Polarizer simulation method.

The realistic simulation of the polarizer define two results:

- The output taken by the photon (e or o)
- The time taken for the crossing (which will be a coefficient to be multiplied with a time constant)

This is done in 2 steps:

- 1: Calculation of an amplitude value depending on the hidden variables of the photon and the angle of the polarizer.
- 2: A test with two threshold values equal to PI/4 and PI/2.

Step 1:

Calculation of the amplitude for the threshold test.

The photon is modelled using 3 variables noted **p, q, r**

With:

p : Angle of polarization.
q and r : Two other angles, of which the nature has not yet been determined.

The value of these three variables are defined by the source during emission with random values between [0..PI] (and uniform distribution).

The amplitude value, noted **e,** is defined as follows:

By setting:

$$d = p - a\_pol$$

(p: photon polarization)
(a_pol: angle of the polarizer)

Then e is defined as:

$$e = d/2 + q/6 + r/12$$

(q and r: local variables associated with the photon)

The amplitude of this value varies between 0 and 3*PI/4, of which 2/3 depends on the difference in polarization angle of the photon / polarizer angle.

Note: if the d value is negative, the polarizer having a periodic PI period operation, the d + PI value is used.

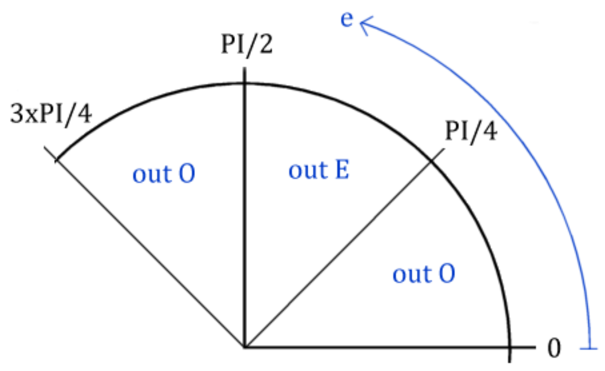
Step 2:

Determination of the output.

It is done with a test comparing the value e with two thresholds values PI/4 and PI/2

If e between PI/4 and PI/2, the output is e, otherwise it is o. (note: this choice is arbitrary).

Here is an explanatory graph:



Coded in C language, this produces the following code:

```
#define OUT_O 0                 // value used to code o out
#define OUT_E 1                 // value used to code e out

int out;
float d, e;

d = pho.p - a_pol;              // a_pol is polarizer angle
if (d < 0)
  d = d + PI;                   // use positive modulus PI value

e = d/2 + pho.q/6 + pho.r/12;

if ((e >= PI/4) && (e < PI/2))
  out = OUT_E;                  // e in PI/4..PI/2 range
else
  out = OUT_O;
```

Note: pho.p, pho.q, pho.r represent the variables p, q, r associated with the photon.

Analogy: A climber on a ladder.

A mechanical analogy can be made in order to fully understand the process.

Imagine a climber on a scale with 3 steps noted o, e, o spaced of PI/4.

The climber is initially on the first step o, and can lift the foot to a height equal to maximum 3*PI/4.
With one step He can climb 0, 1, or 2 steps.

The output taken by the photon will be the step on which it sets foot.

Calculation of the polarizer crossing time.

When it leaves the polarizer, the polarization of the photon is adjusted to the e or o output.

A transit time can be defined by calculating the variation in polarization that the photon have undergone between its input and output from the polarizer.

The crossing time is then proportional to this repolarization value. (To be multiplied by a constant)
This repolarization can reach a maximum of PI / 2.

Note1: Using a nonlinear, sigmoid-shaped time with an inflection point in PI/4, allow to produce detection correlations in $\sin^2$ if the size of the pairing window is not enlarged. (Setting 'st1 delay' in the test program).

Note2: The analogy of the climber for time is more complex, because the angles e and o at the exit of the polarizer are different. (It would be necessary to imagine perpendicular steps, and to define a time of rotation of the foot).

Physical interpretation:

In the model presented, only the variables q and r require interpretation.
The variable p, as the angle of polarization, is defined as a phase difference between the fields E and B.

Here is a first possible interpretation.
It is very qualitative, but clarifications, or other interpretations may come after a study of Maxwell's theory.

It explains the photon/polarizer interaction using the wave/particle aspect of the photon.
However, it is different from the classical interpretation, because it considers the two aspects as dissociated, and the photon as an object which can be located at any time.

The wave aspect is then associated with the polarization variable p.
The corpuscular aspect is associated with the variables q and r.

