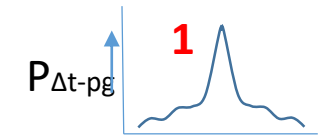
- Exp 1b: Delayed Erasure
- D1 and D2 output is anonymous, $d_s < d_{R1}$
- $t_{R1} > t_s$ (DPD)

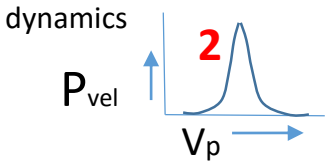


(d_{R1} = distance from slits to R1 ; d_s = distance from slits to Screen) ; d0 is very small

$d_1=d_2=d$, $d_{R1}= d+d_0$, ---- implies d can be changed to suit)

- Time (as action progresses through the experiment setup) determines the order of the logic flow
- The experiment's logic determines the final result



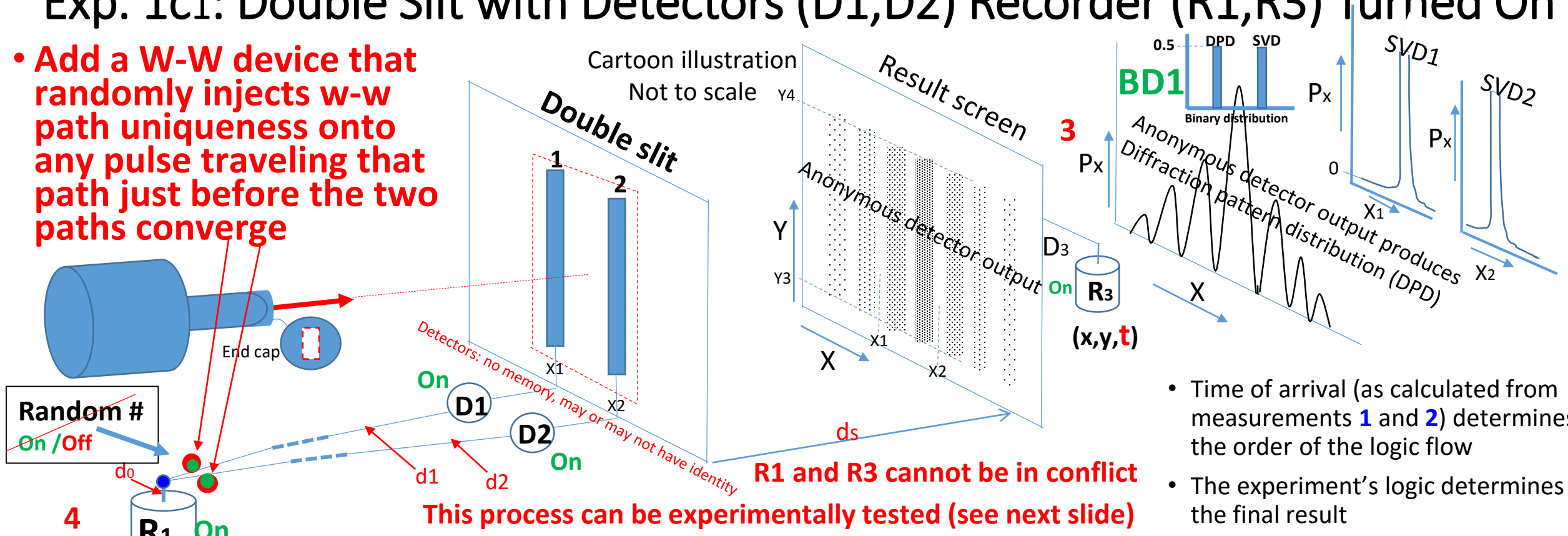


(velocity of massive "particles")

- **screen data R3 is available before R1 data**
- After screen data collected, the which-way data still theoretically exists but, according to the experiments logic, it is unavailable (unmeasured) and will remain unavailable since it will inevitably be erased before reaching R1.
- Because only available **objective** information is important, **I predict measurement 3 is from DPD**
- No **measurement** is taken at the slit or between the slit and R1. No binary distribution (BD) needed…R1 simply gets time data (e.g., a pulse occurs at time t -- 8 times a second) according to measurements **1** and **2**
- Determining which slit a particle goes through is not relevant since the detectors are anonymous).
- **Theoretical (non-objective) "which way" data is not relevant.**

Exp. 1c1: Double Slit with Detectors (D1,D2) Recorder (R1,R3) Turned On

- **Add a W-W device that randomly injects w-w path uniqueness onto any pulse traveling that path just before the two paths converge**



R1 and R3 cannot be in conflict

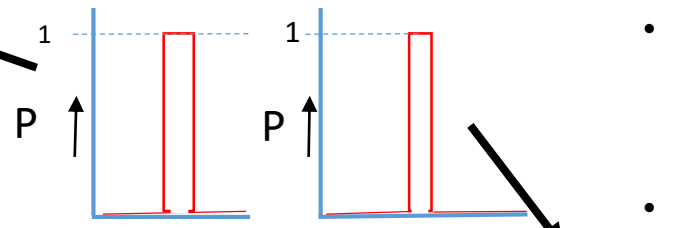
This process can be experimentally tested (see next slide)

- Time of arrival (as calculated from measurements **1** and **2**) determines the order of the logic flow
- The experiment's logic determines the final result

IF Result from BD1 is:
SVD or DVD

SVDon **SVDoff**

BD2
w-w



1: $P_{\Delta t\text{-}pg}$

2: P_{vel}

Random # generator model

Done

- **1c** -- Same as 1b except a "which way" (w-w) device that can add unique which way path information is added to both paths if the w-w devices are turned on (green dot). W-w Devices turned off (red dot). The devices are fast, are both off or both on (for simplicity), and may be activated or de-activated purposely or randomly. Both-off and both-on configurations are discussed separately in Exp 1b (one slide up) and Exp 1e. (4slides down)
- Start experiment with w-w devices off, then just before the detection pulse should arrive at the devices (that time will be known since data related to that pulse has already been observed at R3), randomly turn on the devices. Thus, after the screen data R3(x.t) has been recorded and made observable with w-w devices off, w-w data will "randomly" be made available. Experimental Logic on next slide.
- **Predicted result**: Screen data points **where w-w-devices are turned off (no w-w data) will have a DPD** pattern and those **where the w-w-devices are turned on will have a SVD1 or SVD2 pattern.**

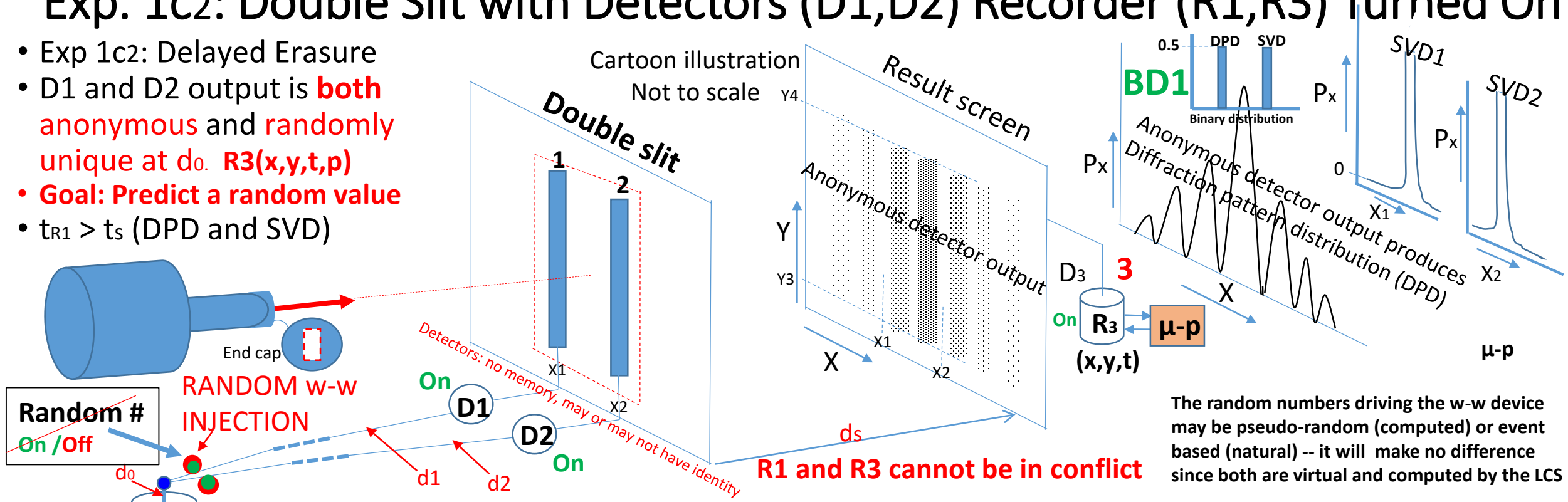
Additional Information Describing Previous Slide

The logic of the experiment changes when the w-w devices are added. Now, the experiments logic flow will run like this:

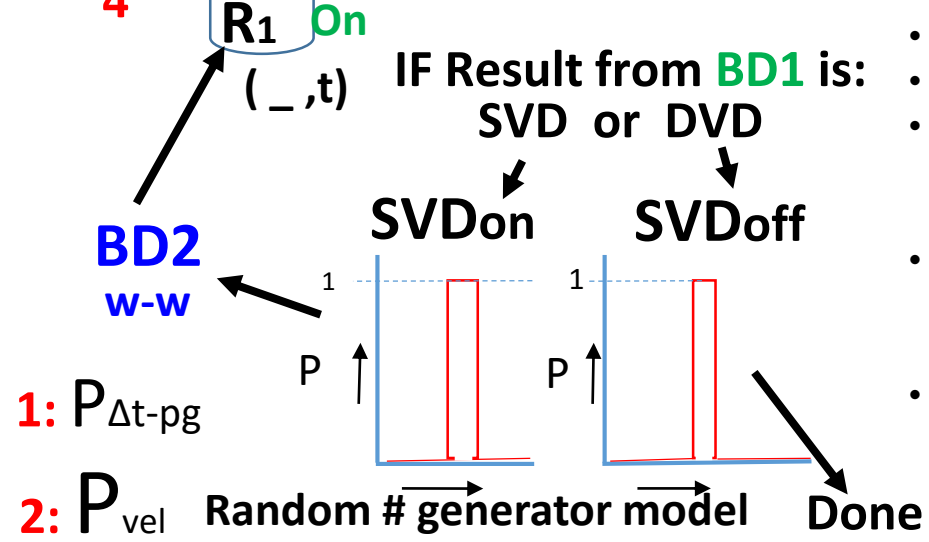
- After measurement **1** and **2** are randomly drawn from their distributions, a binary distribution (**BD1**) supporting data recorder **R_3** will randomly select an SVD or DPD pattern to determine where to place dots on the screen at the appropriate time (as computed from measurement **1** and **2**) . For example, if an SVD screen pattern is picked then **SVD_{on}** is selected to activate the w-w devices while another binary distribution (**BD2**) will randomly pick between SVD1 (slit 1) or SVD2 (slit 2) so the LCE/VRRE will know which slit identity to add to the data going into repeater (blue dot) before entering R1.
- There is no "random" trigger signal that activates (or not) the **virtual** w-w devices. The decision of to turn on or off the w-w devices that add "which-slit" information to the detected signal is automatically made by **BD1** when it chooses to select an SVD or DPD pattern for the screen. If BD1 chooses a DPD then it also must choose SDV_{off}. If BD1 chooses an SVD pattern for the screen, then it also must choose SDV_{on}. It does this to keep the VR consistent: The objective data in R_1 and R_3 cannot be in conflict. Both must support the imposed boundary condition between wave and particle (slide 18).
- Since a draw from **BD1** produces a random result that drives the picking of **SVD_{on}** or **SDV_{off}**, the experimenter will observe an appropriately random (from the viewpoint of PMR) activation of the w-w devices. Event based or pseudo random will work.
- **The predicted result: Screen data points where ww-devices are turned off (no w-w information) will have a DPD pattern and those where the ww-devices are turned on will have a SVD1 or SVD2 pattern.**
- If, this function of turning on and off of the injection of w-w data into R1 could somehow be accomplished by an IUOC avatar using only its free will choice (instead of a virtual "physical" w-w device that randomly switches on and off), then the LCS/VRRE could not control or anticipate a freewill choice. One solution: the LCS/VRRE could first draw from **both** the DPD **AND** from a BD to pick a slit and then use the appropriate SVD1 or SVD2 -- putting both sets of result data (diffraction pattern and two lines) on the screen R3 (or generate two separate **potential screens**) at the appropriate time. Then freewill would select w-w data injection to be on or off. **Because the R3 data is not looked at until the experiment is over**, after writing the appropriate data at R1, the LCS/VRRE could erase the screen data at R3 that was inappropriate, (or simply pick the appropriate **potential screen** data to add to R3 and eventually to an IUOC's data stream). The LCS could use this computational process with the randomly driven virtual w-w device discussed above -- but it would not have been as efficient.

