

XTREME S_PORT_S

XTREME *SORT*



Xtreme Sports

⇒ Capabilities:



Xtreme Sports

- ⇒ Capabilities:
- ⇒ Reliable



Xtreme Sports

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Xtreme Sports

- ⇒ Capabilities:
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AP Photo / Jakub Mosur

Xtreme Sports

⇒ Capabilities:

⇒ Fast



Xtreme Sports

⇒ Capabilities:

⇒ Flexible



Xtreme Sports

⇒ Capabilities:

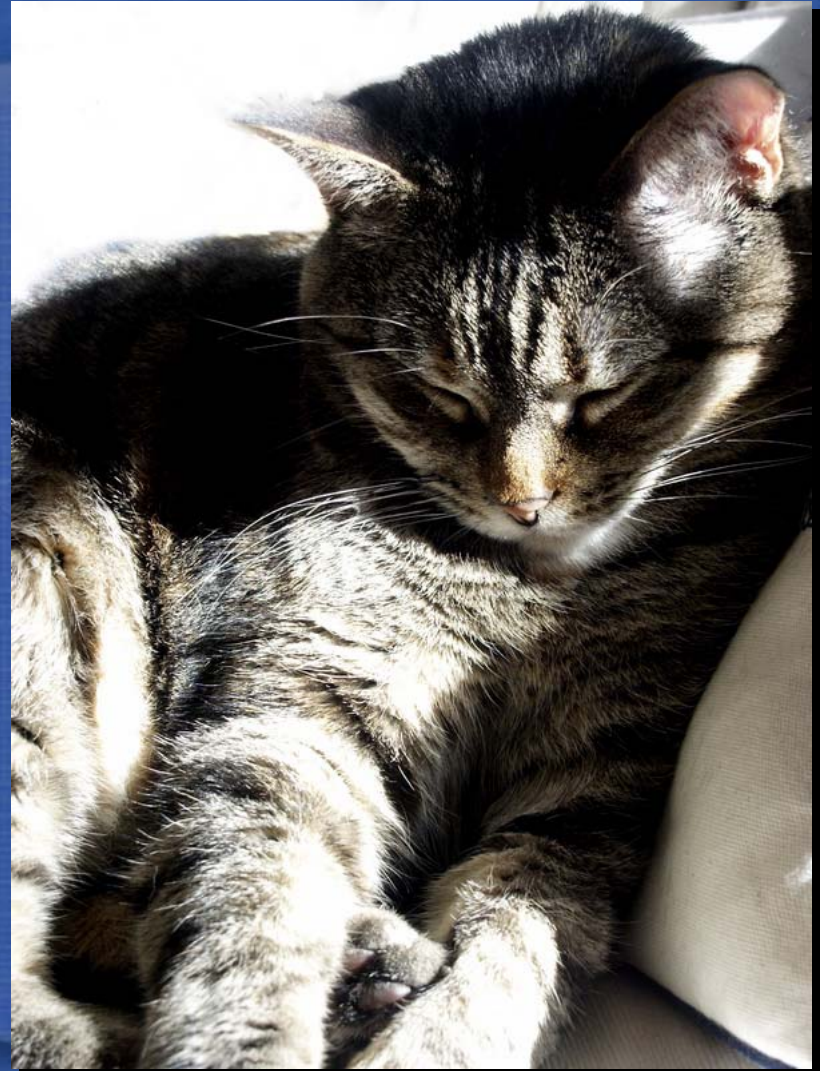
⇒ Size



Xtreme Sports

⇒ Capabilities:

⇒ Heat Resistant



Xtreme Sports

⇒ Capabilities:

⇒ Strong



Back to the Future

⇒ 2001 SWTW
presentation



The image shows the cover of a presentation titled "Enabling X144 Wafer Sort". The background is a dark blue with a faint, stylized image of a wafer sort machine. The title is in large, bold, white letters. Below the title, the names and titles of the presenters are listed in yellow text. At the bottom, there are logos for XANDEX and Agilent Technologies.

**Enabling X144
Wafer Sort**

**Roger
Sinsheimer, P.E.
Chief Engineer
Xandex, Inc.**

**Ken Karklin
R&D Project Mgr.
Agilent
Technologies**

Agilent Technologies
Innovating the HP Way

http://www.swtest.org/swtw_library/2001proc/PDF/S6_04.pdf

Back to the Future

- ⇒ 2001 SWTW presentation
- ⇒ V4400 Flash Memory Interface has 2304 I/O channels, 440mm diameter probe card.

**Enabling X144
Wafer Sort**

Roger Sinsheimer, P.E.
Chief Engineer
Xandex, Inc.

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Innovating the HP Way

http://www.swtest.org/swtw_library/2001proc/PDF/S6_04.pdf

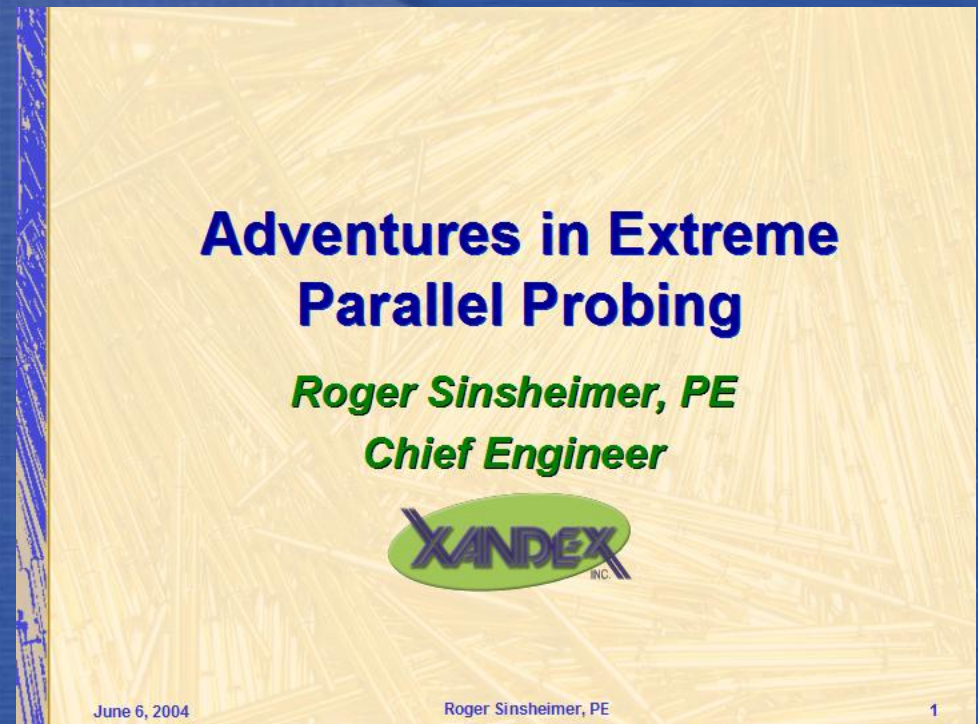
Xtreme Sort

⇒ Reliable



Back to the Future II

⇒ 2004 SWTW
presentation



http://www.swtest.org/swtw_library/2004proc/PDF/S01_03_Sinsheimer.pdf

Back to the Future II, p2

⇒ The fundamental flaw in spring probes is the lack of force driving the plunger against the barrel

DC Resistance: Construction

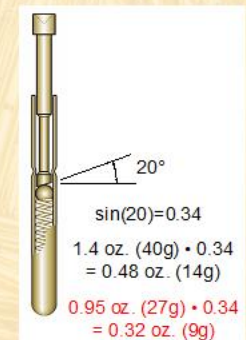
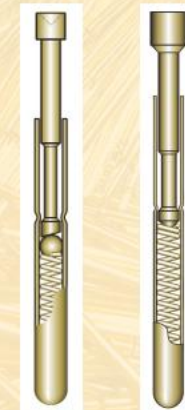
✦ Force Delivery

✦ Ball Bias

✦ Bias Cut

✦ Straight

✦ Other tricks



Images courtesy IDI

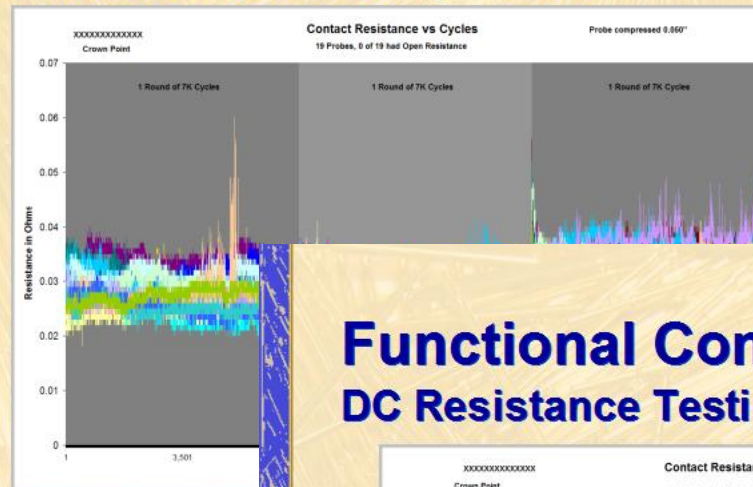
June 6, 2004

Roger Sinsheimer, PE

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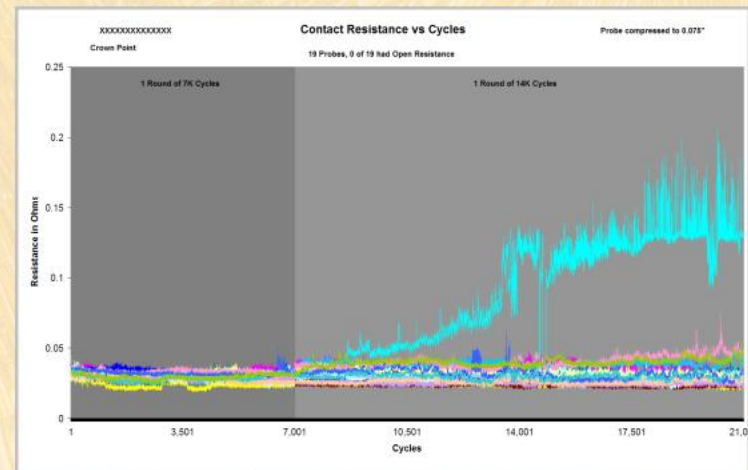
Back to the Future II, p3

Functional Compliance DC Resistance Testing – Good



June 6, 2004

Functional Compliance DC Resistance Testing – Bad



June 6, 2004

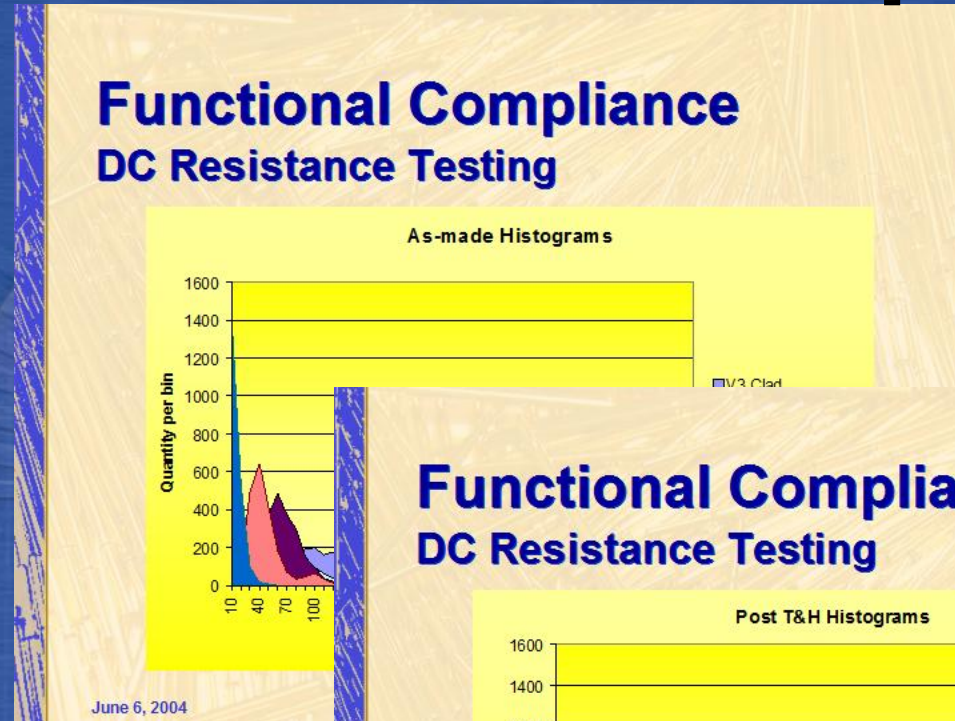
Roger Sinsheimer, PE

➡ The result of this inherent flaw is DC Resistance instability

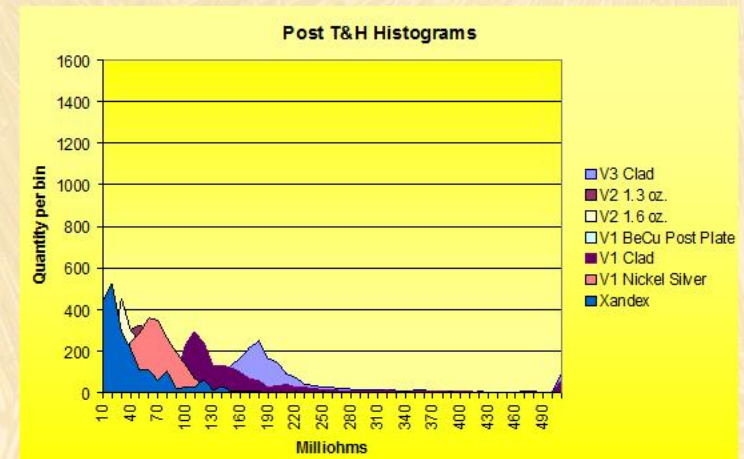
Back to the Future II, p4

⇒ DC Resistance histograms of various types of spring probes.

Functional Compliance DC Resistance Testing



Functional Compliance DC Resistance Testing

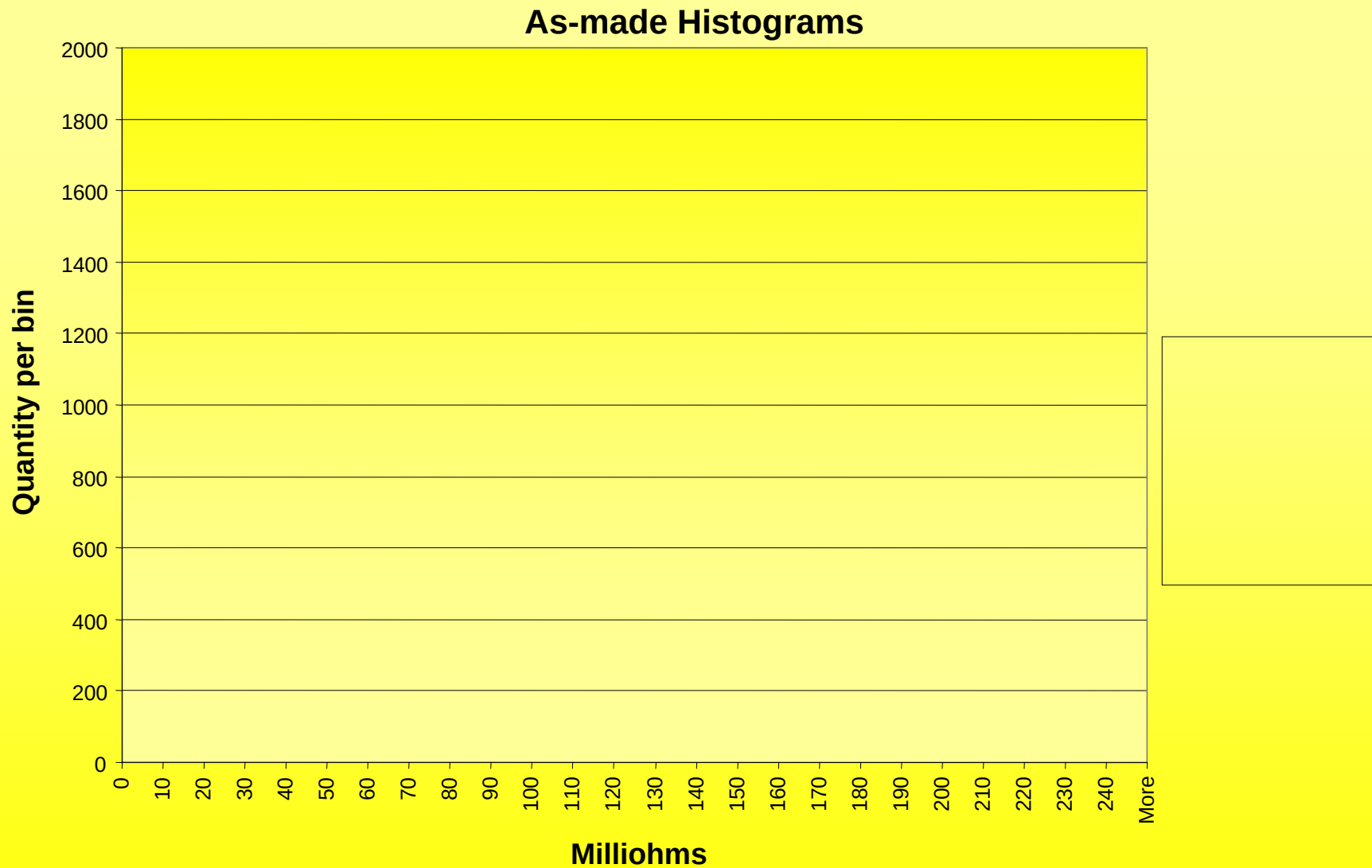


June 6, 2004

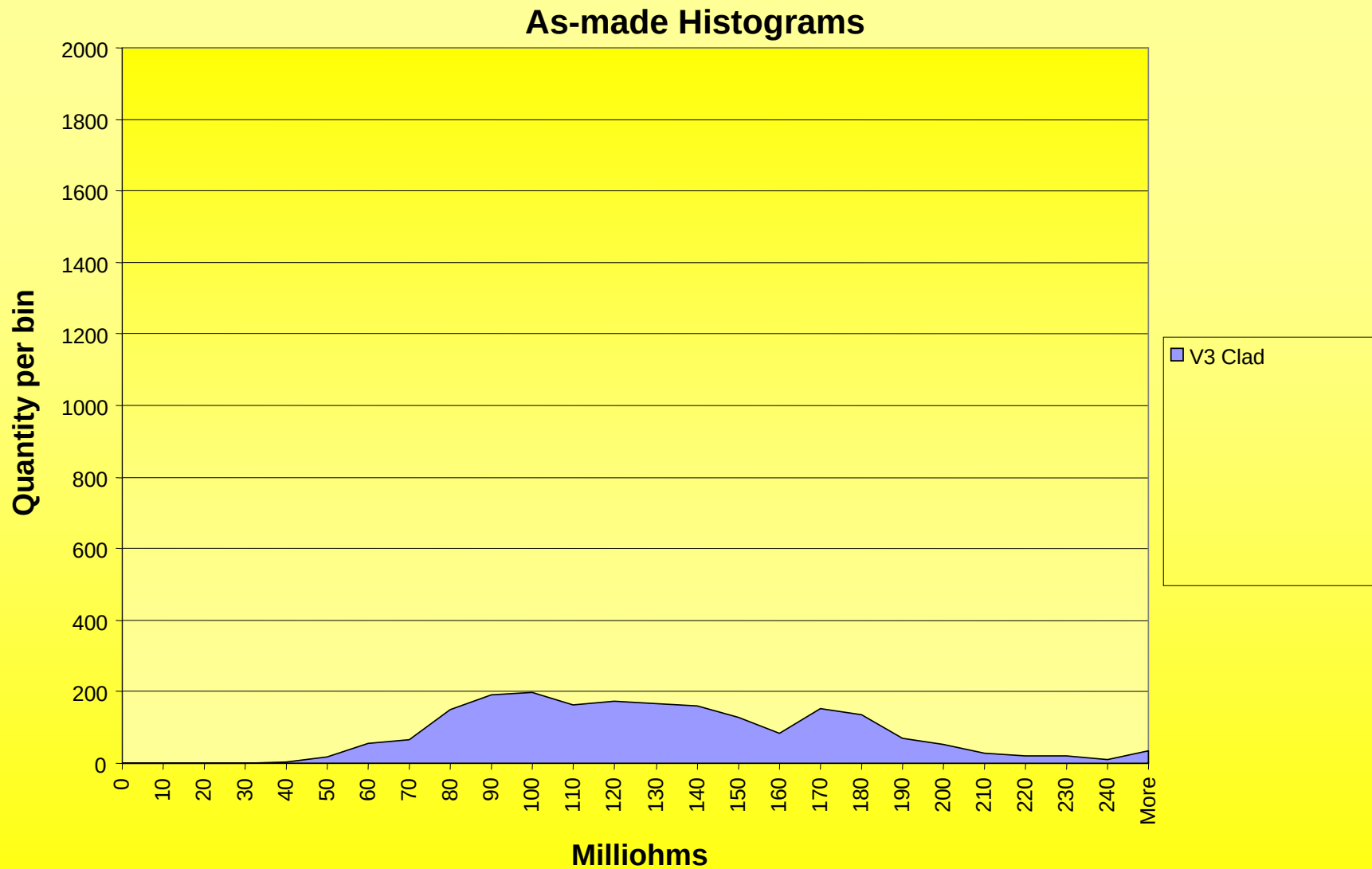
Roger Sinsheimer, PE

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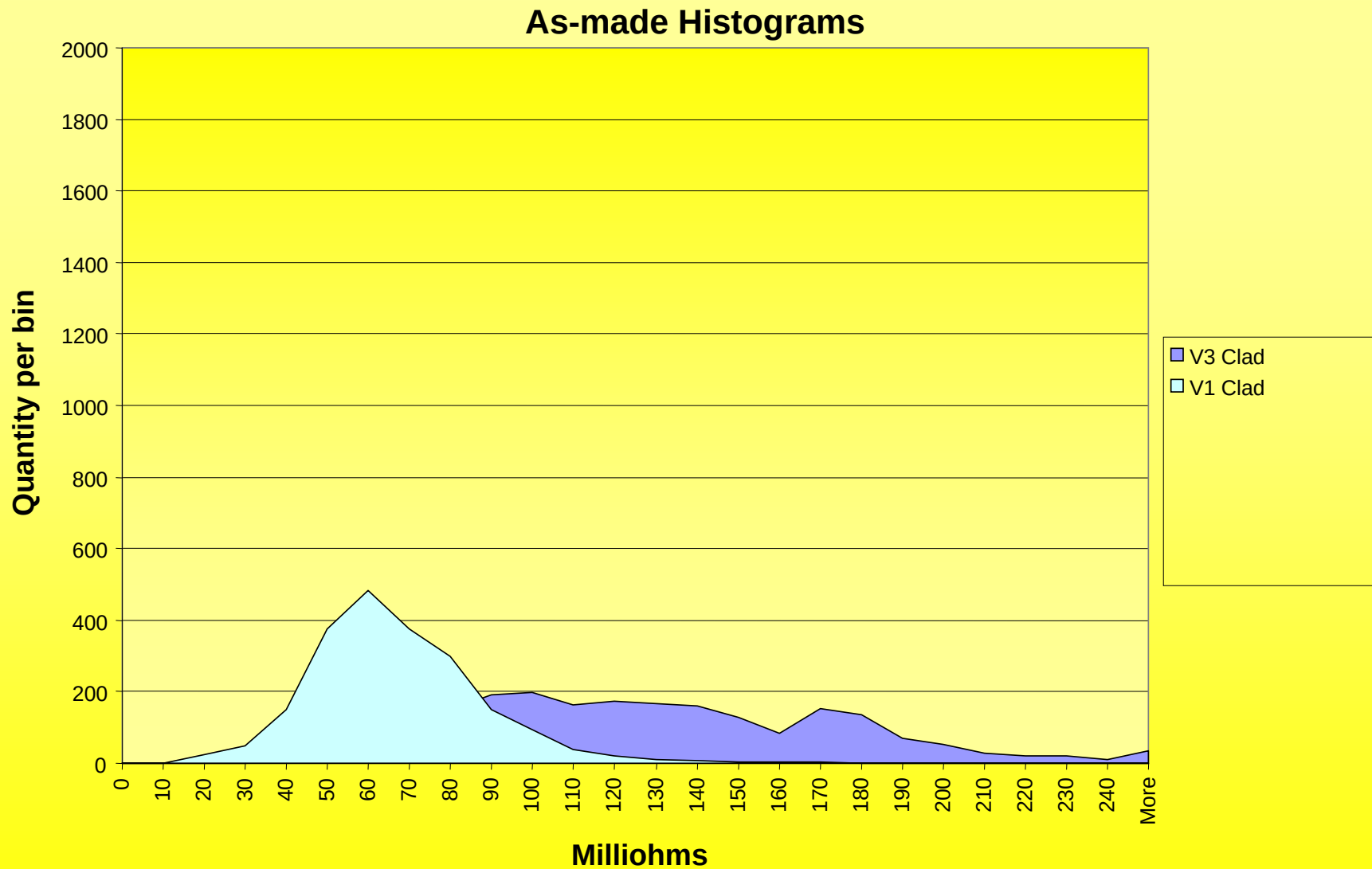
Back to the Future II, p5



