Skyline
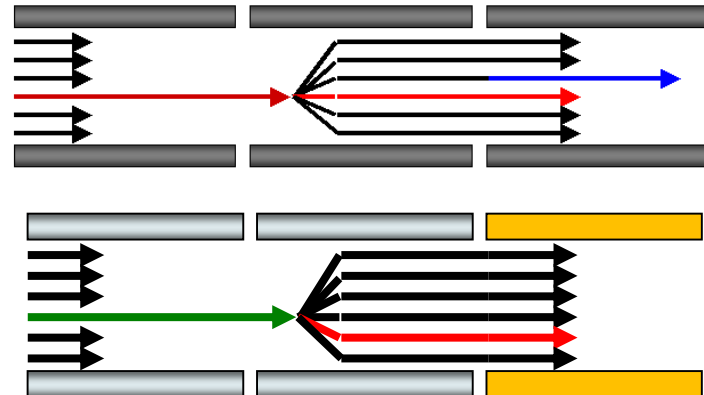
Targeted Proteomics Environment

Status of the Skyline open-source software project
six years after its inception

Brendan MacLean

UNIVERSITY *of*
WASHINGTON

Here Thanks to NIH Funding

- NCI CPTAC   2008 – 2011

- NIGMS   2011 – 2016
- NCI LINCS   2011 – 2019

Instrument Vendor Partnerships

▶ 3 years

Agilent Technologies

▶ 2 years

BRUKER

▶ 1 year

Waters
THE SCIENCE OF WHAT'S POSSIBLE.™

Thermo
SCIENTIFIC

SHIMADZU
Excellence in Science

▶ Next year

AB SCIEX

User Community After 6 Years

▸ 3500+ registered users

▸ 2500+ support posts

▸ 270 registered for this meeting

▸ 53 abstracts at ASMS mention Skyline

▸ 350+ citations of original paper

▸ Chinese and Japanese translations

  ▸ 43 volunteer reviewers

▸

Teaching Targeted Proteomics

- *Weeklong course*, Zurich (July 2013)
- *Weeklong course*, Zurich (February)
- ABRF workshop, Albequerque (March)
- *Weeklong course*, Seattle (April)
- US HUPO workshop, Seattle (April)
- **ASMS short course, Baltimore (June)**
- EPS workshops, Brixen (August)
- *Weeklong Course*, Barcelona (October)
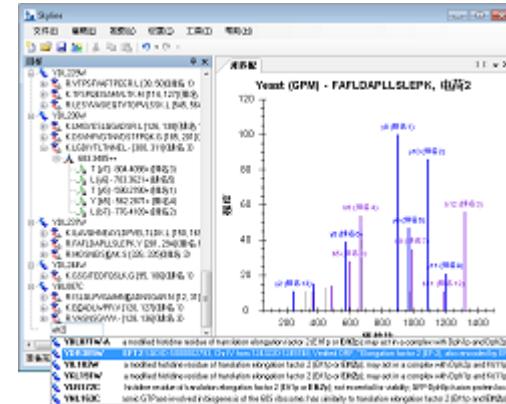- Short course, Seoul (October)
- Short course, Mumbai (December)

Chinese and Japanese Translations

▸ 2 years of preparation
▸ New testing tools
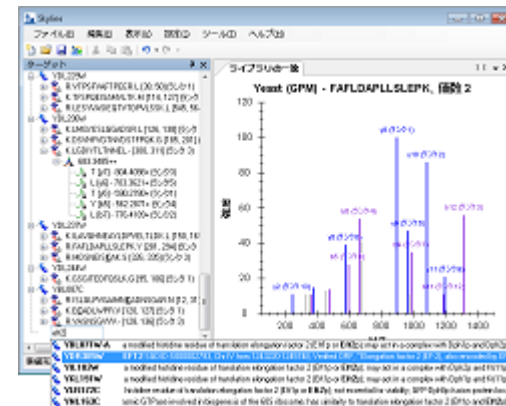▸ Skyline 2.5 Chinese and Japanese
  ▸ Released May 5th

▸ Method Editing tutorial

▸ 5 more in review
▸ Other languages? ($30,000)

靶向方法编辑 (25 页)

ターゲットメソッドの編集 (25ページ)

