

Bob Rucker's Comments on Videos by Reasons to Doubt

Robert A. Rucker, MS (nuclear), February 9, 2024

Introduction

The stated goal of Jordan and Jerod on Reasons to Doubt on YouTube.com is to debunk the Shroud of Turin. They admit they start with the assumption that it cannot be the authentic burial cloth of Jesus and that it cannot be evidence of his resurrection. This is because of their philosophical presupposition of naturalism, which means that only explanations that are consistent with our current understanding of physics are allowed. Explanations that involve anything outside or beyond our current understanding of physics, what they would consider to be “miraculous” or “supernatural”, cannot be allowed. Thus, their conclusion that the Shroud is not Jesus' burial cloth and cannot be evidence of Jesus' resurrection must follow from their presuppositions. They are forced to choose the evidence and logical reasoning which produces the only result that is allowed by their controlling presupposition of naturalism. Thus, they are entirely biased in their consideration of the Shroud, so they cannot truly follow the evidence where it leads, though they like to project an air of objectivity to their audience to gain a hearing.

The main questions in an investigation of the Shroud should be whether it could be Jesus burial cloth and whether it could be evidence of his resurrection. Their presupposition of naturalism forces the answer to both questions to be “no” even before the evidence is considered. When the author recommended to Jordan that the investigation of the Shroud should follow the evidence where it leads by evaluating the evidence using neutral presuppositions, i.e. maybe the Shroud is Jesus' burial cloth and maybe it is not, and maybe it is evidence for Jesus' resurrection and maybe it is not, Jordan replied that he could not do that. He explained that if he started with neutral presuppositions, he would probably believe it to be Jesus' authentic burial cloth and thus possibly evidence for his resurrection. However, this conclusion would conflict with his commitment against anything that was outside or beyond our current understanding of physics. His commitment to naturalism is so strong that it causes him to ridicule any concepts or individuals that differ from his ideas.

In what follows, various videos about the Shroud by Reasons to Doubt are considered, starting from the most recent. The author's comments that were sent to Reasons to Doubt are listed for the various videos. The author's papers on the Shroud are on the research page of his website www.shroudresearch.net.

Video titled “Flawed, but Still (Probably) Medieval” on Reasons to Doubt

I believe this is their ninth video on the Shroud. The duration is 47.55 minutes. My comments regarding this video will be placed here in the next revision after they are submitted to Reasons to Doubt.

Video titled “The Shroud of Turin is NOT Authentic” on Reasons to Doubt

This is their third video on the Shroud. The duration is 57:42 minutes. My comments that were submitted to Reasons to Doubt regarding this video are below.

In this third video on the Shroud, their basic argument is the following. 1) Carbon dating has accurately dated the Shroud to 1260 to 1390 AD. 2) The most famous and popular argument against the accuracy of the carbon date is the Hungarian Pray codex or manuscript. 3) The Pray codex has been dated to about 1192-1195, but it pictures Jesus' sarcophagus and not Jesus' burial cloth, so that the Pray codex does not contradict the carbon dating, thus..4) The carbon dating of the Shroud to 1260 to 1390 proves the Shroud of Turin cannot be the authentic burial cloth of Jesus. I will consider each of these claims below, based on my MS in nuclear engineering, 38 years in the nuclear industry, nine years studying the Shroud of Turin, and my writing 33 papers on the Shroud that are available on the research page of my website Shroud Research Network.

Claim #1. Carbon dating has accurately dated the Shroud to 1260 to 1390 AD.

There are very good "reasons to doubt" this claim. I apologize for aspects of the following that may seem overly technical for the layman, but this is as simple as I can make it and still include all of the necessary information. Regarding the following, I encourage individuals to read my paper titled "Solving the Carbon Dating Problem for the Shroud of Turin". It is available as paper #33 on the research page of my website Shroud Research Network.

Carbon dating is done by measuring the ratio of C-14 to C-12 in samples from an item. In 1988, samples cut from the corner of the Shroud were sent to three dating laboratories in Arizona, Zurich, and Oxford. These laboratories cut their samples into a total of 12 subsamples. Each of these 12 subsamples was carbon dated. The dates for the subsamples from each laboratory were then averaged, producing an average date from each laboratory. These laboratory average values did not agree with each other, i.e. the laboratory average dates were statistically different from each other, and showed that the carbon date depended on (was a function of) the distance from the bottom of the cloth at a rate of about 36 years per cm (91 years per inch) as the location for cutting the sample from the Shroud is moved further from the bottom of the cloth. These three laboratory average values were then averaged, yielding an overall average date of 1260 AD \pm 31 years. This 1260 \pm 31 value is called the uncorrected value because it is not corrected for the changing concentration of C-14 in the atmosphere. When this value (1260 \pm 31) was corrected for the changing concentration of C-14 in the atmosphere, a range of 1260 to 1390 AD was obtained (Ref. 1). This 1260-1390 range is claimed to have a 95% probability that the true date falls within this range, but this claim depends on whether the 1260 \pm 31 uncorrected average date (1260 \pm 31) is the correct average value. There are multiple "reasons to doubt" the results of this process:

1. As stated above, the average dates from the three laboratories do not agree with each other within the uncertainties, but rather indicate that the carbon date depends on the distance from the bottom of the cloth. This should not be the case since all the samples were cut next to each other from the corner of the same cloth.
2. A relatively simple Chi-squared statistical analysis of the carbon dates for the 12 subsamples indicates there is only a 1.4% chance that the carbon dates are consistent with each other (bottom

of left column in Tables 5 of Ref. 2). This indicates that a systematic measurement error likely affected the 12 dates. The laboratory average dates indicate that the magnitude of this measurement error depends on the distance from the bottom of the Shroud. Since the magnitude of this measurement error cannot be determined, the claim that the average uncorrected date is 1260 ± 31 must be rejected, so that the corrected range of 1260-1390 must also be rejected. We can speculate what might have caused this apparent systematic measurement error (reweaving of the original linen fabric with newer thread, neutron absorption producing new C-14 on the Shroud, measurement error due to contamination that was not cleaned off the cloth, etc.), but the values for the 1260 ± 31 average and the 1260-1390 range must still be rejected. They must be rejected until the magnitude of the systematic measurement error is determined so that the true value can be calculated by correcting the measured value by the magnitude of the measurement error.

3. The presence of this systematic measurement error causes the measured carbon dates to be “heterogeneous”, also called “non-homogeneous”, which means that the measured dates are not consistent with each other within their measurement uncertainties, as if the samples came from different pieces of cloth having different dates. This is proven by the more detailed statistical analysis of the carbon dates in three recent papers published in peer-reviewed journals (Ref. 3, 4, and 5). In this situation, it is not legitimate to calculate an average date from the samples sent to the three laboratories, so the 1260 ± 31 average value must be rejected, so the range of 1260-1390 must also be rejected, i.e., be given no credibility.

The recent papers in peer-reviewed journals confirm the above statements. In Ref. 3 (Casabianca, et al.), based on their statistical analysis of the measured carbon dates, the last sentence concludes that “it is not possible to affirm that the 1988 radiocarbon dating offers “conclusive evidence” that the calendar age range is accurate and representative of the whole cloth”. On page 13 of Ref. 4 (Di Lazzaro, et al.), the authors conclude that “Clearly, the statistical analysis do not unveil the correct age of the Shroud”, i.e., they could not determine the true age of the Shroud from an analysis of the measurement data because the data was heterogeneous. On page 7 of Ref. 5 (Walsh & Schwalbe), their statistical analysis of the measured values identified “a statistically significant heterogeneity in the dates reported for the Shroud sample” and that “this finding would preclude the step of combining the individual data sets and reporting the mean date as was done” in Ref. 1 (Damon, et al.). Page 2 of Ref. 6 (Schwalbe and Walsh) confirms that a legitimate average value cannot be calculated from heterogeneous values: “researchers analyzed the raw data and conclude that the results from the three laboratories are statistically heterogeneous, a condition that according to standard analytical procedure precludes these dates from being combined to produce an accurate and unbiased average”. This means that standard analytical procedures applied to the measured carbon dates requires that the uncorrected average value stated in Ref. 1 (1260 ± 31) and hence the corrected range (1260 to 1390 AD) should both be rejected, i.e. given no credibility. Thus, it is not legitimate to claim that the 1988 carbon dating of the corner of the Shroud accurately dated the Shroud to 1260-1390 AD.

