The McMinnville pictures

(Antoine Cousyn, François Louange and Geoff Quick)

This document is made up of two parts:

- The initial study « **Back to McMinnville pictures** », published on the *ipaco.fr* website in April 2013.

- A complementary study « **Evidence of a suspension** thread», added in June 2013.

The 1st part shows how, using adapted interactive tools, one may prove that the explanation of a model hanging from a thread is by far the most probable one, in the absence of irrefutable proof. This study, however, did not uncover the presence of a thread in the pictures.

The 2nd part, written up after having integrated a specific and original detection tool into the IPACO software, uncovered the presence of a suspension thread in both pictures, which should put an end to the study of this case file.

The whole document has been updated in May 2014, with a few modifications of measuring results, but without any significant impact on the conclusions, in order to take into account several new facts:

- The discovery of inaccuracy, in certain cases, when IPACO computed angles and size/distance ratios, and the correction of the identified bug.

- The consideration of height differences in order to refine the assessment of the distance between the camera and the wires (following a constructive criticism from an Internet forum).

- The implementation of an improved version of the *Vertical thread* detection tool (option for spatial high-pass filtering the summation curve).

1st part (March 2013)
Back to McMinnville pictures

On May 11th 1950 in McMinnville (Oregon), between 7:30 and 7:45 PM, the farmer Paul Trent took two pictures (identified as MM_1 and MM_2 hereafter) showing a "UFO" in the sky, in the vicinity of his garage. A brief summary of the event can be read here.

The object seems to have a circular base. These two photographs are among the most well-known in the history of UFO studies. They have already been extensively analyzed by qualified investigators, in particular: William K. Hartmann, Philip J. Klass, Robert Sheaffer, Bruce S. Maccabee, Joel Carpenter (NICAP), Ground Saucer Watch (GSW) and Claude Poher *(See references on the last page)*.

MM_1

MM2

The goal of this paper is certainly not to produce a “scoop”, nor to criticize the conclusions of previous studies. It is specifically focused on the use of a modern interactive tool for a quick pragmatic assessment of this type of dossier. As concerns underlying mathematics and physics, nothing differs from what was found in the past, except that the new tool responds immediately, in a most flexible way, leaving time for the analyst to think and to try without delay several different investigation strategies, in a fully interactive mode.

According to previous investigators, Trent’s pictures are genuine (i.e. a *real* object was effectively photographed) but, because of photometric parameters being difficult to interpret, it remains open as to whether they show a remote (unknown) flying object or a small model hanging from a power wire. Claude Poher is affirmative about the hoax theory. This possible explanation will, of course, be kept in mind.

A deep photogrammetric analysis has been conducted by Bruce Maccabee. Based on physical data obtained on site, he produced a map of the scene (see below) with a reconstruction of the UFO’s sighting line crossing point (SLC) between both pictures. The electric wires’ anchorage points on the house and on the garage being known, as well as Mr. Trent’s respective positions during both shots, he concluded that this crossing point could be either right under the power wires, or a few feet farther, depending on the reconstruction of the sighting area from photographic data and "known" sizes of objects in the photos.

We will not redo this excellent work here, but rather concentrate on what can be derived rapidly from the pictures themselves.

Camera and settings

Camera model:	ROAMER 1, equipped with a 120 (or 620) film
Dimensions of the negative:	6 cm x 9 cm
Focal length:	100 mm
Exposure time:	1/50 s

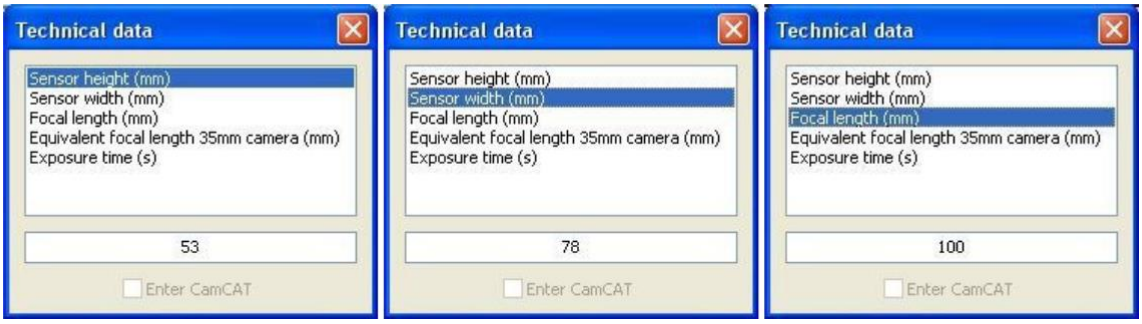
A detailed description may be found here.

Data preparation

There exist several scans of MM_1 and MM_2, looking a bit different from the radiometric point of view, as will be seen later. The geometric part of this work is based on high-resolution scans of MM_1 and MM_2 (displayed above), created by Ray Stanford from first-generation prints delivered to him by Bruce Maccabee, who had the original negatives to hand.

Initially we loaded pictures **MM_1** and **MM_2** into our dedicated software tool ***IPACO***, then used the ***Camera/Technical data*** function to introduce the values of settings that are required for angular measurements.

The focal length is known. On the other hand, the sensor’s dimensions do not correspond exactly to the original negatives’ dimensions, since they had been cropped. Dimensions really taken into account for scanning could be retrieved, thanks to accurate direct measurements taken by Bruce Maccabee on the negatives.

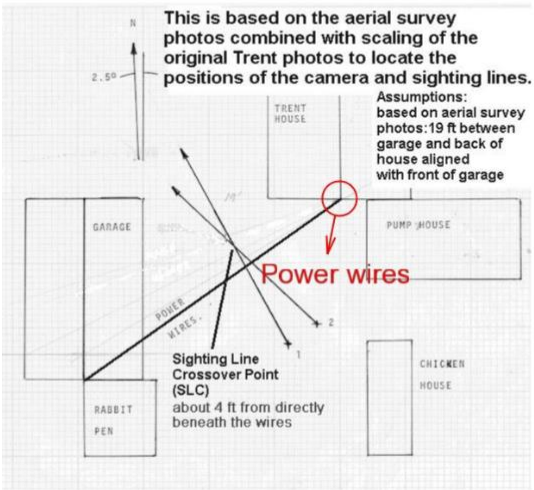


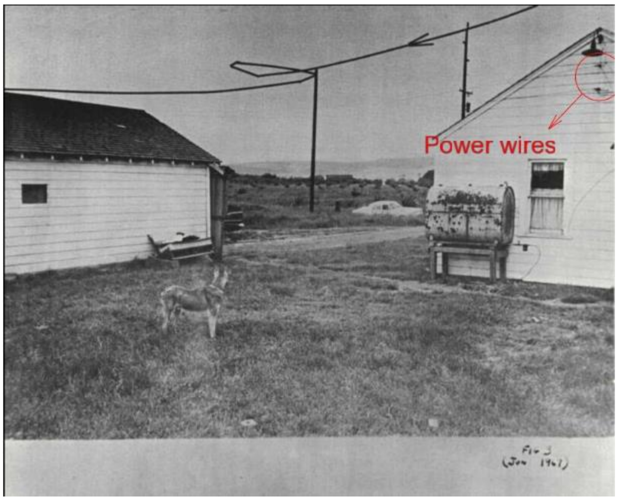
In the first steps of the analysis, we concentrated on the following elements of the scene:

The **UFO**, localized in space by the center of its base, which is assumed to be nearly circular (seen as nearly an ellipse from the camera),

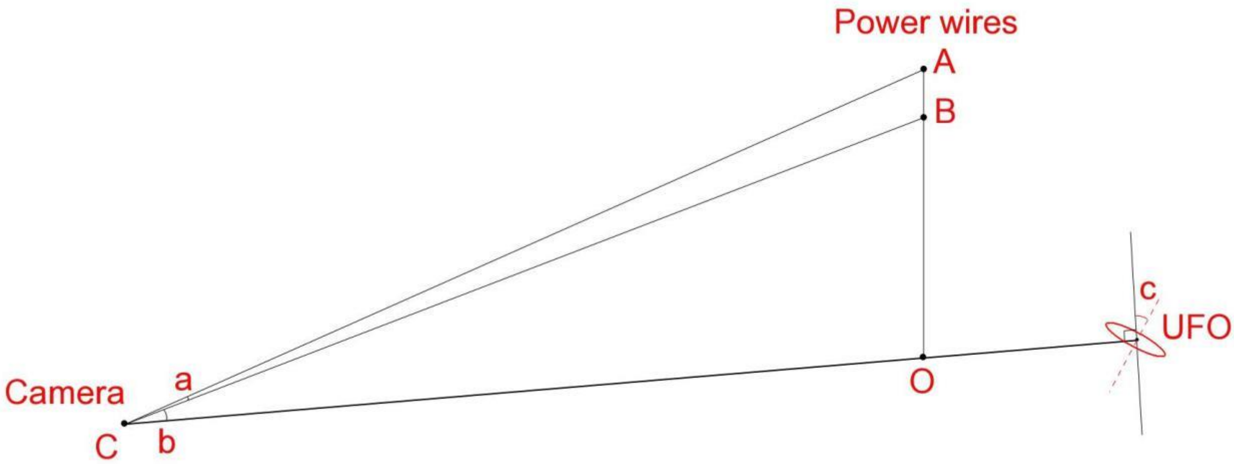
The **two power wires** above the UFO, assumed to be motionless.

It was possible to check, from the already mentioned detailed map of the site established by Maccabee, and from a picture published in Condon report’s Plate 25 (Hartmann 1967), that these two power wires were one above the other (i.e. in the same vertical plane). Therefore, if the UFO is effectively a model, it should logically be hanging from the lower power wire. Knowing the house’s dimensions, it was also possible to assess the height of the lower wire: ca. 11.5 ft.