Exp. 1c2: Double Slit with Detectors (D1,D2) Recorder (R1,R3) Turned On

- Exp 1c2: Delayed Erasure
- D1 and D2 output is **both** anonymous and randomly unique at d_0. **R3(x,y,t,p)**
- **Goal: Predict a random value**
- $t_{R1} > t_s$ (DPD and SVD)



The random numbers driving the w-w device may be pseudo-random (computed) or event based (natural) -- it will make no difference since both are virtual and computed by the LCS

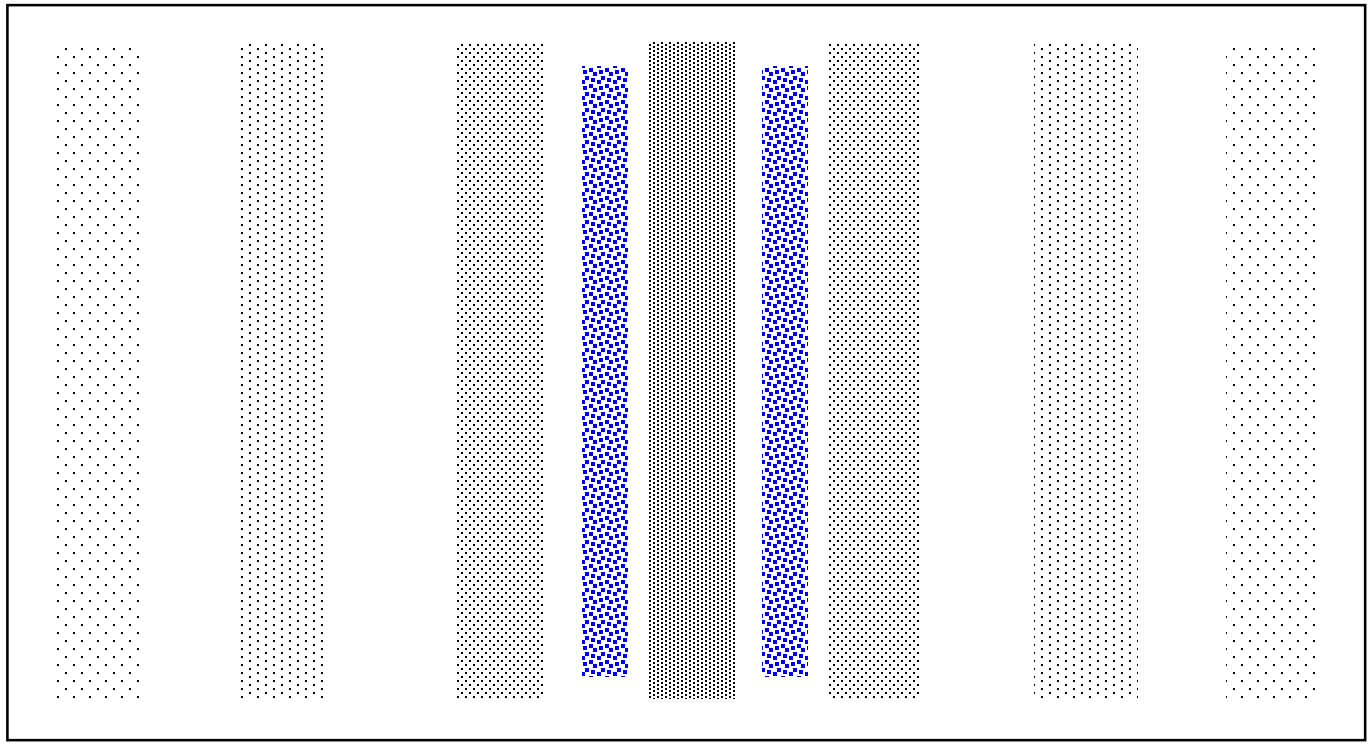


- Adjust Exp 1c1 parameters to minimize overlap between the diffraction pattern and the two bar pattern
- Make two Long data Runs: one with w-w device turned on and one with w-w device turned off
- Use the R3(x,t) data to produce an algorithm that computes the probability, p(x,y), of any screen point (x,y) being part of a diffraction (DPD) or two bar pattern (SVD) -- whichever is most efficient -- p(diffraction = 1- p(two bar)
- Attach a fast microprocessor (μ-p) (containing the algorithm) to R3 so that it will compute the probability of any particle hitting the screen being part of a DPD or a SVD and output this probability to R3(x,y,t,p) (next to the particles position data) **before** the associated detector signal arrives at the w-w device.
- The probability of the supposedly "random" w-w device being "off" when the detection signal arrives at the w-w device will be given by p(diffraction) and the probability of it being "on" by p(two bars). Because of the spread in the points in a diffraction pattern, the value of p will often be > .98 even if the overlap minimization is poor.

Developing an algorithm to compute the probability that any given point on the screen is part of a diffraction pattern or a two bar pattern

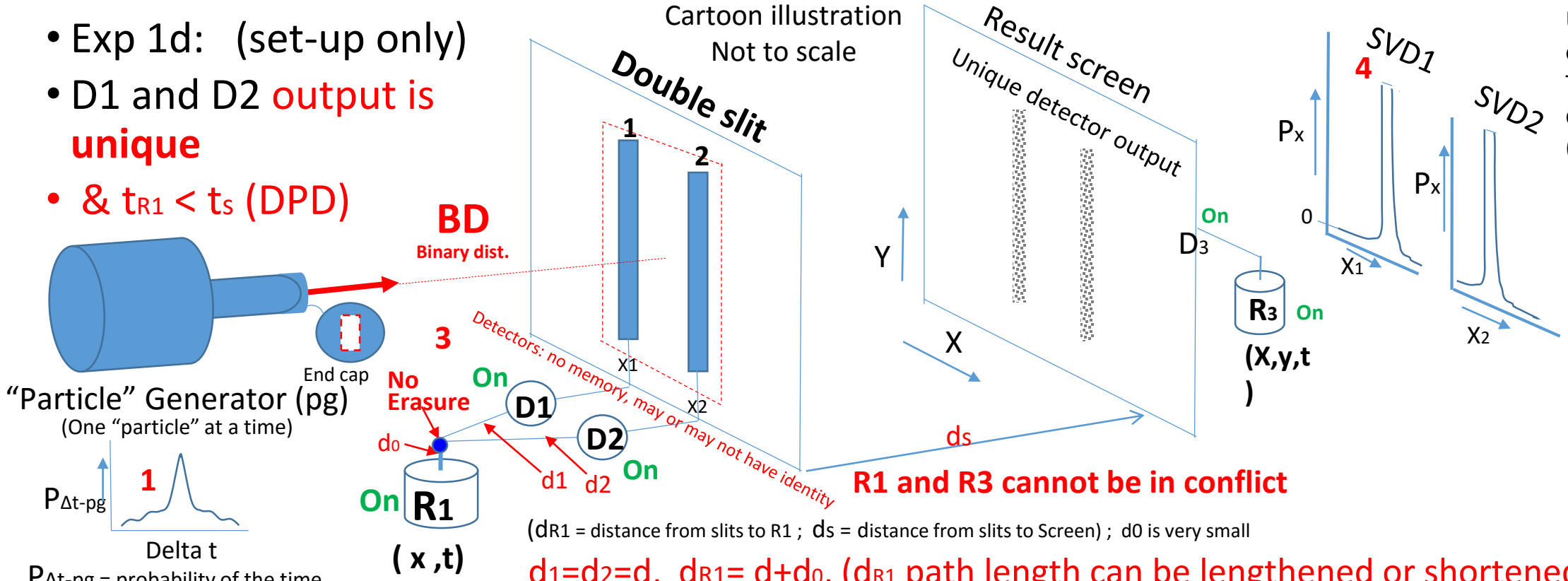
Simple example:
Pick any screen point and determine how many of its N nearest neighbors belong to a diffraction pattern. If that answer is n, then

$P_D = n/N \quad P_{TB} = 1 - P_D$



Exp. 1d: Double Slit with Detectors (D1,D2) Recorder (R_1,R_3) Turned On

- Exp 1d: (set-up only)
- D1 and D2 output is **unique**
- & $t_{R1} < t_s$ (DPD)



$P_{\Delta t\text{-}pg}$ 1 Delta t

$P_{\Delta t\text{-}pg}$ = probability of the time between consecutive "particles" (Δt) being a particular value of Δt [Δt example: If # particles/sec = 4, then Δt=1/4 sec] F=1/Δt

$\overline{F_{pg}}$ = average frequency of particle generation in particles per sec (pps)

dynamics

P_{vel} 2 V_p

(velocity of massive "particles")

R1 and R3 cannot be in conflict

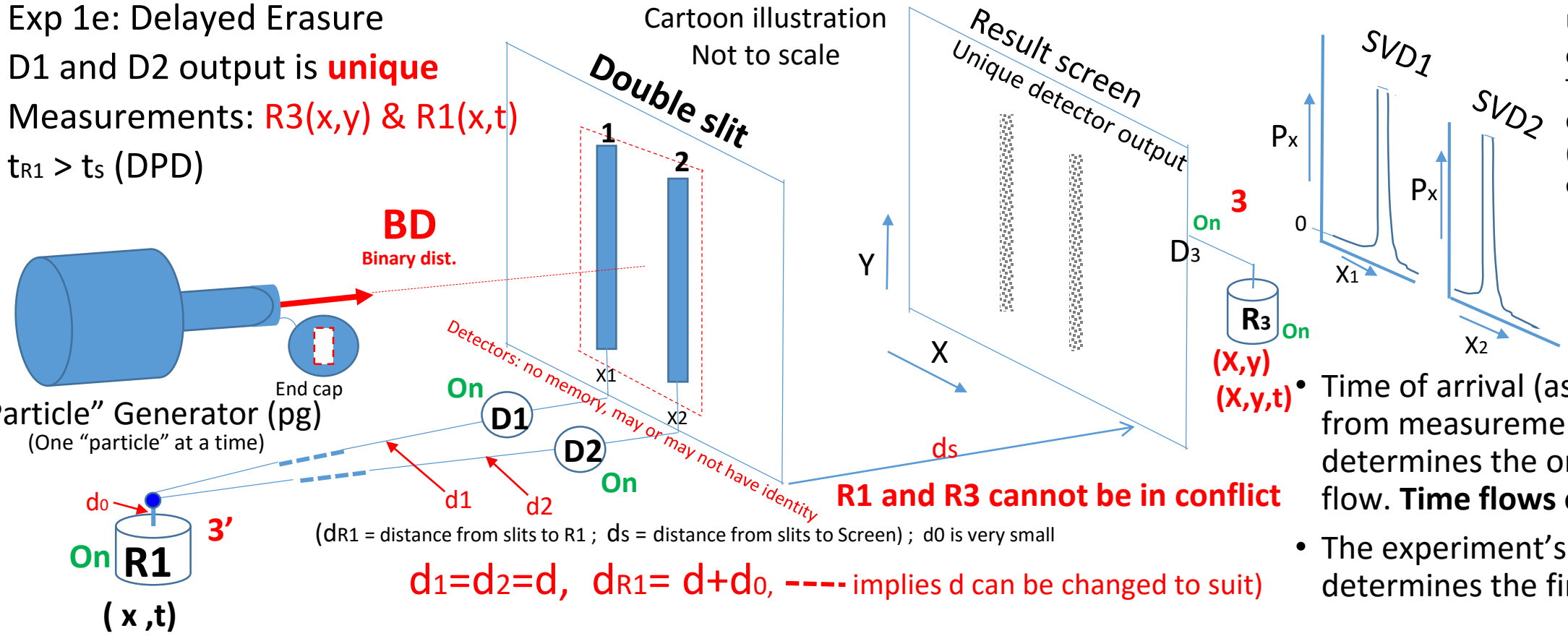
(d_{R1} = distance from slits to R1 ; d_s = distance from slits to Screen) ; d_0 is very small