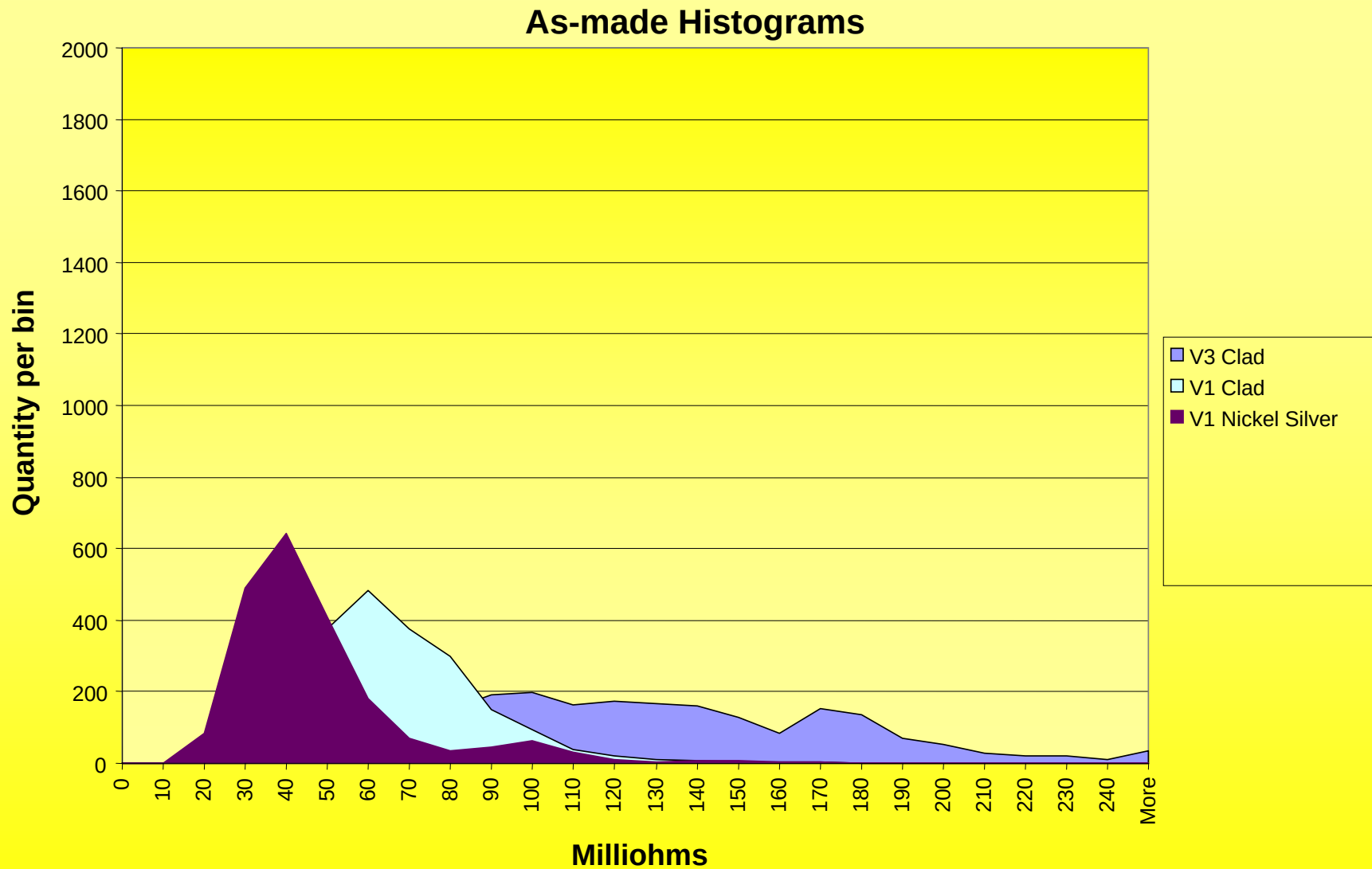
Back to the Future II, p5



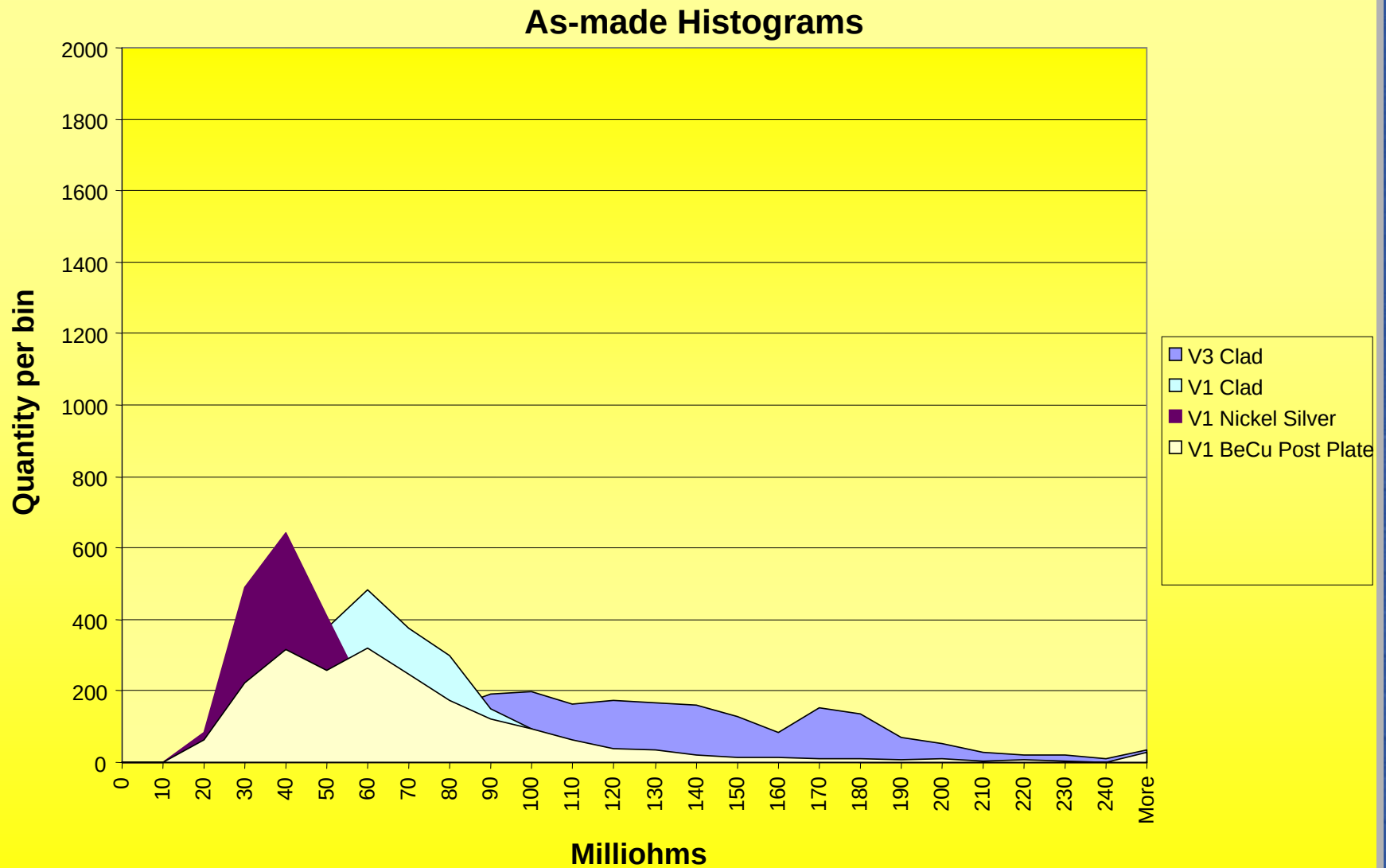
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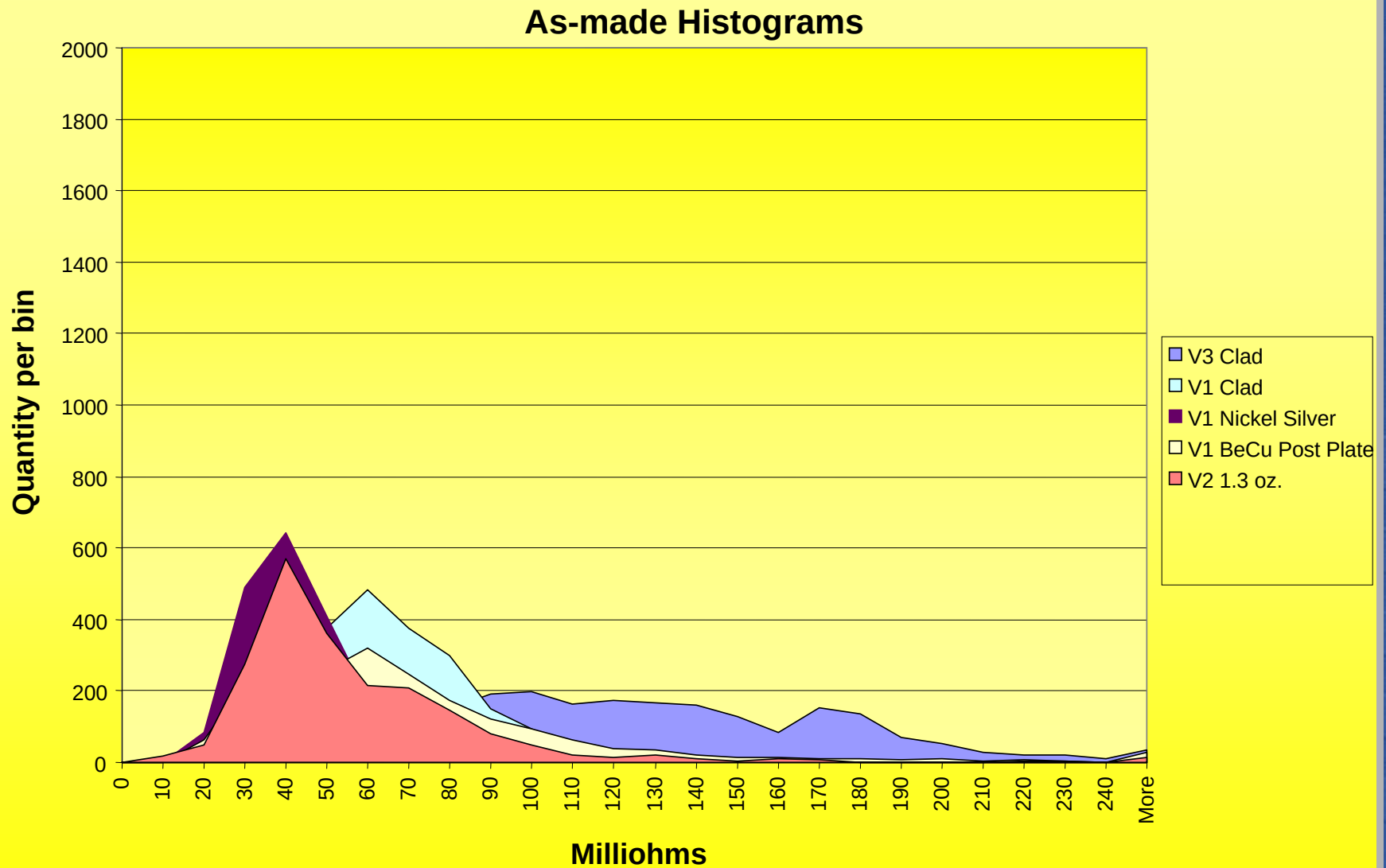
Back to the Future II, p5



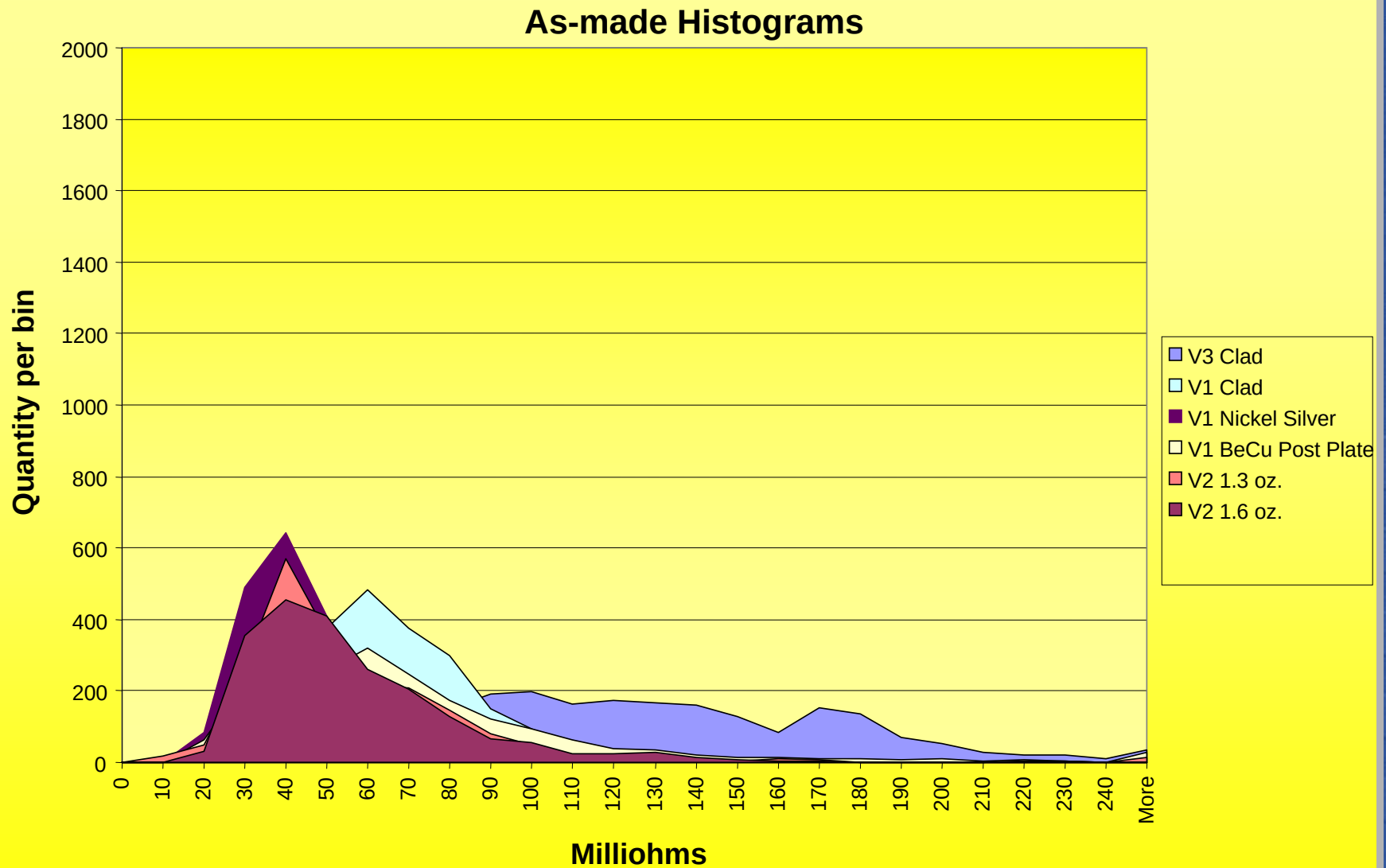
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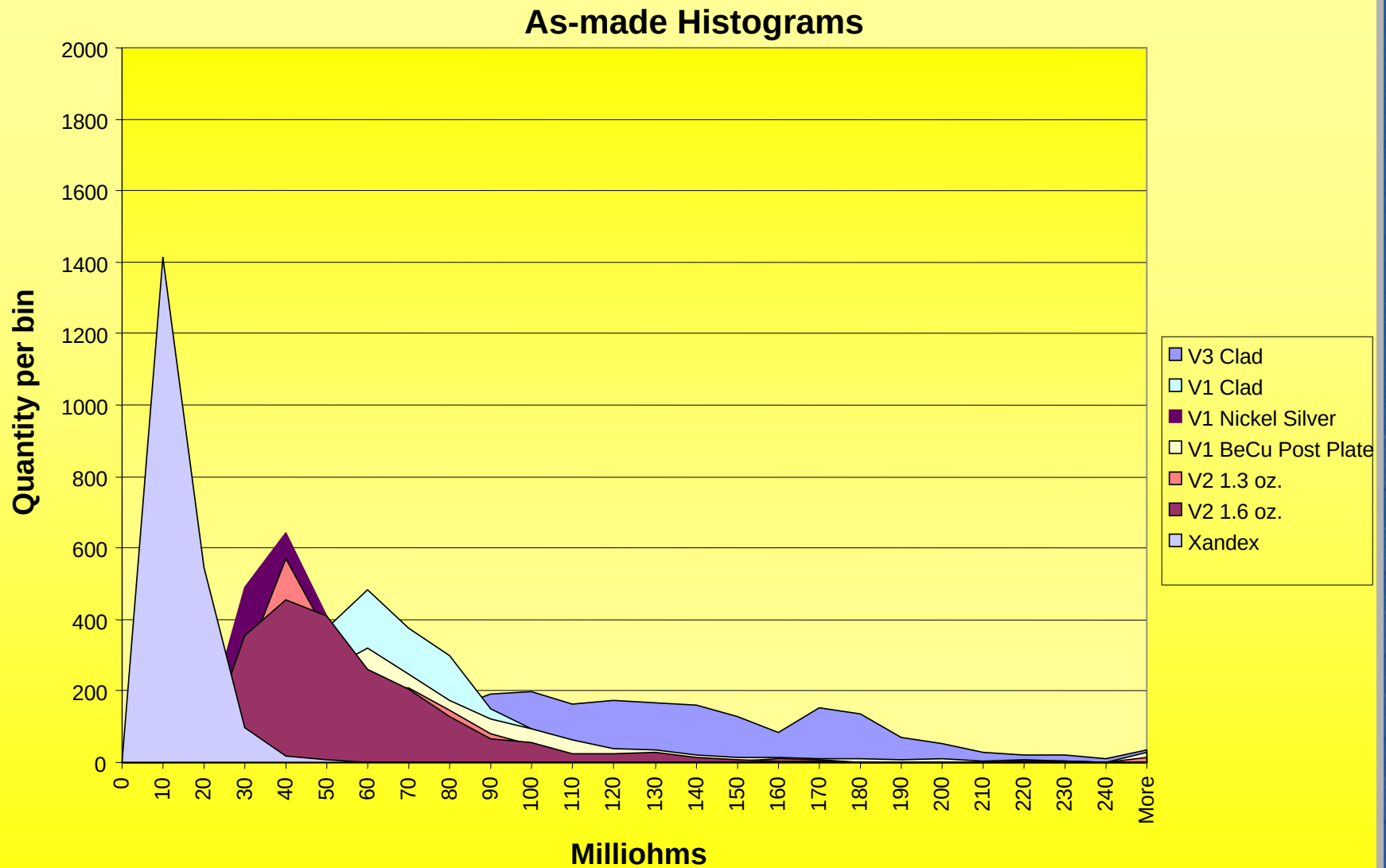
Back to the Future II, p5



