

# Evidence for Image Formation by a Cloth-Collapse Model

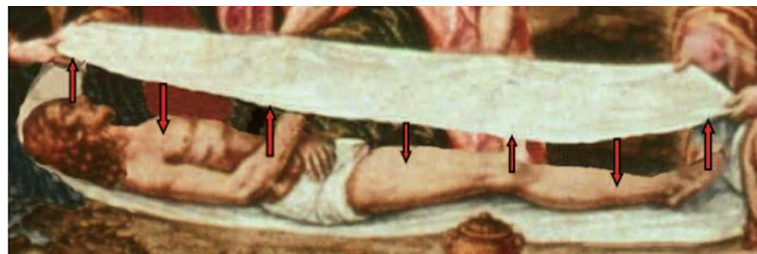
by Mark Antonacci

One of the primary purposes of this presentation is to encourage radiation-based, image-encoding hypotheses for the Shroud of Turin to incorporate the benefits of cloth-collapse models into their hypotheses. I would also like to encourage the inclusion of neutrons into all radiation and/or cloth collapse models. Among the main points of this paper is to show that particle or neutron radiation within a cloth-collapse model can account for *all* the major features and conditions on the unique Shroud of Turin.

The best way to understand that the evidence on the Shroud was caused or accounted for by a cloth collapse model is to first study one of its counterparts. Let's initially study Dr. Rinaudo's pivotal and influential Protonic Model of Image Formation.<sup>1</sup> This model hypothesizes that protons and neutrons were released from a supine or reclined body at an energy of 1.135 MeV, with half traveling straight up and half traveling straight down as indicated in Figs. 1 and 2 below. This requires the occurrence of several preliminary events or assumptions to cause such a release of these particles.<sup>2</sup> Protons and neutrons comprise the basic building blocks of all matter. All matter, including the human body, is made of atoms. Over 99.9% of the mass or weight of all atoms is in their nuclei — which consists solely of protons and neutrons. Protons and neutrons are tiny energetic particles that are held together within the nuclei by the strong nuclear



1.

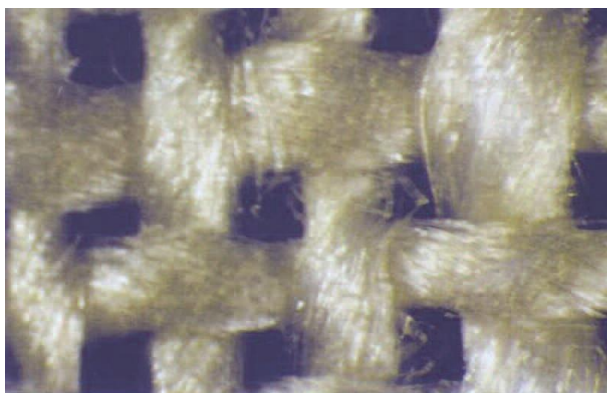


2.

Arrows indicate the directions the protons and neutrons traveled from the surfaces of the body

force. Under this hypothesis, the protons would encode equally intense images on both sides of the cloth and the neutrons would alter the C-14 count on the Shroud.

Protons are not penetrating and would not travel beyond the most superficial fibers of the cloth. These charged particles would evenly or uniformly distribute their energy on the fibers. Dr. Rinaudo conducted a number of experiments in which he irradiated linen with protons at the approximate above energy at the Grenoble Nuclear Studies Center in France. Figure 3 shows some of his results. He produced straw yellow discoloration with no cementation or added pigments on the fibers. These discolored fibers also remained white on the inside. Where two fibers crossed, it was white on the underlying fiber.



3.

Protons easily attenuate or absorb in air, and as they traveled in straight-line directions under this hypothetical model, their energy would subside. At their ideal energy their maximum range in air is less than 12 centimeters (less than 5").<sup>3</sup> Under Rinaudo's hypothetical Protonic Model, the parts of the body *farthest* away from the cloth would encode the *fewest* number of superficial fibers, while the parts of body *closest* to the cloth would encode the *largest* number of superficial fibers. As a result, the number of fibers that were superficially encoded at every location on the cloth would correlate with their distances from the body.

Dr. Rinaudo's straw-yellow discoloring caused the cloth's natural fluorescence to disappear as is the case with the Shroud's body image. The discolored linen consisted of dehydratively, oxidized, degraded cellulose with double-bonded or conjugated carbonyls like the Shroud's body image. Moreover, this straw-yellow color developed over time with a lower intensity of radiation. While this method accounts for many more Shroud features, it fails to account for others. Dr. Giulio Fanti used high-resolution microscopy to examine Rinaudo's image samples, which were irradiated with 1.135 MeV energy, and compared them to the Shroud's image samples. He determined that the coloring on Rinaudo's encoded fibers penetrated beyond the topmost 2-3 superficial fibers, as well as the very outer layers (or primary cell wall) of the straw-yellow fibers, unlike the Shroud's body image fibers.<sup>4</sup> In this paper, we will only cover the Shroud's most difficult and critical body image features, its resolution, vertical collimation, and

three-dimensional information, but a complete discussion of Rinaudo's hypothesis and the two radiant cloth-collapse models can be found in my recent book, *Test The Shroud*.<sup>6</sup>

Under the Protonic Model, the proportionate amounts of vertically collimated radiation that reached each part of the cloth should result in highly-resolved positive images when its negative images are photographed. Perhaps scientists such as Paulo Di Lazzaro, who has experimented with vertically-collimated radiation, can experiment with the resolution and three-dimensional effects on linen when vertically collimated radiation is emitted from contoured sources or surfaces. Of the Shroud's many primary body image features, its high resolution, three dimensionality and vertical directionality are among its most important and difficult features to duplicate. In my analysis of the Shroud's primary body image features, I will focus primarily on these three body image features.

