Agilent CrossLab
From Insight to Outcome

Simple Ways to Boost Lab Productivity and Save Money

by choosing the right sample containment products

Vials and **Sample Containment** Product Manager

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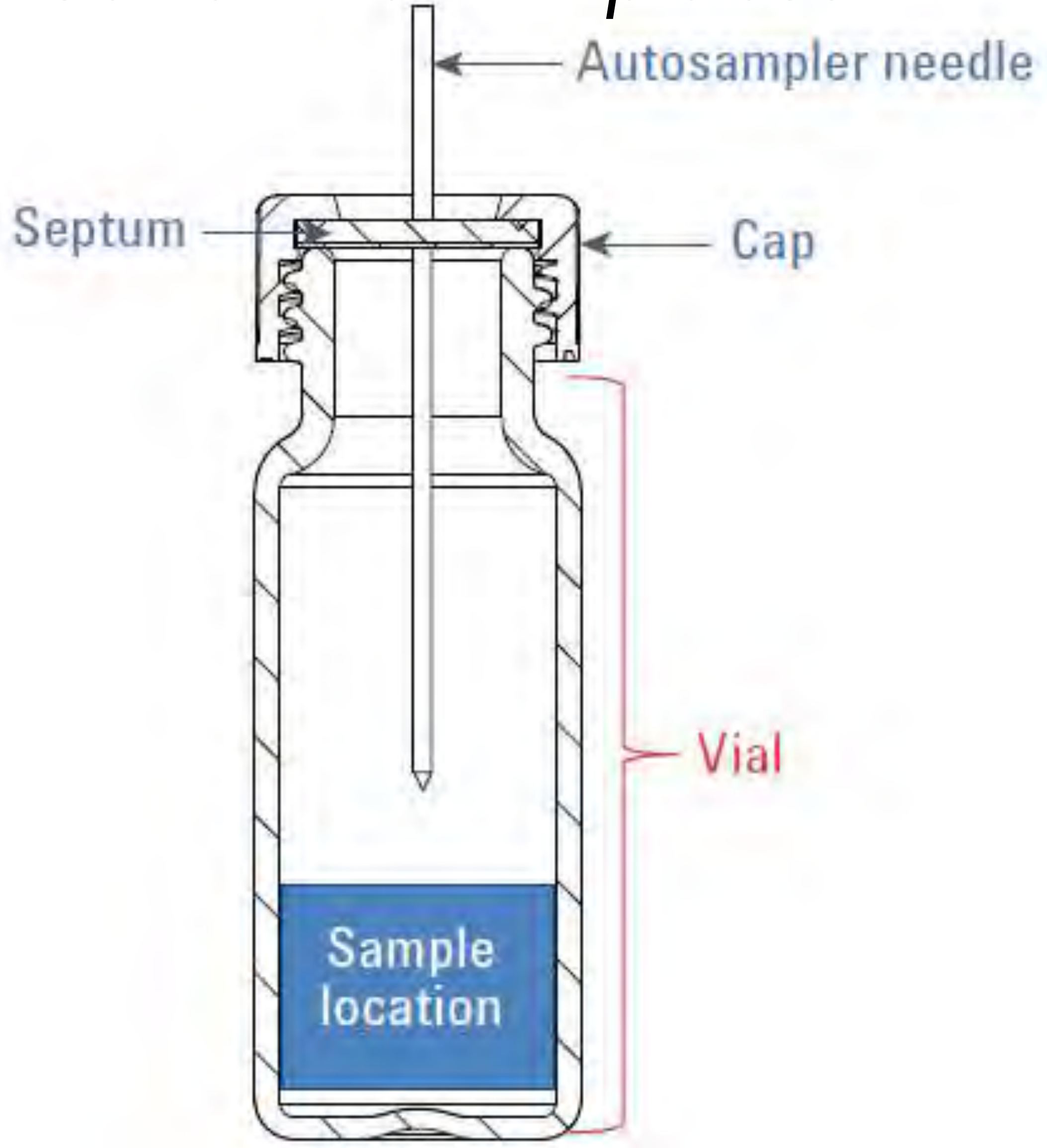
By the end of this webinar you should be able to….

- ✓ Better describe vials*, caps*, septa* and inserts*
- ✓ What makes a “better” vial
- ✓ How vials* work together to provide confidence in sample containment
- ✓ Available ranges for each
- ✓ Making better choices based on application
- ✓ How vials can impact lab productivity
- ✓ Why aren’t vials considered a more important part of the flow path
- ✓ Why Agilent should be your one stop shop for sample containment

*For the purposes of being succinct I may refer to “vials” when discussing all products underlined above

Sample Containment – *up close*



3 ***steps to sample containment***

1 The Vial and or insert can be made of glass or polymer, clear or amber, screw, crimp or snap style – ***it contains the sample***

2 The Cap can be made of aluminum, steel or polymer – ***it holds the septa***

3 The Septum (septa – plural) can be made from PTFE, silicone, rubber, butyl or combination – ***it acts as a pierceable barrier between sample and atmosphere***

Location of vials in your analytical work flow?

Standalone

GC VIALS

HEADSPACE VIALS

LC VIALS

Different vials for different platforms

GC/FID

What's in a GC/FID sample?

Analyte which can be separated by gas phase.

3 *steps to GC/FID sample containment*

Recommendations

1 The Vial is usually made of glass, clear or amber, crimp in style.

2 The Cap is almost always aluminum or steel (if magnetic is important).

3 The Septa is usually a bilayer of PTFE and silicone but not pre-slit.

Main Industries: Environmental, Energy and fuels, Flavours, Forensics

Different vials for different platforms
LC/UV

3 steps to LC/UV sample containment

Recommendations

1 The Vial is usually made of glass, clear or amber, screw, crimp or snap style.

2 The Cap is usually polymer-based but can be aluminum.

3 The Septa is usually a bi-layer of PTFE and silicone. We recommend pre-slit.

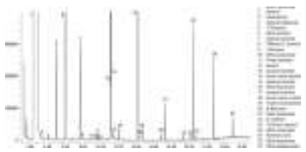
What's in an LC/UV sample?

Analyte which can be separated by liquid phase.

Main Industries: ***Pharmaceutical, Bio-Pharmaceutical, Food, Material Science***

Different vials for different platforms

GC/HS



3 *steps to GC/HS sample containment*

Recommendations

1 The Vial is usually made of glass or polymer, clear or amber, screw or crimp in style.

2 The Cap can be made of aluminum, steel or polymer.

3 The Septa can be made from PTFE, silicone, rubber, butyl or combination.

What's in a HS sample?

Analyte which can be separated by gas phase.

Main Industries: Environmental, Energy and Fuels, Foods and Flavours

Different vials for different platforms
LCMS or GCMS

What's in an MS sample?

Analyte which can be separated by ionic charge.

3 steps to MS sample containment

1 The Vial is usually made of polymer for LC/MS and glass for GC/MS, clear or amber, screw (LC-version), crimp (GC-version).