$d_1=d_2=d$, $d_{R1}= d+d_0$, (d_{R1} path length can be lengthened or shortened)

- Exp 1d is the **standard double slit experiment** when there is "which way" data available
- **Experiment logic flow:** A random draw from **BD** **directly** produces "which way" data in R1 (measurement **3**). Next, using that same random draw from **BD** the LCS selects either SVD1 or SVD2 as consistency requires. Points are then put on the screen as they occur and are recorded in **R3** (measurement **4**).
- it makes no difference whether or not the screen data is looked at in real time or after the experiment is over. Same result if R3 collects (x), (x,y), or (x,y,t)
- Because detector paths are now uniquely labeled within R1 we **predict two bars.**

Exp. 1e: Double Slit with Detectors (D1,D2) Recorder (R_1,R_3) Turned On

- Exp 1e: Delayed Erasure
- D1 and D2 output is **unique**
- Measurements: R3(x,y) & R1(x,t)
- $t_{R1} > t_s$ (DPD)



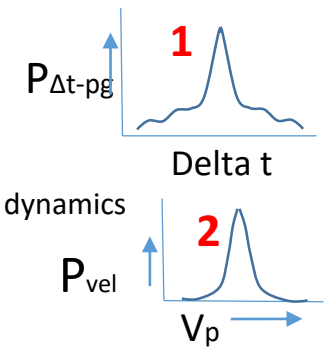
Unique detector output produces Two single value distributions (SVD1 & SVD2), one for each slit

R1 and R3 cannot be in conflict

(d_{R1} = distance from slits to R1 ; d_s = distance from slits to Screen) ; d_0 is very small

$d_1=d_2=d$, $d_{R1}= d+d_0$, ---- implies d can be changed to suit)

- Time of arrival (as calculated from measurements **1** and **2**) determines the order of the logic flow. **Time flows only forward**
- The experiment's logic determines the final result

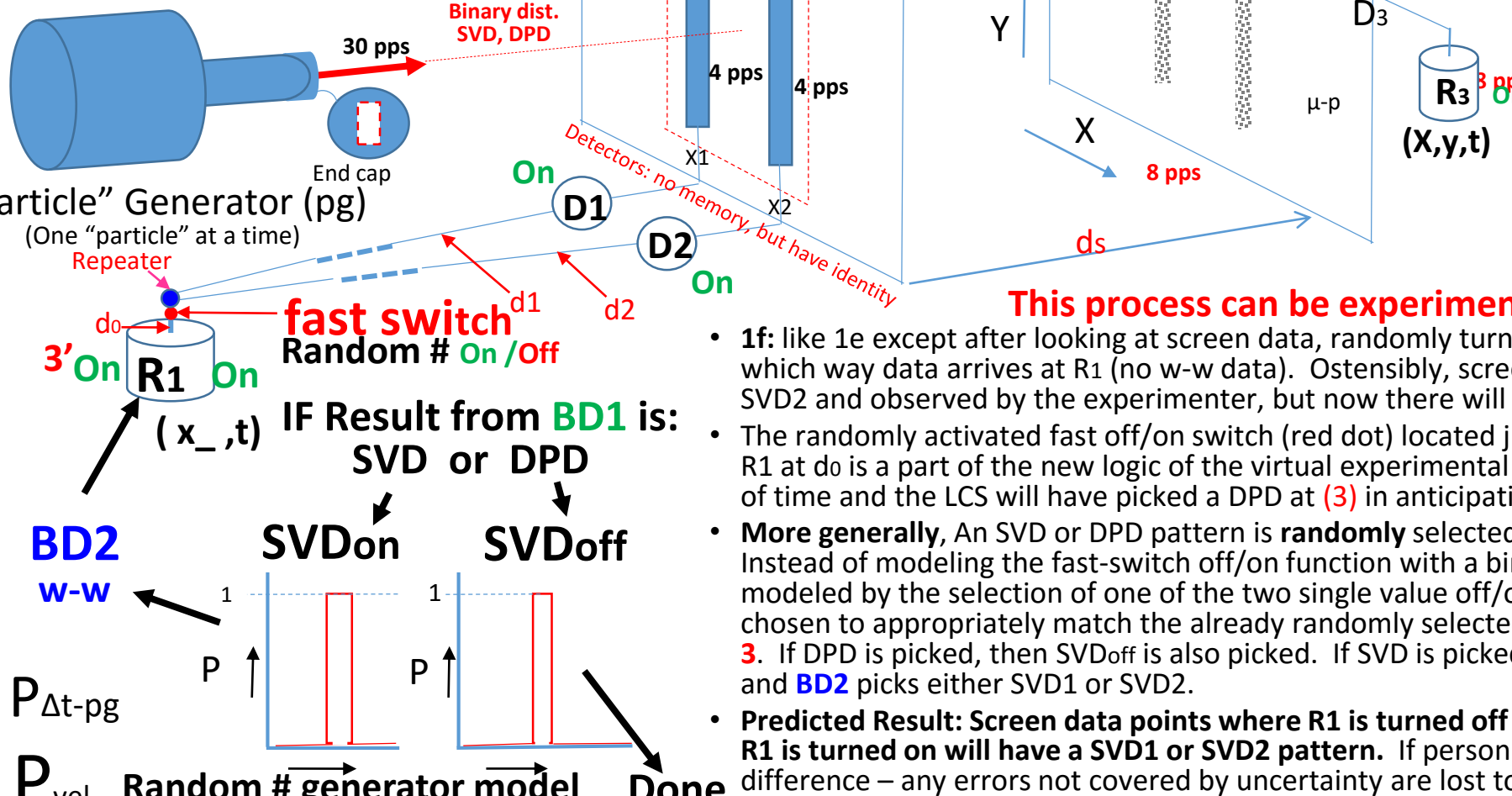


(velocity of massive "particles")

- Experiment VR logic flow for each potential particle: A random draw from **BD** determines whether screen data will be randomly drawn from SVD1 (slit1) or SVD2 (slit2) and places the particle on the screen (on **R3**). That same draw also determines whether slit1 or slit2 "which way" data will be at **R1** (measurement **3'**). Dots are placed on the screen and w-w data placed R1 at the proper time for each according to **1** and **2**. **The objective screen data exists before the objective "which way" data exists. But that is not relevant. Predict two bars**

Exp. 1f1: Double Slit with Detectors (D1,D2) Recorder (R1,R3) Turned On

- Exp 1f: Delayed Erasure
- D1 and D2 output is **unique**
- Collect R3(x,y,t) & R1(x,t)
- **Fast switch disconnects R1**
- $t_{R1} > t_s$ (DPD)



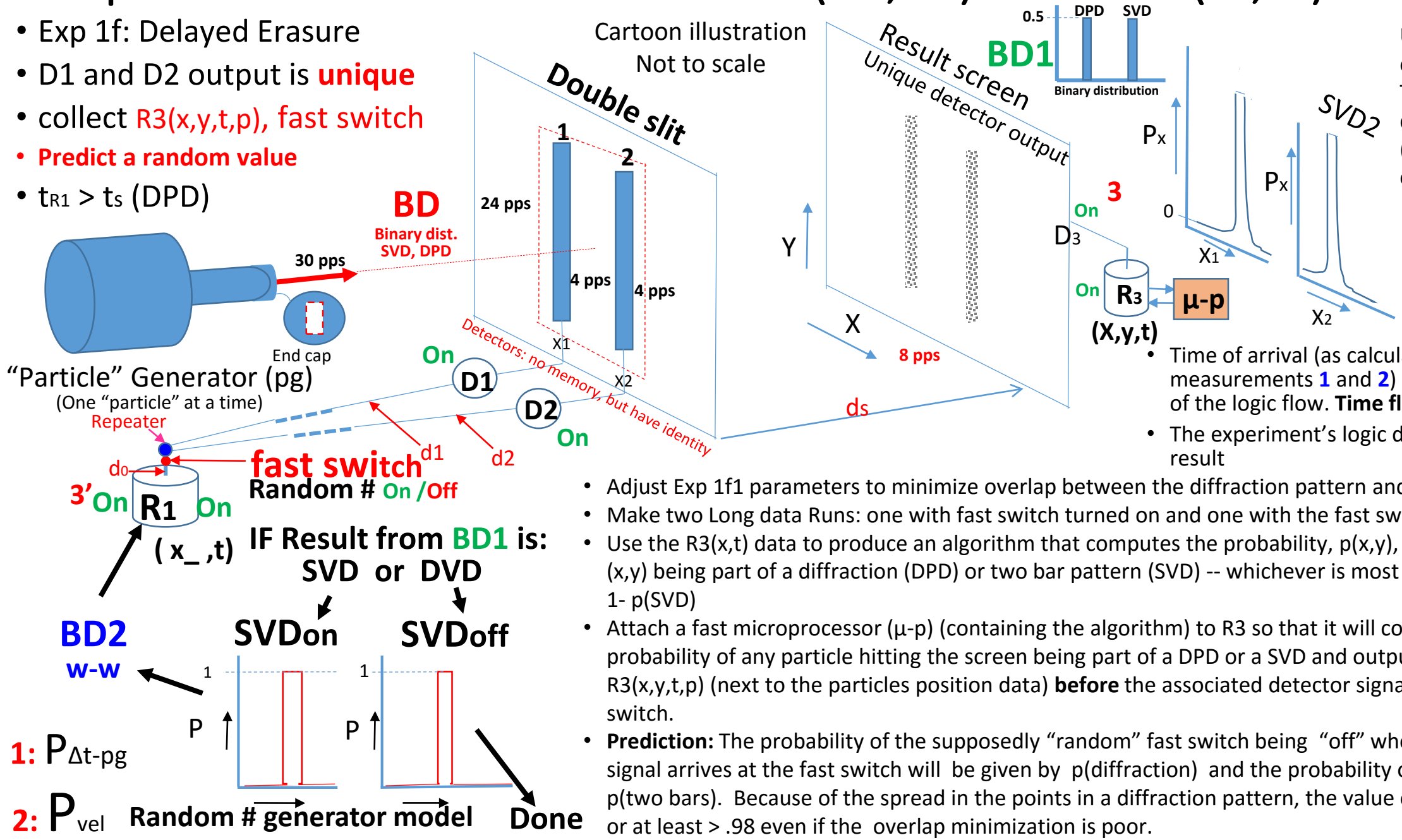
The randomly activated fast switch can be triggered by either a calculated (pseudo random) or event driven (natural) random number generator

This process can be experimentally tested (see next slide)

- **1f:** like 1e except after looking at screen data, randomly turn off R1 with a fast switch just before the which way data arrives at R1 (no w-w data). Ostensibly, screen data has already been placed on SVD1 or SVD2 and observed by the experimenter, but now there will be no w-w data.
- The randomly activated fast off/on switch (red dot) located just under the repeater (blue dot) and before R1 at d_0 is a part of the new logic of the virtual experimental setup and is thus known (anticipated) ahead of time and the LCS will have picked a DPD at (3) in anticipation of the loss of w-w data
- **More generally**, An SVD or DPD pattern is **randomly** selected by a binary distribution (**BD1**) at (3). Instead of modeling the fast-switch off/on function with a binary distribution (BD), that function will be modeled by the selection of one of the two single value off/on distributions (SVD_{off} or SDV_{on}) that is chosen to appropriately match the already randomly selected screen pattern (SVD or DPD) from **BD1** at **3**. If DPD is picked, then SVD_{off} is also picked. If SVD is picked, then SDV_{on} is selected for the fast switch and **BD2** picks either SVD1 or SVD2.
- **Predicted Result: Screen data points where R1 is turned off will have a DPD pattern and those where R1 is turned on will have a SVD1 or SVD2 pattern.** If person with free will throws the switch, no difference – any errors not covered by uncertainty are lost to noise or other anomalous "random" processes.