### **Cloth Collapse Hypotheses**

Cloth collapse hypotheses essentially state that if attenuating low-energy radiation emanated from a *disappearing body* that all of the unique image features found on the Shroud of Turin would be encoded. After this hypothesized event, which probably occurs in less than a second, the Shroud linen cloth and its physical environment all behave according to standard physics principles. STURP scientist John Jackson first introduced the Cloth Collapse Hypothesis at an international Shroud conference held in Paris, France in 1989. He formulated this hypothesis only after all artistic and naturalistic methods had failed for decades to explain the Shroud's image features. Dr. Jackson proposed that ultraviolet light was given off by the body under his model.<sup>6</sup> I had the privilege of informally working with John on numerous Shroud matters (including this hypothesis) from about 1986 - 1992. He, of course, did all of the difficult original thinking regarding the physical and other scientific processes involved in this elegantly direct and understandable model. During this several year period, I literally got to ask him every question that I had about the Shroud and this model.

### **The Historically Consistent Hypothesis**

For decades, I studied many image-forming models including those of Drs. Rinaudo and Jackson. Additionally, I worked on these models and countless scientific matters, including atomic energies and reactions, with physicist Arthur Lind, a Fellow at McDonnell Douglas Aerospace and the Boeing Company in St Louis, and in 2000, I published the Historically Consistent Hypothesis.<sup>7</sup> This cloth-collapsing hypothesis was published in a peer-reviewed scientific journal in 2012 and again in my recent book, *Test The Shroud*.<sup>8</sup> For the last several years, nuclear engineer, Robert Rucker has been an enormous influence on this hypothesis and on many other scientific and historical matters. His calculations and adaptation of the Monte Carlo Neutron Particle (MCNP) code, developed at Las Alamos National Laboratory and used in extremely complex geometries involved in fissile materials, have unique potential. They could not only confirm that the body wrapped in the Shroud gave off radiation, but proportionately

distributed the radiation throughout the cloth and tomb. Bob has also provided new scientific insight into the question of what happened to the body when it disappeared from view. Although I am an attorney, the most qualified scientists that I can think of have been involved in every phase of the formulation and development of this hypothesis.

The Historically Consistent Hypothesis is a cloth-collapse model involving particle radiation consisting primarily of neutrons and protons, but also involving alpha particles, deuterium, electrons and, perhaps, gamma rays (and possibly other electromagnetic radiation, including UV radiation. Corona discharge could even be present according to Robert Rucker.) The majority of this presentation will focus on the effects of protons and neutrons. The energy of the protons (and alpha particles and deuterium, both of which behave like protons) in the Historically Consistent Hypothesis is 0.4 MeV or less, or about one third that of the Protonic Model.

The two cloth collapse hypotheses that were first proposed in 1989 and in 2000 assert that radiation is emitted from the body in a uniform or 360° direction. Since radiation naturally travels in such a uniform manner, this hypothesis contains one less, unnatural assumption within its image encoding process than some other radiation-based hypotheses. As we will see shortly, I think the cloth collapse hypotheses can better explain the vertically-directional (and other) features of the Shroud's body image. However, you could easily incorporate vertically-collimated radiation within a cloth collapse hypothesis and have all the purported advantages that go with this additional assumption.<sup>9</sup>

Like Jesus, the man in the Shroud clearly received an individual burial in this linen cloth. Obviously, the body that was once wrapped in the Shroud has disappeared from it, and it did so within two to three days, for there are no decomposition stains on the cloth. We also know that the body was still wrapped in the Shroud when its full-length frontal and dorsal images were encoded, and that the body was in rigor mortis, which prevents decomposition staining. Therefore, the body's disappearance and the image encoding event could have both occurred in even less time, such as a day and a half. The Historically Consistent Hypothesis assumes that the image encoding event and the body's disappearance occurs simultaneously.

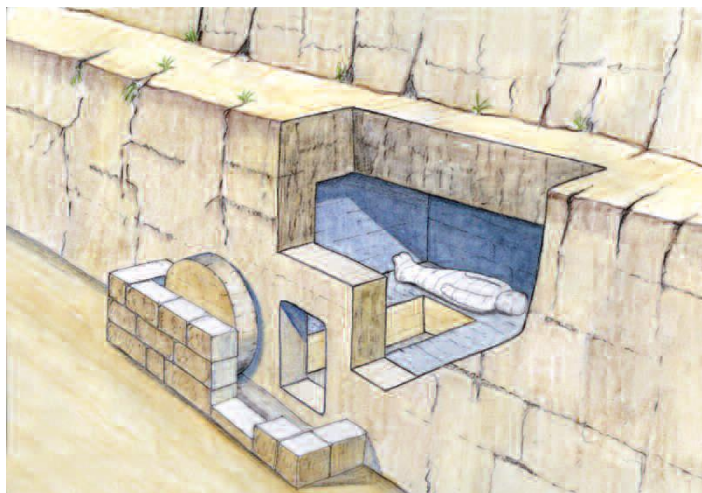
The most unique feature in the above cloth collapse hypotheses is the dead body's disappearance. A principal significance of this feature is that the body's unprecedented disappearance either triggers the radiation, or the unprecedented emanation of radiation triggers the body's disappearance. (Alternatively, the radiation could simply occur simultaneously with the disappearance of the body.) Particle radiation emanating from the disappearing body are the two critical components of the Historically Consistent Hypothesis. When the body starts disappearing, the cloth will begin to fall straight down by gravity into the radiant region once occupied by the body. Regardless of how long the cloth falls, the parts of the cloth *closest* to the body will fall through the radiation for the *longest* period of time; while the parts of the cloth *furthest* away from the body would fall through the radiation for the *least* amount of time. All parts of the cloth at intermediary distances from the body would receive intermediary amounts of

radiation. All parts of the cloth that received radiation from the body, would receive amounts that corresponded to their *original* distances from the cloth. This would result in three-dimensional information being encoded onto the frontal side of the two-dimensional cloth, as is the case on the Shroud of Turin.

The cloth would fall straight down by gravity in the same approximate configuration as when it was draped over the body. When the body suddenly disappeared, this would have created a downward vacuum on the top side of the cloth. Since the largest amount of air would have been above the supine body, the strongest vacuum would have been present over the top portion of the cloth, drawing it down even faster into the radiant body region than gravity alone would have done. A small vacuum on the dorsal or bottom side of the cloth would also have been created, pulling it up vertically a short distance into the radiation.

