Analyze That episode transcript

Handheld XRF best practices - getting accurate results

This transcript has been lightly edited for clarity, readability, and length. The content reflects the original discussion and technical intent of the speakers.

John: Hi, everybody. Thank you for joining us today on this series of Analyze That. We are continuing this series jumping into technology of handheld XRF analyzers. Got a few episodes already going through some of the deep dive into the specific markets for handheld XRF.

Today we want to do a little more general sessions covering best practices, tips and tricks with handheld XRF analyzers.

As always, I'm John with Thermo Fisher Scientific. I'm the product manager for Niton handheld analyzers. I'm very lucky to be joined today, with Nate Newberry. Thank you, Nate. Nate is the founder of a great company that we love to work with.

They provide parts, trainings, pre-owned and rental handheld XRF analyzers. Nate is a fantastic expert in this space. Also has a ton of content that he puts out under the Alloy Geek name. So please, after this video, please check out the Alloy Geek social media on LinkedIn, YouTube for a ton of great content on handheld XRF. Nate, thank you for joining us today.

Nate: Yeah. Thanks, John. I'm happy to be here. So, a big part of what we love doing is helping people in the space. That sometimes means just free content, which we have a lot of that teaches people some tips and tricks for, like how to replace the measurement window in under two minutes. That kind of stuff is helpful for somebody to like, okay, what do I do with my XRF and how am I going to how am I going to change that measurement window? It’s an interesting topic.

There's a lot of like depth here to talk about some stuff that might seem obvious but maybe gets missed and really could help a lot of people out.

John: Yeah, absolutely. I think we talked before we started taping here. You know, the key is you handheld XRF is a powerful, useful tool. Great technology. But the impact and results on different users, it's really going to impact. It's going to depend on your habits and knowing what you're doing with the tool. Right. As with any analytical device.

So yeah, you mentioned trying to get some real get some real-world stories in for practical takeaways. So, if you're new to handheld analyzers just give you a great episode for you to learn from. And even if you're really experienced, maybe you're going to learn a few things here that you didn't know before.

So, cool. With that said, Nate, let's hop in.

So, let's kind of stay on top, like high level. We just talked about how it really depends on knowing how to use the analyzers. So can we kind of start with an example of why perhaps handheld XRF results go wrong.

Nate: I have a lot of stories about this. We work with companies all over the world with handheld, and we kind of set them up in a way for them to be successful. And a handheld is kind of like a calculator in a way where if you have the wrong inputs going in, you're going to get the wrong outputs coming out of it.

So, you've got to be smarter than your XRF and understand things like the geometry of the samples. You know how small they are. Maybe they're really curved or hard to reach. It could be welds. And you've got to understand the geometry of what's happening at that weld where there's some mixed metal sample preparation is a huge deal. You know, XRF is largely a surface technique.

We should talk about that today as well. I know training kind of seems like a boring topic, but sometimes just learning a tip or trick for somebody is all the training you need to really get going. It can be really game changer for your organization to know that results can be much better. Much with a couple of simple tricks that you may not have heard of or may not be aware of.

And there's some tech out there that helps XRF users like test stands and stuff that some people haven't considered that could really improve, like the repeatability of the results as well. And then I think the last thing we have got to cover is the overall setup of XRF. I know a lot of extras have gotten automated.

You know, you guys have your Thermo Scientific™ Niton™ XL5 Plus, which is a great platform to use, but, you know, older platforms like the XL2 to take a little bit more of a manual setup. And that's true for most experts in the market. So, understanding those settings and how they impact your results is key to like ultimately getting the right answer.

John: Yeah, I agree with everything you said. So, let's try and take one more piece of time here. Right. So, we only have so much time, but we could talk for hours. But yeah, let's talk about you mentioned geometry right. Specifically, size. And really, I want to get into the well wire story you referenced. Right. So can you give me an example of how well wired perhaps the size of that material makes a challenge.

Nate: Yeah. So, I think to start and I'm going to pull up these two here. These are two that from you. We've got excessive every brand here. But this is a good example. If you see on the screen here, there's two little holes in the front of the analyzer. That's where the x of the x-rays actually come out.

That spot size it's not perfect analogy but about the size of a dime. So, I've got a dime here. That's about the right size. When we're talking weld wire, we get something real thin like this. And on the screen, guys, I'm showing a piece of weld y over this dime. And what you can see is it's about maybe, you know, 10% the width of the dime or less.