2 The Cap is almost always a polymer for LC/MS and aluminum for GC/MS.

3 The Septa is usually a bi-layer of PTFE and silicone. We recommend pre-slit for LC/MS and non pre-slit for GC/MS.

Standalone sample containment
Storage Vials 4-40ml

A “safe” place to store your customer’s samples prior to analysis

- ✓ A need for low metal glass, high quality cap/septa materials
- ✓ Open and closed cap versions
- ✓ Available in amber and clear
- ✓ Screw style cap only

Extract from page 24 of new Vials brochure

Storage Vials

Vial Size	Unit	Cap Size	Vial Type	Septa Type	Closed Top	Open Top
4 mL, 15 x 45	100/pk	13-425	Clear	PTFE/silicone	5183-4311	5183-4331
	100/pk	13-425	Amber	PTFE/silicone	5183-4321	
12 mL, 19 x 65	100/pk	15-425	Clear	PTFE/silicone	5183-4312	5183-4332
	100/pk	15-425	Amber	PTFE/silicone	5183-4322	
22 mL, 23 x 85	100/pk	20-400	Clear	PTFE/silicone	5183-4313	5183-4333
	100/pk	20-400	Amber	PTFE/silicone	5183-4323	
40 mL, 28 x 95	100/pk	24-414	Clear	PTFE/silicone	5183-4314	5183-4334
	100/pk	24-414	Amber	PTFE/silicone	5183-4324	
	100/pk	24-414	Amber			5190-4000

Vials 2ml



Agilent
Agilent
Agilent
0.5 ml







Agilent
CrossLab




AGILENT SAMPLE CONTAINMENT SOLUTIONS
SMALL DETAILS
BIG PRODUCTIVITY GAINS
INTRODUCING
AGILENT
A-LINE
VIALS

Ever wonder how a glass vial is made?

The following 4 step guide will…

- ✓ Give you some insights into the process of making a vial
- ✓ Help you to appreciate the complex nature of the manufacturing process
- ✓ How each step is critical to making a better vial

1 Raw material sourcing

Vials are made from a selection of basic materials

- Silica
- Soda Lime

Followed by…

- Up to 25 metals

You have all of your materials at the ready. *Now what?*

Clear glass

SiO_2	72 %
Na_2O	14 %
CaO	9 %
MgO	4 %
Al_2O_3	0.8 %
Fe_2O_3	0.1 %

Coloured glass

bronze	+ selenium + cobalt + iron oxyde
grey (ditto bronze)	
green	+ iron oxyde
blue	+ iron oxyde + cobalt

2 Turning raw material into tubular glass

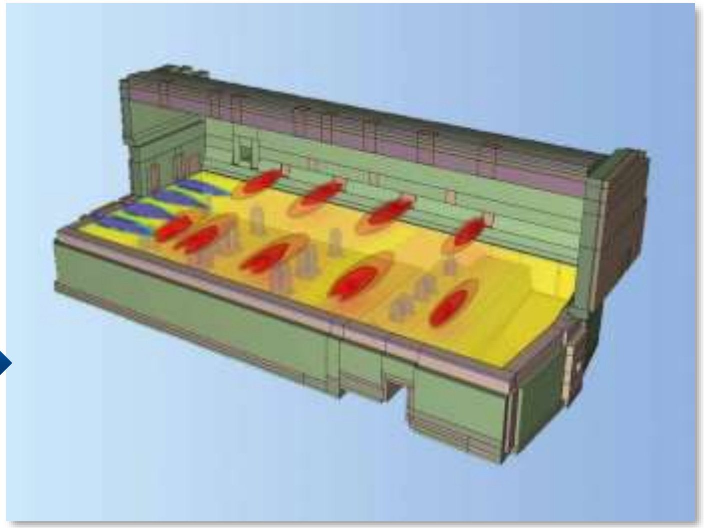
The *"hot end"* process

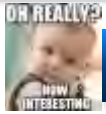
All raw materials are placed "or fed" into a huge furnace at >1500 degrees Fahrenheit

Next…

"Press-and-blow"

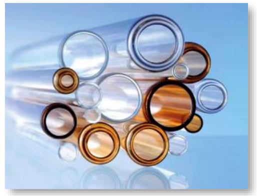
The individual section machine takes the molten material and feeds it though simultaneously to form glass tubes.

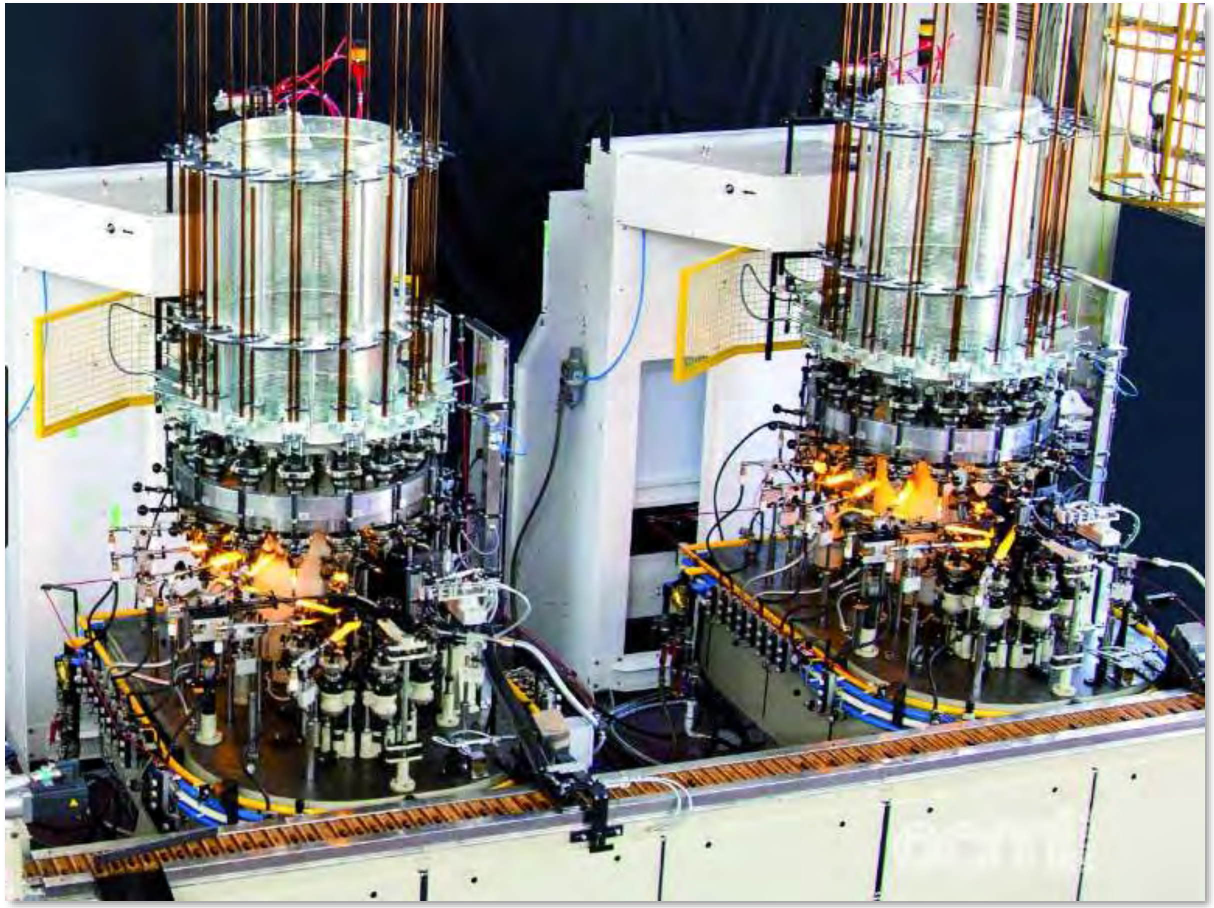




The biggest cost related to vial manufacturing is the energy used to form the product

3 Tubular conversion to vial





You now have 2-4m sections of glass tubing ready for step 3:

Place tubes into a conversion machine

- ✓ ***Flame*** is used to split the tubing rods into vial length sections
- ✓ ***Flamed again*** forming the opening at the top of the vial
- ✓ ***Flamed a third time*** to close the bottom of the vial

No cutting device is used to make the vial. This limits microfracturing and allows for a smoother surface.

