New features in McStas 2.4

ISIS STFC McStas Training
April 2017

Science & Technology Facilities Council
ISIS
McStas

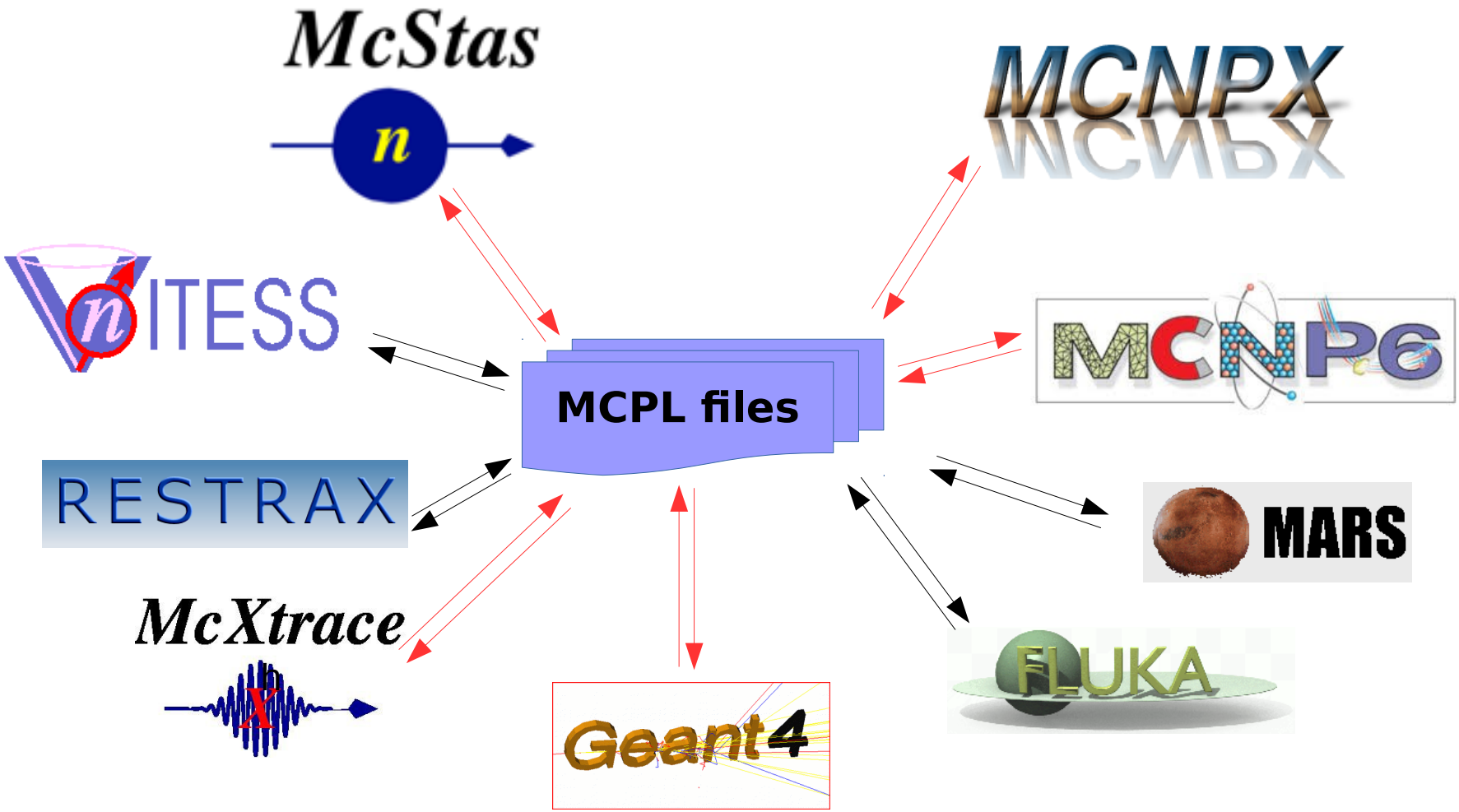
Agenda

- Highlighted new features in 2.3 (April 2016) and 2.4 (May 2017)
  - Support for MCPL event files for interchange with e.g. Geant4 and MCNP
  - New component description of the ESS butterfly moderator
  - New user interface developments
  - The 'Union' component set for e.g. accurate description of complex sample environments

Improved MCPL support

The solution: A common interchange format.

MCPL: Monte Carlo Particle Lists



Improved MCPL support

The solution: A common interchange format.

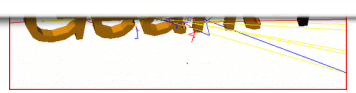
MCPL: Monte Carlo Particle Lists

McStas

MCNPX

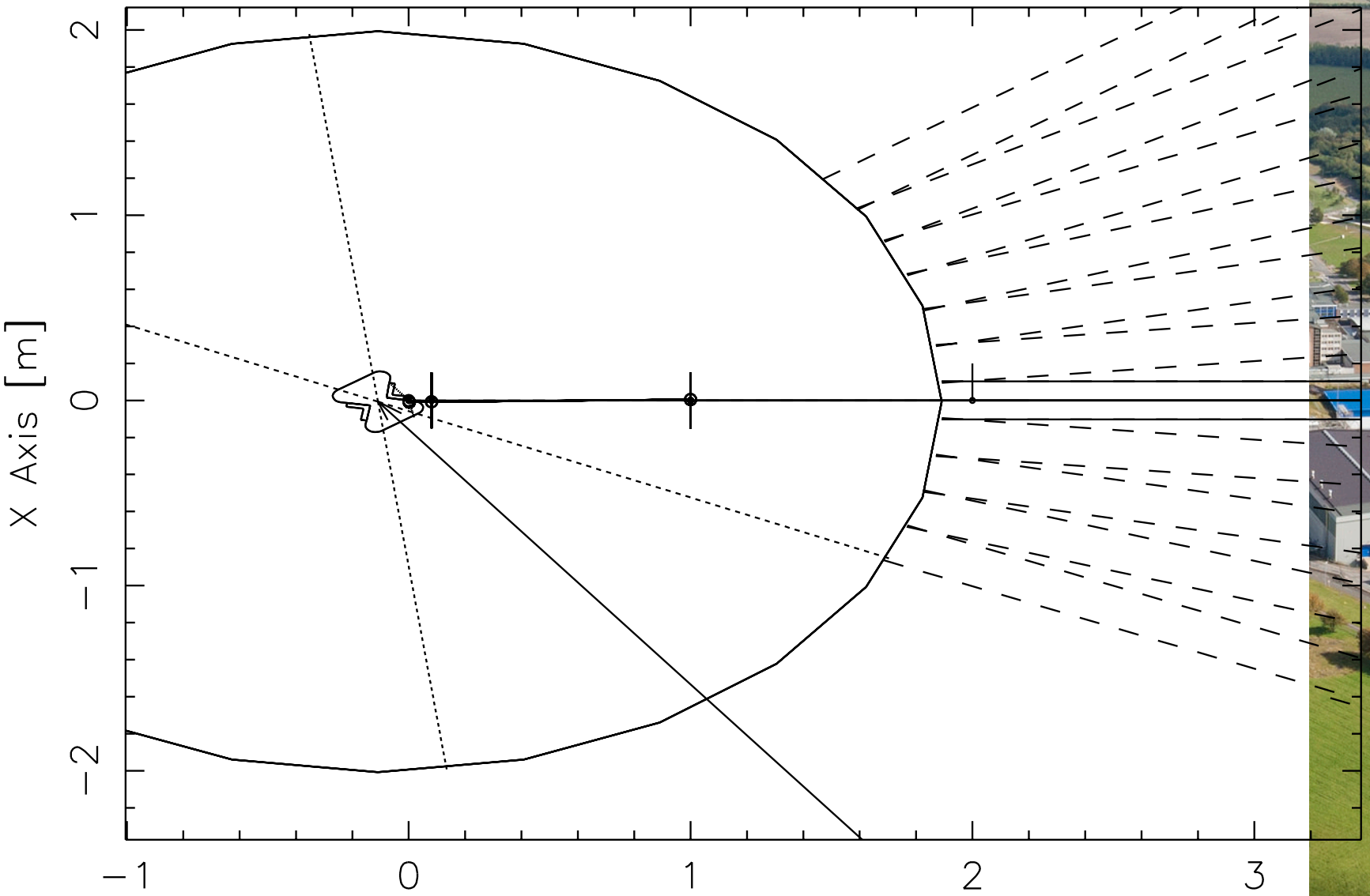
Further information:

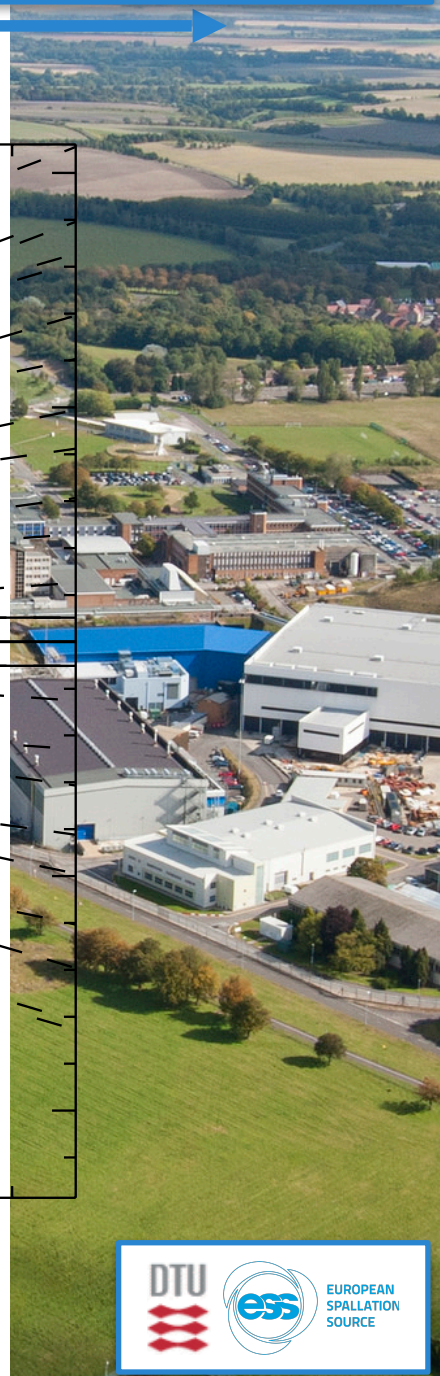
- https://mctools.github.io/mcpl/
- https://arxiv.org/abs/1609.02792
- http://coimbra2016.essworkshop.org



ESS_butterfly mcdisplay output:

sector=N, beamline=5





ESS_butterfly McDoc page:

1. Release document "Update to ESS Moderators, latest version"
2. Release document "Description and performance of the new baseline ESS moderators, latest version"
3. http://ess_butterfly.mcstas.org/ benchmarking website with comparative McStas-MCNP figures
4. html-based, interactive 3D model of moderators and monolith, as seen from beamline N4.
5. Source code for ESS_butterfly.comp at GitHub.

Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
sector	str	Defines the 'sector' of your instrument position. Valid values are "N","S","E" and "W"	"N"
beamline	1	Defines the 'beamline number' of your instrument position. Valid values are 1..10 or 1..11 depending on sector	1
yheight	m	Defines the moderator height. Valid values are 0.03 m and 0.06 m	0.03
cold_frac	1	Defines the statistical fraction of events emitted from the cold part of the moderator	0.5
target_index	1	Relative index of component to focus at, e.g. next is +1 this is used to compute 'dist' automatically.	0
dist	m	Distance from origin to focusing rectangle; at (0,0,dist) - alternatively use target_index	0
focus_xw	m	Width of focusing rectangle	0
focus_yh	m	Height of focusing rectangle	0
c_performance	1	Cold brilliance scalar performance multiplicator c_performance > 0	1
t_performance	1	Thermal brilliance scalar performance multiplicator t_performance > 0	1
Lmin	AA	Minimum wavelength simulated	
Lmax	AA	Maximum wavelength simulated	
tmax_multiplier	1	Defined maximum emission time at moderator, tmax= tmax_multiplier * ESS_PULSE_DURATION.	3
n_pulses	1	Number of pulses simulated. 0 and 1 creates one pulse.	1
acc_power	MW	Accelerator power in MW	5

- See also http://ess_butterfly.mcstas.org

ESS_butterfly mcdisplay output:

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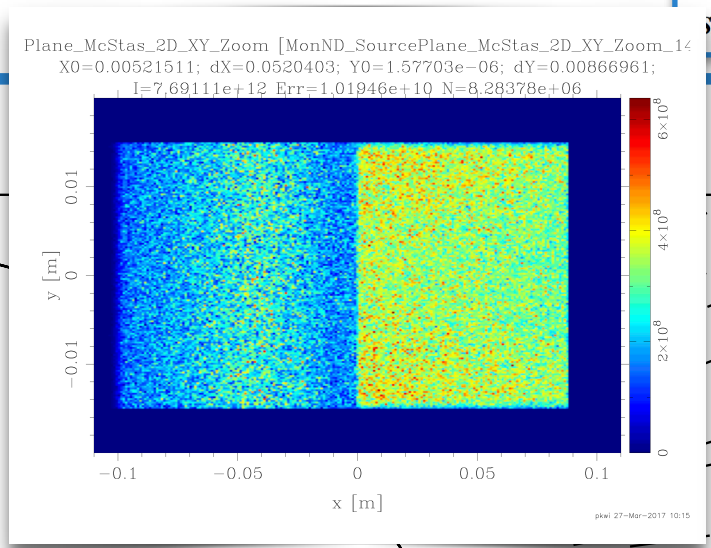
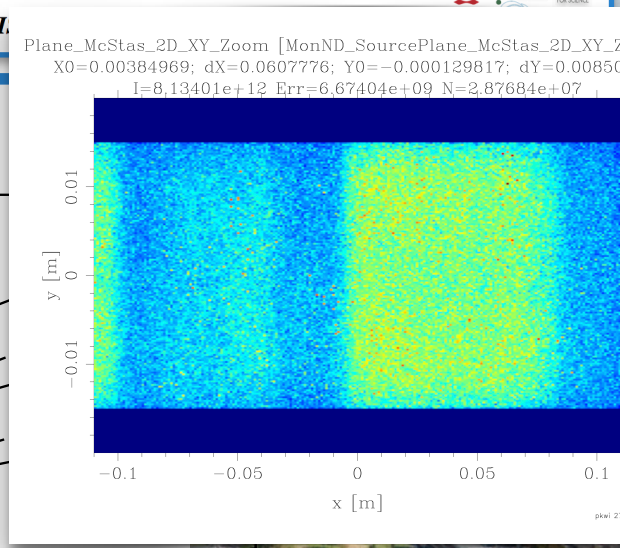
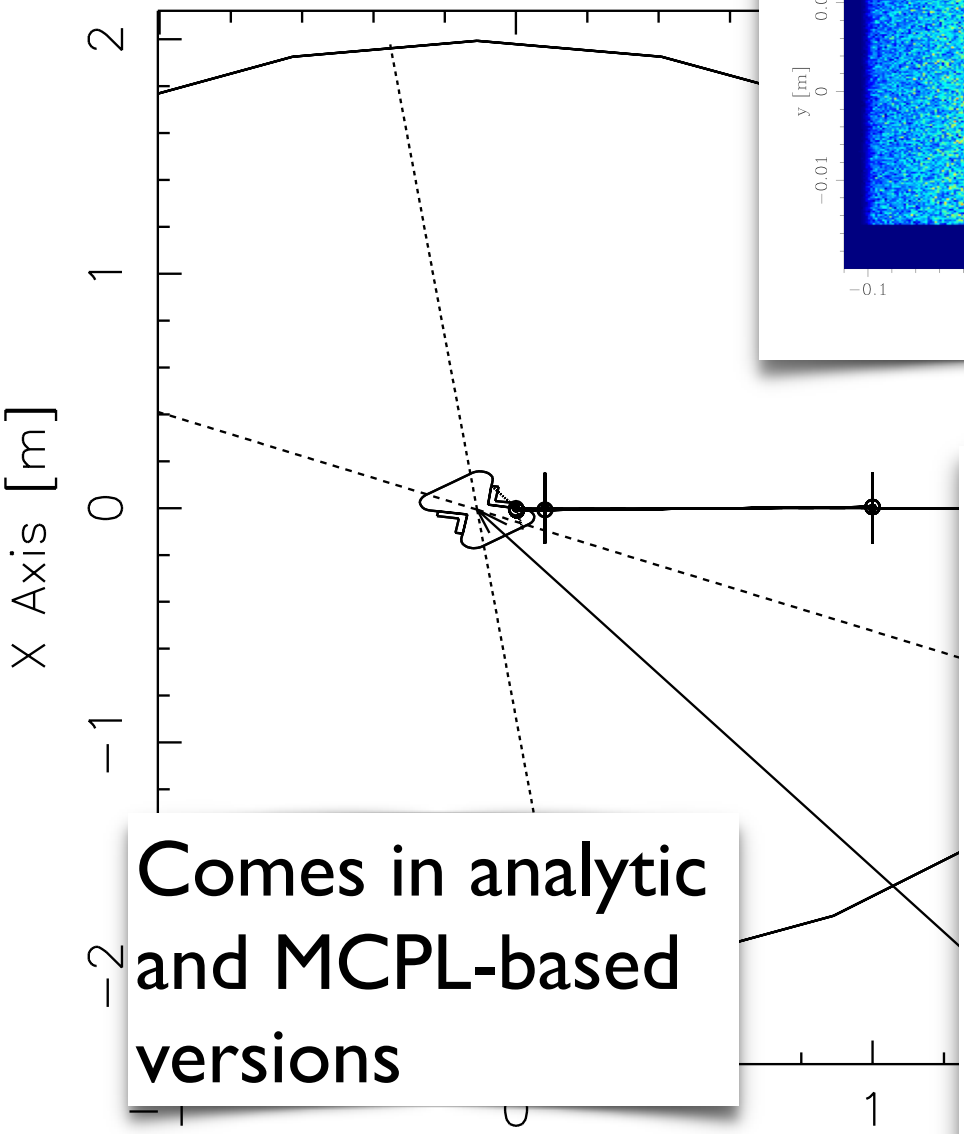
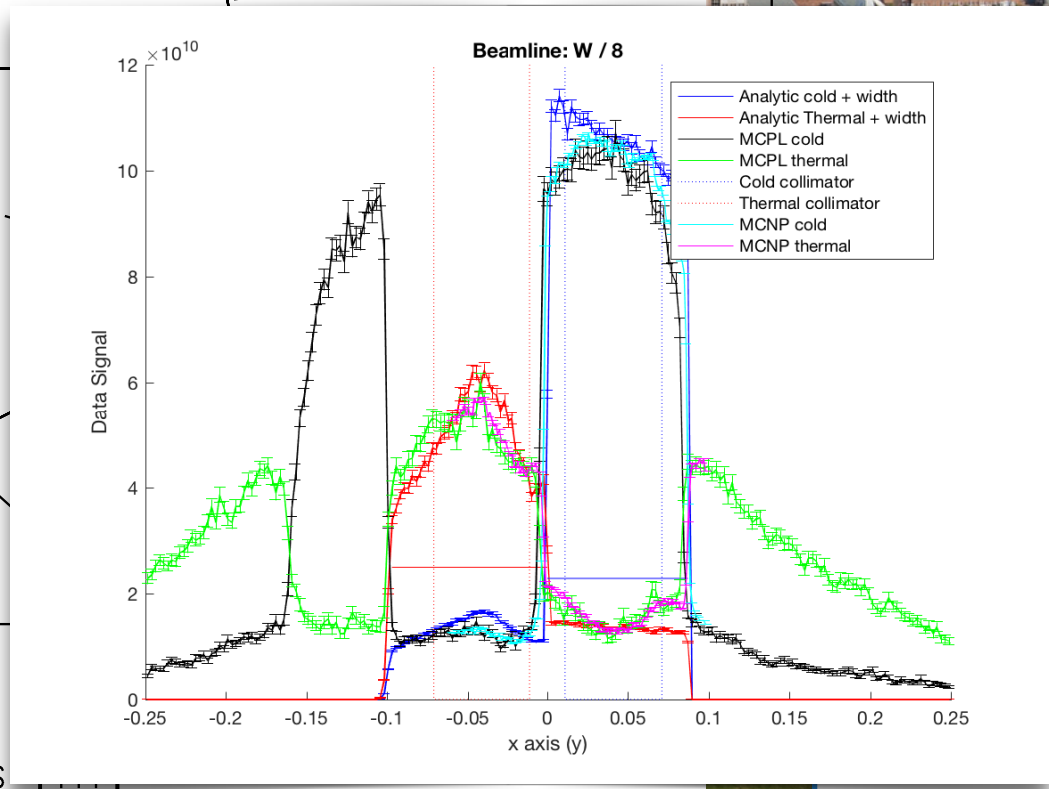