Exp. 1f2: Double Slit with Detectors (D1,D2) Recorder (R1,R3) Turned On

- Exp 1f: Delayed Erasure
- D1 and D2 output is **unique**
- collect R3(x,y,t,p), fast switch
- **Predict a random value**
- $t_{R1} > t_s$ (DPD)



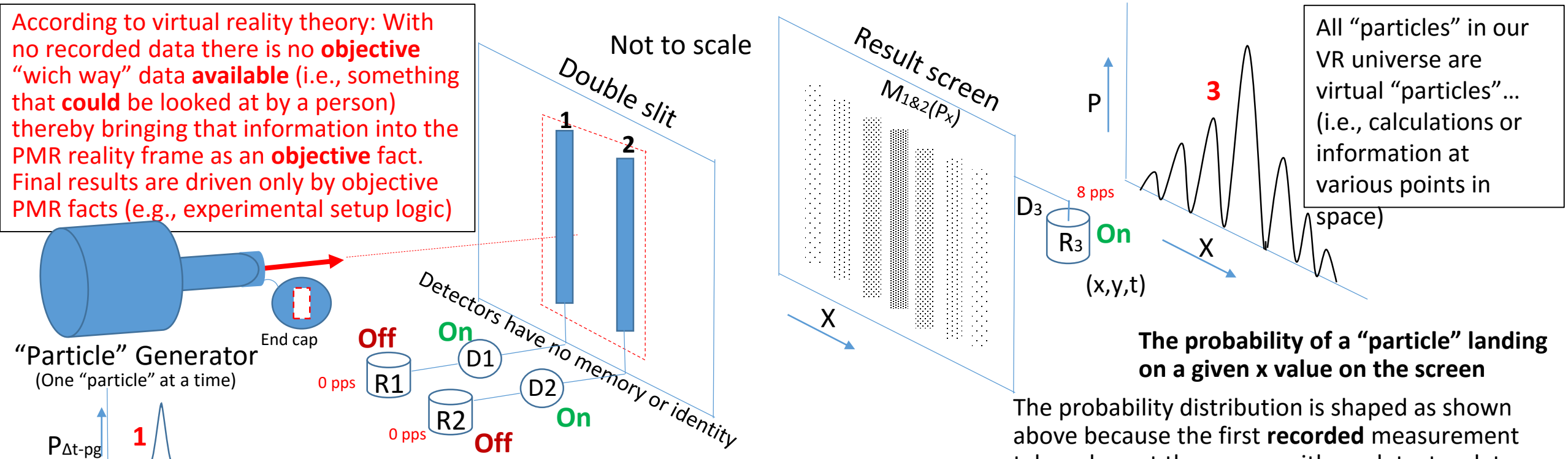
Unique detector output produces Two single value distributions (SVD1 & SVD2), one for each slit

- Time of arrival (as calculated from measurements **1** and **2**) determines the order of the logic flow. **Time flows only forward**
- The experiment's logic determines the final result

- Adjust Exp 1f1 parameters to minimize overlap between the diffraction pattern and the two bar pattern
- Make two Long data Runs: one with fast switch turned on and one with the fast switch turned off
- Use the R3(x,t) data to produce an algorithm that computes the probability, p(x,y), of any screen point (x,y) being part of a diffraction (DPD) or two bar pattern (SVD) -- whichever is most efficient -- p(DPD) = 1- p(SVD)
- Attach a fast microprocessor (μ-p) (containing the algorithm) to R3 so that it will compute the probability of any particle hitting the screen being part of a DPD or a SVD and output this probability to R3(x,y,t,p) (next to the particles position data) **before** the associated detector signal arrives at the fast switch.
- **Prediction:** The probability of the supposedly "random" fast switch being "off" when the detection signal arrives at the fast switch will be given by p(diffraction) and the probability of it being "on" by p(two bars). Because of the spread in the points in a diffraction pattern, the value of p will often be 1.0 or at least > .98 even if the overlap minimization is poor.

Exp 2 : Double Slit with D1 & D2 on and R1 & R2 Off

According to virtual reality theory: With no recorded data there is no **objective** "wich way" data **available** (i.e., something that **could** be looked at by a person) thereby bringing that information into the PMR reality frame as an **objective** fact. Final results are driven only by objective PMR facts (e.g., experimental setup logic)



The probability of a "particle" landing on a given x value on the screen

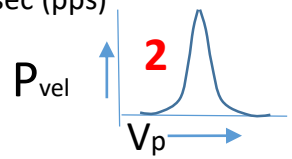
The probability distribution is shaped as shown above because the first **recorded** measurement takes place at the screen with no detector data available. Without objective data, the detectors are not relevant to system probability since the "which-way" data is entirely unknown for both slits.

There is no objective data that constrains the possibilities of the measurement results – thus we get an unconstrained result: a diffraction pattern.

The subjective knowledge gained through inductive reasoning that the detectors **would** have received slit position (which way) data **if** they had been turned in is not relevant.

$P_{\Delta t\text{-}pg}$ = probability of the time between consecutive "particles" (Δt) being a particular value of Δt [Δt example: If # particles/sec = 4, then Δt=1/4 sec] F=1/Δt.

$\overline{F}_{pg}$ = average frequency of particle generation in particles per sec (pps)



Massy "particles"

Purpose:

Exploring how "which way" data is created. What defines a "measurement"?

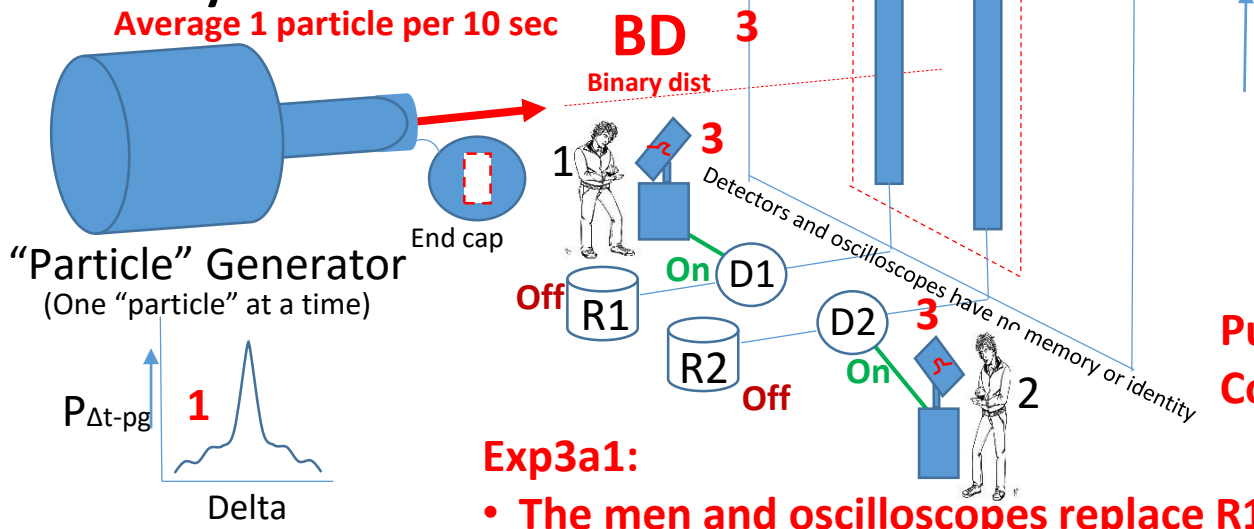
Is mere detection alone relevant to the outcome of the experiment? (No). Must the detection data be recorded, and made available to observers in PMR?. (Yes). **Unrecorded detections cannot be looked at by a person, thus, they are functionally the same as no detections.**

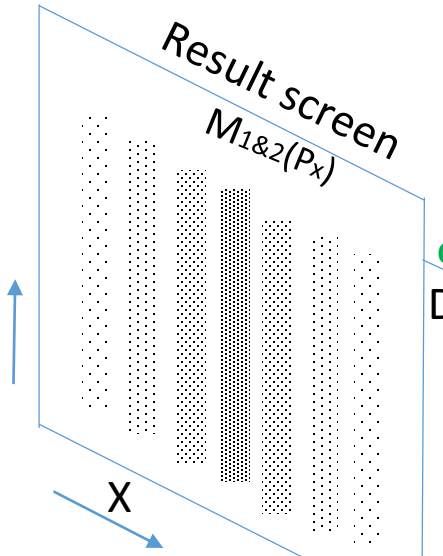
Coming up Next: The Conscious Observer connection

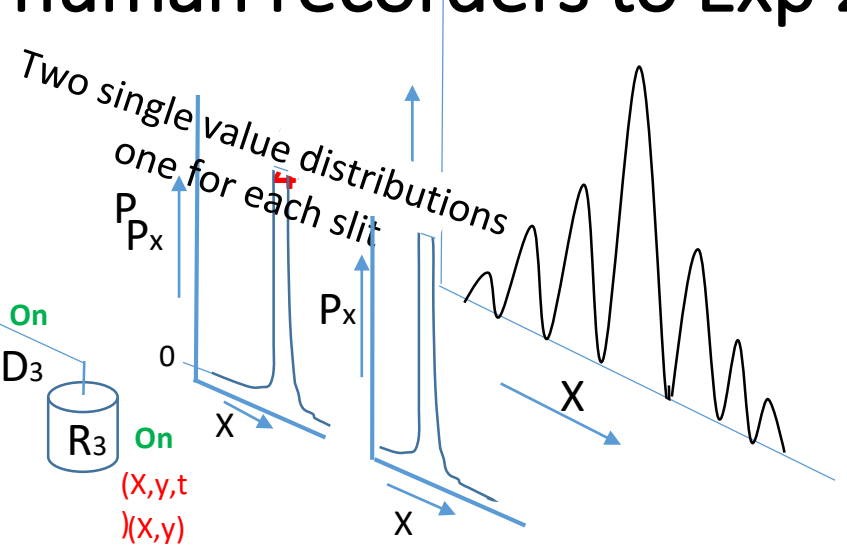
- In Experiment 3, we are going to explore “human factors”, the role of consciousness.
- This is a subject rarely explored, so little hard data is available to guide our predictions.
- Since the LCS has several alternative choices in these experiments that satisfy the conditions for a PMR measurement (as we have defined it here), only experiments can determine what choices it makes in any given situation.
- My predictions are based upon the specific logic flow of each experiment and the relative computational efficiency of choices the LCS might make.

Exp 3a1, 3a2, 3a3, 3a4 3b1, 3b2, 3b3 and 3c : Adding human recorders to Exp 2

Both detectors (D12 & D2) are on and both recorders (R1& R2) are off. A man watches each detection pulse on an oscilloscope that has no memory

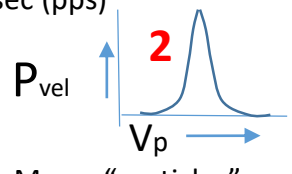






$P_{\Delta t\text{-}pg}$ = probability of the time between consecutive "particles" (Δt) being a particular value of Δt [Δt example: If # particles/sec = 4, then Δt=1/4 sec] F=1/Δt.

$\overline{F}_{pg}$ = average frequency of particle generation in particles per sec (pps)



Massy "particles"

Exp3a1:

- **The men and oscilloscopes replace R1 and R2**
- **The men are always alert, accurate, knowledgeable, and truthful**
- **They silently count pulses on oscilloscope**
- **Screen data R(x,y) is looked at after the experiment**
- **Neither man can see the screen**

Purpose – Exploring The Consciousness Connection:

1) What are the minimum requirements for defining "which way" data?
2) What constitutes an unacceptable logical conflict in PMR?
3) Is subjective human? memory sufficient as data recorder R1 or R2?
4) What constitutes an "observation" of w-w data? objectively **recorded** versus objectively **witnessed**.

The probability of a "particle" landing on a given x value on the screen

The pulses on each oscilloscope represent an objective measurement within PMR (in the data-streams of the two persons) although nothing is recorded to make the data generally available to others.

The probability distributions for these 4 experiments are shaped differently depending on the conditions defining each experiment. Look at the next two slides to get the details and predictions

Exp3 Purpose -- Exploring the minimum conditions required to produce decoherence (two bars):

- Experiment 3 suggests 8 experiments and several additional sub experiments depending on how the initial experiments turn out. These experiments are **only initial suggestions** for the exploration of the consciousness connection within quantum experiments. Their result will point to new experiments.
  - Is human memory (subjective with some uncertainty) sufficient to be the "data recorder" or must it be entirely objective memory without uncertainty (e.g., computer memory).
  - Does an individual's **subjective** experience of an **objective** event count as a measurement or must the event be recorded on objective media equally available to all?
  - Does it matter who or what that observer is? Would a professional physicist or a trained chimp do equally well? Is the objectivity of w-w data defined by sending data to any PMR avatar or is the only requirement that really matters avoiding a **noticeable** PMR conflict?
  - I think the LCS would wish to avoid making subjective analysis of fitness a criteria to determine the result of a physics experiment because any such methodology will be computationally inefficient since it requires the setting of arbitrary thresholds and making subjective judgements.
  - How does the persistence or volatility of "which way" data affect decoherence.

