SHIMADZU

Excellence in Science

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A Vision for the **Future**

Informatics and decision making (AI?)

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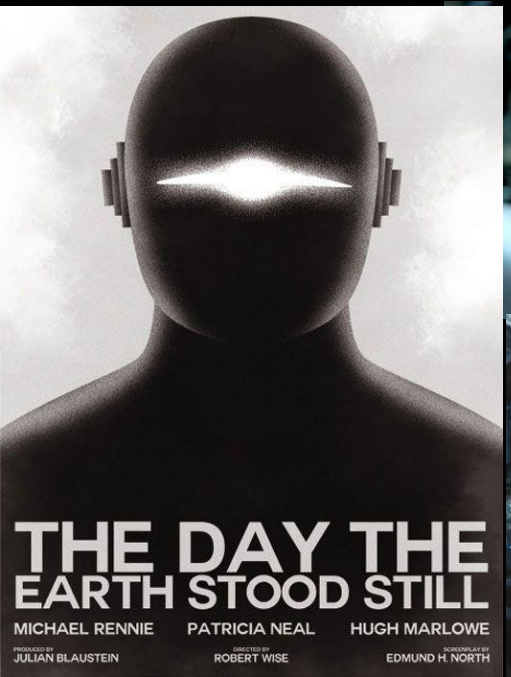
Shimadzu Corporation

Disclaimer | This is purely a speculative and personal view of what may happen and in no capacity does it reflect the views of Shimadzu Corporation



The story line

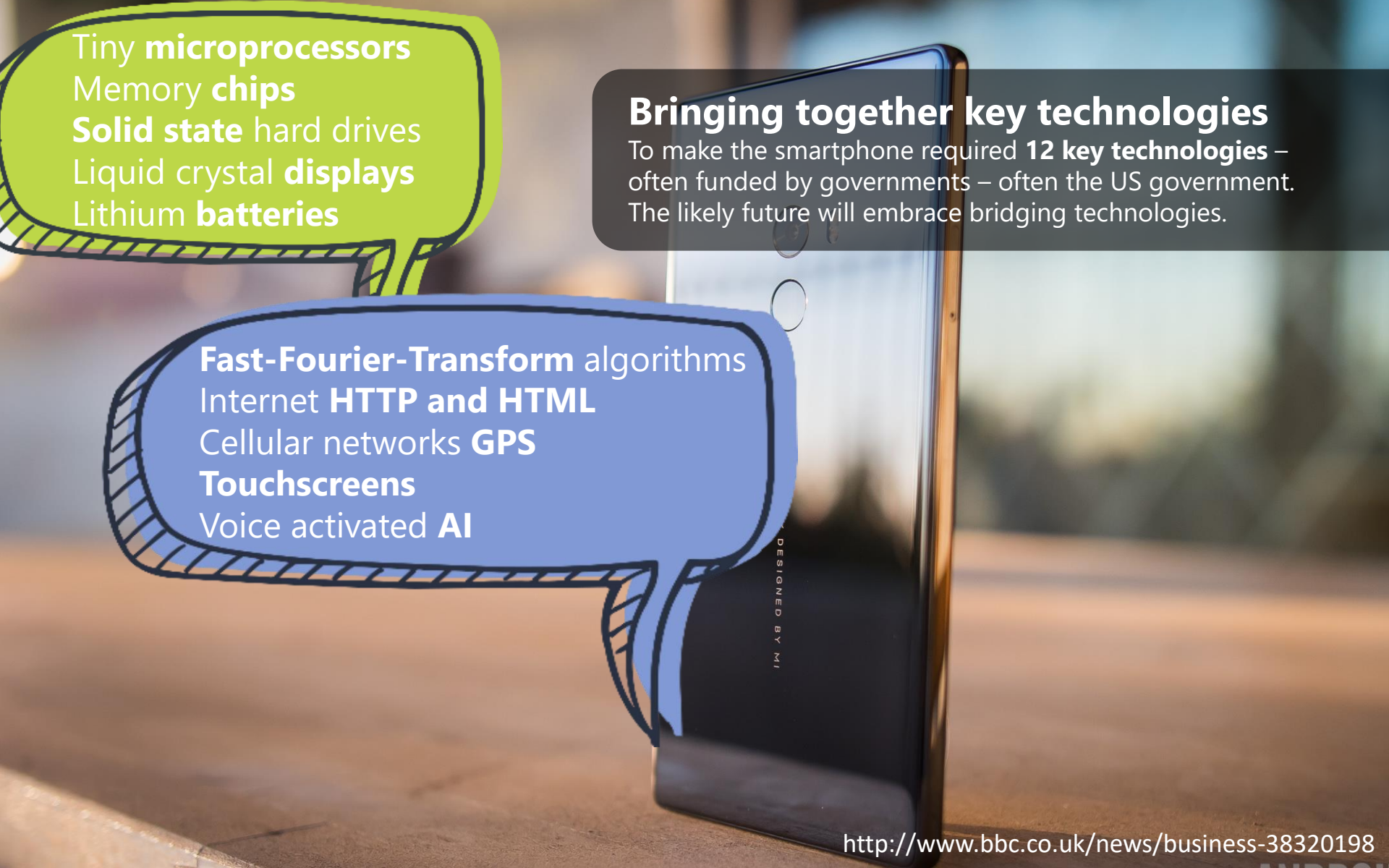
Is a conscious android human?

The Turing test, developed by Alan Turing in 1950, is a test of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human.

2015 independent science fiction psychological thriller film. The film follows a programmer who is invited by his CEO to administer the Turing test to an intelligent humanoid robot.

The development of full artificial intelligence could spell the end of the human race
Stephen Hawking

First the machines will do a lot of jobs for us and not be super intelligent....
A few decades after that though the intelligence is strong enough to be a concern
Bill Gates



Bringing together key technologies

To make the smartphone required **12 key technologies** – often funded by governments – often the US government. The likely future will embrace bridging technologies.

http://www.bbc.co.uk/news/business-38320198

COLLABORATIVE
BRINGING PEOPLE TOGETHER

INTELLIGENT
LIVING SMARTER

NATURAL
FRICTION FREE CREATIVITY

MOBILE
FLUID MOBILITY

Bringing together key technologies

Likely impact of new tools to view data and results.
This is part of the Productivity Future Vision by Microsoft

PRODUCTIVITY FUTURE VISION Microsoft

Informatics in Healthcare Systems

Using AI to help drive higher efficiencies and possibly deliver better decision making

IBM Watson, Google, Microsoft, Phillips

IBM Watson Health

IBM Watson Health Oncology

300 medical journals,
200+textbooks,
15 million pages of text

Designed to analyse a patient's medical records and help personalised treatment options

Medical data

Expected to double every 73 days by 2020

Study in India; , Watson's treatment recommendations were in agreement with those of physicians;

96% lung cancer, 93% rectal cancer, and 81% colon cancer. Similar rates for colorectal, lung, breast and gastric cancer treatments (Thai-based study). Additionally, Watson was able to screen breast and lung cancer patients for clinical trial eligibility 78 percent faster than a human, reducing screening time from 110 minutes down to just 24.