Two of the long frontal and dorsal sides of the 3 1/2 foot wide cloth seen in Fig. 1 could have draped over the inside of the U-shaped bench where the body laid, in a typical newly-hewn Second Temple tomb (illustrated in Fig. 4 below). The other two long sides of the 3 1/2 foot wide cloth would likely have bunched or wrinkled near the interior wall of the tomb that runs parallel with the body. If the bench had been simply hewn into the wall itself, as was sometimes the case, both long sides of the 3 1/2 foot wide cloth could easily have draped over the outer portion of the limestone wall on which the body rested. (See Fig. 5 below) In these circumstances, it is unlikely that a vacuum would draw the overlapping or bunched cloth into the sides of the disappearing body.

The above discussion about a “side vacuum” was based on the assumption the body would have disappeared uniformly. Since bodies do not naturally disappear on their own in a short amount of time, we can’t assume with certainty whether the body disappeared uniformly. However, if it did, I still don’t think there would be any side images visible under such a model for two reasons. One, the downward vacuum would be stronger than any sideward vacuum. Secondly, the parts of the cloth closest to the body would have been the areas running next to the rounded shoulders and upper arms onto the elbows. However, these body image areas are not visible due to fire damage. Moreover, if the supine body disappeared vertically from its frontal and dorsal surfaces toward the interior of the reclined body, there would be no vacuum at the sides of the body. Since there is no known manner in which bodies suddenly disappear, the Historically Consistent Hypothesis postulates that the body disappears in this manner, as will be seen below. This would also enhance the resolution, vertically directional and three-dimensional features found on the Shroud’s body image.



4.



5.

The vacuum on the frontal or top side of the cloth would have *enhanced* its downward speed and provided a short upward impetus for the dorsal or bottom side of the cloth. This could have allowed some areas of the frontal and dorsal images to acquire some exposure to the field of radiation that they otherwise would not have received. This could also have caused other areas of the cloth to acquire earlier and longer exposures to the field of low-energy radiation as they moved through it.

Since each part of the imaged cloth was falling straight down (or moving straight up) through a field of easily-absorbed protons into the part of the body directly below (or above) it, a highly-detailed negative image with three-dimensional and vertically-directional features can be more easily envisioned and understood under a cloth collapse model. This model necessarily explains how all the information from the body was transferred through the space that existed between the draped cloth and the body. We will also see how the downward movement of the cloth into a momentary field of radiation will also explain the motion blurs and distortions found on the Shroud's frontal body image, which no artist would have encoded and no naturalistic method could have encoded.

Under both the protonic and cloth collapse models, the exposure time for the radiation on both sides of the cloth would probably have been only for a fraction of a second. Some have attached significance to the observation that since radiation travels faster than gravity, the radiation from the body would have reached the cloth before it could have collapsed. While this is true, there is no reason to truncate the image encoding process to a nanosecond by assuming that the encoding process begins and ends with only the very initial emission of radiation from the body. This assumption unnecessarily eliminates the brief time for the body's disappearance and overlooks the evidence contained on the Shroud itself for its collapse into a momentary field of radiation that we will subsequently discuss. The disappearance of the body and the cloth's collapse through the very short distances between the draped cloth and the body surfaces could still occur within a second. Gravity alone would cause the cloth to fall this short distance in a

second or less. This would be even more so with the downward (and upward) vacuums making the cloth move even faster.

Since only the surfaces of the man's full-length body (as opposed to the interior parts of his body) were encoded, any radiation hypothesis would seem to begin and end very quickly. The length of time for the radiation hypothesized under the Historically Consistent Hypothesis is simply whatever momentary time that it takes to encode only the Shroud's primary and secondary surface features of the body. There is no scientific, theological, or other reason why the image encoding process must necessarily occur at the speed of light or the fastest way conceivable, especially when the cloth's collapse for a fraction of a second causes or enhances the resolution, vertically directional and three-dimensional features of the Shroud's body image.

Under the protonic and similar radiation models, the radiation flows from the body onto the cloth very quickly. While this also occurs under the cloth-collapse models, there is an additional length of time (and another direction in which) the frontal side of the cloth is also exposed to the radiation. This additional, longer time of exposure is also in direct proportion to its original distances from the body, when it was first draped over the crucified corpse. During this additional time, the cloth is also traveling to and through the radiation straight down, in a vertically-collimated direction by gravity and/or a vacuum. These qualities allow the cloth collapse hypothesis to better account for the Shroud's three primary body image features better than any other radiation (or other) hypothesis. (If a cloth collapse hypothesis assumes that vertically-collimated radiation was emitted by the body, the cloth would have initially received all the encoding information and benefits under the radiant protonic model, and then received the additional radiant information and benefits of a cloth collapse model.)

The preceding presentation by physicist Arthur Lind, indicates that protons released with an energy of 0.4 MeV or less best accounts for the Shroud's delicate microscopic features observed on its superficial body image fibers, as well as the "striping effect" seen on photomicrographs of the body image.<sup>10</sup> According to Dr. Lind, these very low-energized protons probably would have had sufficient energy to reach and thus encode the parts of the Shroud's visible body images that were 11.7cm or 4.6" from the supine body.<sup>11</sup> If the cloth collapses or raises to the radiant body region, an even lower amount of energy could have been released from the body wrapped within the Shroud.

This paper will also show that extensive evidence exists on the Shroud of Turin itself for the two key assumptions of the cloth-collapse hypotheses: that low-energy radiation emanated from the disappearing body wrapped within the Shroud causing the draped cloth to fall or collapse within this momentary field of body radiation. Until further evidence warrants, it is unnecessary for cloth-collapse models to make a third unnatural assumption — that the radiation was also released from the body in a vertically collimated manner, as is required under the Protonic Model and similar models.