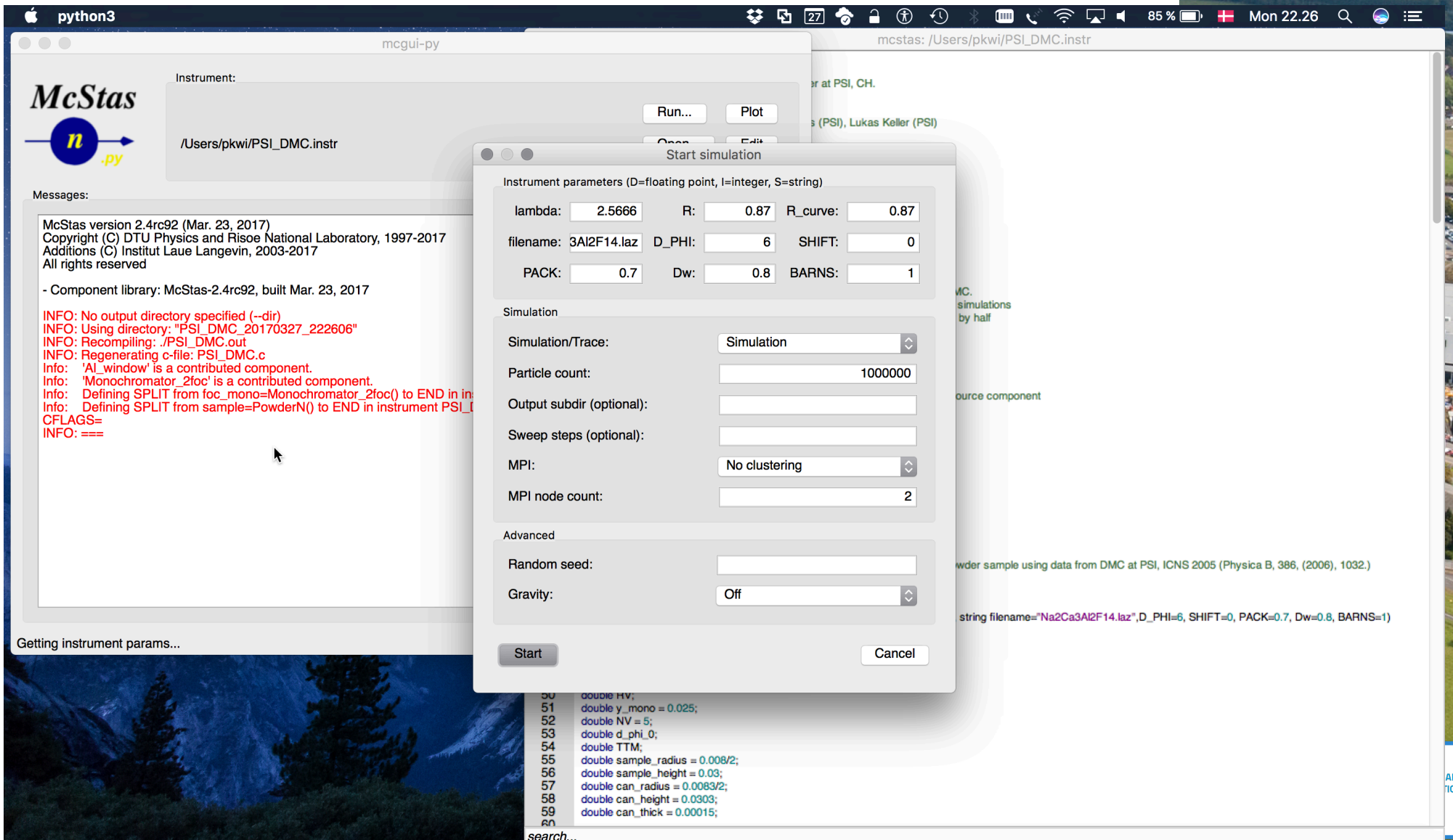




Comes in analytic and MCPL-based versions

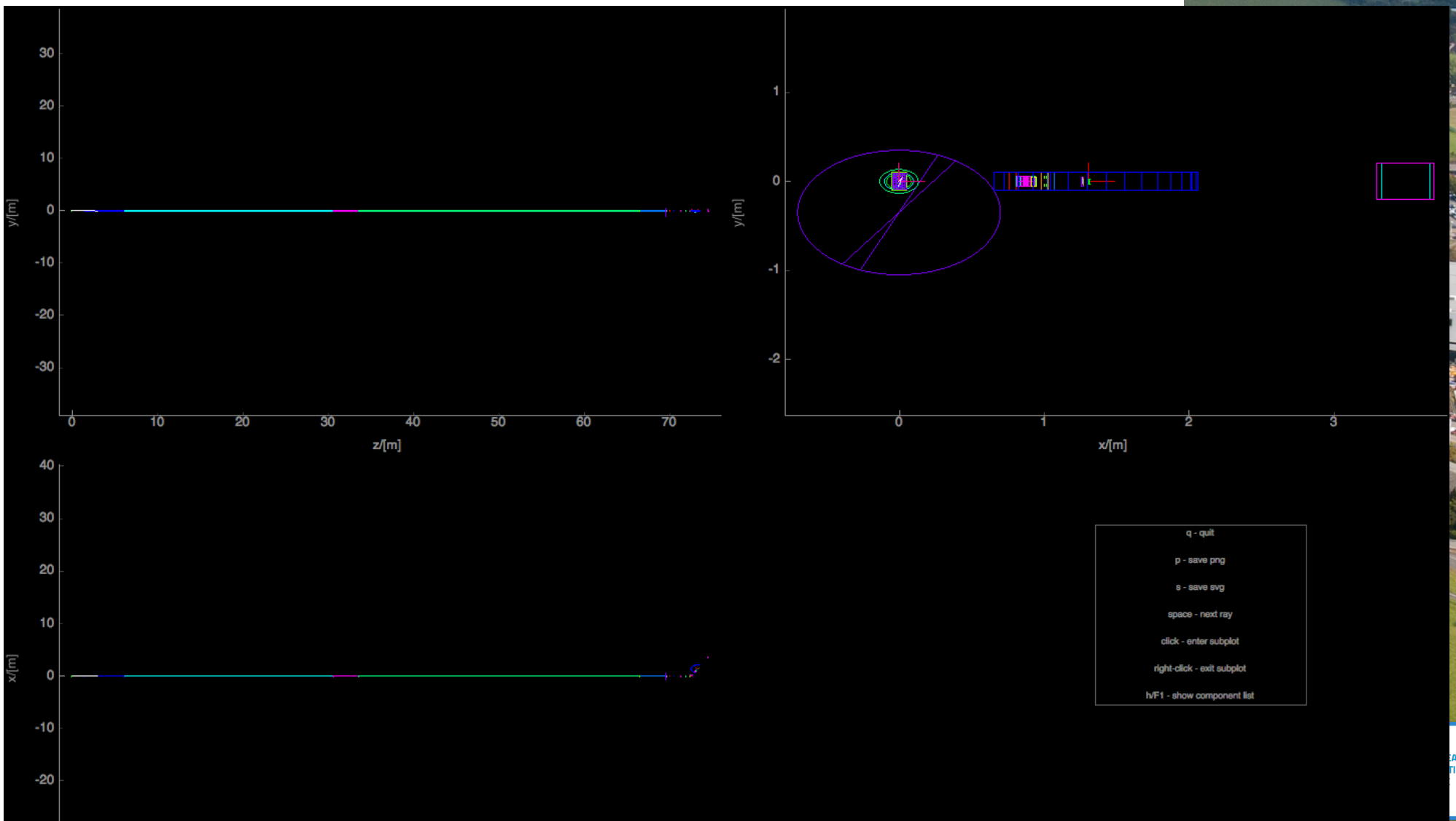
Python tool layer default from 2.4

- mcgui Tk/Perl -> PyQt + QScintilla