4 Reducing the stress in glass during manufacture

The structure of the vial is made but you are not finished yet!

- ✓ The previous processes caused stress which has accumulated in the glass
- ✓ At any time the glass could crack if not explode and would be of no use
- ✓ This final and important step called ***annealing*** helps to reduce this stress

did you know?

Stop your screaming! Vials which rub against each other during manufacturing can cause microfractures or abrasions impacting containment performance

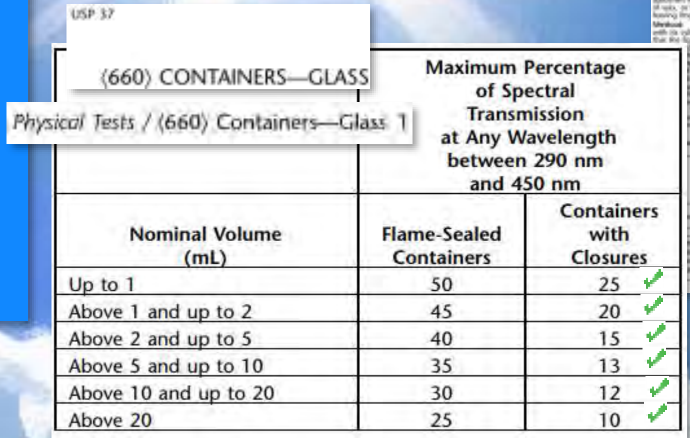
Shedding some light on colored glass
For light sensitive analytes

We all call it amber glass, however, its actually *colored glass*

The "**amber**" tint can vary widely but still be effective

Must meet USP660 requirements

- ➢ Wavelengths 290-490nm
- ➢ Containers <1ml thru >20ml


USP 37

〈660〉 CONTAINERS—GLASS

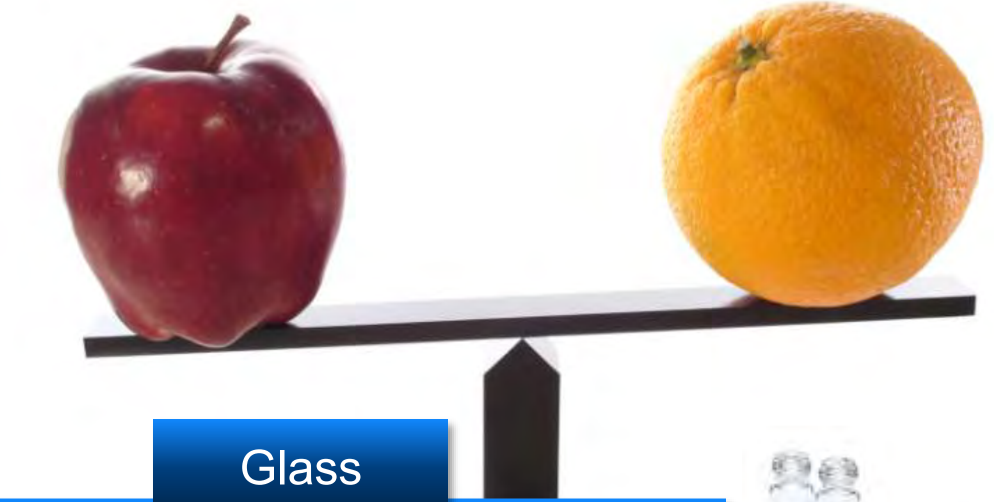
Physical Tests / 〈660〉 Containers—Glass 1

Nominal Volume (mL)	Maximum Percentage of Spectral Transmission at Any Wavelength between 290 nm and 450 nm	
	Flame-Sealed Containers	Containers with Closures
Up to 1	50	25
Above 1 and up to 2	45	20
Above 2 and up to 5	40	15
Above 5 and up to 10	35	13
Above 10 and up to 20	30	12
Above 20	25	10

Sulfur, together with **carbon** and **iron** salts, is used to form **iron** polysulfides and produce **amber** glass ranging from yellowish to almost black!

Glass versus plastic
Which vials are better?

- There isn't one simple answer!
- And you will not be surprised – Its application dependent
- Each have there own pluses and negatives



Plastic

Also known as: *polypropylene-based vials and inserts*

Comes in: *<2ml fill volumes of <1ml or less*

Visually: *"almost" transparent to opaque*

Material characteristics: *limited sodium interference, elevated levels of extractables*

Uses: *LCMS, Bio-Molecular, CE*

Glass

Also none as: *silica-based vials and inserts*

Comes in: *0.1ml – 60ml volumes*

Visually: *clear to dark amber*

Material characteristics: *elevated metals on glass surface, control of raw material sourcing*

Uses: *broadest use in analytical labs*

In summary

You should now have a better understanding of the vial manufacturing process.

Coming up…

Making a cap and septum for your vial

Microvials High Recovery Vials and Inserts <2ml





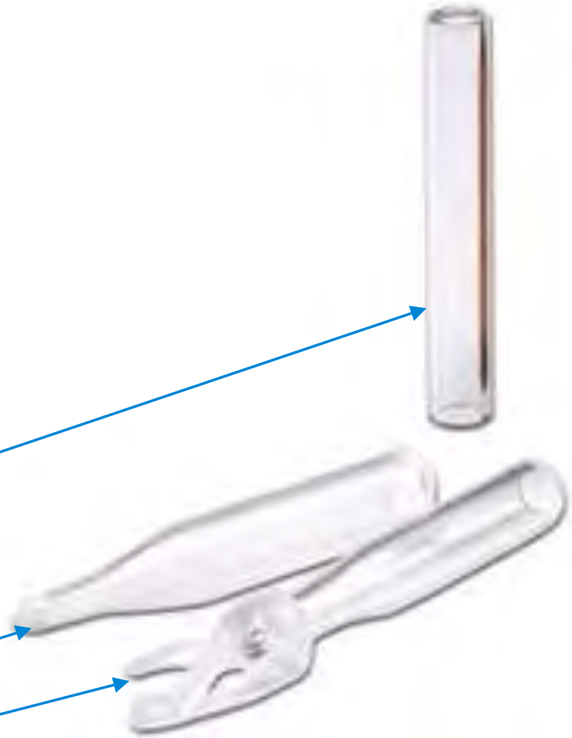


Limited or high value sample?

