MORE THAN 10 REASONS

TO BUY FUJIFILM BRANDED LTO TAPES

2018

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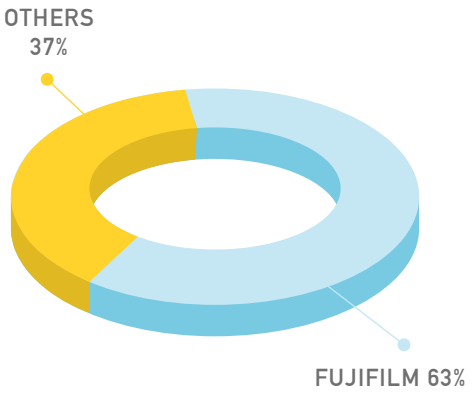
MARKET SHARE

FUJIFILM IS THE WORLD'S LARGEST MANUFACTURER OF LTO TAPES

We can cite a few figures that are fairly representative of Fujifilm's strong presence in the LTO tape market.

1. LTO TAPES MANUFACTURING SHARES – ALL GENERATIONS

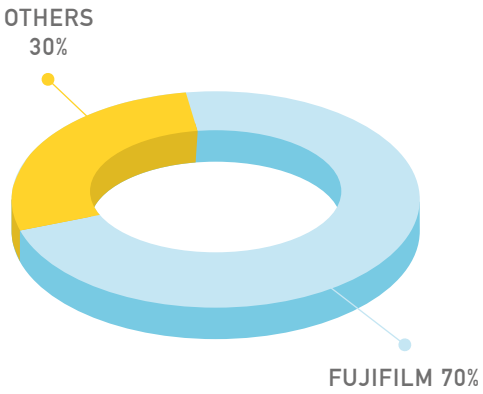
(All figures in % of qty. delivered to the market)



Almost two out of three LTO tapes delivered worldwide are manufactured in Fujifilm's factories.

2. MANUFACTURING SHARES FOR NEW LTO GENERATIONS (LTO6 & LTO7)

(All figures in % of qty. delivered to the market)

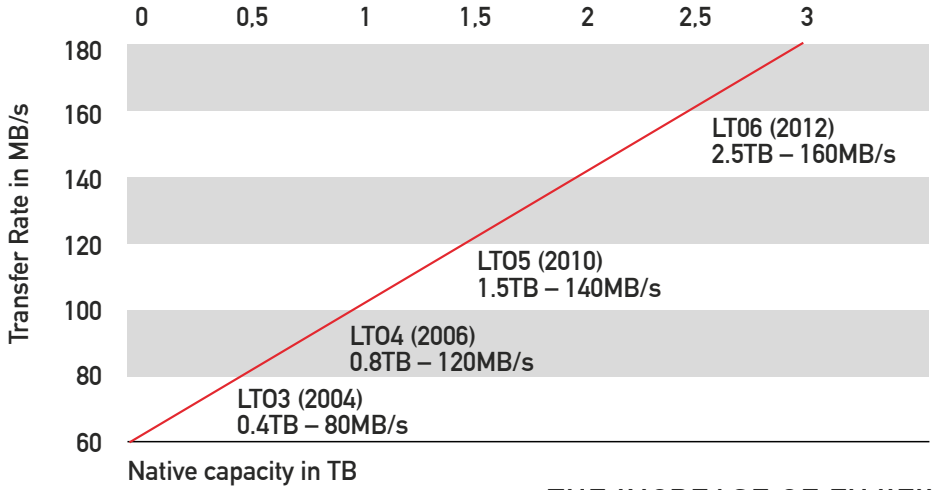


Fujifilm's manufacturing share for the last two generations of LTO tapes is even more important.

We can also see that the manufacturing shares of older generations such as LTO3 and LTO4 were traditionally lower for Fujifilm (around 40%). LTO5 was the first LTO tape generation that allowed Fujifilm to exceed 50% in global manufacturing.

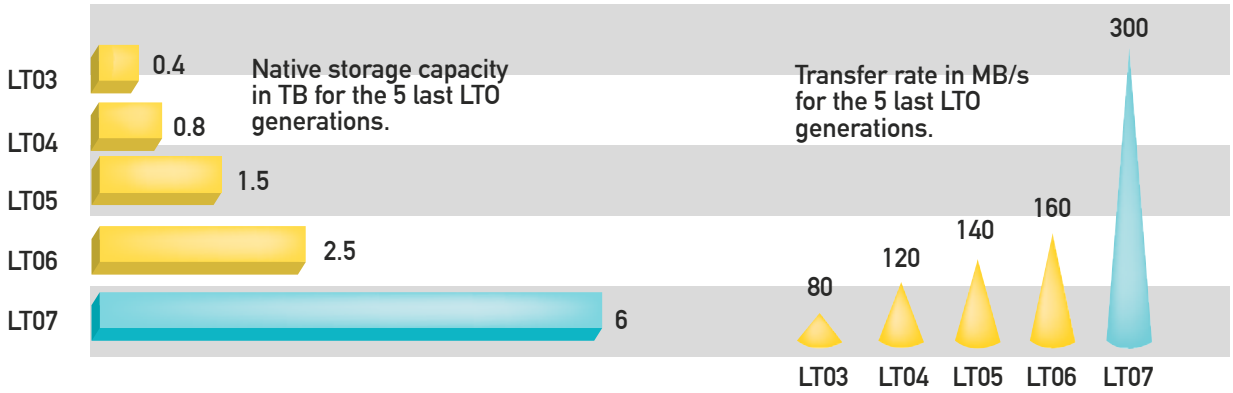
- Why is Fujifilm's manufacturing share increasing for new generations of LTO tapes?

As the market demand in terms of capacity and performance grew, Fujifilm was the only company to invest and develop new storage tape manufacturing technologies. Other manufacturers simply used the same traditional manufacturing method that had been used for former generations of LTO tape.
If we compare the evolution in the performance of LTO tapes, we can see that the manufacturing challenge is not the same for LTO3 tapes as it is for LTO6 tapes. Below, you can see the ratio "native storage capacity in TB vs transfer rate in MB/s" for four generations of LTO tapes launched between 2004 and 2012.

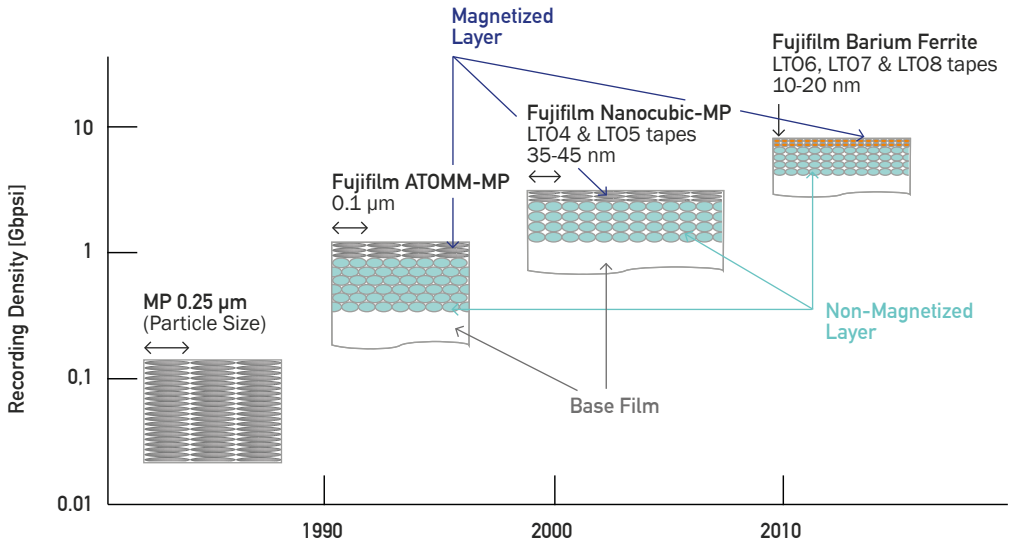


THE INCREASE OF FUJIFILM'S MARKET SHARE IS PROPORTIONAL TO THE INCREASE OF LTO TAPE PERFORMANCE.

Please note, the capacity and speed of LTO7 represent an unprecedented leap forward.



Below, you will find the evolution of the technologies created and developed by Fujifilm, in order to meet the growing demand of the market.