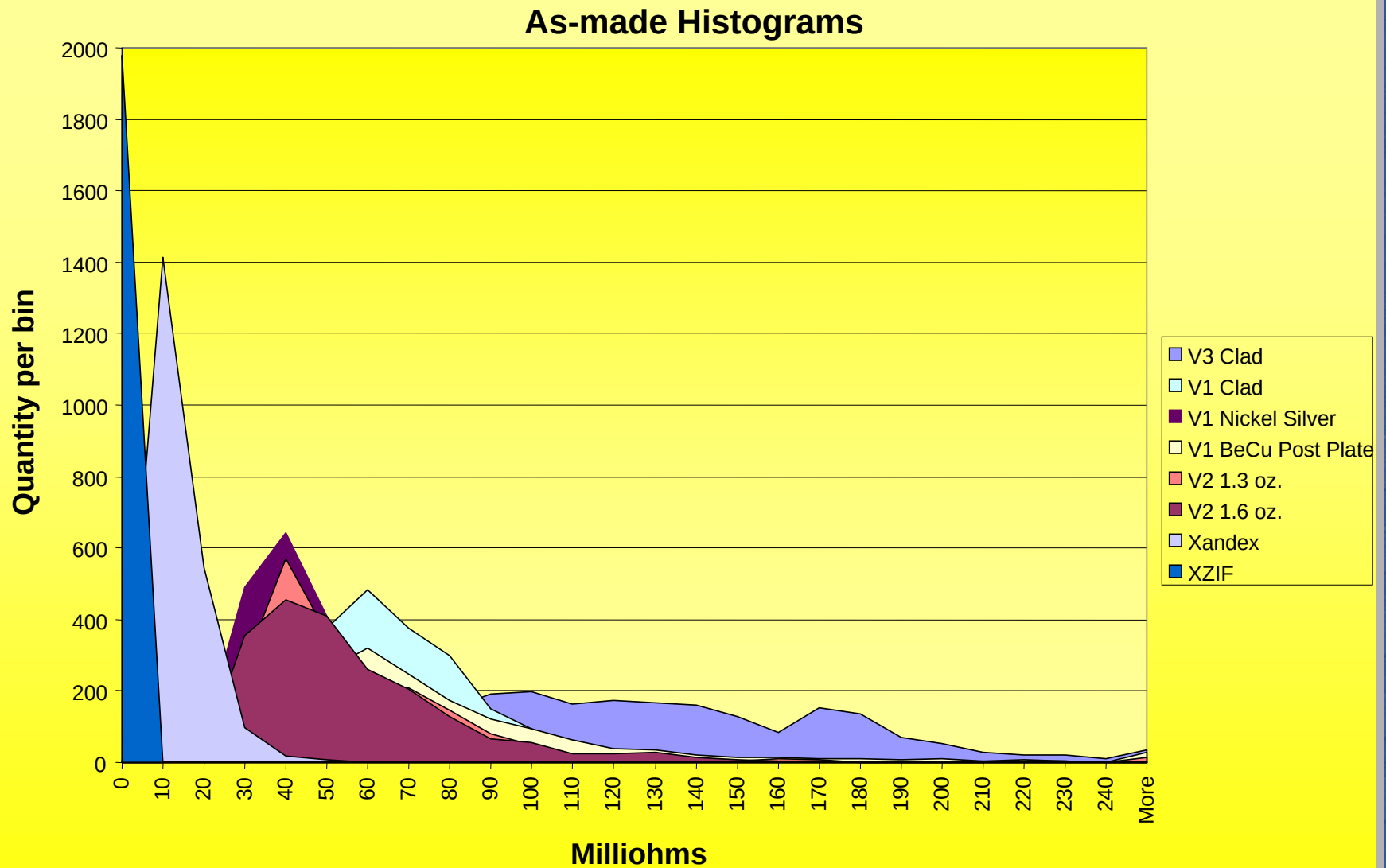
Back to the Future II, p5



Back to the Future II, p5

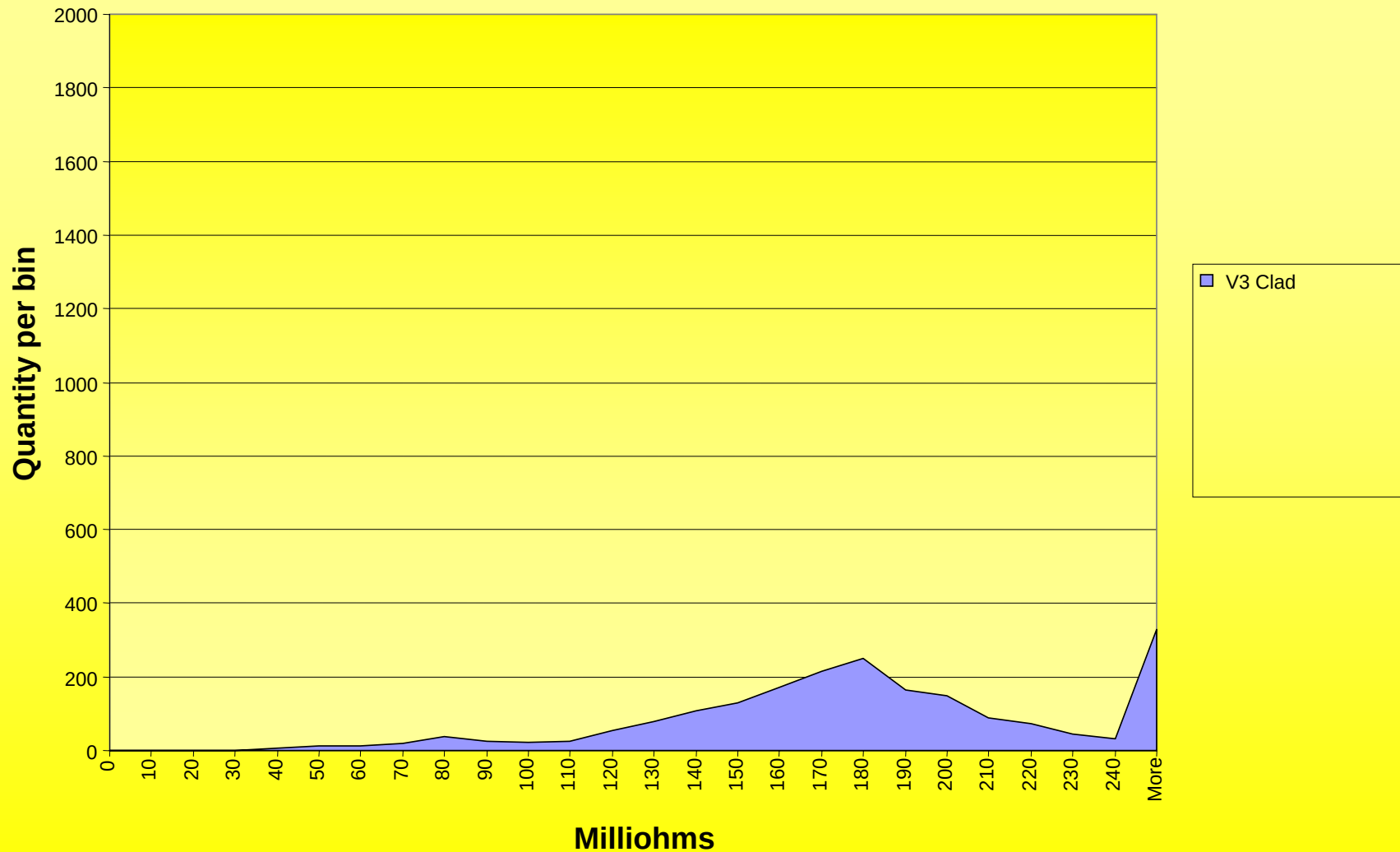


Back to the Future II, p5



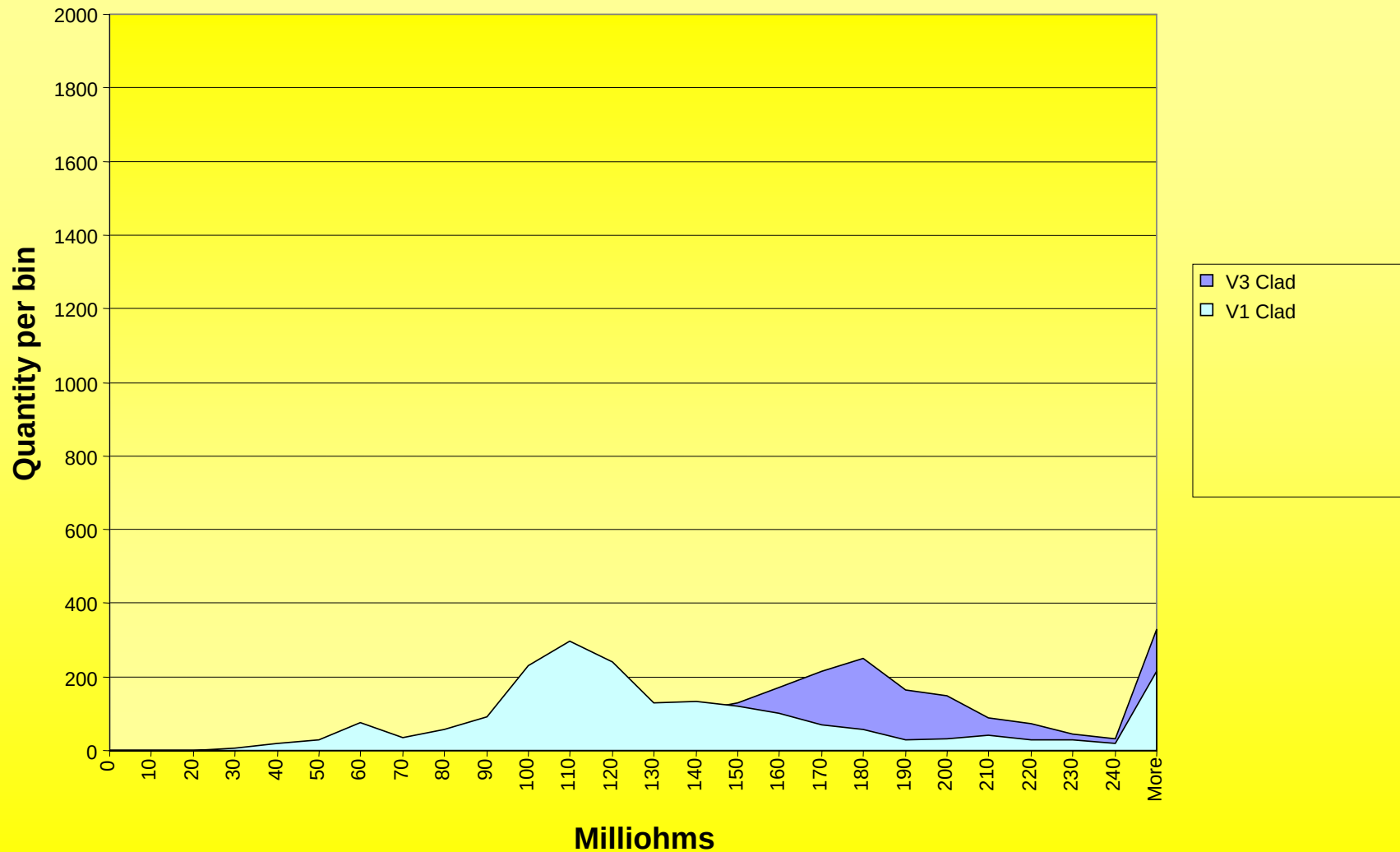
Back to the Future II, p6

Post T&H Histograms



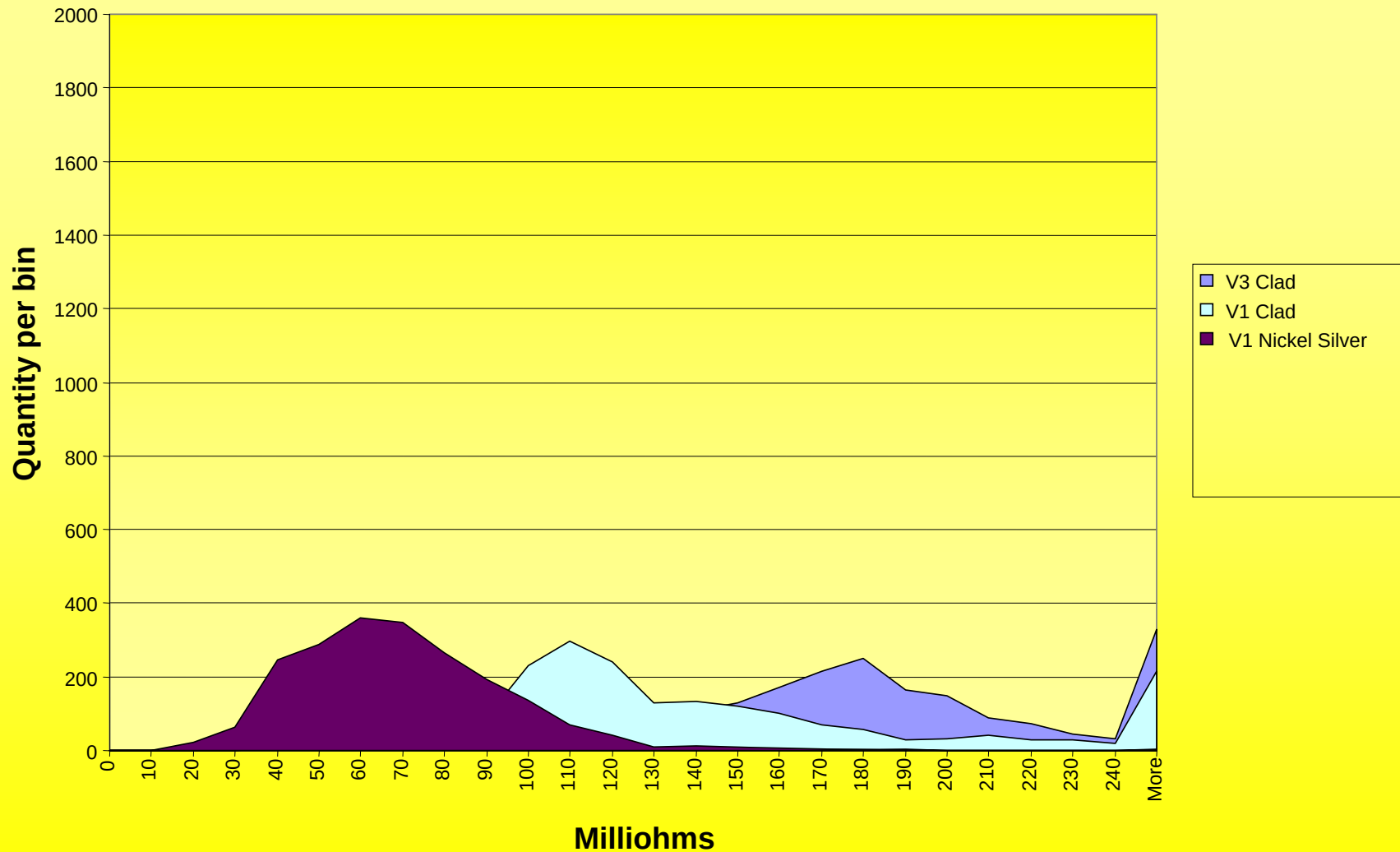
Back to the Future II, p6

Post T&H Histograms



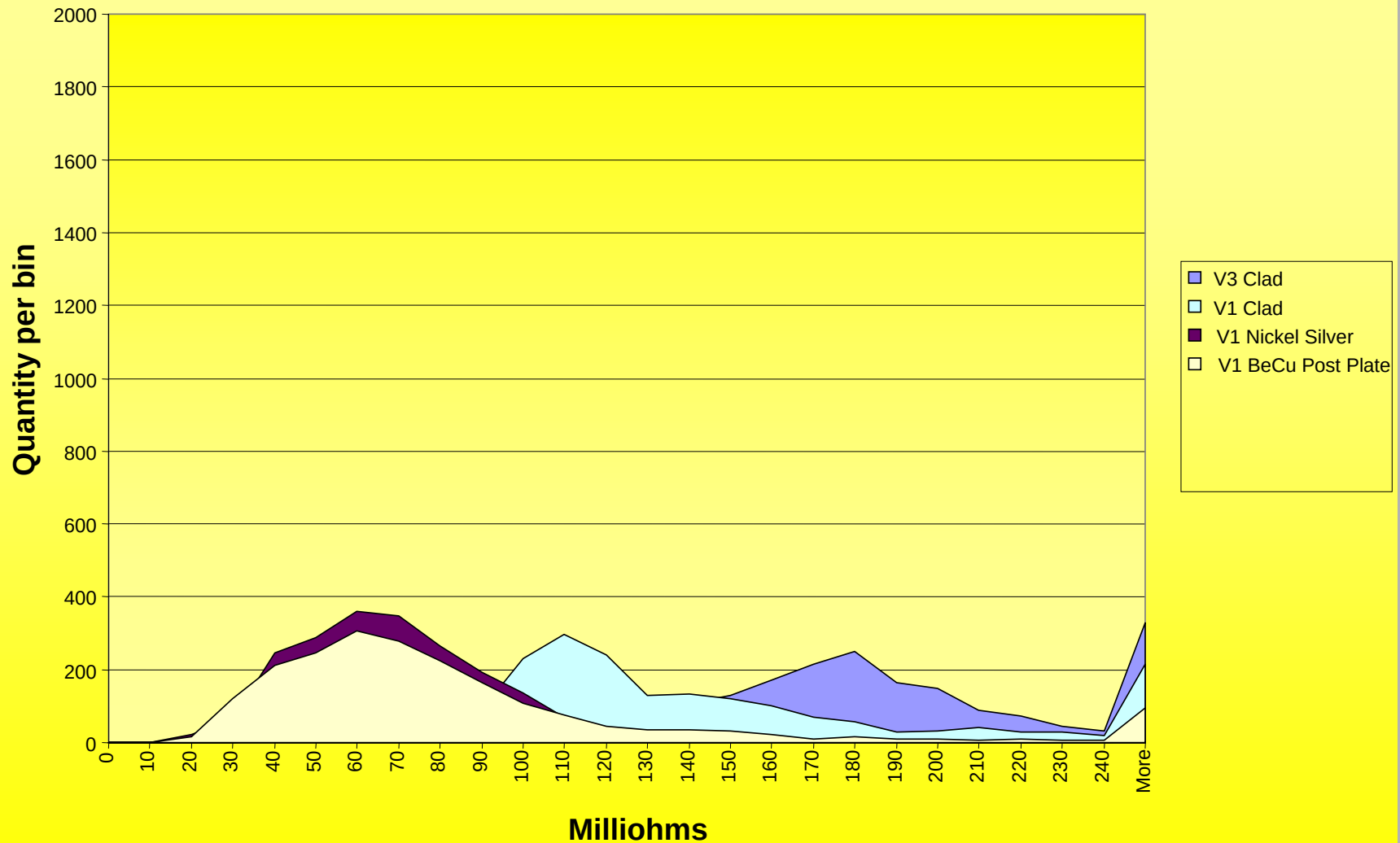
Back to the Future II, p6

Post T&H Histograms



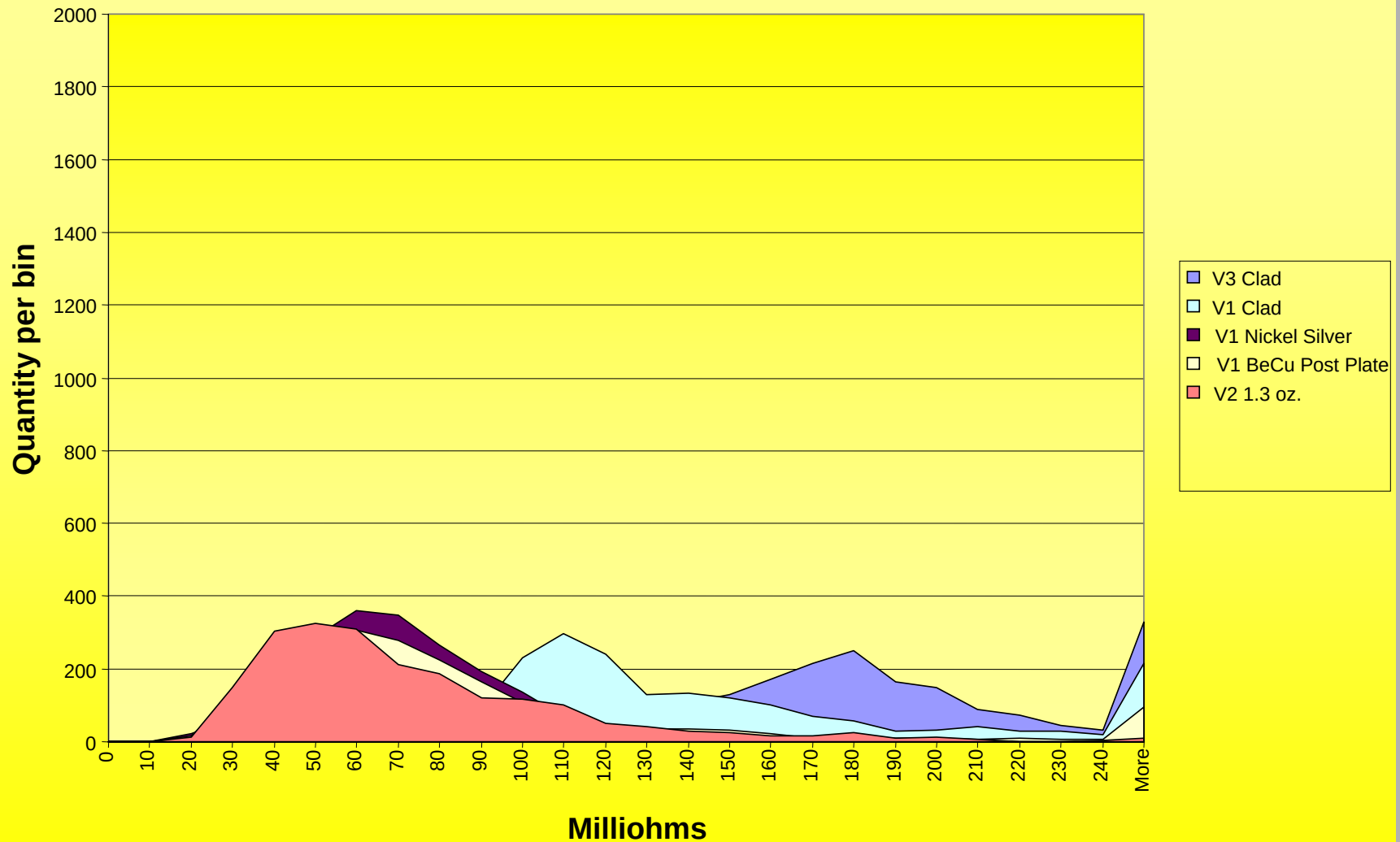
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Post T&H Histograms



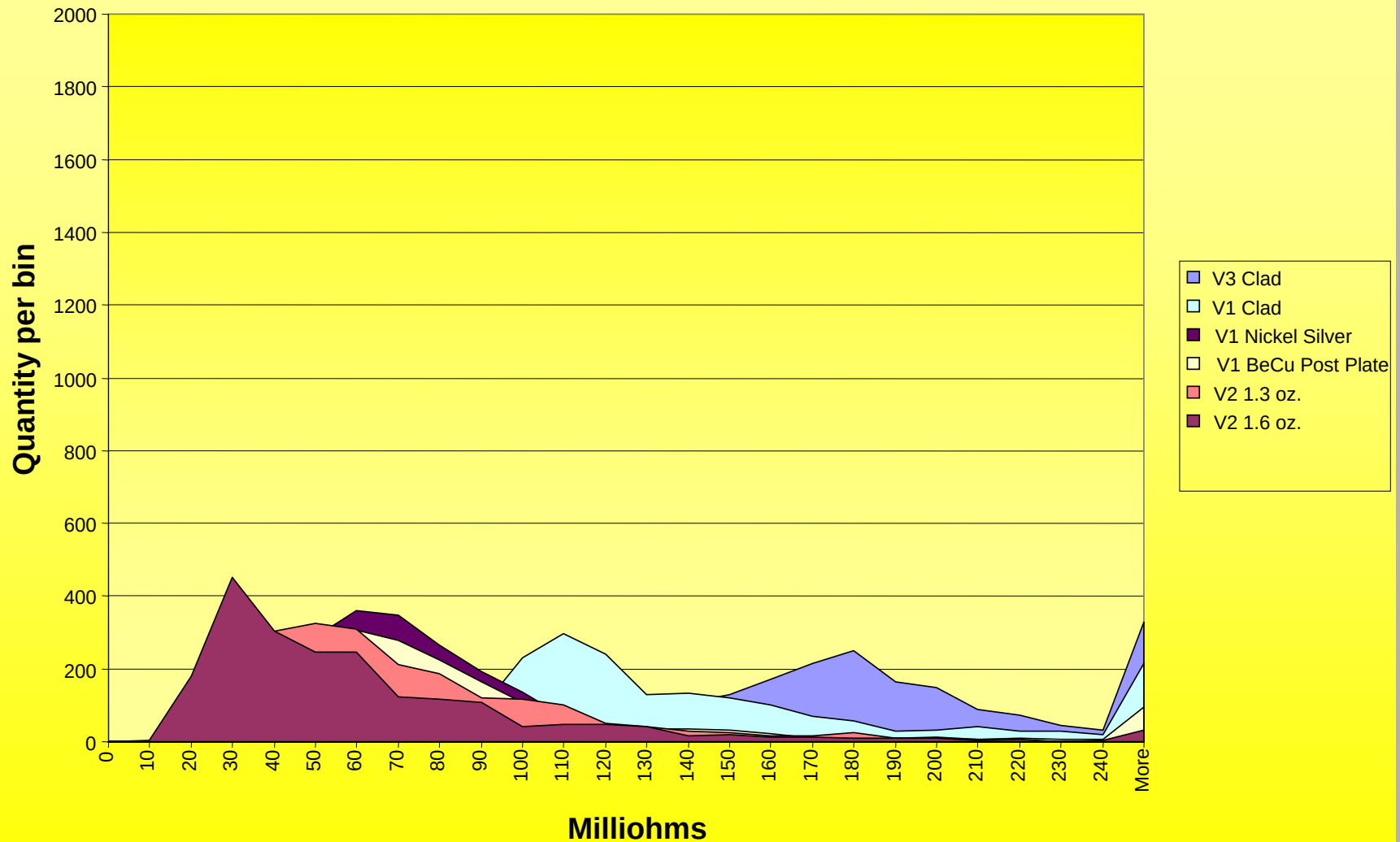
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Post T&H Histograms



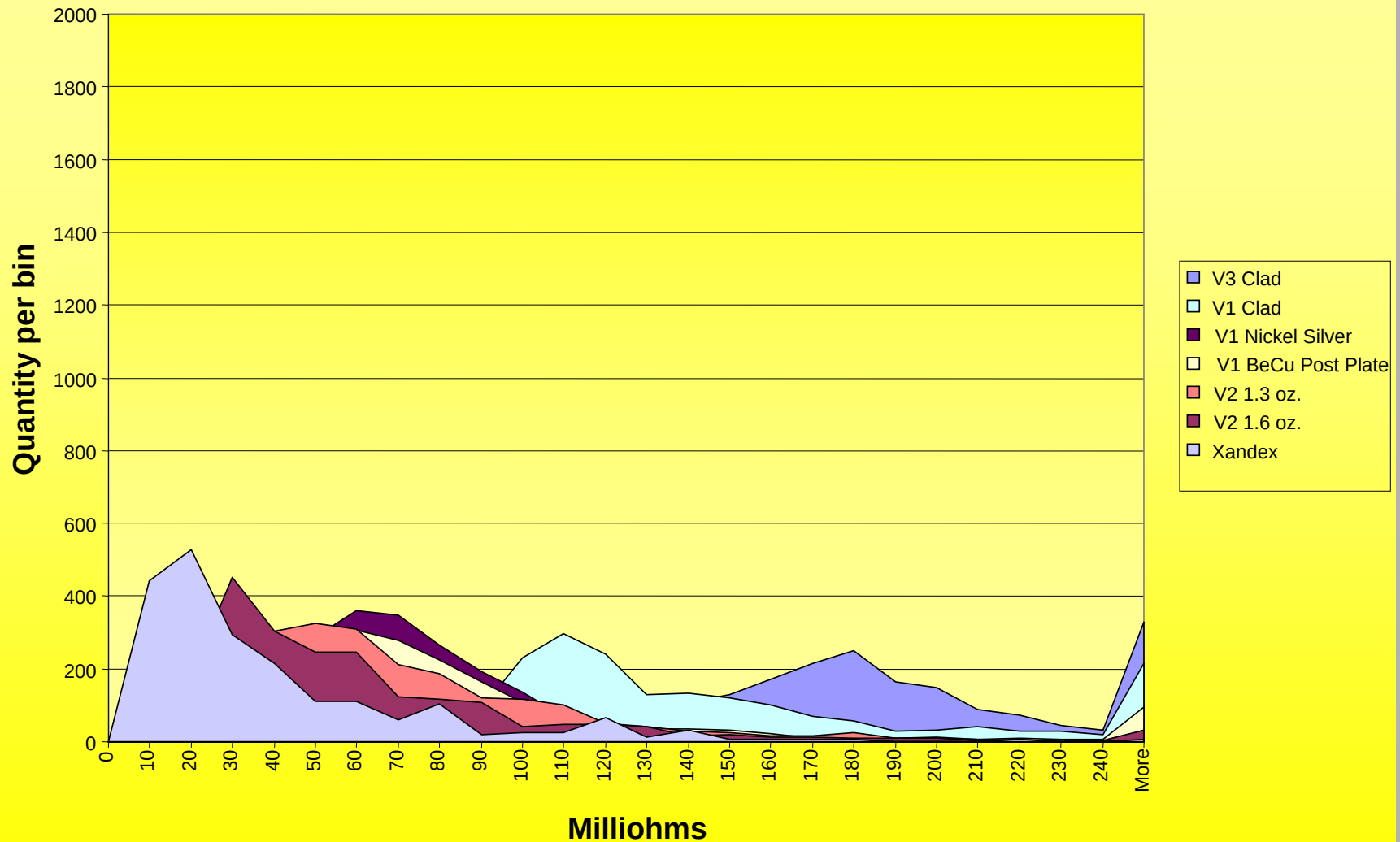
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Post T&H Histograms



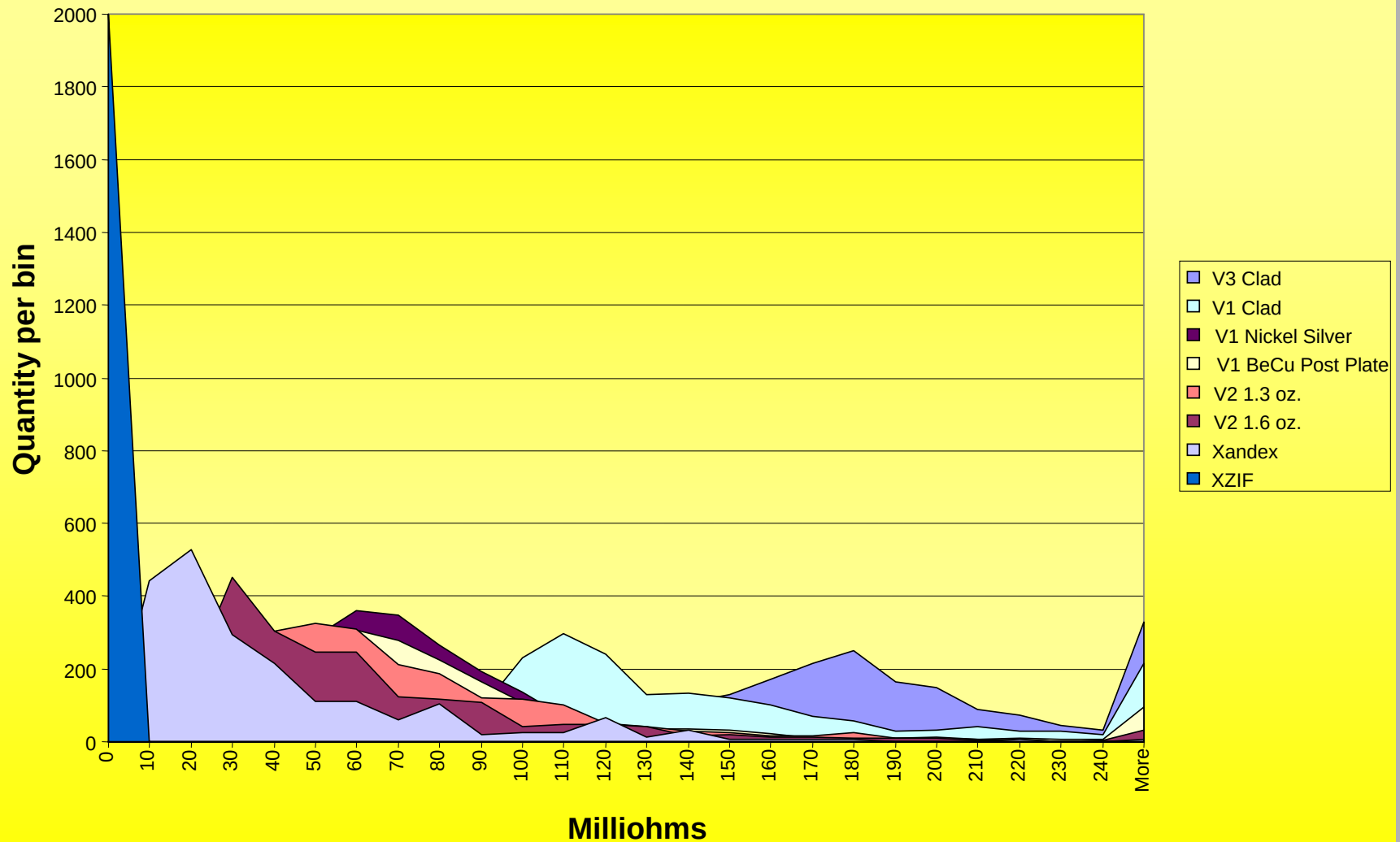
Back to the Future II, p6

Post T&H Histograms



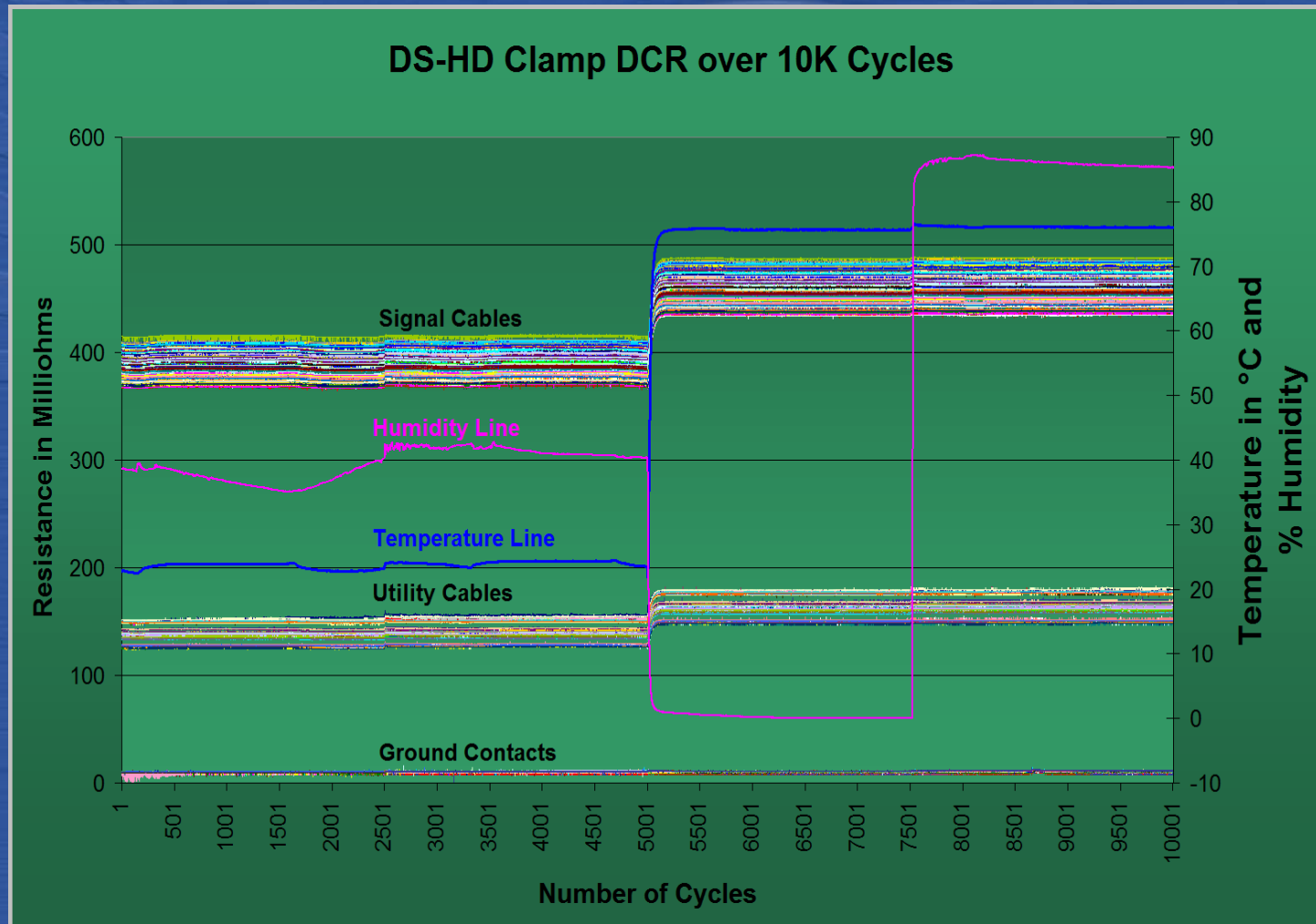
Back to the Future II, p6

Post T&H Histograms

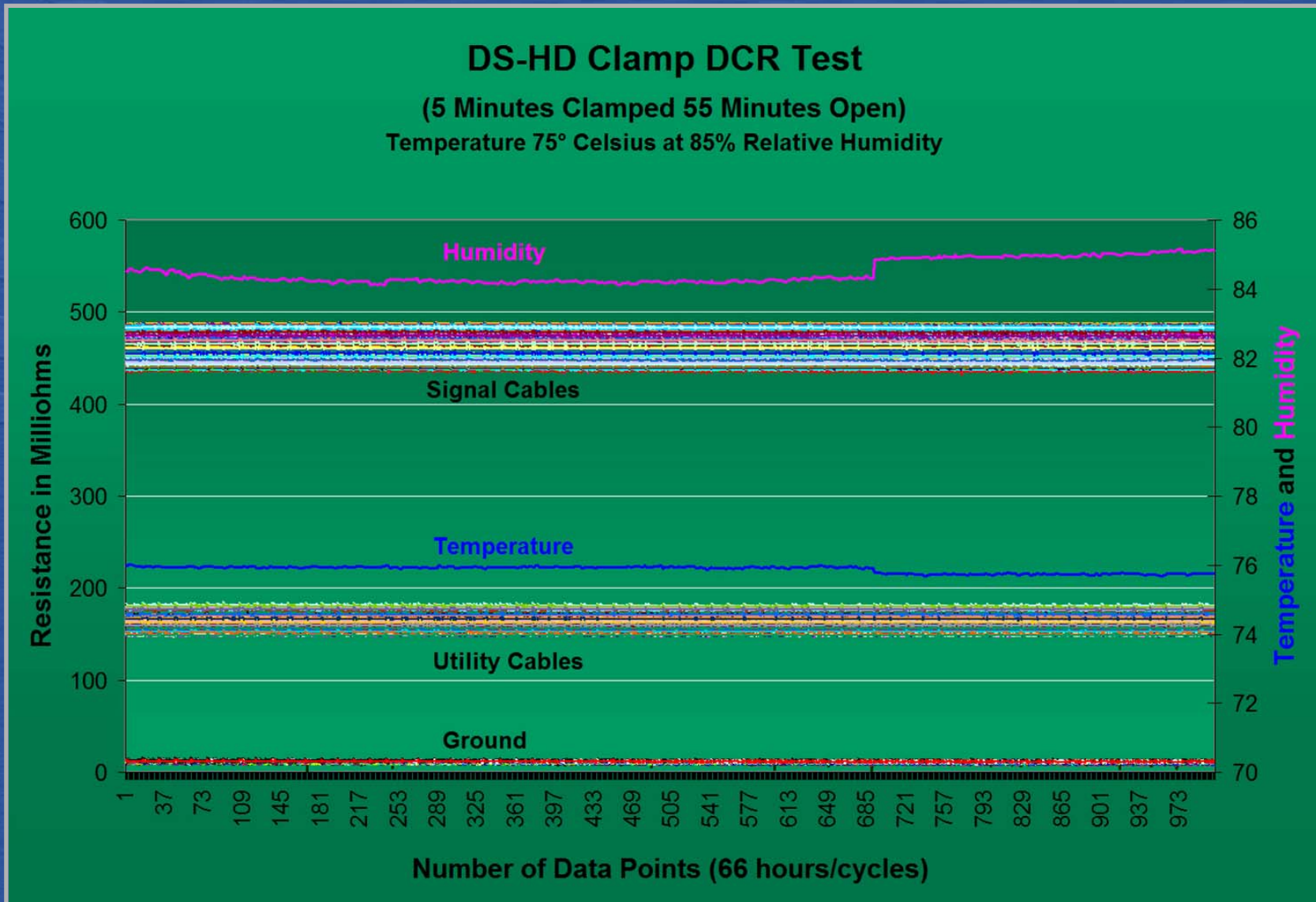


Reliability

⇒ 2.5 million XZIF mate / de-mate cycles



Reliability, p2



So how did we do this?