Python tool layer default from 2.4

- mcdisplay Perl/PGPLOT -> PyQt + PyQtgraph



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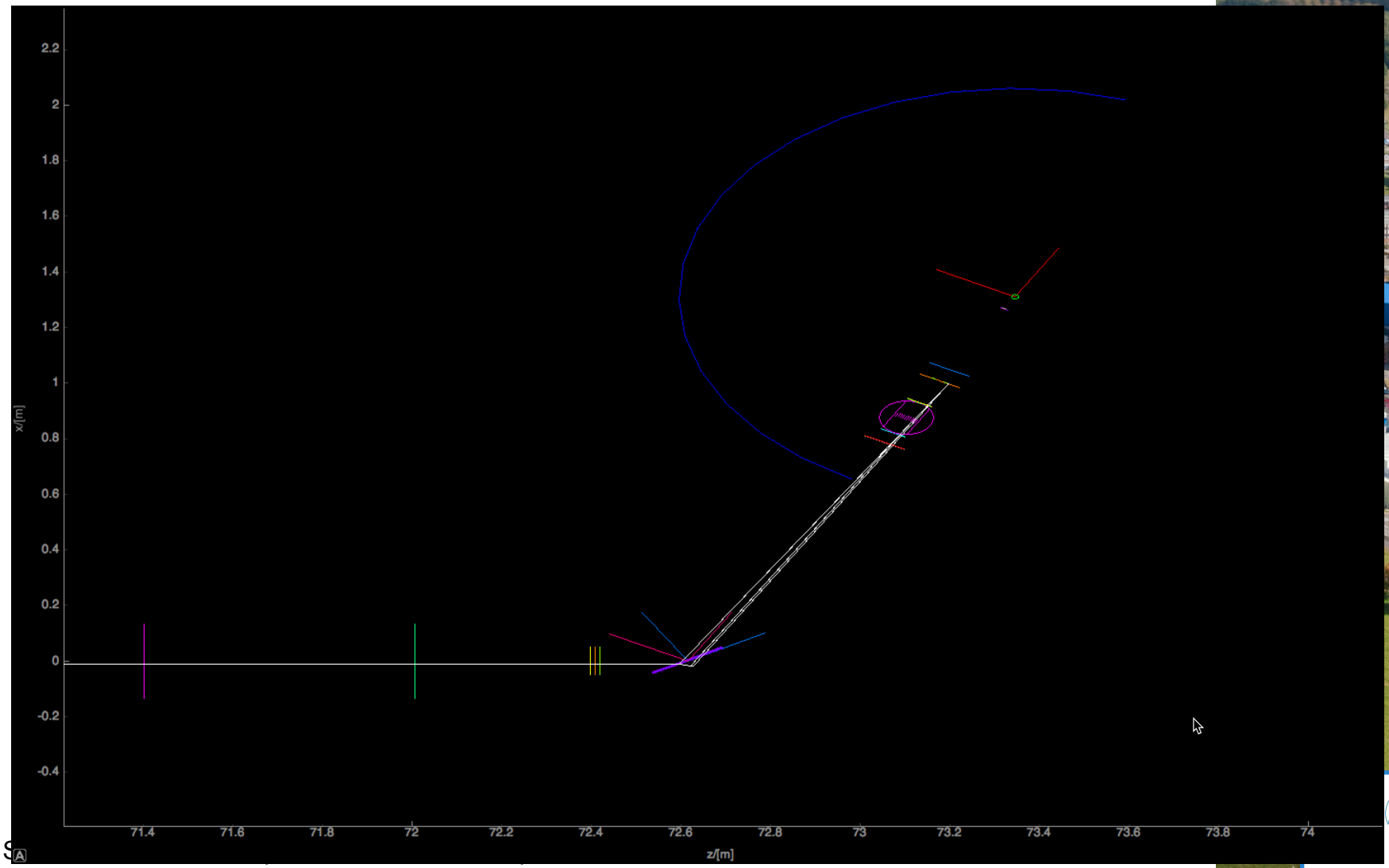
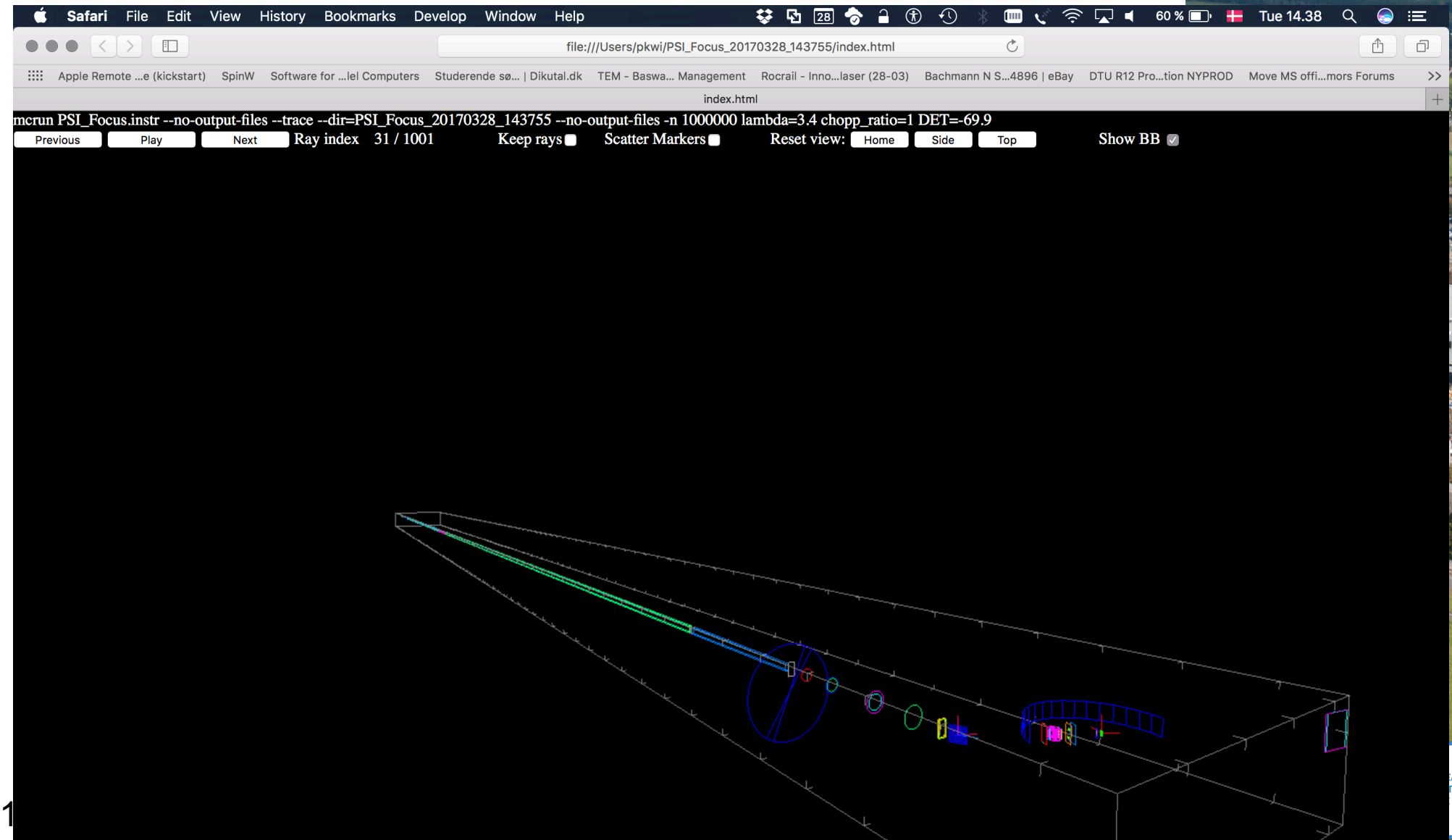