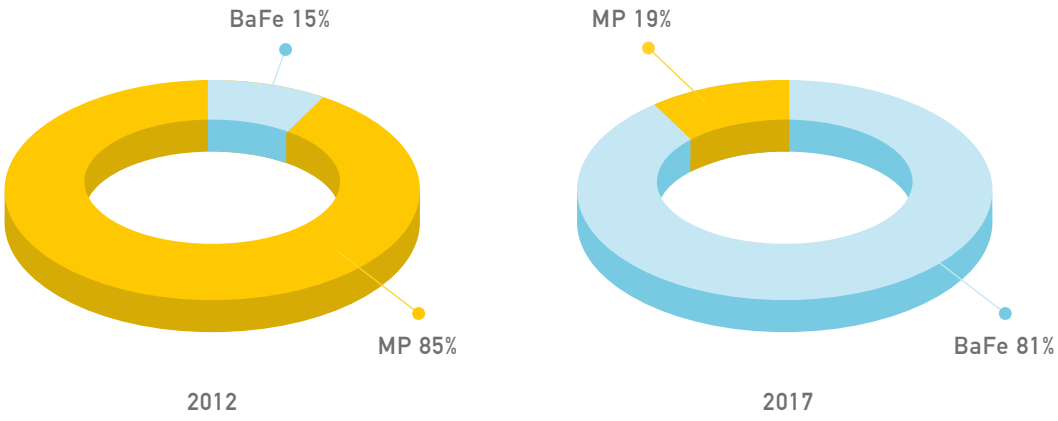
3. MANUFACTURING SHARE PER TAPE COATING TECHNOLOGY:

In order to manufacture higher-capacity & higher performance tape cartridges, Fujifilm has opted for the use of its new tape coating technology, Barium Ferrite.

- The first generation of LTO tapes made from Barium Ferrite is LTO6.
- Fujifilm is the only LTO tape manufacturer using Barium Ferrite technology.
- The other LTO6 tape manufacturers made the decision to continue the use of the old tape coating method, Metal Particles (MP).

⟶ Fujifilm believes that the use of the old technology for the production of LTO6 tapes is synonymous with reduced tape cartridge performance and with a higher risk to data integrity.

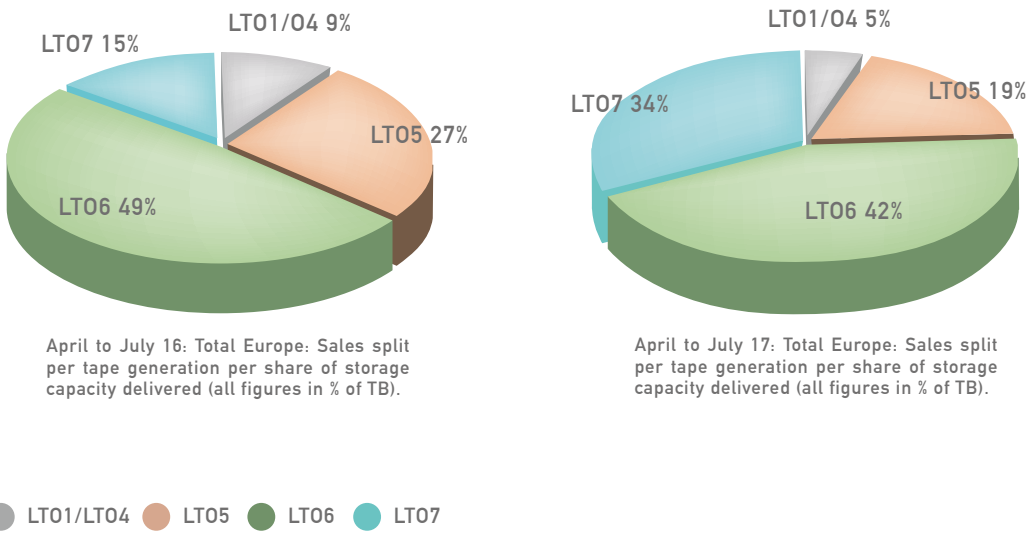
The graphs below show the evolution of the share of storage capacity delivered on all existing tape formats. Therefore, figure includes LTO tapes, IBM 3592 tapes, and Oracle T10000 tapes.



It is clear here that Barium Ferrite is the winning technology in the field of the manufacture of storage tapes.

4. WHAT IS THE BEST SELLING LTO CARTRIDGE IN 2017?

Below, is an estimate of the share per LTO tape generation of the storage capacity delivered on the European market in 2017. All figures are in % of storage capacity.

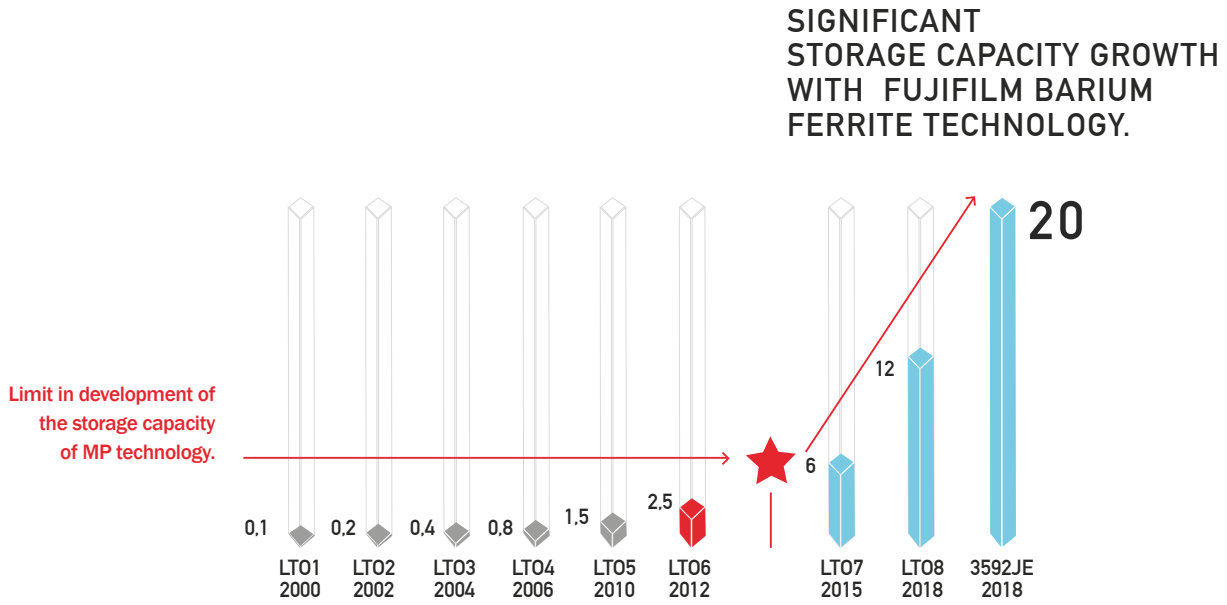


April to July 16: Total Europe: Sales split per tape generation per share of storage capacity delivered (all figures in % of TB).

April to July 17: Total Europe: Sales split per tape generation per share of storage capacity delivered (all figures in % of TB).

5. Why is MP technology gradually disappearing in favour of Fujifilm's Barium Ferrite technology?

Below, is the evolution of the native capacities of storage tapes and the production limit of the old MP technology. All figures are in TB.



CONCLU-SION

- MP (Metal Particle) technology, in competition with Fujifilm's Barium Ferrite technology, is gradually disappearing from the global data storage market.
- The decline in sales of MP tapes is due to the fact that MP technology does not produce tapes of a higher capacity than LTO6 tapes (2.5TB).
- On the other hand, we will see that Fujifilm's LTO6 Barium Ferrite tapes have higher performance and safety levels than LTO6 MP tapes. This difference in quality affects the sale of LTO6 tapes in favour of Barium Ferrite technology.

The organic migration of older generations of LTO tapes (LTO3 to LTO6) to new tapes (LTO7 and LTO8) will considerably reduce the market share of MP technology.

HIGHER PERFORMANCE AND SAFETY LEVELS.