SkylineTester Critical Test Tool

SkylineTester

▸ Automated access to any form in any language

▸ Automated access to tutorial screenshots

▸ Overnight runs of 340 tests in all languages

▸ Detects memory leaks

▸ Running in hospitality suites

  ▸ Agilent

  ▸ Thermo

  ▸ Waters

▸

Storing and Processing

‣ Cloud storage for raw data

‣ Integrated with Skyline

‣ Cloud chromatogram extraction

‣ Free introduction (http://chorusproject.org)

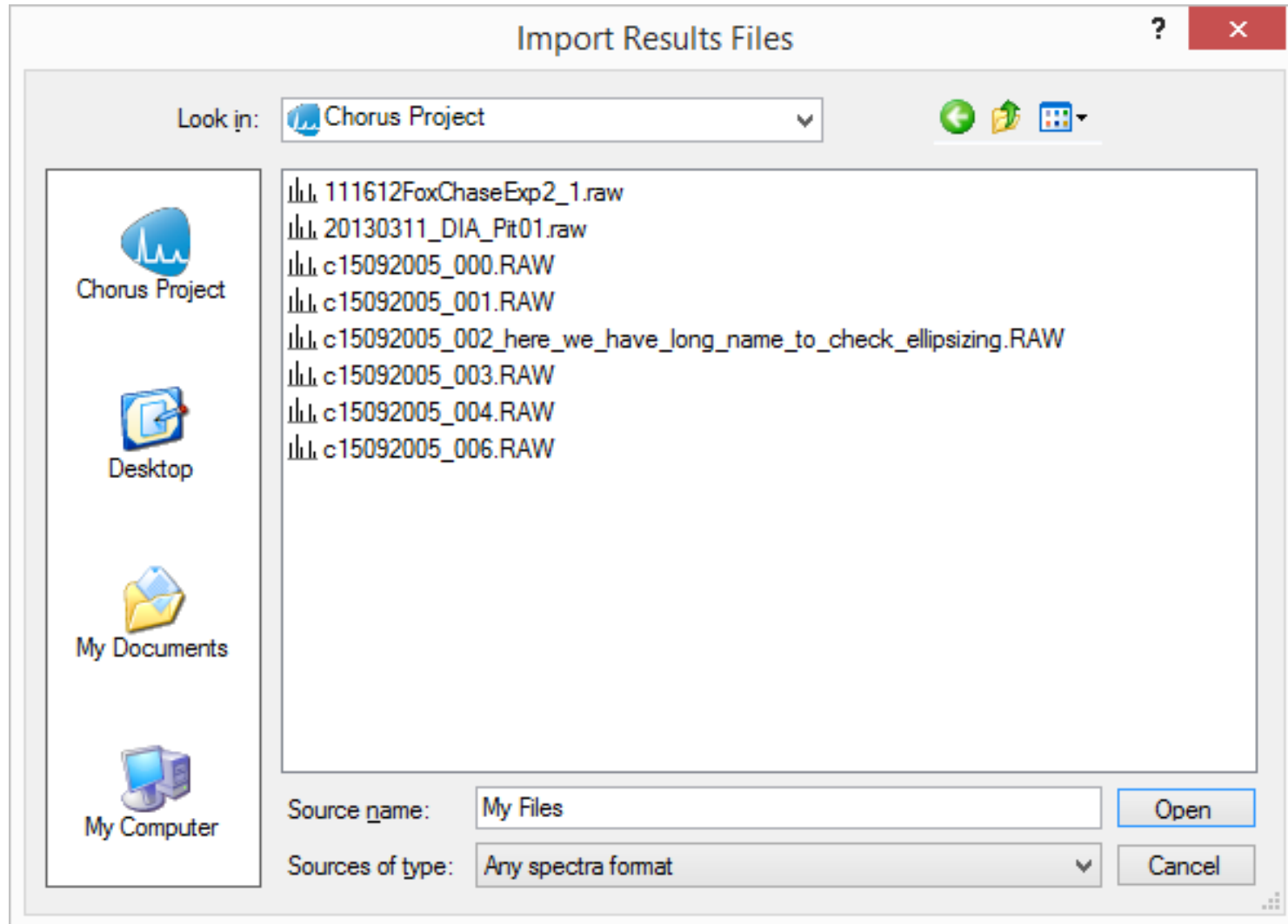   ‣ Amazon hosted and guaranteed