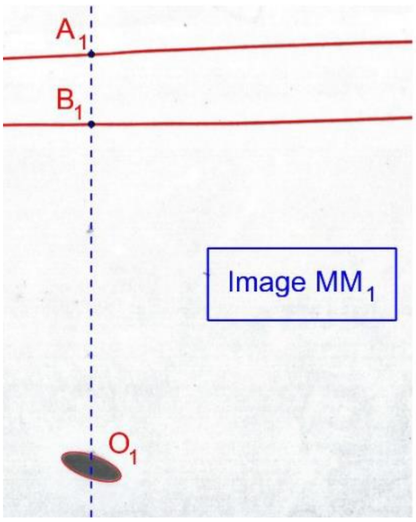


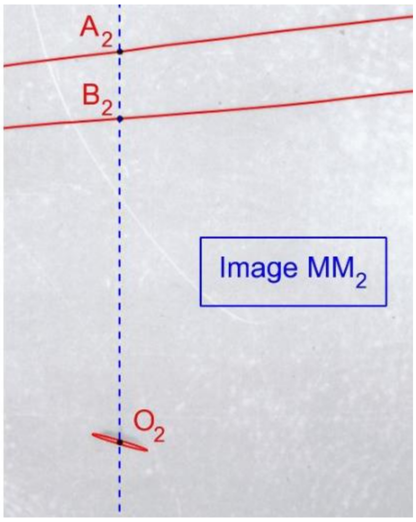
For each picture, assuming that the camera is nearly horizontal, which seems reasonable (a tilt by a few degrees would not modify anything significantly), we considered the **vertical plane Pv** which contains the UFO's sighting line, with the following notations:



Plane **Pv**

We drew the following graphics over both pictures, using the ***Creation/Polyline*** and ***Ellipse*** functions.

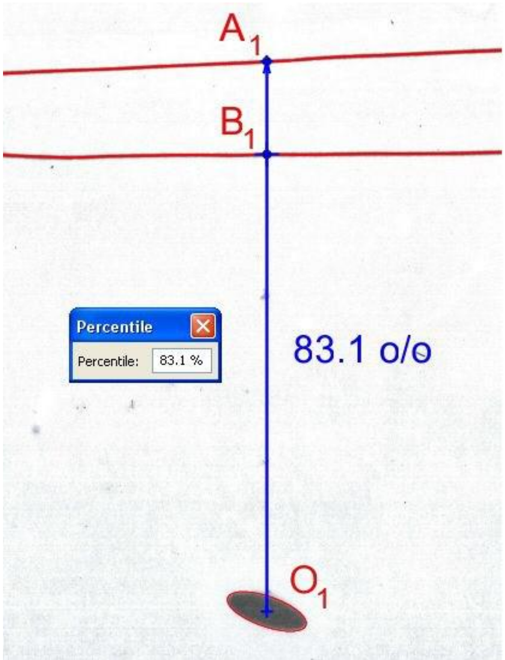


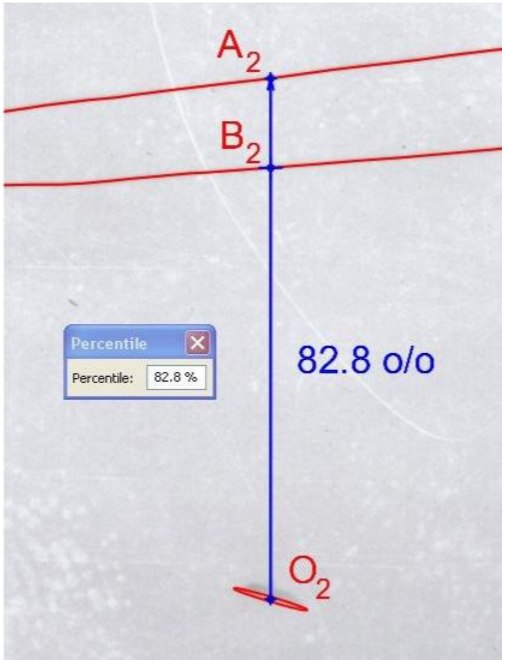


Quick geometric approach

Before performing any detailed measurements, we checked the relative UFO's position v's power wires along the vertical, in MM_1 and MM_2.

Using then the ***Mensuration/Percentile*** function, we assessed immediately the relative position of point **A** in the **OB** segment (ratio OA/OB):





The relative variation of this ratio between both shots, from 83.1 % to 82.8 %, is
< 0.4 %.

The relative position may obviously be considered as **nearly constant**, which can only be explained, from a geometric point of view, **if the object was effectively hanging from the wire OR if its movement between both shots was following precisely its sighting line**.

As Claude Poher points out, this point alone makes the hoax hypothesis rather strong.

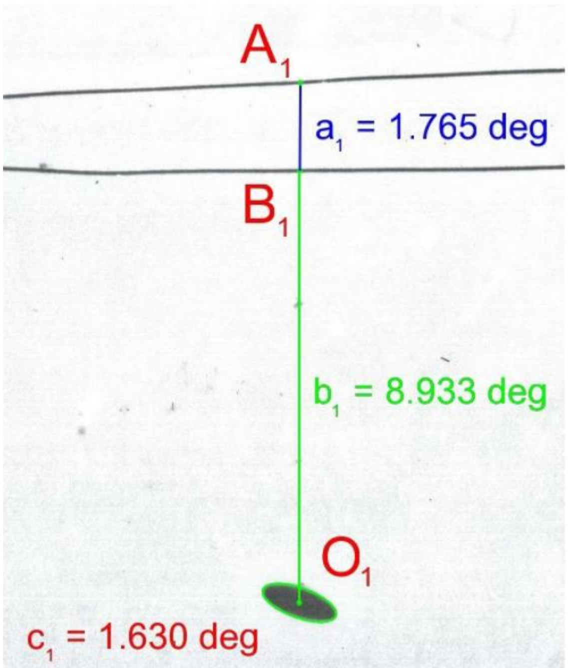
Geometric analysis

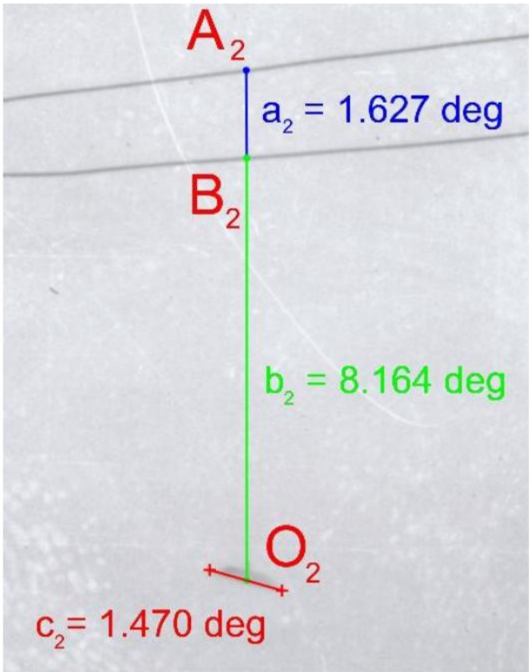
Angle measurements

In order to go further, it was necessary to measure the angular size of the key elements of the scene, as defined above:

Angle **a** subtended by AB, seen from the camera lens
Angle **b** subtended by OB, seen from the camera lens
Angle **c** subtended by the diameter of the UFO's circular base, seen from the camera lens

Using the ***Geometric Mensuration/Angle*** function, we obtained automatically the values of those angles:





One may reasonably assume that points A and B did not move significantly between both shots. The length of AB (thus the angle **a**) will therefore constitute a reference.

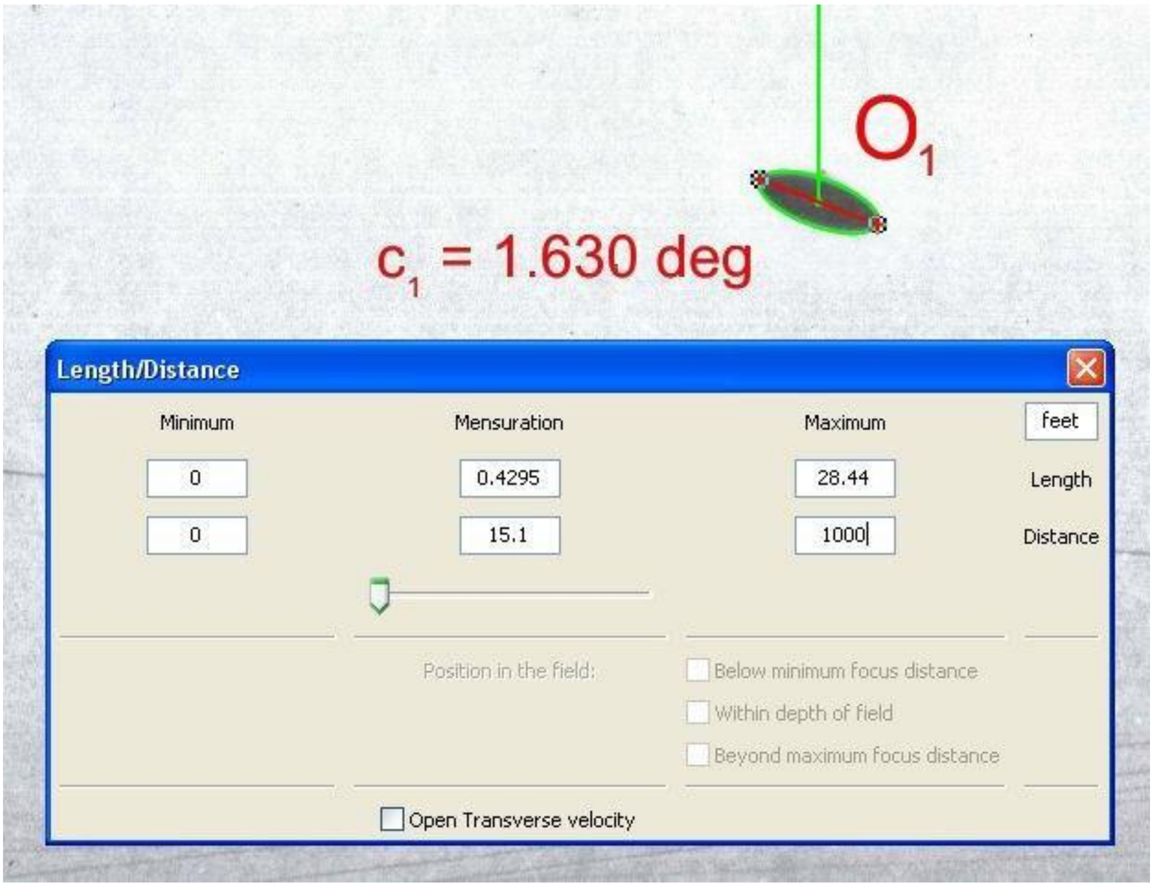
The following table sums up the values of measured angles in each of the pictures:

	Picture MM_1	**Picture MM_2**
Angle a	1.765 °	1.627 °
Angle b	8.933 °	8.164 °
Angle c	1.630 °	1.470 °

Length measurements

From the map established by Maccabee, we knew that the distance between the camera and the power wires was approximately 13.4 ft in MM_1 and 14 ft in MM_2. Assuming the camera was at around 5 ft elevation, i.e. 6.5 ft lower than the lower wire, we found that the actual distance between the camera and the power wires was approximately 14.9 ft in MM_1 and 15.4 ft in MM_2. We used **15.1 ft** for calculation purposes.