2 TAPE PERFOR-MANCE

1. The data integrity of Fujifilm tapes is higher than that of traditional MP tapes.

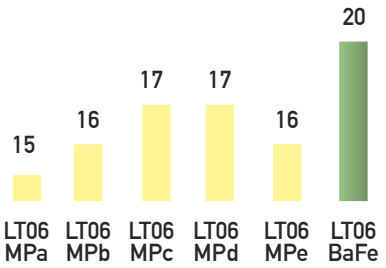
This means that the risk of data loss is lower. Below, is a summary of the mechanism of improvement in the data integrity. You can also find the full description of the process in the Fujifilm document entitled “The role of Barium Ferrite technology in data storage September 17 UK”.

Data Integrity on a storage medium largely depends on the SNR (Signal-to- Noise Ratio).

The SNR
(Signal-to-Noise Ratio) expresses the clarity of the signal transmitted between the tape and the drive head.

The SNR measures the difference between the emitted magnetic signal and the background noise generated when using the drive.
We, therefore, have a positive value and a negative value.

The SNR level of LTO6 Barium Ferrite tapes of Fujifilm is higher than that of the MP tapes. Please see as follows:



The Data recorded with an SNR level that is too low, becomes illegible over time. This results in the loss of data.

The SNR level of Fujifilm branded LTO4 and LTO5 tapes is higher than that of traditional MP tapes.

We could compare the quality of the SNR with the quality of an ink with which one writes on paper. A good level of SNR allows for a better reading of the data.

OVER THE NEXT PAGES OF THIS DOCUMENT, WE WILL SEE THAT THE POSITIVE OR NEGATIVE CONSEQUENCES OF THE SNR LEVEL CAN AFFECT VARIOUS FIELDS SUCH AS: WRITING ERRORS, LOSS OF STORAGE CAPACITY, LIFETIME OF THE DRIVE OR THE WRITING SPEED....

2. WHY DO FUJIFILM TAPES OFFER A HIGHER LEVEL OF SNR?

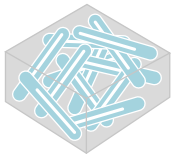
For two main reasons:

IMPROVING DATA INTEGRITY

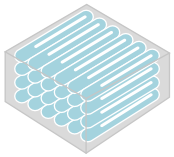
THE CONTRIBUTION OF NANOCUBIC TECHNOLOGY

USED FOR MANUFACTURING: LTO4, LTO5, LTO6, LTO7 & LTO8 tapes

INNOVATION AND PROGRESS: Nanocubic technology allows a better dispersion, alignment and orientation of particles on the surface of the tape.



Natural positioning of Metal Particles.



Aligned positioning of Metal Particles with Nano-dispersion.

THE CONTRIBUTION OF BARIUM FERRITE TECHNOLOGY

USED FOR MANUFACTURING: LTO6, LTO7 & LTO8 tapes

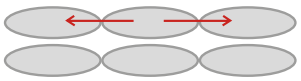
INNOVATION AND PROGRESS: Barium Ferrite technology, thanks to the vertical polarization of its particles, offers a magnetic output that MP technology cannot compete with.

METAL PARTICLES
Low level of SNR

BAFE PARTICLES
High level of SNR

Horizontal polarization of particles.

Vertical polarization of particles.



1.MP technology's horizontally polarized particles generate opposite magnetic forces and thus a chaotic noise that hurts the transmission of the signals. From LTO6, the large number of particles increases the risk of data loss.

2.The vertical polarization of BaFe causes the particles to emit the signals directly in the direction of the drive head = less noise pollution, higher output power and less data loss or write errors.

1. A HIGHER LEVEL OF SNR,
2. THEREFORE, A BETTER DATA INTEGRITY,
3. LESS LOSS OF DATA OVER TIME AND
4. FEWER WRITE ERRORS.

3. FUJIFILM BRANDED LTO TAPES REDUCE THE RISK OF STORAGE CAPACITY LOSS.

WE HAVE SEEN THAT A LOW LEVEL OF SNR GENERATES WRITE ERRORS.

WE HAVE ALSO SEEN THAT FUJIFILM'S LTO4, LTO5, LTO6 AND LTO7 TAPES OFFER A HIGHER SNR LEVEL THAN COMPETING TECHNOLOGIES.

WHEN A DATA IS WRITTEN WITH A LOW LEVEL OF SNR, THE DRIVE HEAD CANNOT RECOGNIZE IT.

DATA → Data written with a good snr level, Thus readable.

DATA → Data written with a low SNR level, Thus unreadable.

WHEN THE DRIVE HEAD NOTIFIES A WRITE ERROR, THE HEAD DOES NOT ERASE THE WRITTEN DATA, BUT REWRITES IT TO A NEW DATA BLOCK.

DATA | DATA

The data is written on the next block.

→ WRITE ERRORS GENERATE A LOSS OF TAPE CAPACITY.

In order to limit the capacity loss of a tape cartridge, manufacturers add an additional amount of capacity, to absorb the loss of capacity from write errors. This delta of additional capacity corresponds to 3% of the total capacity of the tape, namely:
- 45GB for the LTO5
- 75GB for the LTO6

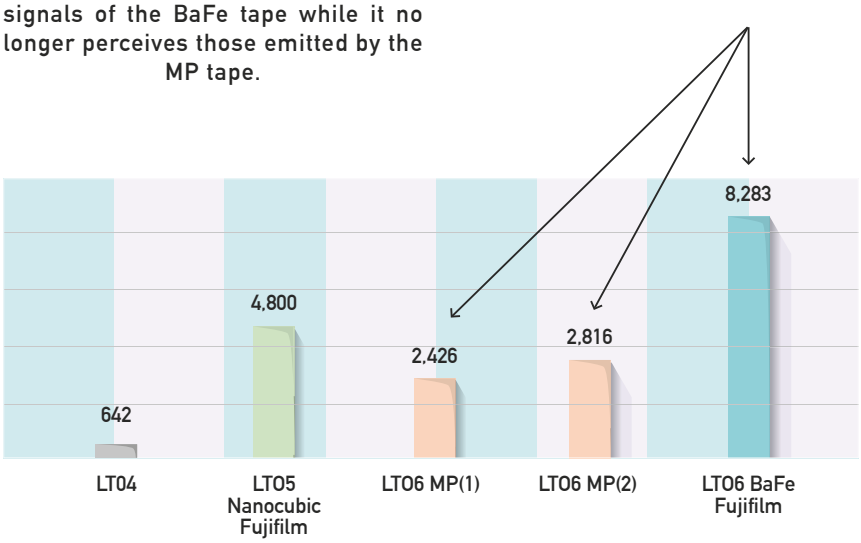
4. An effective test that demonstrates the superior level of data integrity of Fujifilm tapes.

• The best way to measure the actual data integrity of a magnetic tape is to operate it intensively, 24 hours a day.
• We know that an LTO tape drive, unlike 3592 and T10000 tape drives, is not designed to operate 24 hours a day.
• After a certain number of hours, the drive's head, without any form of rest, will gradually see its ability to perceive the signals properly decline.
• The consequence of the slow performance degradation of the head is that it will eventually generate write or read errors, with, as a consequence, a loss of storage capacity of the tape cartridge (see on previous point).
• With the knowledge that an LTO6 tape cartridge contains an additional 75GB to absorb these errors, you only need to measure after how many hours of intensive drive usage, the LTO6 tape cartridge would no longer offer the 2.5TB capacity. This would mean that it will have generated over 75GB of capacity loss due to write errors.

The result is shown on the following graphic (all figures in hours of intensive use of the drive):

Here, the performance of the tape compensates for the deterioration in the quality of the drive head: BaFe tapes "speak louder" than MP tapes. Thus, when the drive becomes "hard of hearing", it continues to hear the signals of the BaFe tape while it no longer perceives those emitted by the MP tape.

It takes three times longer for a Fujifilm tape to generate 75GB of write errors.



5. Fujifilm tapes provide optimum writing speed

In fact, when using a tape solution, the system measures the level of SNR generated between the drive head and the tape cartridge. If the system judges that the SNR level is too low, it will make a decision to slow down the write speed, in order to reduce the risk of write / read errors.

