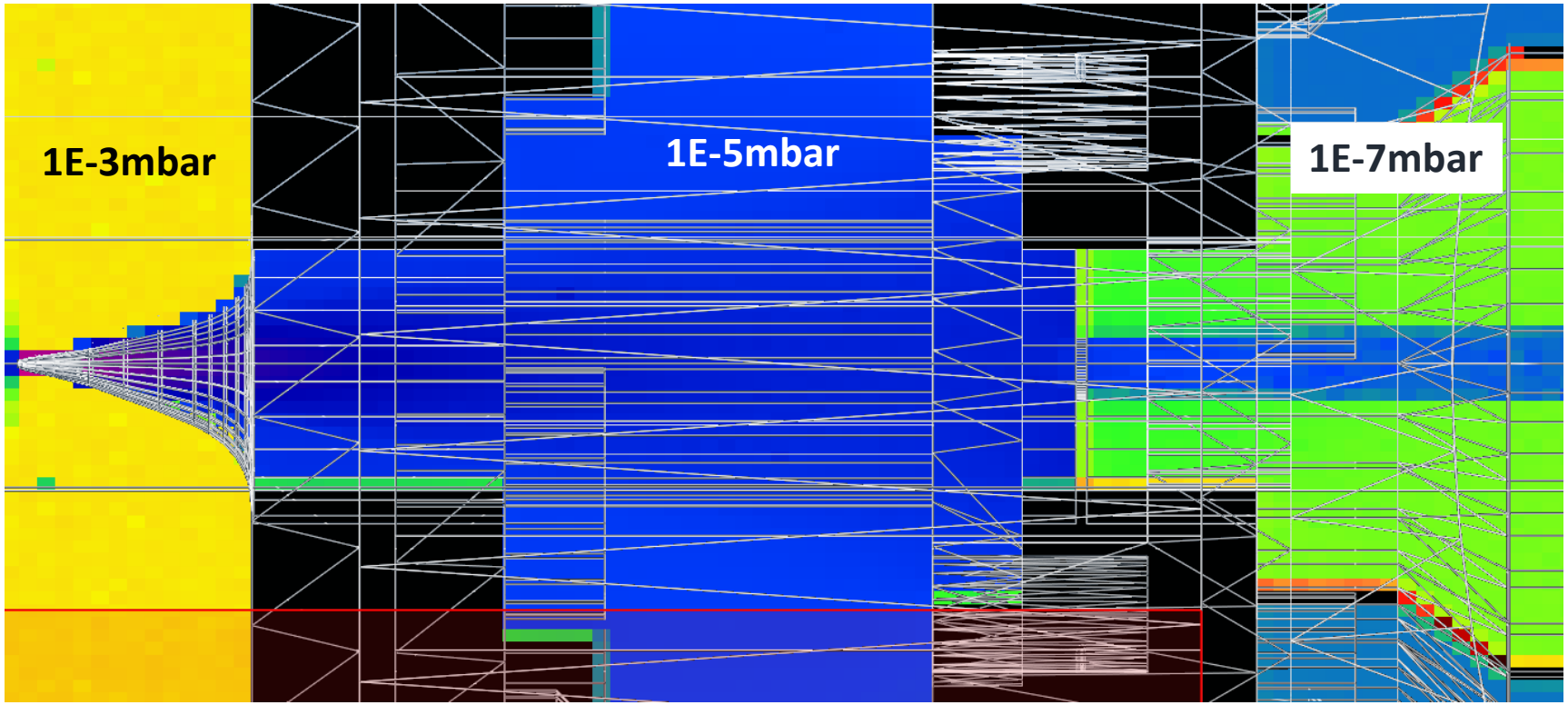
Matching simulations with experimental results

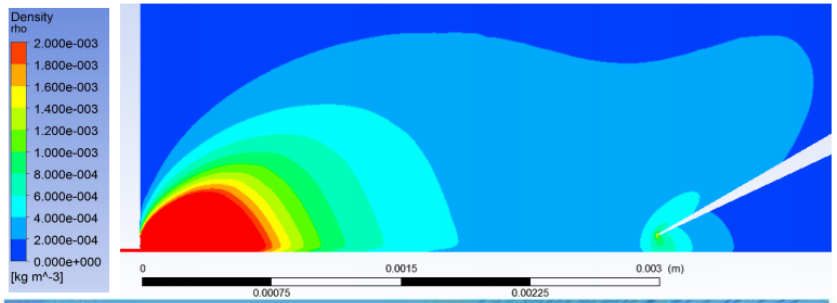
Marton Ady – BGC collaboration meeting

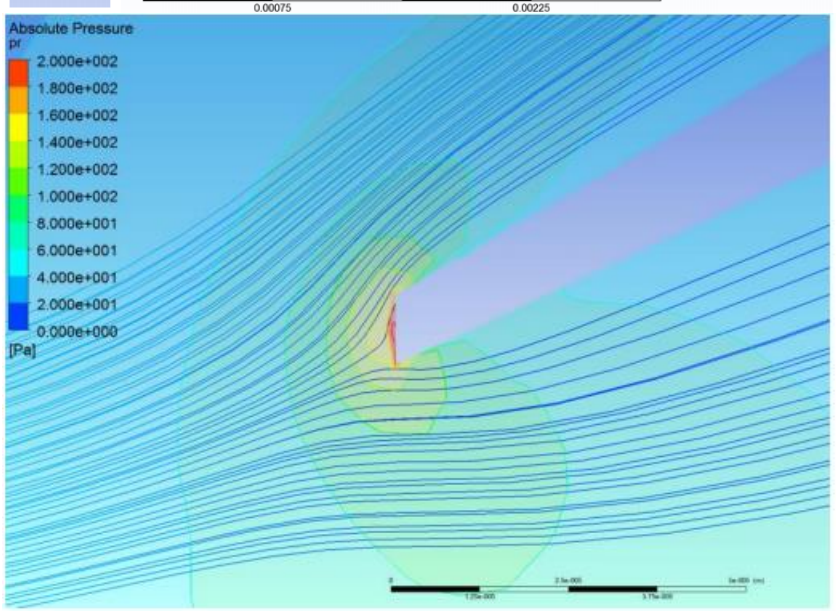
Context

- Skimmer1 is boundary region between molecular and viscous regime
- In my simulations, I desorb from skimmer 1's entrance

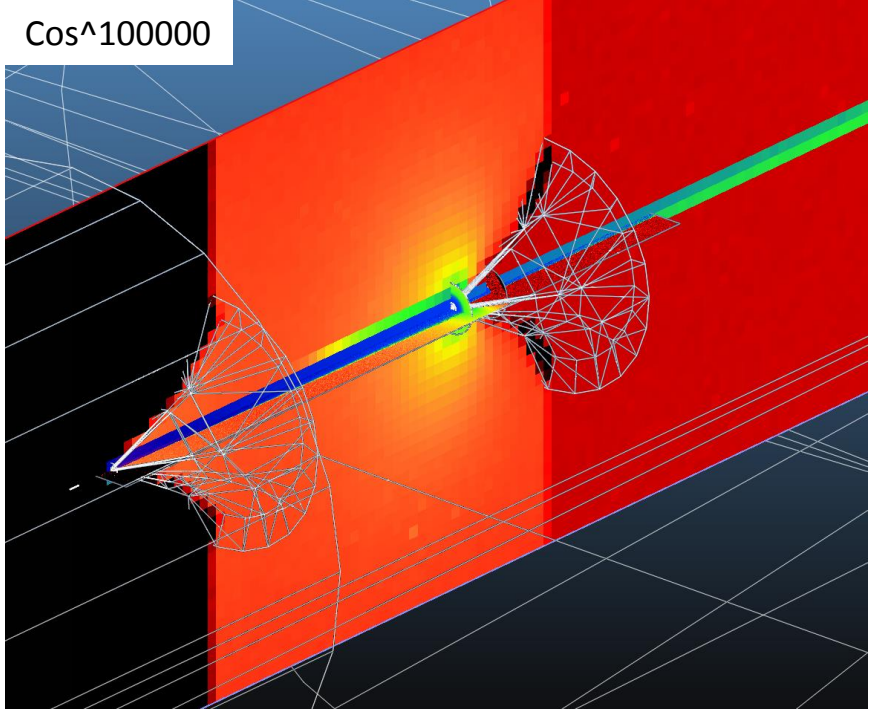


- Exact collimation unknown
- It is described mathematically
  - $P(\Theta) \sim \cos^N(\Theta)$
- Directly controls pass/skim ratio