Three potential causes for this systematic measurement error that led to the heterogeneous measurement dates are: 1) a reweaving with newer thread/fabric into the original linen fabric of the Shroud, 2) neutron capture produced new C-14 in the threads that shifted the carbon date in the forward direction, and 3) inadequate cleaning that left contamination with a different ratio of

C-14 to C-12 on the samples. Such inadequate cleaning was not observed in the carbon dating of the three standards (samples from cloth of known historical dates) that were dated by the three laboratories at the same time as the samples from the Shroud.

It may be asked why the analysis in Damon (Ref. 1) did not report the presence of a systematic measurement error that caused the carbon dates to be heterogeneous. The goal of the dating laboratories was to validate their relatively new small sample dating technique that they used on the Shroud samples. To admit that their measurements resulted in heterogeneous dates would disprove their small sample dating technique. To avoid this conclusion, they assumed, without justification, that the measurement uncertainties were understated, saying “it is unlikely that the errors quoted by the laboratories for sample 1”, i.e. samples from the Shroud, “fully reflect the overall scatter” (page 6 of Ref. 1). This assumption hid the fact that the measured dates were heterogeneous (not consistent with each other within their uncertainties) due to the presence of a systematic measurement error.

It may also be asked why the recent papers on the statistical analysis of the carbon dates were delayed till 2019 when the experiments were performed in 1988 and were reported in 1989 (Ref. 1). The answer is that distribution of the raw measurement data was controlled by the British Museum who refused to release the data until forced to do so by legal action taken by T. Casabianca in 2017. This legal action involved several Freedom Of Information Act (FOIA) requests sent to the British Museum (page 2 of Ref. 3).

- Ref. 1 P.E. Damon, and 20 others, “Radiocarbon Dating of the Shroud of Turin”, *Nature*, February 16, 1989,
- Ref. 2 Robert A. Rucker, “The Carbon Dating Problem for the Shroud of Turin, Part 2: Statistical Analysis”, August 7, 2018, paper 12 on the research page Shroud Research Network.
- Ref. 3 T. Casabianca, E. Marinelli, G. Pernagallo, and B. Torrisi, “Radiocarbon Dating of the Turin Shroud: New Evidence from Raw Data”, 2019, *Archaeometry*, 61(5), 1223-1231
- Ref. 4 Paolo Di Lazzaro, Anthony C. Atkinson, Paola Iacomussi, Marco Riani, Marco Ricci, and Peter Wadhams, “Statistical and Proactive Analysis of an Inter-Laboratory Comparison: The Radiocarbon Dating of the Shroud of Turin”, *Entropy*, August 24, 2020
- Ref. 5 Bryan Walsh and Larry Schwalbe, “An Instructive Inter-Laboratory Comparison: The 1988 Radiocarbon Dating of the Shroud of Turin”, *Journal of Archaeological Science: Reports*, Volume 29, February 2020
- Ref. 6 Bryan Walsh and Larry Schwalbe, “On Cleaning Methods and the Raw Radiocarbon Data from the Shroud of Turin”, *International Journal of Archeology*, 2021; 9(1):10-16

Claim #2. The most famous and popular argument against the accuracy of the carbon date is the Hungarian Pray codex.

As I discussed above, the main argument against the 1260-1390 AD date obtained from the carbon dating of the Shroud is the proper statistical analysis (Ref. 2 to 5) of the carbon dates. Also, the Hungarian Pray codex or manuscript is not the only date indicator that is contrary to the

results of the carbon dating. Ref. 7 lists 15 date indicators for the Shroud from the most recent (carbon dating) back to the oldest. These are summarized below.

1. Carbon dating of the corner of the Shroud indicated 1260-1390 AD for the Shroud.
2. Coins left micro-particles of gold on the Shroud, indicates a date probably before 1204.
3. The Hungarian Pray codex indicates a date for the Shroud prior to 1195 AD.
4. The Shroud is made of hand-spun thread, indicates a date in the 12th century or before.
5. Size of the Shroud (8 by 2 cubits) indicates it was made when the cubit was used.
6. Ancient coins show the face from the Shroud starting about 692 A.D.
7. The Sudarium of Oviedo is Jesus' face cloth, so the Shroud dates prior to 570 A.D.
8. Ancient paintings of the face on the Shroud indicate a date prior to about 550 AD.
9. Crucifixion abolished in the Roman Empire in 337 AD → Shroud prior to this date.
10. Traditions indicate Jesus' shroud was taken to Edessa, Turkey, in 1st or 2nd centuries.
11. Stitch connecting side piece to main Shroud is from 1st century → Shroud is 1st century.
12. Jesus' crucifixion dates to 30 or 33 AD, so his burial cloth would also be 30-33 AD.
13. Possibility of a Roman lepton (29 to 32 AD) over one eye. This is not confirmed.
14. Spectroscopy and tensile strength of Shroud threads → 33 B.C. ± 250 years
15. Radiation damage to Shroud fibers similar to Dead Sea Scrolls → 250 B.C. to 70 AD.

It should be emphasized that even if someone could legitimately disprove the date indicators #2 through #15 above, it would not prove that the carbon dating was correct because the credibility of the carbon date (1260 to 1390) should be rejected based on the statistical analysis of their measurement data as discussed above.

Ref. 7 Robert A. Rucker, "Date of the Shroud of Turin", Nov. 11, 2020, paper #29 on the research page of my website Shroud Research Network

Claim #3. The Pray codex pictures Jesus' sarcophagus and not Jesus' burial cloth, so that the Pray codex does not contradict the carbon dating.

There are very good "reasons to doubt" this claim. I will respond to each of their arguments.

Argument 1: In the upper image, the crossed hands without thumbs is the main evidence that the upper image is Jesus, even though thumbs are often not shown in Byzantine art.

Response 1. No, the main evidence that the upper image is Jesus is the nimbus (halo) around his head. This nimbus pictures a cross behind his head, as if he is standing in front of his cross. Coming horizontally out from behind the sides of his head are the left and right sides of the horizontal beam (patibulum) of the cross and a section of the vertical beam (stipes) is shown going vertically up behind his head. The design of this nimbus is uniquely used for Jesus and so definitely identifies him as Jesus. Other arguments are irrelevant compared to the evidence of this nimbus.

Argument 2. When the Pray codex is compared to other such scenes in Byzantine art, it indicates that the Pray codex is not depicting Jesus' burial cloth but is depicting his sarcophagus with its lid at an angle. The stair-step arrangement on the lid is just a decoration. On the middle

of the lid is something that looks like a cloth, so should be identified with Jesus' burial cloth, as shown in other such scenes in Byzantine art. The four holes in an "L" shaped pattern is the main argument that this is depicting the Shroud of Turin. The Pray codex contains two other pictures (shown at 19:48 and 20:13) that use many circles as decorations, so the four holes in an "L" shaped pattern in the bottom image is only there because the author is "trying to make it look fancy" (20:20).

Response 2. The similarities between the Pray codex and the scenes of similar motif in Byzantine art in no way prevent the artist of the Pray codex from inserting differences for his own purposes. This is proven by the many differences in this general motif (see 15:36 to 17:13 in the video and Figure 9 of Ref. 7): 1) The lid of the box is included in most scenes but is not included in others. 2) The lid, if included, is off the box (sarcophagus) in most scenes but can be on top of the box. 3) Roman guards are present in some scenes but not in others. 4) Most scenes that include the guards have the guards asleep, but they can also be awake. 5) Three women are in some scenes but other scenes have one, two, four, or no women. 6) In most scenes the women are holding containers of material presumably to anoint Jesus' body but in other scenes they are not holding containers. 7) In some scenes each woman has a nimbus (halo) around her head but in others they do not. 8) Some scenes include men as well as women. 9) Some scenes include Jesus after his resurrection but others do not. 10) One scene shows Jesus stepping out of his burial box but most do not. 11) Most scenes include one angel but others include two angles or no angels. 12) Most boxes and lids are decorated but of the 16 scenes reviewed of this motif, only two used circles as part of the decoration. It should be obvious from this that there is great flexibility in Byzantine art so that the artist of the Pray codex can depict Jesus' burial cloth if he wants to, even though most scenes in this motif depict a box (sarcophagus) and often its lid, either to the side or on top of the box.

Consideration of the above scenes in this motif should convince the objective observer that the item shown in the bottom image in the Pray codex is not a box (sarcophagus):

- 1) Most scenes in this motif show the box and/or lid with a significant thickness, whereas the bottom image in the Pray codex shows no thickness, consistent with it being the thickness of a piece of cloth.
- 2) Most scenes in this motif show the box with a front wall, a back wall, and one or two side walls, whereas the Pray codex shows what would have to be assumed to be the front wall of the box but does not show a back wall or side walls of a box.
- 3) Other scenes in this motif show the lid clearly not connected to the box, but the Pray codex shows the top piece at an angle that appears to be connected to the bottom piece on the left side of the image, consistent with this being one piece of cloth that is folded over.
- 4) Of the 16 scenes of this motif that were reviewed, no other scenes show a stair-step pattern on the box or on the lid, but the Pray codex shows a stair-step pattern on the left and right sides of the top piece. This stair-step pattern mimics the three-to-one Herringbone weave of the Shroud of Turin as shown in Figure 4 in Ref. 7, so this pattern identifies the top piece to be cloth with a herringbone weave, like the weave on the Shroud of Turin.