Exp 3a1, 3a2, 3b, 3c : Adding subjective/objective human recorders to Experiment 2

Purpose -- Exploring the minimum conditions required to produce decoherence (two bars):

- **General discription:** Person 1 and 2 (always alert, accurate, fully informed, and truthful) **silently count** detections (say a pulse shape) at each slit on an oscilloscope. The screen data **cannot be seen** by person 1 or 2, and it is eventually looked at only **after** the experiment has completed (person 1 and person 2 collect no time data and record no w-w data objectively). The sum of their observed detections must equal the number of points on the result screen. Thus, every particle captured by the screen was **objectively observed (measured) in PMR (i.e., required data to be sent from the VRRE to the IUOCs of person1 and person2) and subjectively recorded** to have gone through a **specific** slit. Nothing is recorded except in **subjective** human memory. There is no objective correlation data in PMR to uniquely connect a specific detector observation or a specific slit with a specific point on the screen. The fact that the sum of the observed detections equals the total number of dots on the screen **objectively** verifies that each particle was **objectively** detected at a **specific** slit and removes all uncertainty about the accuracy of the counting process. Thus, **if** simple **objective** observation and **subjective** recording are sufficient to define **objective** "which way" data) then we should get **two bars.**
  - **Exp 3a1:** I think it is more likely that **subjective** recording in the human mind of the **objective experience of the objective pulse on the objective oscilloscope is sufficient** to define "which way" data because forcing the LCS (VRRE) to interface with (provide a data-stream to) the IUOCs playing person1 and person 2 sufficiently defines a particle being **observed** in PMR at a particular slit. Also, the subjective recording, as defined by this experiment's logic, has very low uncertainty. Once a potential particle is sufficiently defined as an actual (physical) particle in PMR, it must act like a physical particle. **Therefore, I think the most likely result will be decoherence, accordingly, I Predict: two bars.** If the LCS/VRRE makes this choice (allows w-w data recorded on a highly reliable subjective media to effect decoherence, then it must decide on what sort of subjective media meets its high reliability requirements. If it can do that simply and objectively, this choice may still be computationally efficient. If an objective recording media with no uncertainty attached to its data is required and the result of Exp3a1 is a diffraction pattern, then experiment 3b1 will make that clear.
  - If 3a1 worked as predicted, then follow up with **Exp3a2:** Repeat Exp 3a1 with opaque material covering both oscilloscopes (so detections cannot be perceived) and rerun the experiment. **This time, I predict a diffraction pattern**. Should now be the same as Exp 2. The detections have now become irrelevant, since **no** communication between the VRRE and PMR IUOCs (persons 1and2) is required. Without the LCS/VRRE communicating information to an IUOC in PMR (persons 1and 2), no objective event can happen within PMR. PMR is wholly defined by the data IUOCs receive in their data-streams.
  - If 3a1 worked as predicted, then follow up with **Exp3a3:** Repeat experiment 3a1 except have persons 1 and2 turn their back toward the oscilloscope and not perceive the display. In this case, the information **is available to the PMR shared data space** but nobody is looking at it, so the VRRE does not have to put the information in anyone's data stream – thus no new information enters into PMR. I predict a diffraction pattern since no conflict of information occurs in PMR and no "which way" data is **observed**. This experiment will more clearly define the criteria for an observation causing decoherence.
  - If 3a1 worked as predicted, then try **Exp3a4**: Repeat Exp 3a1 without the counting of pulses, let person 1 and 2 simply observe the pulses. Should work the same way as Exp 3a1 except any pulses they might miss seeing could go to a diffraction pattern. To test this let them both look at their scopes half the time, at the same time, randomly…as well as both random and uncoordinated.
- **Exp 3b1:** This experiment and the next several experiments are particularly important if Exp3a1 produces a diffraction pattern instead of the predicted two bars. In Exp3b1, we are going to add recorded data to Exp 3a1**. Exp3b1:** Repeat Exp 3a1 except let each person (1 and 2) record the data he sees on his oscilloscope (the fact that he sees a pulse) – now we have objective recorded data of an objectively experienced event with no correlation between detector and screen data (since person 1 & 2 collect no time data) – **Thus, if Exp3a1 produced a diffraction pattern, we will see if the addition of objectively recorded data changes that to two bars. If Exp 3a1 produced two bars as predicted, then Exp3b will also produce two bars.**
- **Exp 3b2** Repeat Exp 3a1, and then Exp 3b1 -- except allow persons 1and 2 to see the result screen which will visibly light up for a few seconds in the spot where the latest dot (data point) was added. Now persons 1 and 2 can see immediate correlation between their own oscilloscope data and the result screen. …both with (starting from Exp3a1) and without (starting from Exp3b1) uncertain but reasonably reliable recorded data.
- **Exp3b3:** repeat Ex3b1 with the result screen collecting time data R3(x,y,t) **and** person 1 and 2 collecting time data. **All conditions met for defining objective w-w data: Predict two bars**.
- **Exp 3c:** In this experiment we are going to add an **unrecorded** correlation between each dot on the screen and one of the two slits. Start with Exp 3a1, Exp 3b1 and Exp 3b2 except that **a third person,** watches the screen and calls out the x.y coordinates of each data point as it arrives on the screen. **P**erson 1 and 2 **call out loud** their slit number whenever they see a pulse. If necessary (if result is a diffraction pattern) repeat with a digital audio recorder running. We now have objective observation and objective correlation with and without objective recorded w-w data. **I predict two bars –unless objective certain recording is critical.** (Reason: "objective" conflicts aren't allowed between persons 1 & 2 and person 3). Note: Since the pulses only come at about 1 every 10 seconds, real-time correlation is easy so it doesn't matter who speaks up first - persons 1 & 2 or person 3.

Exp 3a, 3b, and 3c : additional considerations on Adding subjective/objective human recorders to Experiment 2

In experiment two (Exp 2) we suggested that the detection of (w-w) data must be objectively recorded (as required by Exp 2 experimental set-up logic)

However, that condition of requiring objectively recorded w-w data in order to cause decoherence, or generate a two bar pattern on the result screen, can perhaps be more generally expressed by the condition that the LCS/VRRE must send a data-stream to IUOCs "playing" avatars in PMR such that the IUOC-avatars in PMR can have an **objective experience** of the w-w information.

From slide 30: The PMR VR is rendered by the VRRE to each IUOC. PMR is an interactive multi-player game played within a common data-space called the "Physical" universe. PMR facts are objective (sharable with all other players) pieces of information that are for at least some period of time available to IUOCs within PMR. If such a fact is perishable and eventually disappears from the common data-space it remains objective only to those who objectively experienced it or those who were/are objectively impacted by it.

Person 1 and person2 receive data from the VRRE that they interpret as pulse shapes on their oscilloscope. These pulse shapes are objective facts, anyone else who was there looking over their shoulder would also see the pulse shapes since they are part of the PMR shared data-space. However, since they are not being recorded, they are perishable PMR facts. They quickly come into PMR, persist for a second or two and then disappear. According to slide 30 they remain objective objects to all who experienced them and to all affected by them**.** It is easy to envision a set of experiments that explore the effects of various levels of perishability

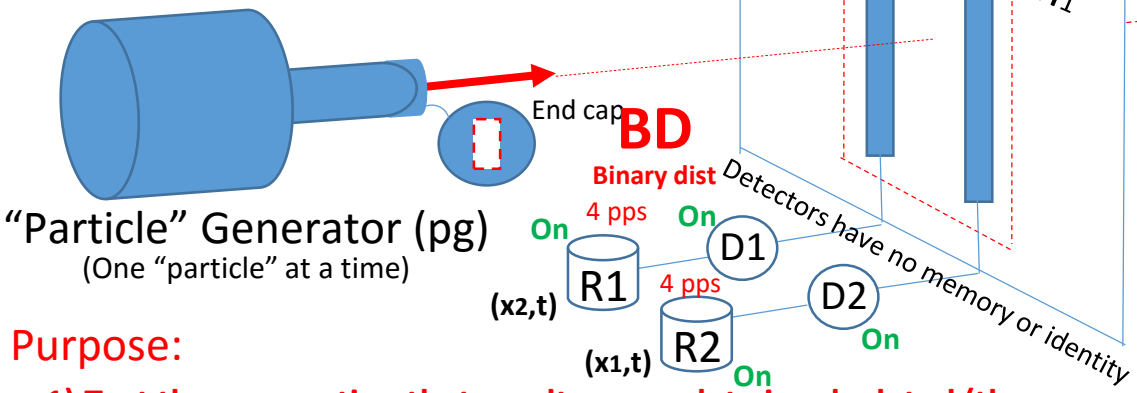
If the experiment 3a1 turns out to produce a diffraction pattern, person 1 and 2 (and anyone looking over their shoulder) would experience a contradiction in the PMR reality – they observed **objective** evidence of a "physical" particle, yet that particle did not continue on to the screen (two bars) as a particle but rather reverted to a potential particle again….ostensibly because the w-w information represented by the observed pulse shape would inevitably be erased according to the logic of the set-up. We can reasonably assume that the persistence of the scope image is very long compared to how long it takes the particle to hit the screen after detection. What if the technology used had a persistence (of the w-w data) that was much longer, like a week or a year or a decade before it would inevitably disappear? Would it then be called a recording? Clearly two bars would be better in that case. How short would it have to be before the LCS would switch its screen result to a diffraction pattern? That would require arbitrary thresholds and subjective judgements. Thus, two bars **in all cases** makes more sense and seems more efficient. Given enough time, all PMR information is perishable.

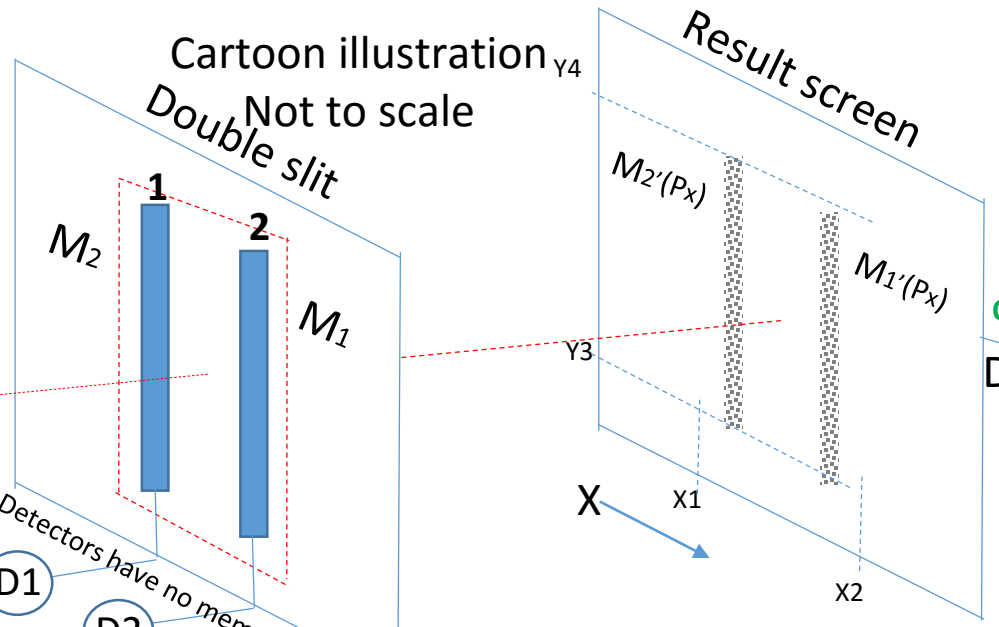
If the experiment 3a1 turns out to produce two bars (incoherence -- no diffraction pattern). In this case would anyone find a contradiction in reality? Perhaps those who believe that recorded data is required to cause decoherence? Or would they simply learn that recording is sufficient but not always necessary, thus, their contradiction would disappear (see slide 30). This leads us to the possibility that if the "which way" data is ever an objective fact available within the shared space of PMR long enough for people to get a good look at it, and if one or more people **do** get a good look at it, then that instance of "which way" data is enough to cause decoherence (two piles of dots on the result screen). Otherwise the LCS/VRRE would have to make case by case judgement calls on **how long** perishable evidence has to be available in the shared PMR space and **how many** people have to see it before it counts as actionable evidence of a particle passing through a specific slit. Such case by case judgements represent an inefficient computational process compared to one objective rule that applies to all cases. The LCS/VRRE seems to prefer efficient computational process.