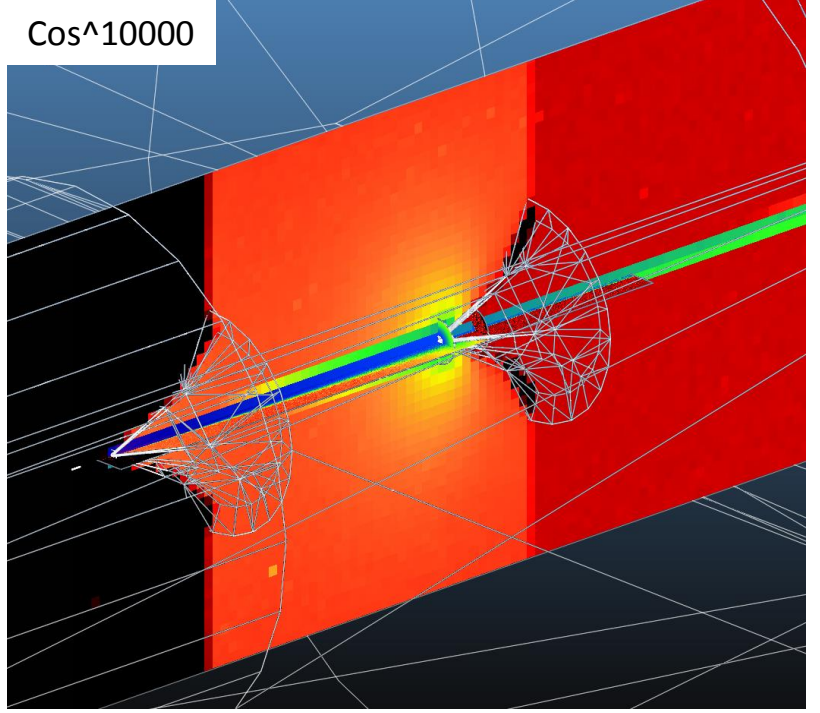




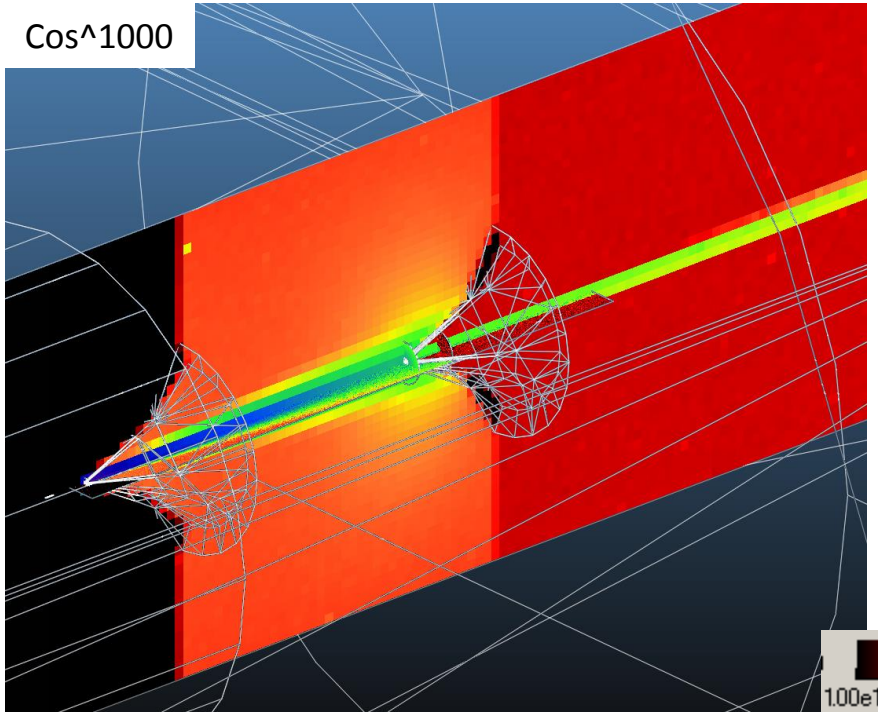
Cos^100000



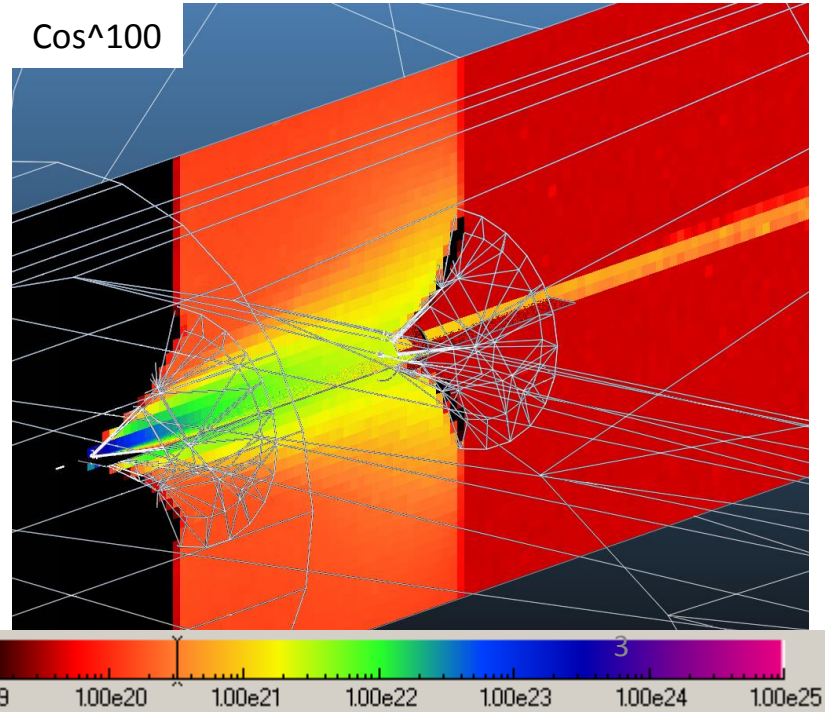
Cos^10000



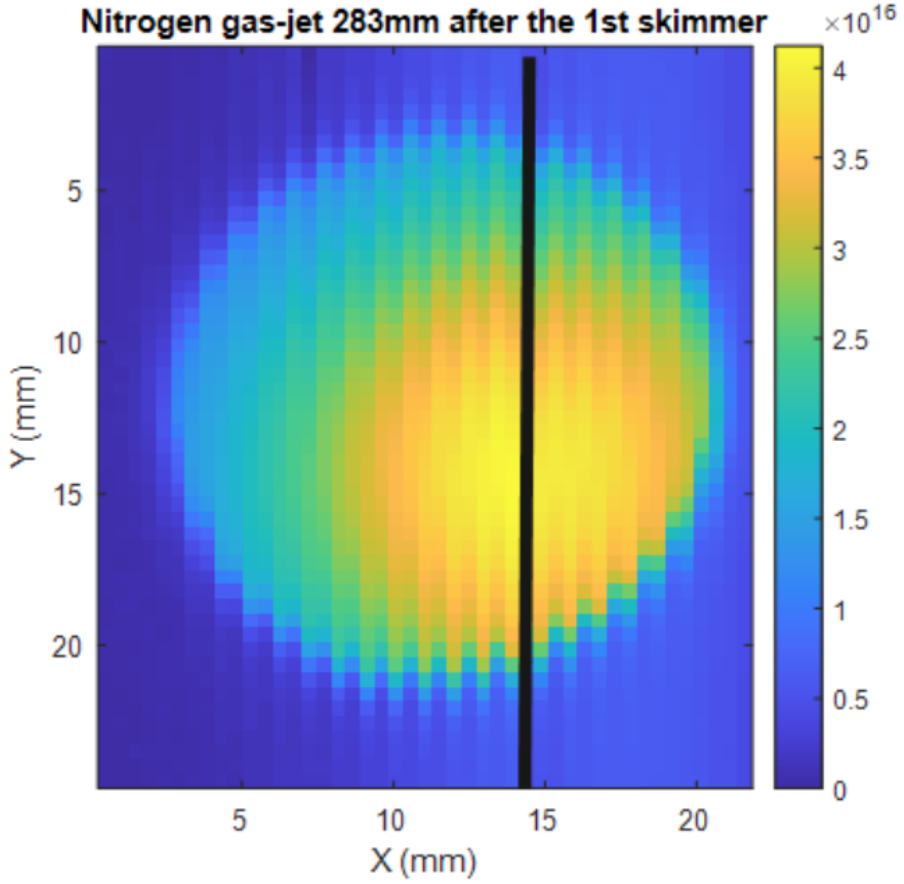
Cos^1000



Cos^100



Cockroft team has now experimental data



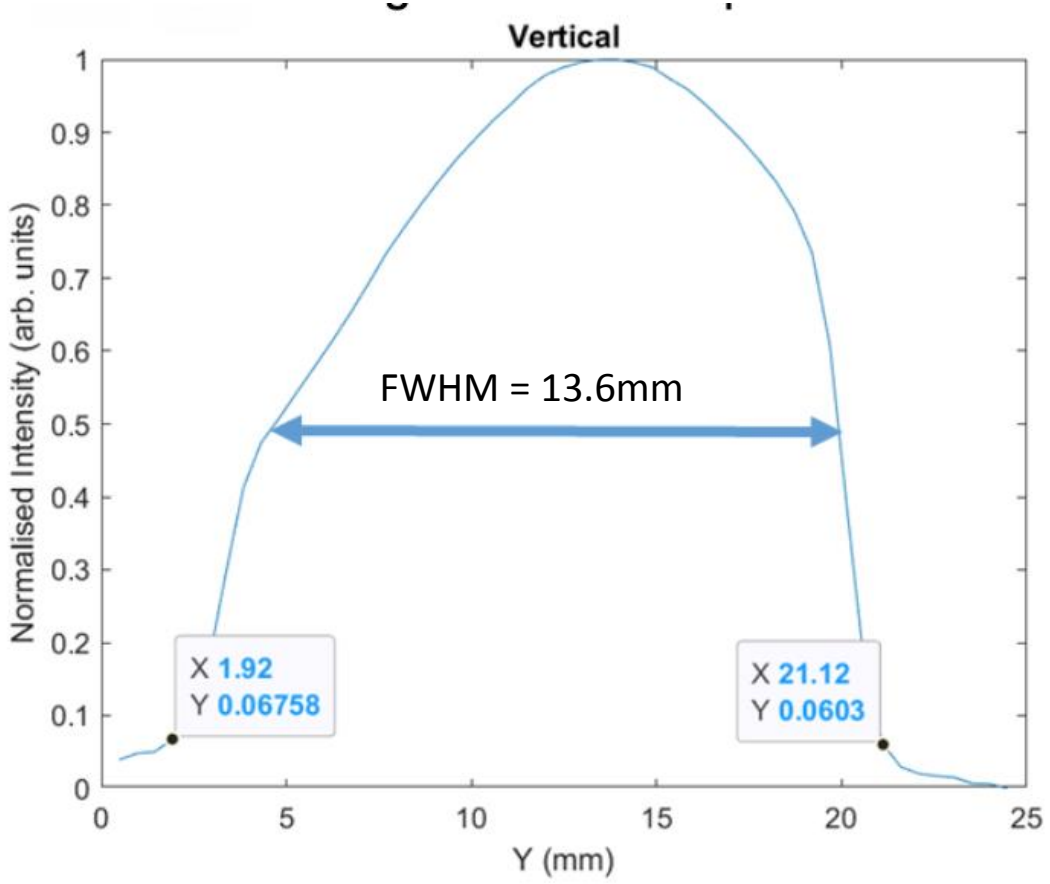
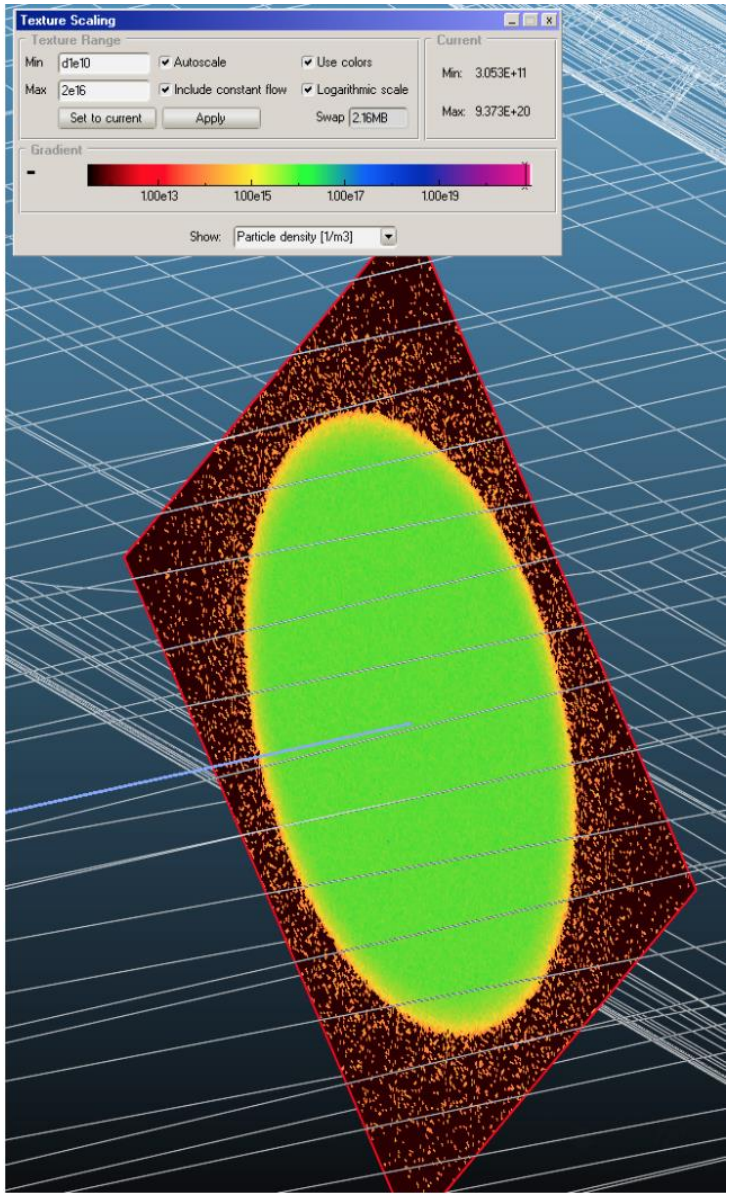
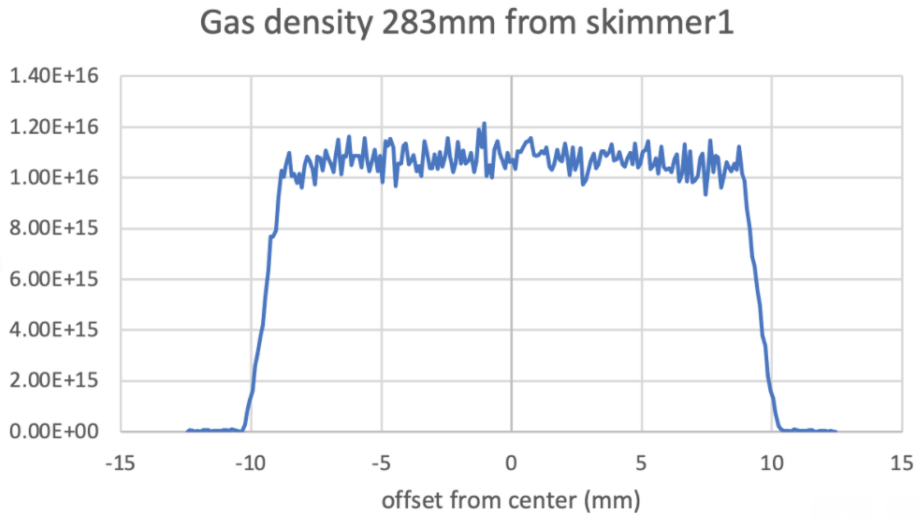
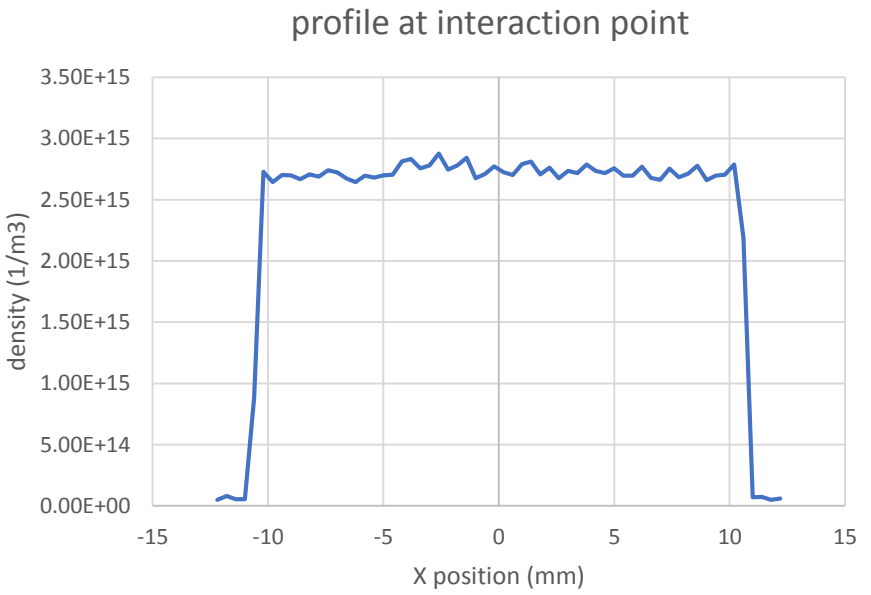


Image: Amir Salehilashkajani, Hao Zhang (private communication)