5) The bottom piece in the Pray codex that was misidentified as the front wall of a box (sarcophagus) is covered with a pattern of crosses that are filled in with an orange-red color. None of the boxes in other scenes of this motif have anything like this pattern of crosses or an orange-red color filling any other shape. What could these crosses filled with an orange-red color represent? A cross is a common symbol of Jesus, because Jesus died on a cross. When crucified on the cross, he would have bled from his wrists, feet, side wound, puncture wounds in his scalp, and perhaps the 120 or so scourge marks on his body. When wrapped in his burial cloth, much of this blood could have been transferred to the side of the cloth that was next to his skin. The crosses filled with the orange-red color covering the bottom piece in the Pray codex is a very good representation of Jesus' blood that would have covered the side of Jesus' burial shroud that was next to his body. Thus, there is good reason to believe that the crosses on this bottom piece in the Pray codex shows Jesus's blood on his burial cloth, so this bottom piece is part of his burial cloth.

6) At some unknown time in the past, with the Shroud first folded at the midpoint of the width and then folded at the midpoint of the length, it appears that hot coals were dropped onto the folded Shroud. These hot coals sequentially burned through the four layers of the folded Shroud. This left four burn holes in an "L" pattern in each quadrant of the Shroud. This "L" pattern of burn holes on the Shroud consists of three holes in a straight line then the fourth hole at a ninety degree angle from the last of the three hole (Figures 2 and 3 of Ref. 7). The top piece in the Pray codex shows four holes in this same "L" shaped pattern. The bottom piece in the Pray codex probably also contains this "L" shaped pattern though one of the three holes is not visible due to the top piece hiding it. There are no other circles on the top or bottom pieces in the Pray codex, so the "L" patterns, one on the top piece and probably one on the bottom piece, are the only locations where circles are located on the top and bottom pieces. To have three and only three circles in a straight line and only one more circle, i.e., a fourth circle, located perpendicular to the straight line of three circles, with the fourth circle perpendicular to the circle at the end of the sequence of three circles, is a very unusual pattern. The only other place that this "L" shaped pattern of four circles occurs is on the Shroud of Turin, where they are the holes that were presumably produced by hot coals burning through the four layers of the Shroud as discussed above. There are multiple reasons that these four circles in an "L" pattern on the Pray codex cannot simply be decorations. 1) There are no other circles on the top and bottom pieces on the Pray codex (Figure 6 in Ref. 7) that are used for decorations. 2) Of the 16 scenes of this motif that were reviewed, only two of them contained circles as part of the decorations on the box and lid, and these two cases contained perhaps a hundred or more circles covering the box and lid. This is very inconsistent with only four circles in an "L" pattern. 3) Circles can also be occasionally used as decorations on clothing but these examples again use many more than four circles, usually have borders on either side of the line of circles (Figure 6 in Ref. 7), and do not show an "L" shaped pattern. Thus, the four holes in an "L" pattern in the Pray codex cannot be legitimately explained as mere decorations, but must be recognized as identifying the bottom image in the Pray codex as depicting the Shroud of Turin.

7) Of the 16 scenes reviewed, no other scene in this motif shows Jesus' burial cloth piled up on top of the lid of the box, so we should not presume that the curved lines in the middle of the top piece in the Pray codex (Figure 6 in Ref. 7), between the left and right stair-step patterns, depicts

Jesus' burial cloth piled up on top of the lid of the box. What then do these curved lines in the middle of the top piece in the Pray codex represent? To identify the meaning of these curved lines, two more items should be identified. 7A) Due to the prominence of the nimbus (halo) around the head of the woman on the left, this woman is evidently Mary, the mother of Jesus. In her right arm she is holding the side view of a man's face or head (Figure 8 of Ref. 7). On the left side of her right arm, in side view from the top downward, can be seen his forehead, ridge over his left eye, nose, closed mouth, and chin with an extended length to include his beard. 7B) At the top of the curved lines in the middle of the top piece on the Pray codex, a knife can be seen (Figure 7 in Ref. 7). This knife had evidently cut something from the top piece, leaving the remaining cloth in disarray. This section of the top cloth that was in disarray is what is misidentified as Jesus' burial cloth piled up on top of the lid. Connecting this knife with the face that Mary is holding indicates that the face had been cut from the top piece of cloth so that the face had been part of the cloth. That this section of the top cloth that contained the face was given to Mary, Jesus' mother, is best explained by the face being that of Jesus. Thus, the knife was used to cut the face of Jesus from the top cloth and then it was given to his mother. This indicates that this cloth contained the image of the face of Jesus, which also confirms that this cloth is the Shroud of Turin.

Argument 3. "This seems to be pareidolia in action where the brain looks for patterns that aren't really there." (20:47)

Response 3. This is not pareidolia because everyone can see there is a four-hole pattern in the shape of an "L" with three holes straight in line with the fourth hole turned at a ninety degree angle.

Argument 4. "This dude doesn't have a beard." (22:22)

Response 4. If you look at an enlarged version of the top image, you should be able to see that Jesus does have a beard except that it is shorter than the longer beards on two of the other men in the top image.

Argument 5. "In the grand scheme of things that (the Pray codex) would push it (the date) back, what, like 70 years, you know, they needed to go all the way back to the first century, right? So that's not good enough." (22:48)

Response 5. This is not true. The uncorrected mean (average) carbon date for the Shroud was 1260 ± 31 years, where 31 years is the one sigma uncertainty (68% probability limit) on the 1260 date. The corrected range of 1260 to 1390 AD is calculated assuming that the correct mean date is 1260 ± 31 years, which has been invalidated by four papers in peer reviewed journals. This means that the corrected range of 1260-1390 should also be given no credibility. If we ignore the fact that his corrected range of 1260-1390 should have no credibility, this range is stated to be a two sigma range, which means there should be about a 95% probability that the true value is within in this range. The date for the Pray codex is stated to be 1192 to 1195, which is more than two sigma below the 1260-1390 range [$(1260 - 1195)/31 = 2.1$ sigma]. The normal criterion for acceptance in statistical analysis is two sigma. The range of 1260-1390 is two sigma and the date for the Pray codex is another 2.1 sigma below the carbon date range of 1260-1390. This

means that if the image in the Pray codex is the Shroud of Turin, which was proven above, then the date for the Pray codex (1192-1195) disproves the carbon date range of 1260-1390. There is no need for the Pray codex to date “all the way back to the first century”, because with a date of 1192-1195 for the Pray codex, it disproves the carbon date of 1260-1390, thus arriving at the same conclusion (the carbon dating should be given no credibility) as the four papers that were published in peer reviewed journals. It is not necessary for the Pray codex to date to the first century. As discussed above under Claim #2, there are other date indicators that take the Shroud back to the time of Jesus:

- Stitch connecting side piece to main Shroud is from 1st century → Shroud is 1st century.
- Spectroscopy and tensile strength of Shroud threads → 33 B.C. ± 250 years
- Radiation damage to Shroud fibers similar to Dead Sea Scrolls → 250 B.C. to 70 AD.

Argument 6. There are no peer reviewed papers on the history of the Shroud of Turin.

Response 6. A paper can be entirely true or contain errors whether it is peer reviewed or not, so the important thing for us to do is to consider the evidence carefully whether the paper is peer reviewed or not. Much and possibly most of the historical research on the Shroud of Turin appears to be in Italian, French, or Spanish, and much of the ancient documentation is in Latin. The most recent book in English on the history of the Shroud is a 2021 book by historian Jack Markwardt titled “The Hidden History of the Shroud of Turin”. This book discusses many issues related to the history of the Shroud of Turin in 384 pages. At the back of his book, he lists 29 pages of references and 54 pages of notes to those references. This indicates there has been a massive amount of research and documentation on the history of the Shroud of Turin. I believe the conclusion of this massive effort is that historical documentation, due to the lack of very early documents, does not prove that the Shroud of Turin is the burial cloth of Jesus, but neither does it disprove it. And in many respects, the history that can be known about the Shroud of Turin is consistent with what would be expected for Jesus’ burial cloth. The conclusion that the Shroud of Turin is the burial cloth of Jesus is based not in historical documentation but in the characteristics of the images on the Shroud, the scientific research on the Shroud, and the efforts to explain the evidence related to characteristics of the full size front and back images that can be seen on the Shroud.