Inserts - continued 150-400ul (0.15-0.40ml)

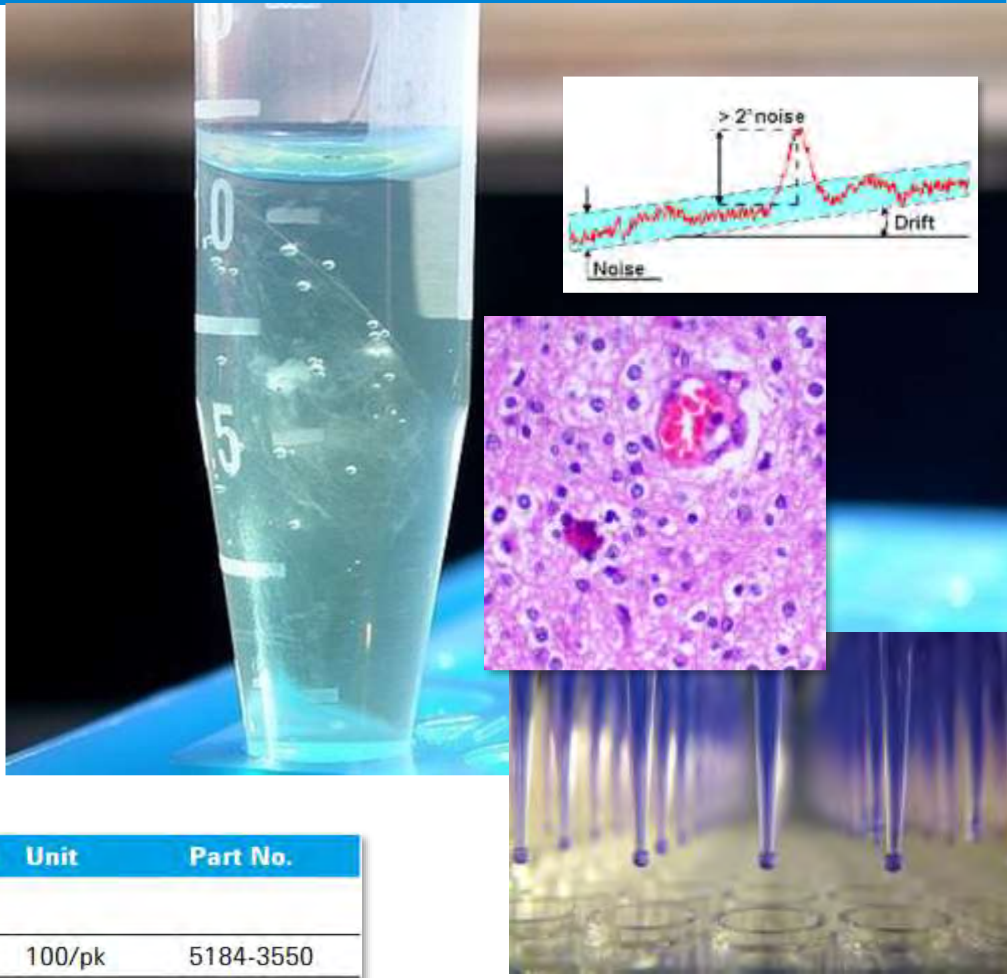
- ✓ You may have limited sample
- ✓ Expensive to prepare analyte
- ✓ Must be used in accompaniment with wide-opening 2ml vials

Description	Sample volume	Material	Certified	Unit	Part No.
Vial insert	100 µL		Y	500/pk	9301-1387
Vial insert, for 2 mL standard opening (8 mm) screw top vials	150 µL	Glass with polymer feet		100/pk	5183-2088
Vial insert, 200 µL measured fill (150 µL recommended), for 2 mL standard opening (8 mm) screw top vials	150 µL	Pulled point glass		100/pk	5183-2089
Vial insert, flat bottom, for 2 mL standard opening (8 mm) screw top vials	200 µL	Glass		100/pk	5183-2090
Vial insert, with graduations	250 µL	Polypropylene		100/pk	5190-4073
Vial insert	250 µL	Glass with polymer feet	Y	100/pk	5181-1270
Vial insert	250 µL	Deactivated glass with polymer feet	Y	100/pk	5181-8872
Vial insert, graduated to 300 µL in increments of 100 µL. Do not fill to more than 250 µL	250 µL	Polypropylene with polymer feet	Y	100/pk	5182-0549
Vial insert	250 µL	Pulled point glass	Y	100/pk	5183-2085
Vial insert, conical	250 µL	Polymer feet	Y	25,000/pk	5185-5958
Vial insert, flat bottom	250 µL	Glass	Y	50,000/pk	5067-0212
Vial insert	350 µL	Glass		1,000/pk	5188-5321
Vial insert, flat bottom	400 µL	Glass	Y	500/pk	5181-3377
Vial insert, flat bottom	400 µL	Deactivated glass	Y	500/pk	5183-2086
Vial insert, flat bottom	400 µL	Polypropylene	Y	500/pk	5183-2087
Cap for 350 µL glass insert				1,000/pk	5188-5322



Limited or high value sample?
High recovery vials 15ul-0.8ml

- ✓ Available in both glass and polymer materials, and combined materials
- ✓ Minimal residual volume of 1-2ul
- ✓ Available in clear and amber
- ✓ Silanized or not



Extract from page 13 of new Vials brochure

Description	Sample volume	Material	Certified	Unit	Part No.
Microvials					
WineGlass shape, 12 x 32 screw top	15 µL	Glass, clear		100/pk	5184-3550
	15 µL	Glass, amber		100/pk	5184-3554
WineGlass shape, 12 x 32 crimp top	15 µL	Glass, clear		100/pk	5184-3551
	15 µL	Glass, amber		100/pk	5184-3555
Crimp top, tapered, 6 mm	100 µL	Glass, clear		500/pk	5180-0844
Crimp top, round bottom, 6 mm, for HTS and HTC PAL liquid injection	300 µL	Glass, clear		500/pk	5180-0841
Crimp/snap top	700 µL	Polypropylene		100/pk	5182-0567
Crimp top, flat bottom	800 µL	Glass, amber		1,000/pk	5183-4487

Limited or high value sample?
High recovery vials 1.5ml

- ✓ Available in both glass and polymer materials, and combined materials
- ✓ Minimal residual volume of 1-2ul
- ✓ Available in clear and amber
- ✓ Salinized or not

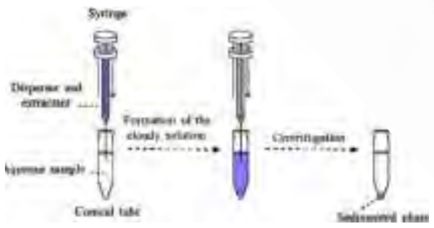
Extract from page 13 of new Vials brochure

Description	Sample volume	Material	Certified	Unit	Part No.
Crimp top	1.5 mL with 30 µL reservoir	Glass, clear		100/pk	5182-3454
	1.5 mL with 30 µL reservoir	Glass, clear (silanized)		100/pk	5183-4497
Screw top	1.5 mL with 30 µL reservoir	Glass, clear		100/pk	5183-2030
	1.5 mL with 30 µL reservoir	Glass, amber		100/pk	5183-2073

Limited or high value sample?

Vials with integrated inserts 250-300ul

- ✓ Similar to high recovery vials but lower in price
- ✓ Not certified
- ✓ Come in amber and clear glass
- ✓ Crimp and screw cap styles



Extract from page 13 of new Vials brochure

Vials with Integrated Inserts

Screw top, with glass insert	250 µL	Polypropylene		100/pk	5188-5390
Crimp/snap top, with glass insert	250 µL	Polypropylene		100/pk	9301-0977
	250 µL	Polypropylene	Y	100/pk	9301-0978
Screw top, with fixed insert	300 µL	Glass, clear		100/pk	5188-6591
Crimp top, with fixed insert	300 µL	Glass, clear		100/pk	9301-1388
Screw top, with fixed insert	300 µL	Glass, amber		100/pk	5188-6592
Crimp top, with fixed insert	300 µL	Glass, amber		100/pk	5188-6572

Standalone sample containment
Test Tubes 3.5-60ml

Are used for…

- ✓ Sample collection
- ✓ Fractionation
- ✓ Centrifugation
- ✓ Reconstitution

Extract from page 24 of you Vials brochure

Test Tubes

Description	Size	Certified	100/pk	250/pk
12 x 48 mm	3.5 mL		5022-6534	
16 x 48 mm	7 mL		5022-6533	
12 x 100 mm	8.5 mL			5022-6531
16 x 100 mm	20 mL			5022-6532
30 x 48 mm round bottom glass	20 mL	Y	5042-6470	
25 x 100 mm round bottom glass	40 mL		5042-6459	
30 x 100 mm round bottom glass	60 mL		5042-6458	

Caps

The Cap

There are mainly 2 types of materials used in the manufacture of autosampler caps

- ✓ **Polypropylene (screw and snap styles)**
- ✓ **Aluminum (crimp style)**

Followed by…

- ✓ **Steel (screw)**
- ✓ **Polyurethane (screw)**

But how do you get from raw material to finished cap?