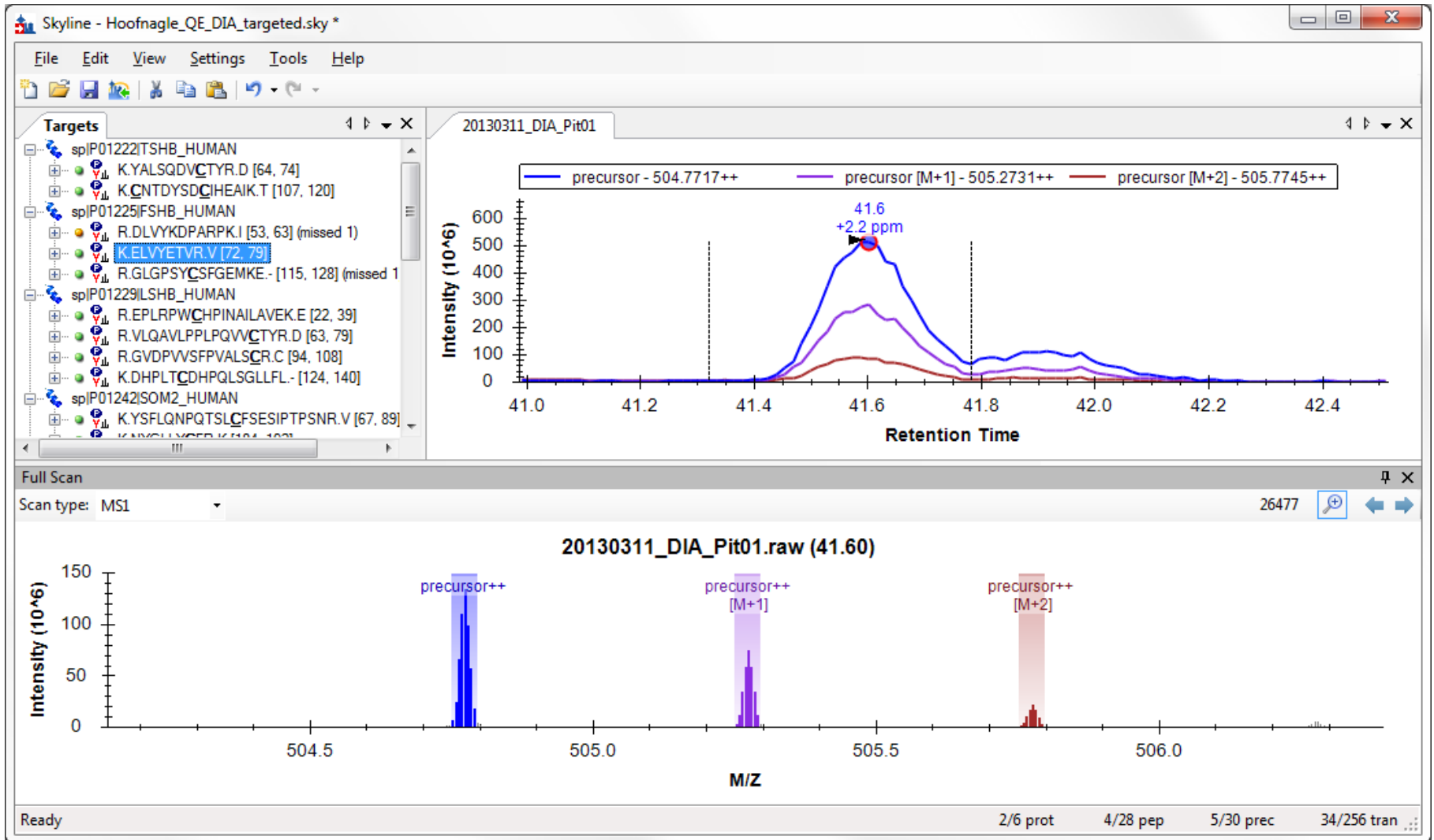‣ Open access

WOG 4:10pm - Brendan MacLean

Rapid Processing of Large Scale Quantitative Proteomics Projects:
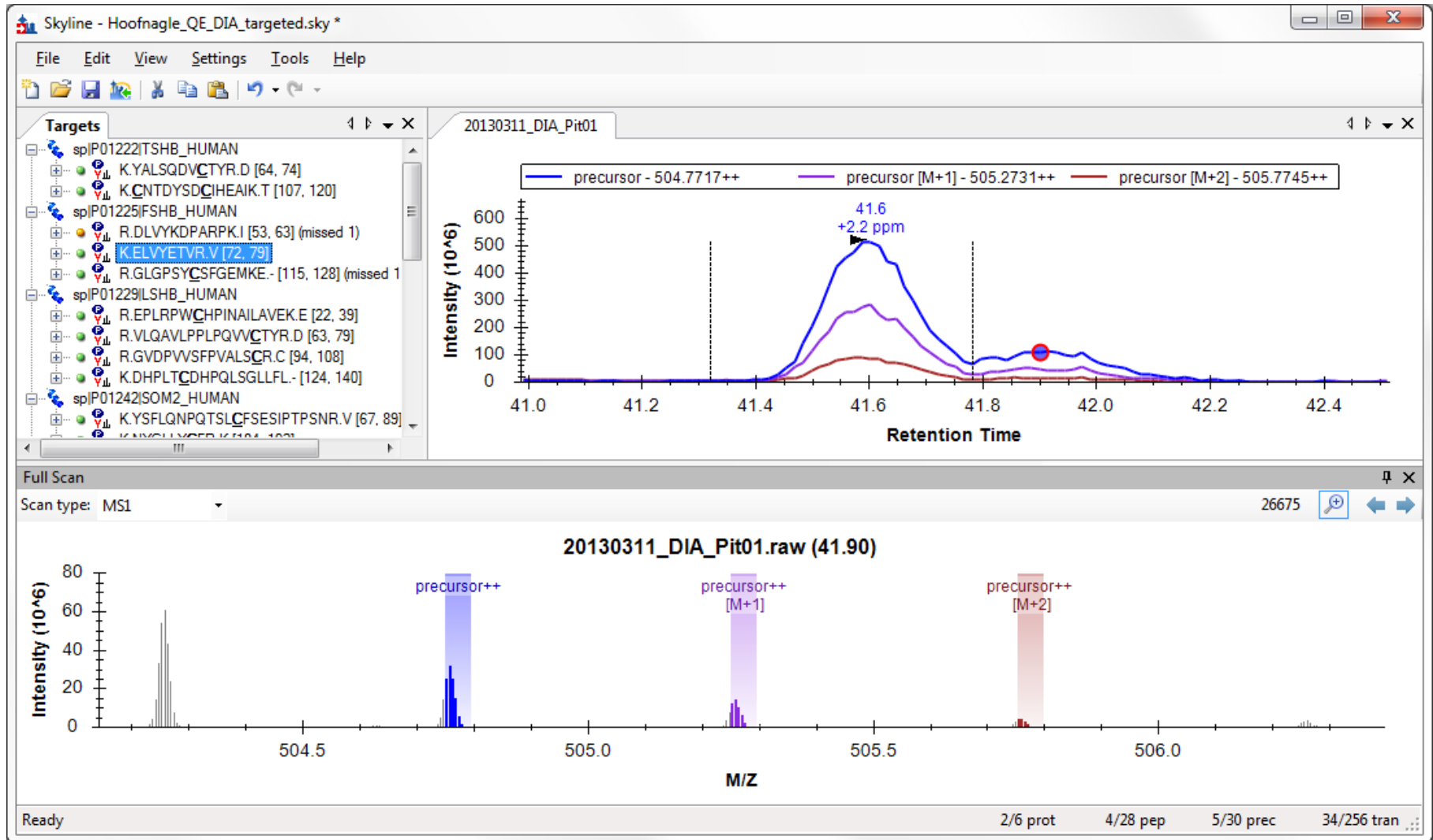Integration of Skyline with the CHORUS Cloud