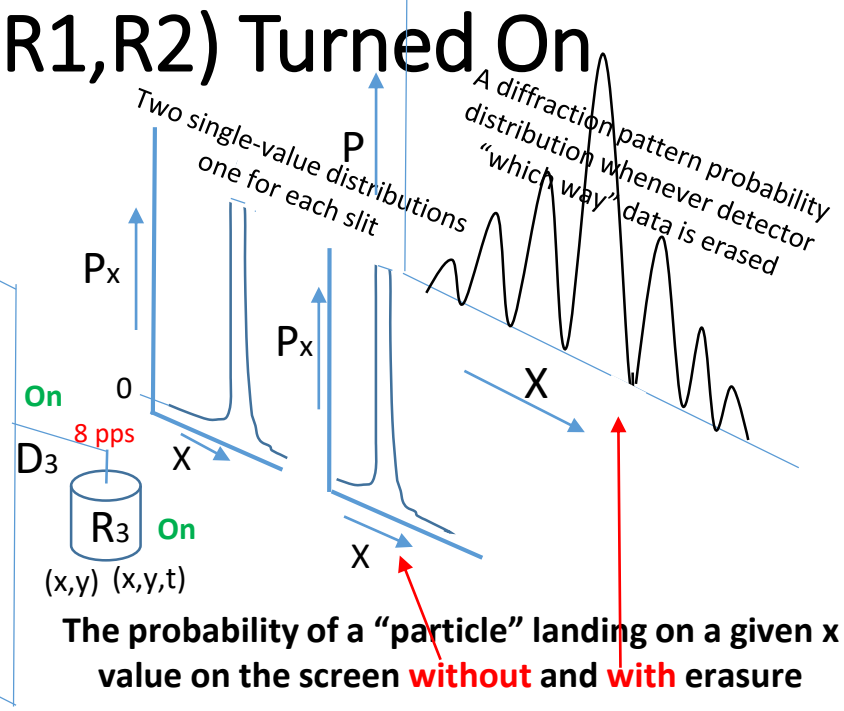
EXP 4 All Detectors (D1,D2) and Recorders (R1,R2) Turned On

The "Envelope Experiment"
(A Schrodinger's Cat investigation)

A macro level delayed erasure experiment with a very long delay







The probability of a "particle" landing on a given x value on the screen without and with erasure

Purpose:

1) Test the assumption that result screen data is calculated (the screen probability distribution is generated) according to objective conditions that exist at the time an IUOC looks at the results (receives screen data from the VRRE). 2) Macro erasure – one physics. 3) Can "which way" data be subjective (derived by highly probable inductive logic)

The probability distributions are shaped as shown above because of the prior measurements of R1 and R2 provide the available "which-way" information.

However, for the screen data associated with experiments where the detector data was later destroyed, there is no longer available objective data that constrains the possibilities of the screen data results, we should get an unconstrained result: a diffraction pattern for those 5 experiments where the detector data was destroyed and 2 bars for the 5 with intact detector data.

The Experiment:

1. Setup, test and use Standard Double Slit experiment: recording "which-way" information on R1 and R2, and screen data on R3
2. R1, R2, and R3 are removable flash drives.
3. Repeat this experiment 10 times (10 sub-experiments) each time using a new set of flash drives. Label all drives (R1, R2, R3)
4. Keep R1, R2, and R3 for each sub-experiment together, each marked with its sub-experiment number (1 to 10).
5. Immediately secure the flash drives after each sub-experiment. No one may look at, write, copy, or duplicate any flash drive data.
6. Make certain that the data handling system **cannot possibly** contain any minute residue of the data that is on the flash drives.
7. Completely physically destroy (crush and melt to 100% smoke and liquid) R1 and R2 for 5 randomly chosen sub-experiments.
8. Look at R3 result screen data for all 10 experiments. **Prediction: that the result screen data for the sub-experiments with destroyed detector data will show diffraction patterns and that all others (those with preserved detector data) will show two bars.**

Information Pertinent To Experiment 4:

- **1. Timing – when is the final result screen data calculated by the VRRE for each "particle"?**
  - **From slide 30: Before** it has been observed by an IUOC (put into that IUOCs data stream as an objective fact), it is not a material particle bur rather a potential or possible particle. When an IUOC (actually an IUOCs avatar) makes a measurement in PMR, the result gets defined by a random draw from the probability distribution of all the possibilities.
  - **From slide 31:** The measurement result is computed only after no future changes to the probability distribution, from which the result of **that specific measurement** is drawn, are possible. This closure of possibilities **may** occur because the avatar is now "looking" at an object (queries the VRRE about that object) thus forcing the VRRE to immediately inject "measurement" information describing that object into the IUOCs data-stream.
    - A. **my prediction:** The final result screen data is calculated by the VRRE only after no future changes to the probability distribution, from which the result screen **measurement** is drawn, are possible. Until the screen data is looked at, it remains possible that the detector data could be erased. This possibility becomes part of the logic of the experiment since such an erasure would change the probability distribution, from which the screen data measurement is drawn. No further changes to are possible once a consciousness looks at the all the result screen data (receives data from the VRRE describing the 10 result screens – i.e., when the result screen data becomes an objective fact in PMR). The LCS/VRRE could simply prepare screen data in real time for all possibilities --10 diffraction patterns and 10 two bar patterns -- (all with the appropriate times if R3 collects time data) and then use whichever result pattern is appropriate for the final result after the possibility of changing the result probability distribution is zero. If the statements on slides 30 and 31 are correct **then I predict that: the result screen data for the sub-experiments with destroyed detector data will show diffraction patterns and that all others (those with preserved detector data) will show two bars.**
- **2. What constitutes "which way" information that is "available in PMR"?**

A. It is my opinion that, according to the logic of this experiment, "available which way data" must be OBJECTIVE information (an objective PMR fact – see slide 30 for definition) that a consciousness could look at (receives from the VRRE) before or after looking at the available objective result screen data. The VR's ruleset logic governing this experiment must be such that the two available data sets (detector data and result screen data -- both objective facts in PMR) are always consistent with each other.

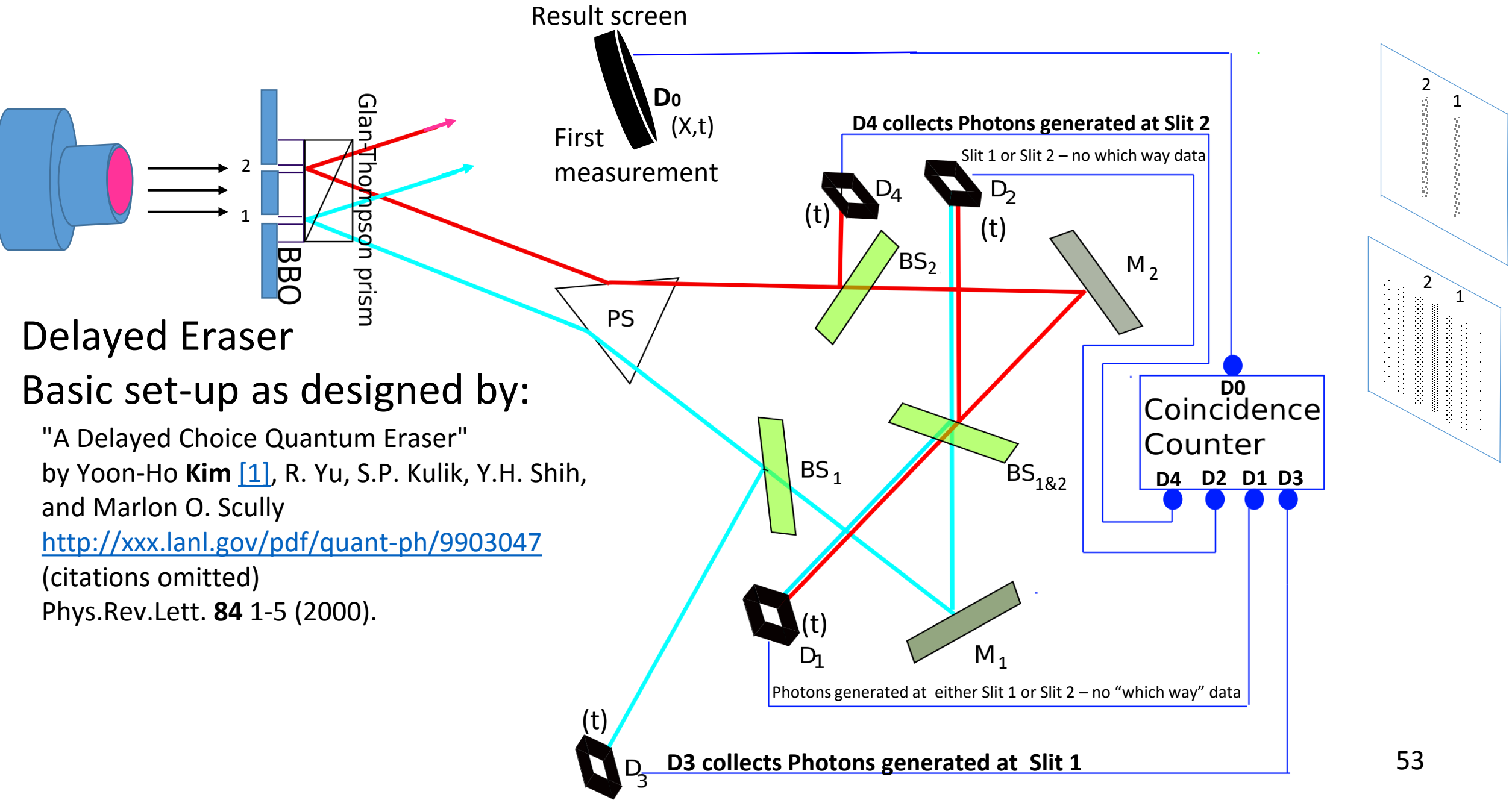
B. It is possible, though unlikely, that "Available which way data" can also be Subjective information indirectly or inductively derived that is NOT an objective fact but rather a highly likely possibility (probability - based on past data)

a. The case against my prediction: The logic of the experiment (without including the existence of any future possibilities that could change that logic) creates a strong informed **belief** among experts (who were present during the entire experiment) that "which way" data **ALMOST CERTAINLY** existed for each individual sub-experiment during and AFTER the experiment was conducted (but before erasure occurred by destroying selected flash drives) and this w-w data has already been indelibly recorded at R1 and R2. Thus, two bar (SVD) patterns must be already indelibly recorded at R3. After all, this result is what this experiment is designed to produce. The only possible exception would be a random failure-to-record error. It is an exceedingly low probability that "which way" data would somehow accidentally fail to be collected only form the randomly selected experiments. Thus, this position is supported by very strong (probable) inductive logic – perhaps strong enough to be considered nearly an objective fact even though it is **not** an **objective** fact because the w-w data has never been looked at.

b. The case for my prediction: Assume the goal is to render PMR without conflict between available "facts". Would the VRRE consider a conflict between a set of objective data (one fact – the result data) and a set of highly probably but non-objective data (almost a fact –a probable fact-- but not an actual fact) a serious enough problem to warrant eliminating it. If so, what is the probability threshold that differentiates between close enough to be considered a fact and definitely not a fact? How could such an **arbitrary** threshold placed upon a **subjective** assessment of fitness for w-w data be implemented without generating additional inconsistency within PMR? And at what added computational cost for the additional overhead processing? It seems to me that the VRRE would open a very unwieldly, expensive can of worms and add unavoidable inconsistency to the PMR VR if it allows non-objective information arrived at through inductive logic to define what is or is not considered a conflict between incompatible PMR VR facts. If facts have to be objective, then the process is greatly simplified because a candidate fact either is or it isn't objective…there is no sort-of objective. Requiring w-w data to be objective (in executing the logic of this experiment) is a much more efficient, cleaner, and simpler way to run a reality. Evolution always moves toward greater efficiency as its logical environment allows.