Although I have primarily concentrated on three primary body image features found on the Shroud, there are actually 33 unique or extraordinary features that are found throughout the full-length frontal and dorsal body images on the Shroud of Turin. And, *only* one agent, low-energy *radiation*, can duplicate or account for all of these features:

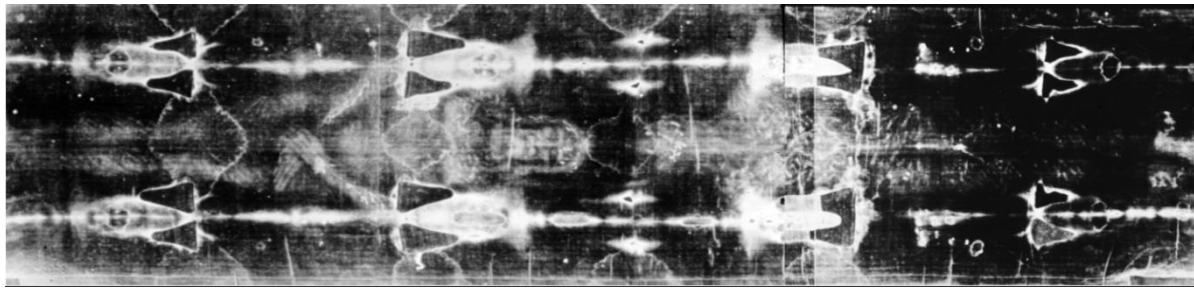
- lack of foreign materials or particulates
- lack of fading
- straw yellow coloration
- only topmost superficial fibers of threads encoded
- individual fibers encoded
- fibers colored 360° around circumference
- only outer layers of individually encoded fibers are colored
- no coloration inside of fiber
- fibers colored with similar intensity
- lower tensile strength of colored fibers
- microscopically corroded appearance of colored fibers
- oxidation and dehydration of body images that
- developed over time
- with double-bonded carbon and oxygen atoms (conjugated carbonyls) that formed after the single-bonded atoms within the linen fibers broke apart
- accelerated aging of the body image with
- stability to water and heating and
- insolubility to acids, reductants and solvents
- gross mechanical properties of linen intact
- reduction of the cloth's fluorescence at body images
- lack of residue
- non-penetrating encoding agent
- agent operated over skin, hair, bones (teeth, coins and flowers)
- non-diffuse body image with sharp boundaries and
- equal intensity for frontal and dorsal images
- lack of two-dimensional directionality
- negative images with left/right and light/dark reversals that develop into
- highly resolved, photographic quality images
- without any magnification
- with skeletal (and dental) features
- three-dimensional information that was
- encoded through the spaces between the body and the cloth
- in a straight-line vertical direction that



- revealed additional details and made quantum leaps in development as technology advanced

When we consider that:

1) All 33 unparalleled features are found *exclusively* throughout the length and width of the Shroud's frontal and dorsal body images (Fig. 6); that



6.

2) Both full-length images are found *only* on the inner parts of the cloth that draped directly over or laid directly under the crucified, dead body (Fig. 7);



7.

3) and that *only* low-energy radiation can duplicate or explain all 33 exceptional body image features;

we can be very confident that the *source* of this radiation and its effects could *only* have been the body wrapped within this cloth.

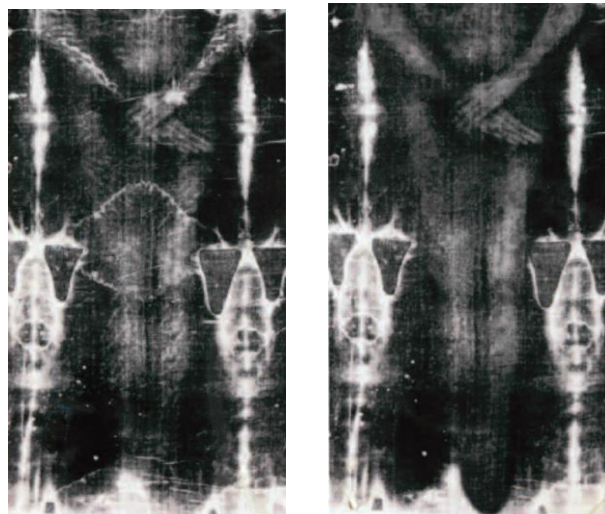
### **Important Body Image Features that are Often Overlooked**

There are about 15 *additional* and important body image features on the Shroud that indicate the body wrapped within it disappeared. It is critical to understand that.

- Only a cloth-collapse hypothesis can account for all of these additional features.

- These features indicate that the body disappeared *during* the image encoding or radiating event.
- The body's disappearance is indicated by various image distortions and motion blurs discussed below that are all consistent with the Shroud linen cloth falling into a radiant body region once occupied by the body wrapped within it.

The first features consist of a distorted thick upper right leg (right thigh) with a distorted thin upper left leg (left thigh), but *only* on the man's *frontal* image as seen in the in Fig. 8 below. The man's right thigh erroneously appears at least twice as wide as the left thigh on the frontal image. In addition, the width of the man's left thigh on the frontal image appears to be only as wide as the man's left (or right) shins or calves. While there is a great difference in the widths of the man's thighs, there is no noticeable difference in the width of his shins or calves in Fig. 8. However, the man's unusually wide right thigh



8.

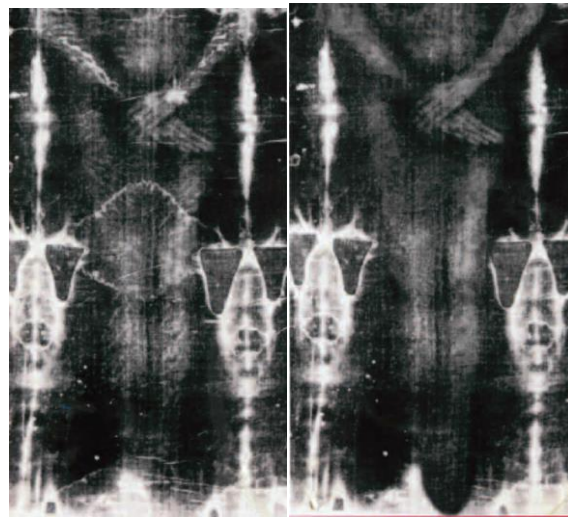
A slightly reconstructed image of the man in the Shroud without the water stain appears at right, next to the Shroud image, better clarifying the appearance of the man's upper legs.

and his unusually thin left thigh are clearly body image *distortions* because when you look at the back of the legs both above and below the knees on the dorsal image, you will see that both of the man's legs are normal and are the same size. (Fig. 9)



9.