Doesn’t look like my jet profiles so far

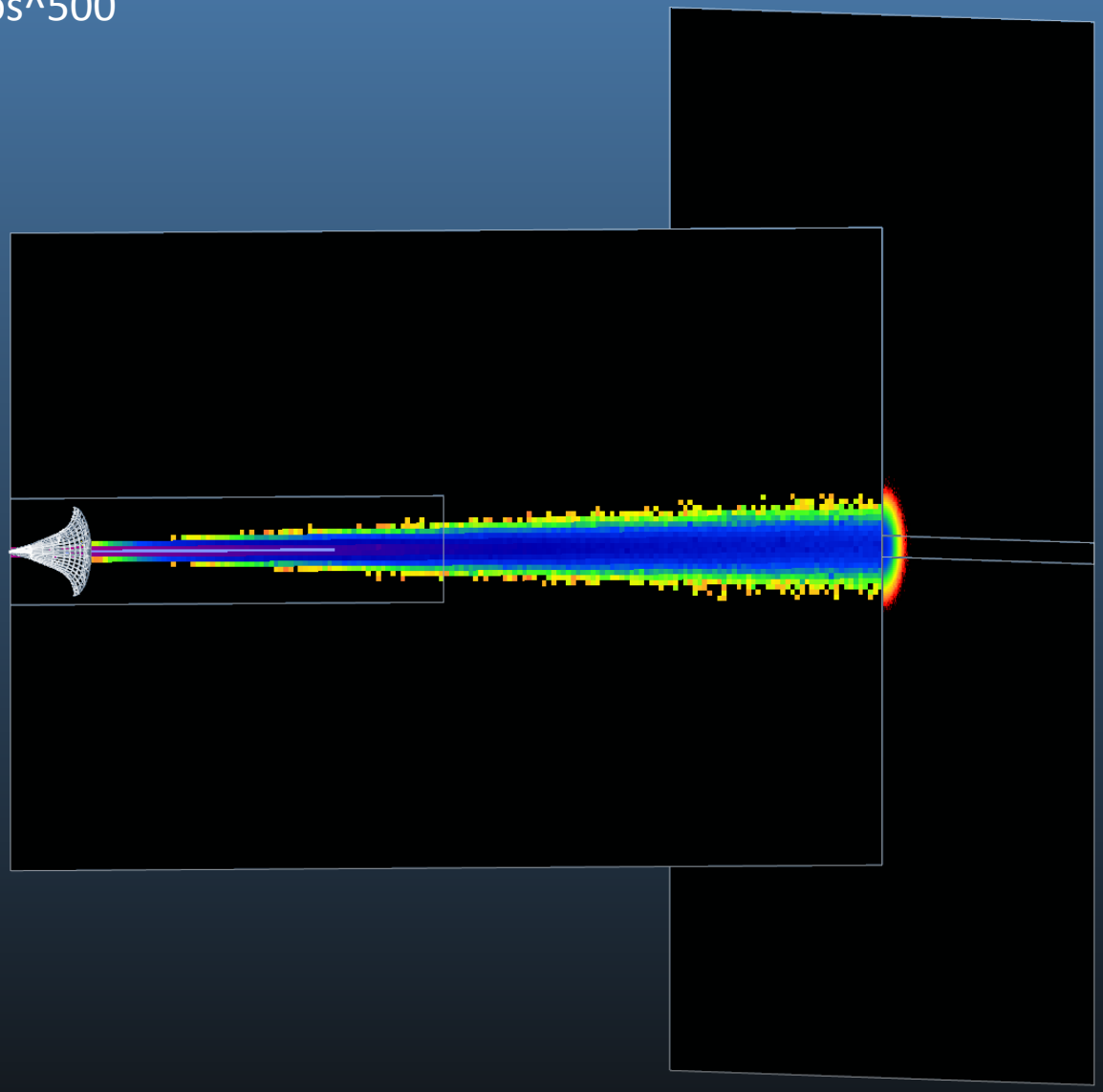


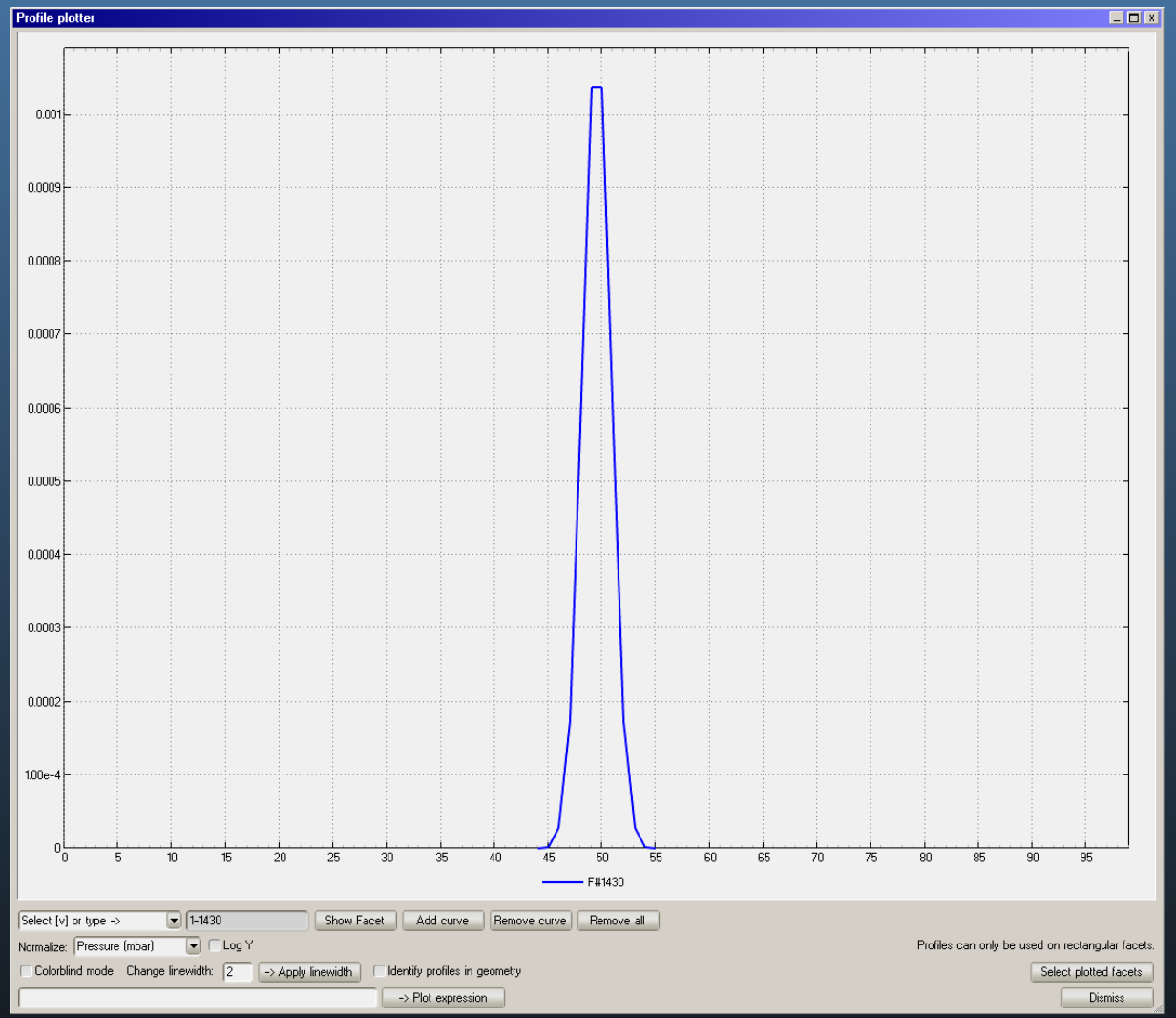




Back to basics: how the jet is formed in molecular flow

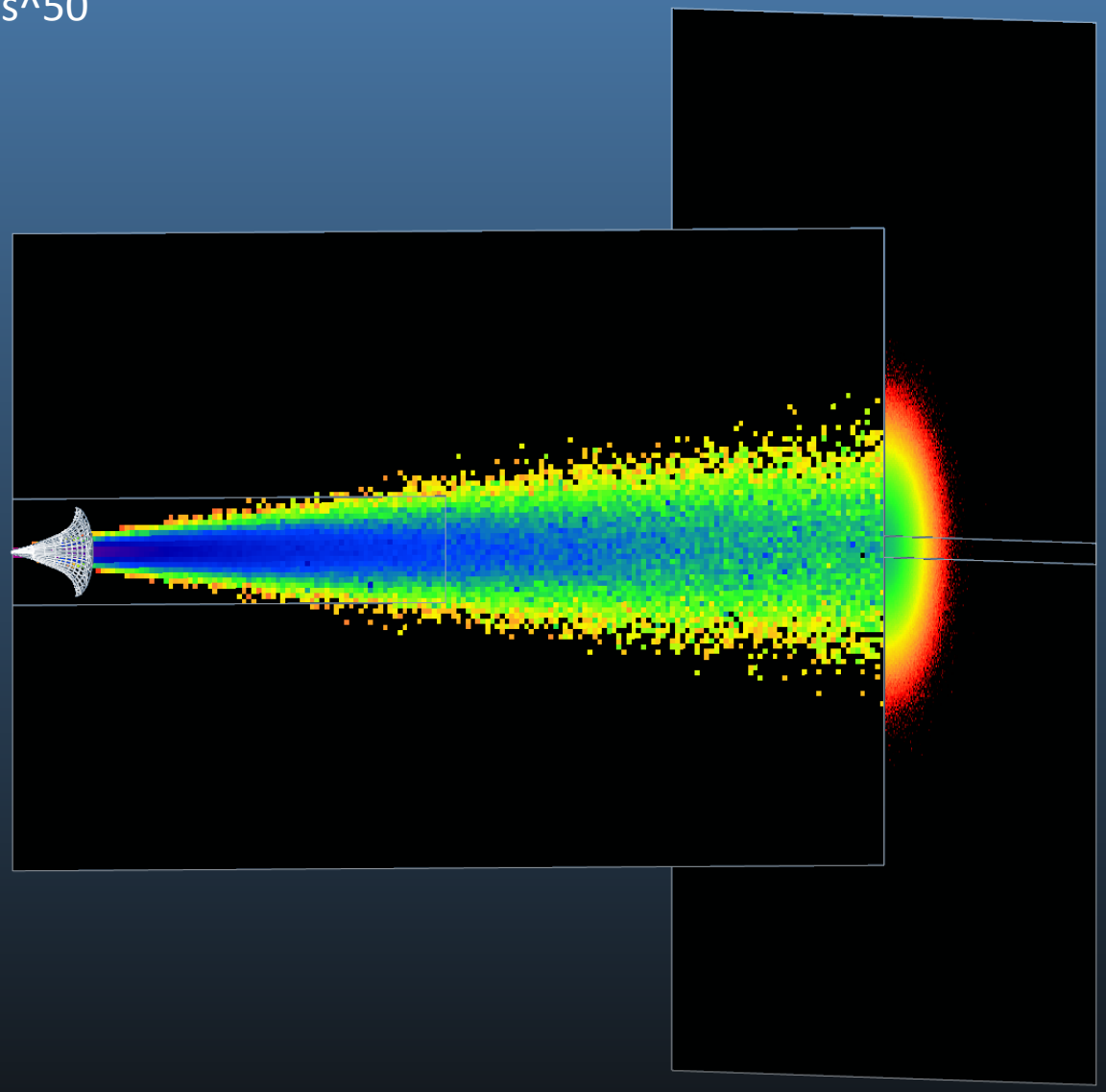
Cos^500

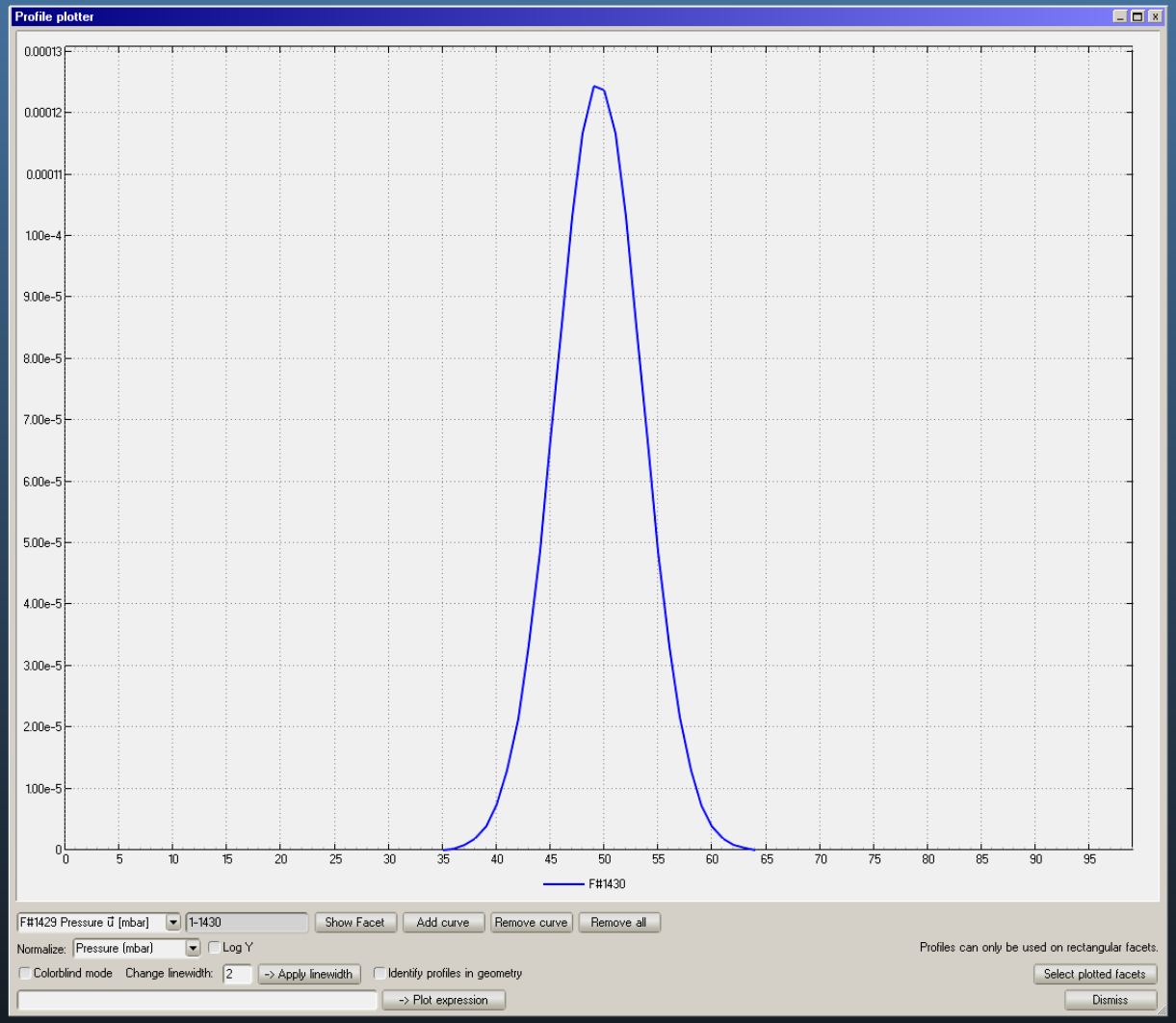




Back to basics: how the jet is formed in molecular flow

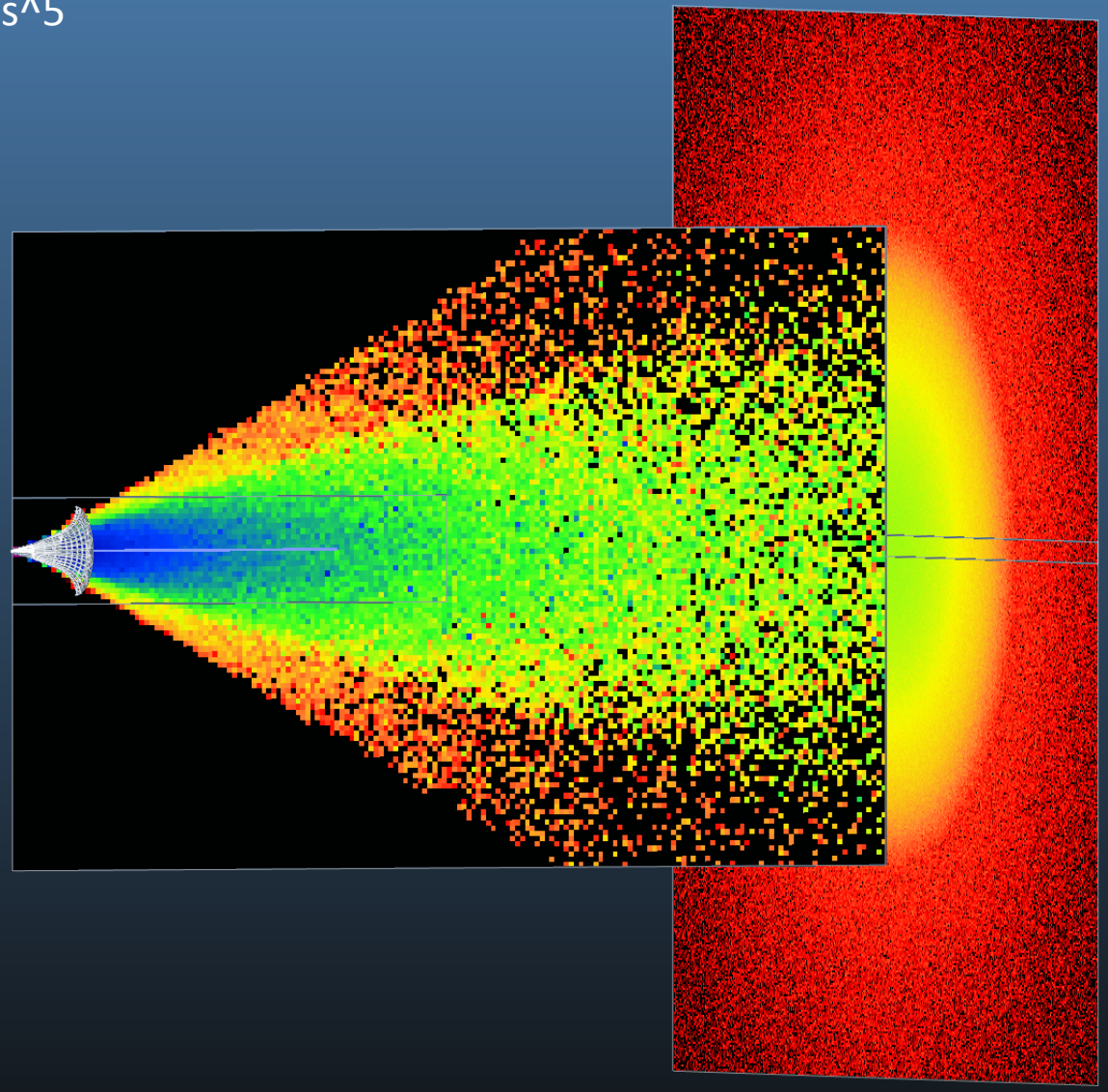
Cos^50

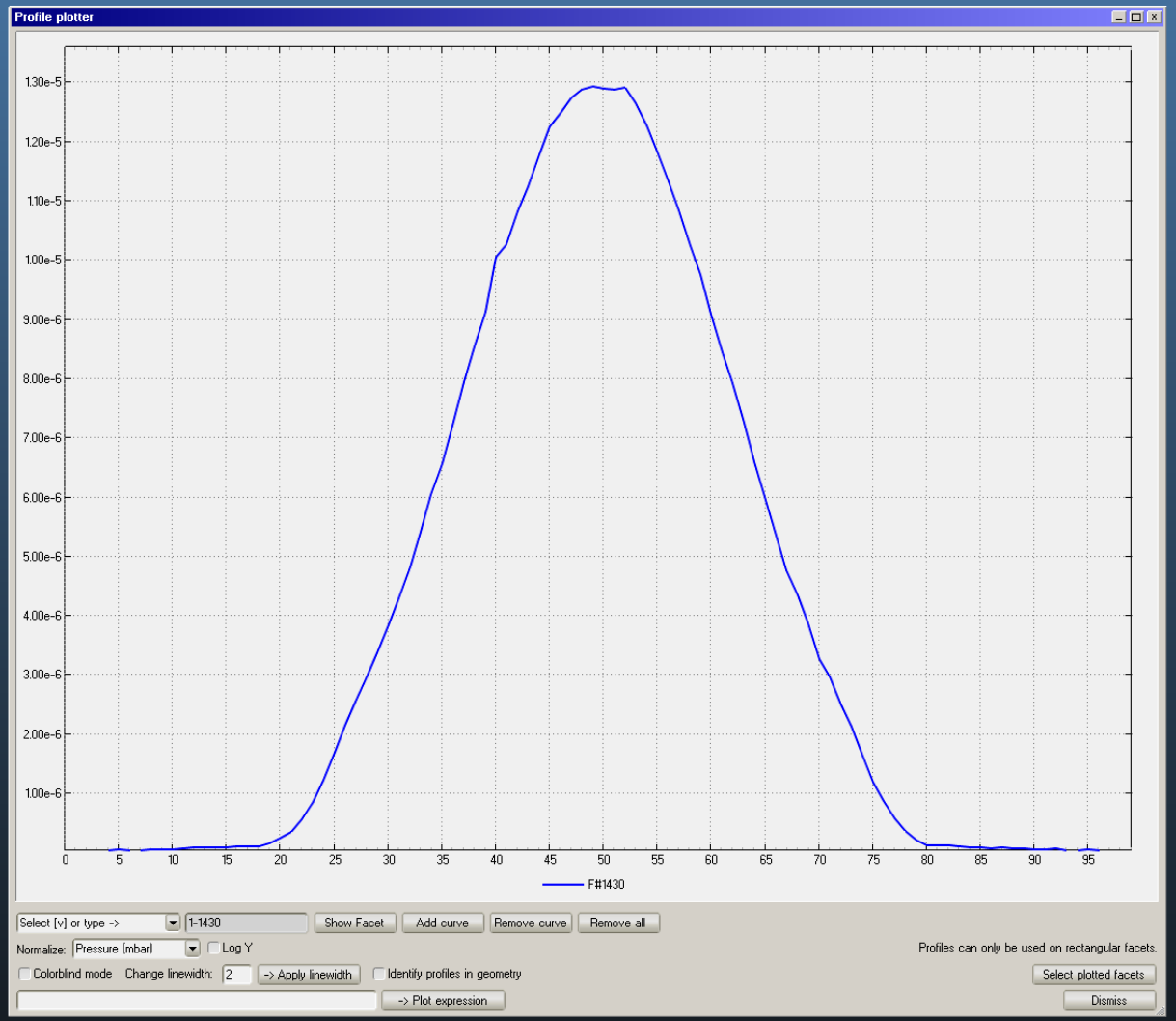


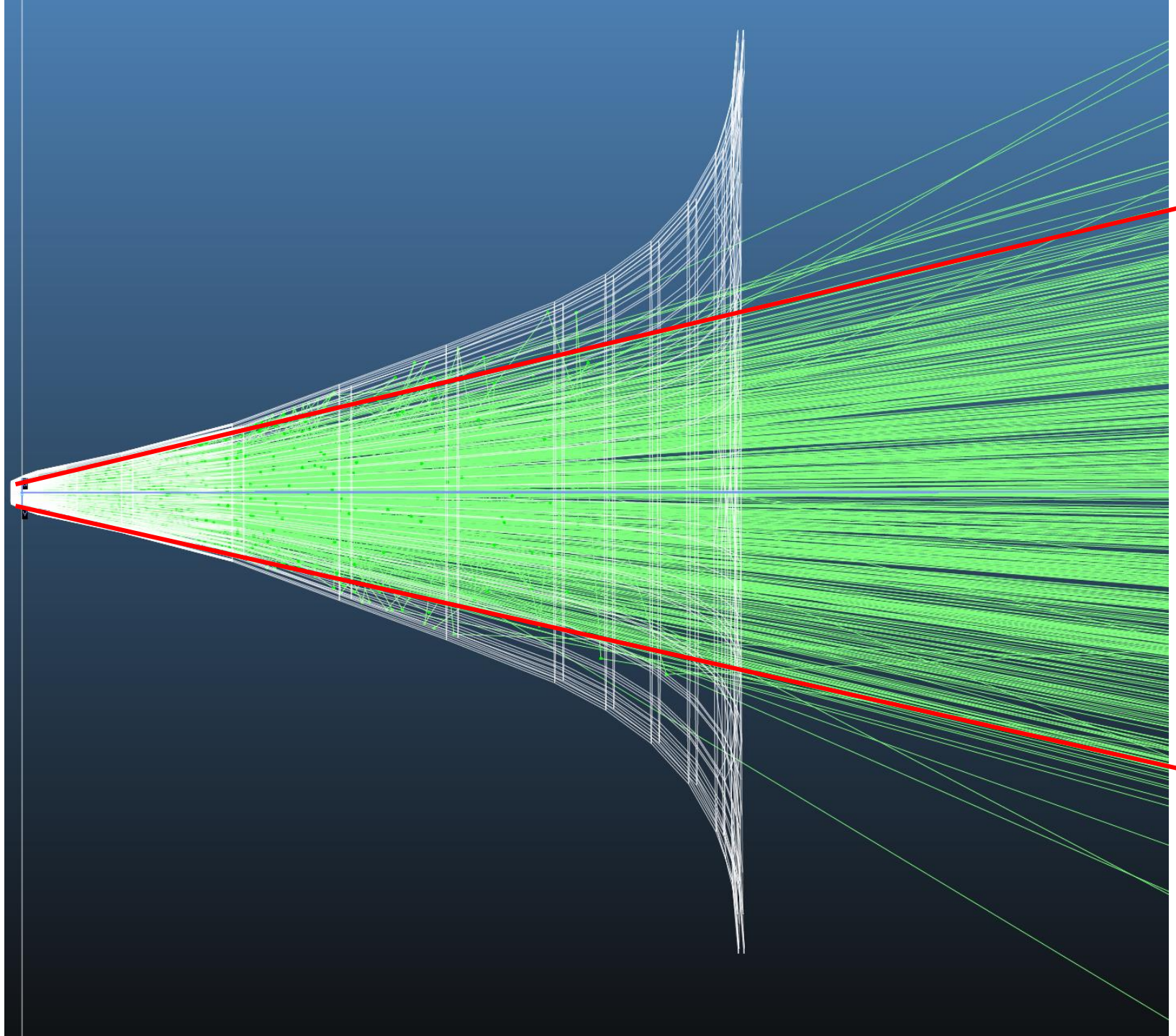