An LTO tape drive can operate with more than a dozen different speeds:
*14 speeds for LTO5 & LTO6 drives
*12 speeds for LTO7 drives

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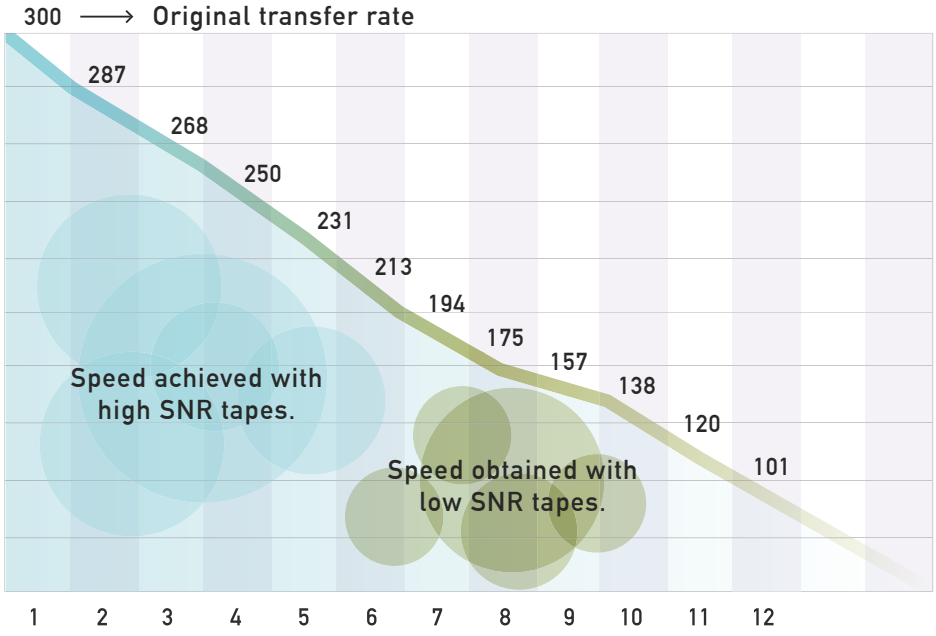
THE SYSTEM MEASURES THE SNR LEVEL OF THE TAPE

→ TRADITIONAL MP TAPES
If the SNR level is low, the system will choose a slow writing speed.

→ FUJIFILM TAPES
If the SNR level is high, the system will select a fast writing speed.

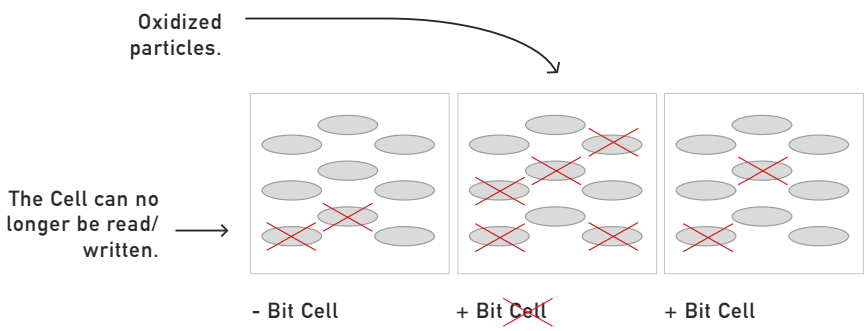
On the following graphic, you will find the different transfer rates that an LTO7 drive can reach (all figures in MB/s):



6. FUJIFILM LTO6 TAPES OFFER A LONGER DATA LIFESPAN THAN LTO6 MP TAPES

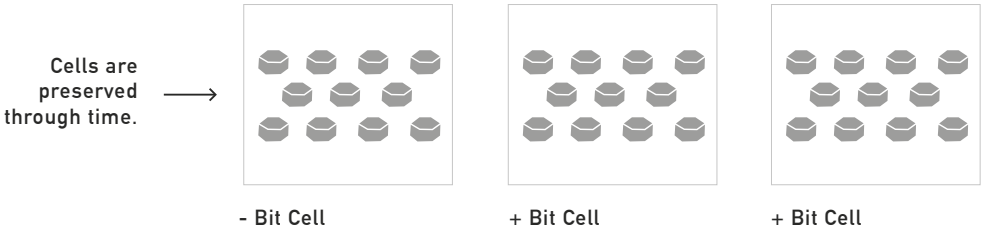
Indeed, the question of the oxidation of the particles shows that BaFe tapes offer a longer archival lifetime than MP tapes. This oxidation phenomenon also plays an important role in that MP tapes are less reliable than BaFe tapes.

a. The MPs (Metal Particles) are made from Iron (Fe).
Therefore, they naturally oxidize over time. The cells they compose will no longer be able to generate read/write processes. There will be a drop in performance as these cells will become invalid. More importantly, this oxidation of MPs is a source of data loss. Please see the diagram below:

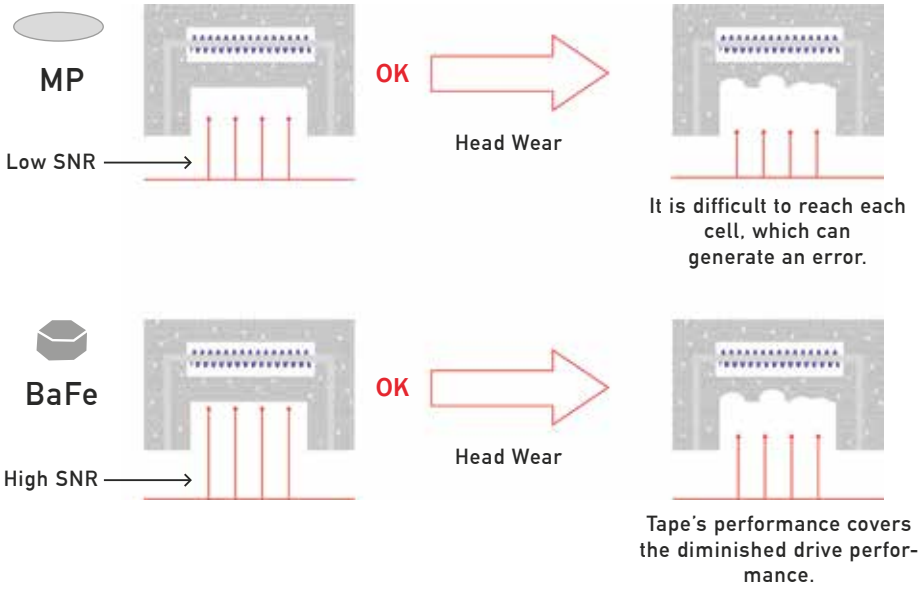


B. AS THE BARIUM FERRITE IS ALREADY AN OXIDE,

there is no phenomenon of deterioration due to oxidation. The LTO tape can therefore maintain its initial performance level. See diagram below:



7. Fujifilm branded LTO tapes allow a longer use of the drive over time.



- Barium Ferrite cartridges can be read and written correctly, even if the head is worn after repeated use.
- The proof of this advantage of Barium Ferrite can be found by referring to the test on page 8, on the duration of use of the drive before the first loss of data. This test clearly demonstrates that it is possible to use Barium Ferrite made LTO6 tapes three times longer over time than MP tapes, under the same conditions of use of the drive.

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3 FUJIFILM'S TECHNICAL HOTLINE

The end user

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Brings the questions to Fujifilm about a technical problem that is difficult to solve.

Fujifilm's hotline

The hardware vendor's hotline

THE FUJIFILM DIAGNOSIS HELPS THE USER TO ISOLATE THE PROBLEM AND INFORM THE MANUFACTURER OF THE LIBRARY.

1. How does it work? The Doctor and the Pharmacist

The best way to characterize the Fujifilm hotline is in the symbolic comparison between a pharmacist and a doctor:

a. Manufacturers of tape drives or libraries offer maintenance contracts, as well as a number of interventions such as the replacement of a defective drive, downloading of firmware updates etc ...

b. A specific request received from users in early 2010 was that, when they knew the nature of their problem, they were able to explain to the hardware vendors hotlines what type of intervention they required. On the other hand, when they found that their system was not functioning adequately, and could not comprehend the problem, they were unable to formulate the request to the vendor hotlines. This naturally led to blockages, to time wasting for the end user and sometimes even to unresolved problems, leading to the purchase of a new and costly data storage system.

c. Fujifilm has set up a European Technical Hotline, headed by Mr. Hartmut Schmeinck, Technical Director of the Fujifilm storage tape business, with the intention of providing end users with a technical diagnostic centre. This technical centre operates in two different ways:

- The need for technical interventions such as data recovery, data migration, data destruction (in accordance with European laws) or initialization of IBM 3592 and Oracle T10000 tapes.
- Technical follow-up: the most frequent types of interventions are processed via discussions, either on the phone or face to face, in order to give advice to users or resellers. We can assume that the diagnosis carried out by a tape specialist such as Fujifilm is always complementary and often superior to that of the hardware specialist.