https://www.engadget.com/2017/06/01/ibm-watson-cancer-treatment-plans/

HIMSS 17

CONFERENCE & EXHIBITION | FEB 19–23, 2017

ORLANDO | ORANGE COUNTY CONVENTION CENTER

Healthcare Information and Management Systems Society Convention

Google has been working on deep learning in the healthcare space for some time, and is expanding its reach into the industry by teaming up with FHIR (Fast Health Interoperability Resources; FIRE)

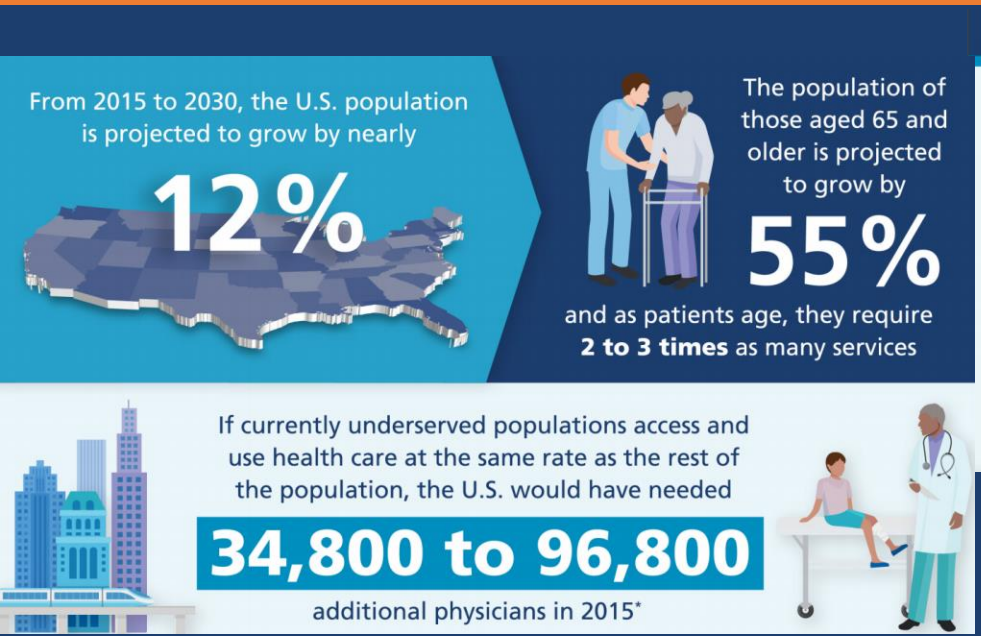
Microsoft Healthcare NExT, 'patient engagement and business intelligence to predictive analytics and genomics'.

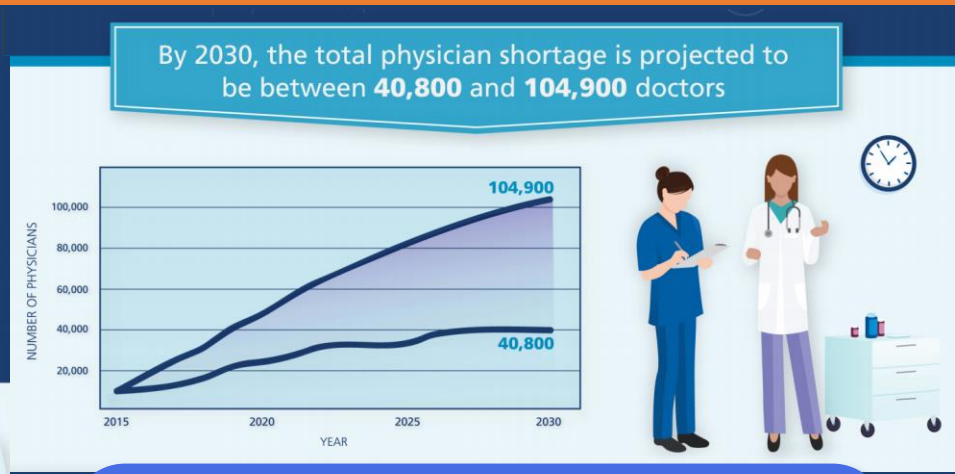
Informatics in Healthcare Systems

Can we do things better?

Use IoT and AI to help speed decision making, increase efficiencies.

The problem is a global ageing population.





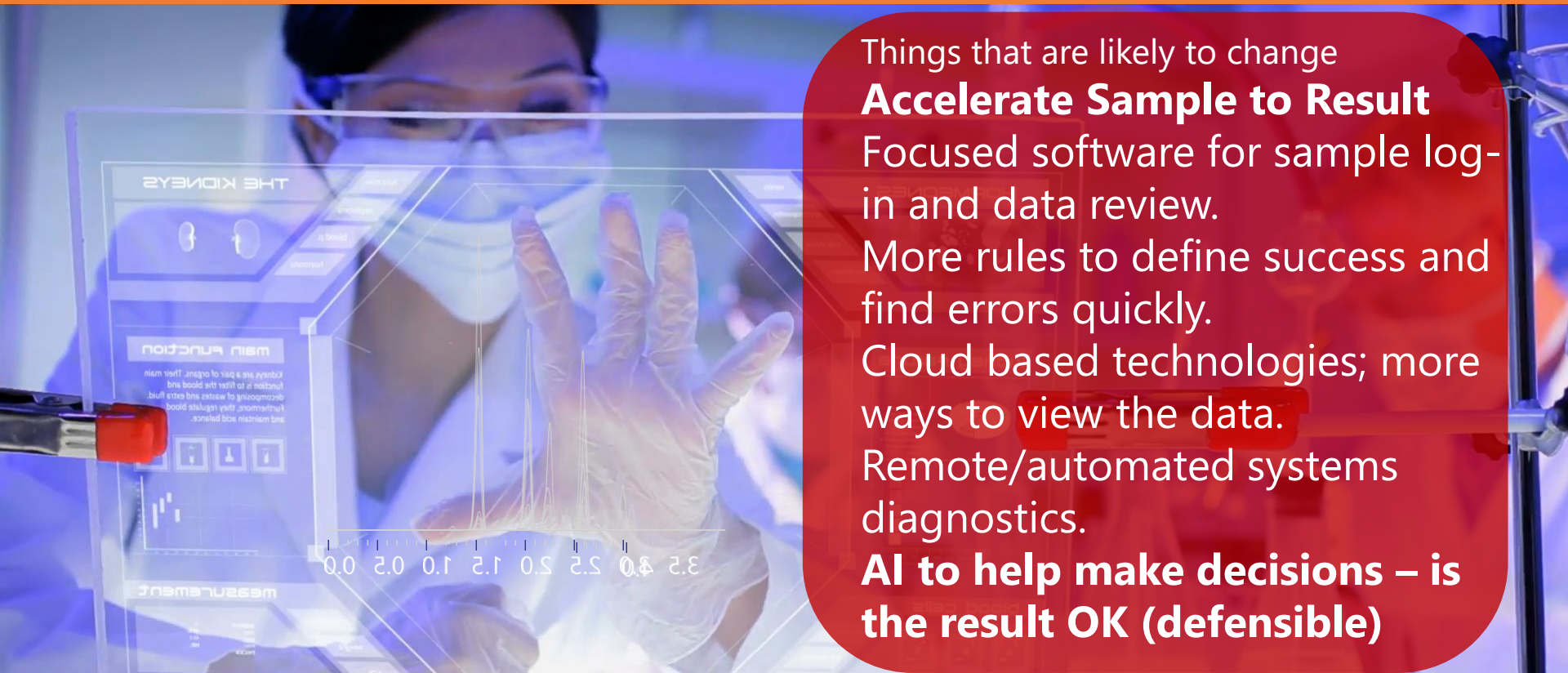
Association of American Medical Colleges
Addressing the shortage will require a multipronged approach, including innovation in delivery; **greater use of technology**; improved, efficient use of all health professionals on the care team

https://aamc-black.global.ssl.fastly.net/production/media/filer_public/05/b2/05b2f855-2a9c-4261-93ee-c78a114c7211/032117workforce_swr_online.pdf