Back to basics: how the jet is formed in molecular flow

Cos^5

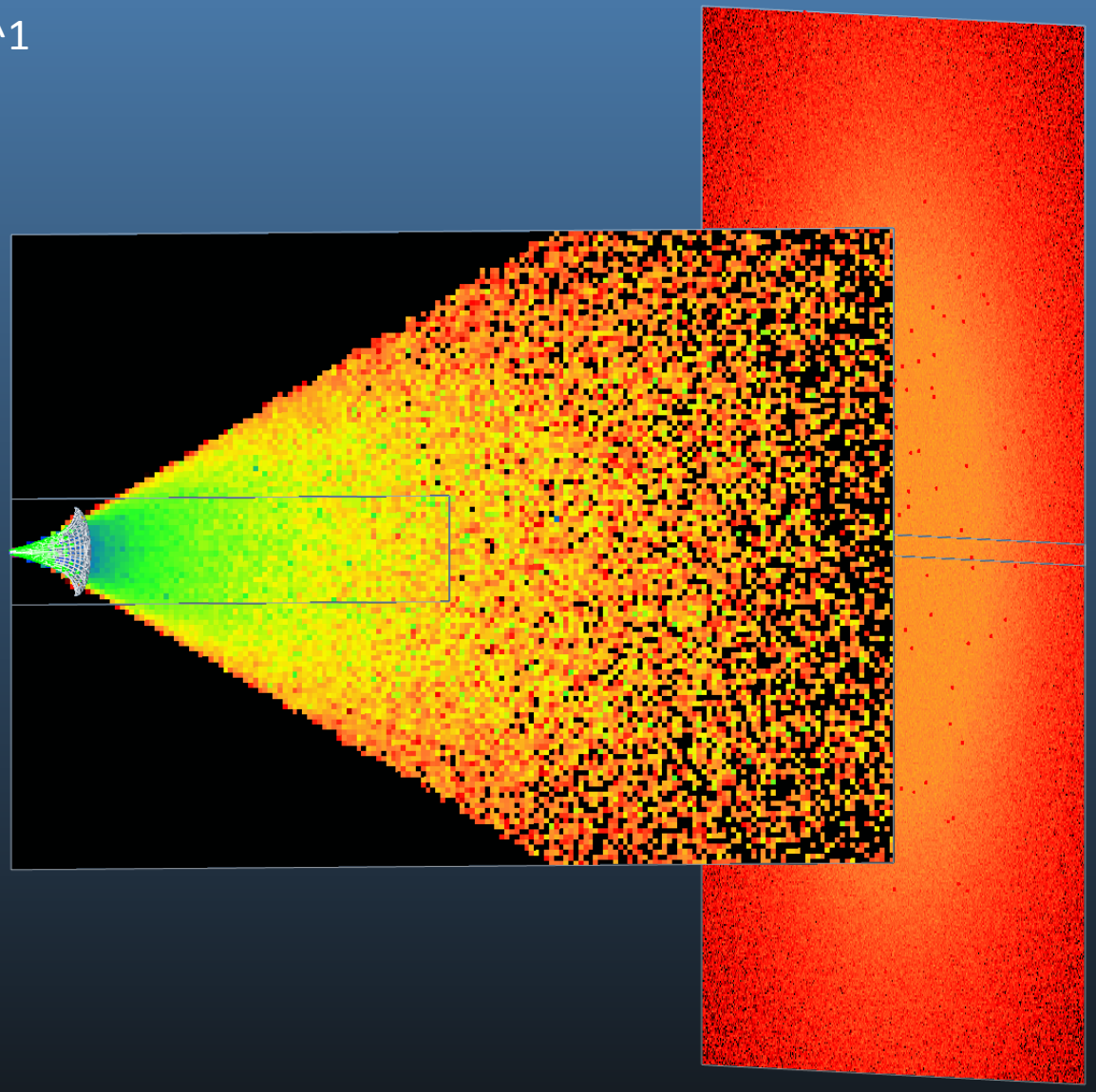


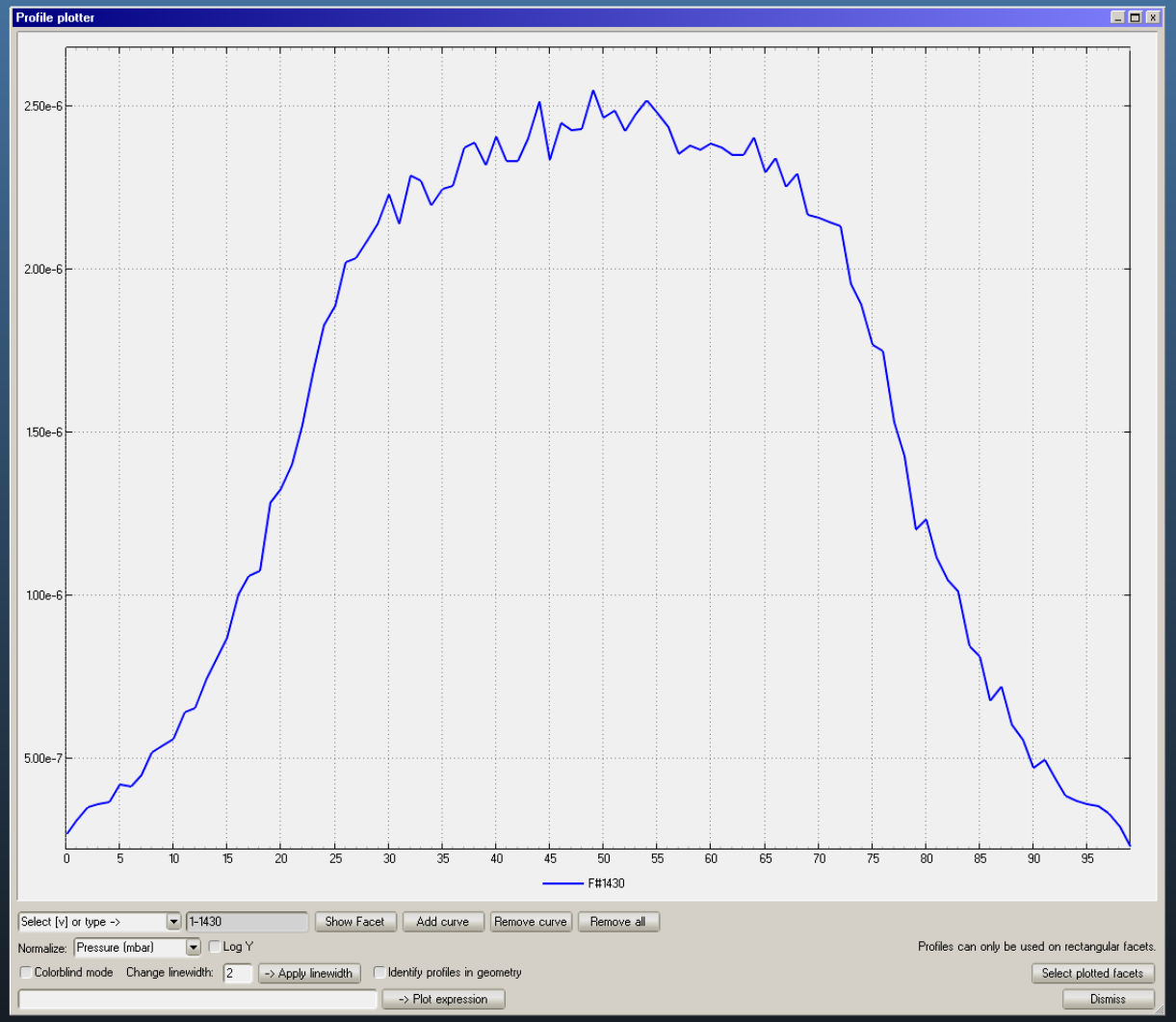


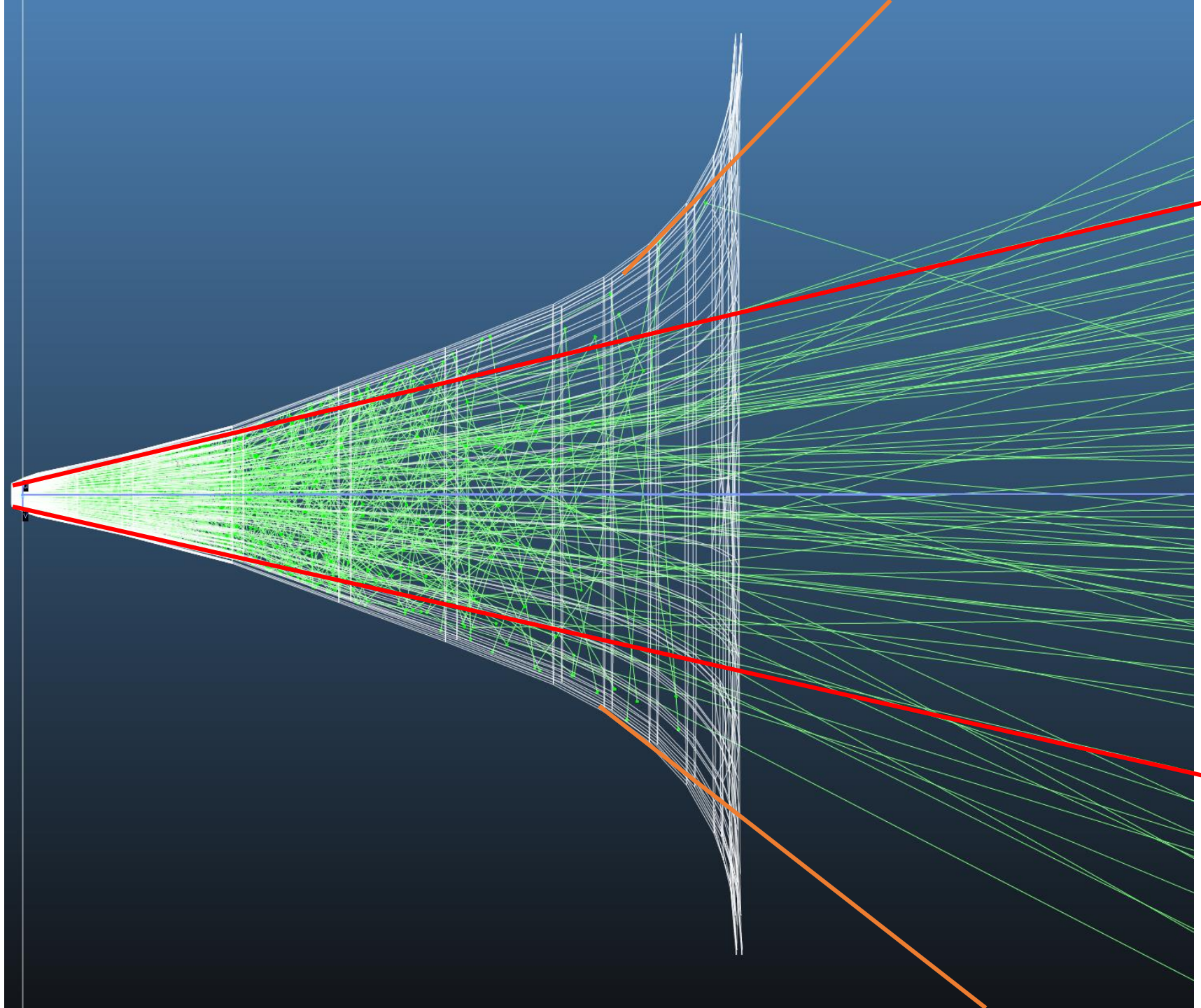

Diffuse part
Direct jet
Diffuse part

Back to basics: how the jet is formed in molecular flow

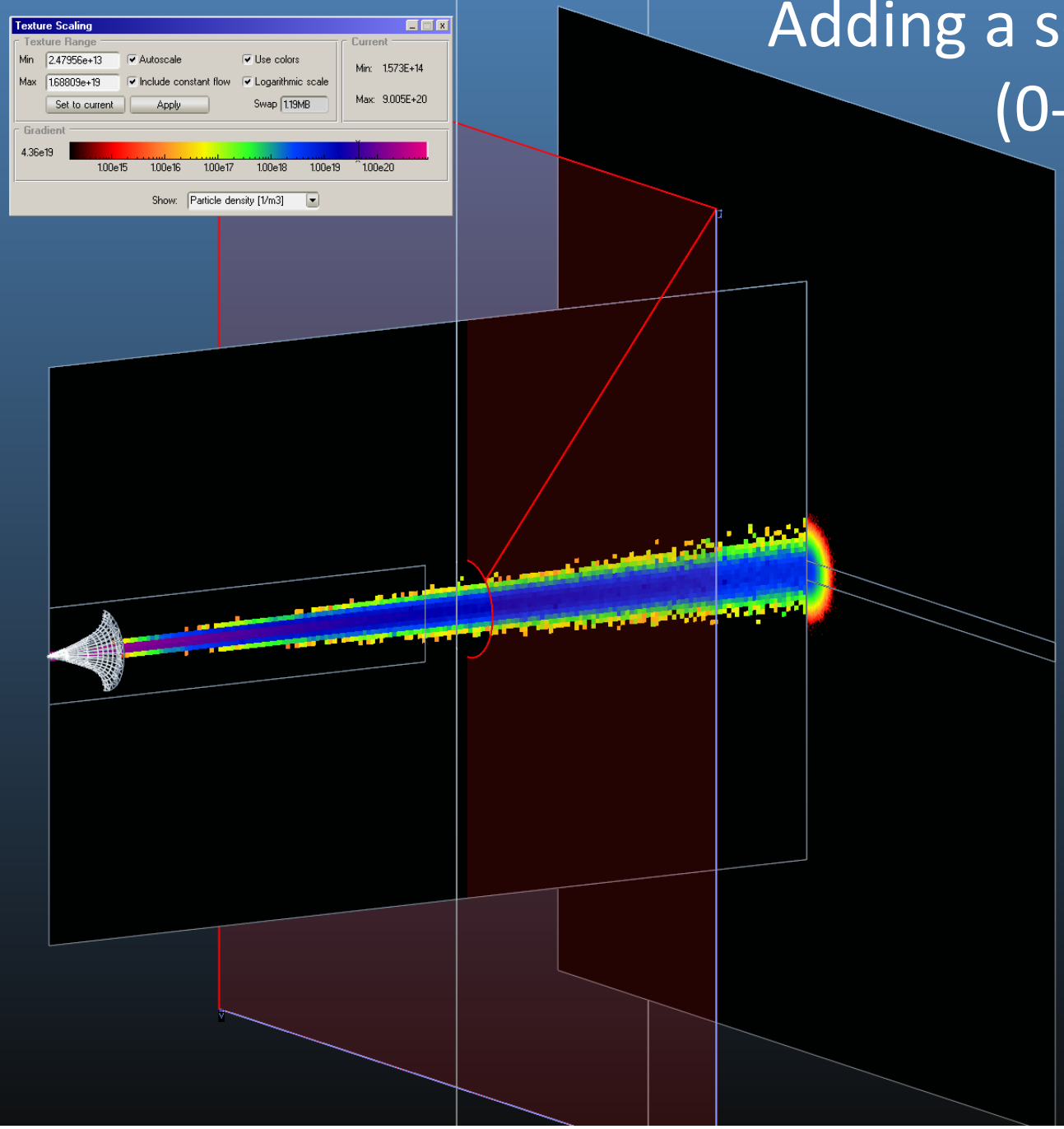
Cos^1

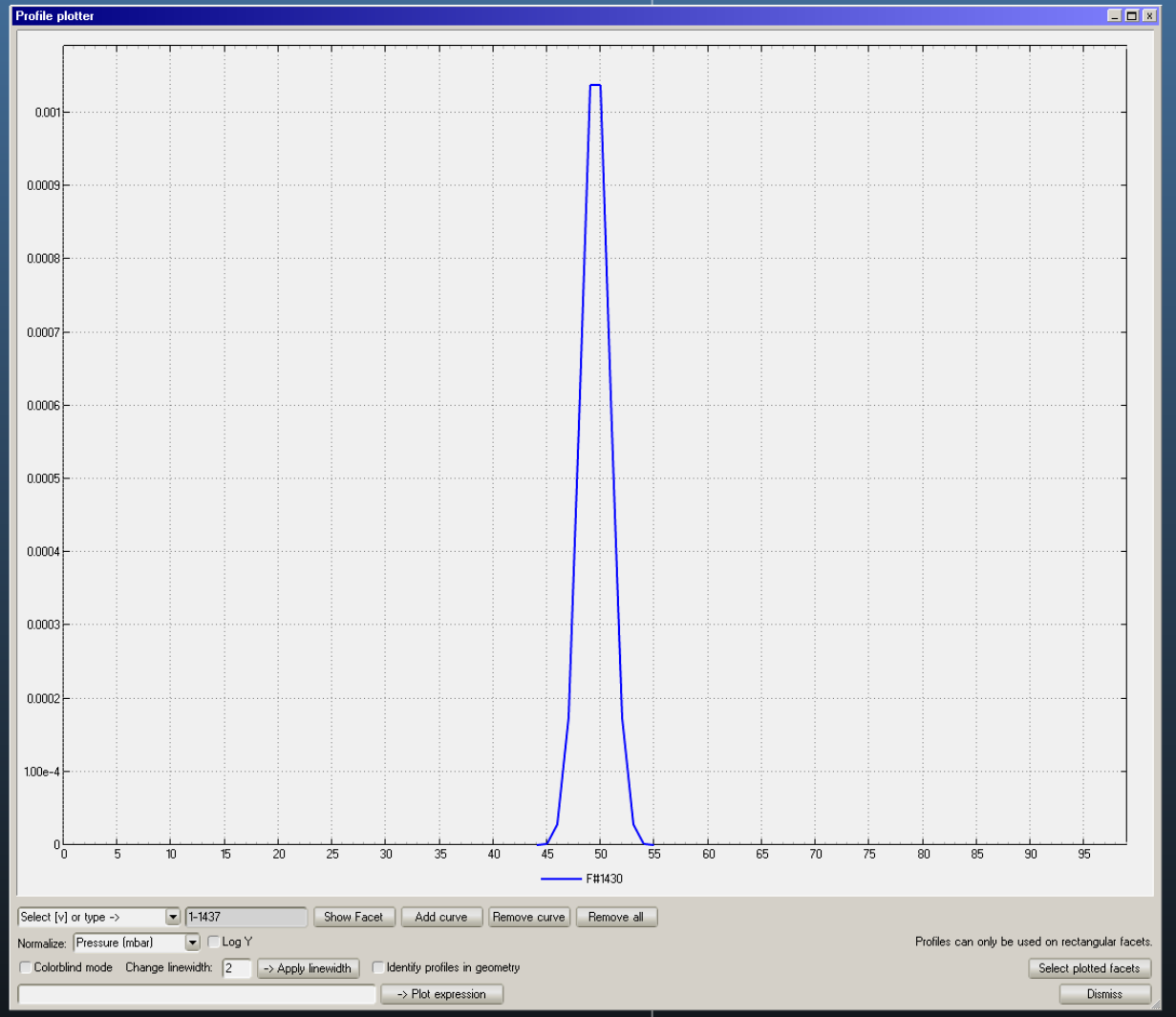


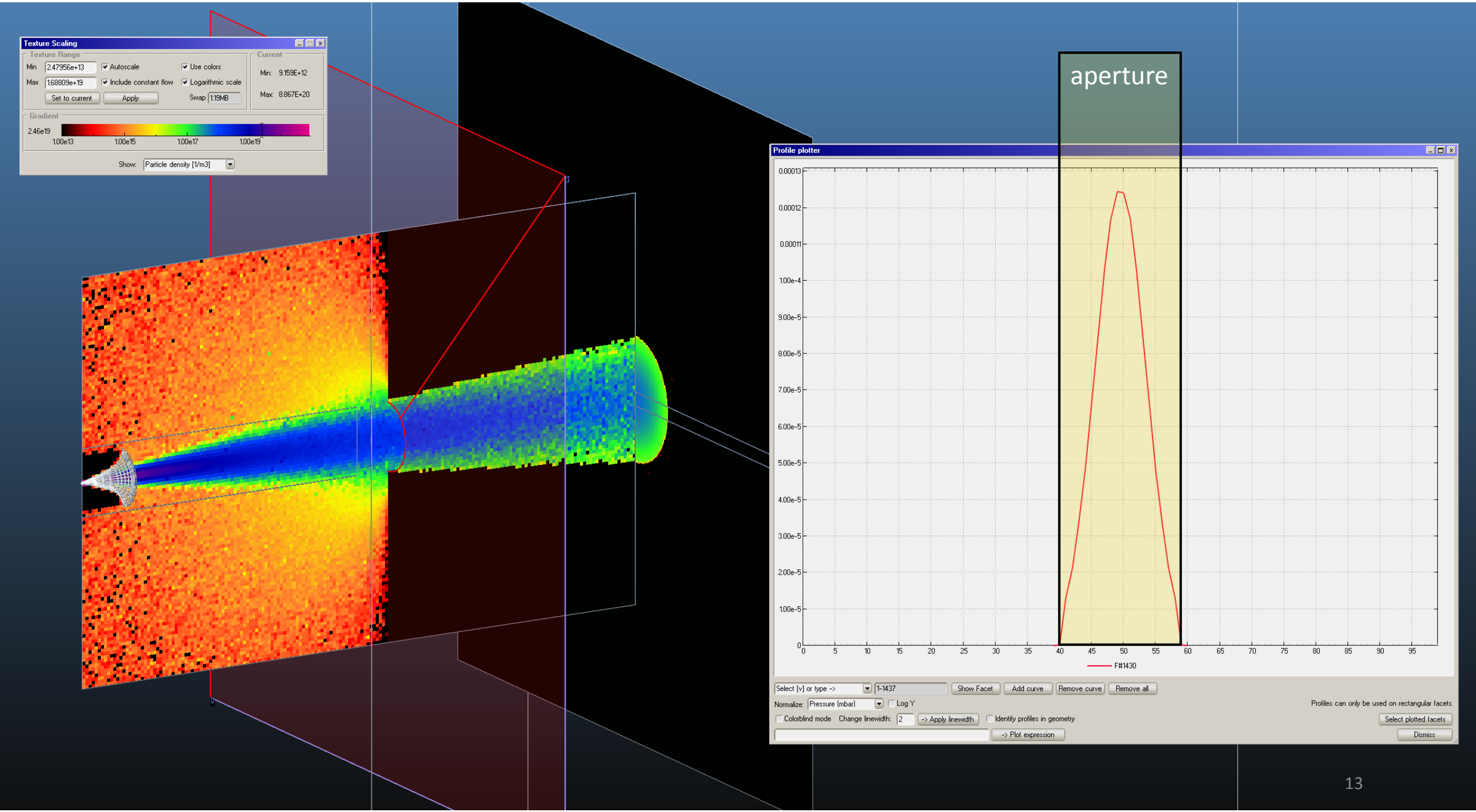


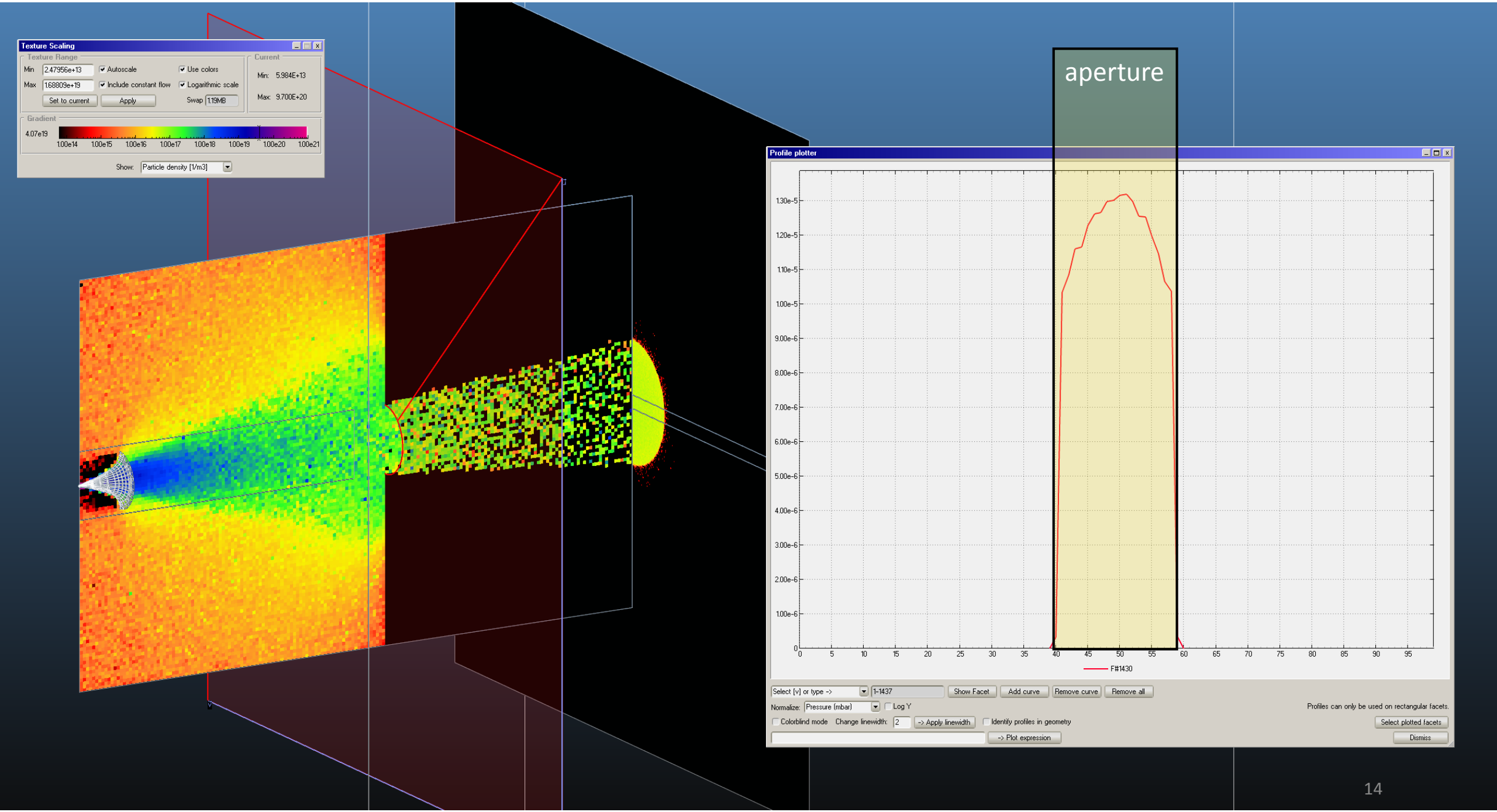