Using the ***Geometric Mensuration/Length-Distance*** function, we obtained immediately length values as functions of distances (or the contrary):



As concerns the **UFO** under study, we obtained the following figures:

Distance (ft)	**Diameter MM₁** (ft)	**Diameter MM₂** (ft)
15.1	0.429	0.385
16.8	-	*0.429*
50	1.42	1.27
100	2.84	2.55
500	14.2	12.7
1000	28.4	25.5
5000	142	127

Assuming the UFO's diameter is constant, we can infer from this table that the camera-UFO distance has increased, between both pictures:

If it was under the wire : by **1.7 ft** (see the 2 first lines), i.e. in proportion by 1.7/15.1 11 %
In all cases : by the same relative value of **+11 %**

If we focus now on an average distance of **15.1 ft**, which corresponds to the hypothesis of a hanging model, we get:

(ft)	**Picture MM_1**	**Picture MM_2**
AB	0.465	0.429
OB	2.374	2.166
UFO	0.430	0.387

which provides the following estimates:

UFO's diameter : **0.35 to 0.5 ft**
Supposed suspending thread's length : **2.1 to 2.4 ft**

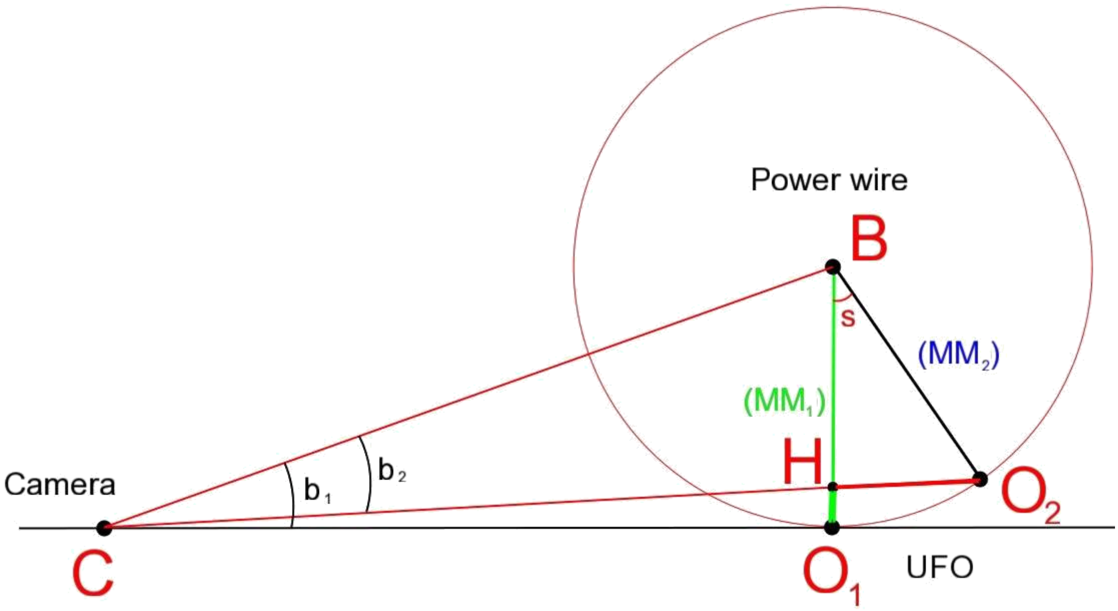
Hypothesis of a hanging model: swaying movement between both shots

The relative length variations between MM_1 and MM_2 were computed:

Ratio	Picture MM_1	Picture MM_2	Relative variation
OB/OA	0.836	0.834	**-0.2 %**
OB/AB	5.105	5.049	**-1.1 %**
UFO/AB	0.924	0.902	**-2.4 %**

The nearly constant value of the ratio **OB/OA** confirms the invariability already noticed above, in the "Quick geometric approach".

If we assume the object is a model hanging by a thread from the power wire, we can check whether the relative variations of ratios **OB/AB** (-1.1 %) and **UFO/AB** (-2.4 %) could possibly be related to a swaying movement, considering that previous investigators reported the existence of a light wind on the site at that time. This is particularly interesting because the change of the apparent shape of the object between MM_1 and MM_2 does suggest a swaying movement, with a significant component in the vertical plane $\mathbf{P_v}$, in the direction away from the camera lens.



For the sake of clarity, this drawing assumes several simplifications, which do not impact significantly upon the results:

It neglects the small already mentioned variation of the camera-UFO distance (1.7 ft), as well as the small horizontal rotation (13°) of the sighting line between MM_1 and MM_2. In other words it considers that both pictures are shot from the same location

It assumes that the line of sight is horizontal, although we know it has an elevation of ca. 11.5°

For MM_1, it assumes that the suspending thread BO_1 is about perpendicular to the line of sight CO_1

Under those conditions, it can be reasoned that:

1. If the component in the drawing's plane of the swaying movement describes an angle **s** between both pictures, the relative decrease of apparent length of the thread **BO,** equal to the relative variation of the ratio **BO/AB** (-1.1 %), is given by:

$$HO_1/BO_1 \quad 1 - \cos \mathbf{s} = .011$$

which provides a first estimate for **s**:

$$s_1 = 8°$$

In fact, this only provides the value for **s** corresponding to the particular case described in the above drawing. In other cases (BO_1 not perpendicular to CO_1), the value of **s** could be different, depending on the initial angular position of the thread. In particular, it would be larger if the angle [CO_1,BO_1] was greater than 90°.

2. On the other hand, the relative decrease of the apparent size of the object, corresponding to the relative variation of the ratio **UFO/AB** (-2.4 %), is equal (in absolute value) to the relative increase of the distance between the object and the camera lens:

$$HO_2/CH \qquad HO_2/CO_1 = (\mathbf{BO_1}/\mathbf{CO_1}) \sin \mathbf{s} = .024$$

where $\mathbf{BO_1}$ is the length of the thread and $\mathbf{CO_1}$ the distance between the object and the camera lens. The ratio $\mathbf{BO_1}/\mathbf{CO_1}$ is equal to tg $\mathbf{b_1}$:

$$\mathbf{BO_1}/\mathbf{CO_1} = \text{tg } 8.933° = 0.1572$$

which provides a second estimate for **s**:

$$s_2 = 9°$$

This second estimate is more reliable than the first one, since it is less dependent on initial angular conditions. We will therefore retain this value:

$$\mathbf{s \quad 9°}$$

This value of 9° corresponds, for a supposed 2.3 ft long suspending thread, to an increase of the camera-UFO distance due to an effective displacement of the UFO of:

$$2.3 \sin 9° \qquad \mathbf{0.36\ ft}$$

This difference, due to the swaying movement, is part of the above-mentioned global increase of the camera-UFO distance (see above) of 1.7 feet.

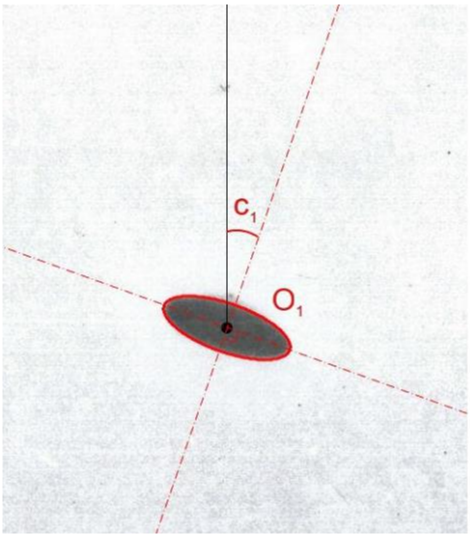
It is interesting to note that this contribution of 0.36 ft, due to the hypothesis that the hanging model moves between both shots, tends to explain part of the discrepancy of 3 to 4 feet, noted by Maccabee, between the camera-power wires distance and the camera-SLC distance. The rest could be due to the lack of accuracy of some of the data available on the physical site's configuration.

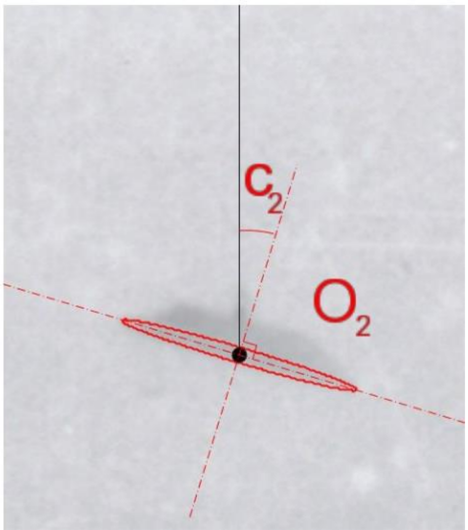
It has therefore been established that all the above measurements are strongly consistent with the explanation of a small model (ca. 0.4 ft) hanging from the power wire (ca. 2.3 ft below), with a swaying movement between both shots describing an angle of ca. 9°, away from the camera lens, in the vertical plane of the UFO's sighting line.

All hypothesis:
UFO's rotation between both shots

Assuming that the UFO's base is circular, we then tried to establish the value of the angle **c** between its axis of symmetry and the vertical. This angle's value may be assessed through two projections: on the picture's plane and on the plane $\mathbf{P_{UFO}}$, perpendicular to the picture, that contains the UFO's axis.