Impact on informatics and AI on routine workflows

Informatics will change how we do our work in the future. Decision making (AI?) tools will enable routine environments to increase productivity and ROI.

There are still many caveats (peak integration, matrix effects) but change is very likely



Things that are likely to change

Accelerate Sample to Result

Focused software for sample log-in and data review.

More rules to define success and find errors quickly.

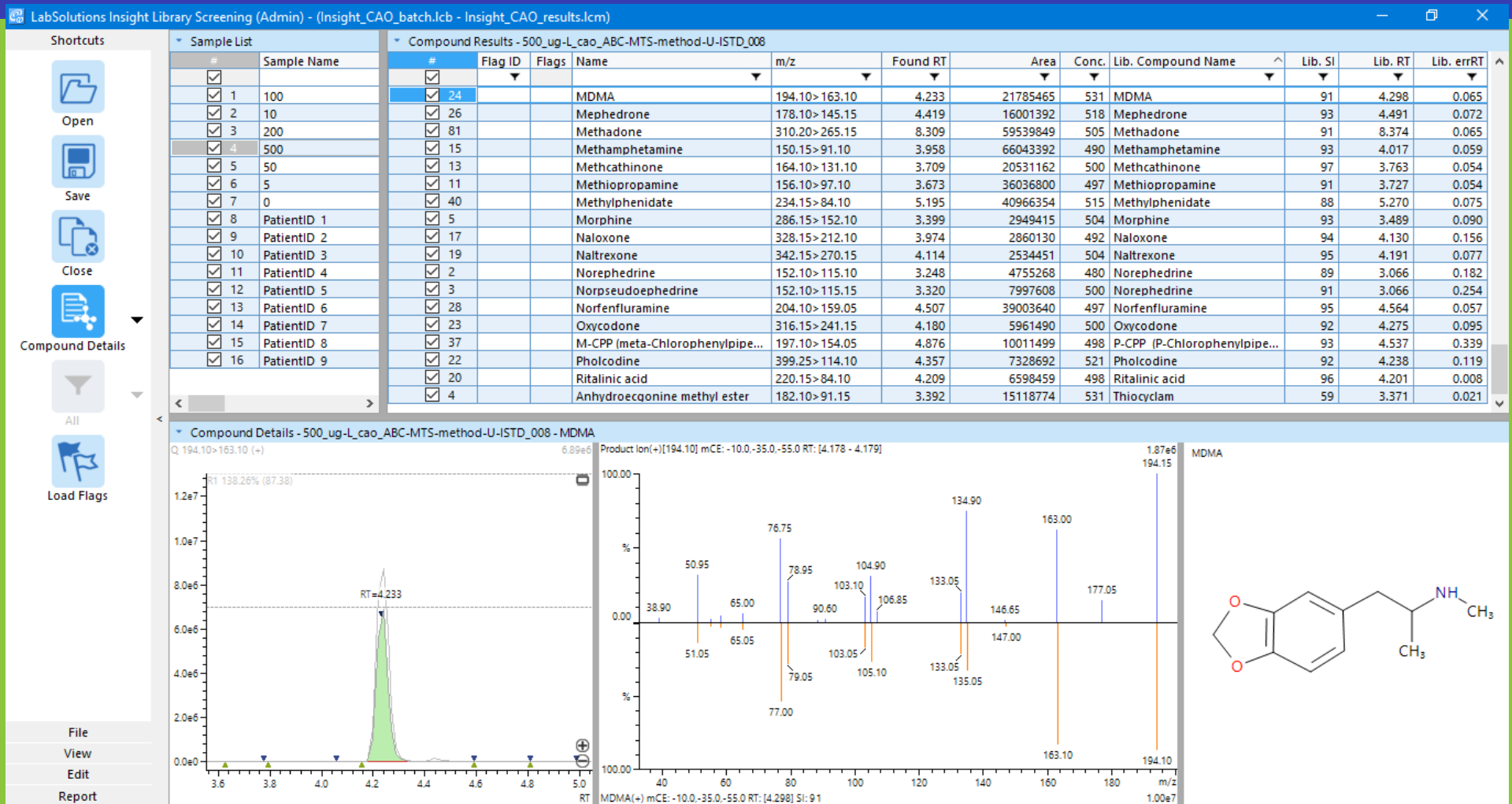
Cloud based technologies; more ways to view the data.

Remote/automated systems diagnostics.

AI to help make decisions – is the result OK (defensible)