And what happens is all of those X-rays end up missing your sample surface. And so, we've set up quite a few people who are doing had companies that are both producing or consuming or fabricating products using weld wire, and they have to verify that the material they're using is the right stuff before they weld the parts that it's going into.

And this gets into a whole mess. But we'll focus on size for now. Most of those x-rays, those x-rays are shooting about the size of a dime are actually going to miss the sample, and they're going to hit whatever's below that. So typically, your tables, your floor, your desk, and you're going to get a lot of scatter and noise in your data

And so, the way to get around this is a test stand where your XRF just clips up into this device. You can you it basically takes the spot size and all those x rays that are missing that are missing the sample hitting the desk now get dissipated into the sample chamber. What that does is it means that you're only measuring the x-rays that are hitting that small, thin piece of weld wire.

And what that does is it gives you the right result every time with very low noise in your data. And a lot of people aren't doing that in that industry.

John: I think that's a great example. Yes. And test that awesome accessories that we provide from Niton. And I know Alloy Geek also provides it directly to users.

Yeah. You mentioned the sort of the repeatability. But also you kind of indirectly touch upon the safety. Right. You mentioned, hey, if you're going a really small sample, the extras are going to go to whatever's behind that.

We don't want that to be a person. Right. So, testing really helps contain that radiation. So not just for your analytical results but for your general operator. Safety is a is a best practice for repeated use. That is something we definitely harp on with the use of test dance.

Nate: And so, we have the same piece of wire and something small like the XL5 Plus. You can still see the overall size of that weld wire, and you don't want your operator holding your finger over that you want to or their hand like I'm doing here on camera right now. You don't want to operate that way. And the test stand is basically going to make a nice surface with like I like to tell people it's like a microwave.

When you close the door, the x-rays are on can be on. When you open the door, the x rays are going to turn off, but essentially you just setting your sample in the chamber and basically, you know, shooting it with x ray that way. The story that I specifically mentioned earlier was about weld wire with both nickel base and with magnesium alloys, and there are two different challenges, but where they really get into the weeds, there is this these are magnesium.

This is a magnesium weld wire here. Whenever we're measuring something with light elements, light elements are very sensitive to getting noise or scattered. So, something like your desk surface is going to give you the wrong answer real quick. Because realistically this weld wire isn't very thin. And so, we're going to get scatter from the desk and noise in our results.

And that ultimately could give you the wrong grade match, the wrong chemistry, all sorts of wrong things. So, it's important to always kind of understand the samples you're trying to test and make sure that when you're not getting that extra noise in your data. So, like a test fixture can just totally solve that. Plus, it's safer, plus it's more repeatable. Plus, it's a little bit easier to use because it's hard to target to begin with. Something, you know, as thin as these two pieces here.

John: Yeah, I think that's a great example. And certainly, application that's common and important right. So yeah, repeatability I think is a huge word. Like could you get the right results without the test in. Sure. But you're just making it a little harder on yourself. And then the repeatability is going to be even more challenging. So great examples. Maybe if we pivot to a similar story but a different application, we know the gold prices doubling over the past two years that jewelers are trying to get their hands on XRFs. There are a lot of new pawn shops and jewelers. New to the space, new the technology. And so, this is a similar situation where not weld wire, but maybe small pieces of jewelry again where that size matters. The test stands a great example.

But also, you know, we offer closed beam systems in our Niton analyzers. Can you share kind of how those closed beam systems offer a similar user experience to a tested.

Nate: So, essentially a close beam benchtop system is again, like a microwave, you know, when you when the chamber is closed, it's got a safety interlock. They call that closed beam operation. So, unlike open beam where your handheld XRF could be pointed anywhere at anyone, which is, you know, there's safe ways to use this to that's not usually an issue.

The test stands actually when they interlock with the XRF, they will not operate just like a benchtop if the chamber is open. So, it makes sure everything is safe, that no one's hands are ever in the way for these small samples. What if you're trying to wonder how small is the sample that you might consider a benchtop, you know, or a test stand?

Typically, what we see is anything that's smaller than the spot size on the front. So, there's a little hole where the x rays come out. If you're smaller than that, either narrower like this weld wire, much narrower but no longer but just narrow, or something like an earring backing or a thin gold chain. That's where those test stands really add a lot of value as far as making sure that testing is both safe and a lot easier to do.