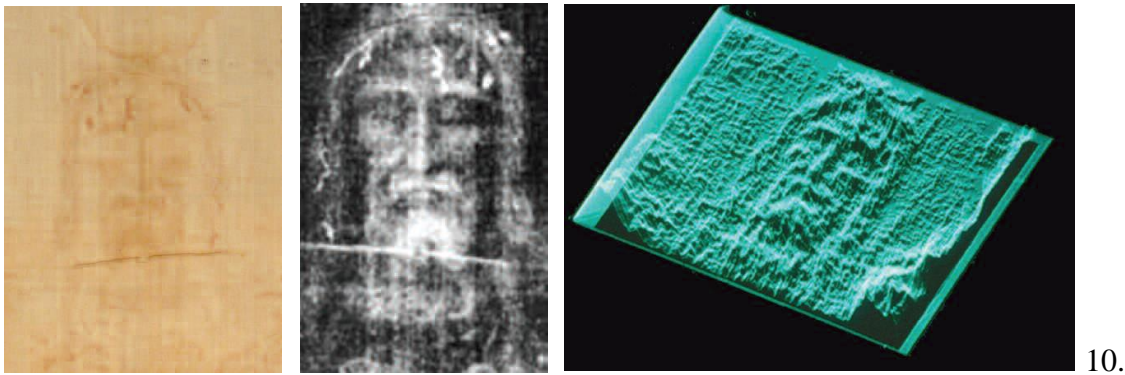
The distortions of both thighs, seen *only* on the frontal image, derive from the cloth falling naturally during the image encoding event, from its original draped configuration over the upraised left leg. (The left leg remained in the upraised position due to rigor mortis.) The upraised left leg caused a tent-like effect to be created on the inner side of the cloth (where the



frontal image resides) with the apex of the tent being just above the upraised left knee. The naturally draped cloth would have slanted away from and lost some contact with the upper part of the upraised left leg. The cloth would have naturally tended to fall toward the bottom of the slant until it reached or landed on the nearest surface — the right thigh as the naturally draped cloth then fell through the radiant region of the disappearing body during the image encoding event, the parts that laid over both of the man's thighs would have acquired even more

pronounced or distorted effects in which the right thigh thus appears twice the width of the narrow left thigh, but *only* on the frontal image.

The negative, positive and three-dimensional images of the face (Fig. 10) clearly show that the man's beard is upturned on the left of center side of his chin. A possible explanation for this and the gaps along the sides of the face is that a small chin band held the mouth closed. The



use of such a chin band could have been allowed during a provisional or makeshift burial, as the Sabbath or Passover drew near or began, all of which appeared to be present at the time and circumstances of Jesus' burial. Such a chin band could have possibly been placed between the man's hair and his temples while continuing over the crown of his head. This could have caused the man's hair on the side of his head to lay over or around the chin band.

We don't know the actual position or thickness of the makeshift chin band, but its use could have allowed the Shroud to be relatively level across the man's face. (We should also note that since the entire cloth is connected, all parts of it would have had a tendency to flatten as it collapsed or rose into the radiation.)

The hair over the man's forehead, and at both sides of the man's head and face ironically seem to have more "elevation" than does the non-blood mark regions of the man's forehead and cheeks. This is most apparent in the three-dimensional relief of the man's supine (reclined) head at the right side of Fig. 10 above, and also indicated in the positive image of the man in the middle of Fig. 10. The increased or raised relief of the hair at the side of the head could have been due to a rectangular stone, rock, or even a piece of wood placed at the back and sides of the head to keep it facing upright. The elevated or raised hair over the forehead, and to some extent at the sides of the head, could have been due to parts of the cap of thorns remaining in the hair. Any of the above effects or their causes would also result in the Shroud remaining level over the face of the man in the Shroud.

The above effects or causes would also be consistent with Dr. Lind's explanation for the absence of body image along the sides of the man's face and the absence of his ears. At energies of 0.4 MeV or less, protons will lose all of its energy when passing only 11.7 cm (4.6 inches) in air. Thus, the protons emanating from these regions on the sides of the man's face would not

have reached the cloth under the protonic or similar model. Nor would the relatively flat cloth have collapsed into these regions of the face under the above two cloth-collapse models.



Notice on the positive facial image as seen in Fig. 11 above that three vertical lines run down from the man's chin, especially below the right side of his beard, which is not as upturned. As part of the contoured cloth lying over the chin fell, it would flatten and acquire such vertical lines or motion blurs at the edge of the radiating chin. Before the radiation ceased, more lines would have been left on the area of the cloth that did not have to fall through as much beard before flattening. This would have been the area on the man's right side, immediately next to where the beard was turned up.

Notice the encoded rectangular area across the man's neck in Fig. 11. This could have been caused by the cloth's original fold or sag as it landed across the neck after it collapsed into the radiating supine body.

Notice also the odd-shaped feature encoded as part of the body image next to the neck area and below the end of the length of hair on the man's left side. This could be a displaced hair image caused by the cloth moving under this method.

There are also two faint body images in the blank space off the left side of the man's face, which is turned slightly to the right. These faint body image marks are located next to the man's left eyebrow and cheekbone. They, too, could be from motion blur by the Shroud collapsing in this region, but their faintness (and the lack of any such image on his right side) could be due to the chin band slowing the complete collapse of the overlaying Shroud cloth.