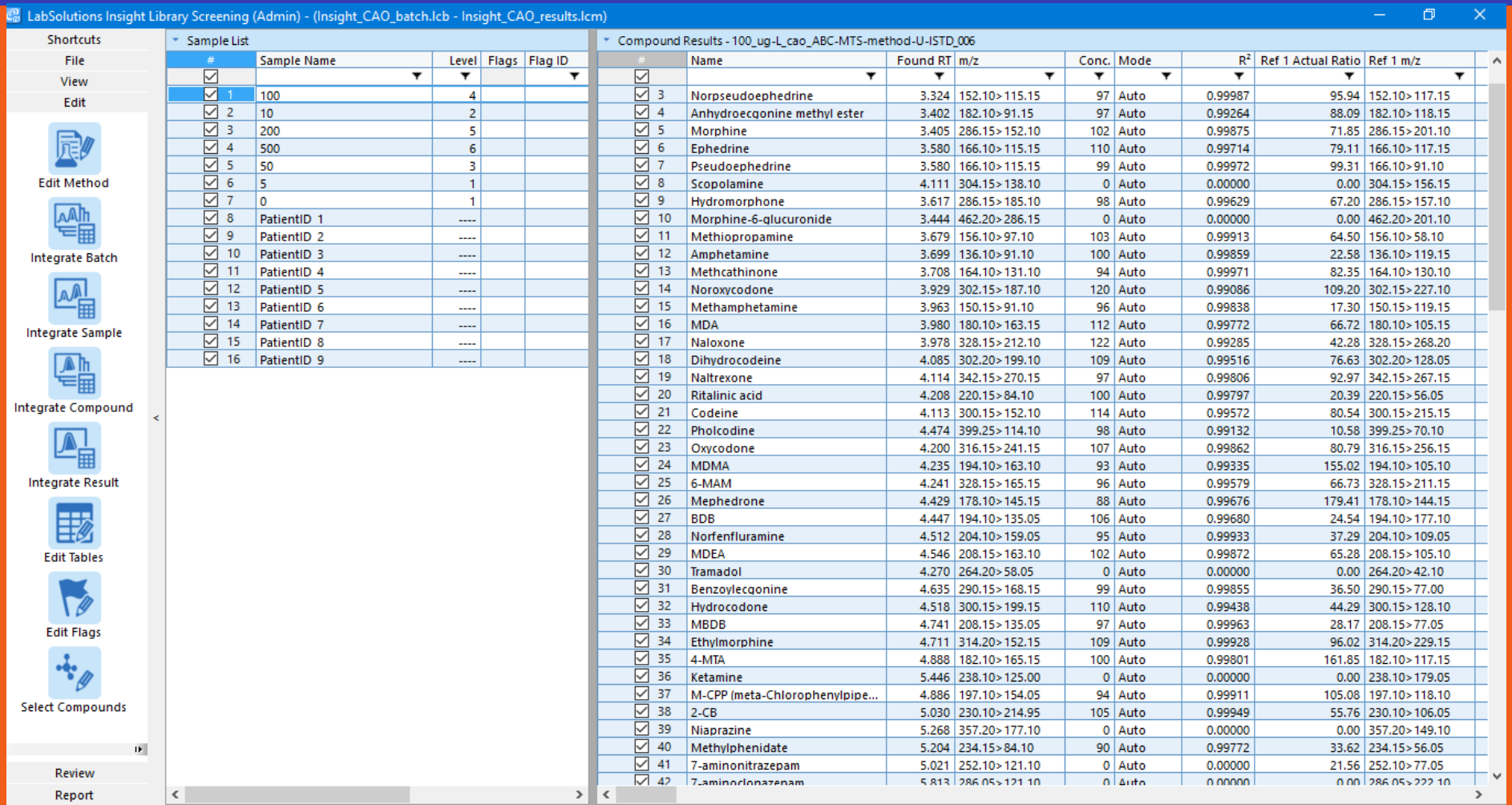
Data spaces to review data and make decisions

Information rich environments



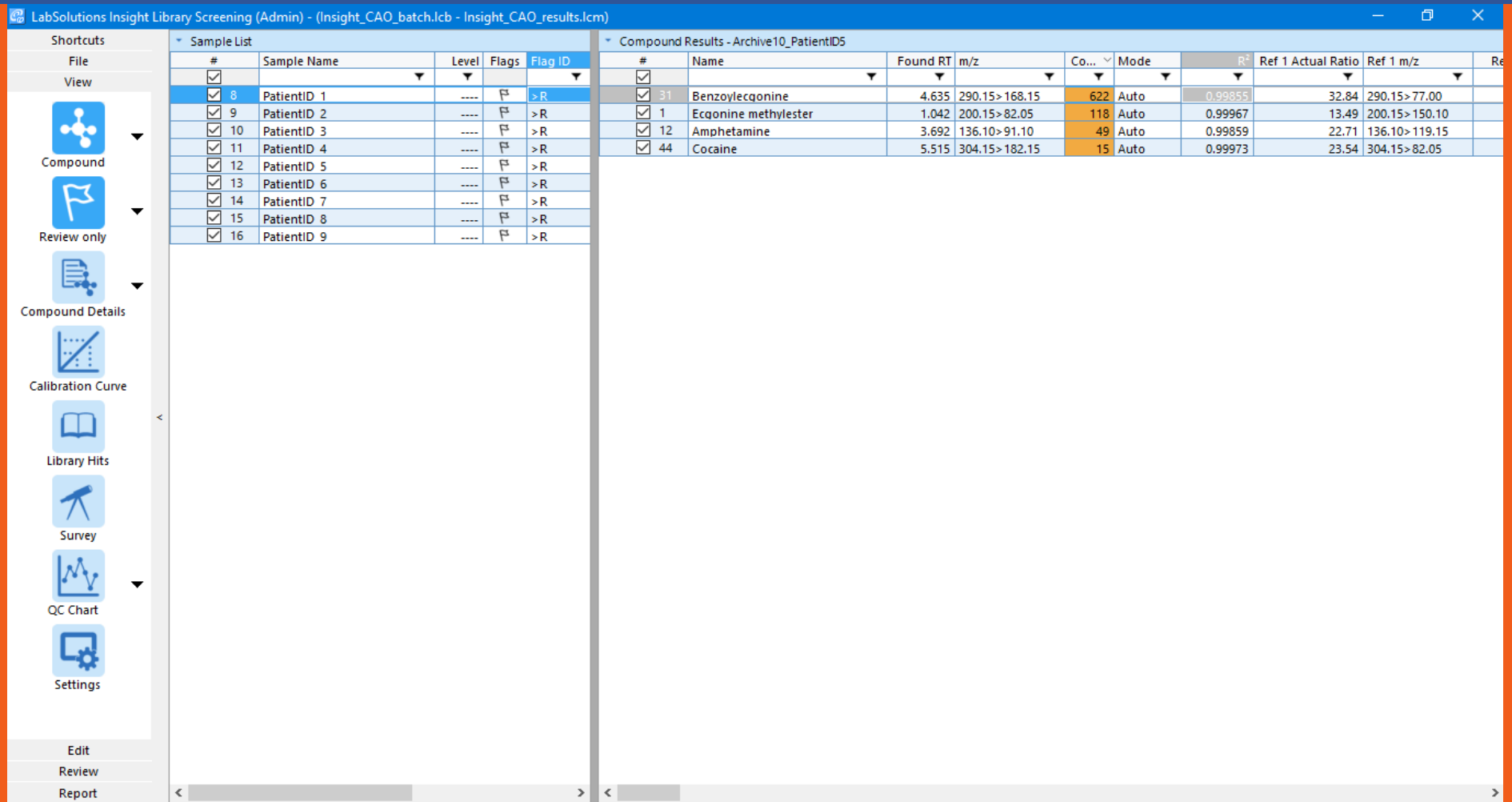
Shaping data spaces to meet differing needs

Change the user experience to just show results….