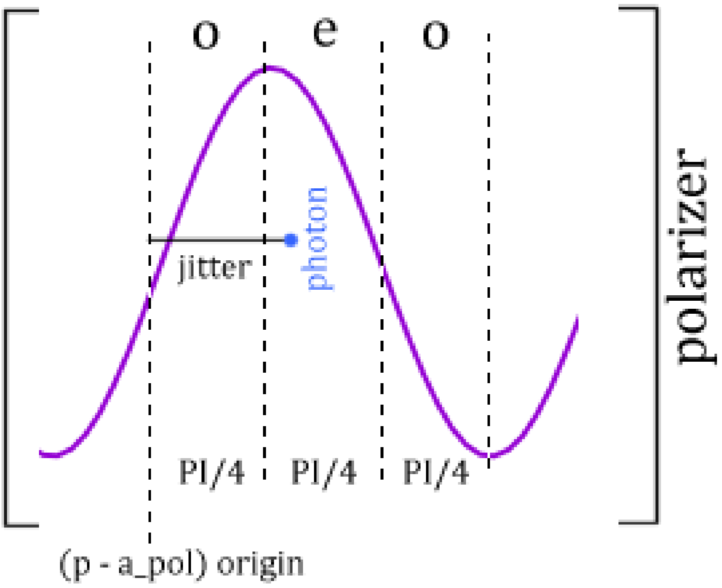
The photon is then associated with a position dependent on the wave field formed by E and B (p), to which a position jitter is added.

This jitter is defined by a distribution generated by the variables q and r.
The sum $q/6 + r/12$ then defines a phase shift representing this position jitter.

Having said this, the interaction at the polarizer is as follows:

We come back to the analogy of the scale.
The wave aspect defines, (by interference?), during the interaction in the polarizer, intervals of PI/4, directing any particle located there towards a determined exit e or o (space between steps of the ladder).
The origin of the PI/4 width intervals is defined by de polarization difference (p – a_pol).
This aspect only depends on p.

The jitter corpuscular aspect specifies, during the interaction, the PI/4 interval in which the photon is located, which makes it possible to determine the output taken.

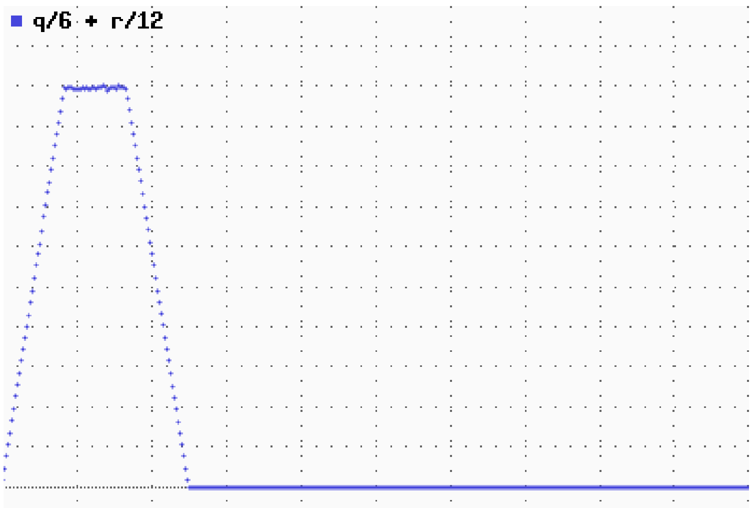


In this explanation:

- The particle is “guided” by the wave.
- The variables q and r are linked to a position.
- The sum e = d/2 + pho.q/6 + pho.r/12 used in the C algorithm represents a phase specifying the position of the photon during the interaction.
- The variables q and r could be grouped into a single variable having a distribution of (2*q + r)/12

The interest of this interpretation is that it does not require considering physical quantities specific to the particle.
A time jitter can be associated with any type of particle, making it possible to apply the method to other types of particles whose position would depend on a local field.

Distribution graph (2*q + r)/12



X axis : 0..PI

Author's Note:

I am not a physicist. I imagined this method as a personal project in my spare time.
What motivated me was to find an alternative to certain paradoxes generated by QM. (Quantum randomness and distant action without information exchange).

The initial objective was to find a computational process simulating a polarizer and making it possible to satisfy the following two points.

- The first is the law of transmittance, which must be in accordance with the Malus law.
- The second, the production of non-local correlations, able to approach as precisely as possible the functions $\cos^2$ and $\sin^2$.

I coded a first model using a method based on specific absorption of certain photons.
I abandoned it later, because it did not allow checking Malus' law for certain angles.

The model presented here is the second version.

Despite its simplicity, it has remarkable properties.
It naturally appears non-local as soon as the detection or pairing is not perfect.
It also exhibits remarkable properties concerning the correlations. It is possible to perfectly separate the pairs which produce noise from those which generate correlations.

It now remains to be determined whether this model describes phenomena that may have a real existence or whether it is only a computational process.

In the first case, the objective is to find links with existing theories.
Maxwell's work seems to me to be a good starting point.
It would be necessary to explain the generation of the PI/4 sections defining the e/o output of the polarizer.
Then, the generation of the time jitter.
This one requires well-defined coefficients of 1/6 and 1/12, thus defining precise constraints to make associations with existing equations.

In the end, it would be very interesting to be able to interpret the complete mechanism involved in the EPR correlations.

If anyone has any ideas on this topic, he can email me here pierrel5@free.fr