⇒ XZIF

- ⇒ Knocked the problem on its ear – turned the signal 90°, delivered 120g of force per contact

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- ⇒ Knocked the problem on its ear – turned the signal 90°, delivered 120g of force per contact
- ⇒ Co-developed rock-solid contact technology

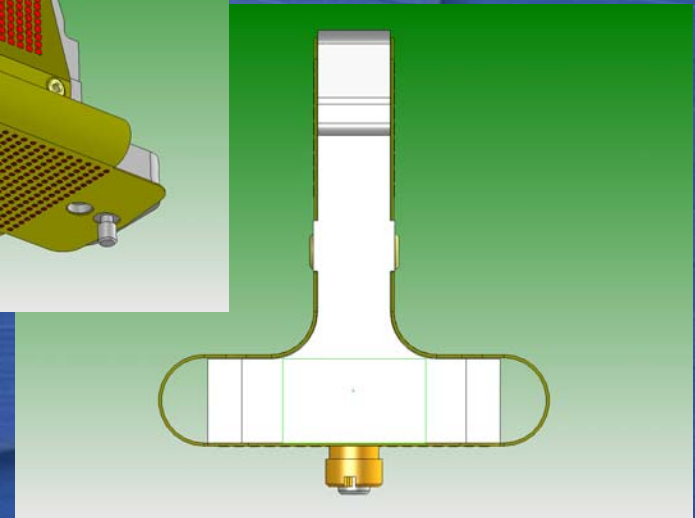
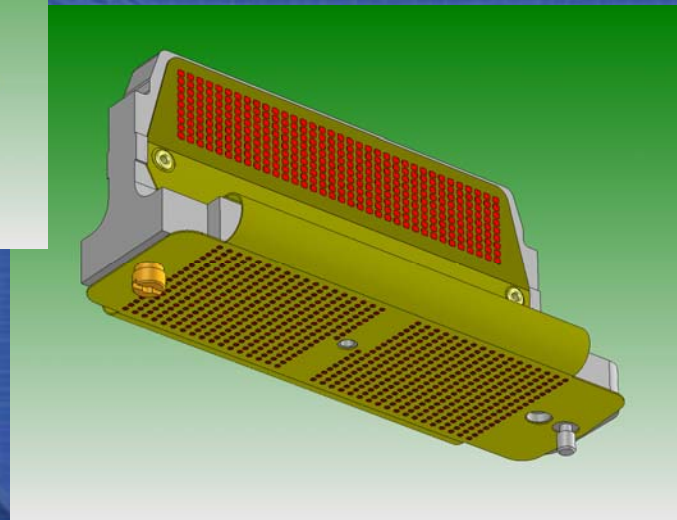
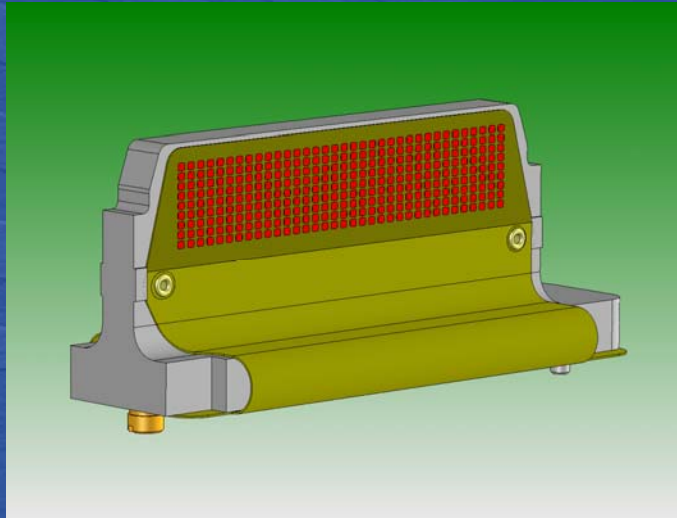
So how did we do this?

⇒ XZIF

- ⇒ Knocked the problem on its ear – turned the signal 90°, delivered 120g of force per contact
- ⇒ Co-developed rock-solid contact technology
- ⇒ Created means for self-alignment between the interconnects

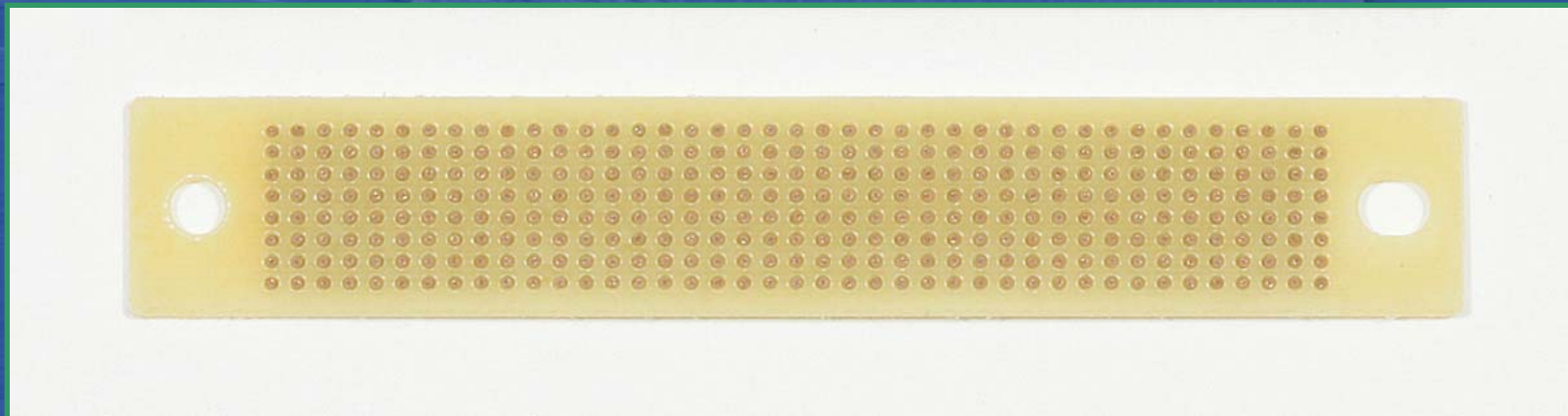
How we did it, p2

⇒ Turned the signal 90°



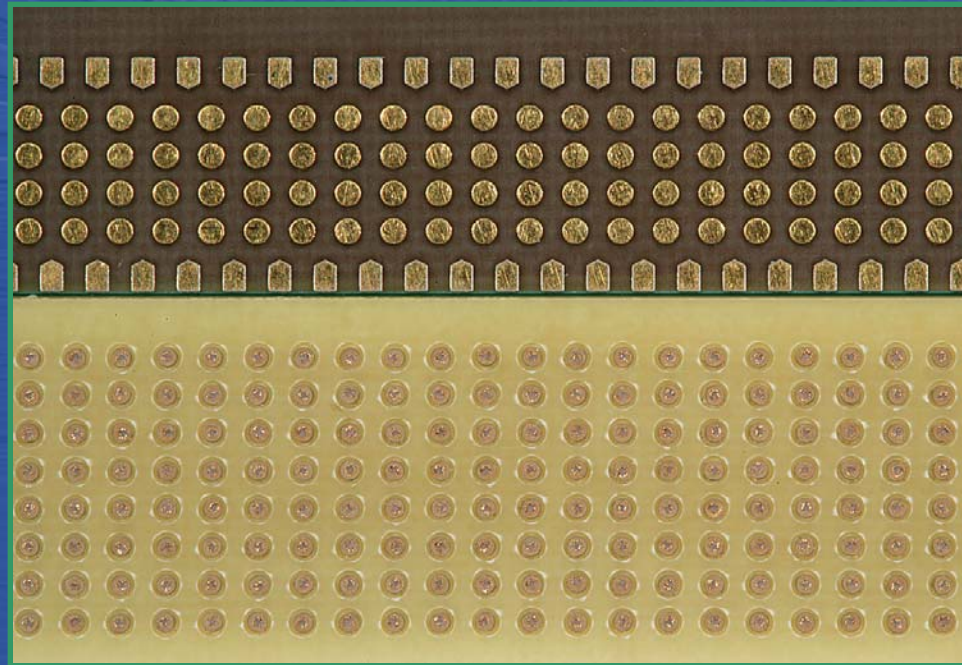
How we did it, p3

⇒ Rock-solid contact technology



How we did it, p3

⇒ Rock-solid contact technology



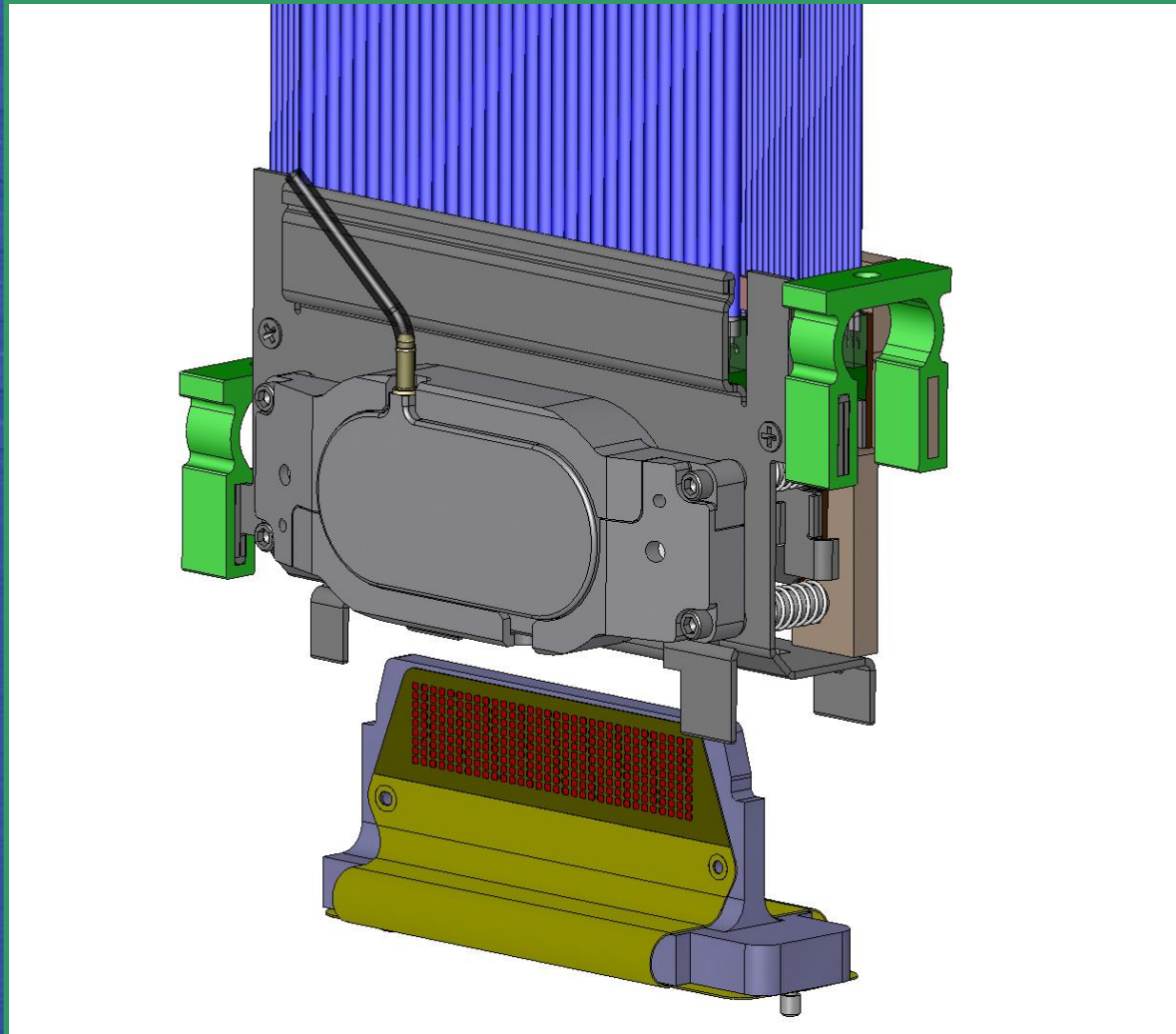
How we did it, p3

⇒ Rock-solid contact technology



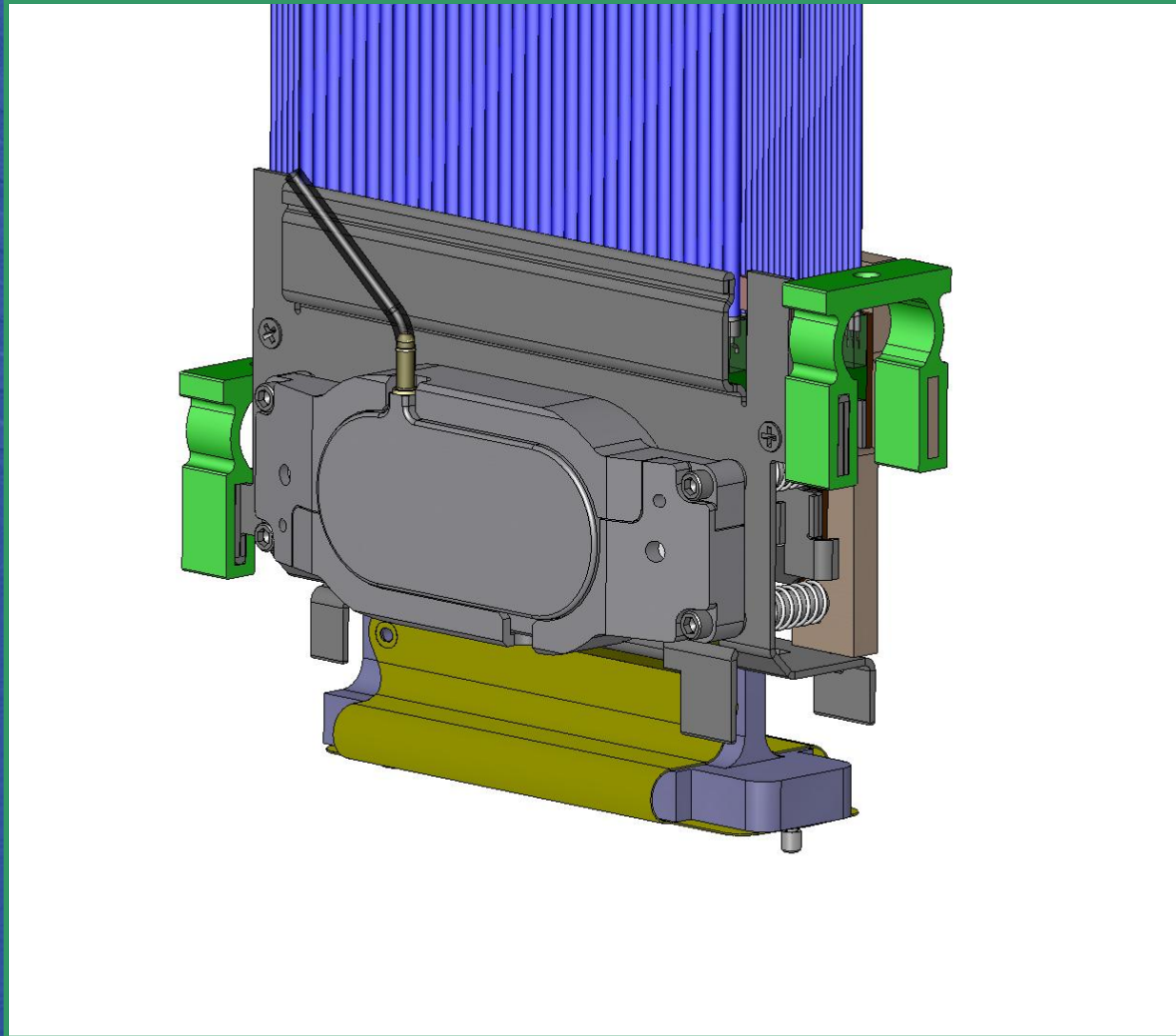
How we did it, p4

⇒ Self alignment



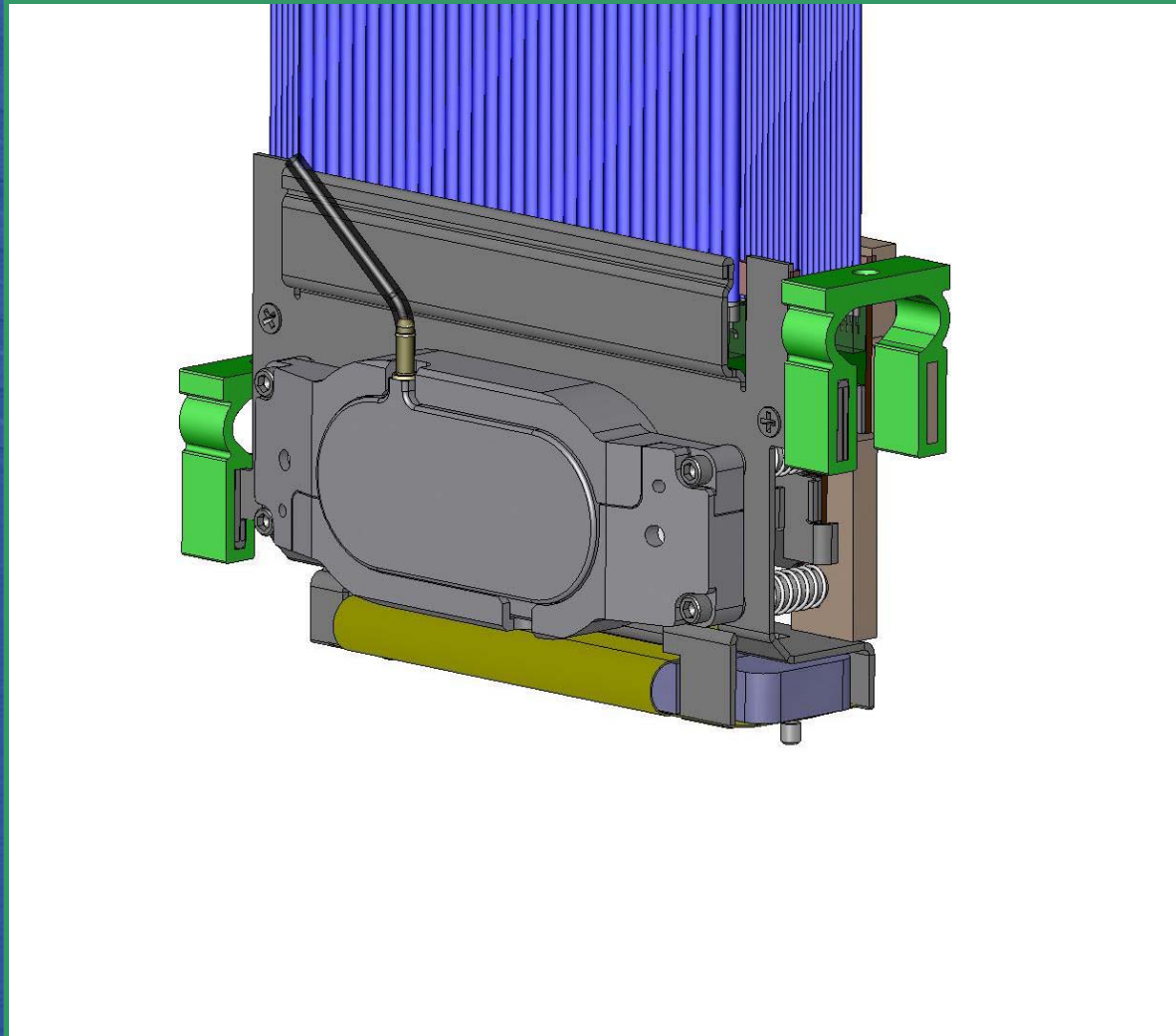
How we did it, p4

⇒ Self alignment



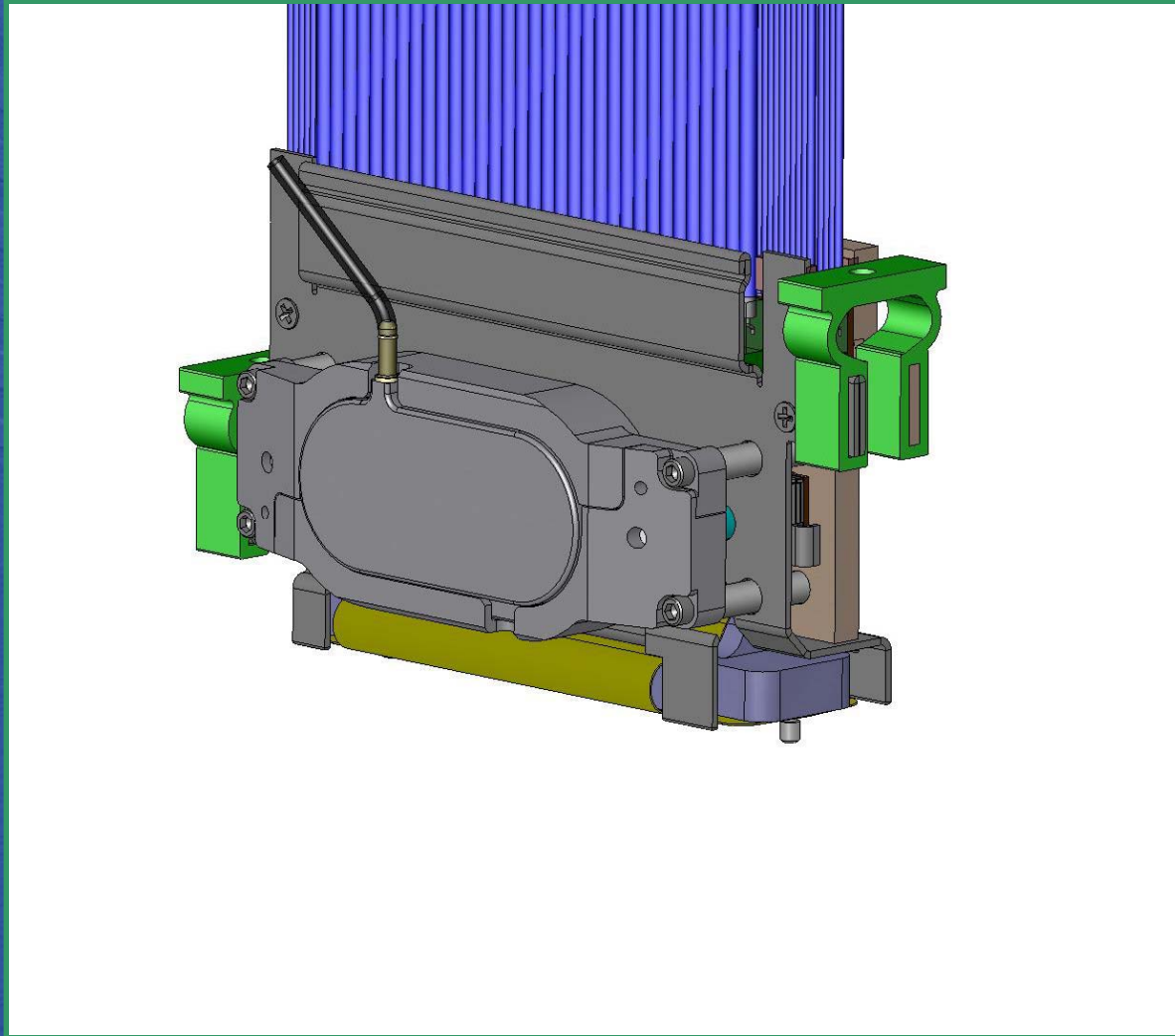
How we did it, p4

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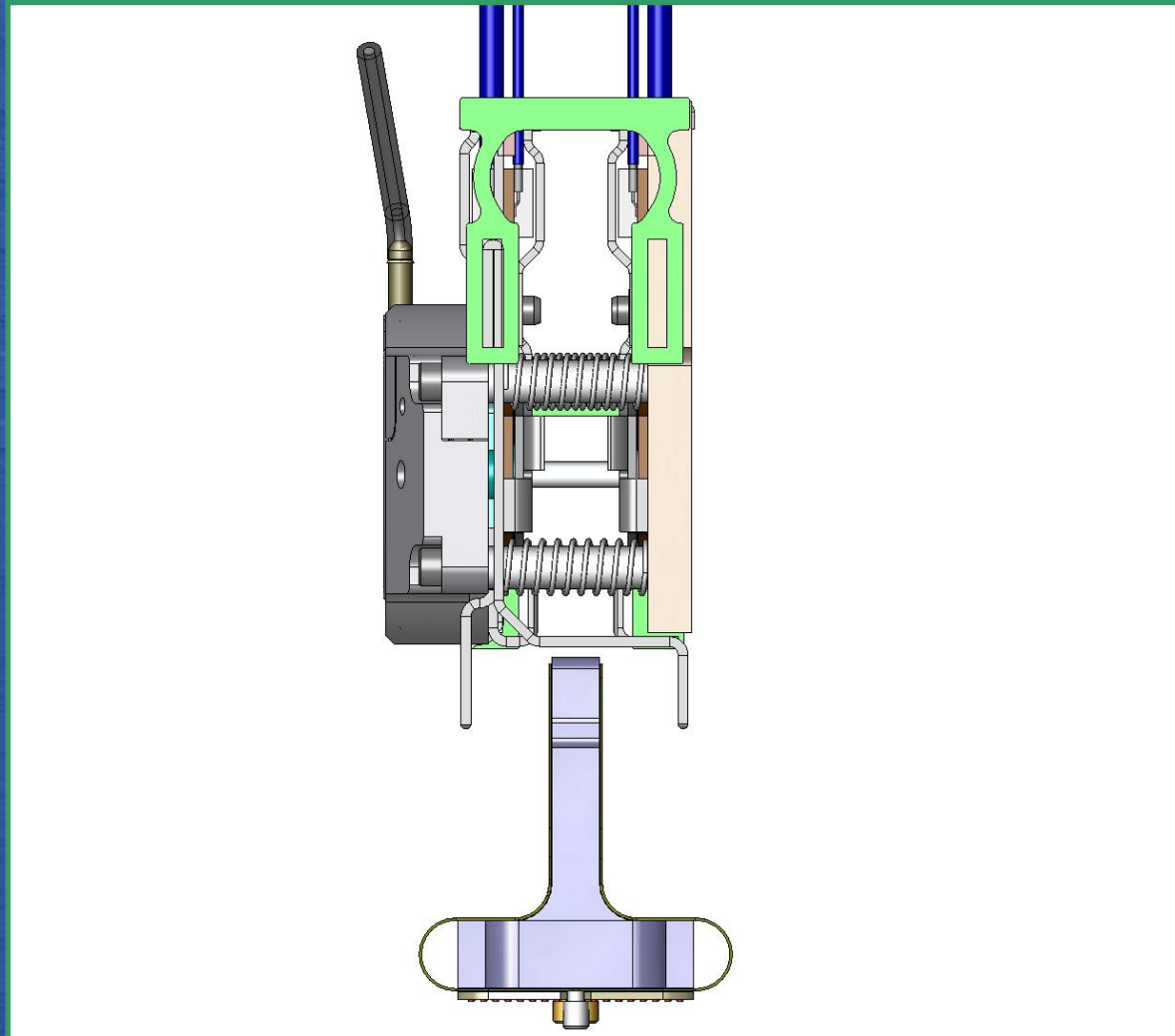
How we did it, p4