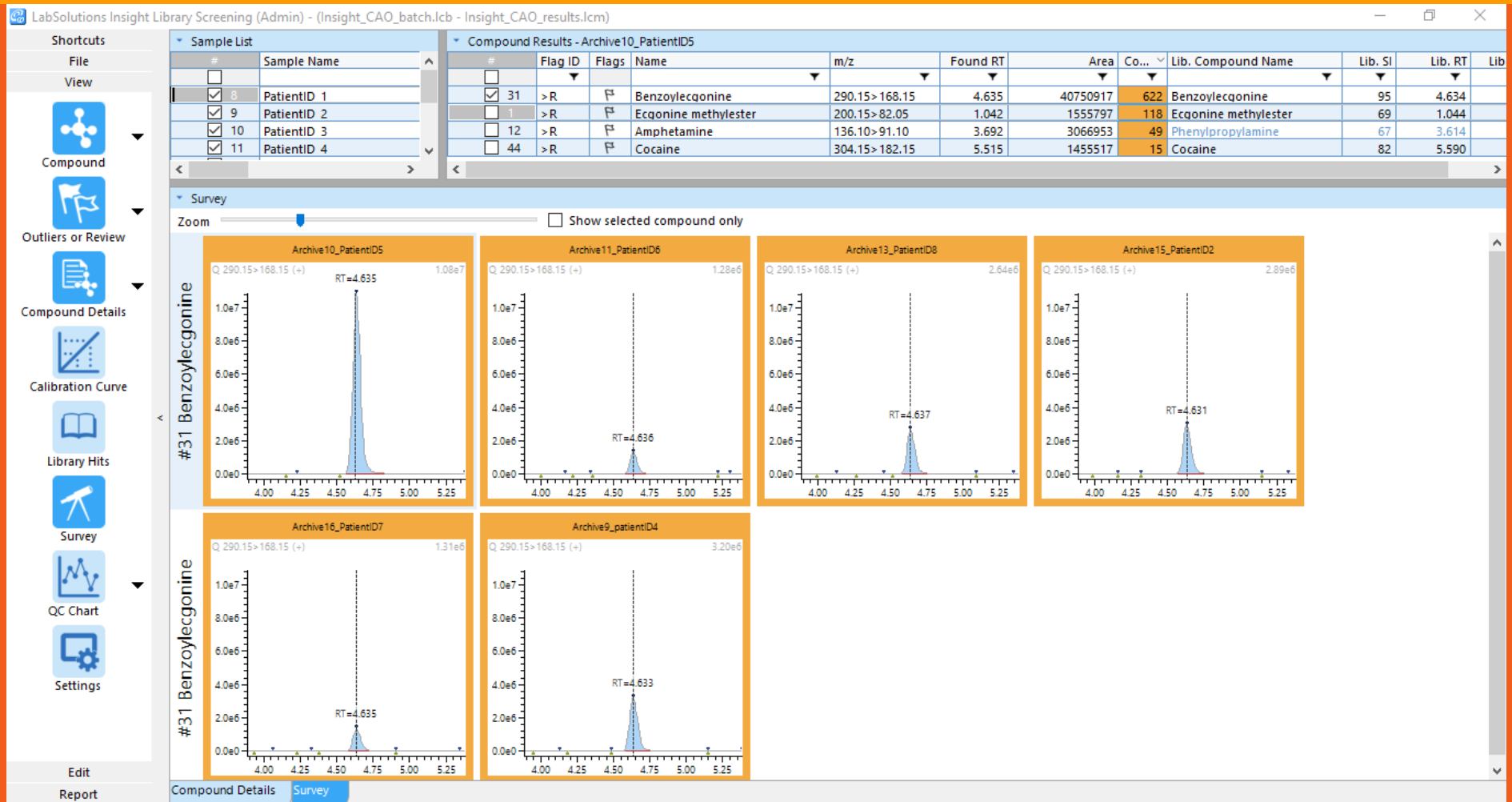
One click to show flagged compounds

Or change the view to show any outliers or problems….



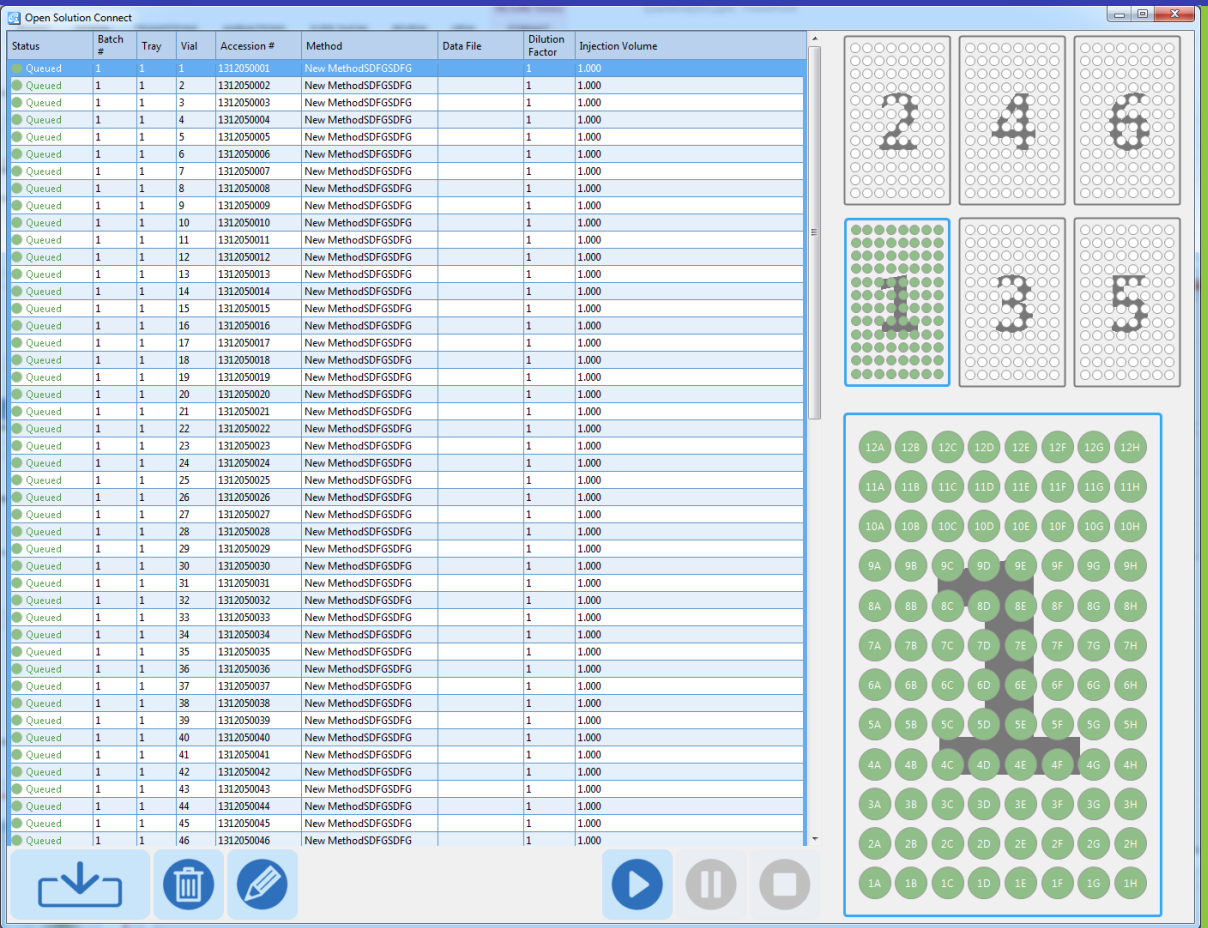
One click to map a compound in different patients

The user experience can be simply changed to meet individual needs….



Touchscreen sample login

To help multi-discipline users it makes a difference to change their experience and adapt to workflows. In this case it is delivering software for clinical environments.