In the sense that, unlike disk, the very theater of the archiving process is transposed from the hardware to the cartridge after one or two years of the tape system's use.

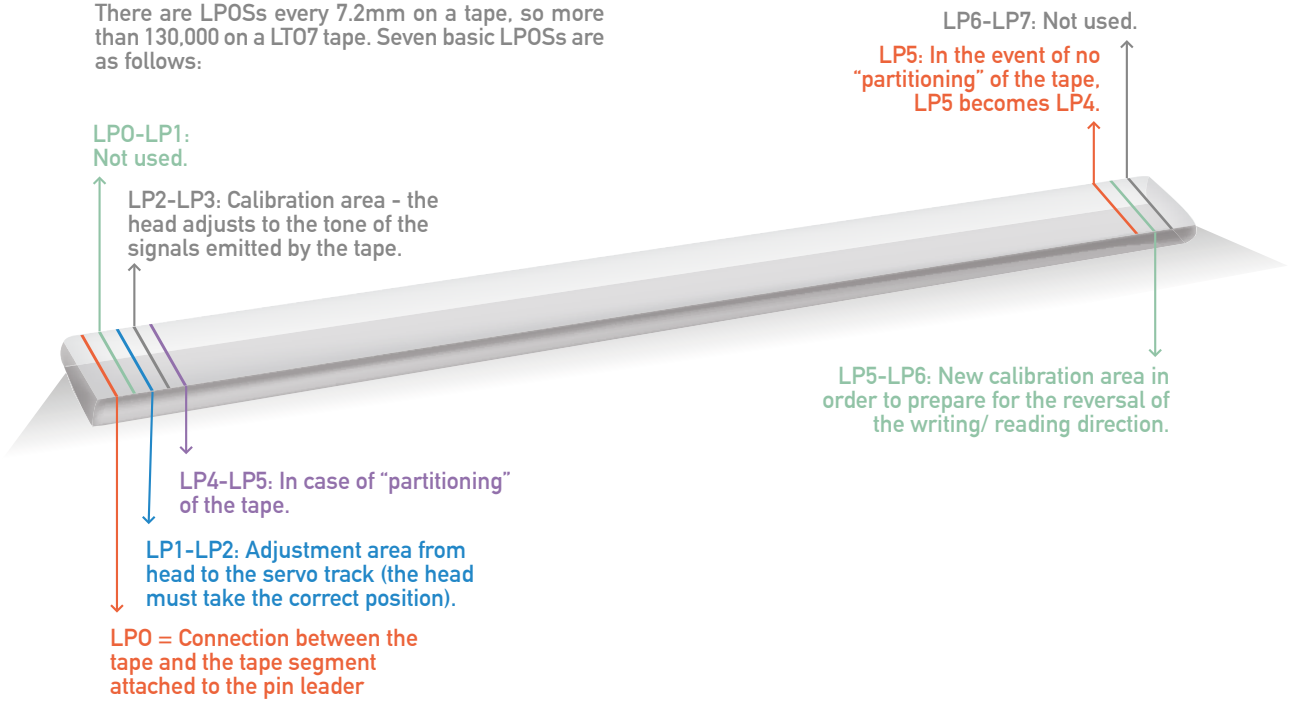
THEREFORE, WE CAN USE THE IMAGE OF THE DOCTOR AND THE PHARMACIST IN THE SENSE THAT:
- LIKE A DOCTOR, THE FUJIFILM TECHNICAL HOTLINE HELPS TO DETERMINE THE PATHOLOGY OF THE SYSTEM.
- THE PHARMACIST, THE HARDWARE MANUFACTURER'S HOTLINE, IS ABLE TO ADMINISTER THE CORRECT DRUG AND CURE FOR THE USER'S STORAGE SOLUTION.

2. Two examples of questions brought to our technical hotline

1st case – the user cannot access the total capacity of their write cartridge. Following the integration of LTO6 drives into their robotics, a user was unable to register all of their LTO5 tapes with them. They obtained 1.3TB of data written instead of 1.5TB, native capacity specified by the Consortium, to be reached with readers 5 and 6 in writing according to the ascending format compatibility. There are several reasons for this problem; the confusion between the decimal capacitance measurement systems (usually used for recording media, hard disk drives etc.) and binary (used by equipment and software), incorrect parameterization of the software saved in terms of the size of the data blocks or the activation of the reduction in the capacity of the tape with it. In this case, a misinterpretation of the LPOS (Longitudinal Position) by the reader system of the tape allowing the reading head to recognize its positioning on the tape which, therefore, did not inscribe the tape to the end. Once known, this phenomenon could be corrected with an update of the firmware.

The LPOS indicates the position of the data on a tape. They're included on the servo track and give the information that the drive needs in order to judge the correct calibration of the tape in the drive. There are several LPOS points that define different stages of the read/write process. A few examples are as follows:
-LP2 indicates the start point of the tape calibration.
-LP3 indicates the position from which the data starts to be recorded.
-LP7 indicates the end of the tape.

There are LPOSs every 7.2mm on a tape, so more than 130,000 on a LTO7 tape. Seven basic LPOSs are as follows:



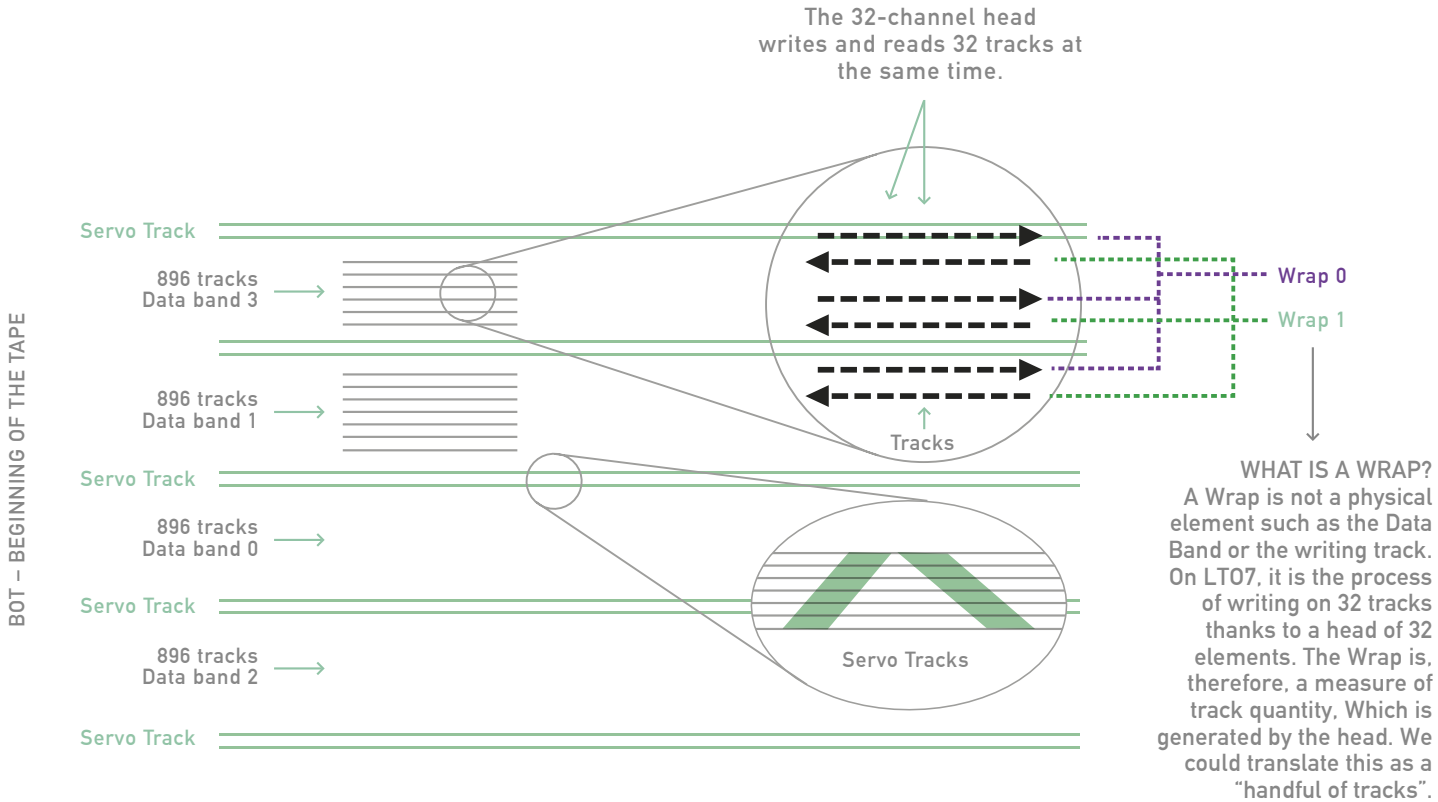
2nd case – what are the causes of a blockage of one or many tape cartridges in a library. In general, we find there that are three cases of cartridge blockages in an LTO tape library.