Put a cap on it!

We talked earlier about making a vial; that's only half of the story

The following slides will…

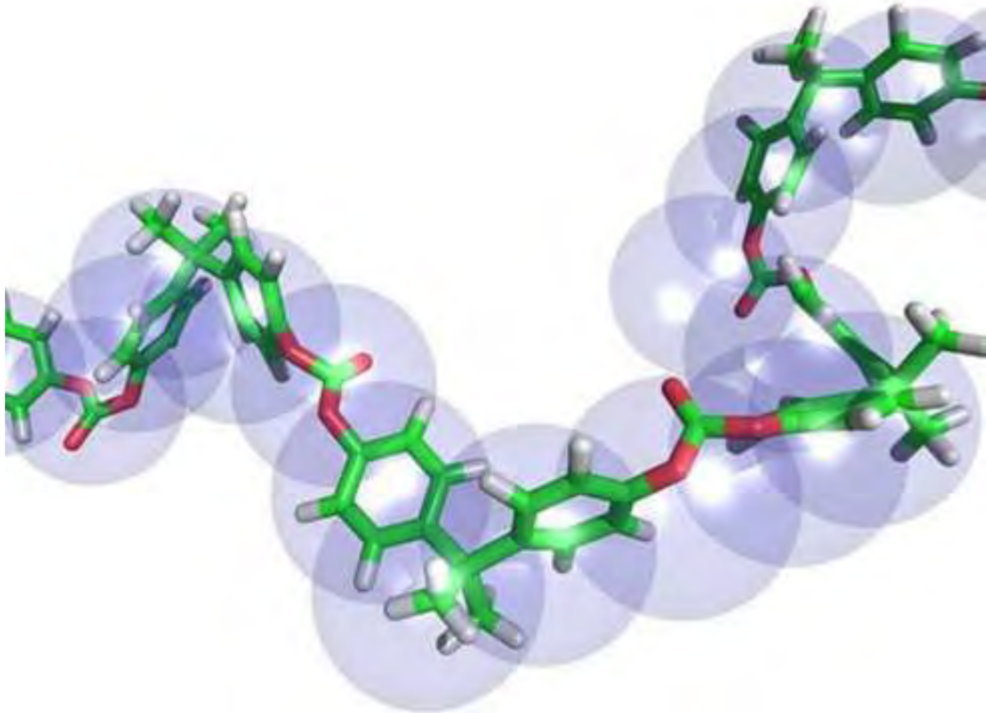
- ✓ Provide some insights into cap and septum manufacturing
- ✓ Help you to appreciate the complex nature of the various processes
- ✓ What's "essential" to make a better cap and septa

Making a cap

Sourcing the raw materials

It's trickier than one might think

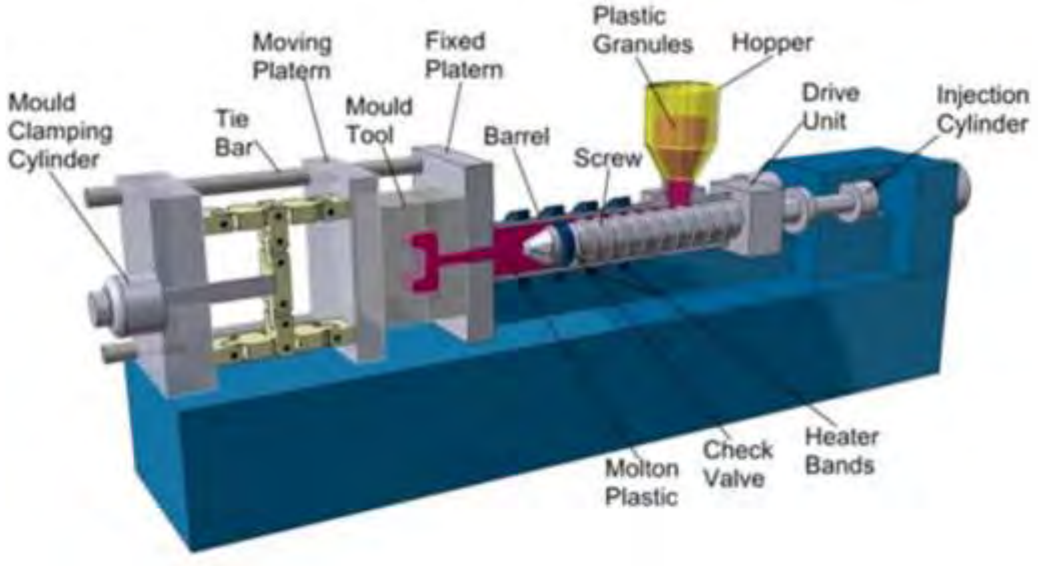
- When it comes to polymers there are many options in the market
- Purer materials are more expensive
- Some manufacturers source recycled materials which are cheaper but lead to leachable contamination of the flowpath



Extractables are compounds which have the potential to leach (producing **leachables**), both organic and inorganic, into the analytical flowpath

Making a cap
Making a Mould

Generic Workflow



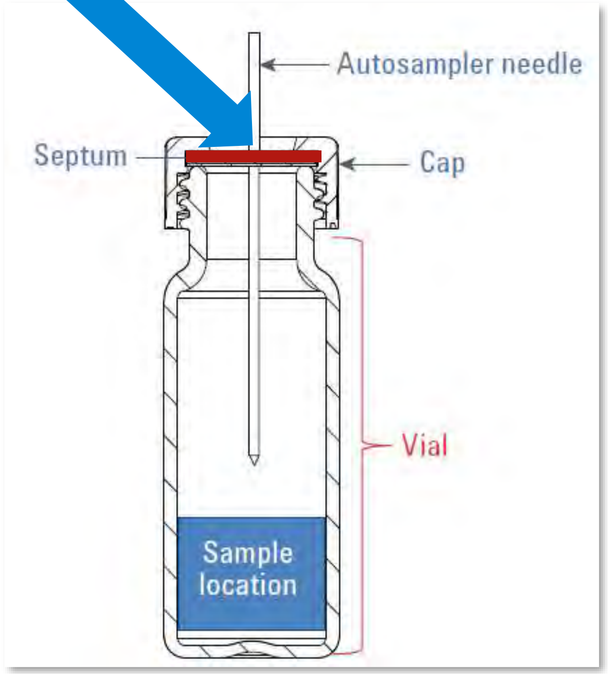
Like any “formed” plastic product a mould has to be designed

- Usually involves a chamber made from stainless steel containing a cavity shaped like the product being designed
- Pellets are dropped into the hopper and are pushed through with heat and fill the cavity, again, again, …

Agilent uses a proprietary processes inclusive of patented internal locking nib, shorter thread, unique external grip pattern and, of course, the Agilent logo.