Sample log-in software designed for each need

Clinical context

Touch screen

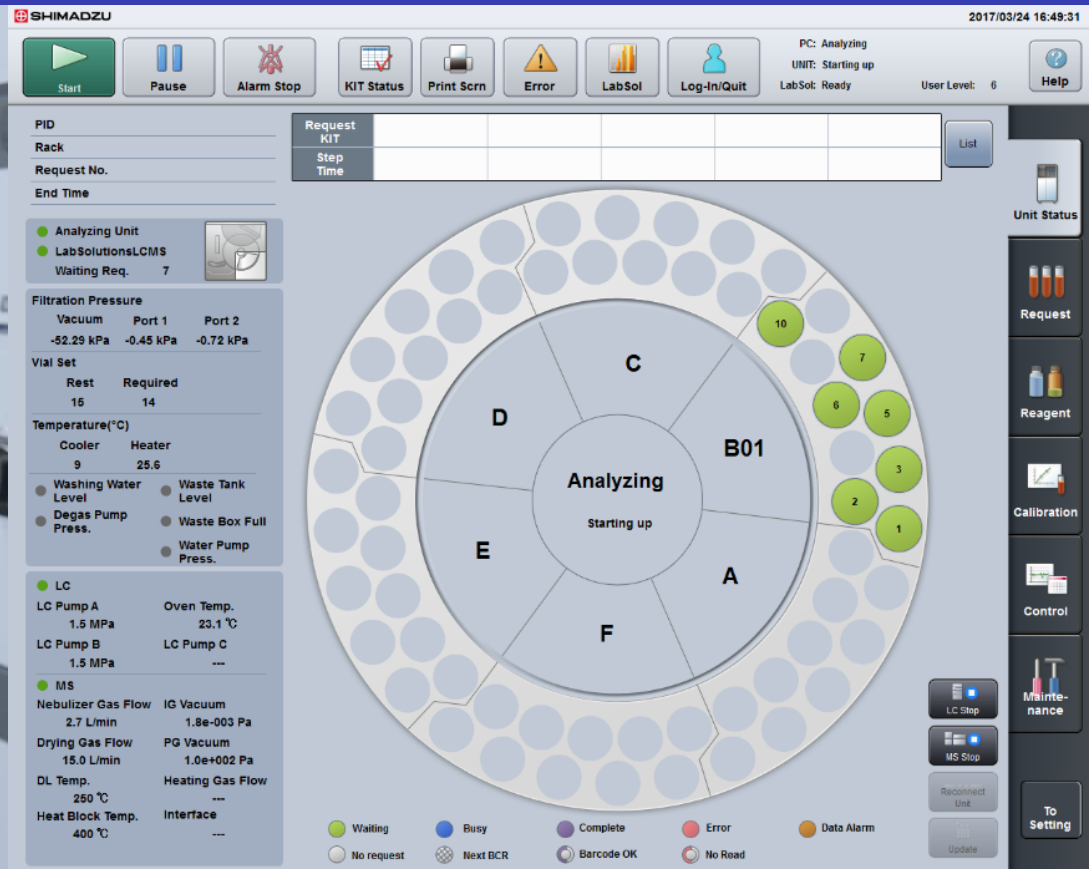
Bi-directional communication with LIS

Designed to make things better, easier and help improve the productivity of the clinical lab

Changing sample management experiences

By developing automated sample preparation tools in the clinical toxicology domain it's also important to design the sample login software for the lab environment

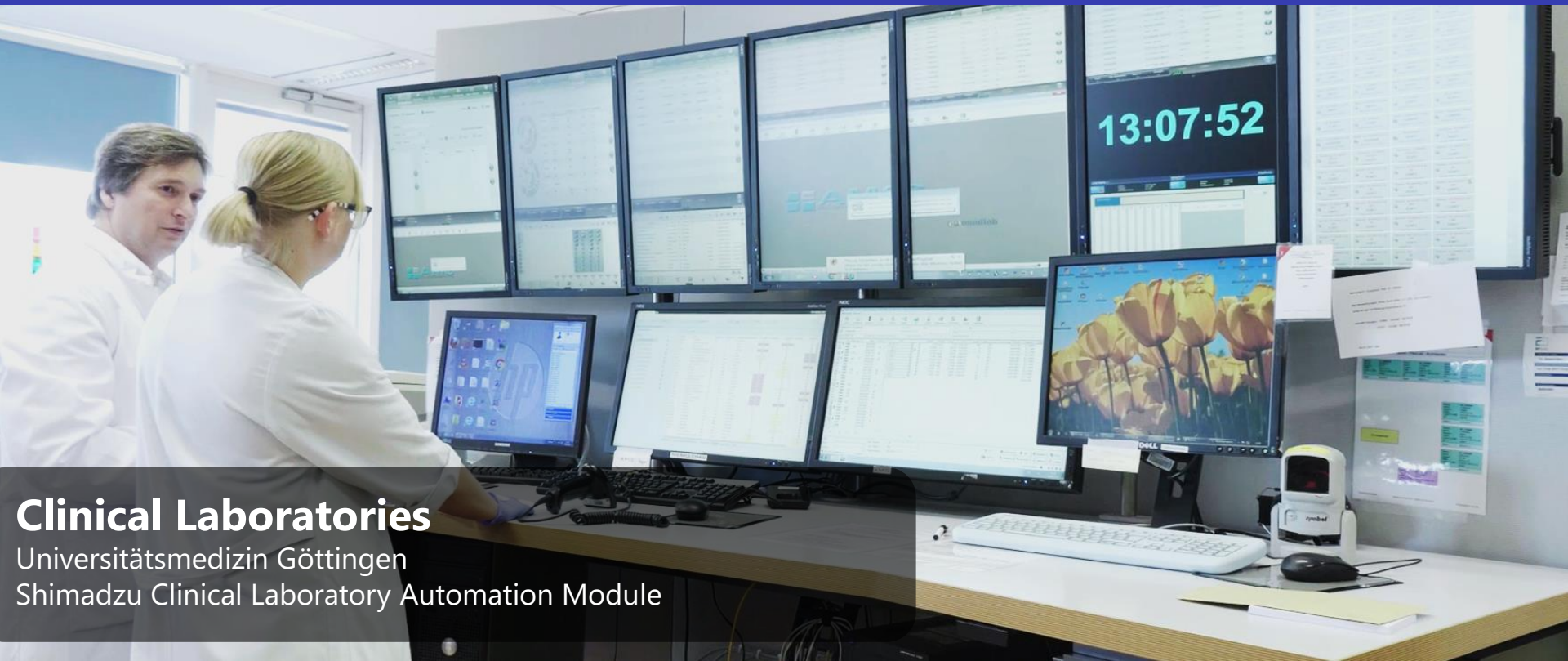
Shimadzu Clinical Laboratory Automation Module



Checking data quality, enhancing automation

In routine LC-MS/MS analysis labs reviewing results and checking data quality are critical components in the workflow.

Creating data spaces to review the analysis, check the data quickly will drive future software designs working with new visualization technologies.