John: All right. So, we've covered the geometry and the small sample size of weld wire or jewelry. Let's take it one step further. Scrap recycling sort of the bread and butter of handheld XRF. We know there's some small samples that get into there with chips and turnings.

But you know, we talk about the operator safety. Can we talk about perhaps how these small samples also present a risk to the analyzer itself?

Nate: For sure. And the biggest risk to any of these XRF, including XL5 Plus, is puncturing the measurement window in the front. And again, we have videos on our YouTube channel that teach you how to do this. It's just popping this clip off and putting a new sticker on essentially on the back side but making sure your operators know when this window.

It's hard to see here, but it's what it is, is a little polypropylene window that's only a few microns thick. And it's designed that way so the x-rays can come in and out of the analyzer without any distortion or attenuation. Okay. And so, because of that, that's your last line of defense against puncture. And something like this weld wire, if you were to try to test on the end could puncture into the analyzer itself that detector, your x ray detector, which is one of the most expensive components inside your XRF, is going to cost and could cost $2,000 to replace, can be broken with a Q-Tip or with compressed air.

We always tell people nothing needs to go inside here. Now, when you're testing things like turnings, right? You could be putting this excerpt directly into a pile of turnings. Now, I know Niton has technology behind the scenes here that protect the detector itself from that, from touching those turnings. But you still run the risk of potentially damaging them.

So, you always want to be mindful of the samples you're testing, so that they don't go in the chamber where the x rays are being generated.

John: I think that's really well put, Nate. Right. So, I think we kind of covered two different components there that I want to make sure we're distinguishing. So, you mentioned like the simple low-cost component, the window at the very front. And you are just. Thank you for demonstrating how easy it is to pop that that little assembly option to replace that.

Yeah. If that if that breaks that's that is an easy fix. But it's the detector, which is then a few, you know, a little bit deeper into the analyzer. That is a much more challenging repair. And yet while we do have the detector programmed in the analyzer to help prevent as a first line of defense certainly if you're putting a Q-Tip or compressed air into you into your window and really trying to get in there, you're going to present problems.

So, we do not recommend anyone trying use those types of tools to clean out. And that is not something a typical user needs to handle themselves.

Nate: And it's hard to see on the screen here. But basically what you can imagine is there's a little button that's about maybe the half the size of a dime, and then there's a black cross mesh here that protects the detector surface. And that mesh is going to prevent most things from touching that detector to begin with.

But again, it's not foolproof. So, you always have to be mindful that nothing should ever go in there and nothing should ever touch it. I mean, even in fact, I think it's weld wire. This one here might be small enough that I poked it in there. I could touch that detector, then I'd be in big trouble.

John: And it's less of trouble. Right. But it's more of the hassle. Right. So, we have you know, you're based here in the US. You know, we have we have service centers, not just in the US but across the globe. So shouldn't issue come up. The Niton service team is ready to handle that. But it's just a challenge.

And it's you know, it's any time away without your analyzer in your operation and something we want to avoid. So, I think that's a really, great tip that may not be obvious to new users.

Nate: We touched on this a little bit. I want to highlight this other part we didn't really talk about with the weld wire. So, this weld wire here, this is a magnesium weld rod okay. So anytime we deal with light elements we get oxidation. So, aluminum light elements would be aluminum magnesium silicon sulfur and phosphorus. Those are the five light elements that we measure with handheld.

And so, this weld wire because it's magnesium okay. It's going to oxidize very quickly. And so, to get a good result it might have a lot of oxidations on the surface. And I'll give you an example here showing you two different aluminum pieces. This is a very shiny piece of aluminum that might have had a protective plastic coating at some point.

Not a lot of oxidations, very clean. And this is like an aluminum extrusion piece that comes out of scrap. And you can see the difference in shininess on the surface. They're ones like a dull gray. The other ones very shiny. Sometimes with weld wire you need to clean the surface, which I think we should talk about Surface Prep two for these parts, because especially when you're dealing with magnesium or aluminum alloys, Surface Prep is going to be king to getting the good results.

Because the truth is, light elements are everywhere in the dust and dirt around us.

John: I think that's well put right. So, let's kind of use that as an into surface prep. You mentioned oxidization right. So, handheld it's a surface technology right. We're detecting what's on the surface here. Can you kind of use an example of not just maybe when something's been clearly protected, but put us in a scrapyard, something where you're going to get a whole variety of, of cleanliness and, and quality of materials.