The Septum (septa plural)

- Determined by sample matrix and analyte of interest
- Can be made from a broad range of materials are used including natural red rubber, various synthetic silicones, butyl rubber, Viton and other synthetic rubber products
- Hardness of septum material will influence sealing; getting this correct is essential
- PTFE – in most cases is used to provide an “inert”/barrier layer facing the sample



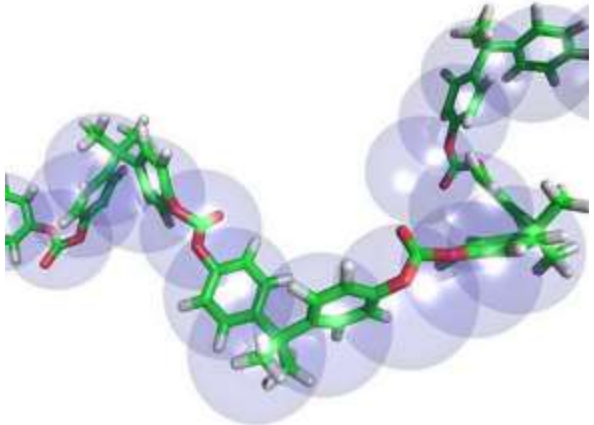
Pierce and **Tear force** testing are important vetting steps to determine septum appropriateness after all septa are a component which directly interacts with moving components of the instrument

Making a septum

Step 1:
Source the raw materials

Step 2:
Form the "Glob" and press it into sheets, as well as "*curing*" the material

Step 3:
Punch the sheets to form septa



See more about curing in Slide 49

Curing is done to polymerize the layers insuring a bond between the PTFE and the silicone.

When 2 becomes one
Combining the cap and septa

We are nearly there…

- ✓ Now take the cap and either manually or automate the placement of the septa within the cap
- ✓ Agilent uses automated systems which lower the variability of manual placement
- ✓ We offer caps in both pressfit and bonded varieties

Why do you now recommend bonded caps? Bonding is a newer technology which keeps the septa from being pushed out of the cap. No chemicals are used in the adhesion process.

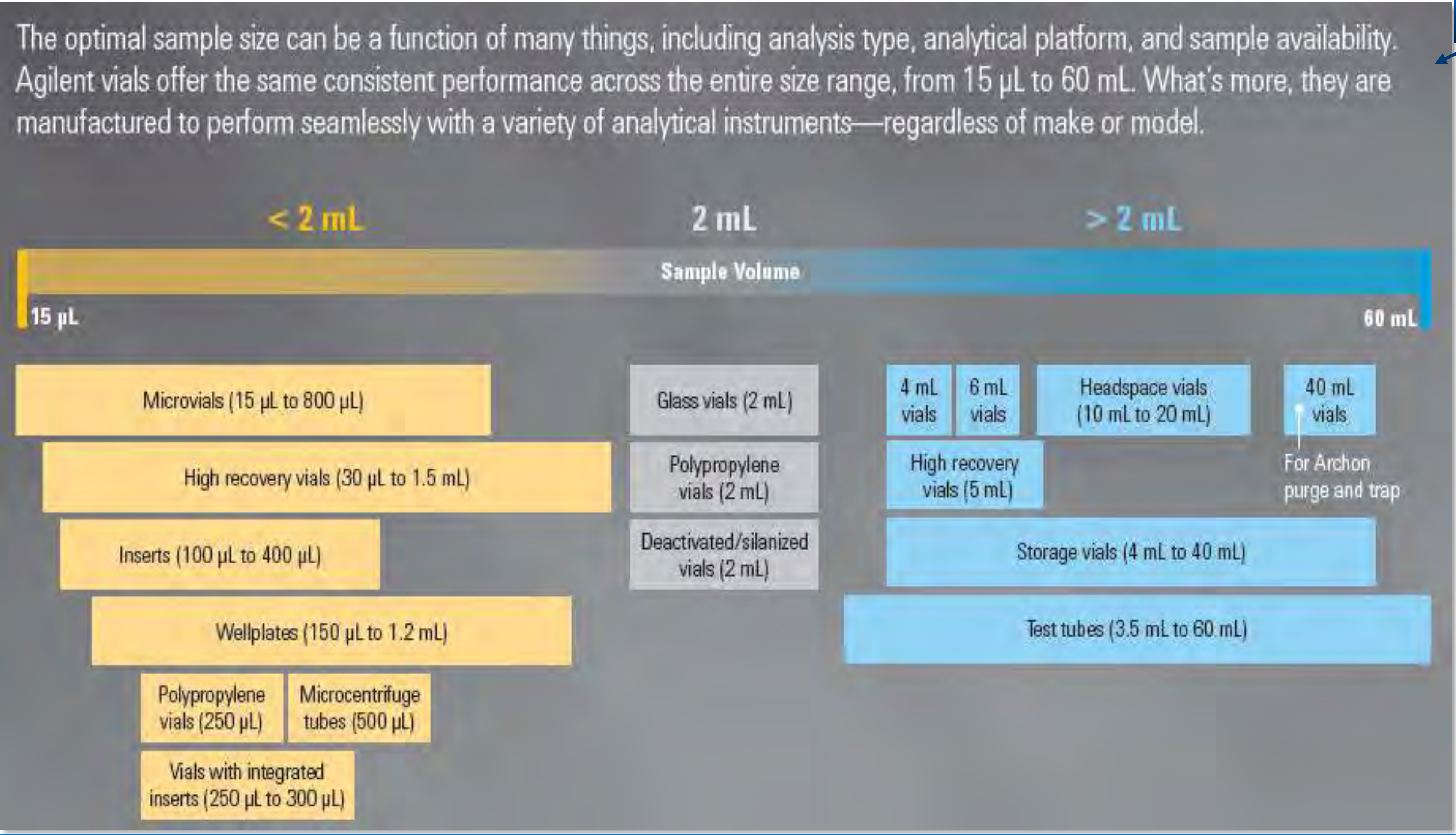
Resources available

General Reference poster

Publication no. 5991-6960

How large does your sample container need to be?

Publication no.
5991-6960



What do they look like when filled?

Publication no.
5991-6960

Good chemistry?

Always make sure the septa you select are chemically compatible with your sample and solvent. Use this chart as a guide, but remember that chemical compatibility can vary based on solvent concentration, molecular weight, and temperature.

Septa Chemical Compatibility

	PTFE	PTFE/Silicone	PTFE/Silicone/PTFE*	PTFE/Red Rubber	PTFE/Butyl
Acetonitrile	♦	♦	♦	♦	♦
Hydrocarbons (hexane, heptane, methane)	♦		♦	♦	
Methanol	♦	♦	♦	♦	♦
Benzene	♦		♦		
THF	♦		♦		
Toluene	♦		♦		
DMF	♦	♦	♦		♦
DMSO	♦	♦	♦		♦
Ether	♦	♦	♦		
Chlorinated solvents (methylene chloride)	♦		♦		
Alcohols (ethanol)	♦	♦	♦	♦	♦
Acetic acid	♦	♦	♦		♦
Acetone	♦	♦	♦		
Phenol	♦	♦	♦		♦
Cyclohexane	♦		♦	♦	

*PTFE/silicone/PTFE has the same chemical compatibility of PTFE ONLY UNTIL PUNCTURED.

Publication no. 5991-6960

Put a cap on it

And don't forget about the septum combination!

Publication no. 5991-6960

Use this chart to determine the right cap and septa combination, based on your application. Note: septa that are too thick can prevent the cap from fitting properly on the vial.