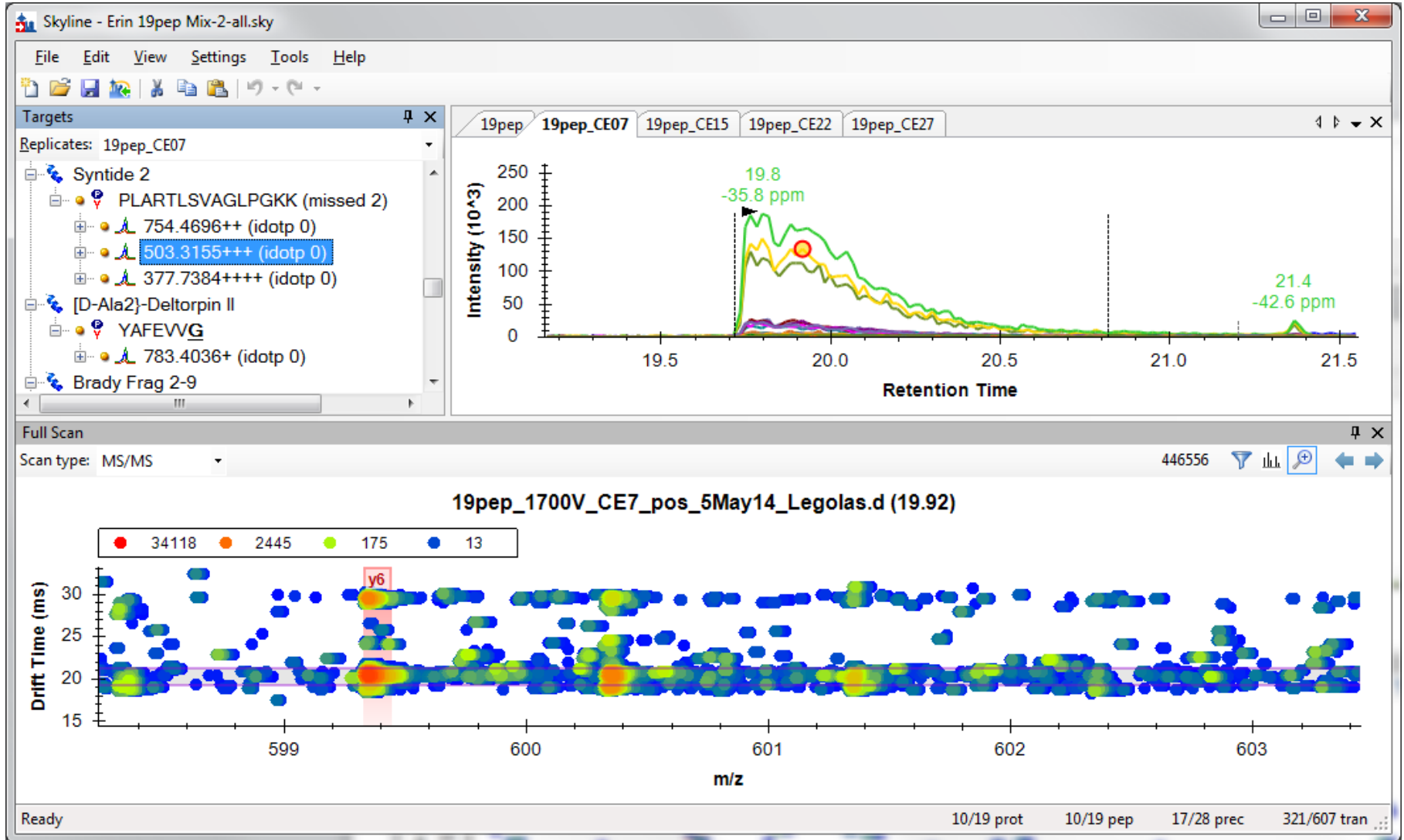# Skyline Direct Access to Chorus