What is the sort of rule of thumb? How does how does a user know if the circle, if the surface is ready to scan or if they have to prepare it more before they

Nate: Okay. And we should also talk about how to prepare the sample surface because,

You don't have to polish it like with a with like a cloth and some, some fines. You can typically an angle grinder is going to do just fine. So, something like this aluminum extrusion is generally okay to test with. But if you look at the other side there's some grime on it.

If you were to test that grime, you might get the wrong result, even if other locations on that same sample surface test. And then looking at the cross section here, we've got a spot where it's been cut and it's hard to see on the camera. There's chips of metals stuck inside of it, which I don't want in my either.

So, I got to be mindful of the whole environment that's around me. Now, what I would typically recommend with most aluminum sorting is if it's if it's any worse than this, a standard aluminum extrusion, I would always grind the sample surface with an angle grinder. You don't have to go deep. You don't want to go deep. You want to just clean whatever's on the surface off there.

That will help a lot with getting the right results. And again, the light elements, which we'll talk about the beams here in a minute. But they're very sensitive to getting attenuated or distorted or contaminated with other light elements, stuff that just exists in nature. Now, I don't have a painted example with me today, but as cast surfaces like I've got an as cast mug here that's got a cast surface that's going to be harder to test as well, much harder to test in this aluminum extrusion.

So anytime you've got an associate surface, you should probably clean that up. This is a 6061 mug by the way. Made this when I was in college. Cast it. But yeah. And then there's painted stuff. So that's the other thing is anytime you're dealing with a surface that's painted, find the clean metal spot on it. Usually there's a crop.

Then especially in scrap, you can find us. You know, the whole thing wasn't dipped in paint usually. But your paints, your industrial paints can be they can contain lead, which we can do lead paint with two, which is a whole other conversation. They can have zinc or titanium or other heavy metal particles in there. When you shoot a part that's painted, you may end up getting a result that says, oh, it's a titanium alloy.

We don't know what it is because the F is just getting blocked or absorbed by the titanium or heavy metal particles that are in the paint.

John: I love that. I think one thing you said is that I kind of want to build upon it, be mindful of your environment. I think that is just such a well, well put way to kind of think about, hey, you know, before you rush into using these devices, just stop and think about, you know, what is the environment and be mindful of your samples. What has that sample have gone through to get in front of you? So having that sort of train of thought before you go into your analysis, I think is key. And I like the idea of you said, hey, you might have to if it's paint or rust, you might have to take an angle dryer to it.

But before you do that, stop and think, is there an end cap? Is there a portion that's already not painted before you take the angle grinder to it? That's just that I smart operational tip to keep.

Nate: Save yourself the time, right? Like if you if you don't have to grind the sample, don't grind the sample. Just find that spot where you know in this sample here

Well, there's a riser that was ground off on the handle. I've got a spot here that's not an associate surface stuff like that. Just thinking about where those locations are on the parts, you're testing is going to be very helpful.

But let's talk specifically about aluminum just real quick. So, aluminum alloys are sorted based on two primary elements magnesium in silicon. That's primarily what we're looking for in aluminum. And magnesium and silicon are those light elements. So, you need an XRF like the XL5 Plus something that has light element capability. I know you guys do have the light metals quicksort, which is sort of a different one. We won't talk about that specifically today. But basically, what we need to do is measure the light elements that are in the, in the, the metal. And that is best done if there is no contamination on the surface, a relatively clean surface, something like these 6061 extrusions should be fine. You know, ideally, always. There's always ideal right to have this shiny, polished look at the sample.

But that's just not the way real world samples typically are even in even in manufacturing. But so, let's talk about this too. So, some people think every XRF is the same. And here I've got a Niton XL2. This is a 100 model right. And over here I've got the Niton XL5 Plus which is a premium model that has light element capability.

The Niton XL2 100 does not have light element capability. So, John, how does that impact our ability to relate elements.

John: You're right. And I think there's a conversation of knowing the specs. Right, so, there's so many specs to get thrown out there. But yeah, the presence of the right filter and the, the elemental range. Right. So, on everything from our XL2 Plus through our XL5 Plus, you know, we have the ability to detect light elements and that's based on the light filter we have present.

So, filters, you know, something that just it's multiple filters will cycle through on an individual analyzer. But yeah, on our, on our simple and basic, most basic Niton XL2 100 without having that that light filters you're not going to see the light elements. So that is something that knowing what you're getting before you purchase it, it's going to make a huge impact.