Observe the eight distorted or unusually long fingers seen on both of the man's hands in Fig. 13 below. Understand also that the folded hands on the supine or reclined body would be almost as high as the face. Under the Historically Consistent Hypothesis, the protons emanating from the surface bones of the hand and fingers became encoded as the cloth fell through this highly-elevated portion of the supine body. Dr. Giles Carter was the first to observe that the man's



fingers remained bent from the crucifixion.<sup>12</sup> After a two-dimensional cloth falls through and encodes curved fingers, when the cloth is then flattened, it results in a longer area of the cloth having been used to encode the fingers than if the fingers had been straight. A simple experiment with a cloth tape measure bears this out. If you measure from the top of your wrist to the end of your bent fingers, and then measure again with your straight fingers, the first measurement will be longer. Thus, the encoded fingers look somewhat longer when encoded under this cloth-collapse hypothesis. By the way, the Shroud's downward and upward movements into a radiant body region would also account for surface skeletal features aslo seen over the man's palms, at his forehead and his spinal column.



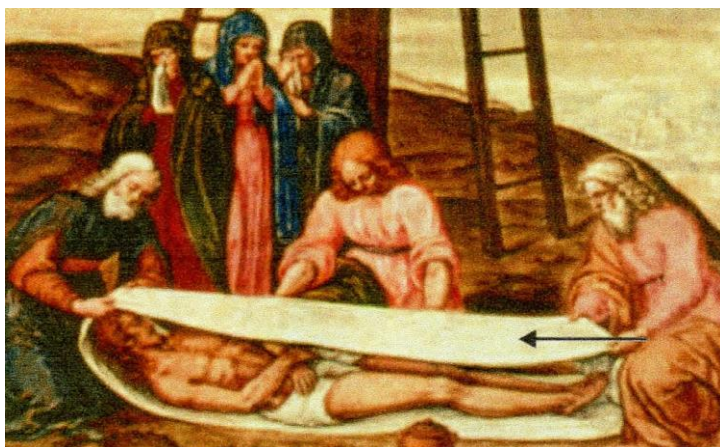
12.

Why would a medieval forger encode unusually long fingers and make the right thigh twice the width of the left thigh, but only on the frontal image, if he wanted his representations to appear realistic? Why would he encode vertical lines running down from the chin, where they are not typically found? Why would he encode as body image the rectangular-shaped feature at the neck and the odd-shaped feature next to the neck area and below the left length of hair? There are no logical answers to these questions, nor are there any explanations how these various secondary body image features could result under any naturalistic method.

These image distortions and blurs indicate downward movement of the cloth due to the body's sudden disappearance from its original position below the draped cloth. The sudden disappearance of the body that was once wrapped in the Shroud is indicated only by cloth-collapse hypotheses. The distortions and blurs can only be collectively explained by a cloth collapse hypothesis. These and the following secondary body image features not only indicate the body disappeared, but it disappeared simultaneously with radiation or particle radiation being emitted from the body.

We saw that as the draped cloth collapsed into the radiant body region, the parts that covered the highest points on the reclined body would fall the farthest distance and for the longest time within the field of radiation. These would be the parts of the cloth that draped over the man's

head and hands. As these two parts of the Shroud linen fell through the field of radiation, their *outer sides* would also have become exposed to this radiation. (See Fig. 13 below) While such discoloration or imaging would not be three-dimensional, vertically directional or have focused



13.



14.

*(Left) Arrow indicates outer side of Shroud behind its backing cloth. (Right) Outer side imaging of the man's hair above and around his face, his eyebrows and nose, and possibly other facial features may be visible above.*

resolution, there would be discoloration on the outer parts of the cloth at these two locations. After photographing the reverse side of the Shroud without its backing cloth in 2002, Professor Fanti identified imaging or discoloration at these two areas.<sup>13</sup> The reverse side at the face is seen in Fig. 14. In 1989 John Jackson first predicted that such coloration would be found at these two high points of a supine body on the outer side of the Shroud.<sup>14</sup> The Shroud's collapse into a radiant region of protons (alpha particles, deuterium or other highly charged particles) or UV radiation (as in Dr. Jackson's hypothesis) from the disappearing body wrapped within it would also best explain its outer side discoloration at the hands and face.

While it is beyond the scope of this paper to discuss the relative merits for all forms of low-energy radiation, thus far, protons at energies of approximately 0.4 MeV or less appear to best duplicate the Shroud's numerous body image features. One additional and important quality not on the earlier list of features is also briefly discussed here. The Shroud's uniform straw-yellow coloration could not be removed when STURP scientists applied an entire range of acids, bases, organic solvents, oxidants and reductants to it. Finally, when a very potent reductant, diimide, was applied, its straw-yellow coloration instantly went away. (In order to duplicate just this *one* aspect of the Shroud's body image features, a medieval forger would have to naturally or artistically encode body image coloration, whose chemical composition was strong enough to survive an entire range of 20<sup>th</sup> century acids, bases, solvents, oxidants and reductants, yet disappear immediately with diimide.) Linen samples irradiated with low-energy protons reacted in the same way.<sup>15</sup> This is the only known encoding agent that I'm aware of for which this claim can be made.



One cloth-collapse hypothesis, the Historically Consistent Hypothesis, not only accounts for both of the Shroud's full-length body images with their 33 primary and 15 secondary image distortions or motion blurs, but also their various skeletal features and the outer side discoloration. It will also account for the Shroud's excellent condition, its possible coin and flower images, the still-red coloration of the man's numerous blood marks, and the Shroud's aberrant C-14 dating.

### **Unique Effects Caused by Neutrons**

Thus far we have examined a number of unique features caused by protons irradiating the Shroud. Let us now examine a variety of features caused by penetrating neutrons released during the Historically Consistent (cloth-collapse) Hypothesis.