Projection on the picture's plane:





Direct measurements on the pictures gave the following results:

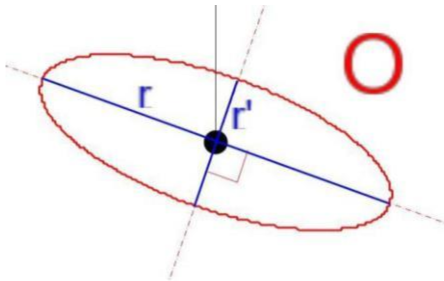
C_1 = 19°
C_2 = 17°

This angle **c** is nearly constant, especially if we take into account the fact that between the two shots, the camera's tilt against the vertical changes a bit (probably by a few degrees). This shows that the object had practically <u>no rotation movement around its axis</u>: it only rotated significantly around the major_axis of the ellipse. This can also be checked by observing the dissymmetry of the upper part of the UFO, which remains apparently constant.

Projection on the perpendicular plane **P_{UFO}**:

For simplification, we will only consider the plane **P_{UFO1}** corresponding to MM_1 (in fact, due to the operator's movement between the shots, **P_{UFO1}** and **P_{UFO2}** differ by an angle of around 13°). The impact on results is not significant.

The angle **d** is directly given by the eccentricity **e = r'/r** of the ellipse in each picture:



The simple formula is:

$$\mathbf{d = \arcsin e}$$

Direct measurements on the pictures gave the following results:

$$e_1 = 0.362$$
$$e_2 = 0.063$$

thus:

$$\mathbf{d_1 = 21.2°}$$
$$\mathbf{d_2 = 3.62°}$$

The UFO's total angular movement in the plane $\mathbf{P}_{\mathbf{UFO}}$, between pictures MM_1 and MM_2, corresponds to the sum of those two values, since the circular base is visible on MM_1 and no more on MM_2 (since it is "on the other side"):

$$\mathbf{D =} d_1 + d_2 \quad \mathbf{25°}$$

Conclusions drawn from the geometric analysis

We obtained the following general results:

Known ratio between the diameter of the UFO's base and its distance from the camera: **ca. 0.03** (see table above).

Movements of the UFO between both shots :

Relative shift away from the camera by **11 %** in the direction of its sighting line
No rotation around its axis of
symmetry Tipping back by **25°**

Moreover, if we take the hypothesis of <u>a model hanging below the lower power wire</u>, we have the following additional results:

Known diameter of the UFO's circular base: **ca. 0.4 ft** (12 cm)
Swaying movement by **9°** in the vertical plane of the UFO's sighting axis

It is reasonable to think that, in that case, the 9° angle of the swaying movement constitutes a large part of the 25° angle of the total tipping movement of the UFO in the same vertical plane, as well as the corresponding 0.36 ft increase of the camera-UFO distance constitutes a part of the ca. 1.7 ft global increase of that camera-UFO distance.

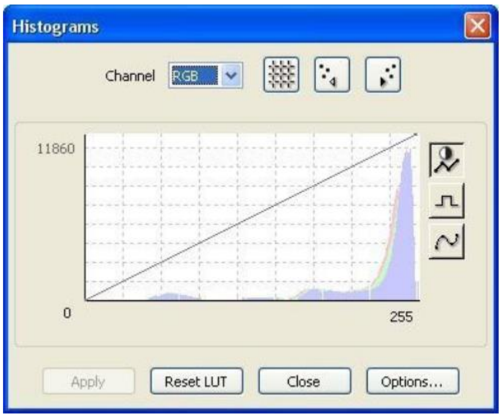
Choice of scans for radiometric measurements

In order to analyze radiometric properties, we must first choose the most appropriate set of data. As already mentioned, there exist several other scans of MM_1 and MM_2, looking a bit different, and in particular those used by Bruce Maccabee, identified hereafter as **$TRNT_1$** and **$TRNT_2$**:

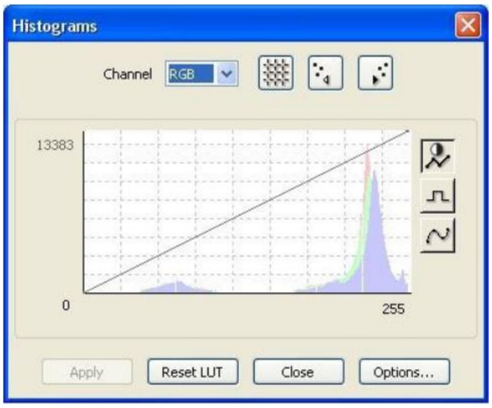
$TRNT_1$

$TRNT_2$

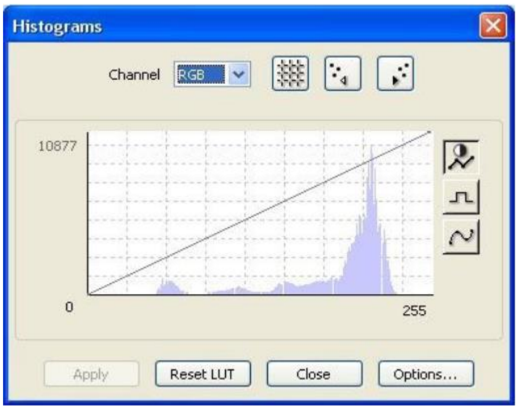
In order to visualize the significant existing radiometric differences between the sets MM_1/MM_2 and $TRNT_1/TRNT_2$, we use the ***Photo/Histograms*** function to display the respective histograms of the four pictures:



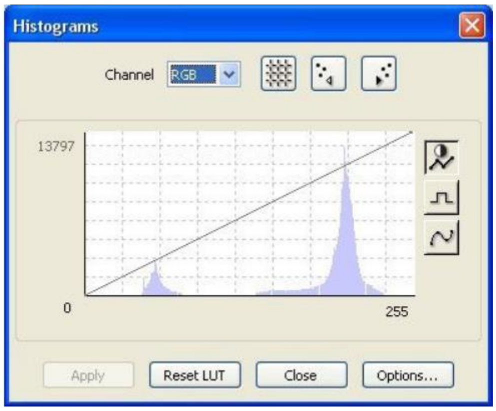
MM₁



MM₂



TRNT₁



TRNT₂

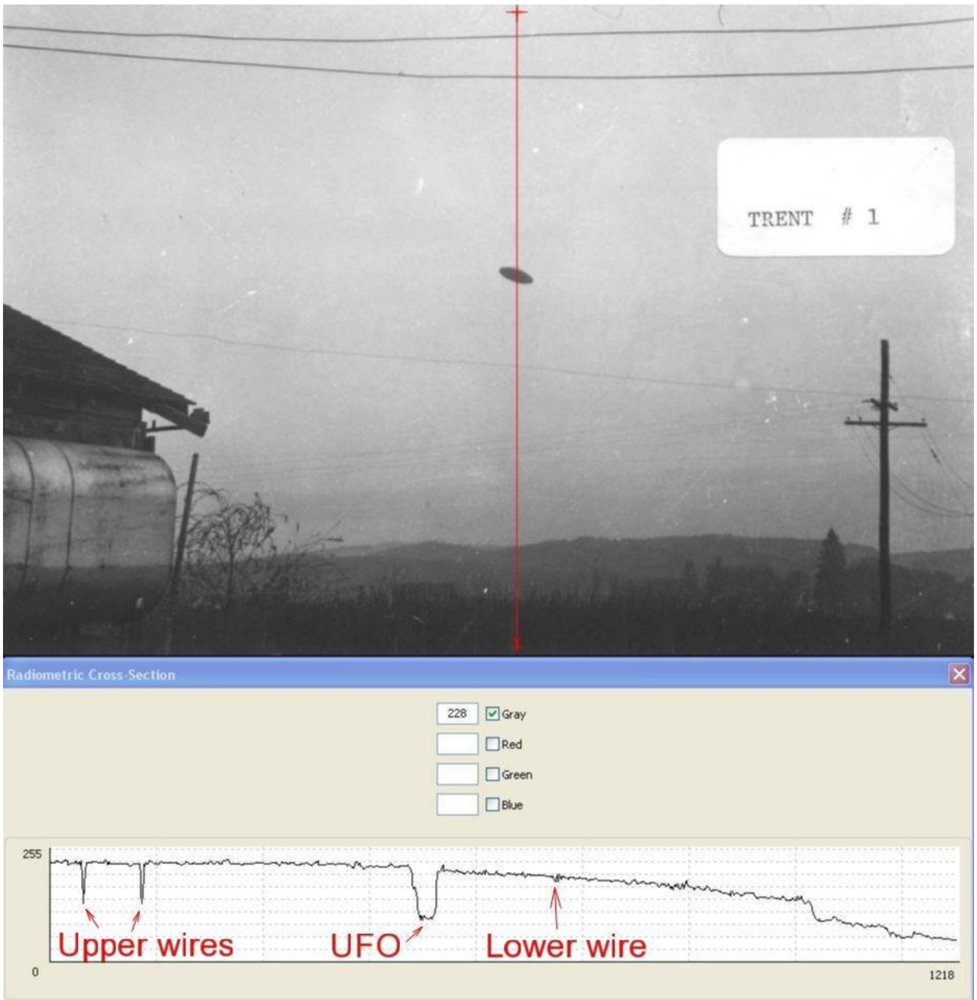
It appears clearly that the histograms of $TRNT_1$ and $TRNT_2$ are closer to one another (position of the main peak) than are those of MM_1 and MM_2. We will therefore chose $TRNT_1$ and $TRNT_2$ for the radiometric part of this study, so as to compare Trent's pictures in more reliable conditions.