And that's again not just specific to Niton but know what you know what range you're getting before you purchase your analyzer.

Nate: So, if you buy a new analyzer, it's typically designed for the application where people get into trouble. Where I see this all the time is somebody buying something on eBay and they get a lead paint analyzer or something like how do I how do I do alloys with it? It's like, maybe you can't depend on the XRF you buy.

Making sure that like if you were to have a Niton XL2 100 series, it's a great XRF for testing basic alloys. But if you need the light element capability or want to do faster light element sorting, you need a more powerful XRF like a 980 model of those. I guess you guys have the XL2 980 plus or upgrade all the way up to the XL5 Plus, and that gives you faster light element analysis.

And but you can't change that. That's a hardware thing right? So, when we look at, we have hardware under the under the hood that we don't always it isn't always obvious. Two XRF’s might look identical, this yellow classic yellow or the lime green for the Niton XL2 Plus they look the same. But if they don't have a silicon drift detector, you're not measuring light elements.

John: I mentioned the filter earlier, but yes, that's worth pointing out to the Pin versus SDD detector. Right. So, pin analyzers, we talk about precious metals analysis for a pawn shop. You're looking to detect gold. Silver that is there on the XL2. Perfectly fine helps you get a lower cost analyzer. But absolutely as you start getting into the more advanced the need for more powerful technology, the SD, the silicon drift detector is what you're going to need.

Yeah. And then beyond just the hardware, we've talked about the presence of filters, the right the right detector. You talk about calibration slightly. And I think that's important as well because yes, if you're finding something secondhand, you may not have the full history on what that analyzer is been calibrated for. And you know, we offer what we call calibrations or modes, but we should probably talk about, you know, the impact those calibrations have.

For instance, you mentioned our light metals quicksort. It's very similar to our general metals, which is, you know, aptly named as it is used on general metals applications. But that is a specific calibration that helps you identify light metal alloys very fast. So, when the matter of seconds instead of five 10s so that that's sort of the difference, you know, really adds up over the course of a day.

But that's just one example, right? So maybe let's talk about this will move into geological space soil and mining modes very similar. We saw a lot of mining analyzers with both. But can you kind of help explain what the difference of a soil and mining mode might be to a user?

Nate: I think this might be your area of expertise, but I will do my best. We have different modes in the XRF and they're not all the same. So, it's just like selecting the right mode in a calculator or another tool. You want to use the right tool for the job. Now an Niton XL5 Plus like this can have a lot of different modes.

And I'm not plugging here for you guys at Thermo, I think you make great analyzers, but this is what I have available right now. So, I thought I would show this. But this you know, ten of these could be looking identical, but they have different modes set up inside of them which are different workflows. You got to have someone actually calibrate for those specific modes, like general alloys, like we said, light metals, quicksort, mining mode versus a soils mode, which are not the same.

We'll talk about that in a minute. Your general alloys, your precious metals. And there are some other modes like rose modes and catalytic converter recycling modes that are designed specifically for very niche applications. But let's focus on a couple of things today, because we talked a lot about metals modes, and in those metals modes we want to select the right thing.

Let's start there. There are pretty much just a couple primarily primary metals mode. So, we have general metals mode that's going to cover most of the general metals testing that we see. That's all industrial stuff. The focus for general metals mode is typically industrial alloys and a good grade match. Right. So, we have very robust-grade libraries that contain almost all the alloys that you're going to run into in the industry.

They work very well for that. You can do aluminum alloys, you know, magnesium alloys, stainless steels, copper, titanium, nickel, cobalt and the list goes on. All those different bases are by default. You don't have to select anything. The analyzers does it? It's great. Okay. But if we're doing precious metals, we have a different elemental range for gold and silver.

And our focus is no longer on grade match. Typically, there isn't a good grade library because we don't care. We care about the care of that gold. We're doing different things in the precious metals mode, like looking for plating. So, if you're like, well, this excerpt will see all metals. Was it general metals and are you doing jewelry or gold buying.

Then if you're doing jewelry and gold buying, you want the right elemental range that will see all the elements and have higher precision on those elements. For like a precious metals mode, you want the plating detection, things like that. And of course, seeing the carrot right on the screen. Right. You test an 18-karat piece of gold; you want to see an 18.1 karat. Okay. We're good. Move on. You don't want to have to do that calculation by hand every time.