Clinical Laboratories

Universitätsmedizin Göttingen
Shimadzu Clinical Laboratory Automation Module

Faster data acquisition, higher data quality, better identification

Trend towards faster data acquisition, higher quality MS/MS

Key driver ‘Driving higher sensitivity but also higher data quality’

High data density

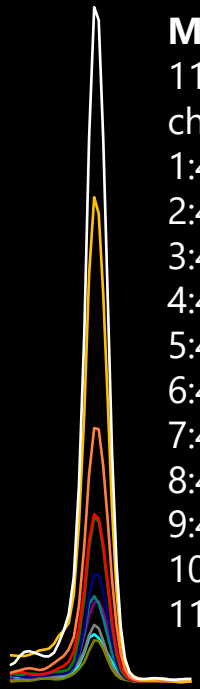
Enables a higher number of compounds in a test panel.

Better identification power (libraries; full scan or MRM)

Do more with faster data acquisition instruments

Using high speed data acquisition systems methods can be changed to deliver high sensitivity but also better identification. Driving informatic workflows.

Key driver 'Library searchable identification, reducing false positive and false negative reporting'.

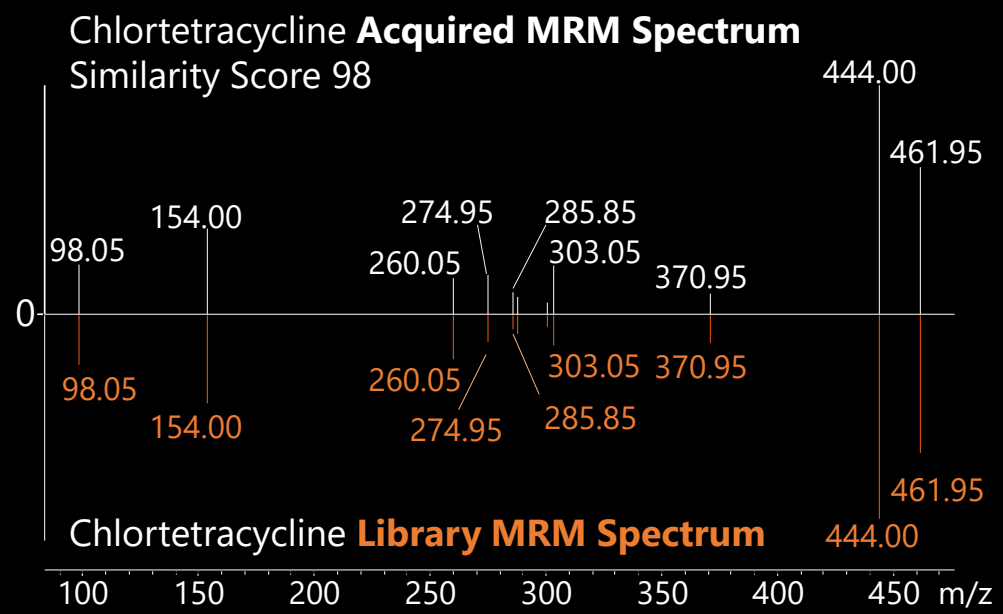


6.50 6.75 7.00 7.25 7.50 min

MRM Spectrum Mode

11 MRM's acquired for chlortetracycline at 10pg/uL

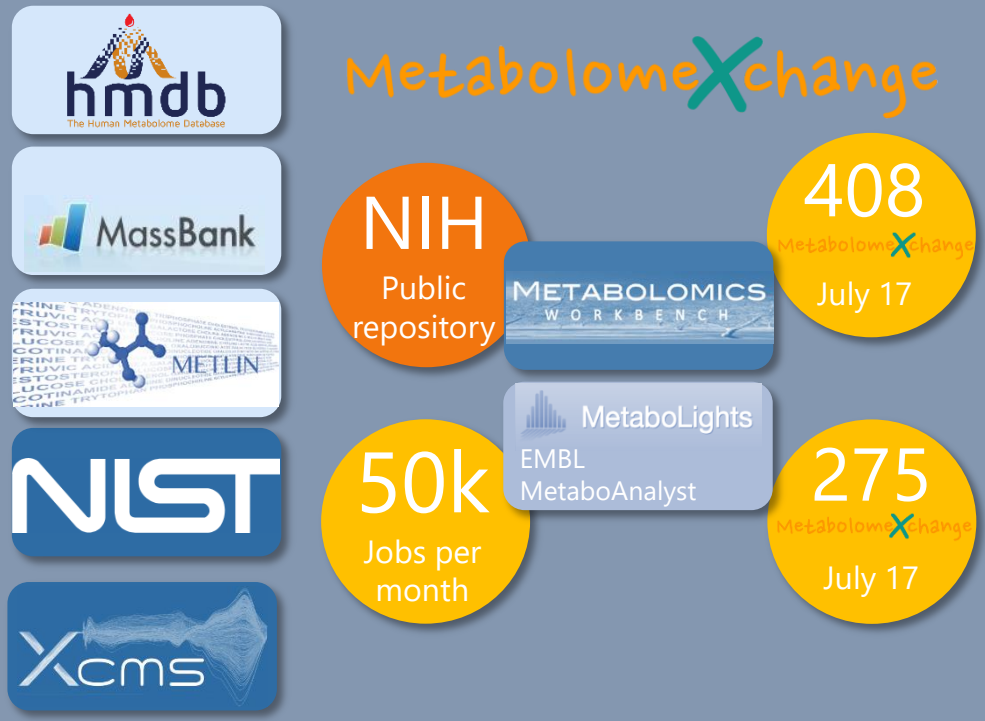
1:479.10>444.00 (+) CE: -23V
2:479.10>461.95 (+) CE: -35V
3:479.10>154.00 (+) CE: -34V
4:479.10>98.05(+) CE: -45V
5:479.10>260.05(+) CE: -60V
6:479.10>303.05(+) CE: -37V
7:479.10>300.80(+) CE: -45V
8:479.10>287.90(+) CE: -53V
9:479.10>274.95(+) CE: -44V
10:479.10>370.95(+) CE: -31V
11:479.10>285.85(+) CE: -56V



How will informatics change knowledge, let's look at metabolomics….

1600 publications (search term metabolomics+biomarker from 2000)

No clinically approved metabolite biomarkers have emerged with failure in validation phases often being a reason.