Quick radiometric approach

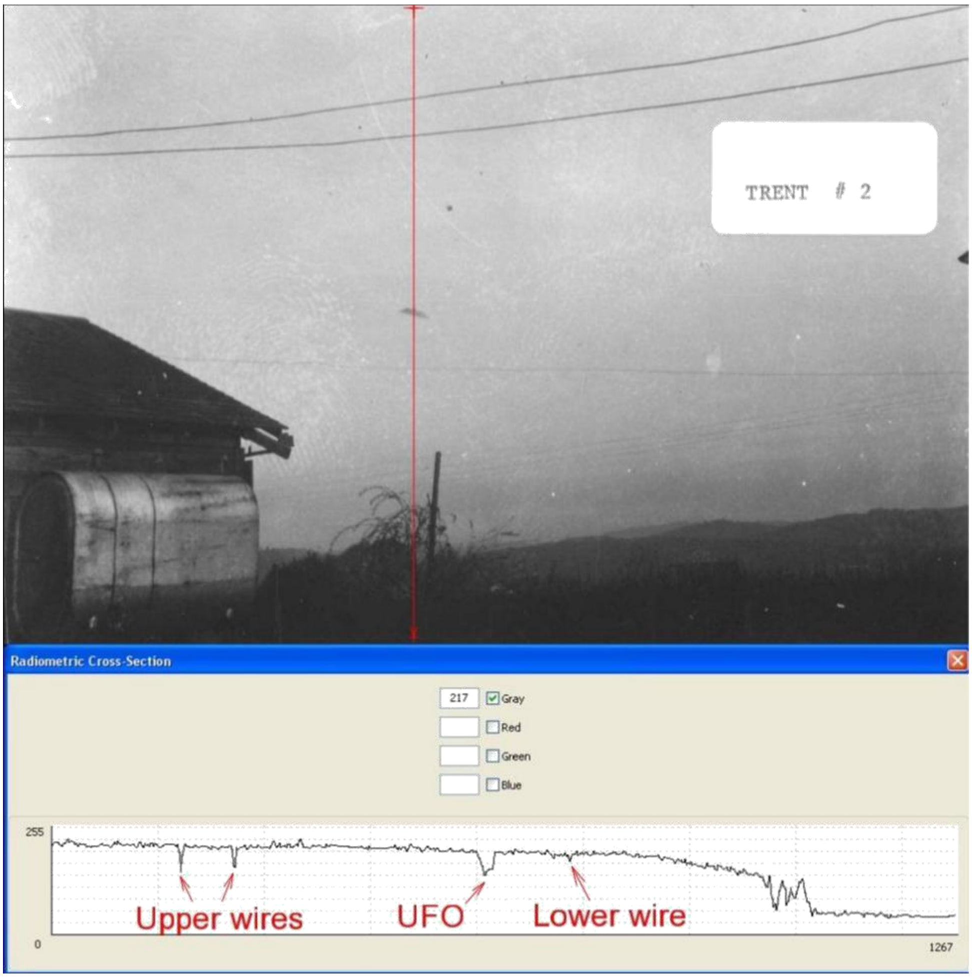
The weather conditions and the scene's illumination are such that the effects of atmospheric diffusion may be measured to assess the distance between a dark object and the camera.

For each picture, we drew a vertical radiometric curve that crossed the UFO's center, using the ***Radiometric Mensuration/Radiometric Cross-section*** function. We took into consideration three specific elements of the scene that may be supposed to be dark: the upper wires, the UFO and the lower wire.

If we assume that these elements are dark enough to be considered as sort of "black bodies" (i.e absorbing all the light they receive), we may compare their respective radiometric levels and infer a classification of their respective distances from the camera: a lower radiometry roughly corresponds to a lower distance from the camera.



TRNT1



TRNT2

From both graphs we may infer that the camera was clearly nearer to the UFO than to the lower wire, i.e. **less than 200 ft**, with means that the UFO's size (diameter of its base) was **less than 6 ft**.

According to the first graph, the camera seems even a little nearer to the UFO than to the upper wires. However, taking into account the fact that this difference is small, as well as the fact we did not take the existing *veiling glare* into account, we carefully adhere to the result:

Camera-UFO distance < 200 ft

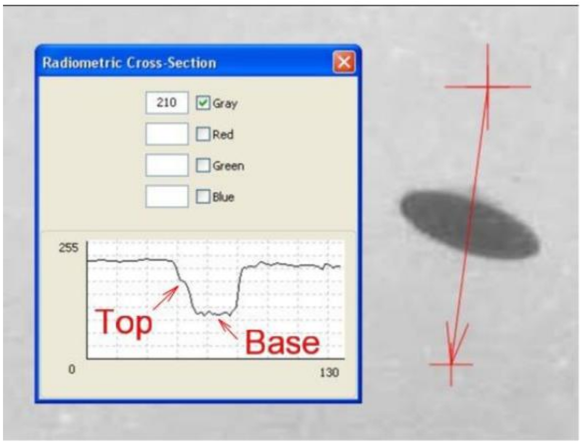
The explanation offered by that of a hanging model cannot obviously be excluded at this point.

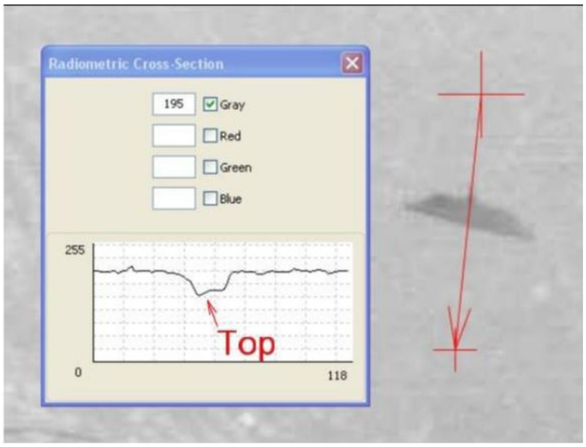
Radiometric analysis

This paragraph presents an attempt to analyze in a little more detail the radiometric properties of the photos. *However, the results are inconclusive, because of the unknown conditions under which information was transferred from the original negatives, via paper prints, until arriving in a digital format.*

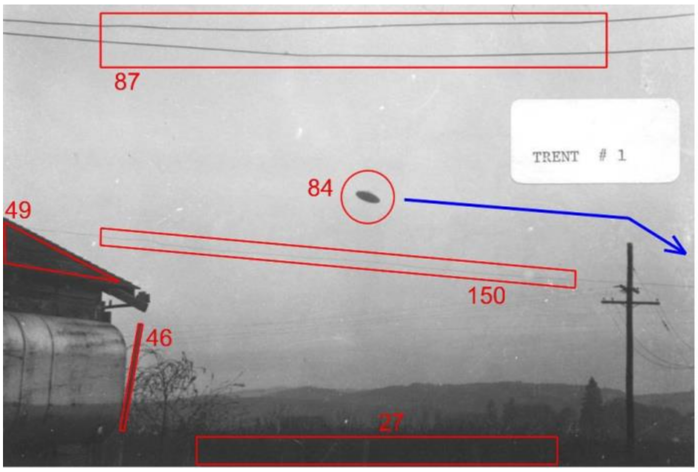
In each of the pictures, we defined interactively, through closed figures (rectangles, polygons, ellipses…), several reference dark areas. Using the ***Radiometric Mensuration/Area*** function, we extracted from each chosen area its lowest radiometric gray value, i.e. the darkest pixel in black and white.

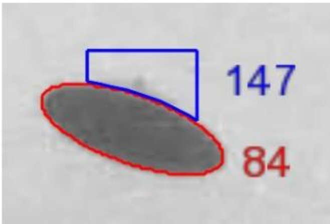
As concerns the UFO, it is obvious that its circular base (which is only seen in $TRNT_1$, since it is "on the other side" in $TRNT_2$) is far darker than its upper part. This is shown in the following radiometric curves, obtained through the ***Radiometric Mensuration/Radiometric Cross-section*** function:



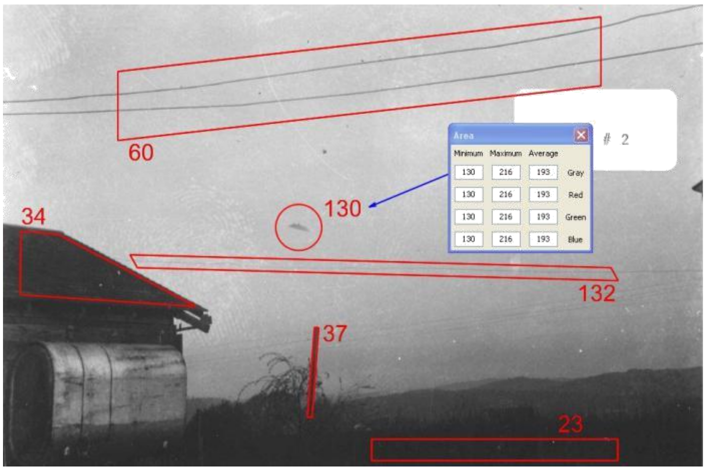


Therefore, in order to compare things that are comparable, we "split" this object into 2 parts: the base and the upper part.





$TRNT_1$



$TRNT_2$

The results regarding the UFO and the 5 reference areas are as follows:

	$TRNT_1$	$TRNT_2$	Variation
Upper wires	87	60	-31 %
UFO's top	147	130	-12 %
UFO's base	84	*n/a*	*n/a*
Lower wire	150	132	-12 %
Roof	49	34	-31 %
Pole	46	37	-20 %
Hedge	27	23	-15 %

Possible interpretation of $TRNT_1$ alone

Assuming that all of the selected objects (the UFO being taken as a whole) are dark enough to be considered as absorbing all the light they receive, and making drastic simplifications from a photographic and photometric point of view (in particular as regards the veiling glare, which in reality has a certain impact on apparent luminance), we have compared their respective radiometric levels (darkest pixel of each object) and inferred the tentative following classification of their respective distances from the camera:

$$\mathrm{Dist}_{\mathrm{Hedgs}} < \mathrm{dist}_{\mathrm{Pole}} \qquad \mathrm{dist}_{\mathrm{Roof}} < \mathrm{dist}_{\mathrm{UFObase}} \leq \mathrm{dist}_{\mathrm{UpperWires}} < \mathrm{dist}_{\mathrm{LowerWire}}$$

The UFO would then be at a distance about equal to that of the upper wires (in the order of 14 ft), hence clearly less than that of the lower wire, i.e. 200 ft (according to Maccabee's estimates), with a size (diameter of the base) therefore in the order of 0.5 ft and, in all cases, less than 6 ft.

<u>BUT</u> if the wires and the other referenced elements may reasonably be supposed to be more or less dark, no information is available about the UFO's albedo (dark or light aspect, color, possible translucence). Therefore, the classification above is most probably

wrong, but the UFO’s distance and size may only be smaller than the above-mentioned maximum value (estimated for a black object).

The only useful conclusion is therefore:

Camera-UFO distance in $TRNT_1$ < 200 ft

This remains compatible with a hanging model.

Possible interpretation of $TRNT_2$ alone

In the same way, if we assume that all objects are dark enough, we obtain the following classification:

$dist_{Hedgs} < dist_{Roof} \quad dist_{Pole} < dist_{UpperWires} < dist_{UFOtop} \quad dist_{LowerWire}$

For the UFO, this would mean a distance comparable to that of the lower wire (200 ft), thus a size in the order of 6 ft.