Other arguments: etc.

Claim #4. The carbon dating of the Shroud to 1260 to 1390 proves that the Shroud of Turin cannot be the authentic burial cloth of Jesus.

There are very good “reasons to doubt” this claim. The claim that the carbon dating of the Shroud dated the Shroud to 1260-1390 has been disproven by the proper statistical analysis of the experimental values as documented in four peer reviewed journals. Also, as proven above, the Pray codex, dated to 1192-1195, pictures Jesus’ burial cloth and not his sarcophagus so it also contradicts the 1260-1390 date of the carbon dating. Also, as discussed above, there are also many different date indicators, all of which contradict the 1260-1390 date from carbon dating and some of which are consistent with the first century.

Video titled “The Shroud of Turin Image is NOT Jesus” on Reasons to Doubt

This is their second video on the Shroud of Turin. The duration is 1:08:0 minutes. My comments that were submitted to Reasons to Doubt regarding this video are below.

Comment 1

I will make my comments on the material prior to their discussion of my radiation hypothesis (27:00 to 1:02:10) for image formation. I will have to comment later on image formation by radiation.

You said (0.03 and 0.30) that your purpose is to debunk the Shroud of Turin. This displays the bias of your presuppositions; that you start your investigation with the presupposition that the Shroud cannot be the authentic burial cloth of Jesus and that it cannot be evidence for his resurrection. Starting from these presuppositions, you conclude that the Shroud is not the burial cloth of Jesus and is not evidence for his resurrection, but your presuppositions confine you to these conclusions. Your thinking process is goal oriented to prove your presuppositions, so that it becomes merely an exercise in circular reasoning. I started my investigation into the Shroud nine years ago with the neutral presupposition that the cloth may or may not be the authentic burial cloth of Jesus and may or may not be evidence for his resurrection. If you want to be honest seekers of truth, you should start your investigation with neutral presuppositions.

In your discussion of the image being a photonegative (3:34 – 4:41), the image being a negative merely means that the light and dark areas are reversed from a photograph of a person. This was an astonishing discovery when it was first discovered in 1898 when Secondo Pia took the first photo of the Shroud. This was astonishing because they realized that this meant that the Shroud could not be a painting because no artist could have painted a negative image of the face because no one would have seen a negative image by about 1355, which is the earliest uncontested date for the Shroud.

In your discussion of the 3D information that is encoded into the 2D Shroud (4:57 to 5:57), the best way to understand this 3D information is that it is the distance of the cloth from the body, so that a 3D statue can be produced from the 2D Shroud. The significance of this is that no painting or photograph has 3D information encoded into it so that the image on the Shroud cannot be a painting or a photograph. Draping a cloth over a statue or a corpse with its surface containing a colorant would only transfer pigment where the cloth was touching the body, which would not produce the smooth gradation of discoloration we see on the Shroud and could not transfer 3D information to the cloth related to the distance of the cloth from the body. The 3D information on the Shroud indicates that the image formation mechanism was not the result of contact between the body and the cloth but was the result of something that acted across the distance between the body and the cloth. This is why, in the four-day conference on the Shroud that I organized in 2017, with day four dedicated to image formation, all the speakers on image formation used radiation as the basis for their hypothesis.

At 7:30, you say the outer discolored depth on a fiber is 0.4 microns. This is probably an older number. This discolored layer on the circumference of an image fiber is now usually quoted as being less than about 0.2 microns (micrometers). I agree that this discolored layer usually goes around the entire fiber.

At 9:20 to 9:30, you say that in the image when one thread goes under another thread, the lower thread is not discolored where it is under the upper thread. I agree but why is this? This indicates that the image was formed by something that flowed from the body to the cloth that was prevented from reaching the lower thread by the upper thread. Again, radiation is a good answer to what could have caused this effect.

At 11:04 to 11:22, you said “the Bishop, d’Archis, who was the Bishop of Troy, he wrote a letter to his pope saying that this was a forgery and it was done by a painter and he knew it was done by a painter because his predecessor had wrong a confession out of the artist who had made it.” I discuss this issue in Section 6.2 of my paper #17, “Evaluation of ‘A BPA Approach to the Shroud of Turin’” on the research page of my website Shroud Research Network. The d’Archis Memorandum is an angry letter written by Pierre d’Archis, Bishop of Troyes, France, to Pope Clement VII in Avignon, France. Troyes is 12 miles from Lirey, France, where the Shroud of Turin was exhibited as the true burial cloth of Jesus by its owner, Geoffrey II de Charny, in about 1355 or 1356. In 1389 it was being exhibited again with permission of Pope Clement VII. This angered Pierre d’Archis, because as Bishop of Troyes with authority over Lirey, his permission should have been required. In the memorandum, Pierre d’Archis claimed that the previous Bishop in Troyes, Bishop Henry de Poitiers, investigated the Shroud when it was previously exhibited in Lirey 34 years earlier (1355 or 1356) and that Poitiers had found a painter who admitted to painting it. The reasons for rejecting this allegation in the d’Archis memorandum are many: 1) We only know about the d’Archis memorandum based on two draft copies, 2) There is no evidence that the memorandum was ever sent to Pope Clement VII, 3) There is no indication that d’Archis had any personal knowledge of this alleged investigation 34 years earlier, he makes no mention of any documentation so he evidently found none, so his allegation is probably based on second-hand hearsay evidence, 4) Though the memorandum is about six pages long, there is only one sentence in the memorandum regarding this painter that admitted that he painted it, though no name is given and no other information, 5) If there was a painter that said he painted the Shroud, he may have only meant that he painted a copy of the Shroud, since there were 40 to 50 copies made of the Shroud, and 6) the Shroud of Turin Research Project (STURP) that spent five days, 24 hours a day, of hands-on scientific examination of the Shroud in 1978 concluded that the images were not due to paint, dye, or stain for multiple reasons. Thus, there is no reliable historical documentation to indicate that the Shroud of Turin originated in the 13th or 14th centuries.

In 11:41 to 12:22, you discuss the painting hypothesis of Walter McCrone. This hypothesis was thoroughly investigated at the time by the 33 members of STURP and rejected. This is documented in the 225 page book “Report on the Shroud of Turin” by Dr. John Heller, 1983. Walter McCrone was not a member of STURP, but was loaned fibers from the Shroud by a member of STURP. It is not clear what McCrone was seeing in his microscope, but it may have been burned red blood cells or iron oxide from the retting (rotting) process used in extracting the linen fibers from the flax plant.

Comments 2, 3, 4, and 5

The following is my comments regarding your statements on my image formation and carbon dating hypotheses for the Shroud of Turin. In general, my responses below are given at the first occurrence of the issue.

Starting at 31:48, you discuss some of the problems that must be solved to determine a workable solution to how the images could have been formed by radiation. These problems that you discuss result from an assumption that the discoloration is a direct result of the damage done by collisions of the protons with the material in the fibers. I have recognized these problems for many years. These problems caused me to realize that the discoloration was evidently caused by secondary effects of the protons, rather than the direct result of proton collisions. I believe you briefly mentioned the possibility of secondary effects of these protons. In my image formation hypothesis, these secondary effects that cause the discoloration are electrical and static discharge effects caused by the deposition of the positive charge of the protons onto the cloth, rather than by direct proton collisions. I could go into great detail regarding this, but I choose not to in this format at this time. To get the details, you can read my next paper (#34) on the research page of

my website Shroud Research Network. I will be writing this paper to document a PowerPoint presentation I will be making at a conference in March.

At 38:08, you discuss the fact that normal emission of radiation is isotropic (equally probable in all directions). But under special conditions, it can also be emitted as coherent radiation, as in a laser. This means that all the radiation travels only in one direction, i.e., collimated, with the oscillation or frequency of each particle in step with each other. This radiation emitted from the body should not be assumed to be “normal” because the Shroud is totally unique, so could have a totally unique cause. Jared points out (39:39) that isotropic emission of radiation in the body would cause the image on the Shroud to simply be a blur, rather than the good resolution image that is on the Shroud. This is true. Jordan also point out (40:10) that if there were isotropic emission of radiation from the body, then we should see side images of the body on the Shroud, which is contrary to the evidence. Thus, to be consistent with the evidence of the good resolution image on the Shroud and no side images, it is reasonable to propose a hypothesis that includes vertically collimated radiation. This is the only type of radiation that could cause the good resolution image on the Shroud and encode the 3D information on the Shroud related to the vertical distance between the body and the cloth. Thus, the vertical collimation of the radiation is required by the evidence on the Shroud.