Variations on Experiment 4: If Experiment 4 unexpectedly fails to show macro erasure effect (the LCS VRRE decides to swallow the extra overhead cost and arbitrariness), these experiments may show just how close to being objective is required

- Exp 4a: If Exp 4a indicates that "which way" information can be established by subjective observers without recorded information, then redo Exp 4 with a random and stealthy turning both D1 and D2 on and off for N sub-experiments. If roughly half show 2 bars and half show diffraction patterns, then this type of macro erasure is having no effect on results. If there are more diffraction patterns than double bars to a degree that is statistically significant, then the macro erasure effect is working as expected after we removed the subjective, unrecorded knowing of how each sub-experiment is set up.
- Exp 4b: Repeat Exp 4a (above) with D1 and D2 detectors in the state of "both off" or "both on" each state occurring both randomly and stealthily for 4 iterations (sub-experiments). Immediately delete the detector data of all sub experiments.
  - Experimenters have no idea when detectors are on or off. Thus no subjective expectation per run and a much smaller expectation (roughly 50/50) for the collective result
  - Question: Will any of the screen results show two bars? If no, repeat Exp 4b, and so on. if a "yes" occurs repeat experiment for 10 iterations. If roughly half show 2 bars and half show diffraction patterns, then this type of erasure is having no effect on results.



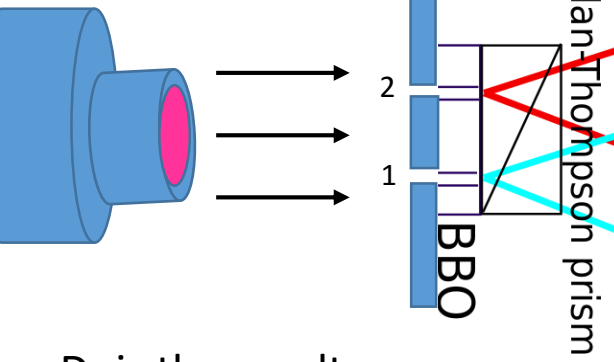
Delayed Eraser

Basic set-up as designed by:

"A Delayed Choice Quantum Eraser"
by Yoon-Ho **Kim** [1], R. Yu, S.P. Kulik, Y.H. Shih, and Marlon O. Scully
http://xxx.lanl.gov/pdf/quant-ph/9903047
(citations omitted)
Phys.Rev.Lett. **84** 1-5 (2000).

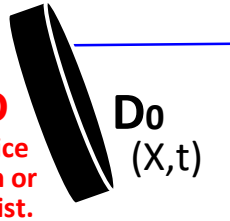
How the Delayed Choice Erasure Works in a VR

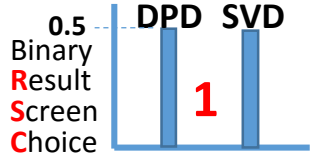
A laser triggers an entangled pair of virtual particles behind **either** slit 1 **or** slit 2



Result screen
D0 is the First measurement

1 **BDRSC:** **DPD or SVD**
Result Screen Choice
Diffraction pattern or two single value dist.

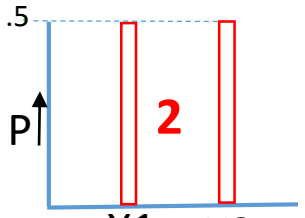


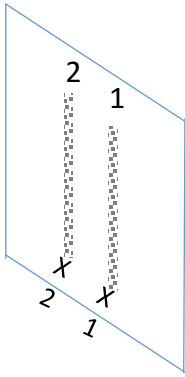


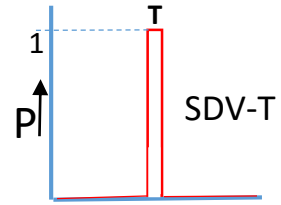
Have or not have which way data is 50/50

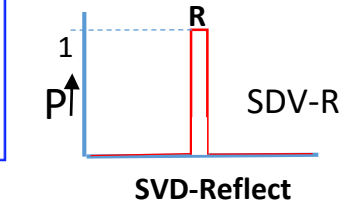
D4 collects Photons generated at Slit 2

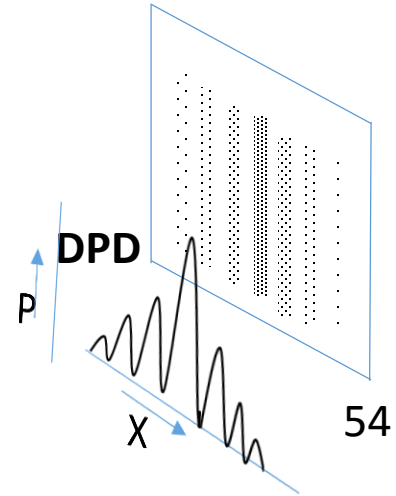
Slit 1 or Slit 2 – no which way data

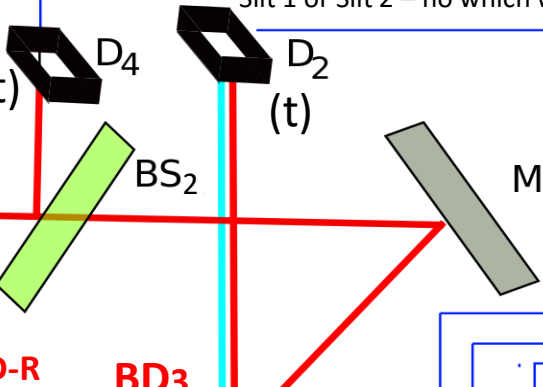


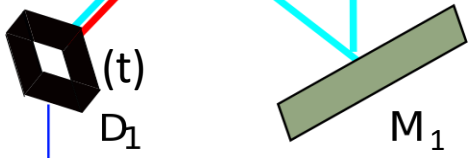


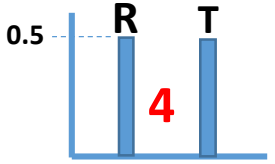




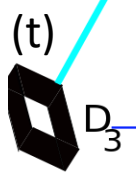








Photons generated at either Slit 1 or Slit 2 – no "which way" data



D3 collects Photons generated at Slit 1

- D_0 is the result screen
- D_3 and D_4 provide "which way" information
- D_1 and D_2 ($BS_{1\&2}$) erases "which way" information
- Time always runs forward

A random draw from a binary distribution B_0 to decide which slit will initiate the entangled pair. The other three binary distributions BD1, BD2, BD3 determine whether a particle is reflected or transmitted at each beam splitter.
1) BD_{RSC} (DPD or SVD, 2) BD_0 (x_1,x_2) 3) Modify BD1 or BD2 into SVD-R or SDV-T

If x1 and DPD, then measurement 3 is: SVD-T
If x1 and SVD, then measurement 3 is: SVD-R
If x2 and DPD, then measurement 3 is: SVD-T
If x2 and SVD, then measurement 3 is: SVD-R

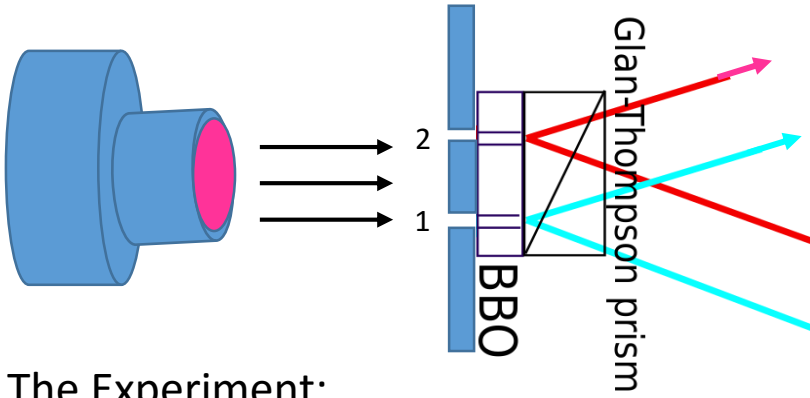
Our virtual reality represents an intelligent simulation, not a deterministic material machine

Description of logical process describing the Delayed Choice Quantum Eraser Experiment in the previous slide

- Time always runs forward because of the way an outer time loop drives a dynamic reality frames simulation one delta-t at a time. Lets trace a virtual particle through the experiments logic:
- First measurement: At D0 the LCS randomly draws from BD_{RSC} -- a binary distribution (BD) of the result screen choice of two distributions DPD, and SVD -- a 50/50 chance of drawing from either of these two distributions [because BD_2 and BD_1 are both binary (50/50) whether they collect which way data (reflect) in D_3 or D_4, or erase the which way data (transmit) in D1 or D2]. When that is done, If the LCS picked a diffraction pattern, it immediately, randomly, draws from the DPD and "places" data in D_0 where the virtual "particle" would impact. Next, it draws from the binary distribution BD_0 to determine the "which slit" the virtual particle has gone through (slit 1 at x_1 or slit 2 at x_2). On the other hand, if a two bar pattern (decoherence -- SVD) was drawn from BD_{RSC}, the LCS immediately draws from the binary distribution BD_0 to determine the "which slit" information (x_1 or x_2) and then the proceeds to "place" data in D_0 where that virtual "particle" would impact by choosing SDV1 or SDV2 (see earlier explanation). At this point there is data in D_0 representing this virtual particle (in either a diffraction (DPD) or double bar pattern (SVD)), and we are ready to go onto the next step in the logical process as it is defined by this particular experimental setup. Next BD_1 or BD_2 will be **updated or changed** to reflect any new logical conditions (depending on which slit BD_0 picked – **if BD_0 picked slit 2**, then BD_2 will change to suit the choice of DPD or SVD). If the choice was DPD, then DB_2 is replaced by SVD-transmit (SVD-T). If choice was SVD, then DB_2 is replaced by a SVD-reflect SVD-R). Likewise, **if BD_0 picked slit 1**, then BD1 will change to suit BD_{RSC}'s previous choice of DPD or SVD). If the choice was DPD, then DB1 is replaced by a SVD-T. If choice was SVD, then DB1 is replaced by a SVD-R.
- Of course, a different logical flow would have worked as well. We could have started with picking "which way' data from BD_0, and then moved on to BD_{RSC} to determine the screen pattern distribution at D_0 (DPD or SVD) and then written the appropriate data on detector D_0. Next would come updating or changing BD1 or BD2 to SVD-T or SVD-R
- Fortunately, we can test the soundness of the above logical process with Exp 5

Exp 5: Predict whether a particle will be reflected or transmitted at BS_2 and BS_1

1) Pick parameters so that the two bar pattern falls between diffraction peaks



The Experiment:

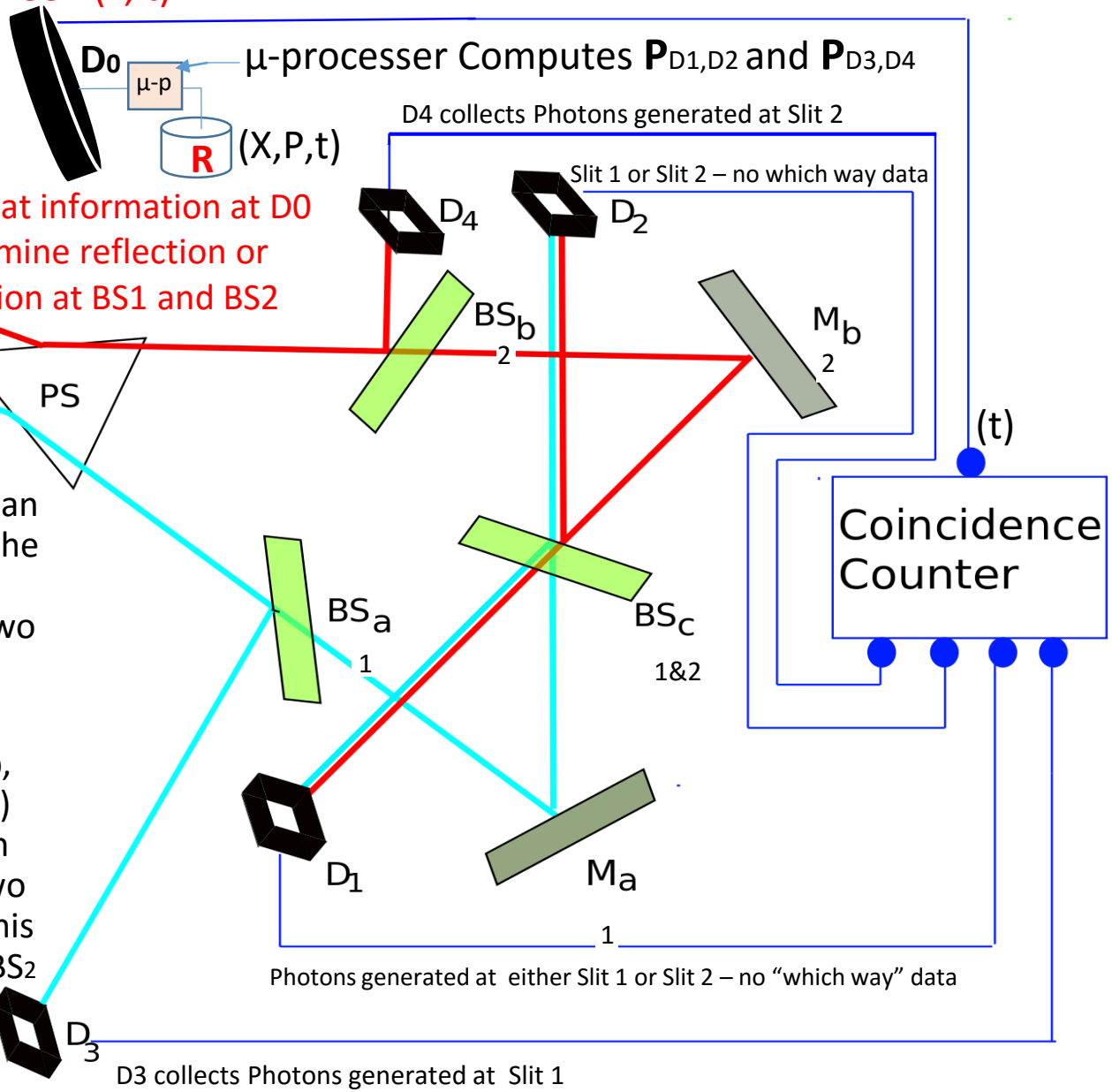
2) First, Run sufficient number of particles (more is better) through this experimental setup to generate an algorithm that: given an X value from D_0, computes the probability that that x value would be part of a diffraction pattern (was captured by D1 or D_2) or a two bar pattern (was captured by D_3 or D_4) [e.g., pick K nearest neighbors: $P_{D1,D2} = N_{D1,D2}/K$]. Test accuracy