EUROPEAN SPALLATION SOURCE

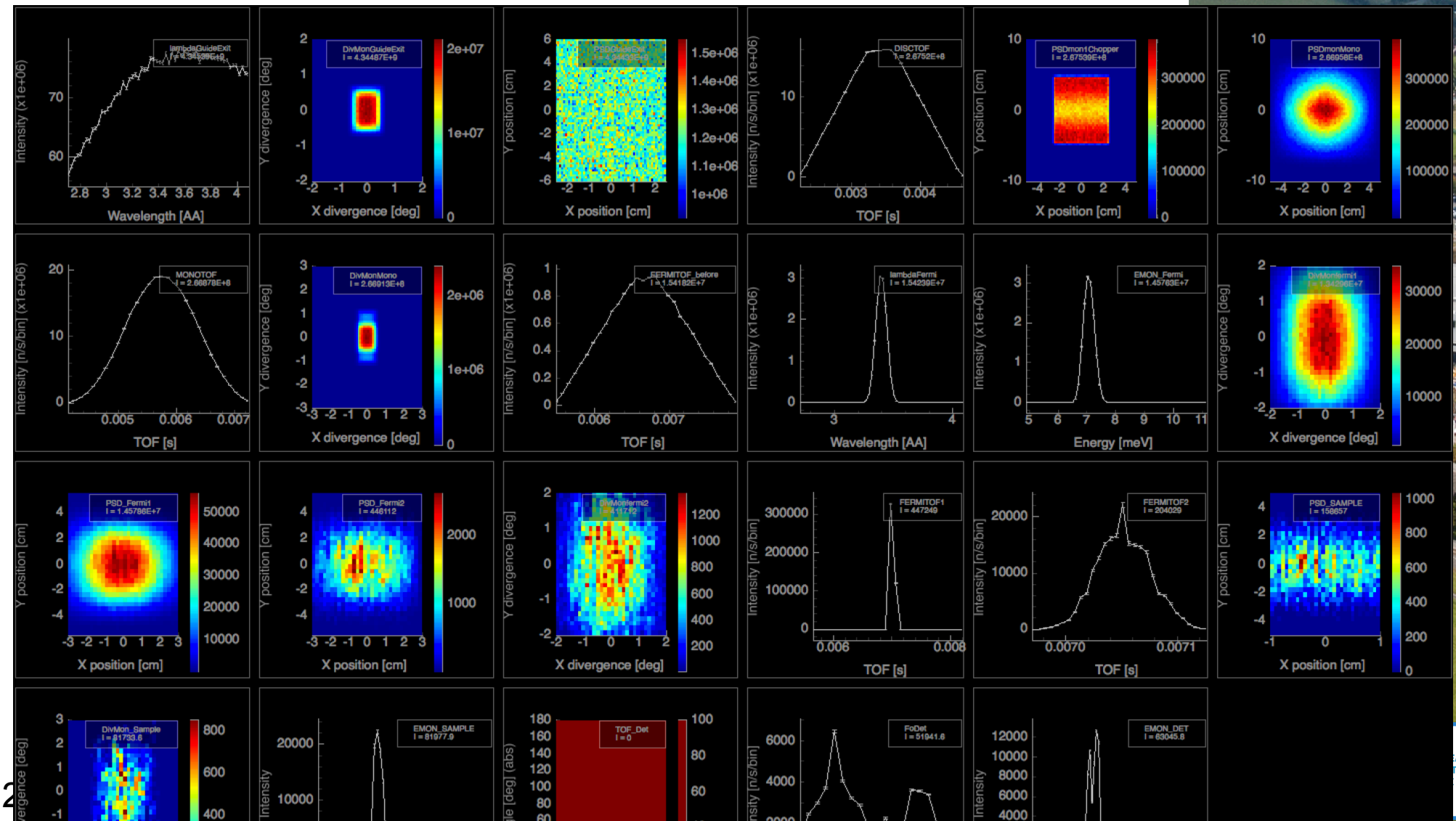
Python tool layer default from 2.4

- mcdisplay Perl/PGPLOT -> Python + Webgl



Python tool layer default from 2.4

- mcplot Perl/PGPLOT -> PyQt + PyQtgraph



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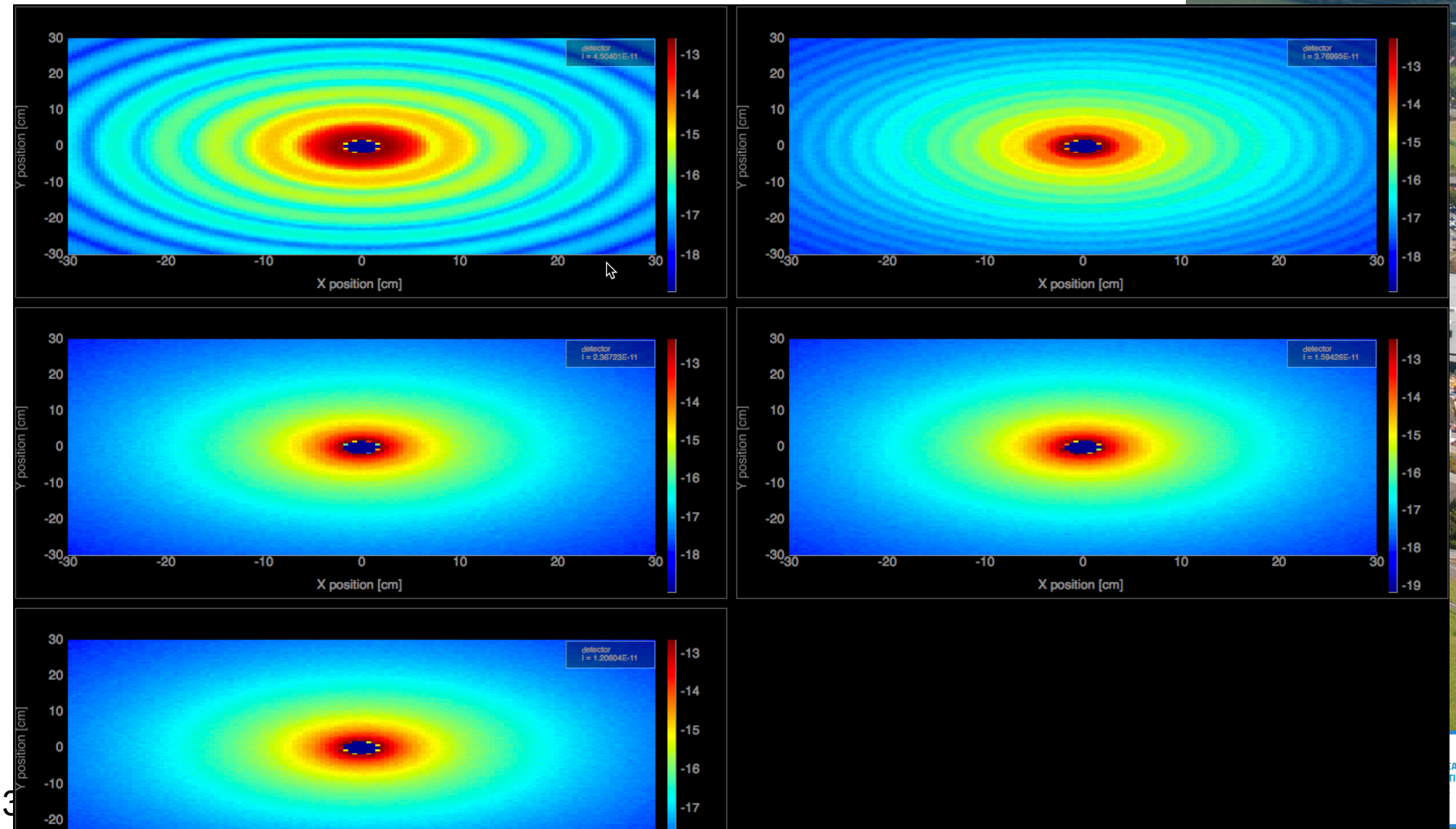
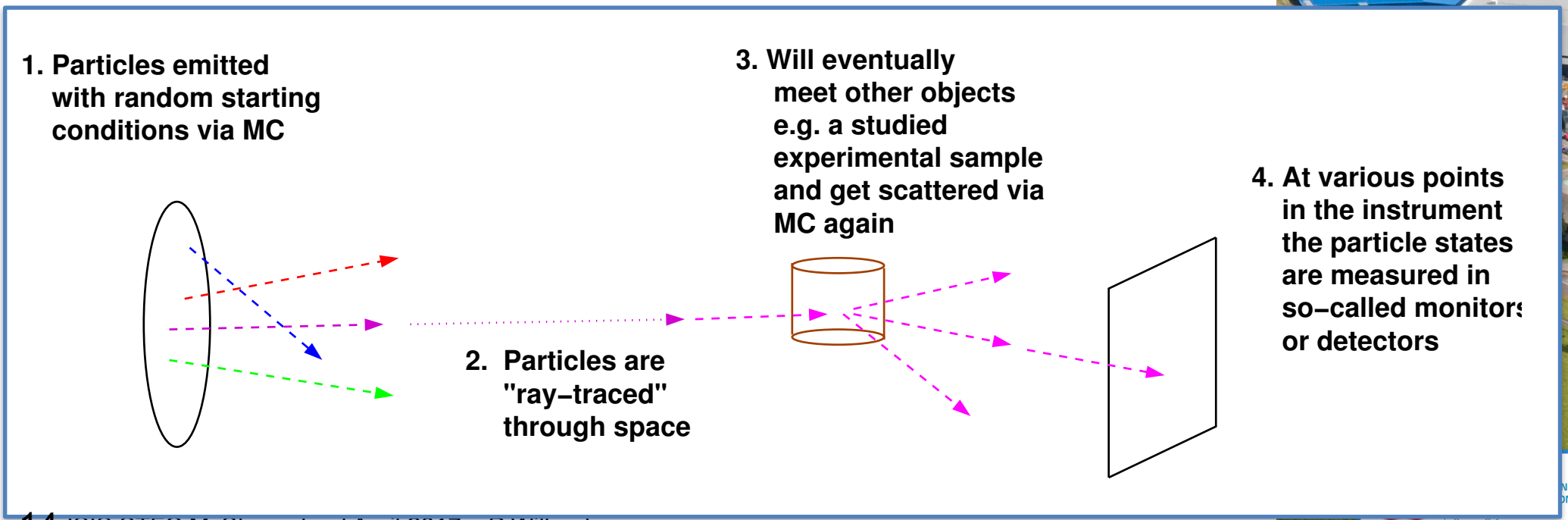


McStas overall picture

- Important efficiency mechanisms:
  - "Focusing" - e.g. source to beamport only (4π vs. limited solid angle only)
  - Rather vs. single particle description, absorption handled though statistics and downscaling the ray weight



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Algorithm limitations:

1) Linear comp seq. unless "hacks" are used
- **GROUP for comps in parallel**
- **JUMP (a GOTO…)**
- **EXTEND for further free-form C-code**

2) Multiple scattering by default "within" component only
- **Some comps support "concentric" geometries e.g for sample inside sample env**

3) Physics and geometry generally not separated
- **Both a strength and weakness, simple to write new comps < 200 LoC, one place.**

The UNION concept by Mads Bertelsen, KU is an attempt to do something about the above points…

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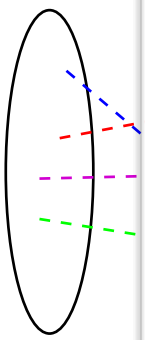

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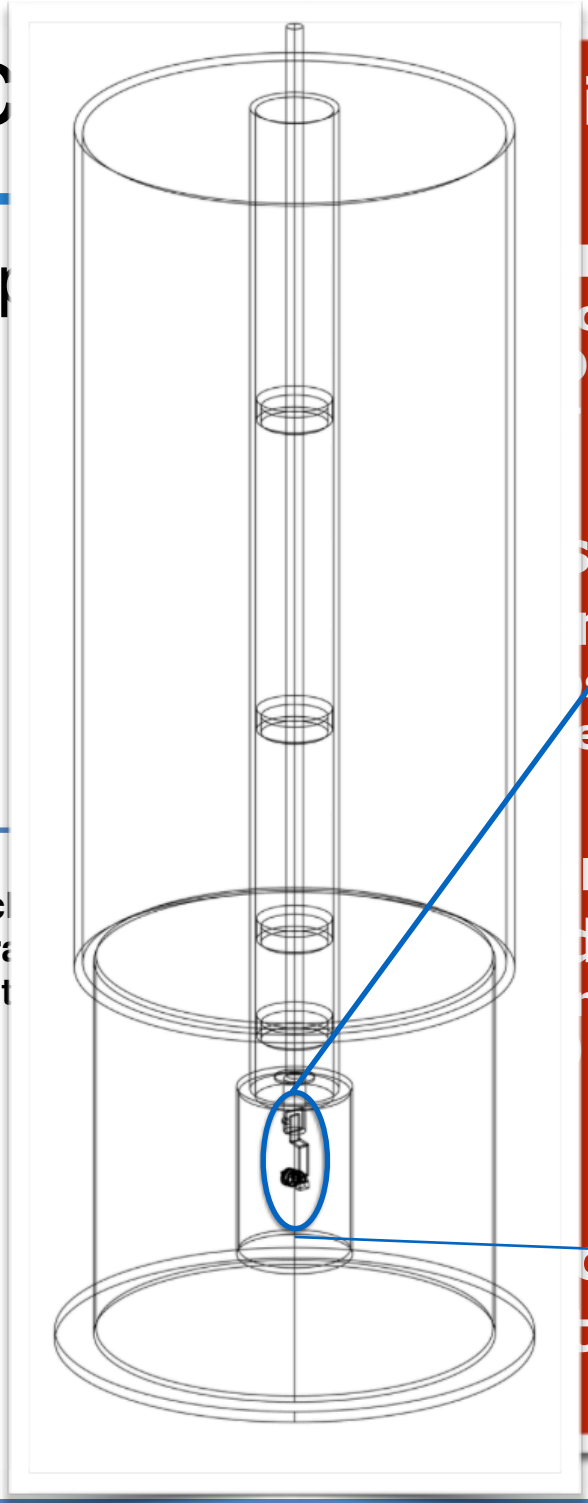