Cap and Septa Compatibility

	High Performance Septa	Thin PTFE	PTFE/Silicone*	PTFE/Silicone/PTFE*	PTFE/Red Rubber	PTFE/Butyl
Part number †	5190-3986 (18 mm) 5190-3987 (20 mm)	5062-3582 (11 mm)	5190-7021 (9 mm)** 5190-7023 (9 mm pre-slit)**	5182-0723 (9 mm)	5181-1210 (11 mm)	5183-4479 (20 mm)
Temperature range	40 to 300 °C for up to 1 hour	Up to 260 °C	-40 °C to 200 °C	-40 °C to 200 °C	-40 °C to 90 °C	-50 °C to 150 °C
Use for multiple injections	No	No	Yes	Yes	No	No
Price	Most expensive	Very economical	Economical	Most expensive	Very economical	Economical
Resistance to coring	Excellent	None	Excellent	Excellent	None	None
Recommended for storage	No	No	Yes	Yes	No	No
Best for	High temperature headspace applications	Superior chemical inertness, short cycle times, and single injections	Most common HPLC and GC analyses, not as resistant to coring as P/S/P	Superior performance for ultra analysis, repeat injections, internal standards	Chlorosilanes more economical option for single injections	Organic solvents, acetic acids; impermeable to gasses

* Agilent silicone is peroxide cured, making it more inert and less likely to interact with samples

** Now available in bonded

† These are just a few options, many more are available

How can vials reduce common pain points you face?

Working with vials and caps

What's on your mind?

- **Productivity**
- Client satisfaction
- **Cost efficiency**
- **Technical problem**
- **Downtime**

Procuring vials and caps

What's on your mind?

- Financial benefit
- Strategic partnership
- Simplified buying process
- **Purchasing costs**

Common productivity issues faced if you are a Purchasing Manager

Issue Type	Is it common?
Reducing labor costs	Yes
Reducing downtime	No
Increasing throughput	Yes
Improving well-being	No
Product availability	No
Training and support	No

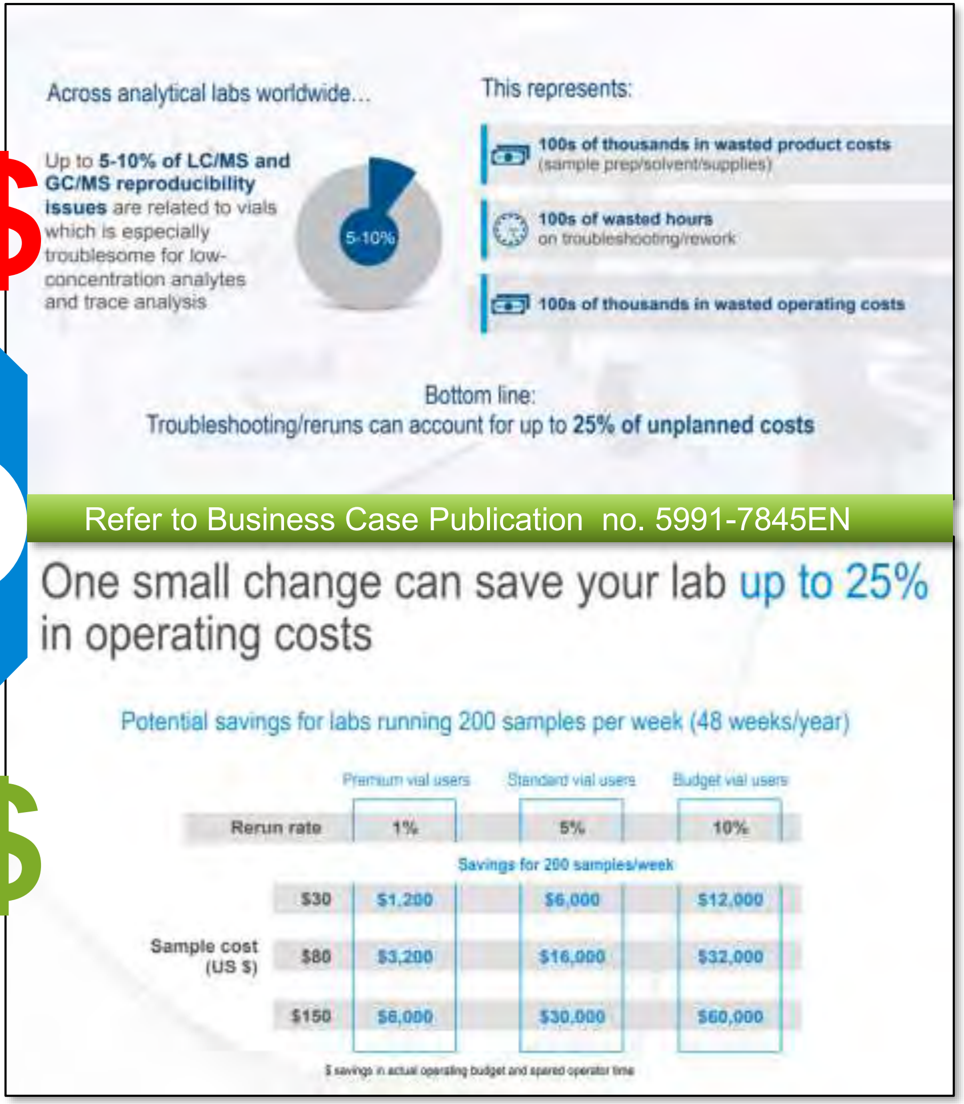
Common productivity issues faced if you are a Scientific/Technical user

Issue Type	Is it common?
Reducing labor costs	No
Reducing downtime	Yes
Increasing throughput	No
Improving well-being	Yes
Product availability	Yes
Training and support	Yes

Co$t versus benefit$ of using better vials

Choosing the correct vial or cap can…

- ✓ Limiting sample reruns
- ✓ Limit downtime
- ✓ Lower Instrument repair and service calls
- ✓ Reduce troubleshooting
- ✓ Improve customer well-being
- ✓ Reduce environmental impact



Across analytical labs worldwide…

Up to **5-10% of LC/MS and GC/MS reproducibility issues** are related to vials which is especially troublesome for low-concentration analytes and trace analysis

5-10%

This represents:

100s of thousands in wasted product costs (sample prep/solvent/supplies)

100s of wasted hours on troubleshooting/rework

100s of thousands in wasted operating costs

Bottom line:
Troubleshooting/reruns can account for up to **25% of unplanned costs**