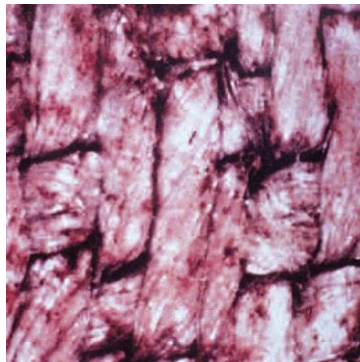
**Excellent Condition of the Cloth.** While there are cloths that are older than 2,000 years, I'm not aware of any ancient cloths, including medieval, that are as large as the Shroud and in as excellent condition. STURP scientists Roger and Marion Gilbert not only confirmed the Shroud's excellent condition, but described it as "extremely soft and pliable with no apparent degradation of strength."<sup>16</sup> Dr. Jackson described it as having a feel similar to a T-shirt.<sup>17</sup> A major reason for its excellent condition was pointed out by Dr. Kitty Little, a retired nuclear physicist from Britain's Atomic Energy Research Establishment in Harwell. Dr. Little stressed that penetrating neutrons and perhaps gamma rays released from the body would have strengthened the cloth by passing through it and causing some of the molecular bonds to break and reform in the non-crystalline regions of the cellulose that comprises the linen.<sup>18</sup> (Crystalline regions have specific internal and symmetrically arranged structures.)

Neutrons would have ricocheted off the bench, walls, and ceiling of the tomb, and many would have passed through the cloth again especially from the dorsal side. Although gamma rays would not ricochet within the tomb like neutrons, they would have easily passed through the cloth once. Such repeated breaking and reforming in the non-crystalline areas would cause these molecules to cross-link thus giving this burial cloth greater resistance to solubility, oxygenation and chemical reactions. This type of cross-linking combined with the high crystallinity of good quality linen would account for the Shroud's lack of degradation and contribute in several ways to its excellent condition.

**Possible Faint Coin and Flower Images.** When some of the many neutrons from the body hit some of the many nuclei of copper, the primary component of ancient bronze coins, some of the nuclei could absorb the neutron and give off either protons, alpha particles, or deuterium, which encode superficial images on cloth. If given off the coin's surfaces, they could possibly encode its faint features. When the neutrons strike heavier elements such as iron, calcium and potassium in flowers, they could also become absorbed causing protons and alpha particles to be given off their surfaces and thus leaving faint impressions of flowers. Low energy gamma rays are also given off by the heavier elements in flowers, as well as in coins that, in turn, could cause

ultraviolet rays, long-wave or short-wave X-rays or visible light to be given off. These events could also possibly encode coin or flower features.<sup>19</sup>

**Excellent and Pristine Condition of Blood.** The blood on the Shroud still appears fresh in the sense that it still retains a reddish coloration as seen in Figs. 15 and 16. Even if the Shroud is medieval, its blood should have long ago turned dark brown or black, like other centuries-old blood. Blood will actually start turning dark within hours of leaving the body and being exposed to air. Even today when the Shroud is exposed to sunlight, its blood marks appears to be even redder.<sup>20</sup> The late Dr. Carlo Goldoni undertook experiments to explain these remarkable attributes and concluded that when blood marks are first exposed to *neutron radiation* and then to ultraviolet light (such as the Shroud would naturally receive from sunlight during exhibitions) it resulted in the blood marks having a bright red coloration. Dr. Goldoni found this reddish coloration existed regardless of the blood's bilirubin content,<sup>21</sup> which has been the traditional explanation for the Shroud's centuries-old red coloration.



15.



16.

Photomicrographs of blood marks on Shroud, 200 – 300 times enlarged.

Further experiments with particle and other forms of radiation should be undertaken to build upon these initial experiments. Particle radiation emanating from the man in the Shroud is the only hypothesis that claims to account for the still-reddish color of the man's blood marks after all these centuries.

The Historically Consistent Hypothesis also accounts for other unique conditions of the blood marks described below that no other hypothesis has explained.

- The blood marks consist of abrasions, bruises, scourge marks, punctures, arterial, venous, and capillary bleeding from pre-mortem and post-mortem wounds. These blood marks are in different sizes, shapes, and thicknesses.
- All the blood marks appear on the cloth in the same shape and form as when they formed and flowed on the body.
- The edges around the blood marks are not broken or smeared.
- The bloodstains consist of coagulated human blood with serum-surrounding borders that weren't discovered until the 20<sup>th</sup> century.

- They are uniquely *aligned* on the body image, but only on the positive body image (which is how the man appeared as he laid in the cloth at the time of the image encoding event).
- All of these blood marks are *embedded* in the cloth.
- The blood marks consist of human hemoglobin, human immunoglobulins, human albumin, human DNA, and human whole blood serum from a multiply-wounded, crucified corpse in rigor mortis, who incurred a variety of pre-mortem and post-mortem wounds at different times and with different instruments, all while he was in the vertical position.

### **Second Part of the Historically Consistent Hypothesis**

The second part of this hypothesis is both independent from, yet consistent with, the first part. The second part asserts that, like the body, the blood marks that formed and flowed on the man's skin also disappeared instantly at the time of image formation. While the man's body reappeared outside of its original position within the Shroud, the blood marks reappeared instantly within the cloth, as it was starting to collapse on its frontal side and rise on its dorsal side. This explains how all the coagulated, human blood marks and their unique features were embedded into the Shroud, were unbroken or unsmeared, and were in the same shape and coagulated condition as they were in when they formed and flowed on the body. As seen in more detail in Chapter 12 of *Test The Shroud*, this could explain how many of the man's blood marks that were not originally in contact with the cloth when it draped over his body were also embedded into the Shroud. This could even explain how some of the blood marks are encoded as body image features and how the blood marks became displaced onto the outer parts of the man's hair. The presence and appearance of the 130 or more bloodstains embedded in the Shroud are also consistent with their absence on Jesus' body on Easter Sunday.

### **Radioactive Effects Caused by Neutrons**

We have seen in other presentations in this conference and elsewhere how only neutron radiation can create radioactive atoms such as Carbon-14 (C-14), Chlorine-36 (Cl-36) and Calcium-41 (Ca-41), most of which would still be present on the Shroud today, even though the irradiation occurred almost two thousand years ago.<sup>22</sup> Their presence on strategically selected blood, linen, and charred material selected from the Shroud of Turin could not only prove that every location on this burial cloth was irradiated by neutrons, but also the amount of neutrons that each location received. The various amounts of these radioactive atoms on the Shroud could also prove that the source of the neutron radiation was the length, width, and depth of the multiply-wounded, crucified corpse wrapped in this burial cloth. These and other measurements would not only completely refute the Shroud's medieval radiocarbon dating, but would establish its actual age, when this miraculous radiating event occurred, and confirm the identity of the man in the Shroud. If these radioactive atoms are found within one of Jesus' reputed burial tombs, they would not only identify his actual burial tomb, but would reveal where this miraculous

radiating event occurred. All of these points could be proven with *billions* of unforgeable radioactive atoms found in any dot-size blood sample or postage stamp-size linen sample from the Shroud or a small amount of limestone from Jesus' burial tomb. These radioactive atoms can only be created by neutron radiation, which was not even discovered by scientists until the 20<sup>th</sup> century.