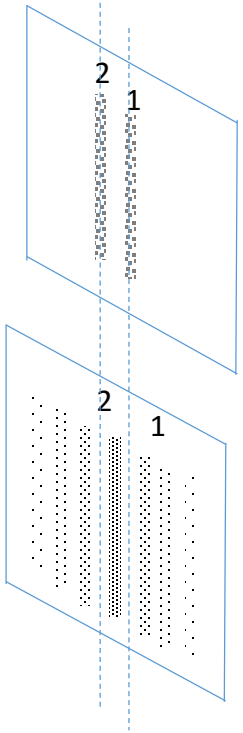
3) Run the experiment, and as soon as a particle hits D_0, use this algorithm to predict (compute probability of) whether its' x value is likely to be part of a diffraction pattern (will be captured by D1 or D2) or part of a two bar pattern (will be captured by D3 or D4) [Making this prediction before the particle reaches either BS_1 or BS_2 (or at least having started the deterministic computation process before then) is important]

4) Assess the accuracy of the prediction.

Result screen (x, t)

Every particle that hits D0 is associated by time with the detector its idler impacted





Experiment 5 (More detailed description)

- From a previous test run, look at where result screen D_0 dots fall when there is no "witch way" data (diffraction pattern) and with "which way" data (de-coherence – "two bars" pattern). From this test run data of D_0 x values and the detector associated with its' idler twin, develop an algorithm that gets the x value of each particle position on the result screen as an input, and outputs a probability that that particle is part of a diffraction pattern (associated idler was detected by D_1 or D_2) or part of two lines (associated idler was detected by D_3 or D_4). Adjust experimental parameters to make that algorithm as accurate a predictor as possible (adjust setup such that the "two lines" fall on Nulls of the diffraction pattern). Test the accuracy of the predictor.
- During the experiment: As soon as a signal particle is detected at the result screen D_0 (before its' associated idler particle gets to Beam splitter BS_1 or BS_2) pass its x value to the algorithm to compute (or at least to begin the deterministic calculation) the probability that the detected particle is a part of a diffraction pattern or that it is a part of a "two bar" pattern, whichever calculation is the quickest.
- Predicted result: That algorithmic predictor will very accurately predict (to a high statistical significance) whether the idler particle will be reflected or transmitted by BS_1 or BS_2 **before** it reaches the half-silvered mirror BS_1 or BS_2 where the eventual erasure decision is made (normally a 50/50 random choice). We should see that the beam splitter's choice between transmit or reflect is no longer random – instead, it is determined by the signal particle's **objectively measured** position at detector D_0 and the prediction algorithm.

Summary Of The Experiments

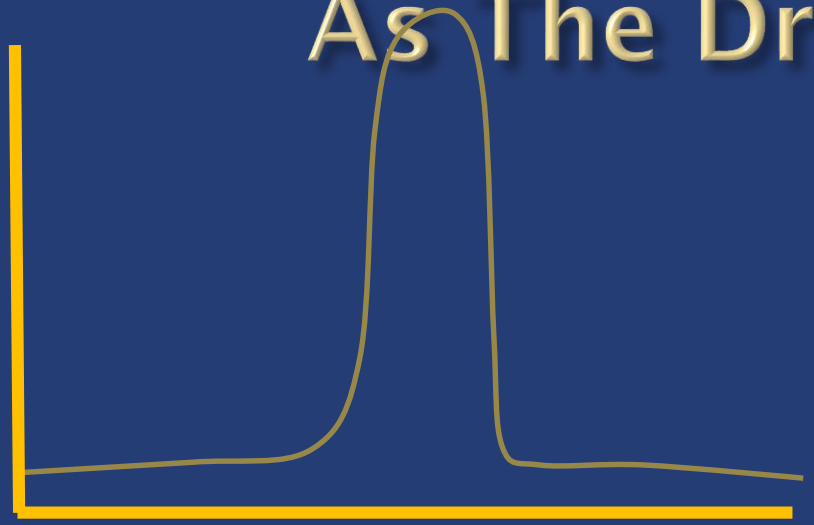
- Exp 1f2 depends on Exp 2 producing a diffraction pattern but Exp 1c2, Exp 4 and Exp 5 do not – they are completely independent of the outcome of Exp 2 and are also independent of each other. This means that if Exp2 fails, then Exp 1f2 will also fail.
- Exp 1c2 and Exp 1f2 are very similar (almost redundant in function), however, the difference is that Exp 1f2 is considerably easier to implement. Thus, if Exp 2 fails, one can still do Exp 1c2, and if Exp 2 succeeds, one can do the easier, less expensive Exp 1f2
- Exp4 may seem odd and even unscientific because of the human interaction in the experiment and because the experiment is done in the macro-world instead of the micro-world, but that is more the result of prejudice than any real problem of good science.
- Exp 5 has no off-the-beaten-path strangeness or unusualness, but its set-up and equipment are more complex and difficult to construct.
- Experiments 1c2, 2, 4, and 5 are the core experiments here (all independent), each has the potential to rewrite quantum theory.
- Experiment 3 will initiate the breaking of new ground with a study of the interaction of the PMR VR (our so called physical reality) with consciousness.

Deriving a logical foundation under Chaos Theory

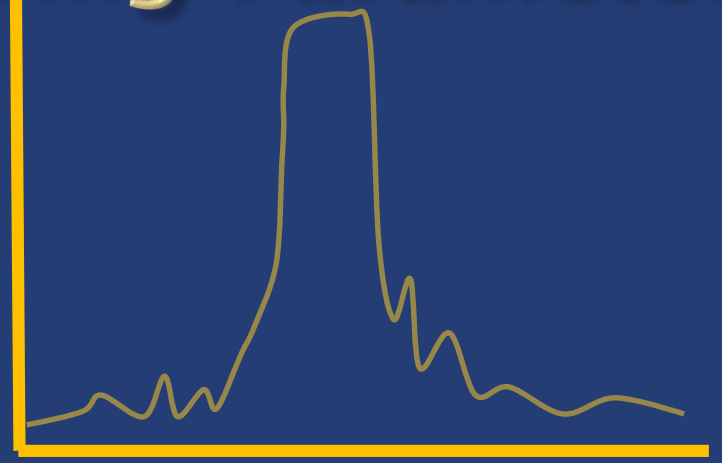
At This Point: Speculation Only

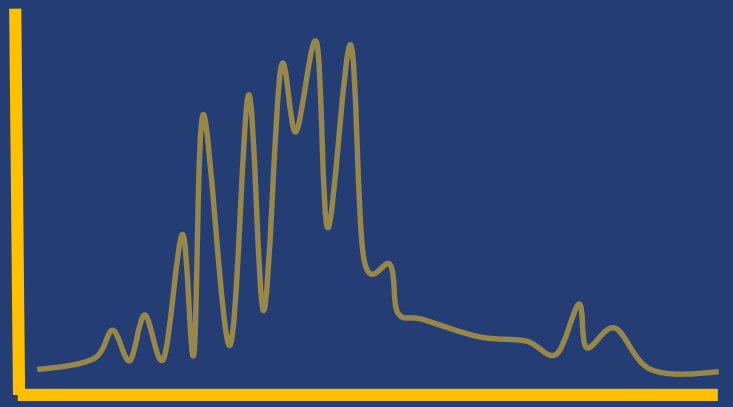
- Small changes drive large changes
- Minimum of 3 non-linear differential equations with iterative self modifying feedback loops
- Fluid flow example
- Chaos is a result of the fact that PMR is computed probabilistically from random draws from the probability distribution of the possibilities -- A process fractal:
  - Three nonlinear feedback mechanisms: 1) The driving parameter (feedback) pushes up the number of possibilities (complexity) which creates more possibilities –positive feedback -- and 2) every subsequent calculation has a flatter but more complex probability distribution. However, 3) each new probability distribution is limited by past choices – Chaos with evolving constraints
  - For any given driving parameter, there is still the constraint of a limited number of possibilities that can simultaneously satisfy the ruleset and history constraints…and eventually the distributions become saturated with self-similar change creating something that looks like a mixture of chaos and areas based upon more uniform probability distributions (steady state conditions). Thus, chaos generates order within itself out of the complexity of disorder and the constraints placed upon new possibilities…. until the driving parameter is changed once again.

Probability Distribution Of The Possibilities As The Driving Parameter Increases:

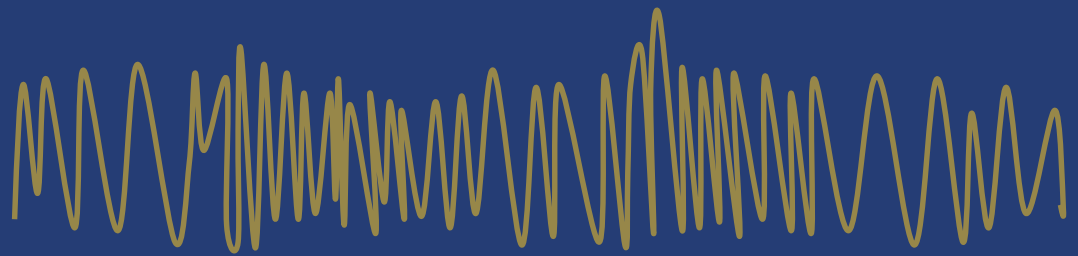


Limited Possibilities



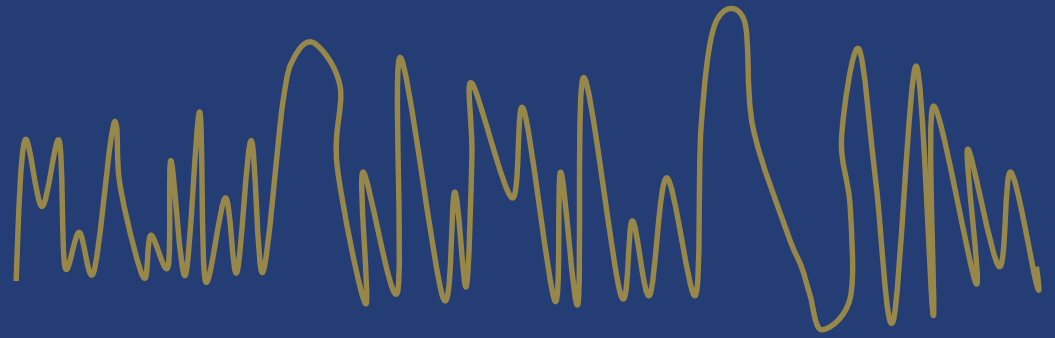


More Possibilities



More frantic motion at smaller levels of detail all at about the same level of probability

Many new Possibilities with less variation of probability amplitude



Areas of calmness interspersed with areas of chaos