Refer to Business Case Publication no. 5991-7845EN

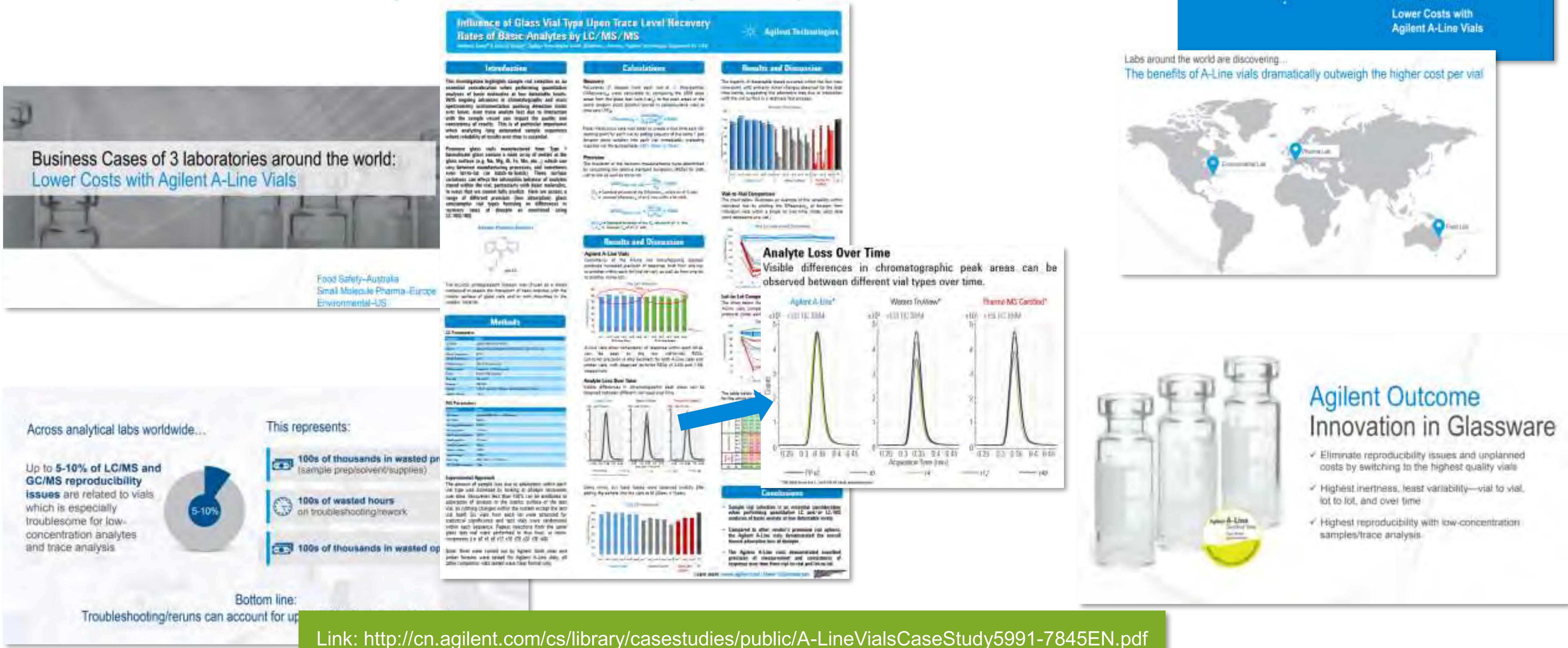
One small change can save your lab up to 25% in operating costs

Potential savings for labs running 200 samples per week (48 weeks/year)

		Premium vial users	Standard vial users	Budget vial users
Rerun rate		1%	5%	10%
		Savings for 200 samples/week		
Sample cost (US $)	$30	$1,200	$6,000	$12,000
	$80	$3,200	$16,000	$32,000
	$150	$6,000	$30,000	$60,000

$ savings in actual operating budget and spared operator time

Business Cases
Positive financial Impact of switching to Agilent A-Line vials



Link: http://cn.agilent.com/cs/library/casestudies/public/A-LineVialsCaseStudy5991-7845EN.pdf

Crimp your vial not your style

Does your customer crimp loads of vials daily?

Help your customer to…

- ✓ Save time
- ✓ Get a better seal
- ✓ Increase productivity
- ✓ Consistency of crimping performance

You Tube https://www.youtube.com/watch?v=9VNQXr0FbXc

The right vial is only a few clicks away

Use our online selection tool to quickly find the right products for complete confidence in your sample containment.

- Answer a few simple questions to identify your best options
- Search by technique, product number, vial type, or instrument manufacturer
- Make a perfect pick from more than 600 vials, caps, and septa

Go to **www.agilent.com/chem/selectvials**

Learn more
www.agilent.com/chem/vialsresources

Find a local Agilent customer center in your country
www.agilent.com/chem/contactus

USA and Canada
1-800-227-9770
agilent_inquiries@agilent.com

Europe
info_agilent@agilent.com

Asia Pacific
inquiry_lsca@agilent.com

India
india-lsca_marketing@agilent.com

You should now be able to….

- ✓ Better describe vials*, caps*, septa* and inserts*
- ✓ What makes a "better" vial
- ✓ How vials* work together to provide confidence in sample containment
- ✓ Available ranges for each
- ✓ Making better choices based on application
- ✓ How vials can impact lab productivity
- ✓ Why aren't vials considered a more important part of the flow path
- ✓ Why Agilent should be your one stop shop for sample containment

*For the purposes of being succinct I may refer to "vials" when discussing all products underlined above

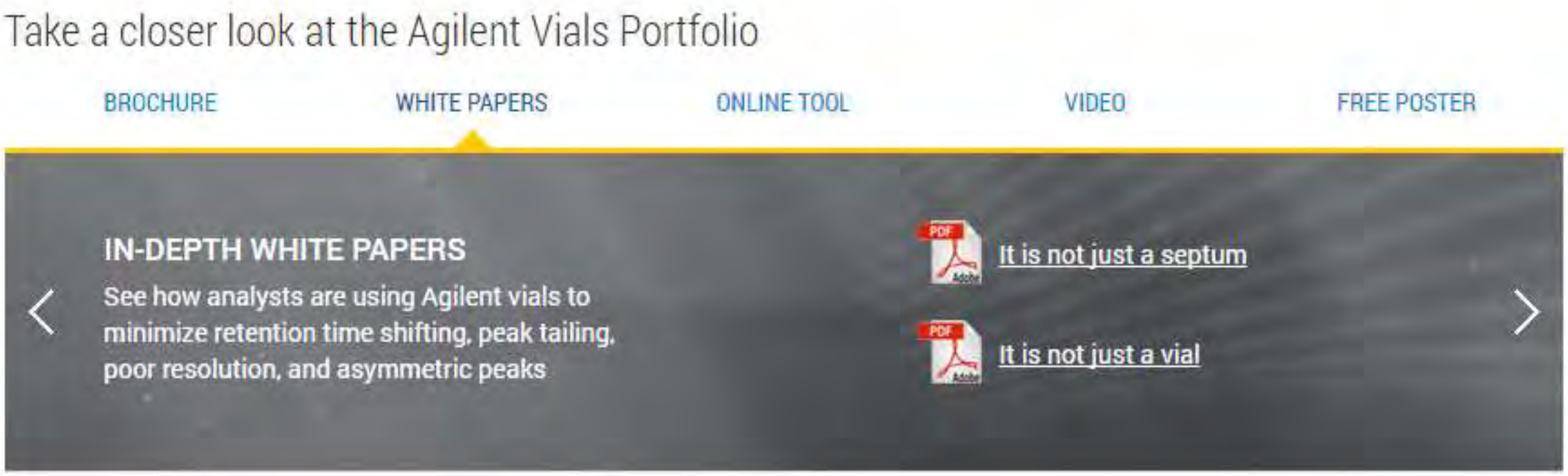
THANK YOU FOR
YOUR LİSTENİNG

DO YOU HAVE
ANY QUESTİONS?

Appendix

Resources available

2 White Papers *for more details on Septa and Vials*



An Agilent Septum is Not Just a Septum

An Agilent Vial is Not Just a Vial

Vials brochure

Downloadable

Link: https://www.agilent.com/cs/library/brochures/5990-9022EN_LR.pdf

Contains: 450+ products

Chemical compatibility charts

Our latest advances with technical explanations

Curing (or Conditioning)
The art of limiting siloxane bleed while improving ease of use

Previously we discussed how the raw material is converted into the glob, rolled out and stamped into septa. I mentioned “**curing**”; lets go into more detail on this ***very*** important step…

Curing is an important step improving the septa performance:

- **Chemical:** Curing longer produces lower bleed but has a negative impact on the physical or mechanical structure of the material.
- **Mechanical:** Curing (or conditioning) makes the septa harder making it more difficult for the autosampler needle to penetrate.
- **Chemical/Mechanical:** Getting the balance right between the need for lower bleed and material malleability is the “art”.

Agilent’s range of septa provides exceptional overall performance (chemical and mechanical)