a. Where a single cartridge is stuck in the library: If one cartridge is stuck in the library, it means that there is probably some damage on the tape cartridge dating from the beginning of its manufacturing stage.

Generally, in this case, it should be noted that the incident occurs after 50% of the capacity of this tape has been used. Most of the physical damage occurs on the outer parts of the tape.

An LTO tape is segmented into four bands called "Data Band". Please see the diagram below:
The writing process is carried out by the two data bands in the first medium, and continues thereafter on the outer portions of the tape. This outer part is the most fragile portion of the tape. In short, when a cartridge is blocked for a reason related to this physical integrity, it generates a write error, which indicates the automatic shutdown of the writing process as the system is unable read the "LPOS" points. We call this a case of EOD3 (EOD = End Of Data).

In such a case, the user can perform a test to generate a definitive diagnosis on the issue. In fact, there is a function known as "Recycling" that can restore the mechanism of reading the LPOS points of a tape. If the user initiates this process and the tape still doesn't work, we can conclude that there is substantial damage due to this tape. However, we recommend that in an emergency some of the tapes concerned should be sent in order for us to analyse the exact source of the blocking or the stopping of the writing process.



b. When several tapes are blocked in the library - 1st type of incident, related to the tape library charger.

We noticed that sometimes the charger from the library encounters this phenomenon of blocking the cartridge.
It is possible that the act of pushing on the spring that's integrated in these chargers can sharpen the edge of the aforementioned spring. In this case, it is conceivable that the edge of the spring is so sharp that it enters the plastic material constituting the tape cartridge and, consequently blocks the cartridge by holding it.
In this situation, the library manufacturer will just have to lightly grind the edge of the spring in order to make it smoother.

c. When several tapes are blocked in the library - other cases. We also see two other possibilities:

• If multiple tape cartridges have the same problem as mentioned in the first point, that is to say, an EOD3 type of problem, then there are chances that there is a mechanical malfunction on the tape pass (the belt that helps the tape crossing into the drive). This mechanical malfunction would damage the edges of most tapes passing through the drive.
• If this is an interface problem (software, transfer, speed, connectivity etc. ...), then a message named EOD2 will be indicated, implying that the problem is not related to the cartridge but to the system.

You can also contact us for any type of question related to tape technology, such as:

- What are the environmental conditions of conservation of the tape cartridge?
- Can we degauss an LTO tape cartridge and use it again?
- What are the most common cases of data loss that we see?
- Why could a cleaning cartridge be immediately ejected after being loaded into the drive?
- A user has experienced a power failure, causing the cooling system in the computer room to be interrupted. What is the risk for the tape cartridge?
- What explanation can you give when the level of transfer rate indicated by the drive is no longer achieved operationally?
- Etc... etc....

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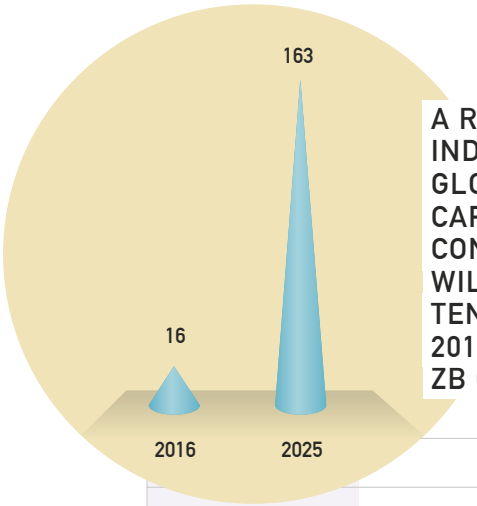
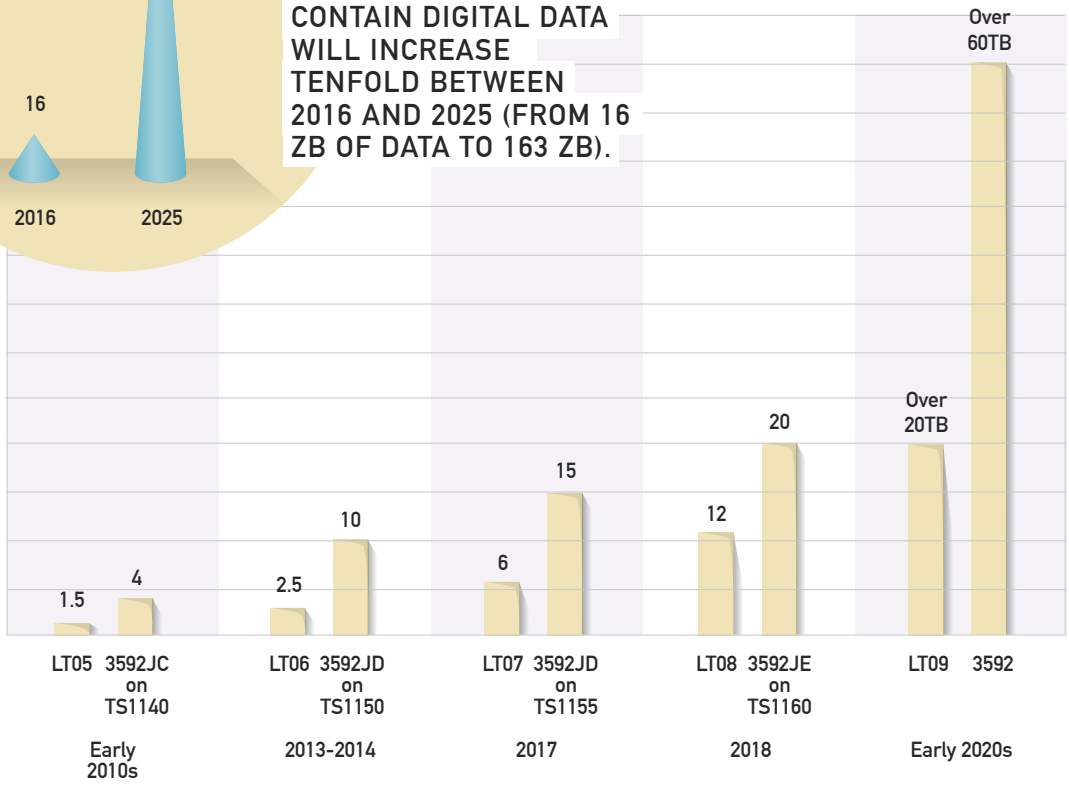
STRONTIUM FERRITE TECHNOLOGY FROM FUJIFILM

WHAT TAPE WILL WE BE USING IN THE 2030S?

Formats and generations of tapes exceeding 60TB capacity are already in development. The summary below shows the evolution of the storage tape offer. (All figures in TB). Please note, the storage capacity of new tapes must be confirmed by the technology owners.



A RECENT IDC STUDY INDICATES THAT THE GLOBAL STORAGE CAPACITY NEEDED TO CONTAIN DIGITAL DATA WILL INCREASE TENFOLD BETWEEN 2016 AND 2025 (FROM 16 ZB OF DATA TO 163 ZB).



Barium Ferrite technology can produce tapes with a capacity exceeding 200TB of data. What technology should be used when a capacity of 400TB is required? Fujifilm's Strontium Ferrite technology will be the one that will take over from Barium Ferrite and produce the tapes that we will use in the 2030s.