⇒ Self alignment



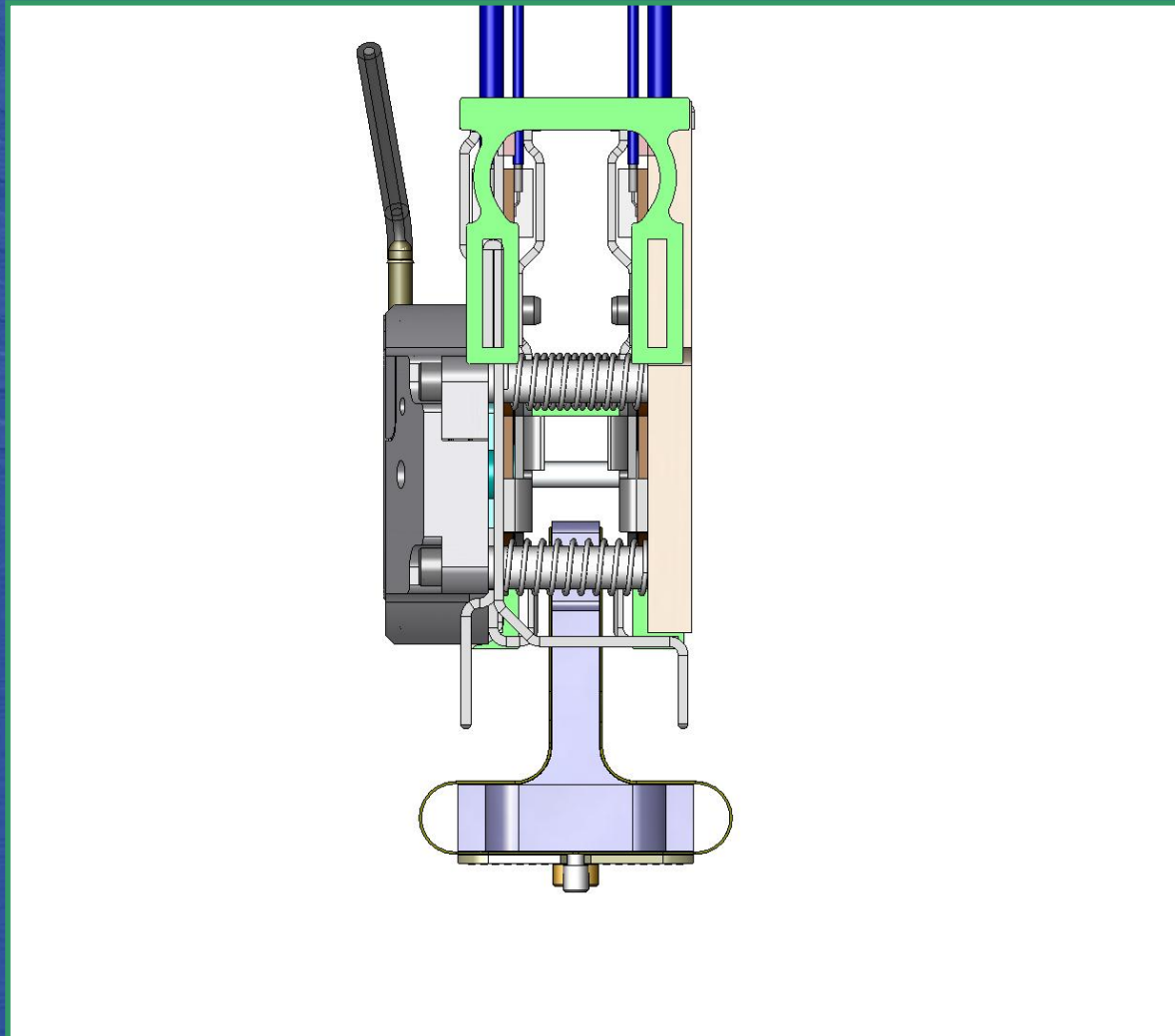
How we did it, p4

⇒ Self alignment



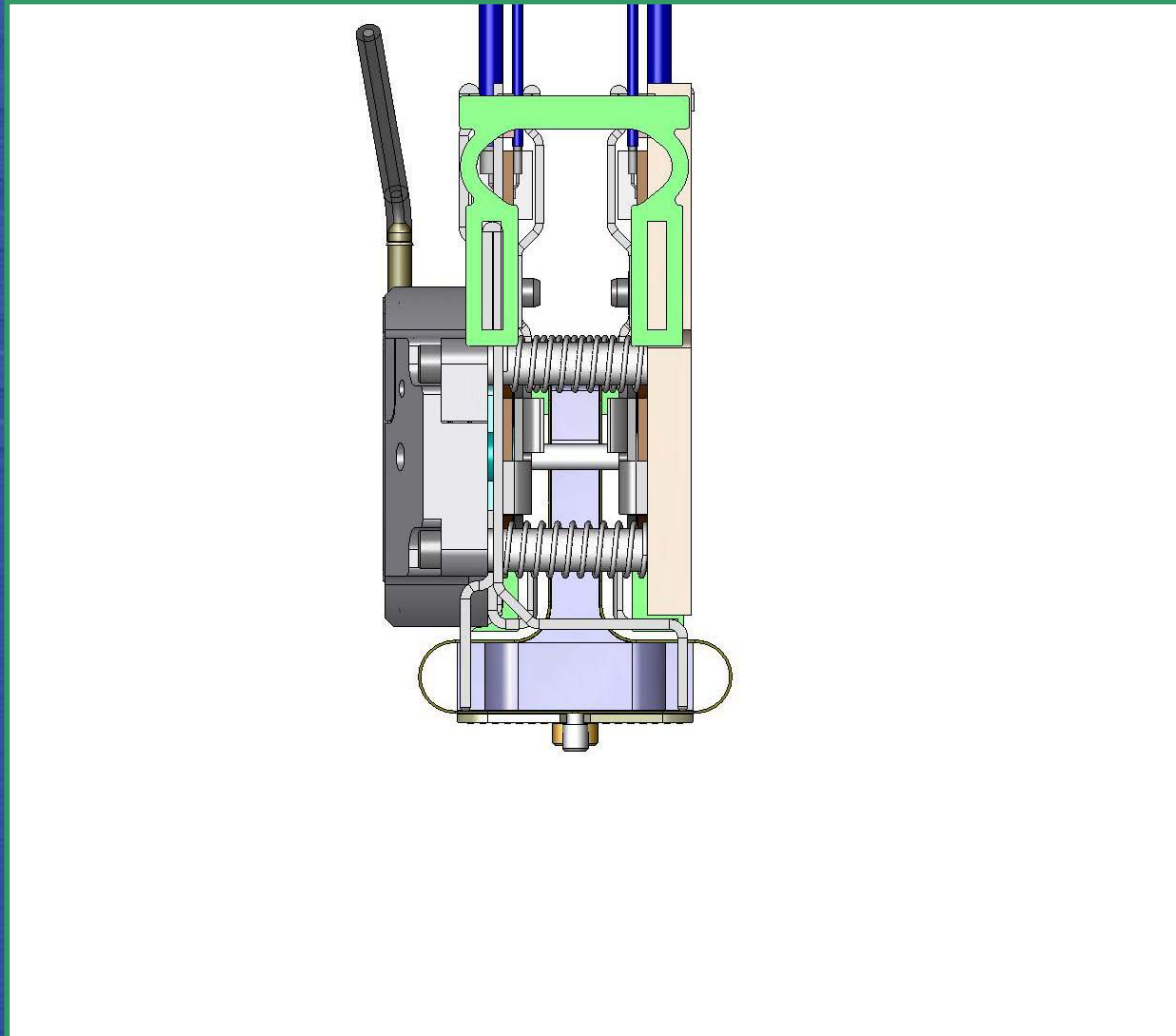
How we did it, p4

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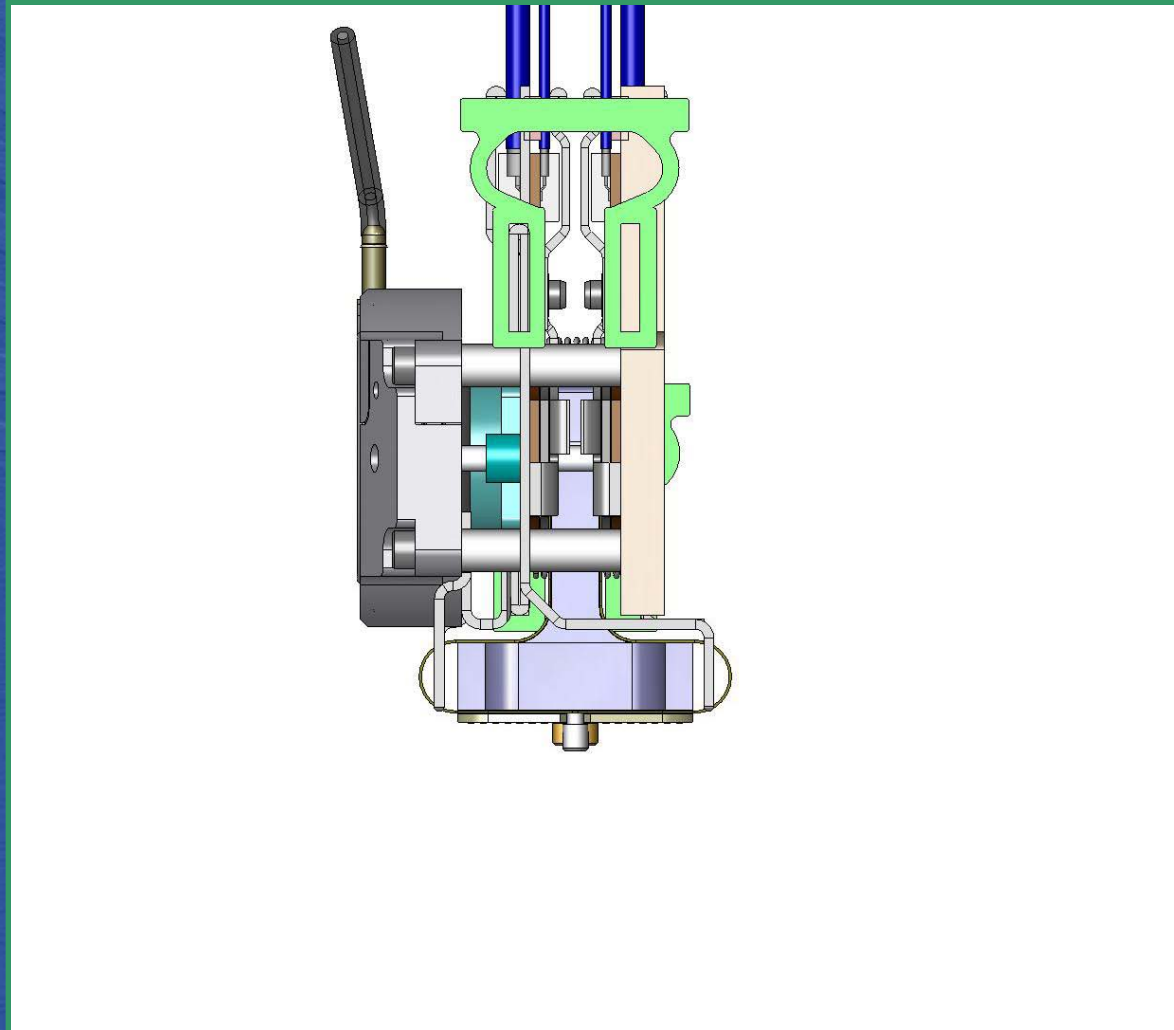
How we did it, p4

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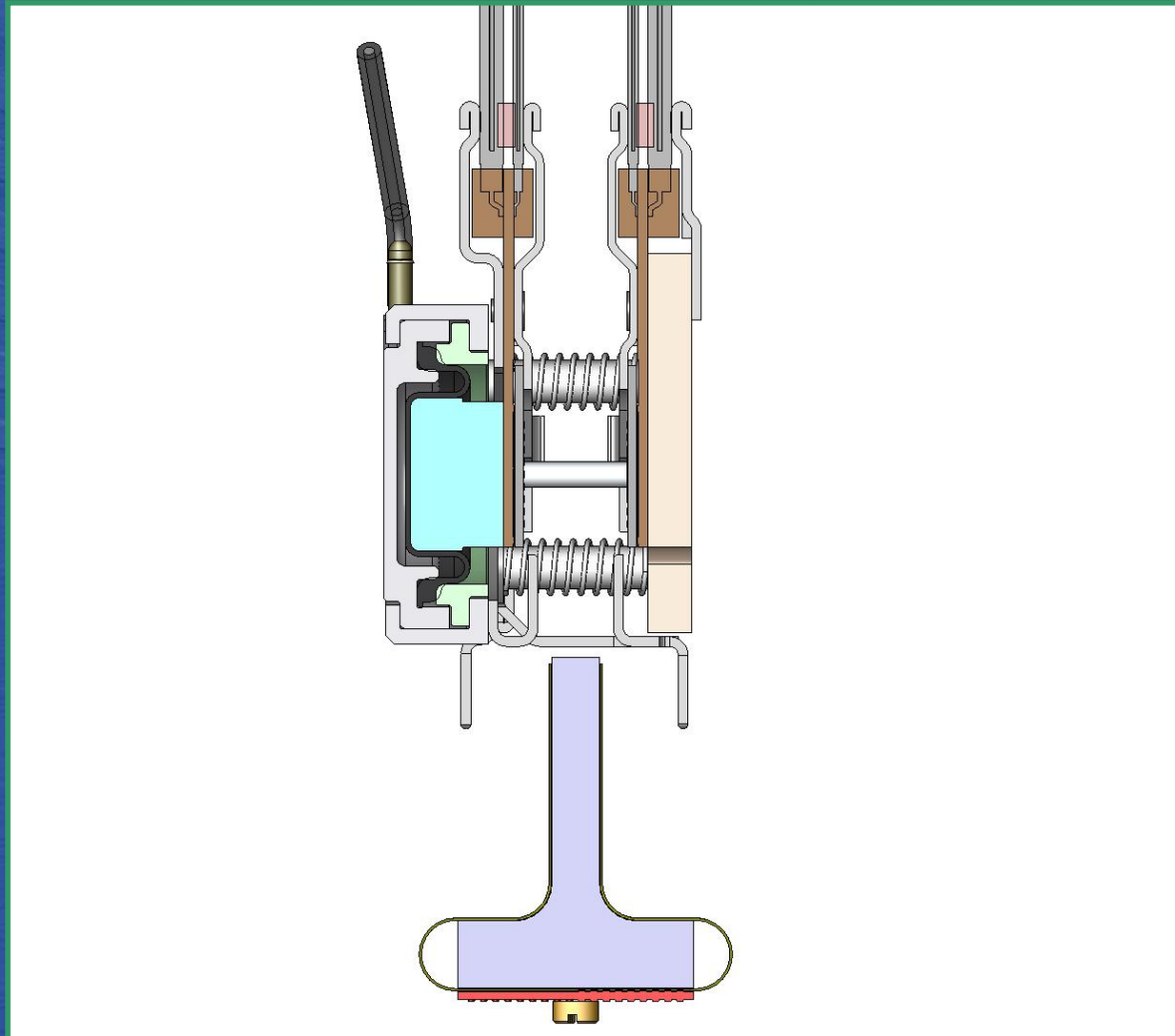
How we did it, p4