At 40:50, Jordan brings up the question of what mechanism caused the radiation to be vertically collimated, and acts as if we are not allowed to ask this question. Well, we are allowed to ask this question because the answer may allow us to make predictions that are testable. This is how science is done. But we should also recognize that we should not reject what we can know based on what we may not yet know. Thus, we should not reject the radiation being vertical because it must be vertical based on the evidence from the Shroud. This is logically following the evidence where it leads. What then caused the radiation to be vertically collimated? To correctly answer this question requires us to have experimental evidence from the Shroud that we do not have at this time. This is a good reason for the decision makers to allow additional experiments on the Shroud. I also want to consult with particle physicists and string theorists to determine if there is anything in our current theories, or extrapolation of those theories, that could help us better understand what could have caused this radiation to be vertically collimated. If it turns out that the vertical collimation of the radiation cannot be explained by additional experiments or by theories in particle physics and string theory, then the Shroud could turn out to be the “Rosetta Stone” for an expanded understanding of physics that includes alternate dimensions.

At 41:10, the question of where the protons came from is brought up. This brings up my Vertically Collimated Radiation (VCRB) Hypothesis, which is briefly discussed in some of the papers on my website (Shroud Research Network) and which I communicated to them in my comments to their previous video.

At 45:01, they say it is “supposedly just a coincidence” that the carbon date of the corner of the Shroud to 1260-1390 “just so happens” to agree with the display of the Shroud in about 1355 in Lirey, France. This argument is often used to imply that the carbon date for the Shroud (1260-1390) is confirmed by the date of the Shroud’s exhibition in Lirey, France. I would say that this is simply a matter of historical cherry picking. If the Shroud was carbon dated to 1500 to 1630, then it would be said that this date confirms the Shroud was made just before it was brought into

Turin, Italy in 1578. If the Shroud was carbon dated to 1170 to 1300, then it would be said this confirms that the Shroud was made when the Pray manuscript was made in 1192-1195. If the Shroud was carbon dated to 650 to 780, then it would be said that this confirms that the Shroud was made when the first coin was minted containing an image of the face from the Shroud in 692 AD. If the Shroud was carbon dated to 470 to 600, then it would be said this confirms that the Shroud was made just before the Pantocrator icon was painted. And if the Shroud was carbon dated to 330 to 500, then it would be said this confirms that the Shroud was made when tradition says it was found hidden above a gate in the wall around Edessa, Turkey.

At 46:10, they say that I assumed the neutrons to be vertically collimated in my MCNP nuclear analysis computer calculations, and that they were assumed to be thermal (slow) neutrons. MCNP is a common computer code used for nuclear analysis. The acronym MCNP stands for Monte Carlo N-Particle where N stands for neutrons. I spent about six months doing these MCNP calculations because each calculation would take 6 to 13 hours to run on my desktop computer to follow 30 million neutrons one at a time as they interacted with the all the materials in the model including a limestone tomb as it would have been built in first-century Jerusalem. I ran so many neutrons to give me good statistics in the results. I had to run about 400 such calculations to bound all of the unknowns in the problem, including emitting of neutrons vertically up, vertically down, and with isotropic emission. In my papers, for simplicity, I reported the results of only one of these 400 cases. In this case that was reported, the neutrons were assumed to be emitted isotropically, not vertically (#4 on page 19 of my paper #13 on the research page of my website Shroud Research Network). In the one case I reported, I assumed the neutrons to be emitted at a thermal (slow, 0.025 electron volts) energy but in other cases, I ran the neutron emission energy progressively up into the MEV (million electron volts) energy range. I found that the results were not very sensitive to the initial emission energy because the fast (MEV) neutrons would scatter around in the limestone of the tomb and eventually become thermal (slow) neutrons.

At 46:28, they say there is no explanation for the radiation to be vertically collimated, as though this is an argument against the possibility that it could ever happen. I believe it is true that there is no explanation in our current understanding of physics for radiation emitted in human body to be vertically collimated, at least as far as I know. But such an extremely brief, extremely intense burst of radiation has never been emitted from any human body, whether it is alive or dead, yet these characteristics (extremely brief, extremely intense, vertically collimated) are the characteristics that are required to form the images on the Shroud in a way that is consistent with all the evidence from the Shroud. See my response at 40:50 for further discussion.

At 47:43, Jordan refers to a systemic error in the measurement data that makes it appear that the carbon date depends on the distance from the bottom of the Shroud. In the study of measurement errors, the two types of measurement errors are random measurement errors and systematic measurement errors. It is systematic errors, not systemic errors.

At 49:55, "It seems like we are working backwards here. Yes, what's happening here is that this hypothesis, the problem with it, is that it is completely, utterly, and fully ad hoc. It is starting at the end point and working backwards." In solving a difficult maze, it is often beneficial to work both ends to the middle, i.e., begin at the starting point and work forward, and at the same time,

start at the end point and work backwards. The same applies in trying to solve a difficult scientific problem, such as the carbon dating of the Shroud or how the images were formed. The ultimate question is not the sequence in which the hypothesis was developed but whether the hypothesis is consistent with the evidence and whether it makes predictions that are testable and falsifiable. To develop my hypotheses to explain the carbon dating and the image formation, I started from the evidence that was available from the Shroud and then, for each of the evidences, I asked the question “What could have caused this”. I worked this manner so that I could objectively follow the evidence where it led. For the carbon dating, I started from the average value from the 16 measurements (1200 ± 31), the three average values from the three laboratories which indicated that the carbon date depended on the distance from the bottom of the cloth (slope = 36 years per cm = 91 years per inch), the distribution and range of the 16 individual measurements performed by the three laboratories, and the statistical analysis of all this data. Later I also considered the carbon date for the Sudarium of Oviedo. For development of my image formation hypothesis, I started with the 10 evidences below, then for each of the evidences again I asked the question “What could have caused this” so that I could follow the evidence where it led. The evidences related to the images on the Shroud can be summarized as the following.

1. The pristine nature of the blood that is on the cloth indicates that a crucified man was wrapped in the cloth. This is the main conclusion from the first 75 years (1898 to 1973) of research on the Shroud of Turin.
2. The front and dorsal images have good resolution and are negative images with light and dark areas reversed. These images are not due to pigment, scorch from a hot object, any liquid, or photography.
3. The cloth does not contain images of the sides of the body or the top of the head.
4. Only the top one or two fiber layers in a thread are discolored.
5. Only the outer circumference of the image fibers is discolored.
6. The linen fibers that make up the Shroud have a diameter of about 15 to 20 micrometers, which is about one-fifth the diameter of a human hair. But the discoloration on the circumference of the fibers is less than 0.2 micrometers thick, which is only about 2% of the fiber radius. The inside of the image fibers is not discolored.
7. The discolored fibers occur in a mottled pattern across the area of the images.
8. The discoloration of the thin outer region in a fiber is due to single-electron bonds being changed to double electron bonds in the cellulose of the fiber, as though from an oxidation-dehydration process.
9. The images were encoded even where the cloth would not have been touching the body.
10. The images on the Shroud are 2D images, yet they contain 3D information related to the vertical distance of the cloth from the body.

This process of carefully considering the evidence to develop my hypotheses has taken about nine years of my effort. I hope it is clear that the development of my hypotheses to explain the carbon dating and the image formation has not been a simple ad hoc process. To say that my process of developing my hypotheses is “completely, utterly, and fully ad hoc” is to essentially misunderstand what I have done and the process that I have gone through.

At 50:40, the issue is raised why I proposed that the neutrons and protons came from the splitting deuterium nuclei when “deuterium is super stable”. The answer is that the deuterium nucleus requires less energy input to the nucleus to cause it to split (fission) than any other isotope of any other element.

At 51:00, “He (Rucker) says that only a small number of the deuterium will fission, in fact it is 0.0004% of the deuterium fissions. ... My question is why only 0.0004%.” In response to their request a few days ago, I explained these values in my last comment to their previous video on the carbon dating of the Shroud. There I said “My previous MCNP nuclear analysis computer calculations indicated that a homogeneous emission of 2×10^{18} neutrons in the body would be required to shift the carbon date for the corner of the Shroud from about 33 AD to about 1325 AD, which is the midpoint of 1260-1390 AD. Emission of this number of neutrons from the body is only about one neutron for every ten billion neutrons that were in the body. If 2×10^{18} neutrons were emitted in the body by splitting of deuterium nuclei, it would only require 0.0004% of the deuterium nuclei to split (fission).” This is merely a statement of what it would take to shift the carbon date from 33 AD to 1325 AD, if the Shroud were the burial cloth of Jesus from the first century and if the corner of the Shroud carbon dated to 1260-1390 AD. To accomplish this shift in the carbon date from 33 to 1325 AD at the corner of the Shroud, it would require 2×10^{18} neutrons, if they were emitted homogeneously in the body. This is only one in every 10 billion neutrons that are in the body, and would occur if 0.0004% of the deuterium nuclei in the body were to split. If you doubt these values, perhaps you can calculate them yourselves to check my values. These values are just information to give people a feel for what it would take for the carbon date of the corner of the Shroud to be shifted to 1260-1390 AD if the cloth is the authentic burial cloth of Jesus from 33 AD. There is no reason here is reject my hypothesis to explain the carbon dating or the image formation.