WHAT IS STRONTIUM FERRITE – GENESIS & FEATURES

- Question: *What is Strontium Ferrite? Is it different from Barium Ferrite technology? What are its properties (e.g. difficulty to miniaturize particles, magnetic output etc...). In general, what will its use be in the market?*

-Answer: Strontium Ferrite (SrFe) is a magnetic material, Hexagonal Ferrite, like Barium Ferrite (BaFe) and in which the position of the element Ba is replaced by the element Sr. We use the same method of synthesis of molecules as for Barium Ferrite: Grouping of atoms, ions, and aggregates of molecules by chemical reaction. This same synthesis allows us to control the molecules in order to develop fine particles. Finally, it is extremely important to carry out a very precise control of the nucleation of the particles. What's new is that the majority of the magnetic properties of SrFe are superior to those of BaFe, which will enable us to reach a higher level of performance whilst further reducing the size of the particles. SrFe-based magnets are, for instance, used in the automotive industry.

- Question: *Have Strontium Ferrite based magnetic tapes already been launched in the data storage market?*

- Answer: No.

WE BELIEVE WE CAN SUCCEED IN REDUCING THE VOLUME OF PARTICLES BY 40% WHILE MAINTAINING OR IMPROVING A MAJORITY OF THE MAGNETIC PROPERTIES OF PARTICLES AND, THUS, OF THE TAPE.

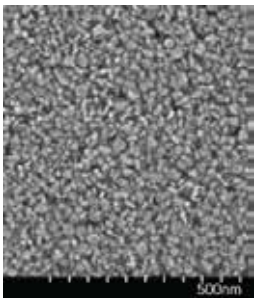
- Question: *What sort of technology was used to stabilize the particle miniaturization process?*

-Answer: We achieved the miniaturization by changing the composition of the raw material and by improving and optimizing the quality of the chemical additives.

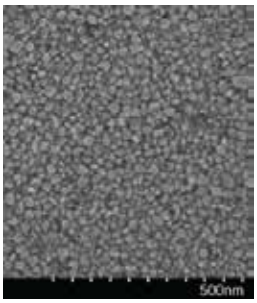
- Question: *What is the characteristic of Strontium Ferrite technology developed by Fujifilm, and how can it be compared to Barium Ferrite?*

-Answer: By comparing to Barium Ferrite technology with which we managed to coat a capacity of 220TB (158 Gbpsi) on a single tape in 2015, we believe we can succeed in reducing the volume of particles by 40% while maintaining or improving a majority of the magnetic properties of particles and, thus, of the tape.

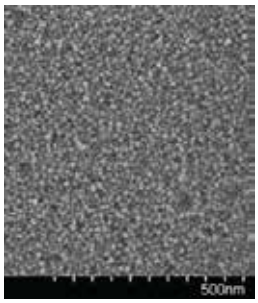
EVOLUTION OF PARTICLE SIZES (From Barium Ferrite to Strontium Ferrite)



Current BaFe particle
(LTO-7)
Particle volume: 1900nm^3



BaFe particle used in
(220TB)
technical demo in 2015
Particle volume: 1600nm^3



Announced SrFe particle
Particle volume: 900nm^3

Question: *What year did Fujifilm's research begin on Strontium Ferrite?*
- Answer: The initial research was undertaken in the second half of 2012.
- Question: *Has Fujifilm developed Strontium Ferrite on its own, alone?*
- Answer: Yes, the miniaturization of SrFe magnetic particles in the field of magnetic tape is solely the result of the research and development of Fujifilm.
- Question: *What storage capacity can be produced by using SrFe technology?*
- Answer: The capacity of 400TB can be exceeded on a single tape cartridge. This represents tapes of a capacity that are 67 times larger than LTO7, the most recent LTO tape generation available in the storage market. We can also say that 400TB is a capacity that's equivalent to 85,000 DVDs!
- Question: *Will the particles used on tape storage media be further reduced in the distant future? Is there a way to further improve the storage capacity of Strontium Ferrite?*
- Answer: Yes. Fujifilm believes that new potential, in terms of particle miniaturization, can be achieved by improving synthetic processes and by further adjustments in the use of chemical additives.

INFORMATION ABOUT THE TIMELINE AND ANNOUNCEMENT

- Question: *When do you plan to conduct a technical demonstration of this new technology?*
- Answer: Probably within three years.
- Question: *When do you intend to launch the first Strontium Ferrite based data tape?*
- Answer: The current view of Fujifilm is that Barium Ferrite technology can be used until at least the manufacture of LTO10, which should offer a compressed capacity of almost 120TB, as Barium Ferrite has already proven its ability to coat a single tape of 220TB. Therefore, it is very likely that Fujifilm will begin the production of Strontium Ferrite tape cartridges for generations beyond LTO10. The basic idea would be to introduce Strontium Ferrite in about ten years' time, by 2027, depending on the development schedule set by the drive manufacturers.
- Question: *Between now and the launch of the first SrFe tape, what challenges might Fujifilm face?*
- Answer: This interview is just the announcement that we have developed the particles so as to coat them on a magnetic tape. We still have a few developments to achieve. As with any tape coating technology, we must adapt the results of our research to the advances that will be made in the new tape drive technologies. We, therefore, enter a new phase which consists of maximizing our potential in terms of industrial development, as well as those of the SrFe magnetic particles.
- Question: *Why, then, an announcement on this day?*
- Answer: It's because we have just filed the intellectual property rights on this technology.
- Question: *Will other tape manufacturers develop or produce SrFe tapes?*
- Answer: The know-how and expertise that we have used in order to develop Strontium Ferrite is the result of a long period of research and development on Barium Ferrite - 25 years of research. Consequently, it will not be easy for other tape manufacturers to develop and manufacture Strontium Ferrite technology. Therefore, this seems rather improbable.

ABOUT THE TAPE TECHNOLOGY AND THE NEAR FUTURE

- Question: *What are the competing products of magnetic tape today?*

- Answer: In our area, which is long term data retention or data archiving, Hard Disk is our main competitor. There are new technologies available in the HDD and optical disc industries, but in both cases we have seen that the use of these new products is constantly delayed (technical issues or low demand from users) and that, on the other hand, the growth in storage capacity for these product segments has slowed considerably, to the point of saturation.

Tape technology is constantly growing, day after day, in the field of research and development.

It is enough to observe the unprecedented growth in storage capacity proposed on tape since the launch of Barium Ferrite.

We are convinced that new data storage tapes are the best option when addressing key issues such as data security, write speed, long-term data retention, floor space reduction, ecological footprint or the cost of use.

- Question: *Is the creation of Strontium Ferrite linked to a possible development limit of Barium Ferrite?*

- Answer: No, we are still in the process of reducing Barium Ferrite particles. Moreover, it would be a terrible mistake to launch new development projects just because we would perceive limits in an actual technology. We do not work this way. The very characteristic of Fujifilm is the R&D. We are constantly looking for new technologies and opportunities for new product creation. Barium Ferrite and Strontium Ferrite are two technologies that we have succeeded in developing. That said, these are not the only two areas that we are researching.

- Question: *Has the development of Strontium Ferrite required significant investments?*

- Answer: No. As mentioned above, the structure of Strontium Ferrite is identical to that of Barium Ferrite and can be synthesized according to the same method as the BaFe magnetic particle. There is, therefore, no need to invest heavily.

- Question: *Fujifilm's mother company in Japan made the announcement of Strontium Ferrite in July in Japan. Why wait so long in Europe?*

- Answer: It was because we're already explaining the real roadmap of tape technology to European users. At the time of LTO3, in the mid-2000s, when we were talking about a potential capacity of 3.2TB for the LTO6 cartridge, this seemed like a big leap forward. What can we say about our present situation? The best-selling tape today is still, for a very short time, the LTO6 cartridge that offers 2.5TB of storage capacity. At the same time, the vision of the near future that we can bring to the market is as follows:

• LTO8 which will be on the market in 2018 will most likely offer 12TB capacity.

• IBM's new 3592JE tape, which will also be launched in 2018, would offer 20TB of capacity (please note, in both cases that we must await the final confirmation of the specifications by the rights holders).

• Finally, we are currently working with IBM on a tape project that would offer over 60TB of capacity.