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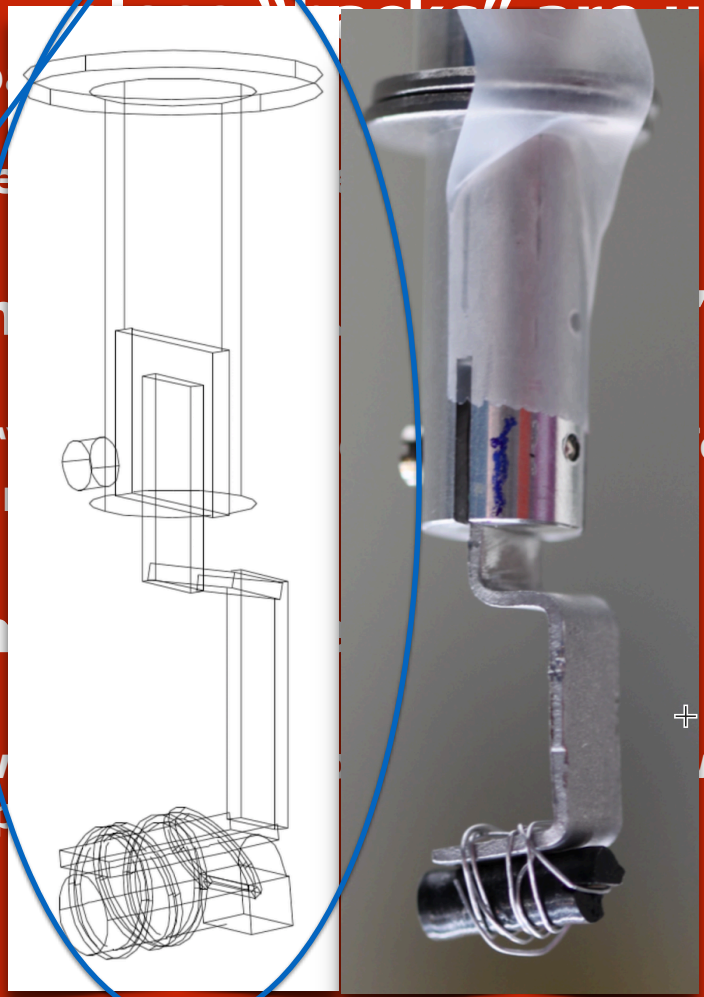

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McStas Union concept

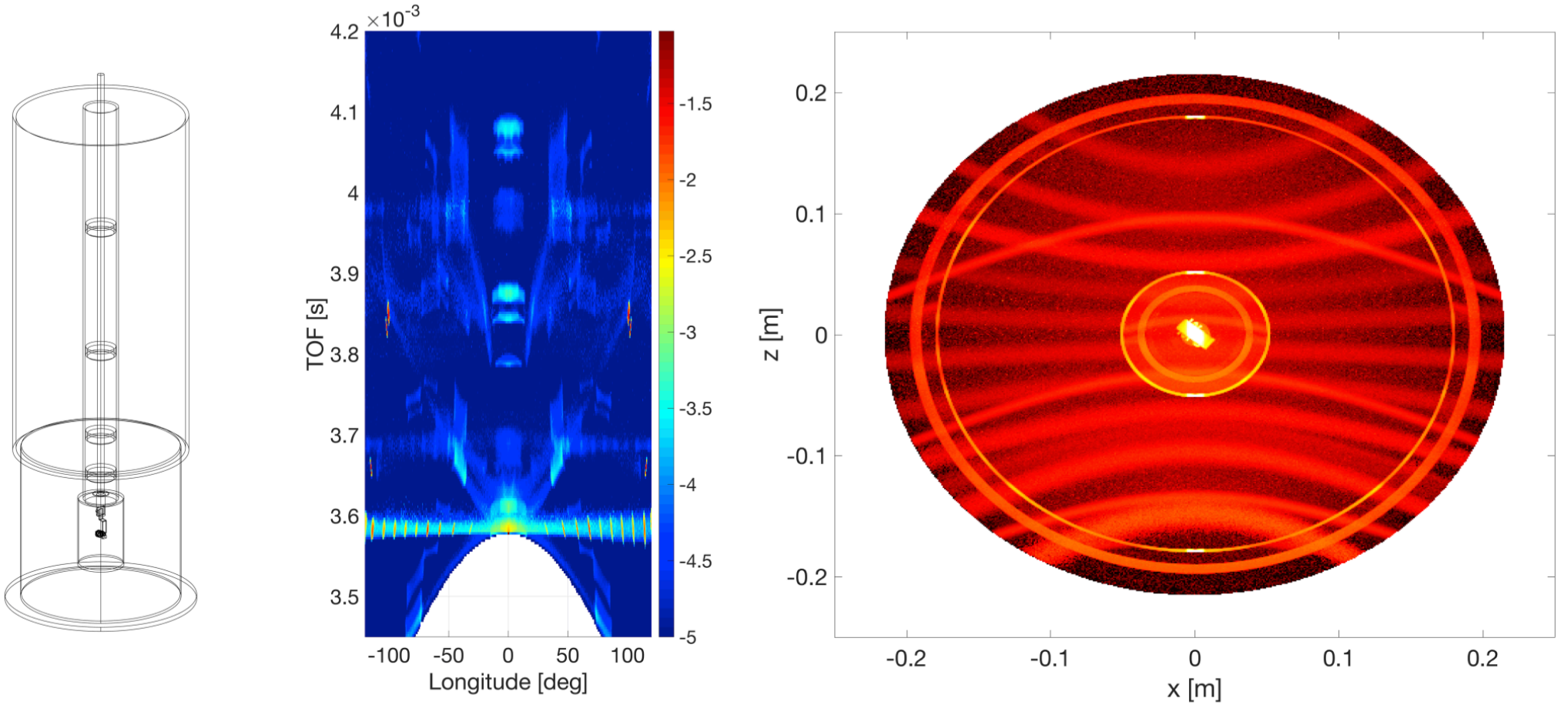

Figure 1: Left: Depiction of cryostat/sample model. Center: Time of flight banana monitor showing spurions. Right: Histogram over scattering locations in cryostat as seen from above.

See online-video at http://media.mcstas.org/ESS_DMSC_20161117/DMSC_talk_MBertelsen_McStas_Union.mp4 + ICANS XXII proceedings

Next: Demo!