52:10. They are again assuming that I require that the neutrons be emitted in the thermal (slow) energy range so that the protons would also be emitted in the thermal (slow) energy range, so that they would not penetrate sufficiently to discolor the front three fibers. I have explained above that I do not required the neutrons to be emitted in the thermal (slow) energy range, but most of them end up in that energy range after scattering off atoms in the limestone of the tomb. Therefore, the neutrons and protons can be emitted at a higher energy. And again they are creating problems for protons to create the image by assuming that the image is produced by proton collisions in the fibers, whereas my hypothesis is for the deposition of the positive charge of the protons onto the cloth to cause electro-static effects that discolor the fibers by heating in the $0.2 \mu\text{m}$ thick region around the circumference of the fiber and possibly also by electron discharge causing ozone that chemically attacks the fiber from the outside. This is quite different than their assumption.

53:56. “But that doesn’t work because he (Rucker) needs way more neutrons than protons, orders of magnitude more.” This results from his assumption that the neutrons and protons are emitted by deuterium splitting on the surface of the body, which is not my hypothesis. My hypothesis is for the source of the protons and neutrons to be homogeneous (uniform) throughout the body. A high percentage of the neutrons would escape from the body, probably over 99% depending on the energy with which they are emitted. A much lower percentage of the protons would escape the body but it would again depend on the energy with which the protons are

emitted. My estimate that the image could be formed if about 20% of the protons exited the body is an estimate based on Dr. Art Lind's experiments of proton irradiation of linen titled "Image Formation by Protons" available on Mark Antonacci's website.

55:00. "The word he (Rucker) uses is astonishing." I am not sure I remember using this word but I may have used it regarding the agreement between my MCNP calculations and the results of the three laboratories regarding the dependence of the carbon date on the distance from the bottom of the cloth. The experimental value of this dependence from the three laboratories is a slope (the rate at which the carbon date changes as the distance from the bottom of the cloth increases) of about 36 years per cm = 91 years per inch, and the MCNP calculations produced a very similar slope. This was astonishing to me when MCNP first calculated these results.

55:16 "It should be astonishing to absolutely nobody because that is the input to his model." Has he reviewed my MCNP input file to determine whether this is true? No. If he had my MCNP file in front of him, would he know how to make sense of it? Probably not. None of my input into MCNP forced it to calculate the same slope for the carbon date (as a function of the distance from the bottom of the cloth) as produced by the carbon date measurements from the three laboratories. To have this very close agreement between theory (my MCNP calculations) and experiments (carbon date results from the three laboratories) indicates that my hypothesis of neutron emission in the body has significant merit.

55:19 "If you take nothing else away from this very long diatribe on radiation, understand this. Rucker's model has no value because all of the known data points are input to his model. It cannot help but to match that." Is it true that "all of the known data points are input" to the model that I used in MCNP? What did I model in MACNP? In MCNP, I modeled a horizontal human body using simple geometrical volumes, surrounded by linen cloth in a box geometry, laying with the head to the right on the back bench in a limestone tomb as it would have been designed in first century Jerusalem. I had to run about 400 MCNP calculations to bound (low to high values) all the variables for which I did not have specific values, including neutron emission energy, neutron emission direction, distance of the toes from the limestone wall, etc. None of this included any of the "known data points". What are the "known data points"? There are four "known data points" relevant to the carbon dating of Shroud. They are:

1. All samples sent to the three dating laboratories were cut from the Shroud at the same time in 1988. These samples were cut next to each other from the corner of the Shroud. The dating laboratories were in Oxford England, Zurich Switzerland, and in Tucson Arizona. Each of the three laboratories then cut their sample into multiple subsamples, so that 16 subsamples were carbon dated. An average carbon date was then calculated for each laboratory using the carbon dates that were measured at that laboratory. These laboratory average values were then combined into one overall average value: 1260 ± 31 AD. This "uncorrected value" was then corrected for the changing concentration of the carbon-14 in the atmosphere. This correction process produced a range of 1260 to 1390 AD. The central date of this range is 1325 AD. The range of 1260-1390 supposedly has 95% probability of containing the true date, but this is only true if the uncorrected value of 1260 ± 31 years is known with certainty. This uncorrected value of 1260 ± 31 years should be rejected due to the probable presence of a systematic measurement error that

caused the measured values to be “heterogeneous” or “non-homogeneous”, as indicated by four papers in peer-reviewed journals. This is a very detailed study that can be ignored at this point. The bottom line is that the first “known data point” is the 1325 date for the average of the 16 subsample measurements.

2. The second “known data point” is the average date for each of the three laboratories: 1201 ± 31 , 1274 ± 24 , and 1303 ± 17 for Oxford, Zurich, and Tucson, respectively. These values indicate that the carbon date depends on the distance from the bottom of the cloth, at the rate of 36 years per cm = 91 years per inch. A chi-squared statistical analysis of these values indicates there is only a 1.4% chance (bottom of column 1 in Table 5 of my paper #12 on my website Shroud Research Network) these values are consistent with each other, which is below the usual 5% criteria. This indicates the probable presence of a systematic measurement error in the data. Since it is not possible to determine the magnitude of this systematic error, the only option is to reject the conclusion that the Shroud dates to 1260-1390 AD.
3. The third “known data point” is the 16 carbon dates for the 16 subsamples. These values are available in Table 6 of my paper #12 “The Carbon Dating Problem for the Shroud of Turin, Part 2: Statistical Analysis” on the research page of my website Shroud Research Network.
4. The fourth “known data point” is the measured carbon date of about 700 AD for the Sudarium of Oviedo, which is believed to be the face or head cloth for Jesus mentioned in John 20:7.

These are four requirements that a carbon dating hypothesis must satisfy to be true.

It was said that “Rucker’s model has no value because all of the known data points are input to his model.” Is it true that the overall average value (1325 AD), the three laboratory average values (1201 ± 31 , 1274 ± 24 , and 1303 ± 17), all the 16 carbon dates for the 16 subsamples, and the 700 AD value for the Sudarium of Oviedo are all “input to his model”? No. I will try to clarify the confusion on this issue.

When MCNP is run, the output values are normalized to one neutron in the model. To have the values meaningful, the output values must to be renormalized to something that is of significance. For example, if I was running MCNP for a nuclear reactor, I would normalize all the output values to the power level of the nuclear reactor, so that they would have the correct values for that power level. For my Shroud calculations in MCNP, the only thing that I could renormalize the output values to is the average carbon date for the 1988 samples obtained by the three laboratories, either 1260 AD for the uncorrected value or 1325 AD, for the midpoint of the corrected range 1260-1390 AD. For the MCNP calculations I performed in 2014, I chose to renormalize the output values to the uncorrected 1260 date though I now believe the corrected date of 1325 would have been more appropriate. From the MCNP output that was normalized to one neutron, I was able to calculate how many neutrons would have to be emitted from the body to result in a carbon date at the 1988 sample area of 1260 AD. This number was about 2×10^{18} neutrons. I then renormalized all the MCNP output values by multiplying them by 2×10^{18} neutrons. This was done in EXCEL. The result was that the carbon date at the 1988 sample location was 1260 AD. This is the “known data point” #1 above.