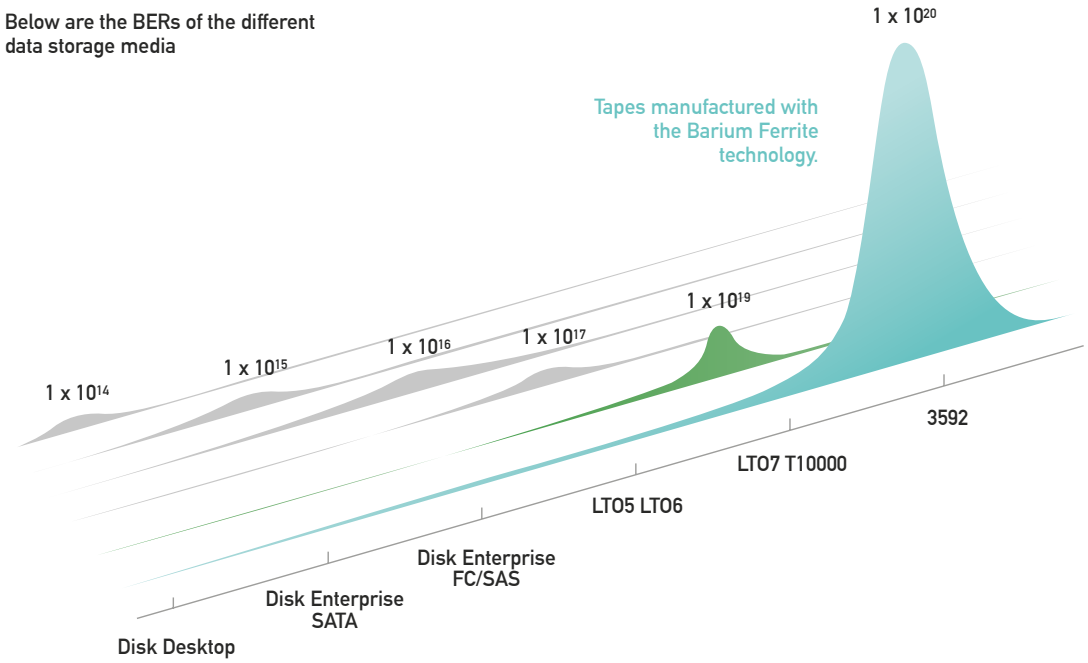
THE VERY CHARACTERISTIC OF FUJIFILM IS THE R&D. WE ARE CONSTANTLY LOOKING FOR NEW TECHNOLOGIES AND OPPORTUNITIES FOR NEW PRODUCT CREATION.

So we are talking, here, about multiplying the capacity of the tape cartridge by 8 between LTO6 and 3592JE, and this revolution will be accomplished in the space of 6 years! Even more impressive is that, in the next few years we can say that we managed to multiply the capacity of tapes by 24 in under 10 years! This is the real long-term roadmap and is showing such dramatic growth that it will take time for the market to integrate this new offer. What other product in the history of data storage has achieved such a dramatic revolution?

We can continue by comparing the transfer rate of LTO6 from 160MB/s to the 400MB/s that 3592JE could achieve, which is a multiplication of the speed by three in the space of 6 years. At the launch of the 3592JE, tape technology will be able to offer an operational writing speed that will be five times faster than that of hard disk for 1GB files!

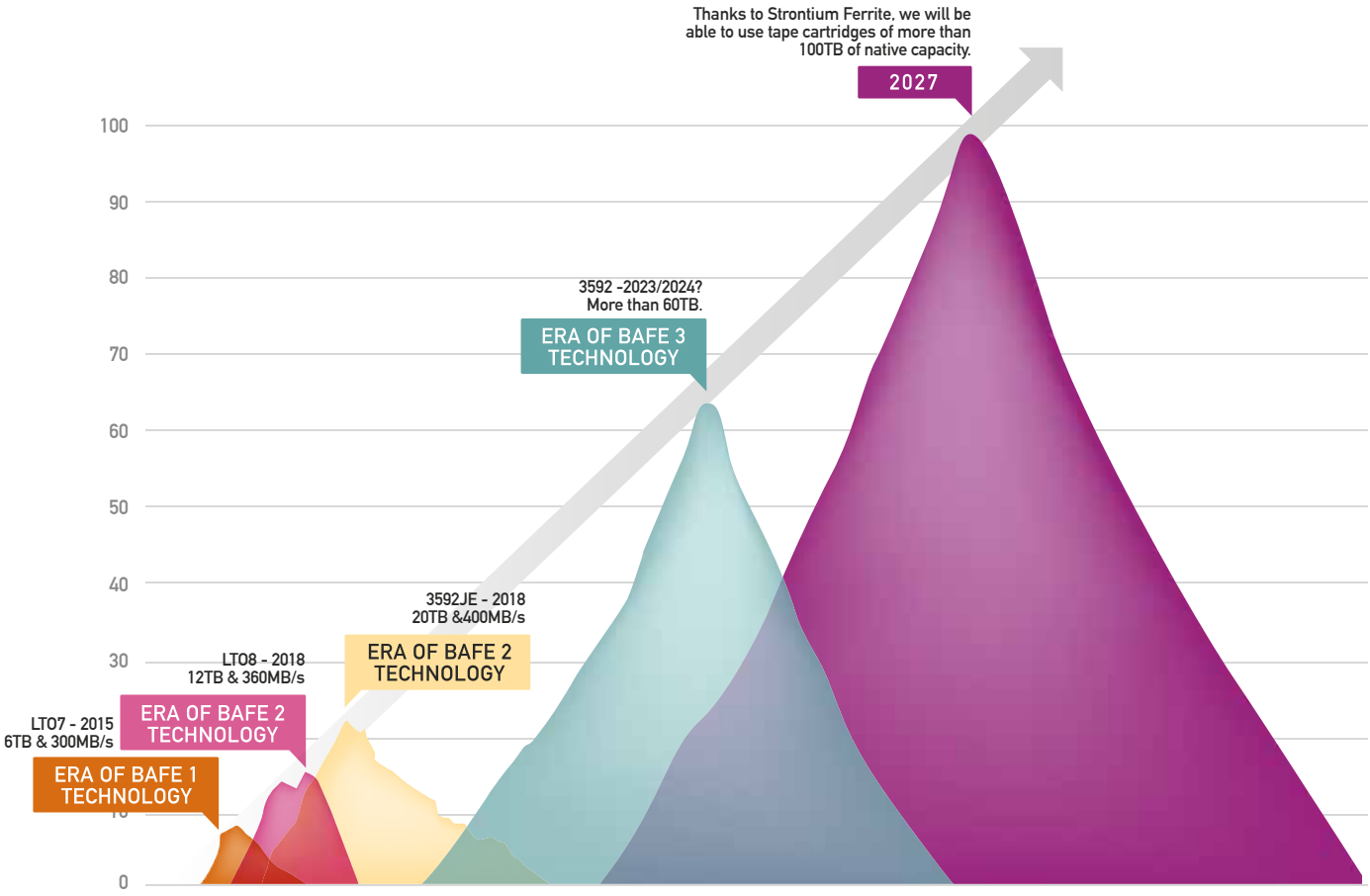
The third unprecedented phenomenon is in the improvement of the data integrity. LTO6's Bit- Error-Rate (BER) is 1 x 10^{17}, while the Enterprise SATA hard disk is at 1 x 10^{15}. This means you can write 100 times more data on an LTO6 tape than on a hard disk before the risk of a write error.

The BER that tape technology offers through the IBM 3592 range is of 1 x 10^{20}, which means that you can write 1000 times more data on a 3592 tape than on an LTO6 tape before you risk a write error, and 100,000 times more data than on a SATA enterprise hard disk!



Going back to Strontium Ferrite, our message is that while we are preparing storage solutions that will allow users to secure their data the next 10 years, we have also foreseen the technology that will enable companies to back up their data in the 2030s. Increasing the performance of storage solutions, improving data security and increasing the capacity of tape media in order to reduce the cost of conservation of tape cartridges will always be our primary motivation in terms of research and development in the field of data storage.

Below is an analysis of the evolution of the storage capacity offered by tape technology:



HIGHER PERFORMANCE AND SAFETY LEVELS.