But the same remark as above does apply: those figures may only be considered as maxima, which remains compatible with a hanging model.

Moreover, we do know that the UFO has a dark circular base, although it does not appear at all in $TRNT_2$. This distorts the interpretation of that picture alone, leading to no meaningful conclusion.

Possible interpretation of $TRNT_1$ and $TRNT_2$ together

Looking at the above table of radiometric minima, the following points stand out:

- The scene’s illumination conditions seem to vary significantly between $TRNT_1$ and $TRNT_2$, because the important radiometric changes of close objects (especially in the upper part of the pictures) can by no means be explained by atmospheric diffusion
- This change is uneven, depending on the position and distance from the camera of each element, with a maximum for the upper wires and the roof, and a minimum for the lower wire and the top part of the UFO

This is probably due, at least partially, to different technical conditions under which each of the pictures has been processed from an original negative to the final digital image, via a paper print. In this (probable) case, we cannot expect further useful explanations.

If we assume, on the contrary, that processing conditions were about equal for both pictures, we must assume also that the second picture $TRNT_2$ was taken when the daylight produced locally a lower ambient illumination than for $TRNT_1$ (Change in local configuration of clouds?).

The scenario could then have been as follows:

> In $TRNT_2$, the illumination went down, particularly on the roof and the upper wires. These elements displayed a large negative radiometric variation (depending on their respective reflecting factors in the direction of the camera)
> In contrast, other elements only displayed a smaller negative radiometric variation: the hedge, the lower wire and the UFO's top

In any case, it is noticeable that, if the UFO was a hanging model, it could not be dark (at least its top part), because of the existing contradiction between the two above-mentioned classifications.

Conclusions drawn from the radiometric analysis

No final conclusion may be derived from radiometric considerations only (this was already the case with far more refined photometric analyses previously published), apart from the **maximum distance of 200 ft between the camera and the UFO**.

It may nevertheless be noticed that the explanation by a hanging model is not excluded at all (but it infers the fact that the UFO's top was not dark)

General conclusion

This quick analysis using our interactive tool confirms the following points about the object under study, whatever the final explanation:

First picture MM1/$TRNT_1$:
Camera-UFO distance < 200 ft

Changes from the first picture to the second one:
Different illumination conditions (or different processing conditions for the two pictures)
Movement of the operator (as indicated on Maccabee's map)
Increase of the camera-UFO distance by **11 %**
Tipping back of the UFO by **ca. 25°**

Two explanations are still open, although with very different probabilities:

Explanation 1

The UFO is a model hanging **ca. 2.3 ft** under the lower power wire, at a distance of **ca. 15.1 ft** from the camera.
Its size (diameter of its circular base) is **ca. 0.4 ft**. It is **not dark** (at least its upper part).
Between both shots, its distance from the camera increases by **1.7 ft**.
Between both shots, it has a swaying movement backwards of **ca. 9°** in the vertical plane of the UFO's sighting axis, with a total tipping back rotation of **ca. 25°** around the diameter of its circular base which is perpendicular to its sighting line.

Explanation 2

The UFO is an unknown object, at a distance in the order of **200 ft** from the camera.
Its size (diameter of its circular base) is in the order of **6 ft**.
It is **dark**.

Probabilities

Explanation 1 should be the final explanation with a very high probability, even if it cannot be 100 % proven, because:

Explanation 1 is consistent with <u>all</u> measurements, without any "exotic" assumption.
Explanation 1 is quasi-consistent with Maccabee's photogrammetric study of the SLC (Sighting line cross).

Explanation 2 requires to assume that the UFO is moving away exactly in the direction of its sighting line, so as to explain the constant ratio of its distance from both power wires on both pictures, or – special case - that it is not moving at all (which, according to the above geometric analysis, is only consistent with the explanation by a small very close model).
Explanation 2 requires to admit that the UFO is moving away by 11 % (geometric study) from an initial maximum distance of 200 ft (radiometric study), while its radiometric darkest value (top part) decreases by 12 %, which is not consistent with atmospheric diffusion effects.

Our conclusion

At the end of this simple geometric and radiometric analysis, we conclude that the hypothesis of a small object hanging below a power wire is the most convincing.

The various contradictory photometric analyses conducted by previous investigators (Hartmann, Maccabee, Poher …) came to the common conclusion, in the hypothesis of a hanging model, that the object could not be opaque, because of the "too clear" appearance of its circular base, in spite of its short distance from the camera. According to Maccabee and Poher, the material(s) which made up the object could then only be translucent, with different characteristics for the circular base and for the upper part. The UFO could have had a composite structure, with a non-uniform translucent upper part, leaving incident light propagate down to the bottom part, which would be made of another material, also translucent but uniform and more opaque.

We propose here a different possible explanation, which has the advantage of being simpler as regards how the object might have been faked: **the object was hollow underneath**, like a dustbin lid or a lampshade. It could be light, hence bouncing about in a light breeze, like a light metal lampshade or glass fiber or plastic lid or cover.

The observed uniform dark (but not black) radiometry in the ellipse could then be explained as follows:

The undersurface of the hollow part was a matt, dark, rough and non-reflective surface, in shadow, acting as extremely low reflector in the optical wavebands
The light going in to the underside of the "lid" was already quite diffuse, as it was mostly reflected up from the Earth's surface, unlike direct sunlight
This light was, to a large degree, absorbed by the surface material itself, and the remainder underwent a large amount of reflections around within roughness of the "hollow" shape
Consequently, the amount of light reflected back out of the concavity could be comparatively very low indeed to ambient
Under those conditions, we may reasonably explain the very low uniform reflectivity observed in the ellipse (in $TRNT_1$).

Moreover, this explanation would easily justify why a very thin (invisible) thread, such as a fishing line, had been sufficient to support this light object.

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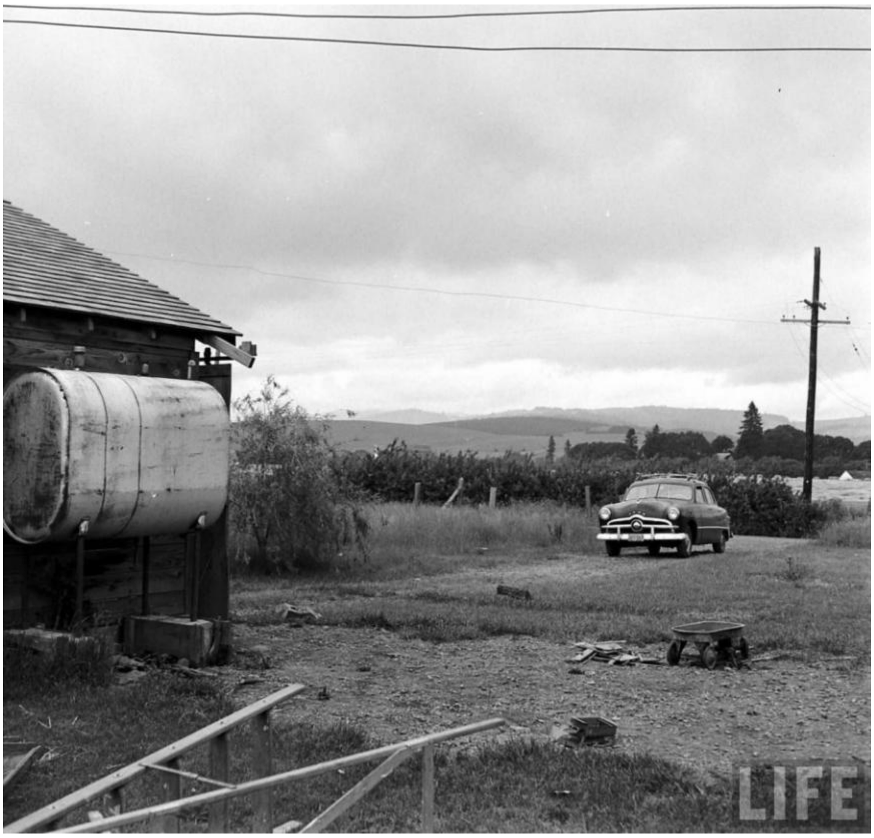
Epilog

The following lines do <u>not</u> constitute a scientific proof, but at least an interesting **oddity**.

In June 1950, about one month after the shooting date of MM_1 and MM_2, a reporter for LIFE, Loomis Dean, went back to the site and produced a few pictures, one of which (identified hereafter as $\mathbf{MM_{LIFE}}$) was shot from nearly the same location as Paul Trent:



$\mathbf{MM_{LIFE}}$

One may reasonably assume that, concerning the power lines' configuration, nothing had changed meanwhile. However, if the UFO had effectively been a hanging model, its weight might have slightly bent the lower wire, on May 11th, 1950. If the new MM_{LIFE} picture could be correctly registered, respectively with MM_1 and MM_2, the curvature could then possibly be brought out.

We deliberately used a simple linear registration tool (translation + rotation + scaling), based on only 3 control points (***Registration/Registration 3 points*** function), in order to preserve ratios along any given axis and to avoid elastic effects, which would invalidate in advance any conclusion. The 3 control points were chosen on both wires (in principle in the same vertical plane), and the resulting images are the following:

MM$_1$ + MM$_{LIFE}$ registered (3 control points)

MM$_2$ + MM$_{LIFE}$ registered (3 control points)

In both cases, the lower power line appears lower in Trent's pictures than in LIFE's picture, over an area centered above the UFO, which inevitably leads to think that this might have been the result of the model's weight…

2^{nd} part (June 2013)
Evidence of a suspension thread

After the previous study, the crucial question of the evidence of a suspension thread remained pending, even though the different approaches, including the registered images shown in the epilog, had shown that this presence was highly probable.

Latterly, an original detection tool has been designed, developed and integrated into the IPACO software, specifically dedicated to the search for any more or less vertical threads on an alleged UFO picture. A detailed description of the adopted logic may be found, in the « Analysis methodology » section of the website, as well as in the IPACO *User's manual* (*Analysis* Menu).