Metabolomics Databases

Glycan Mass Spectral Database (GMDB)
Human Metabolome Database (HMDB)
LIPID MAPS Structure Database (LMSD)
LIPID MAPS Proteome Database (LMPD)
MassBank
Metlin
MetabolomeXchange
Metabolights
Metabolomics Workbench
mzCloud
Metabolome Express
XCMS

Connecting software tools and instruments

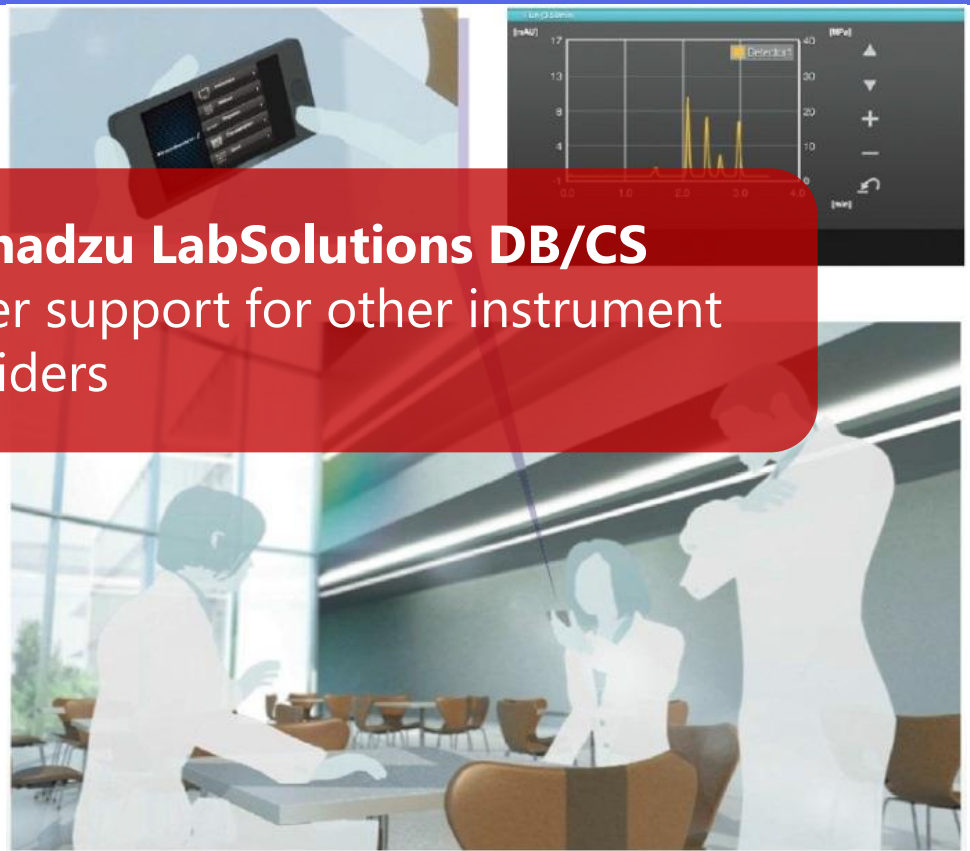
Key words; vendor neutrality, open source but also remote service centres, remote diagnostic tools

Bringing together business models and good ideas, delivering better science

PROTEIN METRICS
Powerful software for protein characterization

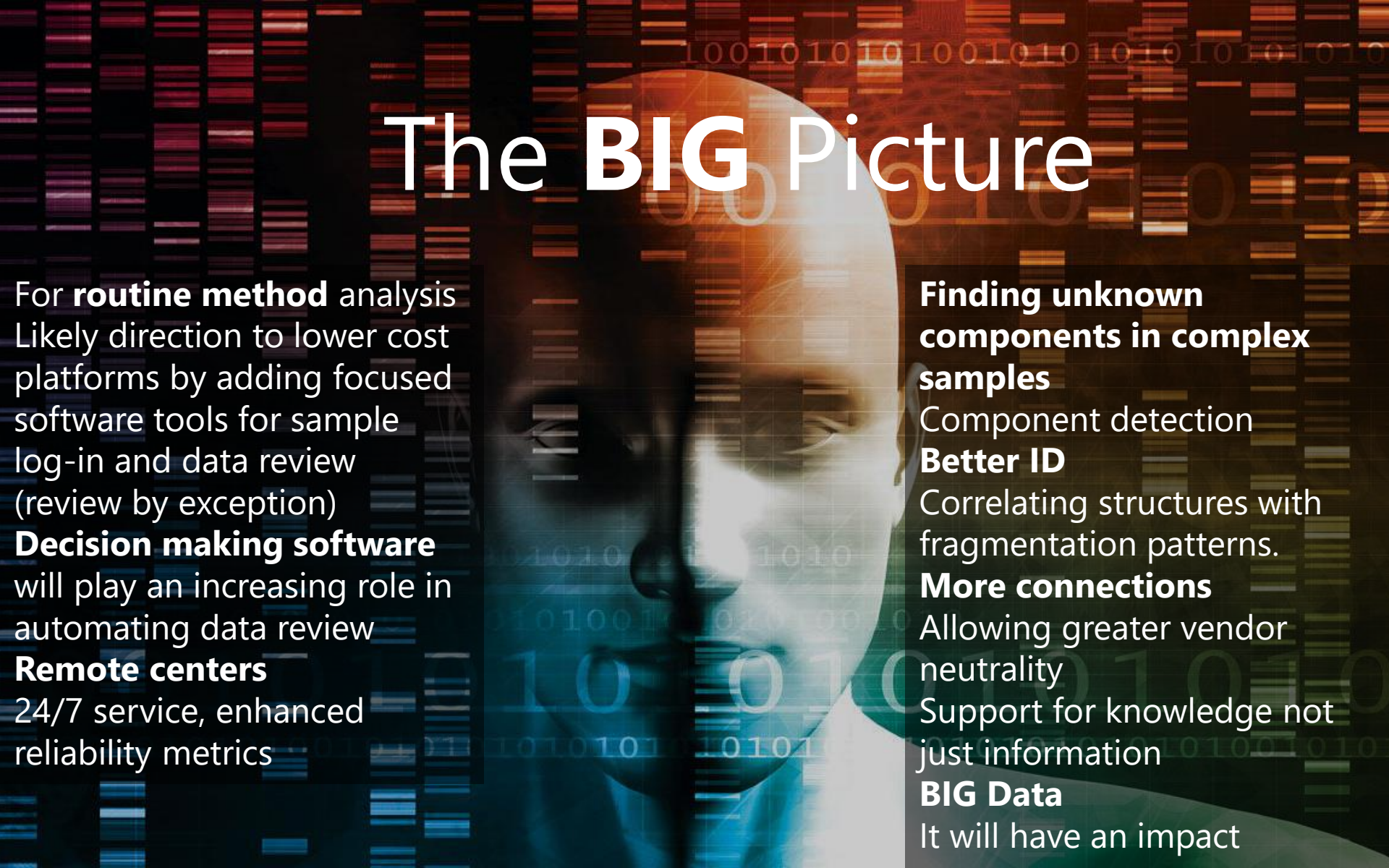
Skyline

Allotrope Foundation
Building an Open Framework for Laboratory Data



Shimadzu LabSolutions DB/CS
Driver support for other instrument providers

The **BIG** Picture



For **routine method** analysis
Likely direction to lower cost platforms by adding focused software tools for sample log-in and data review (review by exception)
Decision making software will play an increasing role in automating data review
Remote centers
24/7 service, enhanced reliability metrics

Finding unknown components in complex samples
Component detection
Better ID
Correlating structures with fragmentation patterns.
More connections
Allowing greater vendor neutrality
Support for knowledge not just information
BIG Data
It will have an impact

What can we do now? One example, Shimadzu LabNIRS | Machine brain interface

In vivo optical imaging using functional near-infrared spectroscopy (fNIRS) to map blood flows, add in EEG and you can extend the capability of measuring cortical currents with high spatio-temporal resolution

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