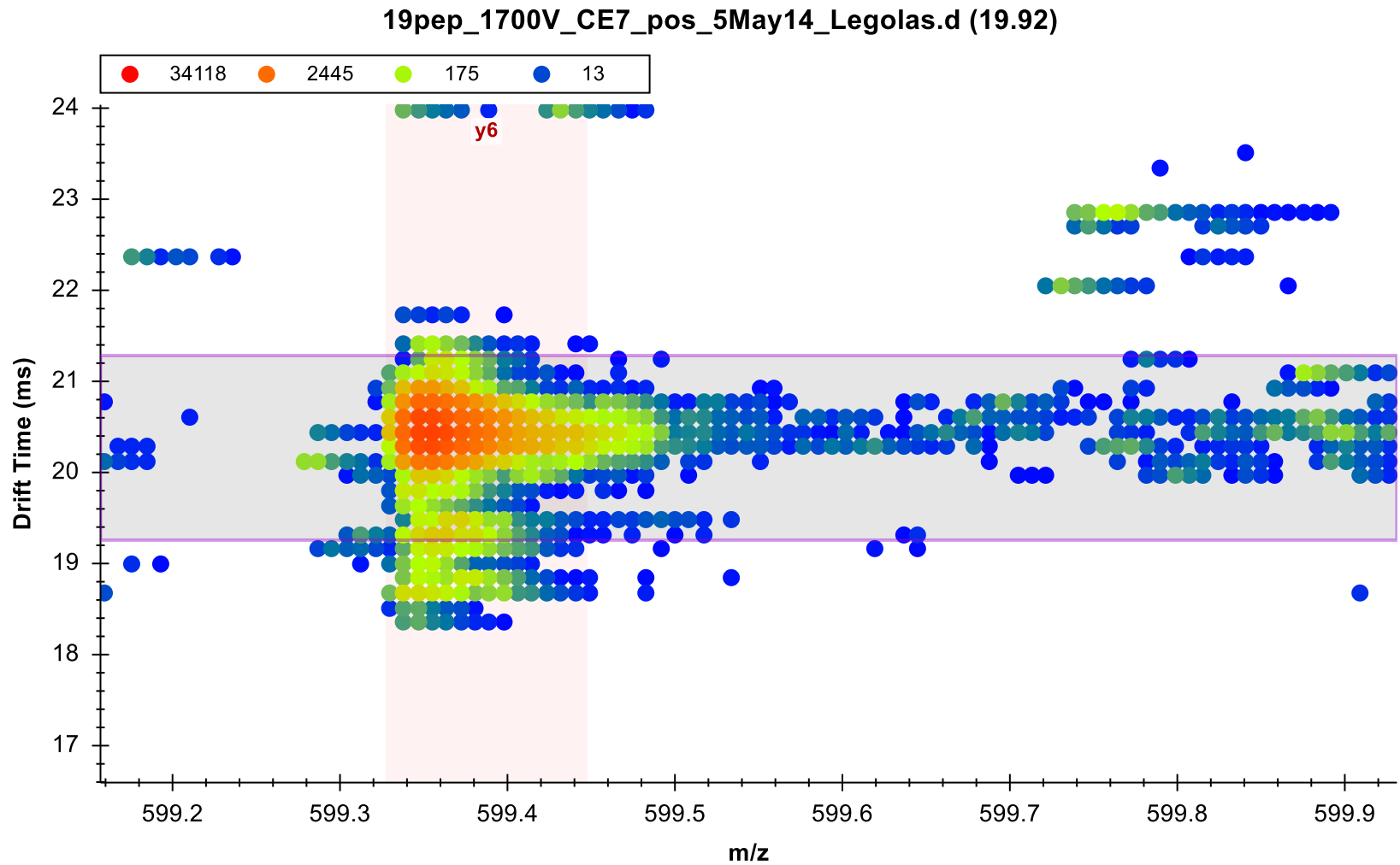
Full Scan Spectrum View