⇒ Self alignment



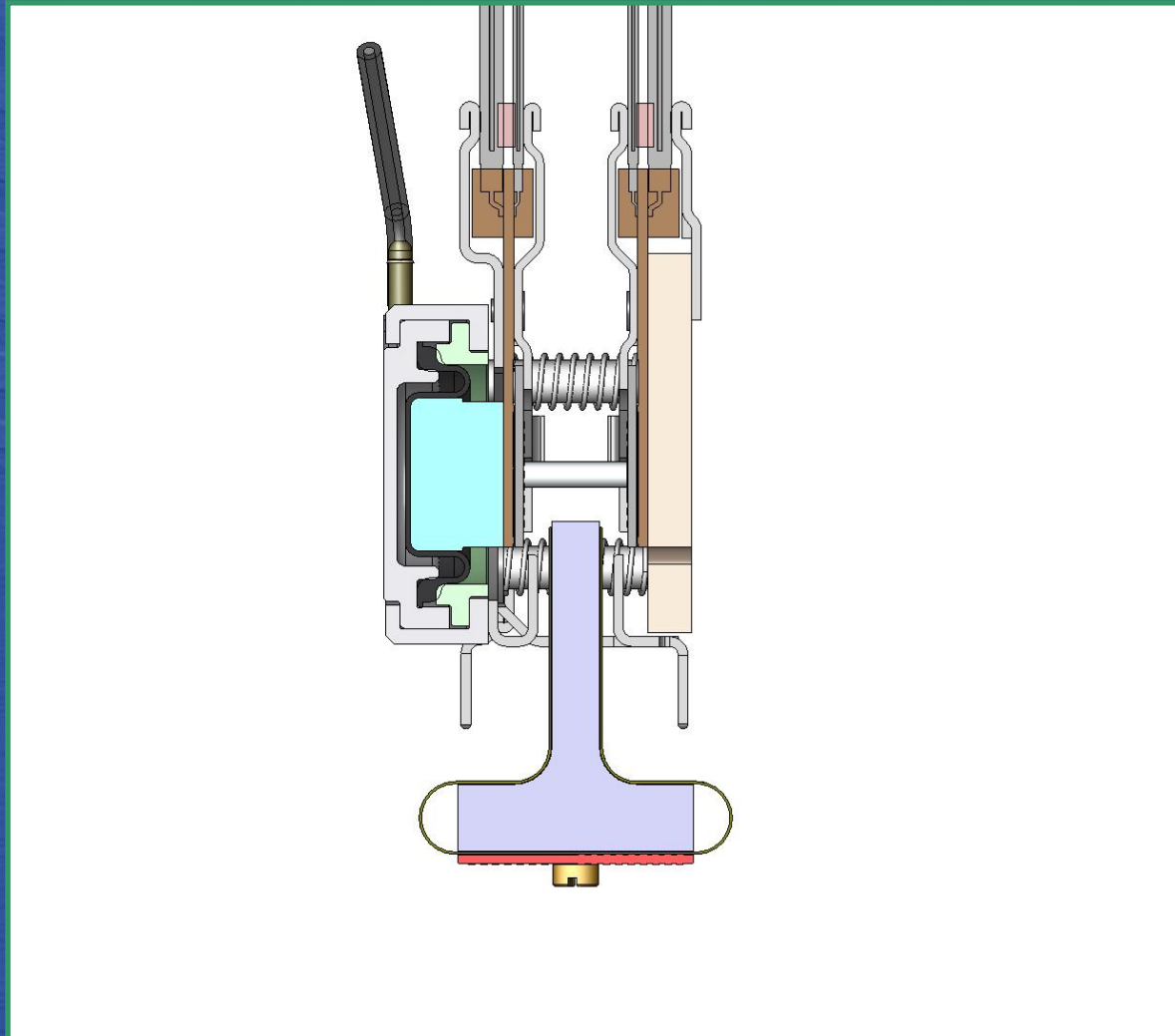
How we did it, p4

⇒ Self alignment



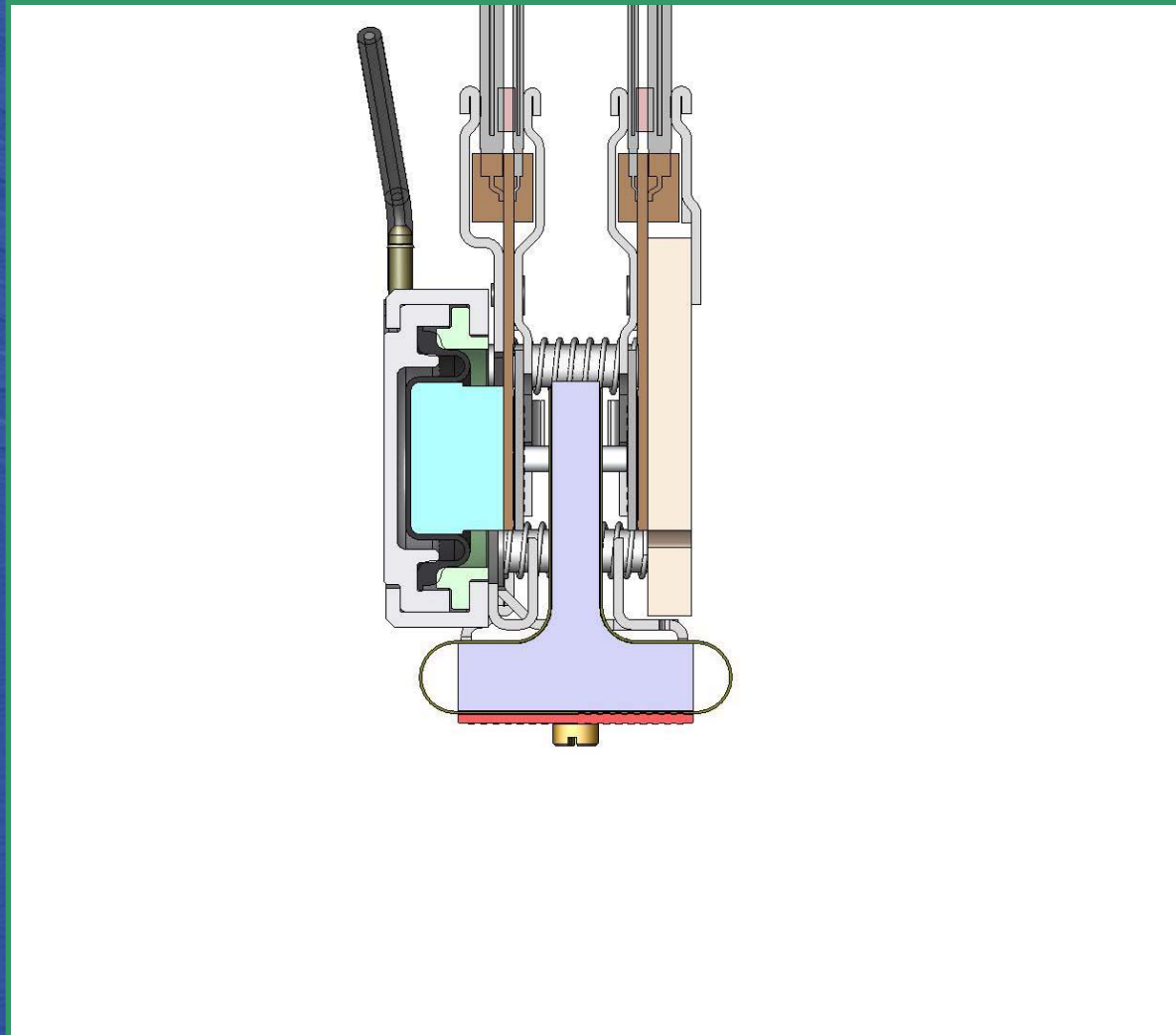
How we did it, p4

⇒ Self alignment



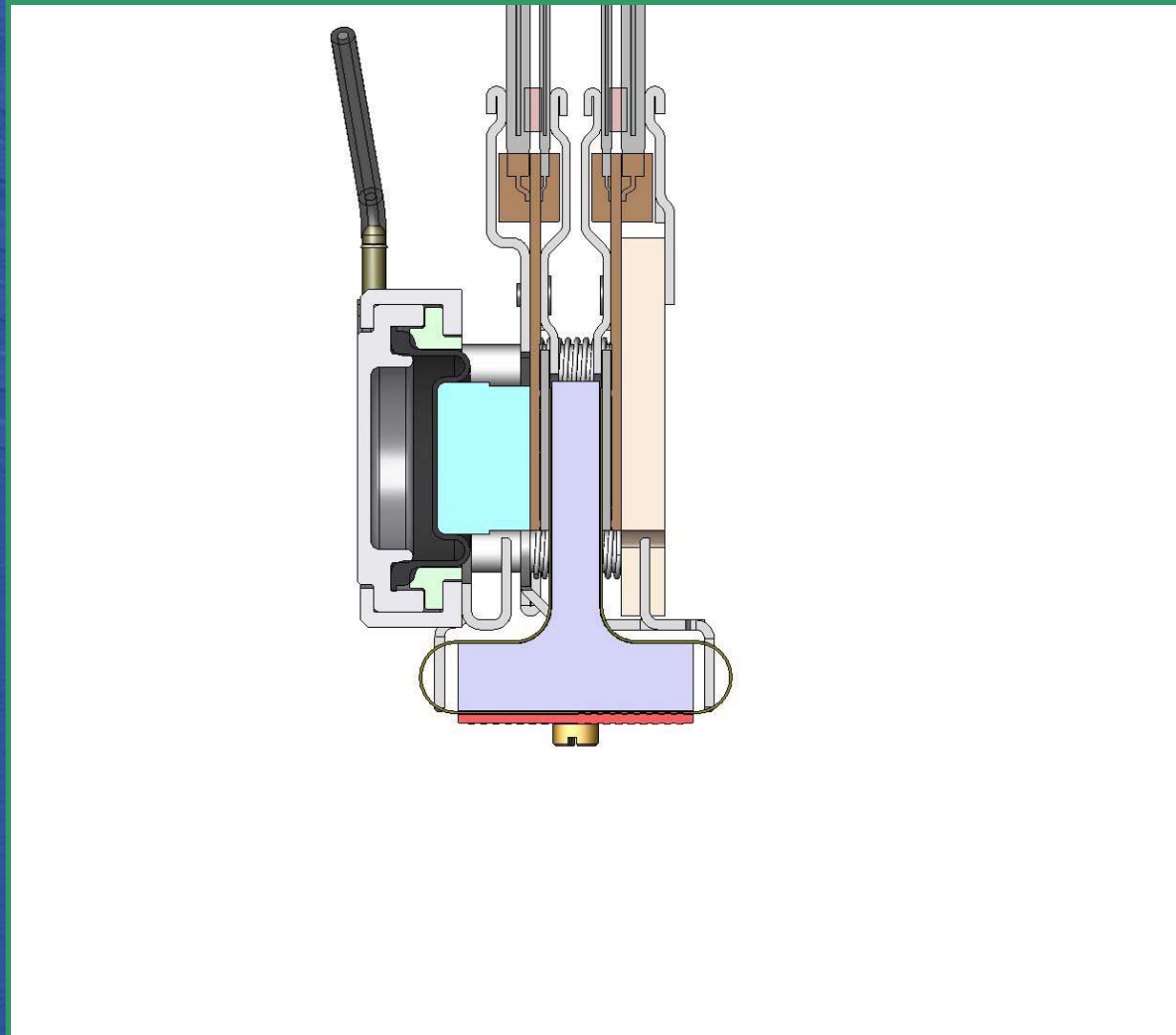
How we did it, p4

⇒ Self alignment



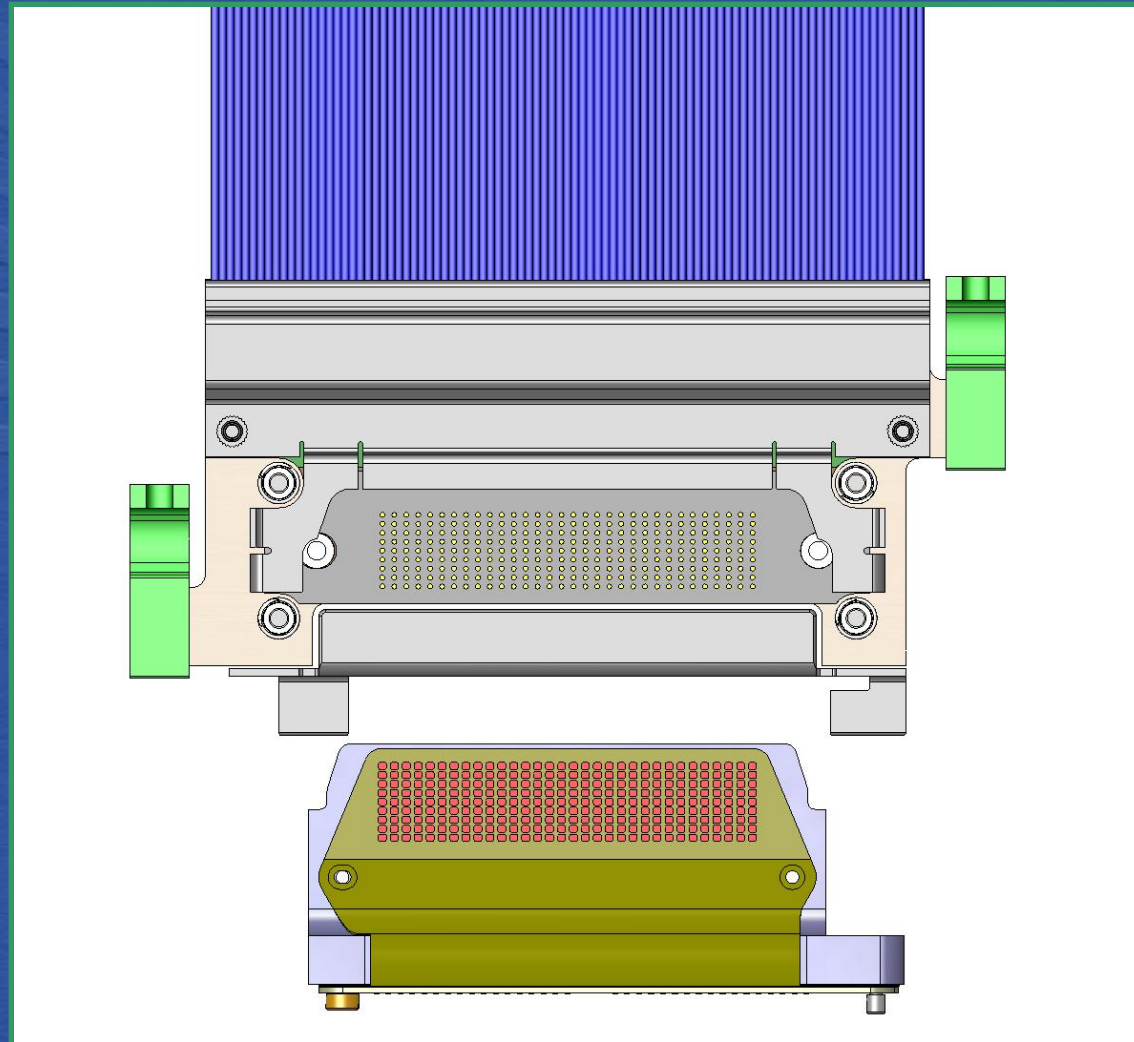
How we did it, p4

⇒ Self alignment



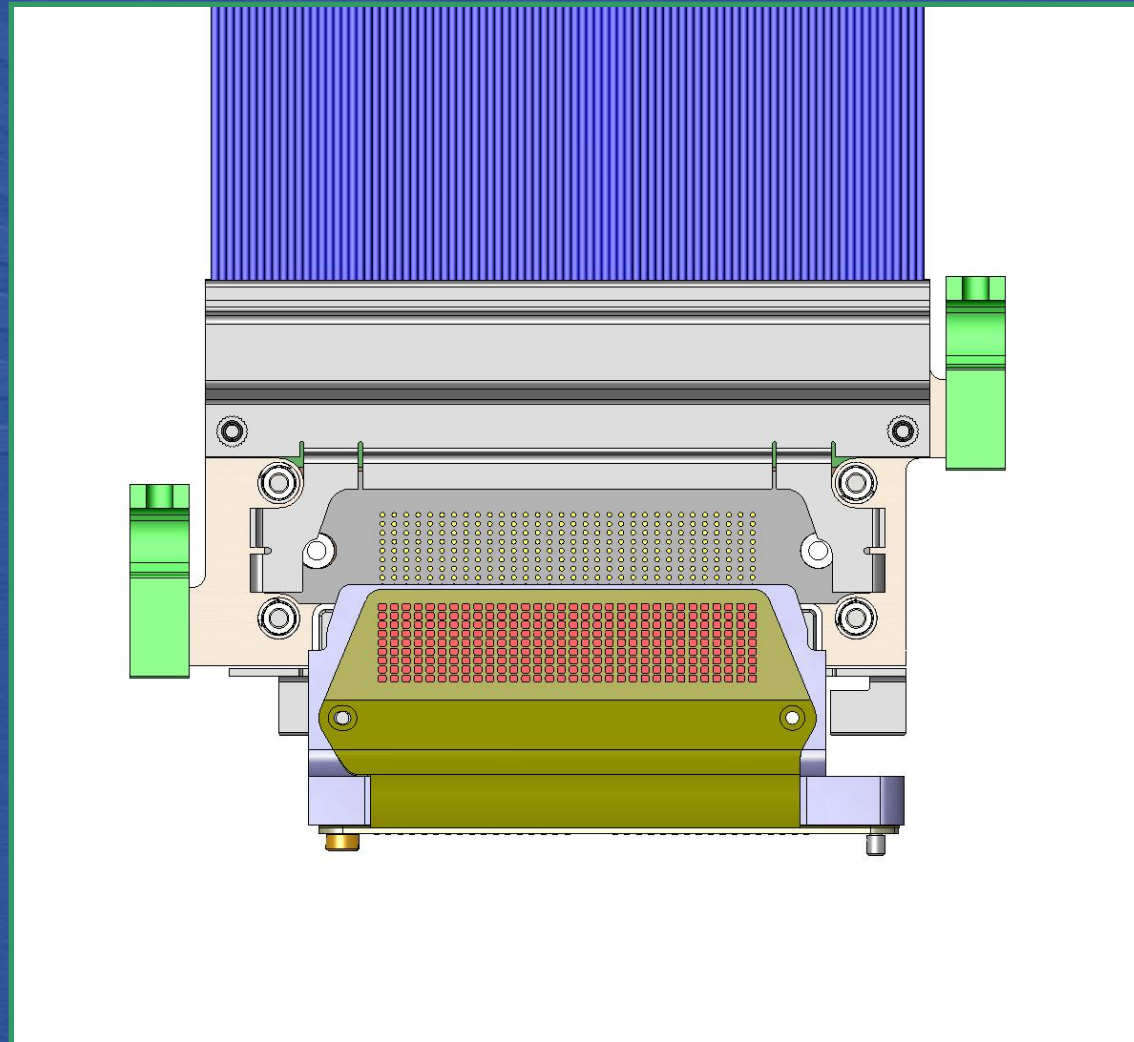
How we did it, p4

⇒ Self alignment



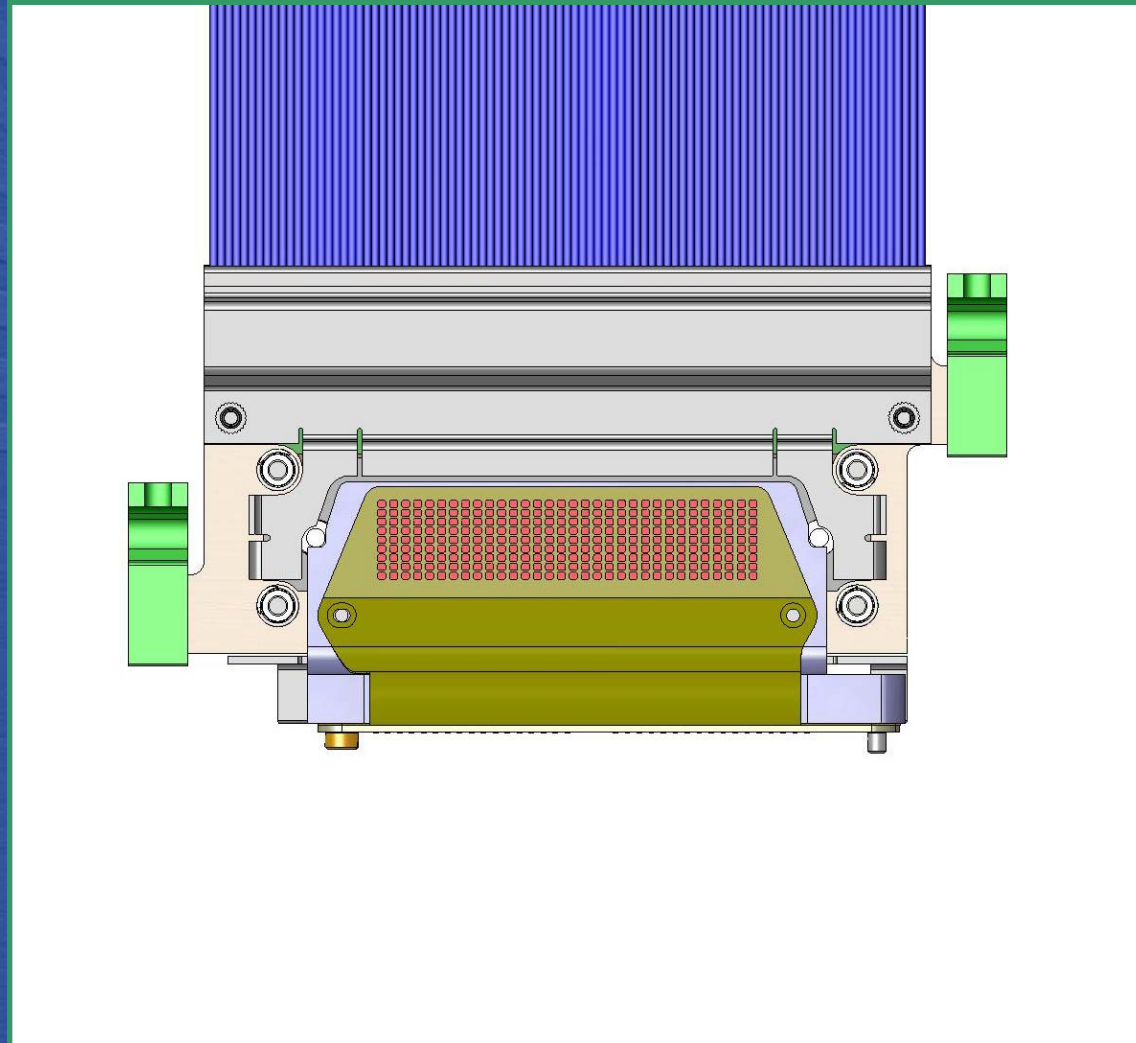
How we did it, p4

⇒ Self alignment



How we did it, p4

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Okay, it's reliable. So what?

- ⇒ Now we've got a reliable interconnect, one that doesn't push on the probe card to create the connections . . .

Okay, it's reliable. So what?

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How about 13,056 (34x384) I/O channels?

Xtreme Sort

⇒ Fast

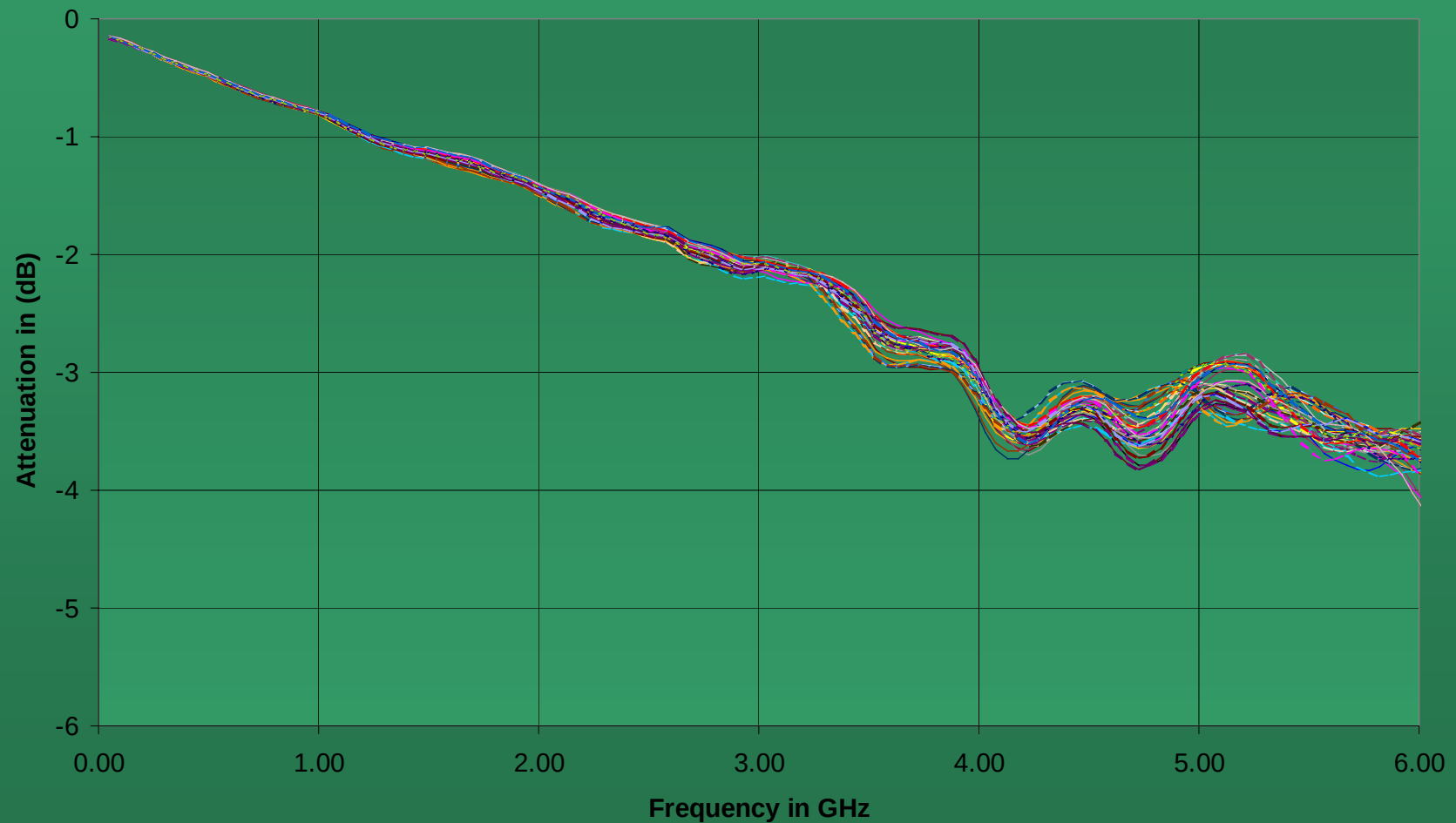


So how fast is it?



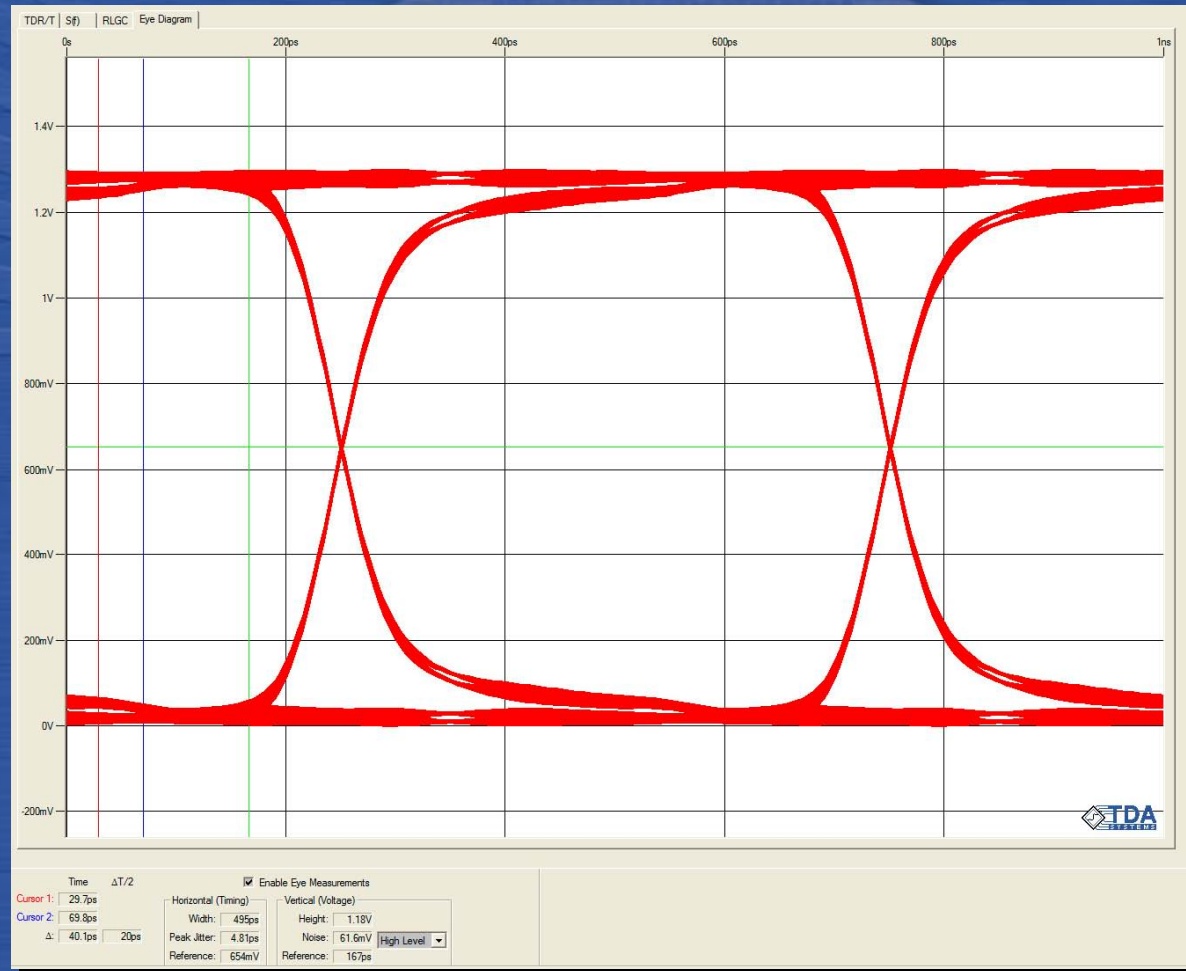
How fast is it? p2

DUT Connector with Clamp Bandwidth Data
Vector Network Analyzer (8720ES)



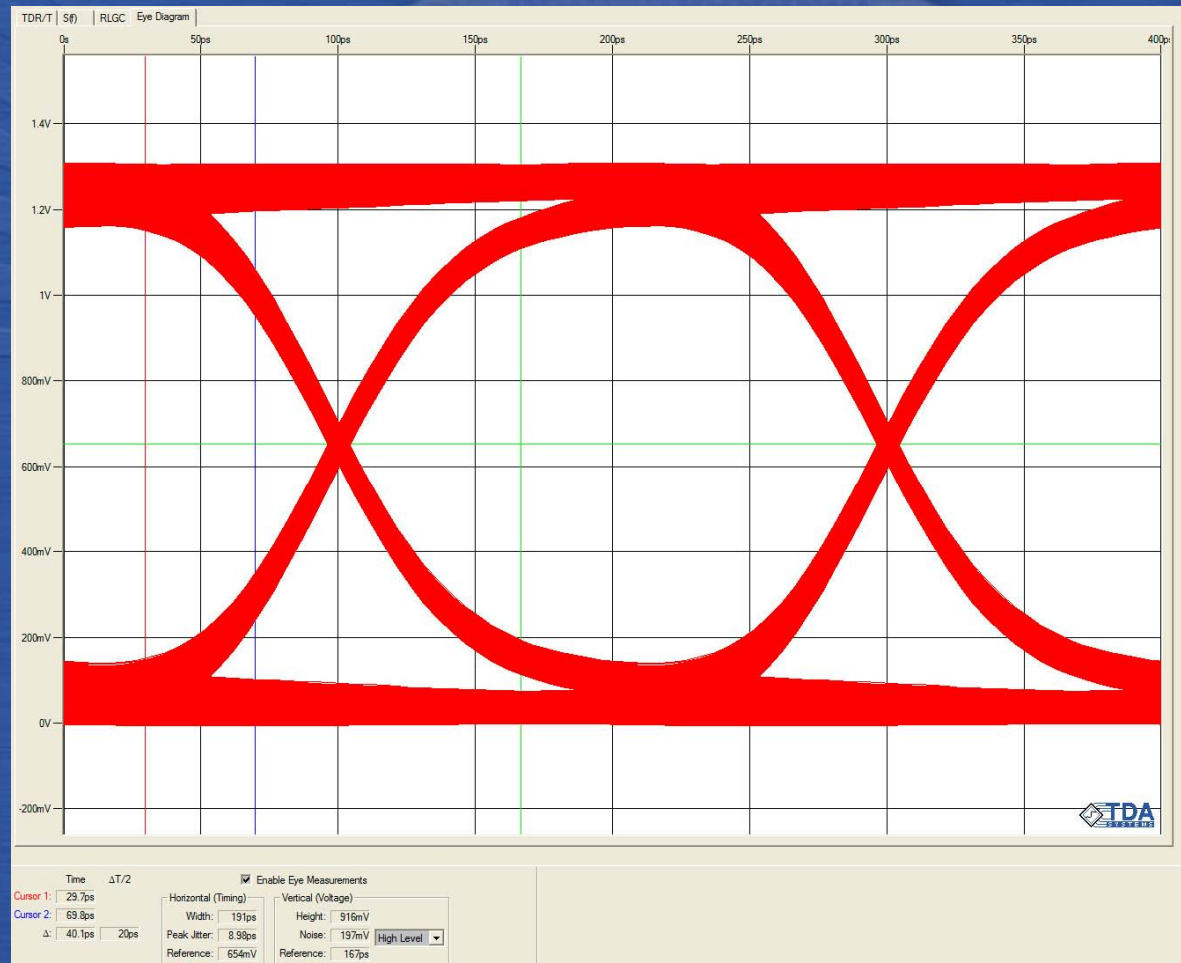
How fast is it? p3

⇒ Eye diagram – 2 Gb/s



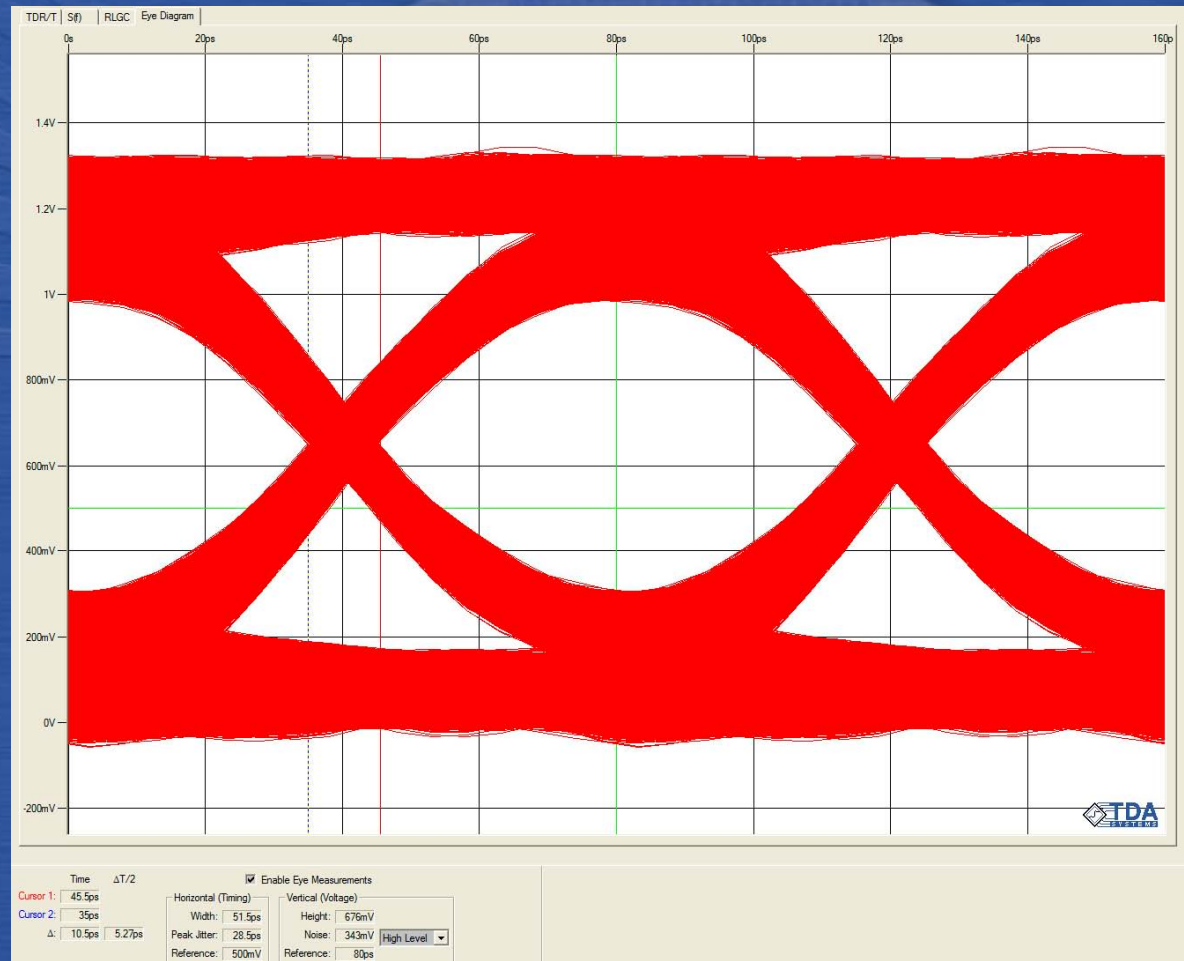
How fast is it? p4

⇒ Eye diagram – 5 Gb/s



How fast is it? p5

⇒ Eye diagram – 12.5 Gb/s



Xtreme Sort

⇒ Flexible



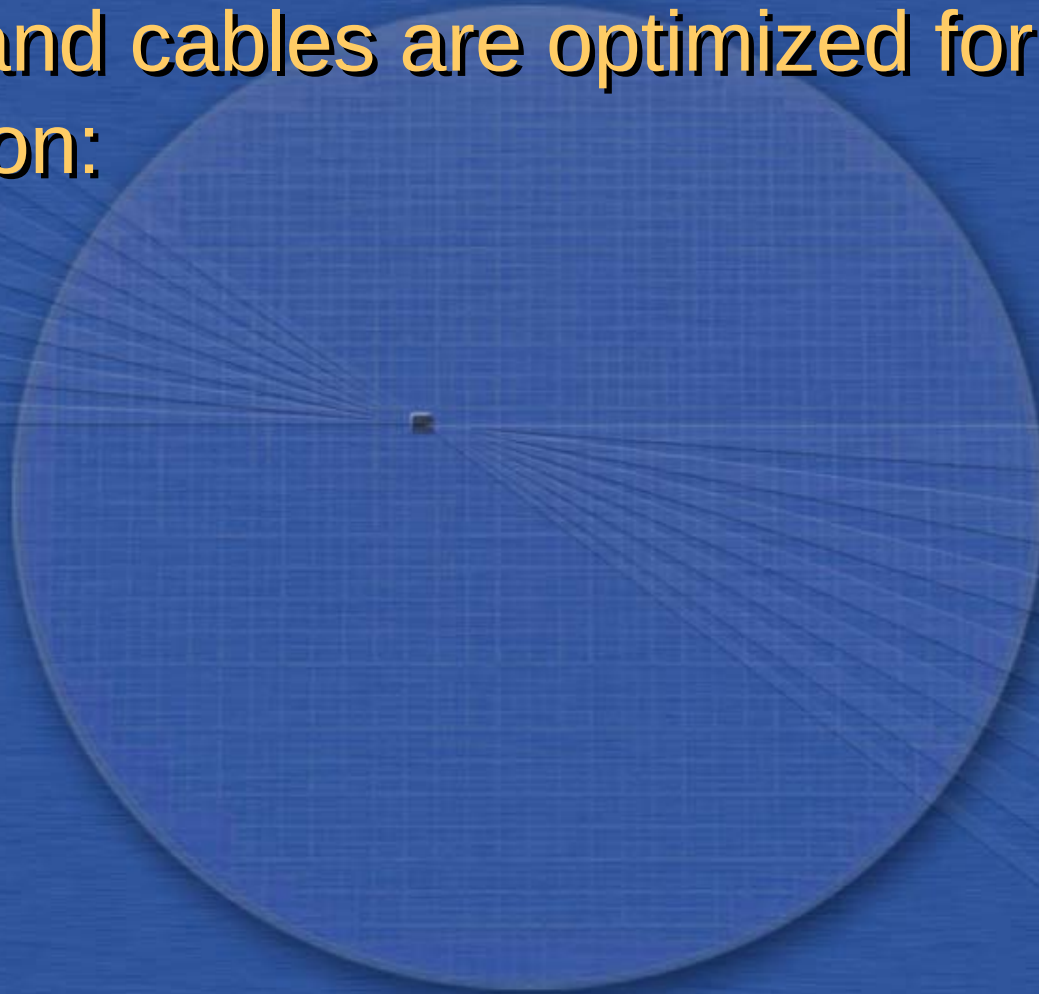
How we did it, p5

⇒ Use boards for the ends, cables for the long stretch



How we did it, p6

⇒ Boards and cables are optimized for the application:



How we did it, p6

- ⇒ Boards and cables are optimized for the application:
 - ⇒ Air-enhanced Dielectric Coaxial Cable for high speed channels

How we did it, p6

- ⇒ Boards and cables are optimized for the application:
 - ⇒ Air-enhanced Dielectric Coaxial Cable for high speed channels
 - ⇒ Standard Ribbon Cable for Utility channels

How we did it, p6

⇒ Boards and cables are optimized for the application:

- ⇒ Air-enhanced Dielectric Coaxial Cable for high speed channels
- ⇒ Standard Ribbon Cable for Utility channels
- ⇒ Twisted Pair or “Shieldless Coax” Cable for inexpensive, low speed (<25 MHz) channels

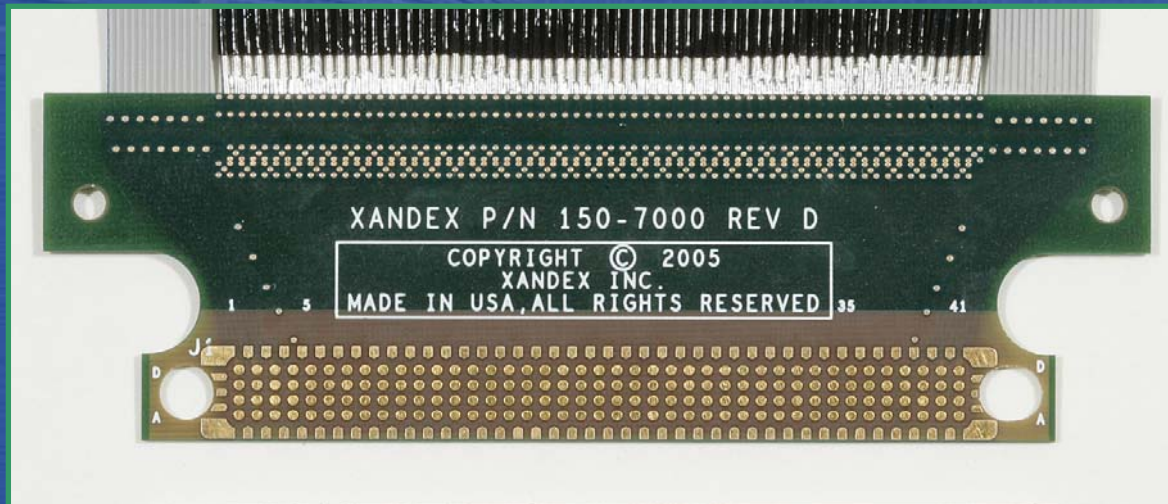
How we did it, p6

⇒ Boards and cables are optimized for the application:

- ⇒ Air-enhanced Dielectric Coaxial Cable for high speed channels
- ⇒ Standard Ribbon Cable for Utility channels
- ⇒ Twisted Pair or “Shieldless Coax” Cable for inexpensive, low speed (<25 MHz) channels
- ⇒ Ultra-low Inductance Coaxial Cable for Power channels

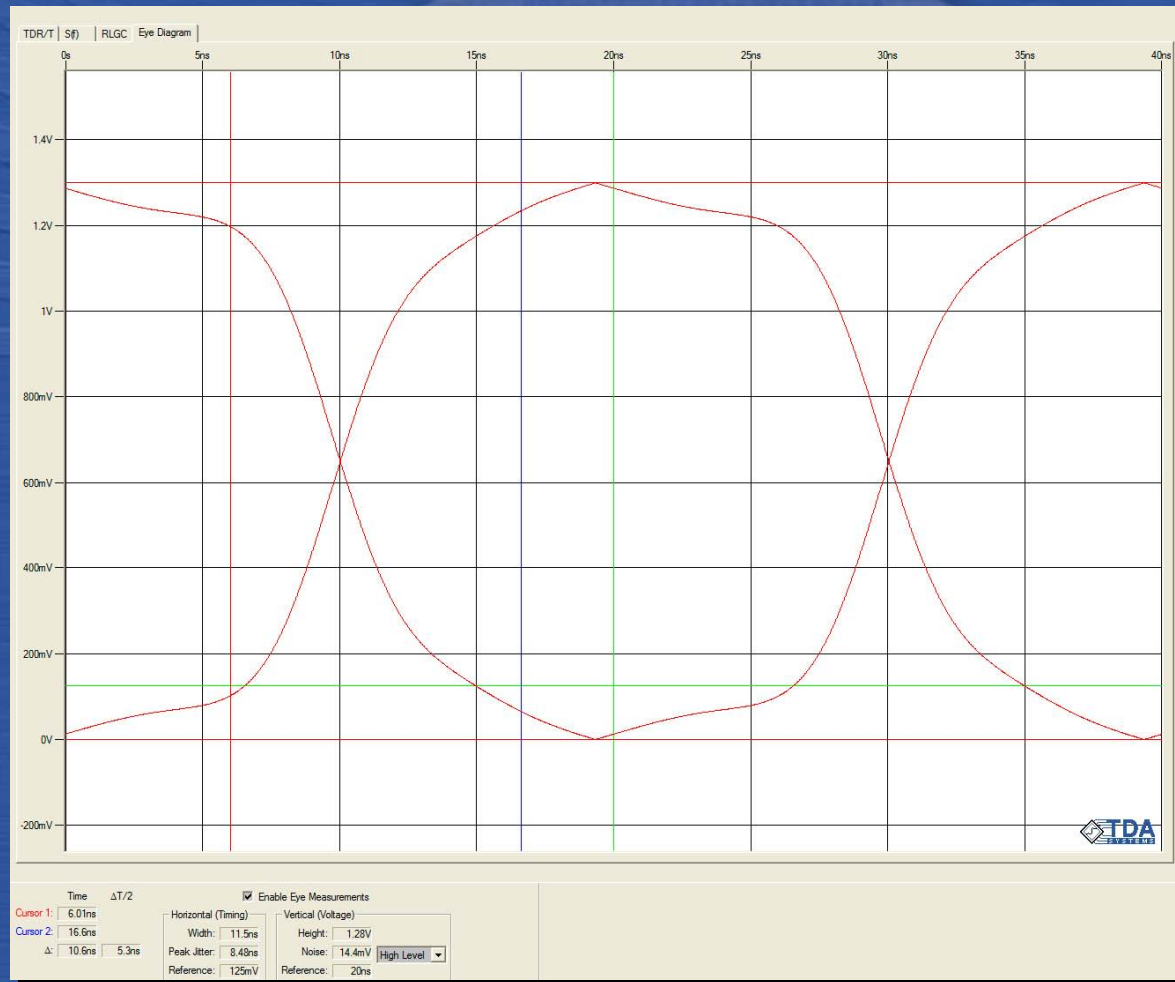
How we did it, p7

- ⇒ Channel requirements can be mixed and matched within a single board / XZIF clamp assembly



How fast is it? p6

⇒ Twisted Pair Eye diagram, 50 Mb/s



Got Power?