The neutron absorption hypothesis can be stated as follows: “If 2×10^{18} neutrons are emitted uniformly in the body, then all four of the above requirements are satisfied.” Each of these requirements is one of the four “known data points”:

1. The carbon date at the 1988 sample location should be 1260, or 1325, whichever is chosen. This is automatically satisfied by assuming that the correct number of neutrons (2×10^{18}) is emitted in the body to shift the carbon date for the 1988 sample location from 33 to 1260 AD.
2. MCNP calculated a value at the 1988 sample location that was very close to the experimental value of 36 years per cm. There was nothing put into MCNP that forced the code to calculate the same slope to the data as the measurements indicated. Thus, theory (MCNP calculations) was in close agreement with experiments (carbon dates measured by the three laboratories).
3. The MCNP calculations in 2014 did not have sufficient spatial resolution to confirm the distribution and range of the carbon dates for the 16 subsamples. I need to restart my MCNP calculations with a finer spatial resolution to confirm the distribution and range of the carbon dates for the 16 subsamples.
4. After I finished my MCNP calculations related to the carbon dating of the Shroud, it occurred to me that there was also the carbon dating of the Sudarium of Oviedo, which as the face or head cloth of Jesus (John 20:7) so is related to the Shroud. It was my understanding at the time that the Sudarium was carbon dated to about 700 AD, though these measurements were not well documented. The problem is where the Sudarium may have been placed in the tomb. In thinking about it, it occurred to me that the most likely place for the Sudarium to have been dropped in the tomb was probably on the right bench, because most people are right handed, and to the side of the person doing the burial, who would have been at the front of the pit or stand-up area in the tomb. Thus, after he took the face cloth off the body, he most likely would have dropped the face cloth on the right bench where his right arm and hand (with his arm hanging down) would have been located, about 15 to 18 inches in front of the back bench where the body would have been located. This was my prediction. I then took my previous case and inserted a linen layer on the top of the right and left benches in the tomb, and then reran this new MCNP case. When I got the MCNP calculated results back, I found that my predicted location for the face cloth on the right bench had a carbon date of about 700 AD, in very good agreement with the experimental values. No aspect of my input into MCNP forced the code to give such good results between my predicted location for the face cloth and the measured carbon date of the Sudarium.

Thus, the above requirements #1, #2, and #4 are satisfied for my hypothesis, and requirement #3 needs to be further tested by running MCNP with a finer spatial resolution. These are the four “known data points” related to carbon dating of the Shroud, and only #1 is true because I normalized all the values to the correct number of neutrons (2×10^{18}) to shift the carbon date from 33 to 1260 AD at the 1988 sample location.

55:58 “He normalizes his curve so it automatically agrees with the first requirement.” As explained above, this is exactly appropriate. It is the good agreement for requirements #2 (slope) and #4 (face cloth) that indicates my assumption of neutron emission from the body has merit.

There is nothing in my input to MCNP that forced the computer to calculate this good agreement.

56:04 Regarding the good agreement for the face cloth, see 4 above on the face cloth. MCNP calculated the correct carbon date for the face cloth for my predicted most likely location for it in the tomb. I did not put it there to give me the answer that I wanted. I predicted the location, then calculated the dates, which for the predicted location, were in good agreement with the experiments.

58:56 Regarding the curve of the carbon dates for the 16 subsamples. As I stated above, “A chi-squared statistical analysis of these values indicates there is only a 1.4% chance (bottom of column 1 in Table 5 of my paper #12 on my website Shroud Research Network) these values are consistent with each other, which is below the usual 5% criteria. This indicates the probable presence of a systematic measurement error in the data. Since it is not possible to determine the magnitude of this systematic error, the only option is to reject the conclusion that the Shroud dates to 1260-1390 AD.”

1:00:08 “Or, what if Oxford was 0.7% better at eliminating contaminant because they had different lab cleaning methods, which they did. ... All you need is 0.7% more contamination cleaned by Oxford and it explains everything.” Let’s analyze this. The vertical axis is labelled RCYBP, which refers to Radio Carbon Years Before Present, where present is defined as 1950. If we translate this into years AD, then, as I state above, the dates are “1201 ± 31, 1274 ± 24, and 1303 ± 17 for Oxford, Zurich, and Tucson, respectively”. His statement “All you need is 0.7% more contamination cleaned by Oxford and it explains everything.” means that if 0.7% more contamination is cleaned from the Oxford subsamples, then it would decrease the date from 1303 to perhaps 1238, which is the average of 1201 and 1274, or perhaps Zurich’s value of 1274. What contamination is he referring to specifically? If this contamination were more effectively cleaned from the subsamples, how does he know which way the date would change and how much it would change? Where does this 0.7% come from? What is his reference for it? The reference that I think of is “On Cleaning Methods and the Raw Radiocarbon Data from the Shroud of Turin” by Larry Schwalbe and Bryan Walsh, in *International Journal of Archeology*, 2021, but I do not find the 0.7% value there. The following makes me skeptical about this suggestion of contamination to explain the different dates from the three laboratories.

1. Lack of specifics. What is the contamination? How does it affect the carbon date? How do we know which direction the carbon date would change with further cleaning? Where does the 0.7% come from?
2. There is no evidence for this hypothetical contamination.
3. Three cloth standards of known historical dates were dated by the same laboratories at the same time as the Shroud samples. The effectiveness of the laboratory’s cleaning methods can be determined from the dates obtained for these three cloth standards. There is not a significant difference in the three laboratory’s dates for the three cloth standards, so that this alleged need for further cleaning of the Oxford subsamples is not confirmed.
4. In the analysis of the cleaning methods in the above reference (Figure 1 of Schwalbe and Walsh), they recognized the presence of a bifurcation (division into two branches or parts) of the dates obtained at Arizona and Zurich, which was not present at Oxford.

They were unable to explain this from the perspective of cleaning methods, but it can easily be explained using the neutron absorption hypothesis, considering the direction in which the subsamples were cut from the samples. Arizona and Zurich evidently cut their sample horizontally and vertically to obtain their subsamples, whereas Oxford only cut their sample vertically. The specific locations of these subsamples relative to the shape of the neutron distribution in the tomb can explain this date bifurcation. The point is that cleaning methods do not explain this bifurcation whereas the neutron absorption hypothesis can explain it.

Also at 31:06, you mentioned Jean-Baptiste Rinaudo's experiments with protons. His experiments were presented at a previous conference on the Shroud of Turin ["Modello protonico di formazione dell'immagine sulla Sindone di Torino" (Protonic Model of Image Formation on the Shroud of Turin) presented June 6, 1998, in Torino, Italy, at the III Congresso Internazionale Di Studi Sulla Sindone (3rd International Congress of Studies on the Shroud)] and handouts were distributed at that conference, but I don't believe his work was further documented. A more recent reference is Dr. Arthur C. Lind, "Image Formation by Protons".

Video titled "The Shroud of Turin is Fake" on Reasons to Doubt

This is their first video on the Shroud of Turin. The duration is 58:47 minutes. My comments that were submitted to Reasons to Doubt regarding this video are below.

Comment 1

The 1988 carbon dating of the Shroud concluded that the Shroud dates to 1260-1390 with a 95% confidence, based on a mean (average) date of the 16 subsamples equal to 1260 ± 31 . But this mean date of 1260 ± 31 does not take into account that the individual average dates from the three laboratories indicates that the measured carbon date depends on the distance of the sample location from the bottom of the cloth (slope of the date as a function of the distance from the bottom of the cloth = about 36 years per cm = 91 years per inch), which should not be the case. It also does not take into account the distribution and range (1155 to 1410 AD) of the 16 subsamples that were dated. When a statistical analysis is performed on all the data released by the British Museum in 2017, it is concluded that the measured data very likely included a systematic measurement error that caused the samples to be heterogeneous (non-homogeneous), as concluded in four papers in peer-reviewed journals. The magnitude of this measurement error cannot be determined, so the only option is to reject the results, i.e. give no credibility to the carbon date of 1260-1390. This conclusion cannot be voided by simply saying there could have been contamination present when there is no evidence for such contamination. If it is not proven that contamination caused the systematic measurement error, then the 1260-1390 carbon date must still be rejected due to the presence of this systematic measurement error.

Carbon dating is done by measuring the ratio of C-14 to C-12 in samples. The systematic measurement error indicated by the measurement data for the Shroud could either be due to errors in the measurements of the C^{14}/C^{12} ratio for the samples, or due to the C^{14}/C^{12} ratio in the samples being altered. When the Shroud was dated in 1988, three standards were also dated.

These three standards were cloth with known historical dates. These historical dates were confirmed with reasonable accuracy by the carbon dating process in 1988, which confirms that the C^{14}/C^{12} ratios were being measured with acceptable accuracy. Thus, it can be concluded that the systematic measurement error indicated by the data for the Shroud was very likely not caused by a measurement error of the C^{14}/C^{12} ratios for the Shroud samples but was rather due to the C^{14}/C^{12} ratios for the samples being altered by some process. I have proposed the neutron absorption hypothesis to explain this conclusion. In this hypothesis, neutron absorption in the trace amount of N-14 in the cloth produces new C-14 which increased the C^{14}/C^{12} ratios for the samples, thus shifting the carbon date in the forward direction. This was first proposed by Tom Phillips in 1988 in the journal *Nature*. It was the first concept proposed to explain the 1988 carbon dating of the Shroud.