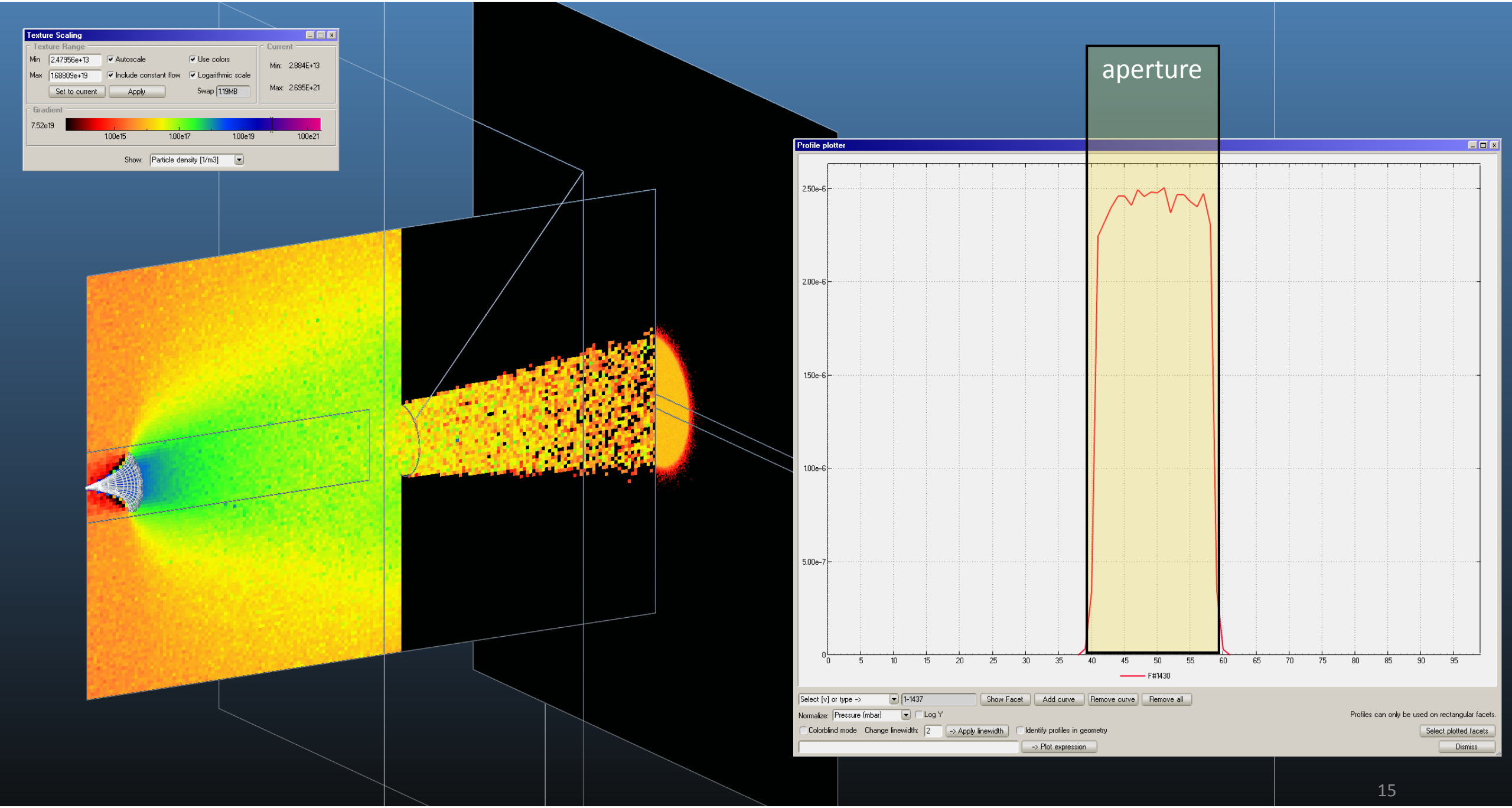
Adding a second skimmer (0-length)

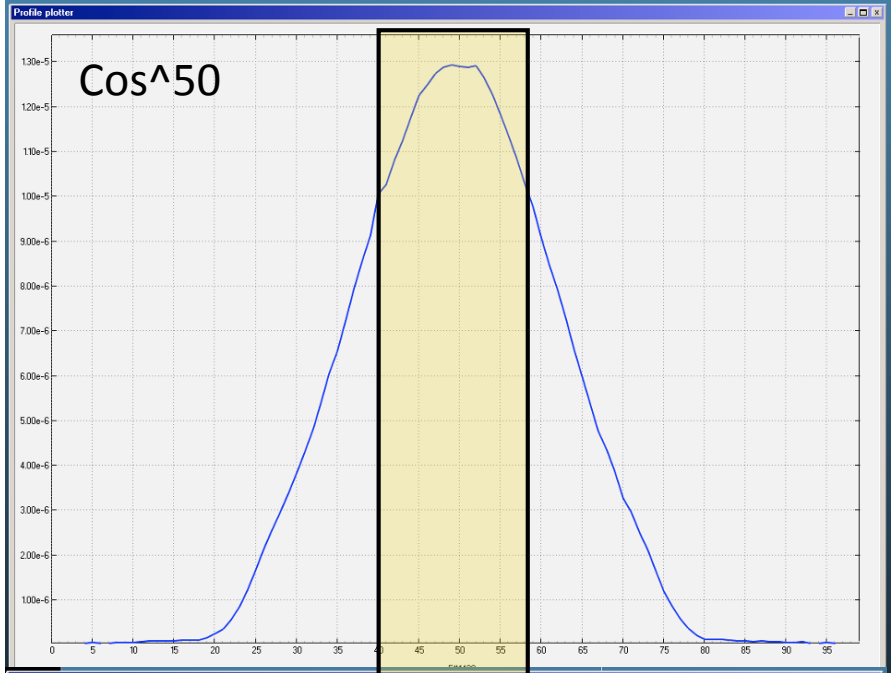


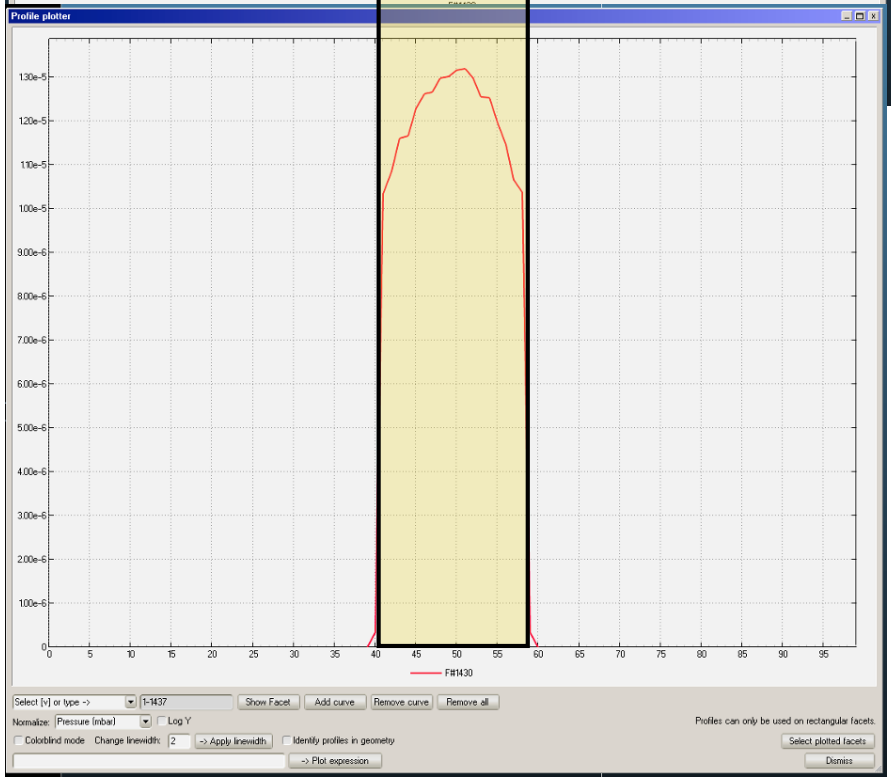


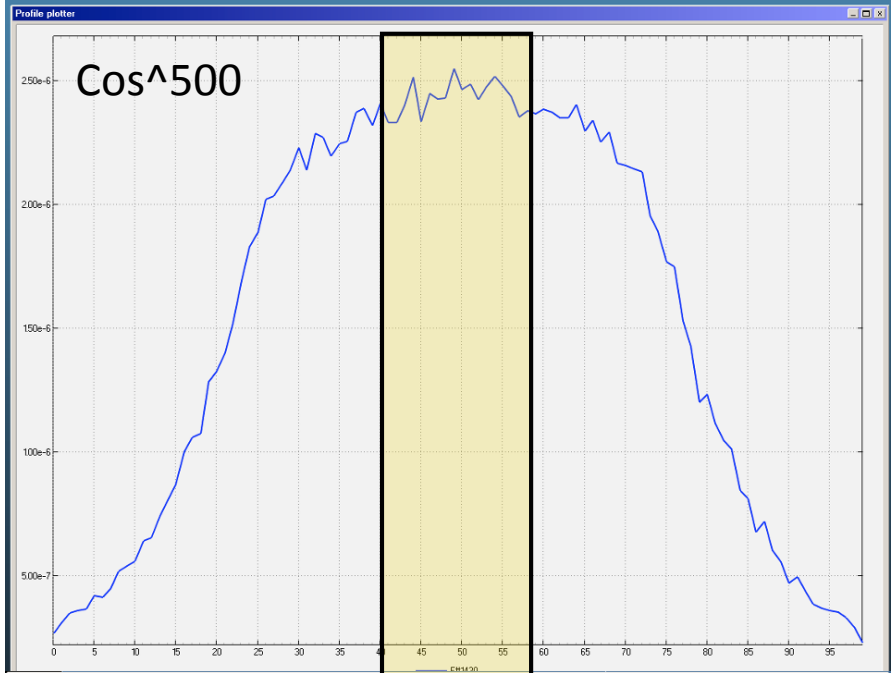

Texture Scaling
Texture Range
Min 2.47956e+13
Autoscale
Use colors
Max 1.68809e+19
Include constant flow
Logarithmic scale
Set to current
Apply
Swap 1.19MB
Current
Min: 9.159E+12
Max: 8.867E+20
Gradient
2.46e19
1.00e13
1.00e15
1.00e17
1.00e19
Show: Particle density [1/m3]
aperture
Profile plotter
0.00013
0.00012
0.00011
1.00e-4
9.00e-5
8.00e-5
7.00e-5
6.00e-5
5.00e-5
4.00e-5
3.00e-5
2.00e-5
1.00e-5
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
F#1430
Select [v] or type ->
1-1437
Show Facet
Add curve
Remove curve
Remove all
Normalize:
Pressure (mbar)
Log Y
Profiles can only be used on rectangular facets.
Colorblind mode
Change linewidth:
2
-> Apply linewidth
Identify profiles in geometry
Select plotted facets
-> Plot expression
Dismiss