- ⇒ Power transmission line spec's:
 - ⇒ 500 nΩ round-trip DCR
 - ⇒ 150 pH Inductance
 - ⇒ 35 mΩ Impedance – stable into MHz range

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- ⇒ Power transmission line spec's:
 - ⇒ 500 nΩ round-trip DCR
 - ⇒ 150 pH Inductance
 - ⇒ 35 mΩ Impedance – stable into MHz range
- ⇒ Energy dissipated across the entire path @ 400A load is 30W

Got Power?

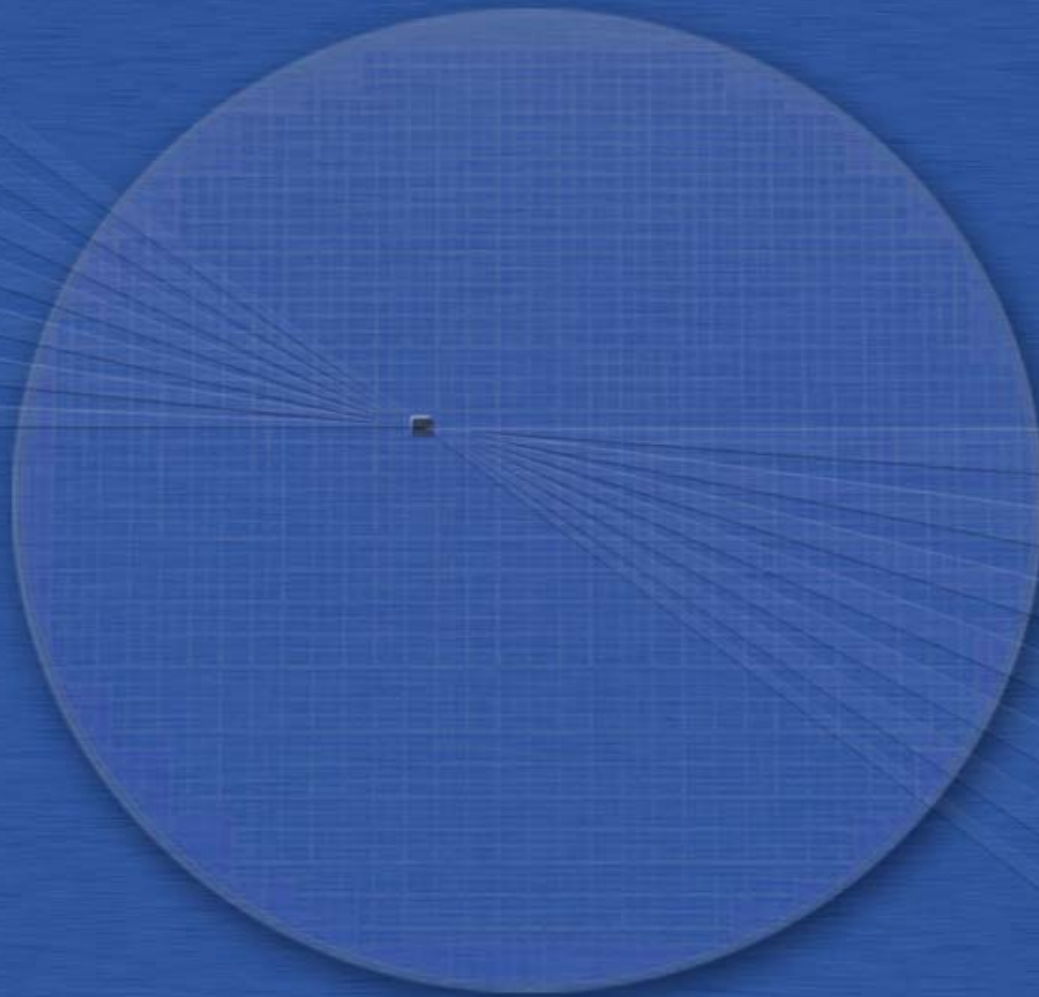
- ⇒ Power transmission line spec's:
 - ⇒ 500 nΩ round-trip DCR
 - ⇒ 150 pH Inductance
 - ⇒ 35 mΩ Impedance – stable into MHz range
- ⇒ Energy dissipated across the entire path @ 400A load is 30W
 - ⇒ Force is carried by >300 contact structures

Xtreme Sort

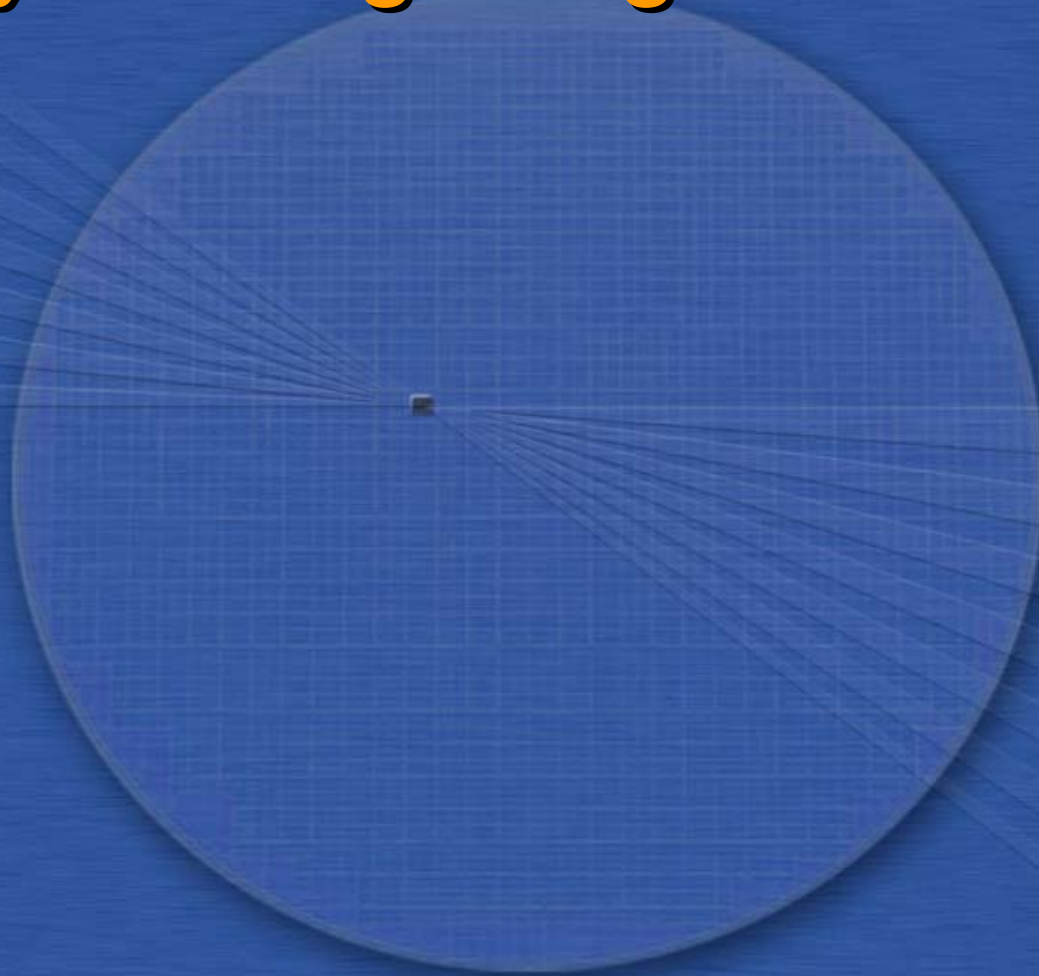
⇒ Size



What about probe card size?



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What about probe card size?

They're not getting smaller

- ⇒ In 2001 440mm diameter was big
 - ⇒ Design target was to touch down on $\frac{1}{4}$ of a 200mm wafer – 165mm diameter application space with 2304 I/O was adequate

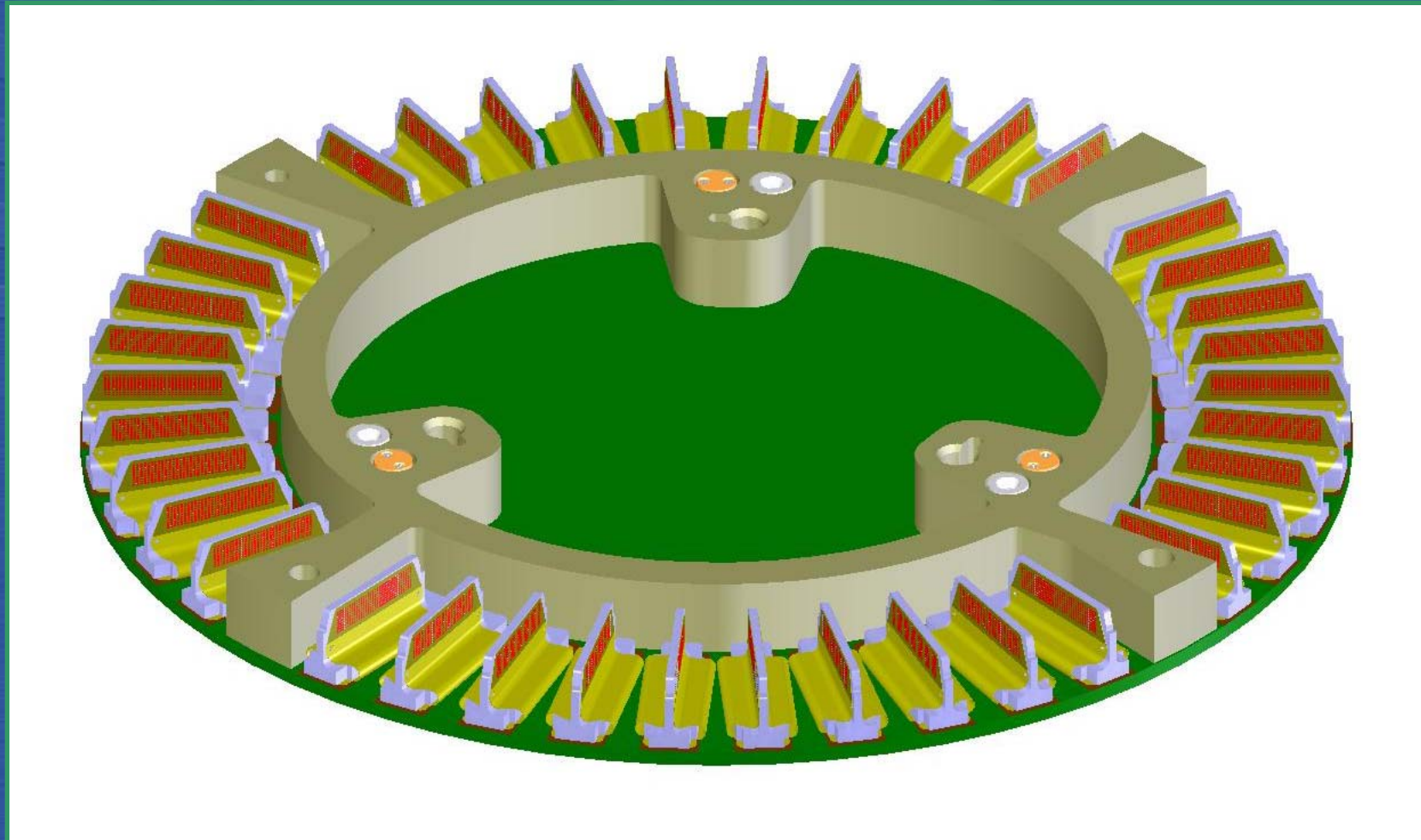
What about probe card size?

They're not getting smaller

- ⇒ In 2001 440mm diameter was big
 - ⇒ Design target was to touch down on $\frac{1}{4}$ of a 200mm wafer – 165mm diameter application space with 2304 I/O was adequate
 - ⇒ 2006 target is a 300mm single-touch probe card – must have a much bigger application space

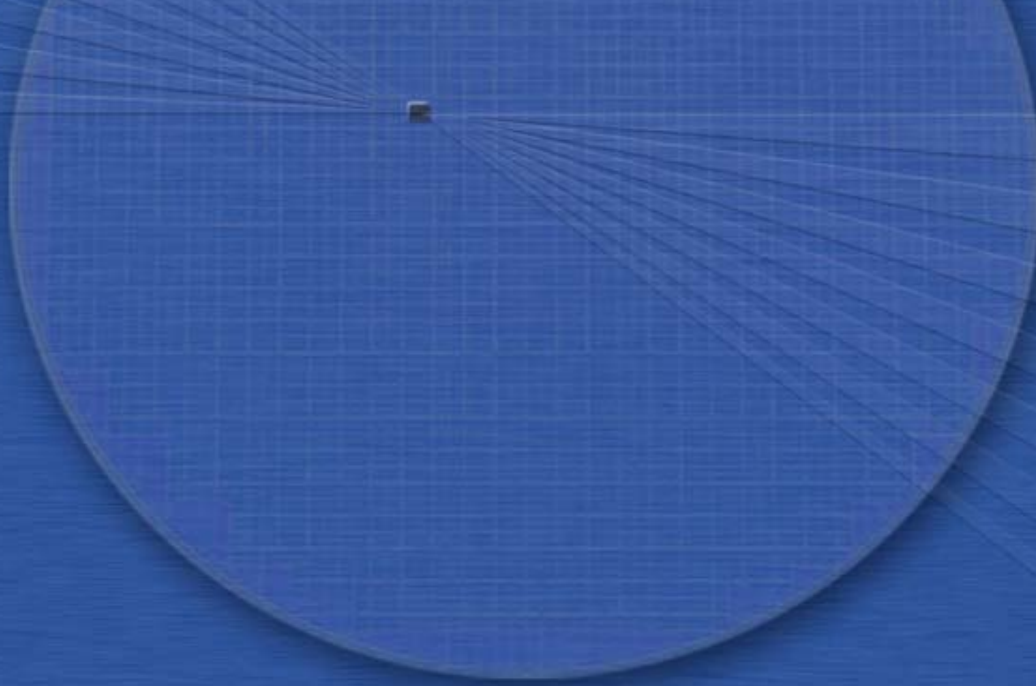
Big probe cards are coming

⇒ 520mm probe card with 320mm app' space



This is a really big probe card

- ⇒ A high pin count 300mm single-touch probe card is estimated to weigh as much as 75 pounds (35 kg)



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- ⇒ A high pin count 300mm single-touch probe card is estimated to weigh as much as 75 pounds (35 kg)
- ⇒ It will most likely cost somewhere in excess of US\$150k
- ⇒ Would you want to carry this beast around the sort floor in your hands?

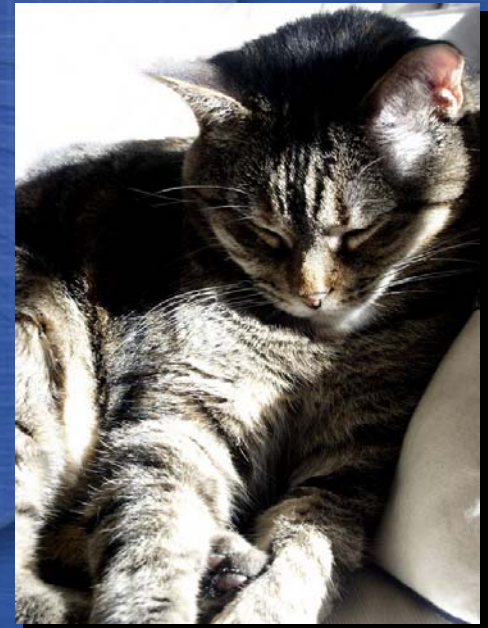
This is a really big probe card

- ⇒ A high pin count 300mm single-touch probe card is estimated to weigh as much as 75 pounds (35 kg)
- ⇒ It will most likely cost somewhere in excess of US\$150k
- ⇒ Would you want to carry this beast around the sort floor in your hands?
 - ⇒ I didn't think so.

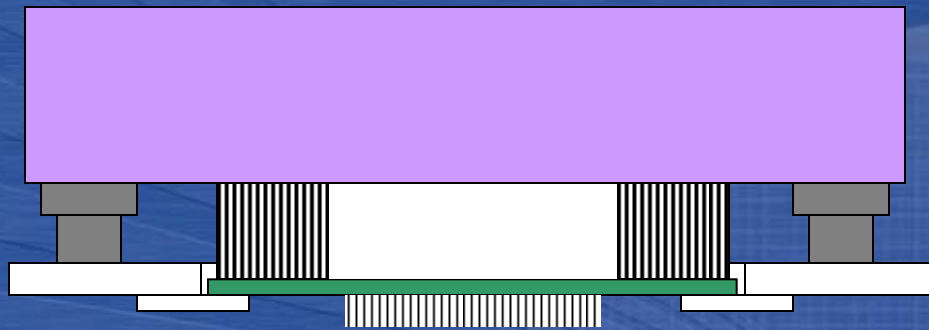


Xtreme Sort

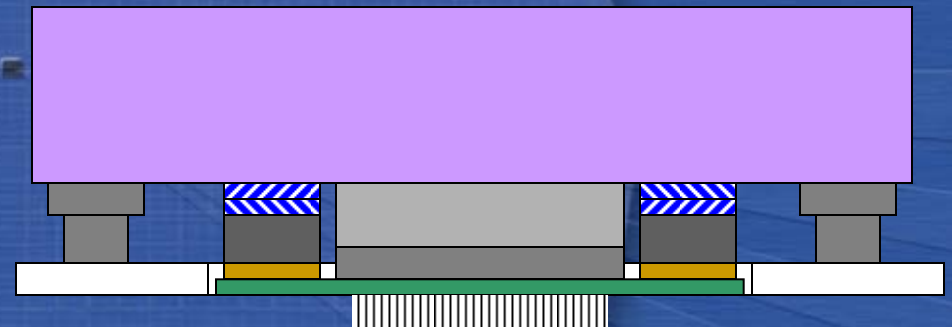
⇒ Heat Resistant



Direct Dock



Indirect Dock

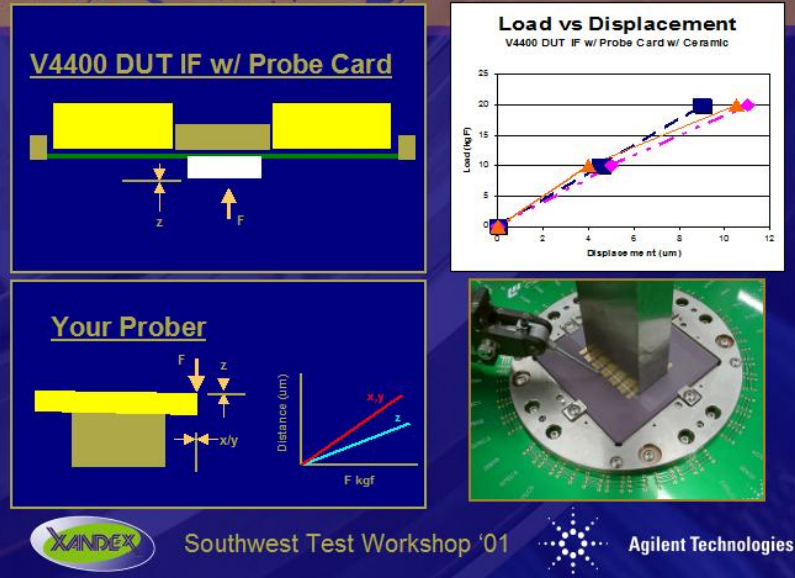


XZIF Direct Dock

Back to the Future, p2

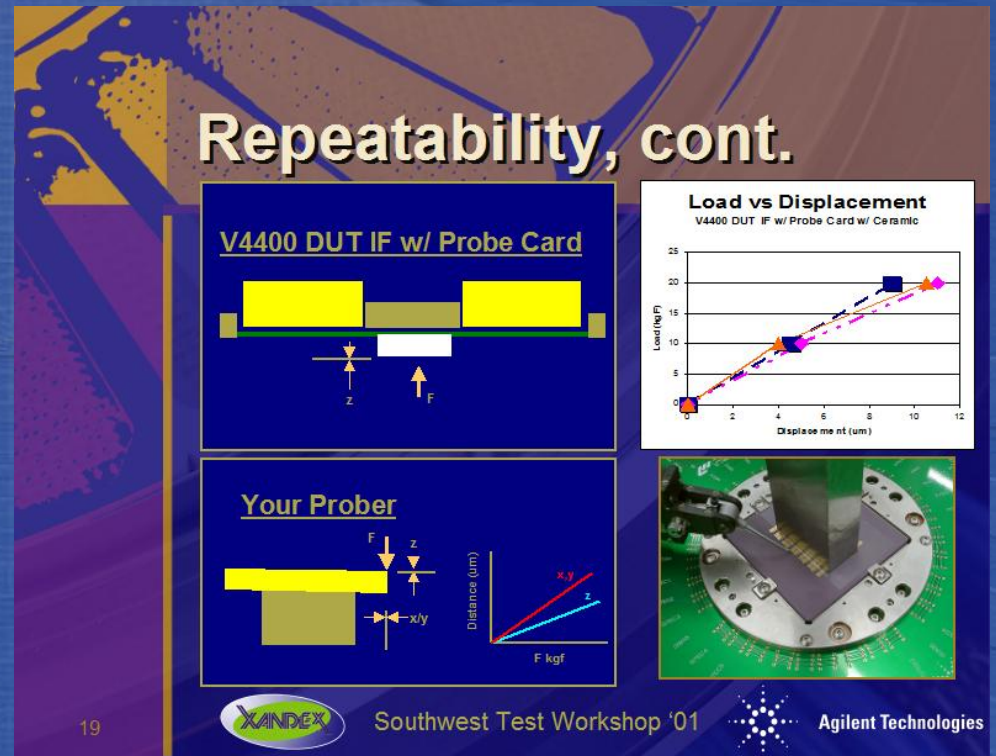
- ➔ By using Direct Dock, we can make the mechanical support behind the probe card *very* rigid.

Repeatability, cont.

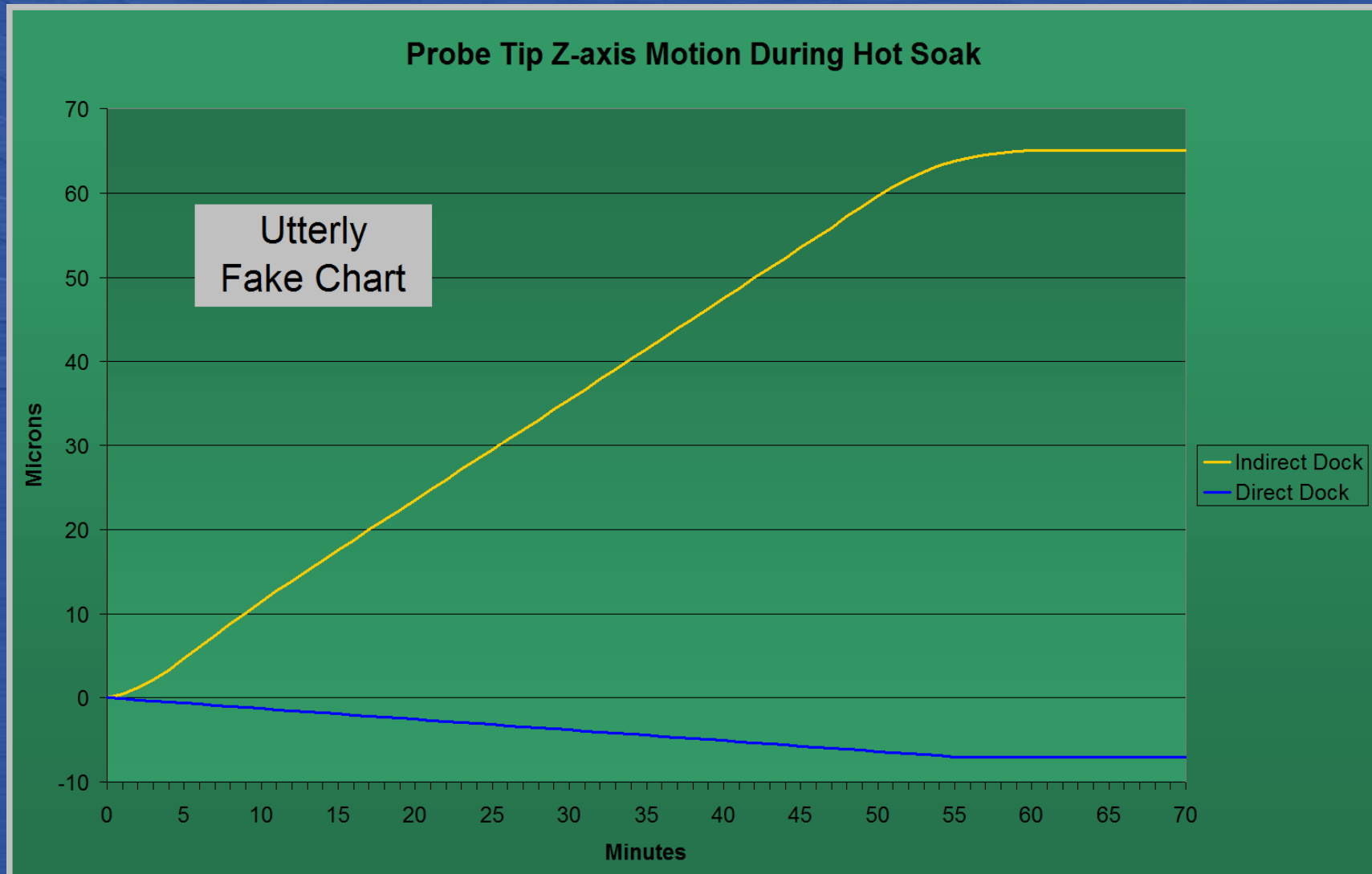


Back to the Future, p2

- ➔ By using Direct Dock, we can make the mechanical support behind the probe card *very* rigid.
- ➔ Thermal isolation of the probe card support dramatically reduces Hot Sort soak time



Direct Dock, p2



Xtreme Sort

⇒ Strong



What happens to the prober?

- ⇒ Imagine a 300mm single-touch probe card
 - 60,000 probe needles, 300 kg (60k x 5g) to compress the probe needles.

What happens to the prober?

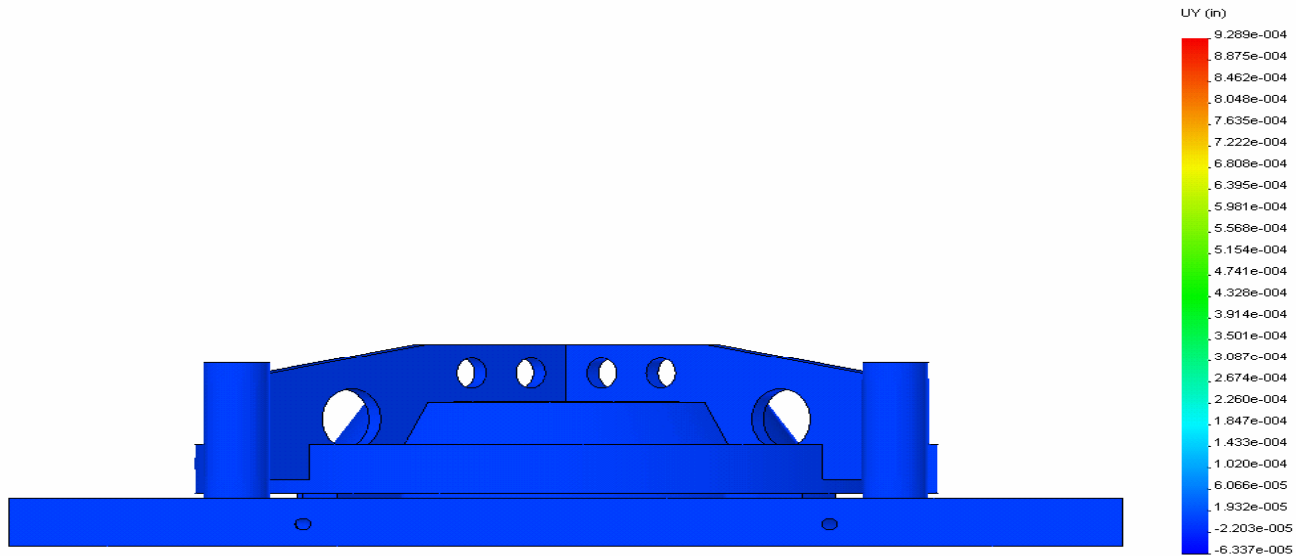
- ⇒ Imagine a 300mm single-touch probe card
 - 60,000 probe needles, 300 kg (60k x 5g) to compress the probe needles.
- ⇒ Wafer chucks don't put out that much force . . . today

What happens to the prober?