"Like taking the blinders off"

Exploring Ion Mobility MS/MS Scans

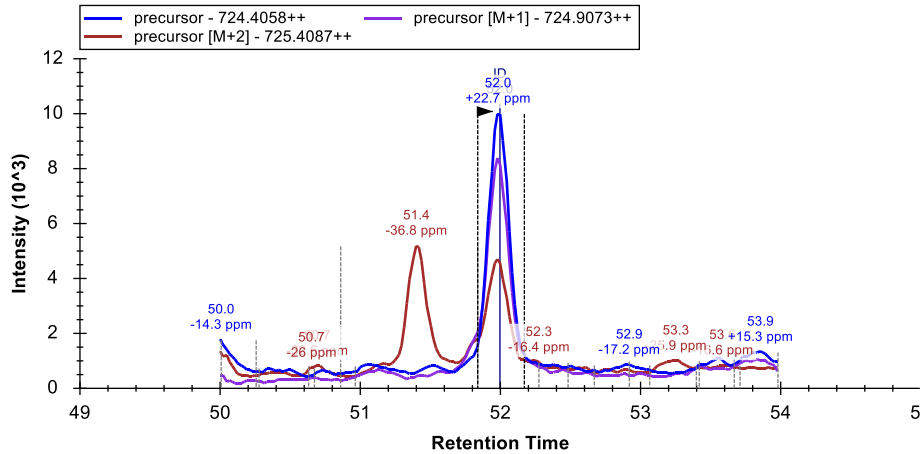# Exploring Ion Mobility MS/MS Scans

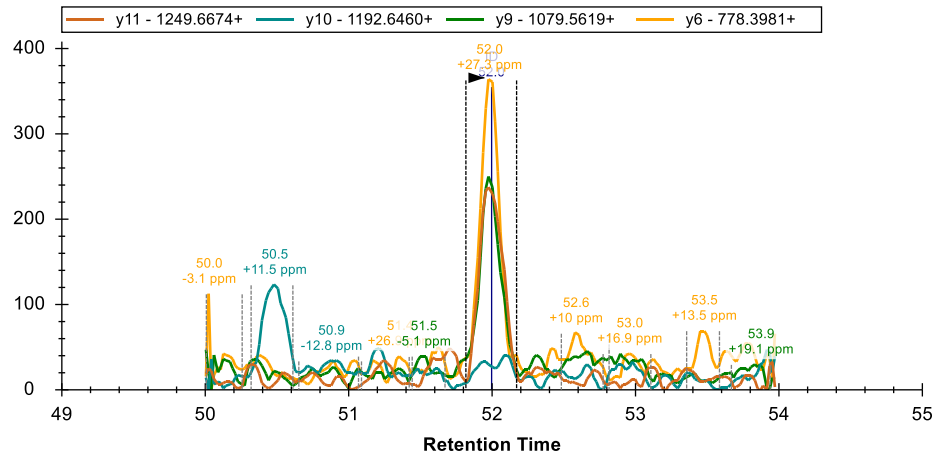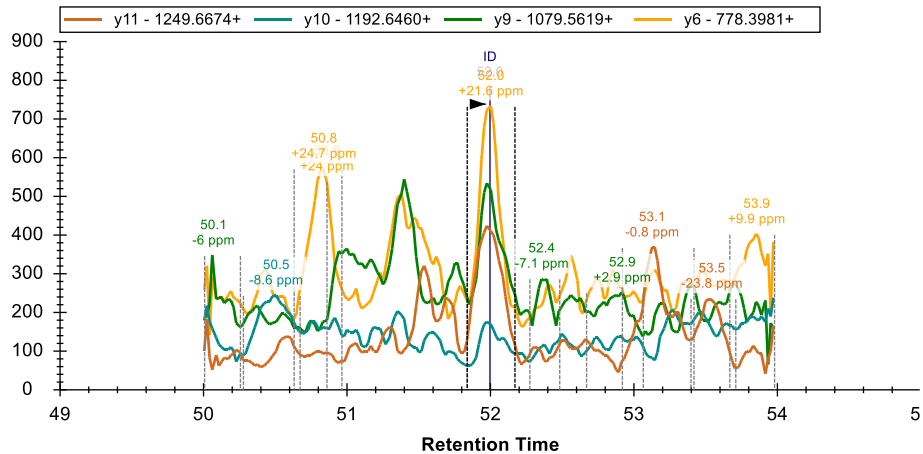19pep_1700V_CE7_pos_5May14_Legolas.d (19.92)

Yeast Peptides in Mouse Brain

Without IMS Drift Time Filtering

With IMS Drift Time Filtering, Rs=40
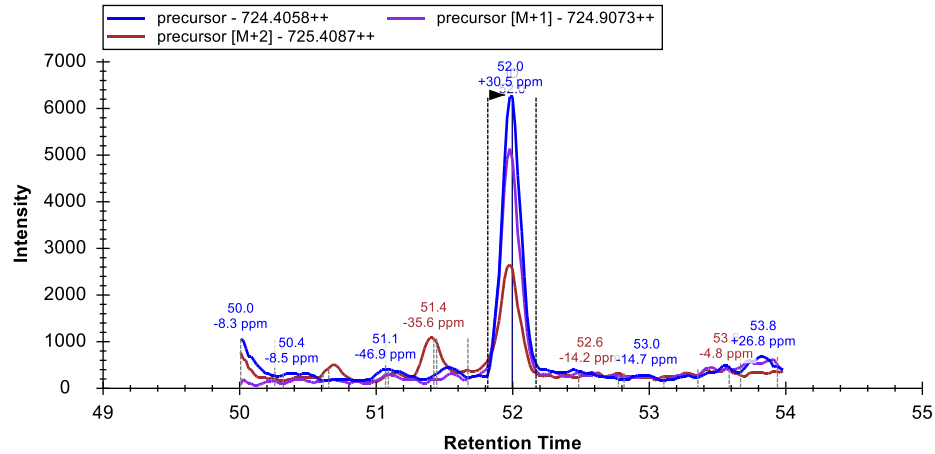
Aggregating and Publishing