I have been researching the Shroud of Turin for the last nine years, focusing on the carbon dating of the Shroud. I have written 33 papers on the Shroud that are available on the research page of my website Shroud Research Network. 13 of these papers are on the carbon dating of the Shroud. I have been focusing on the carbon dating because I am a nuclear engineer (MS, Nuclear Engineering, University of Michigan, 1971) and worked in the nuclear industry for 38 years primarily running nuclear analysis computer calculations for nuclear reactor design. In discussing the carbon dating on YouTube, you should also interact with my work, which proposes the neutron absorption hypothesis to explain the carbon dating of the Shroud. It is the only hypothesis that is consistent with all the carbon dating results. I recommend you read my last paper (#33) titled "Solving the Carbon Dating Problem for the Shroud of Turin". The neutron absorption hypothesis is one part of the larger Vertically Collimated Radiation Burst (VCRB) hypothesis that also includes a hypothesis to explain how the images were formed on the Shroud, so that the explanation for the carbon dating is interrelated with formation of the images. Please contact me if you would like to discuss this subject. I can also be available to be on your show or on Dale Glover's show, Real Seekers Ministry.

To be honest seekers of truth, you need to recognize your presuppositions as bias, and then adjust your thinking so that you start your considerations with neutral presuppositions. If you do not do this then your conclusions can easily be just the result of a goal-oriented thinking process, which is nothing but circular reasoning, i.e., if you assume the Shroud cannot be authentic, then you can conclude that the Shroud cannot be authentic. This is a serious problem for research on the Shroud of Turin because it is simpler for our minds to think in terms of what we already believe to be true. If you can adjust your thinking to achieve neutral presuppositions, then you can correctly follow the evidence where it leads.

Comment 2

I do not think in terms of miracles, the miraculous, or the supernatural. I have learned that it is beneficial in doing Shroud research to think in purely scientific terms. I do not use these terms because people have so many different definitions of them that it only leads to misunderstandings. For example, when you use the term "supernatural", do you only mean something that is above or outside the natural order of things, or do you include the concept of God doing something that can be observed in our reality, or do you define this as an event that contradicts the laws of physics? I hope you see my point. But I think it is correct to allow for

the possibility of events occurring that are outside of our current understanding of the laws of physics. This view recognizes that:

- 1) Naturalism cannot be scientifically or philosophically proven to be true. Naturalism is the assumption that explanations of phenomena are only allowed if they are consistent with the laws of physics as we currently understand them.
- 2) In the past history of physics, we have discovered many new phenomena and new laws of physics that we previously did not know.
- 3) We may not have perfect knowledge of what is possible.
- 4) We may not have perfect understanding of the totality of reality.
- 5) There may be extra dimensions that our scientific methods cannot access. Due to experiments in modern physics that cannot be explained in terms of our perception of four dimensions (three dimensions in space and one dimension in time), string theorists have postulated that between 10 and 26 dimensions are needed to explain these experimental results. Thus, our four-dimensional perception of reality may be only a very small part of the 10 to 26 dimensions that appear to be necessary.
- 6) There are many types of unexplained phenomena that may require extra dimensions for us to fully understand such as human consciousness, the origin of the universe, dark matter, dark energy, the first life arising from dead chemicals, the information required for the transitions between the various kinds of living organisms with a systematic lack of transitional fossils in the fossil record, UFOs/UAPs that apparently do not obey the laws of physics of our universe, post-death visions and experiences, etc.

In assuming naturalism, you automatically reject an entire category of explanations that may be the best explanation for the scientific evidence that is available. If we are open-minded and want the truth, we should not do this.

Comment 3

Science is done by the development of hypotheses to explain phenomena. I previously developed my neutron absorption hypothesis which is now an integral part of my vertically collimated radiation burst (VCRB) hypothesis. The VCRB hypothesis is currently under development but even at this stage of development, would be categorized as a very good hypothesis because it satisfies three criteria: 1) it is consistent with all the evidence, 2) it makes predictions that are testable and falsifiable, and some of which are unique, and 3) it proposes explanations to multiple mysteries of the Shroud. The VCRB hypothesis is the only concept regarding the Shroud that is consistent with these three criteria. This hypothesis proposes explanations for how the front and dorsal (back) images were formed, how the corner of the Shroud could be carbon date to 1260-1390 even though the cloth could be from the first century, and provides a possible explanation for how the blood that would have dried on the body could have been transferred to the cloth even though dried blood does not absorb into cloth. The evidence for the VCRB hypothesis is its unique consistency with the evidence, but as with any hypothesis, testing of its predictions will be necessary to achieve general belief that it is true. This is the normal process of science.

To determine how the front and dorsal images were formed on the Shroud, we need to first consider the evidence from the Shroud. Ancient tradition has long claimed that the Shroud of Turin is the authentic burial cloth of Jesus due to the presence of the full-size images of a man on the cloth that was crucified exactly as Jesus is described as being crucified in the New Testament. Scientific testing in 1978 by the Shroud of Turin Research Project concluded that the discoloration of the fibers that cause the images is not due to pigment, scorch from a hot object, any liquid, or photography. The characteristics of the images include the following:

- The front and dorsal images have good resolution and are negative images with light and dark areas reversed. These images are not due to pigment, scorch from a hot object, any liquid, or photography.
- The cloth does not contain images of the sides of the body or the top of the head.
- Only the top one or two fiber layers in a thread are discolored.
- Only the outer circumference of the image fibers is discolored.
- The linen fibers that make up the Shroud have a diameter of about 15 to 20 micrometers, which is about one-fifth the diameter of a human hair. But the discoloration on the circumference of the fibers is less than 0.2 micrometers thick, which is only about 2% of the fiber radius. The inside of the image fibers is not discolored.
- The discolored fibers occur in a mottled pattern across the area of the images.
- The discoloration of the thin outer region in a fiber is due to single-electron bonds being changed to double electron bonds in the cellulose of the fiber, as though from an oxidation-dehydration process.
- The images were encoded even where the cloth would not have been touching the body.
- The images on the Shroud are 2D images, yet they contain 3D information related to the vertical distance of the cloth from the body.
- Real blood is on the cloth consistent with a crucified man being wrapped in the cloth.

Several hypotheses have been proposed to explain the images but in general fail to be consistent with all the above evidence. The Vertically Collimated Radiation Burst (VCRB) Hypothesis was derived from the above evidence so that it is consistent with the above evidence. Development of this hypothesis was done by following the scientific evidence where it leads. This process was done with neutral presuppositions so that my presuppositions would not be imposed on my interpretation of the evidence. This process was done by asking the question “What would produce this effect?” upon consideration of each evidence from the Shroud.

The VCRB hypothesis proposes that a very brief intense burst of vertically collimated radiation was emitted within the body. My previous papers on Shroud Research Network list the many reasons that radiation is the best explanation for the images. The evidence listed above is most consistent with the radiation that formed the images being charged particles, though the possibility of some electromagnetic radiation being present cannot be excluded. A human body is composed of atoms that are composed of protons, neutrons, and electrons. The weight of the man that is imaged on the Shroud is estimated to be about 77 to 79 kg (170 to 175 pounds). I calculated the number of protons in such a body to be about 2×10^{28} . There would also be an equal number of electrons and a somewhat larger number of neutrons. Some previous Shroud researchers have suggested that proton radiation is the main contributor to image formation, which I also believe is most likely. As also suggested by previous researchers, it is most

reasonable to assume that the protons were emitted by splitting (fission) of deuterium nuclei in the body since less energy is required to split the deuterium nucleus than an isotope from any other element. My previous MCNP nuclear analysis computer calculations indicated that a homogeneous emission of 2×10^{18} neutrons in the body would be required to shift the carbon date for the corner of the Shroud from about 33 AD to about 1325 AD, which is the midpoint of 1260-1390 AD. Emission of this number of neutrons from the body is only about one neutron for every ten billion neutrons that were in the body. If 2×10^{18} neutrons were emitted in the body by splitting of deuterium nuclei, it would only require 0.0004% of the deuterium nuclei to split (fission). Splitting of these deuterium nuclei would emit the same number of protons, i.e. 2×10^{18} . Based on experiments by Dr. Art Lind on proton irradiation of linen, I calculated that about 20% of these protons would be needed to produce the front and back images on the Shroud. This is consistent with the majority of protons emitted in the body being absorbed in the body, with only about 20% of them exiting the body. These protons that exited the body would have carried the information to the cloth that was required to control which fibers were to be discolored and the length of that discoloration so that the images of the front and back of a crucified man could be formed on the cloth. If you look through all of our historical documents, these images of a man that was crucified exactly as Jesus was crucified and their formation by a burst of radiation from within the body is only consistent with Jesus in his resurrection.