The second part of the Historically Consistent Hypothesis also states that the release of neutrons at thermal energy from inside the cool burial tomb just before dawn could possibly explain the relatively minor earthquake described in Matthew 28:2. This earthquake is very minor compared to the first one following Jesus' crucifixion wherein Matthew 27:51 and 52 state that "... the curtain of the temple was torn in two, from top to bottom; and the earth shook and the rocks were split; the tombs also were opened ...." In the second earthquake neither Jesus' burial shroud nor his tomb is damaged.

The first part of the Historically Consistent Hypothesis not only accounts for both of the Shroud's full-length body images and their 33 primary and 15 secondary body images features, but also their skeletal features, and the outer side discoloration. It will also account for the Shroud's excellent condition, its possible coin and flower images, the still-red color of its centuries-old blood marks, and its aberrant C-14 dating. This part of the hypothesis could possibly add physical qualities to the unwitnessed resurrection of Jesus such as the presence of radiation emanating from his disappearing body, the types of radiation involved, and their approximate energies.

The independent second part of the hypothesis explains all of the numerous physical features attributed to the Shroud's original and unique blood marks. Their extensive presence in the Shroud and their total absence on Jesus' body or his wound sites on Easter Sunday is completely consistent with the descriptions of Jesus' appearances on the morning of his resurrection. This part of the hypothesis also attempts to explain that during the disappearance of the man from within the shroud and Jesus' disappearance at his resurrection that the body never ceased to exist. It simply transitioned from our four dimensional reality to an alternate dimensionality. Modern physics related to super symmetry and string theory generally postulates there are from 10-26 dimensions. Jesus simply disappeared from our view when he transitioned into an alternate dimensionality and reappeared to our view when he returned to our four dimensional reality.<sup>23</sup> These disappearances and reappearances not only occurred at the time of Jesus' resurrection, but in several instances after his resurrection.<sup>24</sup>

No other hypotheses begin to try to explain all of the primary and secondary body image, blood mark and wide variety of other features found throughout the Shroud, let alone the critical and miraculous events described in the Gospels.

## Endnotes

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2. This model hypothesizes that if vertically polarized gamma rays were given off the surface of a supine or reclined body, protons and neutrons would be released from the nuclei of deuterium atoms that are uniformly distributed over the surface of the body.
3. A. Lind, "Image Formation by Protons," *International Conference on the Shroud of Turin*, Pasco, Washington, July 19-22, 2017.
4. G. Fanti, "Hypothesis Regarding the Formation of the Body Image on the Turin Shroud. A Critical Compendium," *Journal of Imaging Science and Technology* 55(6): 060507-1-060507-14, 2011. Some scientists refer to the very outer layers of the linen fiber as the primary cell wall. G. Fanti, J. A. Botella, P. Di Lazzaro, T. Heimburger, R. Schneider, N. Svensson, "Microscopic and Macroscopic characteristics of the Shroud of Turin image superficiality," *Journal of Imaging Science and Technology*, 54:4, 2010.
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6. J. P. Jackson, "Is the Image on the Shroud Due to a Process Heretofore Unknown to Modern Science?," *Shroud Spectrum International* 34 (March 1990): 3-29, 9; J. P. Jackson, "An Unconventional Hypothesis to Explain All Image Characteristics Found on the Shroud Image," *History, Science, Theology and the Shroud*, A. Berard, ed. (St. Louis: Richard Nieman, 1991), pp. 325-344.
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8. M. Antonacci, "Particle radiation from the body could explain the Shroud's images and its carbon dating," *Scientific Research and Essays* Vol. 7(29), pp. 2613-2623, (2012); M. Antonacci, *Test The Shroud*.
9. The original Cloth Collapse Hypothesis by John Jackson hypothesizes that the radiation is released uniformly, as does the Historically Consistent Hypothesis. However, the latter hypothesis leaves open the possibility, as a secondary option, that the radiation was released in a vertically collimated manner.
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11. A. Lind, "Image Formation by Protons."
12. G. F. Carter, "Formation of the Image on the Shroud of Turin by X Rays: A New Hypothesis," *ACS Advances in Chemistry No. 205 Archaeological Chemistry III*, J. B. Lambert, ed. American Chemical Society, 1984, pp. 425-446.

13. G. Fanti, R. Maggiolo, "The double superficiality of the frontal image of the Turin Shroud," *J. Opt. A, Pure Appl. Opt.* 6 (2004): 491-503.
14. Dr. Jackson was also the first to observe that the irregular features located at and next to the man's neck could be due to the cloth's collapse. J. Jackson, "Is the Image on the Shroud Due to a Process Heretofore Unknown to Modern Science?"
15. Rinaudo, "Protonic Model" and personal communication.
16. R. Gilbert, Jr., and M. M. Gilbert, "Ultraviolet-Visible Reflectance and Fluorescence Spectra of the Shroud of Turin," *Applied Optics* 19:12 (June 1980): 1930-1936.
17. Dr. John Jackson, personal communications.
18. K. Little, "The Formation of the Shroud's Body Image," *British Society for the Turin Shroud Newsletter*, No. 46, November/December 1977, pp. 19-26.
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23. These possibilities originated with and were explained to me by nuclear engineer Robert Rucker. They are explained in more depth in chapter 12 and Appendix H of *Test The Shroud*.
24. John 20:19-20; 26-28; 21:1-14; Luke 24:13-31; 33-43; Matt 28:9-10; 16-20; Mark 16:12, 14;

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