- Publish fully annotated Skyline documents
  - Publication protocol in 2014
- Build chromatogram libraries
- Aggregate lab QC data (future)

- Free hosted version (http://panoramaweb.org)
  - 66 separate projects so far (LINCS, CPTAC and ABRF sPRG)
  - >780 data sets uploaded
  - User controlled security
- Locally installable server application
- Free and open source (Apache 2.0)

Panorama Partnership Program

▸ 2 additional labs

▸ Seeking leading edge targeted proteomics infrastructure

▸ Local Panorama server installation

▸ Direct collaboration with Skyline/Panorama team

▸ Full support for 1 year

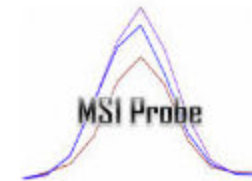▸ Josh Eckels (LabKey Software)

6 External Tools

Msstats (Vitek)

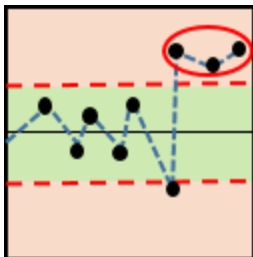grouped study statistics

QuaSAR (Carr)

response curve statistics

MS1 Probe (Gibson)

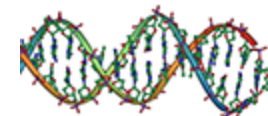MS1 filtering statistics

SProCoP (MacCoss)

system suitability

Protter (Wollscheid)

transmembrane topology

Population Variation

mutation frequency

Replicate Annotations and Live Reports

Live Reports

- 100x faster
- Responsive to document changes
- Direct editing and pasting
- Filtering
- Linked to other views

What's Next?

- More of the same
  - Peak picking investigation and improvements
  - Production release of Chorus integration
  - Complete translations to Chinese and Japanese
  - More great visualizations
  - More great support and instruction
  - Keep of with innovation from 6 instrument vendors
- Integrated calibration
- Integrated differential statistics
- Integrate with search from Sangtae Kim

Skyline Team

- Nick Shulman

- Don Marsh

- Brian Pratt

- Dario Amodei

- Vagisha Sharma

- Kaipo Tamura

- Yuval Boss

- Jarrett Egertson

- Max Horrowitz-Gelb

- Danny Broudy

- Trevor Killeen

Collaborators:

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  - Oleksii Tymchenko
- **U. of Wa.**
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  - Jim Bolinger
  - Jimmy Eng
  - Andy Hoofnagle
  - Andrew Stergachis
  - Sonia Ting
- **Broad Institute**
  - Jake Jaffe
  - Steve Carr
  - Hasmik Keshishian
  - D. R. Mani

- **Buck Institute**
  - Birgit Schilling
  - Matthew Rardin
  - Brad Gibson
- **Duke**
  - Will Thompson
  - Arthur Moseley
- **IMSB**
  - Rudolph Aebersold
  - Christina Ludwig
  - Olga Schubert
  - Hannes Röst
  - George Rosenburger
  - Lucia Espona Pernas

- **PNNL**
  - Sam Payne
  - Sangtae Kim
- **Purdue**
  - Meena Choi
  - Olga Vitek
- **Stanford**
  - Dario Amodei
  - Parag Mallick
- **Vanderbilt**
  - Matthew Chambers
  - Daniel Liebler
  - David Tabb

Instrument Vendor Collaborators

- **Agilent Technologies**
  - Christine Miller
  - Joe Roark
  - Juli Salcedo
  - Shripad Torvi

- **Bruker**
  - Carsten Baessmann
  - Marius Kallhardt
  - Stephanie Kaspar
  - Pierre-Olivier Schmit

- **AB Sciex**
  - David Cox
  - Mark Cafazzo
  - Christie Hunter
  - Steve Tate

- **Shimadzu**
  - Alan Baynes
  - Junko Iida
  - Neil Loftus
  - Kiriko Matsuo

- **Thermo-Scientific**
  - Sue Abbatiello
  - Markus Kellmann
  - Andreas Kuehn
  - Vlad Zabrouskov

- **Waters**
  - James Langridge
  - Roy Martin
  - Kieran Neeson
  - Keith Richards