- ⇒ Imagine a 300mm single-touch probe card
 - 60,000 probe needles, 300 kg (60k x 5g) to compress the probe needles.
- ⇒ Wafer chucks don't put out that much force . . . today
- ⇒ Prober structure will be working extremely hard.

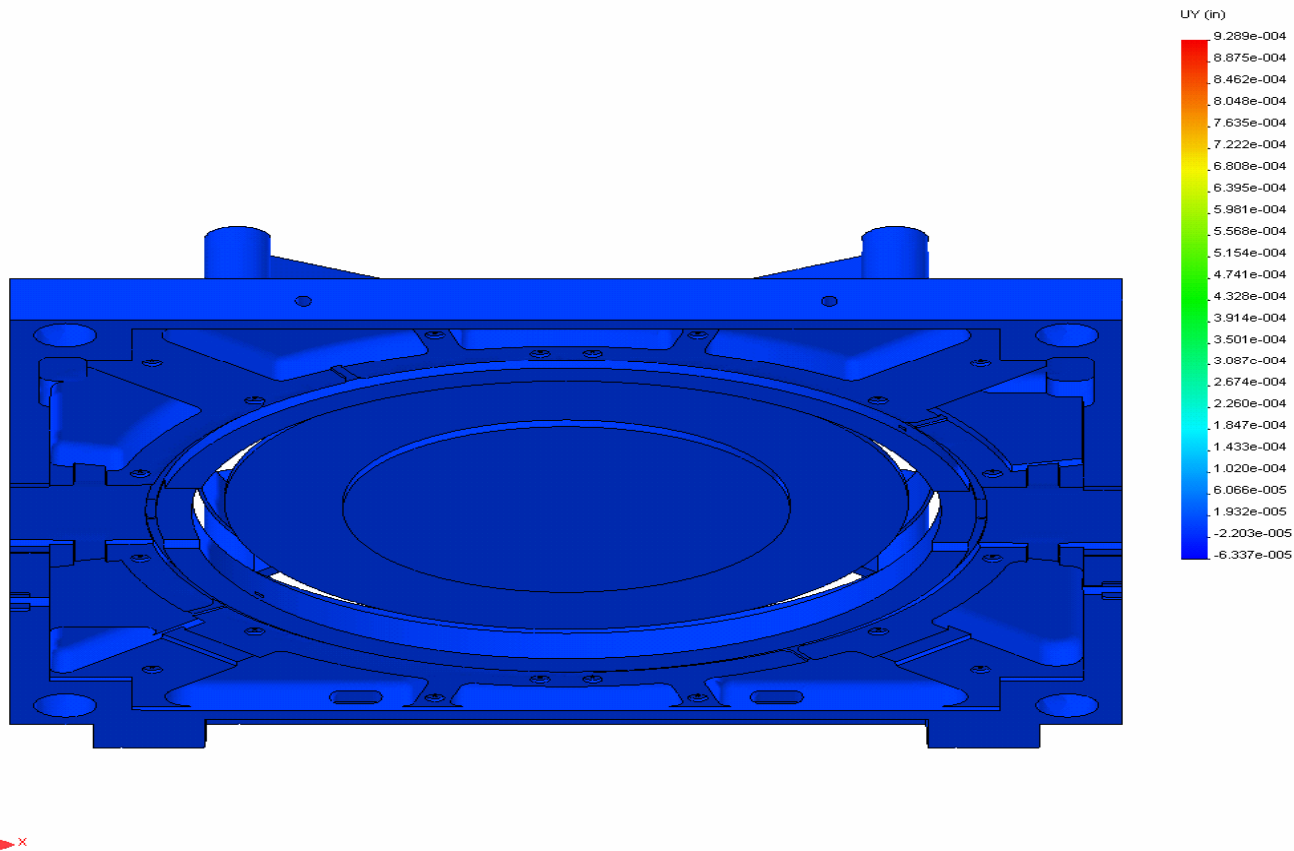
What happens to the prober? p2

Model name: Top FEA Layout 052206
Study name: Study 1
Plot type: Static displacement Plot1
Deformation scale: 3797.69

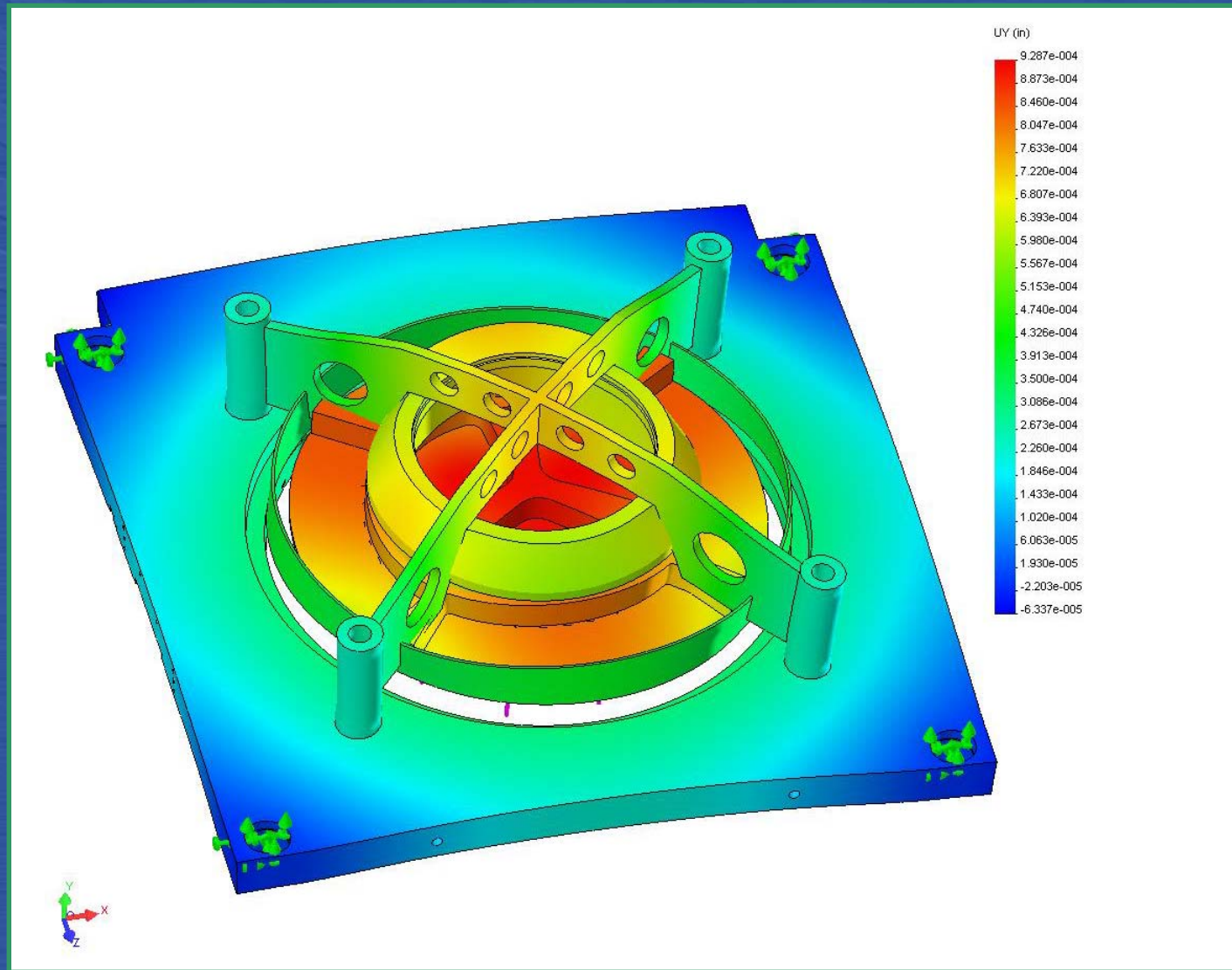


What happens to the prober? p3

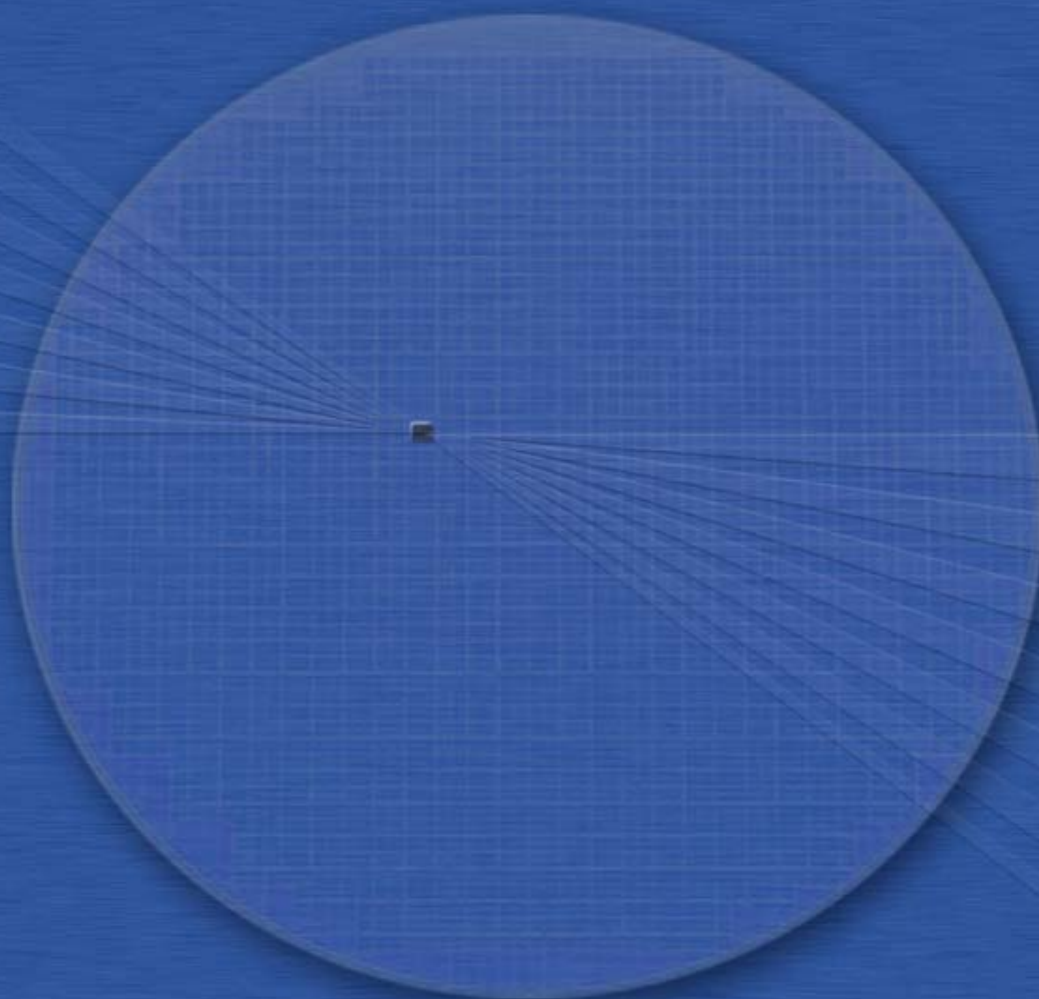
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Study name: Study 1
Plot type: Static displacement Plot1
Deformation scale: 3797.69



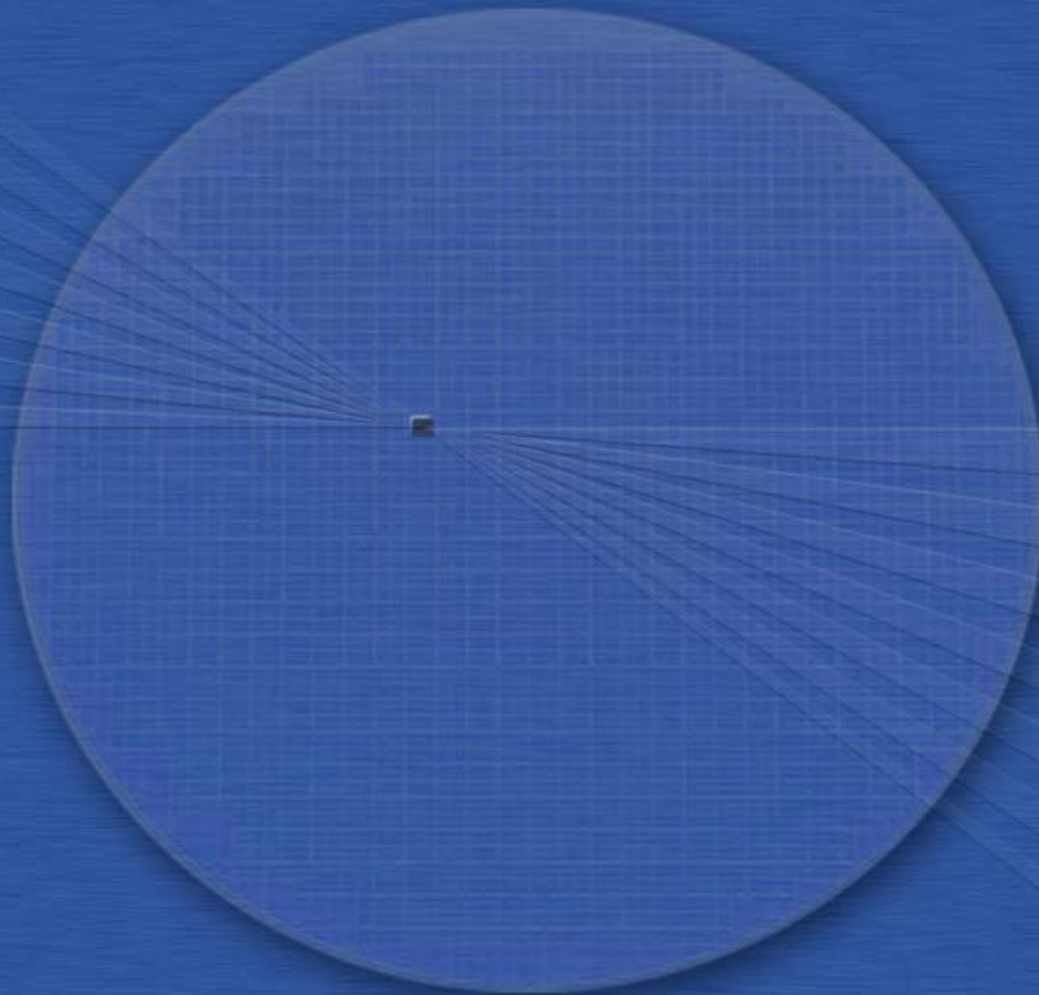
What happens to the prober? p4



Xtreme Sports

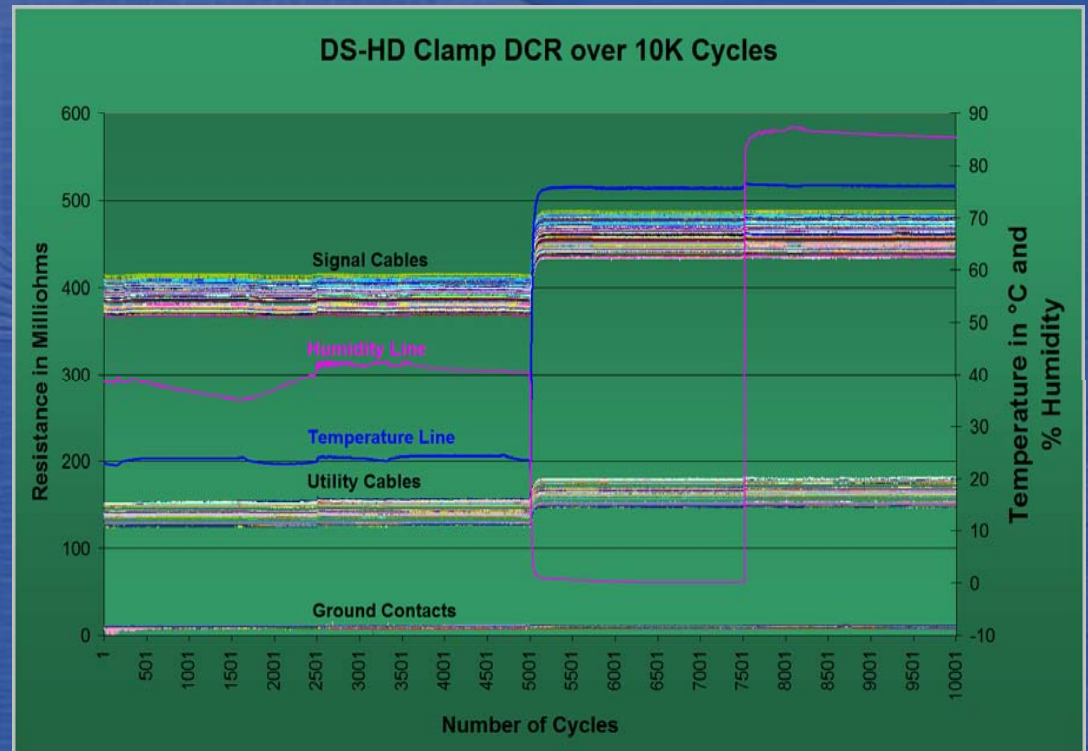


Xtreme Sort



Xtreme Sort

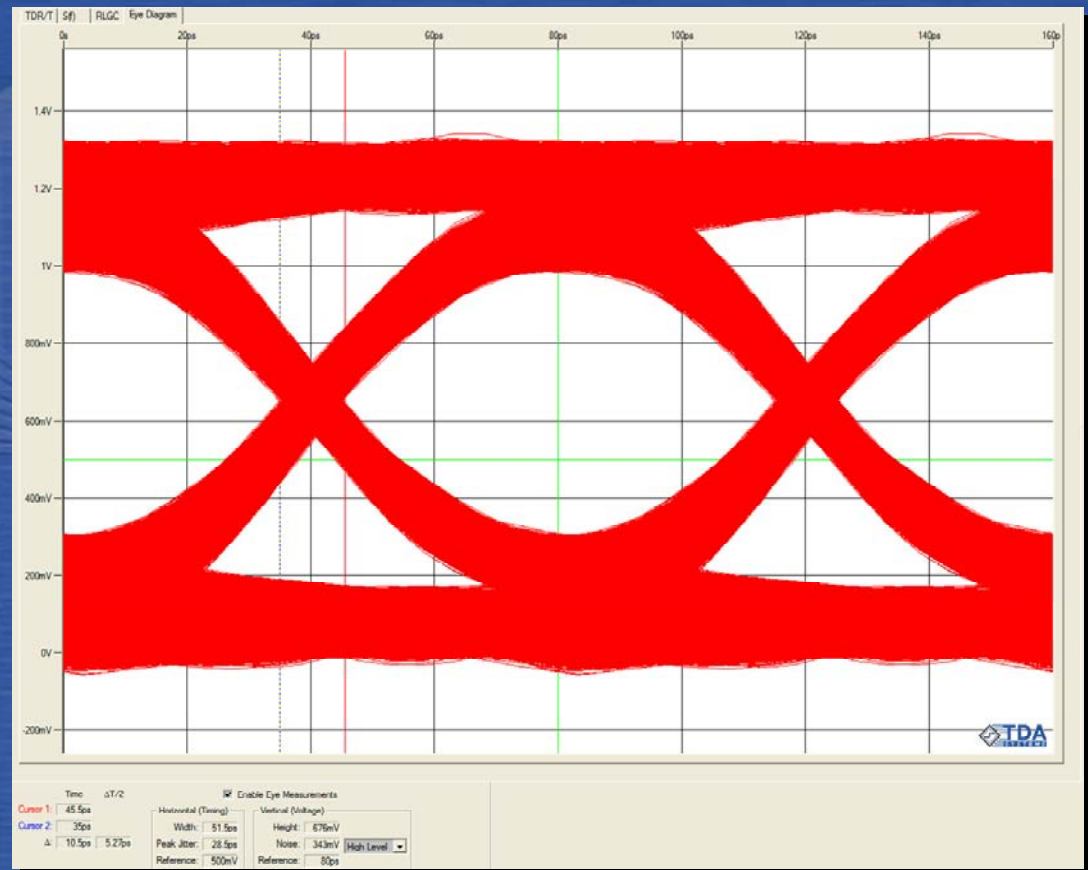
⇒ Capabilities:
⇒ Reliable



Xtreme Sort

⇒ Capabilities:

⇒ Fast



Xtreme Sort

⇒ Capabilities:

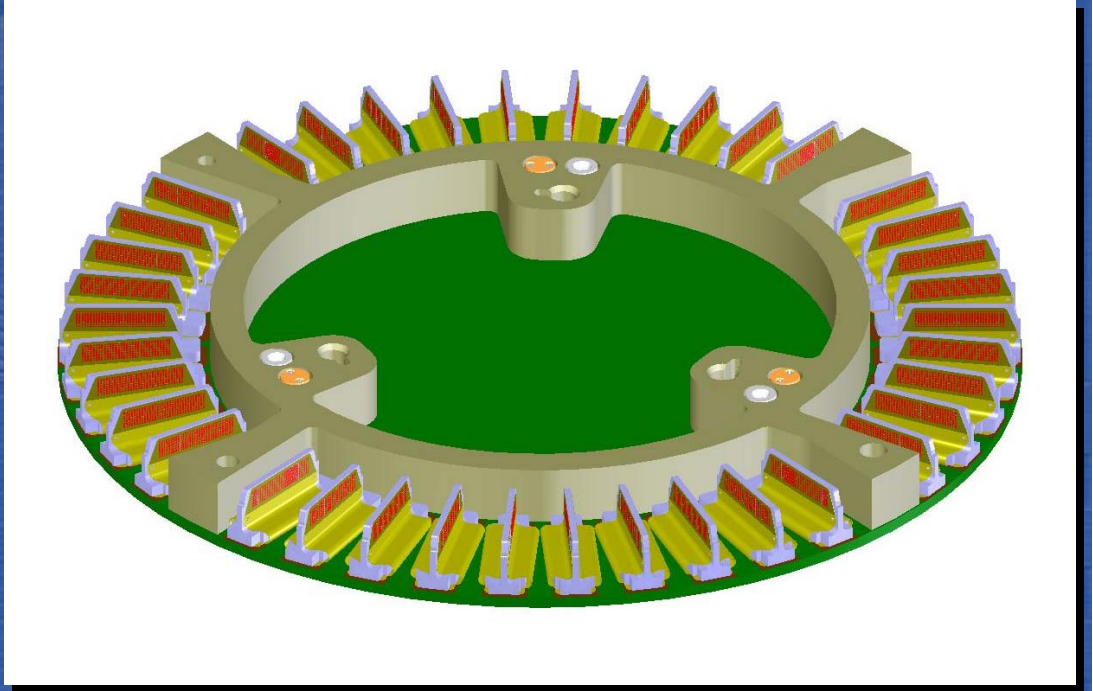
⇒ Flexible



Xtreme Sort

⇒ Capabilities:

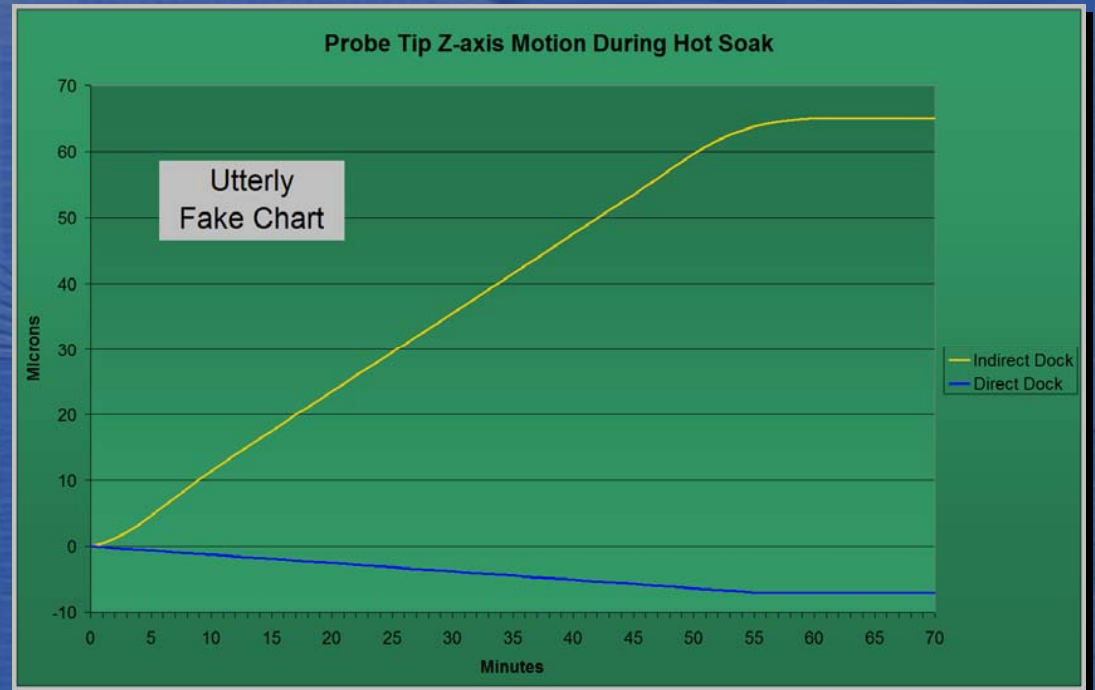
⇒ Size



Xtreme Sort

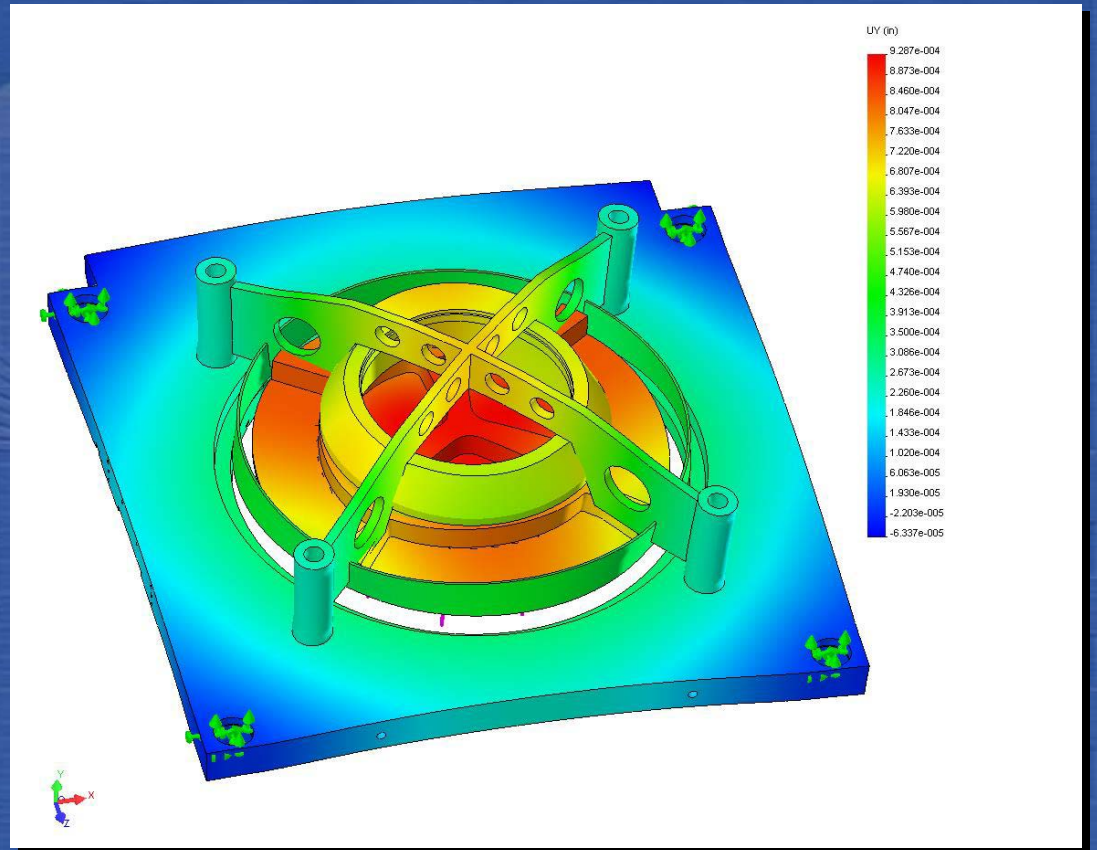
⇒ Capabilities:

⇒ Heat
Resistant



Xtreme Sort

⇒ Capabilities:



⇒ Strong

Credit where credit is most certainly due:

⇒ Xandex

- ⇒ Evan Williams, Staff Mechanical Engineer
- ⇒ John Wood, Senior Quality Engineer
- ⇒ Kevin Peebles, Mechanical Engineer
- ⇒ Tyrus Hudson, Mechanical Engineer