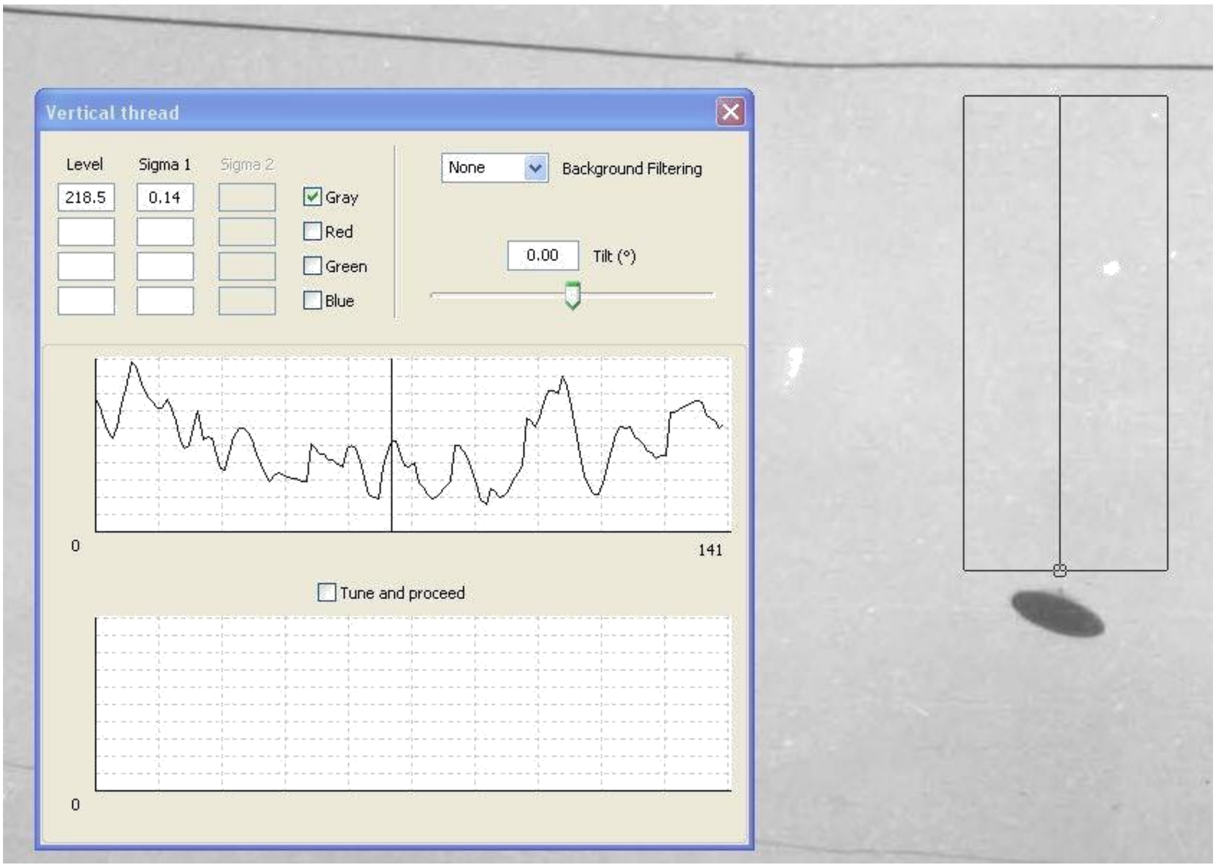
The basic idea is that if there are traces of a thread in a picture's pixels, above an object hanging from this thread, and if this trace is « buried in noise » within the sky's background (noise due to atmospheric diffusion and/or to the digitizing process), it should be possible to increase the signal-to-noise ratio thus uncovering the thread, by summing pixels along columns parallel to the thread. It must be stated however, that this principle makes the tool likely to be ineffective if the sky's background does not appear uniform at all in the area above the object in the image.

The image files TRNT1 and TRNT2 were chosen for examination because of their better radiometric dynamics, as previously mentioned. This choice proved to be the right one, in so far as the results presented here are present but less marked with the other sets of scans from the original silver pictures, which are of lower quality.

The following steps were applied to the first picture TRNT1:

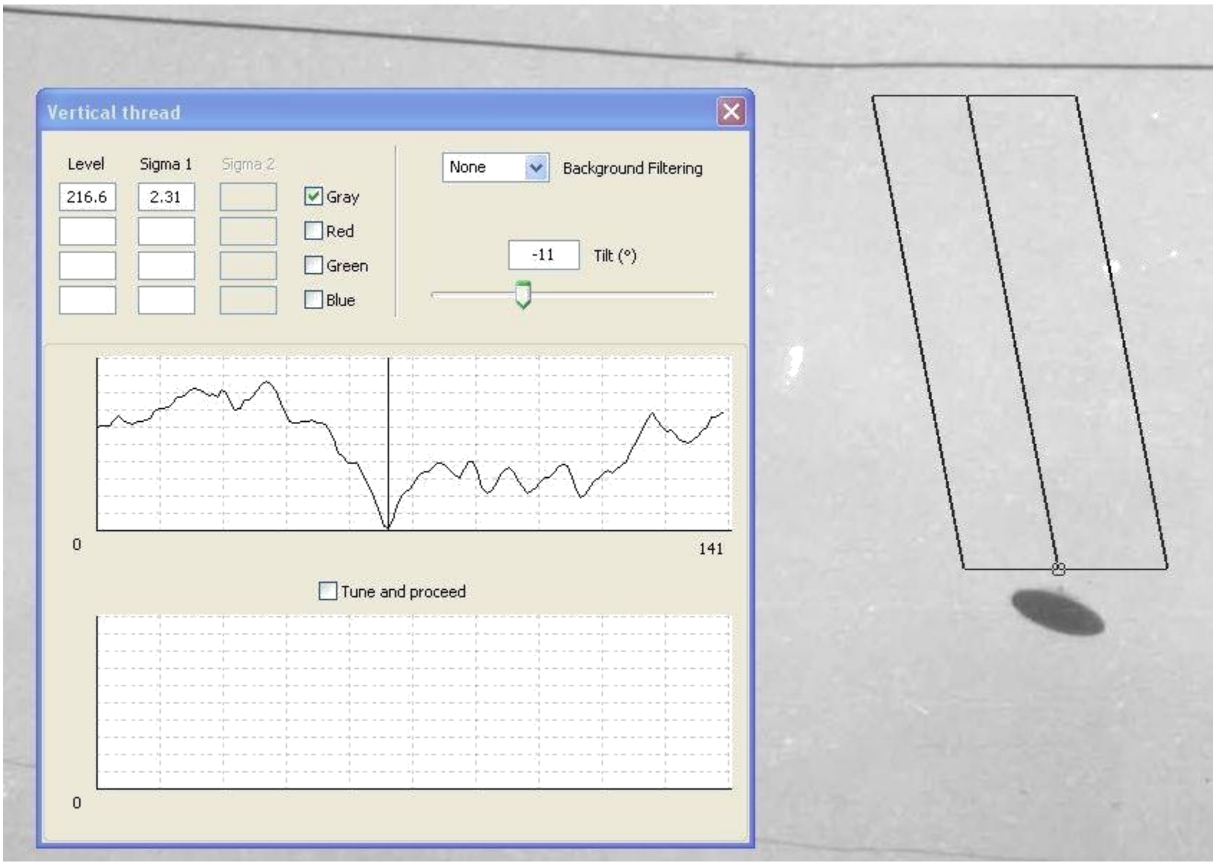
1. Designation of a vertical rectangle covering the area where the suspension thread may be located, here between the UFO and the power wire. A curve was displayed in a window, showing the mean value of pixels (here in gray) for each column of the rectangle.

2. Positioning the cursor on the lower side of the rectangle, near the supposed location of the thread's attachment point then monitoring the vertical bar at the corresponding position of the curve. The mean value of the pixels of the column corresponding to the bar's position was then permanently displayed, as well as the variation between this value and the curve's mean, normalized by the standard deviation (number of sigma).



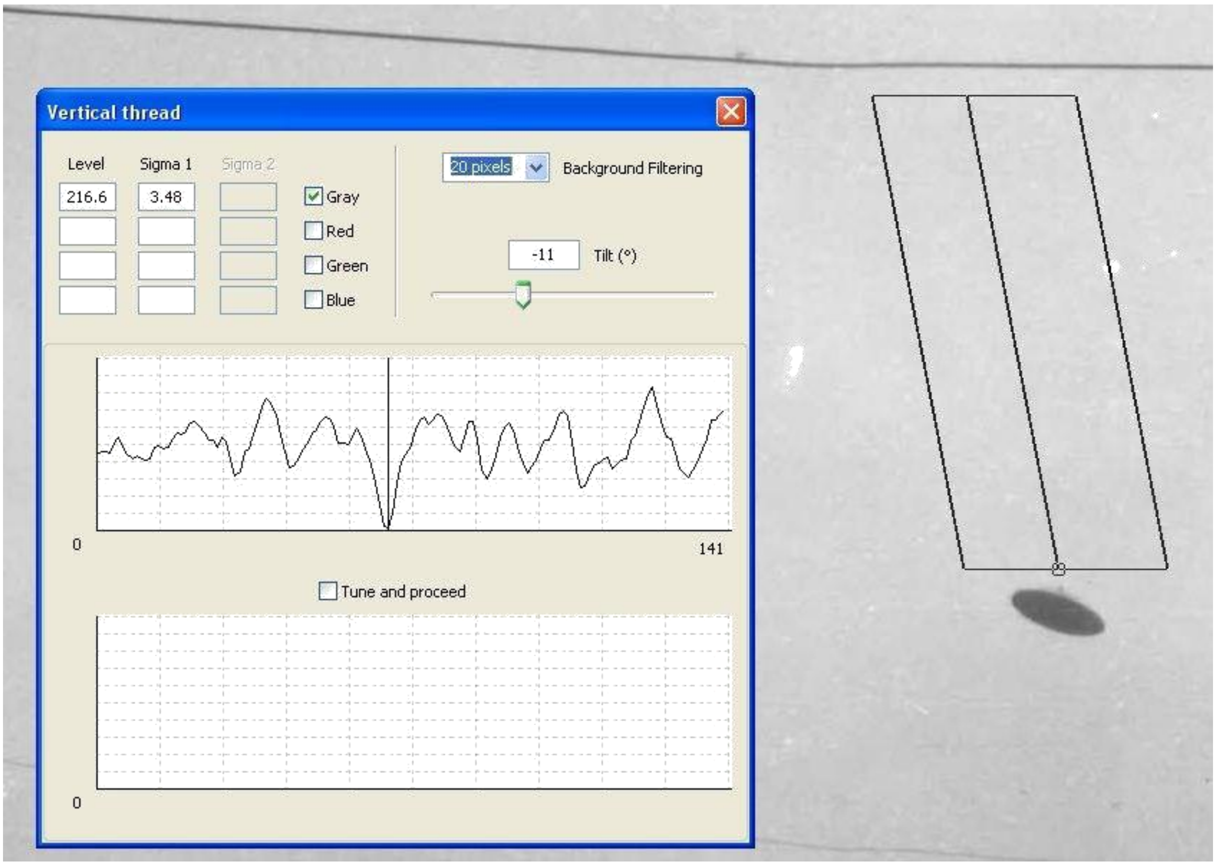
3. A thread is typically not strictly parallel to the picture's vertical axis. Thus the rectangle was then tilted, by an angle between -30° and +30° from the vertical. More precisely, the rectangle is reshaped into a parallelogram, the lower side of which remains fixed, and the height constant. The pixel summing columns are also tilted by the same angle, with the curve changing as the angle is modified.