John: Yeah, I think it's a great example. And you talk about the precious metals, and I think it's worth connecting to something we talked about earlier where it's primarily a surface technology. Right. We're detecting what's on the surface of a sample with precious metals. And I just maybe say for scrapyard example, we're talking about rust paint things that are maybe, you know, inadvertently on the on the surface of the analyzer.

But for precious metals, sometimes we'll find something that's very much intentionally put under the surface of the, of the sample to try and confuse or hide the actual composition. So, the plating detection important for precious metals. And our precious metals mode has built in technology determined for instance this ring is solid 14 karat. It shows up as solid 14 karat. This watch was $100 from Casio. Our analyzers will detect this right away as gold plated. Right. So, it does detect the gold in the surface. But it lets you know right away this is not a solid gold material. This is just gold on the surface.

Nate: So, we should talk about that because I think a lot of people don't know in the precious metals space, they look at stuff like a plated gold thing. Now standard handheld XRF is going to penetrate about ten times as far as the standard gold plating. That's why you can do plating detection to begin with. However, if you get counterfeit gold bullion or something like that, it isn't going to go more than the surface.

You’ve got to do your homework; make sure everything you're buying is legit. Typically, that means cutting or buying or cutting or drilling a gold bar to make sure that it's solid if it's a really thick gold bar. But think of it this way if you are at the doctor and you break your hand and you get an x ray, you're going to see your ring light up, right?

It's going to turn bright white because the x rays aren't going to penetrate that. The same is happening. We're using the same physics here. The x rays are going to stop at that denser material. So standard gold-plated stuff cool. But counterfeit detection. You got to have an eye to do that as well. But the XRF is a great tool on the journey of counterfeit detection.

That whole thing is a conversation for another time, John, but I just thought we'd touch on it because there's a lot of times people think, well, I can see in the middle I can see tungsten in a gold bar. And it's like if it's way in the middle, if it's buried more than 10 or 20 microns into the sample surface. No, you can't and there isn't there isn't a certain brand that can do it. It's a physics limit for, you know, essentially a battery powered x ray that's designed to do chemical analysis of the service.

John: Couple of calls one. Yes. In general, we're talking about handheld technology in general. So yeah, thank you for showcasing the Niton products as we talked. But certainly, we're really referring to the general technology here. The other thing you mentioned, you mentioned the medical example. I think most people their association and their familiarity with x rays is that medical example, what they think.

Oh, with that x ray, you know, it's going through material and it's a bone. Right. So it must be able to go through this sample I have in front of me. But no density. That is the keyword you mentioned. It's going to. It's going to stop it that that that dense material. Right. So, if that's on the surface, if that's the first thing the x ray hits, that's what the analyzer is going to see.

I think that's a good distinction. On the impact of handheld analyzers used in industrial settings versus the far more powerful x rays that might be used in a medical setting. So good call. Thank you, Nate.

Nate: So, there's one more mode. So, we covered the two biggest ones, which are general metals being the biggest and most widely used I think mode with any extra out there. The second one being probably precious metals for the metals and alloys. The third one is a newer mode, which you guys call light metals, quicksort or LMQS. And that that's doing aluminum alloys.

Right, John, how does that work different than a standard XRF? Like how is it different than traditional ways XRF was characterizing aluminum? And where can someone see a benefit with that today?

John: When we talked about sort of detecting light metals, I mentioned the filter. And so there's more math going on behind the scenes. But really what we're doing for that lighthouse quicksort mode is we're using the light filter first. Instead of matching purely on just elemental composition, we're trying to match against alloys that are in a library.

You mentioned that that mug, the cool mug is 6061, 6063 and the common aluminum alloys. We have a library. And so that with that the LMQS (light metals quick sort mode). What we've done is just we've trained the analyzers to try and match the material to a known alloy library. Right. So, if you are that scrap recycler and you have a large sample, a large group of unknown samples, and you just want to sort them through and say, hey, what's the most valuable out of here?

Instead of taking the general metals mode, which is going to have the light filter come in, maybe 10s or however you filter it, so you can have maybe 15 seconds per scan. You can do three five seconds scans to quickly identify, hey, it's this alloy. And we should get into some of the challenges that that goes in to that that grade matching.

But that's the tool that it's built upon. It's trying to provide the speed and quick analysis. So, you can sort a large volume of materials quickly.

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