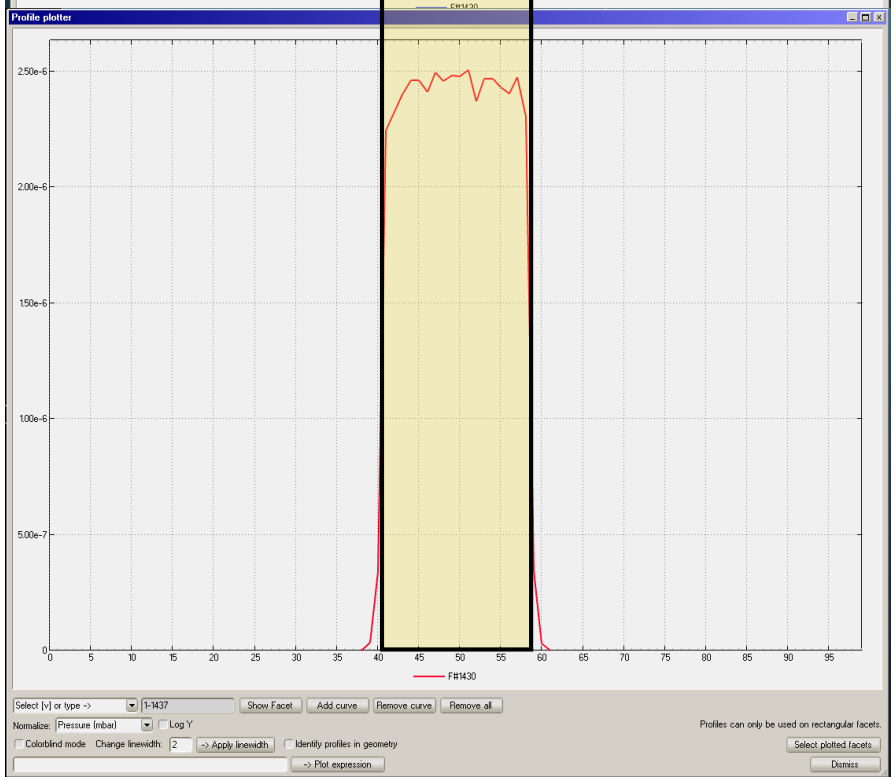

Texture Scaling
Texture Range
Min 2.47956e+13
Autoscale
Use colors
Max 1.68809e+19
Include constant flow
Logarithmic scale
Set to current
Apply
Swap 1.19MB
Current
Min: 5.984E+13
Max: 9.700E+20
Gradient
4.07e19
1.00e14 1.00e15 1.00e16 1.00e17 1.00e18 1.00e19 1.00e20 1.00e21
Show: Particle density [1/m3]
aperture
Profile plotter
1.30e-5
1.20e-5
1.10e-5
1.00e-5
9.00e-6
8.00e-6
7.00e-6
6.00e-6
5.00e-6
4.00e-6
3.00e-6
2.00e-6
1.00e-6
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
F#1430
Select [v] or type ->
1-1437
Show Facet
Add curve
Remove curve
Remove all
Normalize: Pressure (mbar)
Log Y
Profiles can only be used on rectangular facets.
Colorblind mode
Change linewidth: 2
-> Apply linewidth
Identify profiles in geometry
Select plotted facets
-> Plot expression
Dismiss


Texture Scaling
Texture Range
Min 2.47956e+13
Max 1.68809e+19
Autoscale
Include constant flow
Use colors
Logarithmic scale
Set to current
Apply
Swap 1.19MB
Current
Min: 2.884E+13
Max: 2.695E+21
Gradient
7.52e19
1.00e15
1.00e17
1.00e19
1.00e21
Show: Particle density [1/m3]
aperture
Profile plotter
2.50e-6
2.00e-6
1.50e-6
1.00e-6
5.00e-7
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
F#1430
Select [v] or type ->
1-1437
Show Facet
Add curve
Remove curve
Remove all
Normalize:
Pressure (mbar)
Log Y
Profiles can only be used on rectangular facets.
Colorblind mode
Change linewidth:
2
-> Apply linewidth
Identify profiles in geometry
Select plotted facets
-> Plot expression
Dismiss

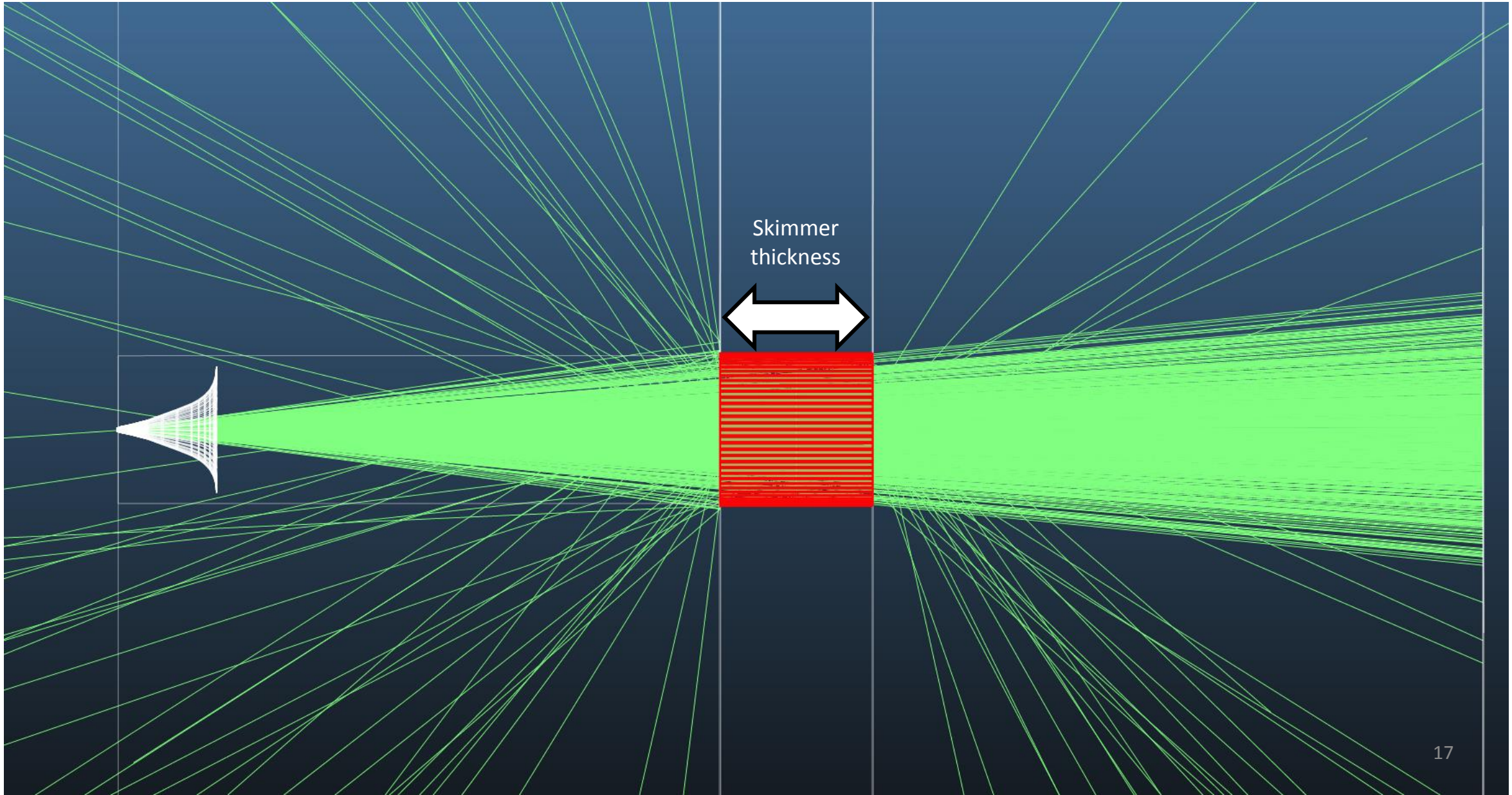

Profile plotter
Cos^50


Profile plotter
F#1430
Select [v] or type ->
1-1437
Show Facet
Add curve
Remove curve
Remove all
Normalize:
Pressure (mbar)
Log Y
Colorblind mode
Change linewidth:
2
-> Apply linewidth
Identify profiles in geometry
Profiles can only be used on rectangular facets.
Select plotted facets
-> Plot expression
Dismiss

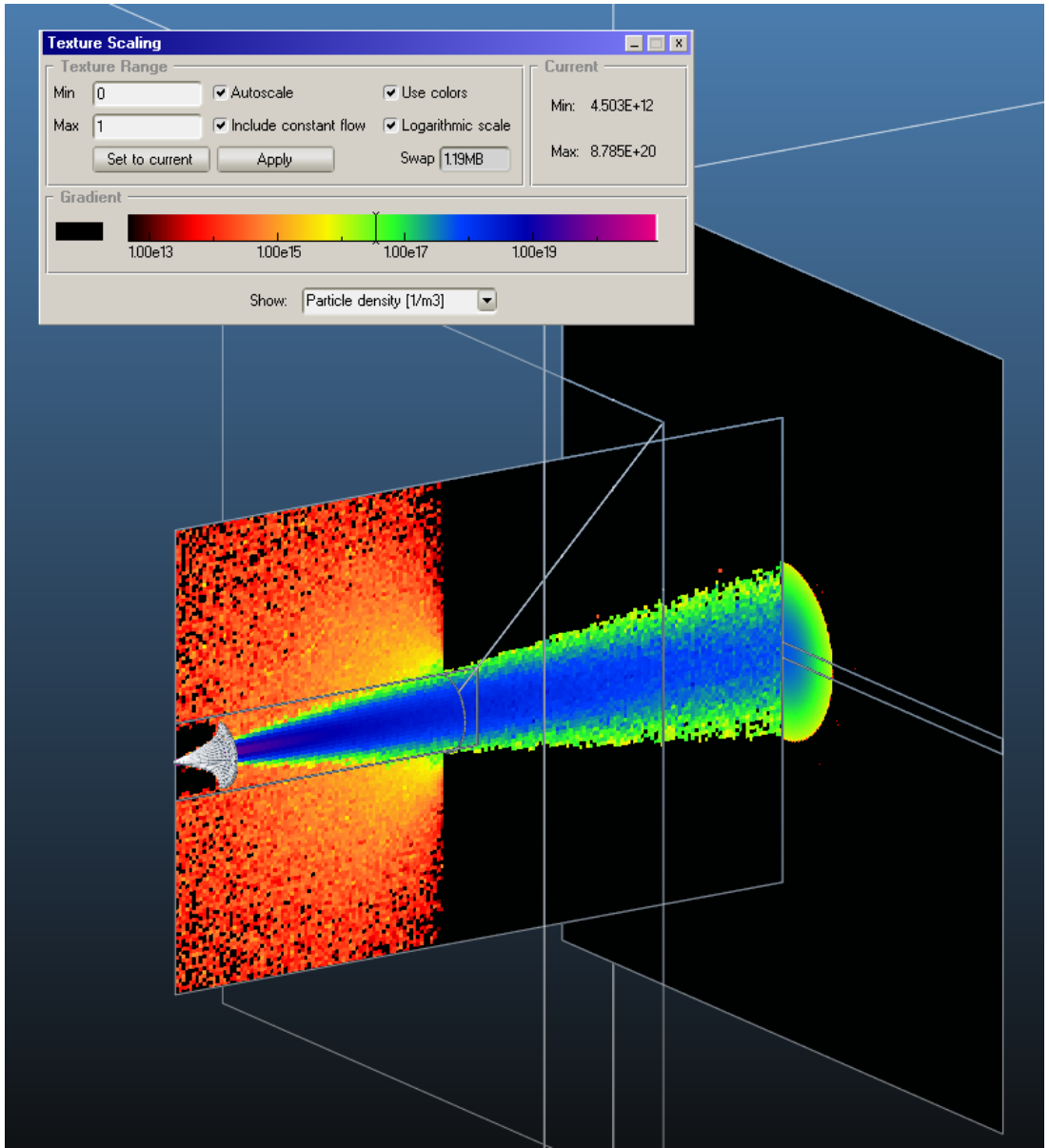

Profile plotter
Cos^500


Profile plotter
F#1430
Select [v] or type ->
1-1437
Show Facet
Add curve
Remove curve
Remove all
Normalize:
Pressure (mbar)
Log Y
Colorblind mode
Change linewidth:
2
-> Apply linewidth
Identify profiles in geometry
Profiles can only be used on rectangular facets.
Select plotted facets
-> Plot expression
Dismiss