4. Searching was then done interactively for an angle, if it existed, for which a significant peak appeared in front of the supposed location of the attachment point. Such a peak would indicate the probable existence of a thread, especially if the difference between this peak and the mean value was noticeably significant.



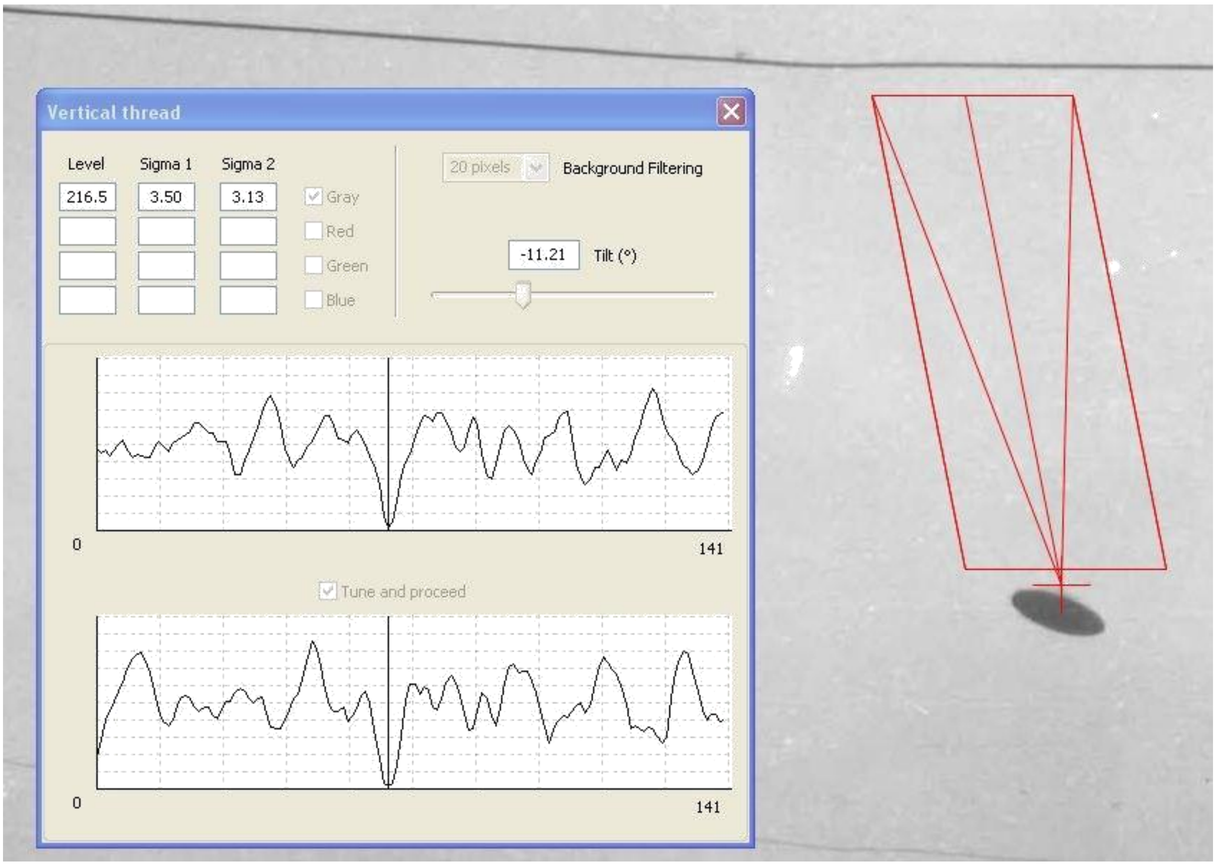
For the TRNT1 picture, the presence of a negative peak (thread darker than the sky) was clearly observed which matched exactly to the supposed attachment point, with a significant difference of 2,38 sigma, for a tilt angle equal to -11°.

5. In order to get rid of the slow variations of the sky's background luminosity, it is possible to apply spatial high-pass filtering to the summation curve. Here, the background was filtered by a 20-pixels wide window, and the difference reached 3.48 sigma.



6. At this point, the software tool launched an automatic optimization which accurately tuned the tilt angle and the bar's position so as to obtain a maximum difference between the peak and the curve's mean value.

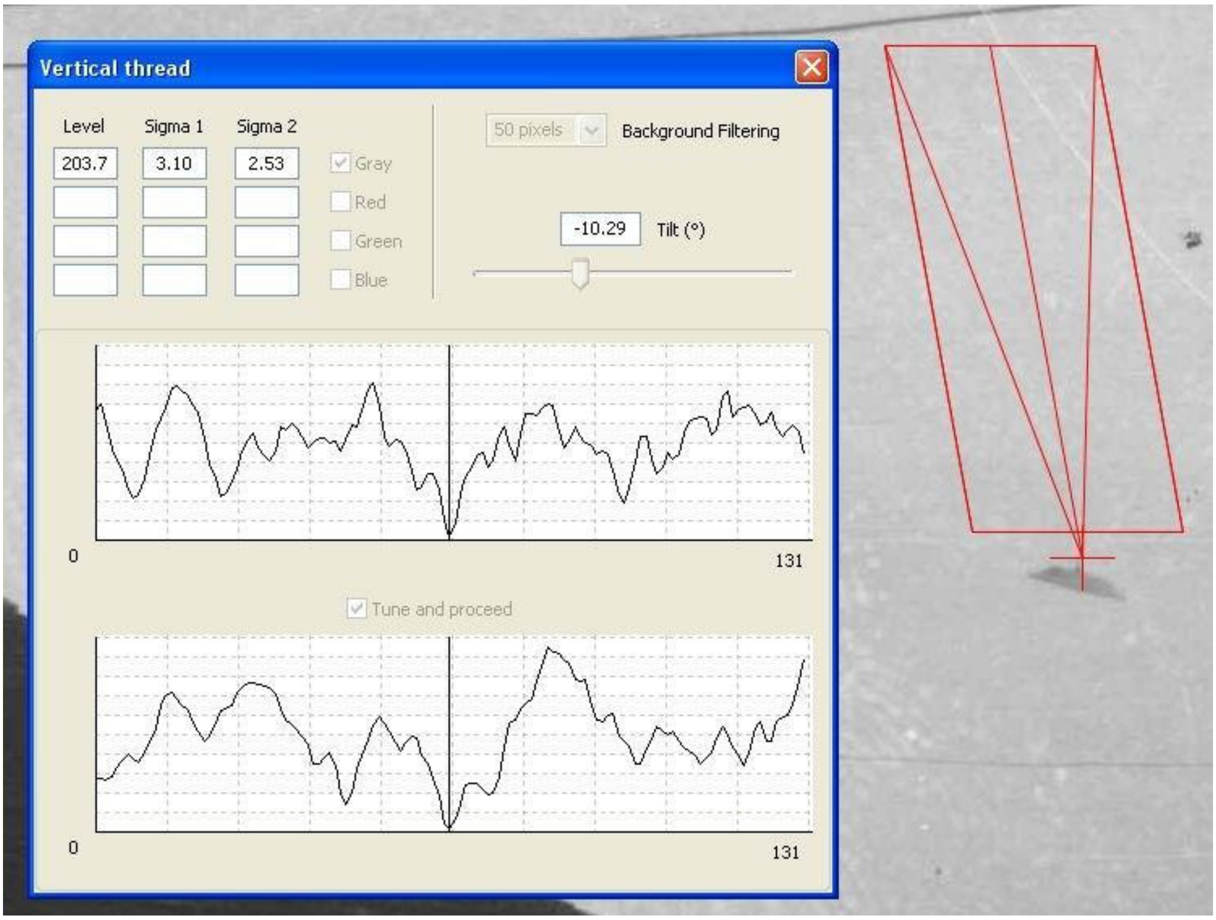
7. An extra verification was then performed. Based on the most probable straight line for the thread's location and also on the supposed position of the attachment point on this line, a circular scanning was performed around this point: pixels of the columns taken into account for the summation were those contained in the parallelogram. A second curve was then displayed in the window, showing the mean value of each column's pixels during the scanning. If another peak did appear, corresponding to the previously found angle, the probability of existence of a thread would be doubly established, especially if the difference between the new peak and the second curve's mean value was significant.



For the TRNT1 picture, a perfect matching between both peaks for a tilt angle of -11.21° was obtained, with results well over 3 sigmas.

Many random tests have been conducted on the same image, in order to check that there were no random false alarms which might question the validity of the method. Those tests were conclusive.

Application of the same method to the second picture TRNT2 provided comparable results, with a tilt angle of -10.29 ° and results of over 2.5 sigma.



The clearness of the result, as well as the perfect coincidence of the negative peaks with the object's attachment point, leave no doubt about the validity of the demonstration.

Final conclusion

The clear result of this study was that **the McMinnville UFO was a model hanging from a thread**.

The low values of the tilt angles between the suspension thread and the verticals of both McMinnville pictures are quite compatible with the presence of a soft wind on the site, and with the hypothesis of a rather light suspended object. They are also coherent with the registered images presented above (1st part's *Epilog*).