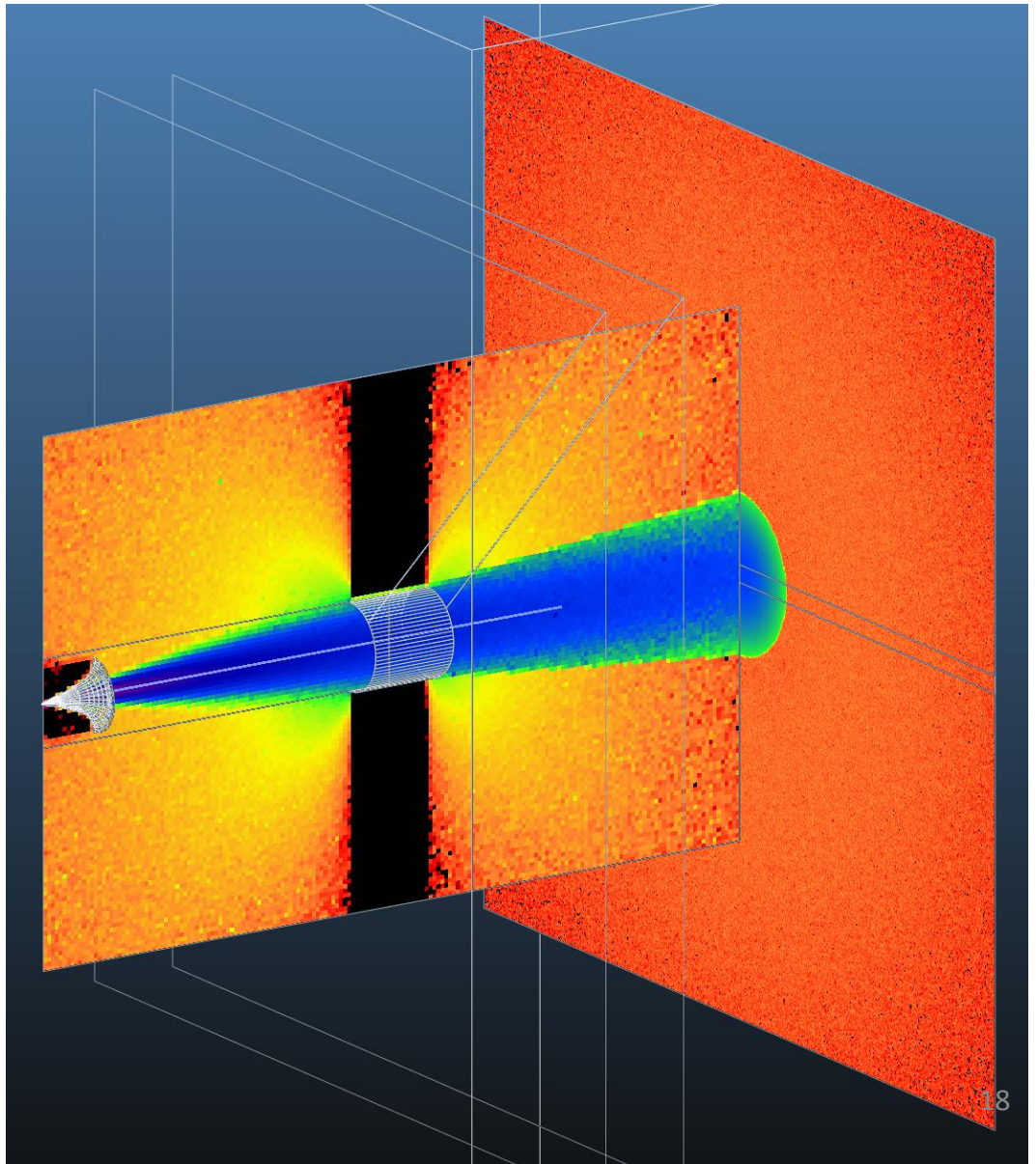
Towards a real-life system

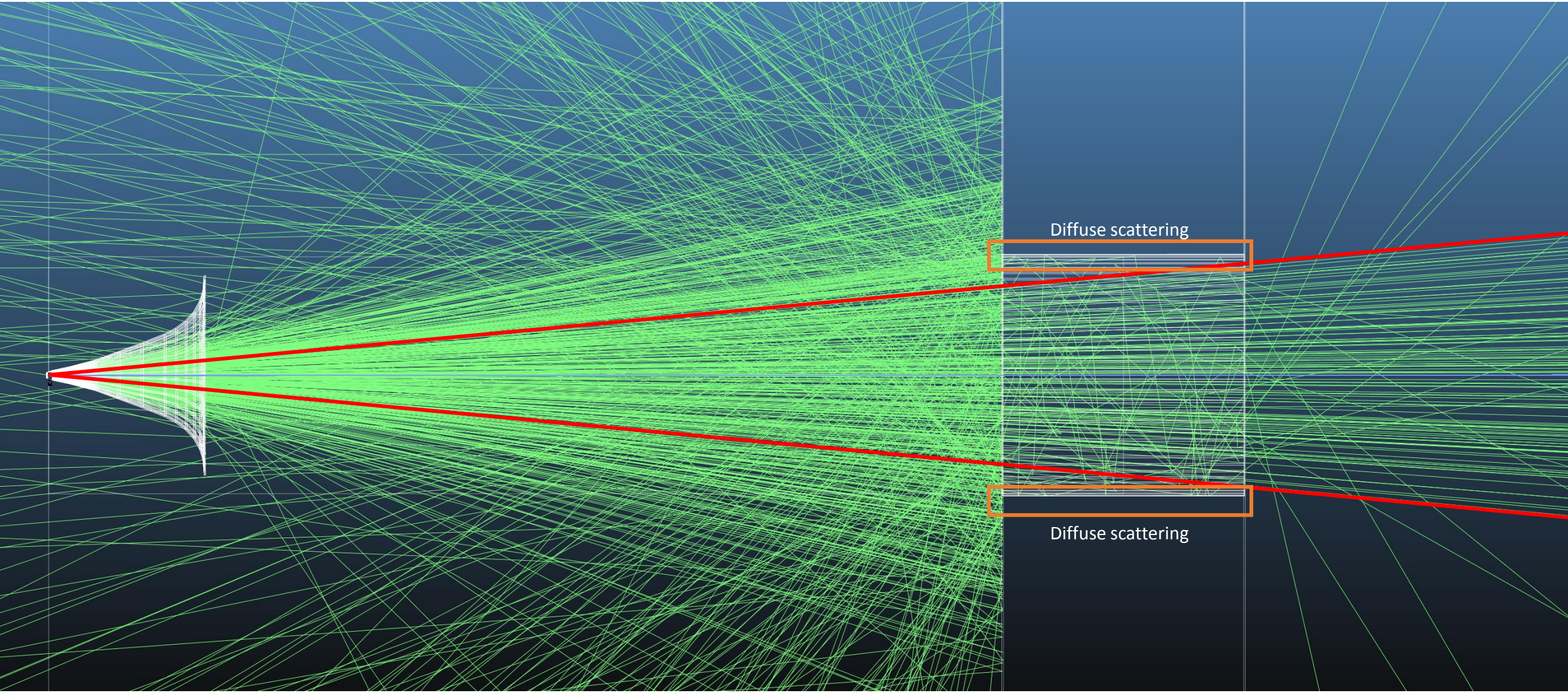


0-length skimmer 2

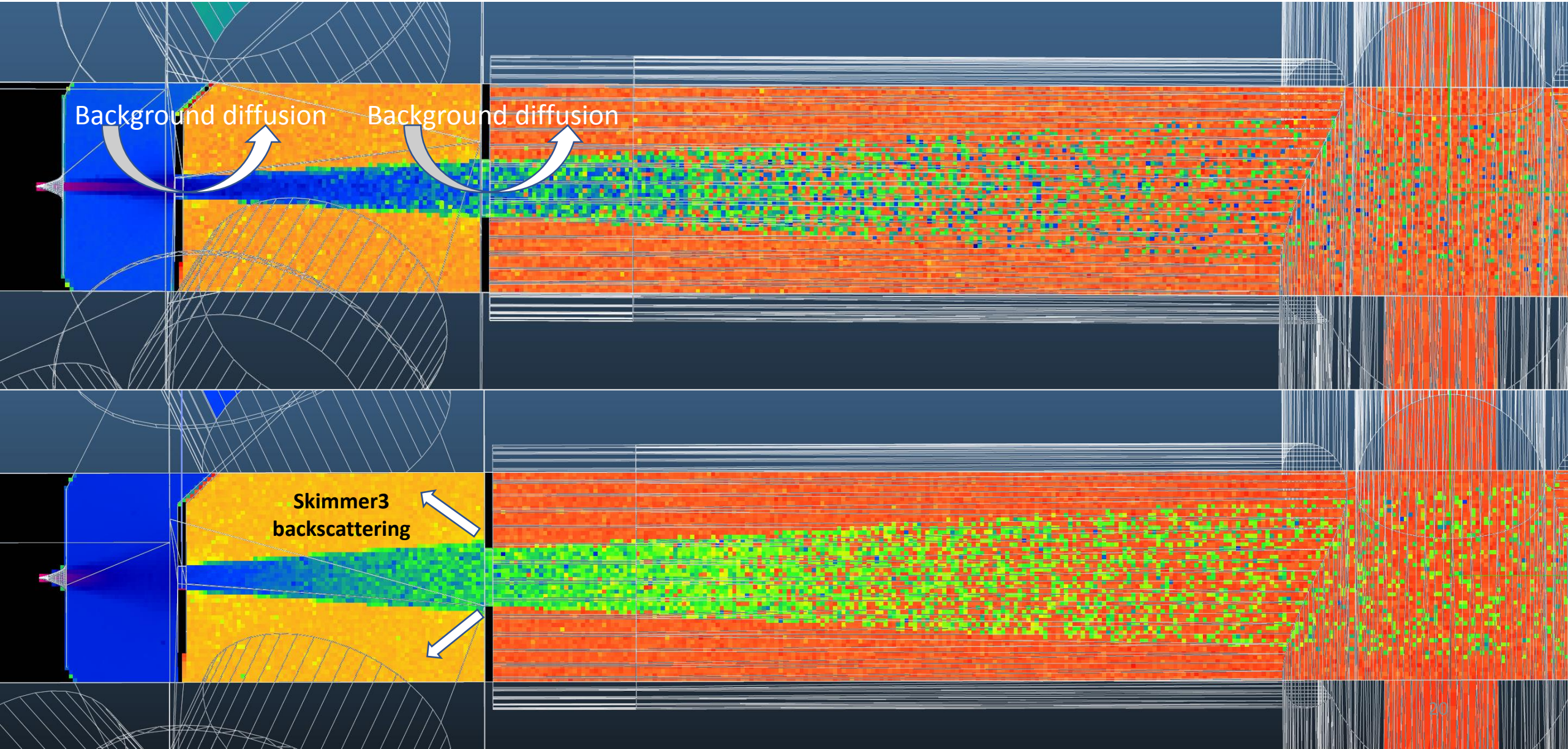


thick skimmer 2



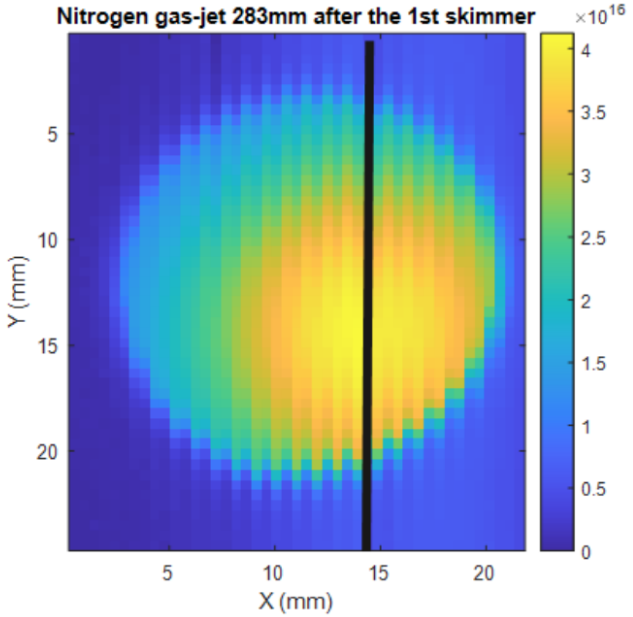

Diffuse scattering
Diffuse scattering

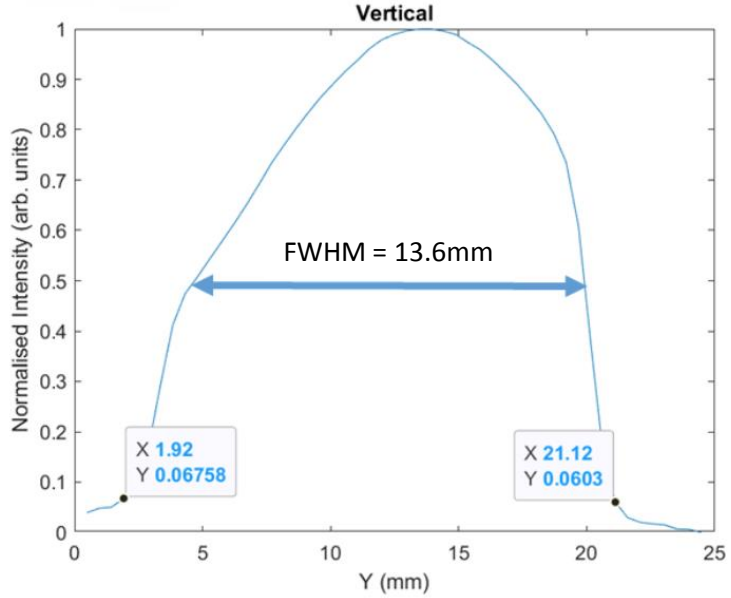
Full system: skimmer 3 and background diffusion



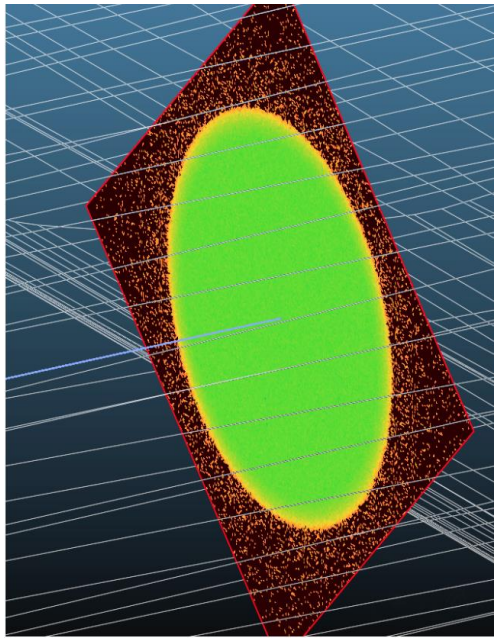
Is it possible to find a match?

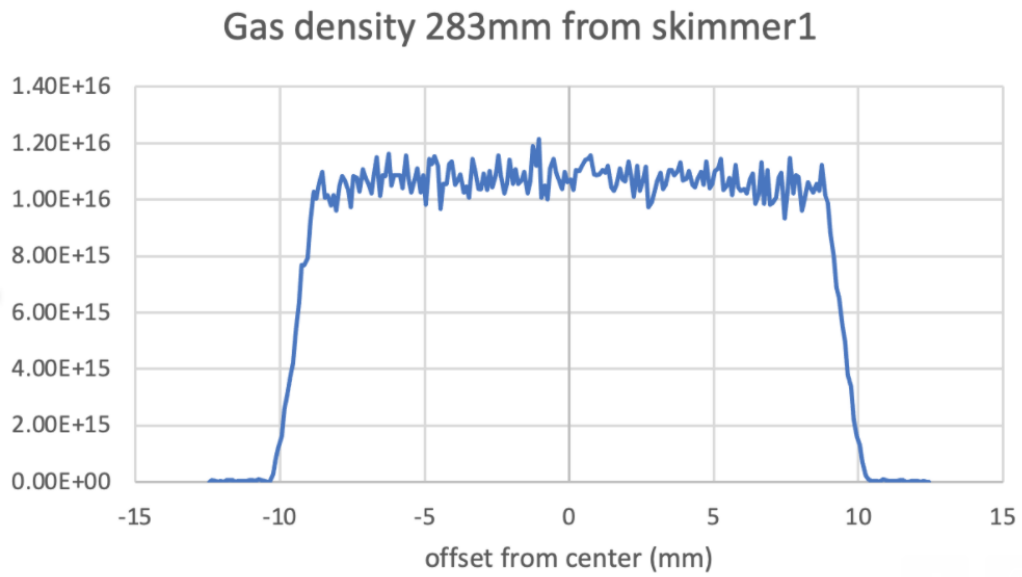
Experiment





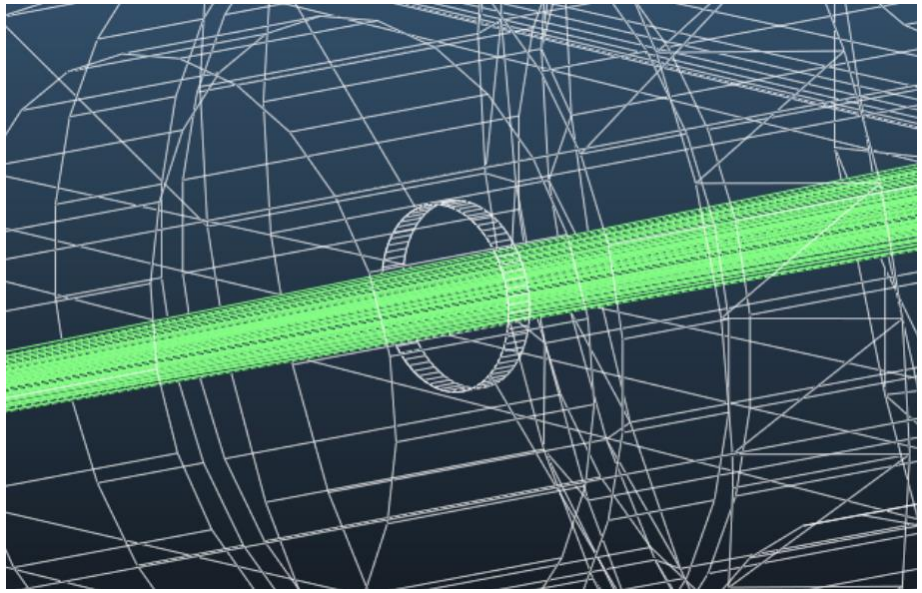
Simulation

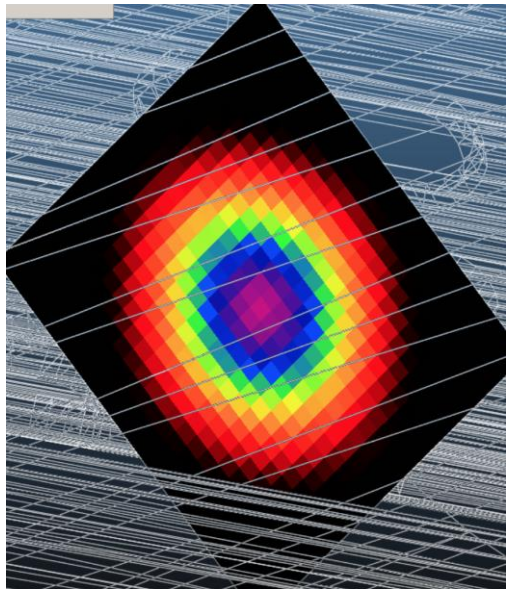




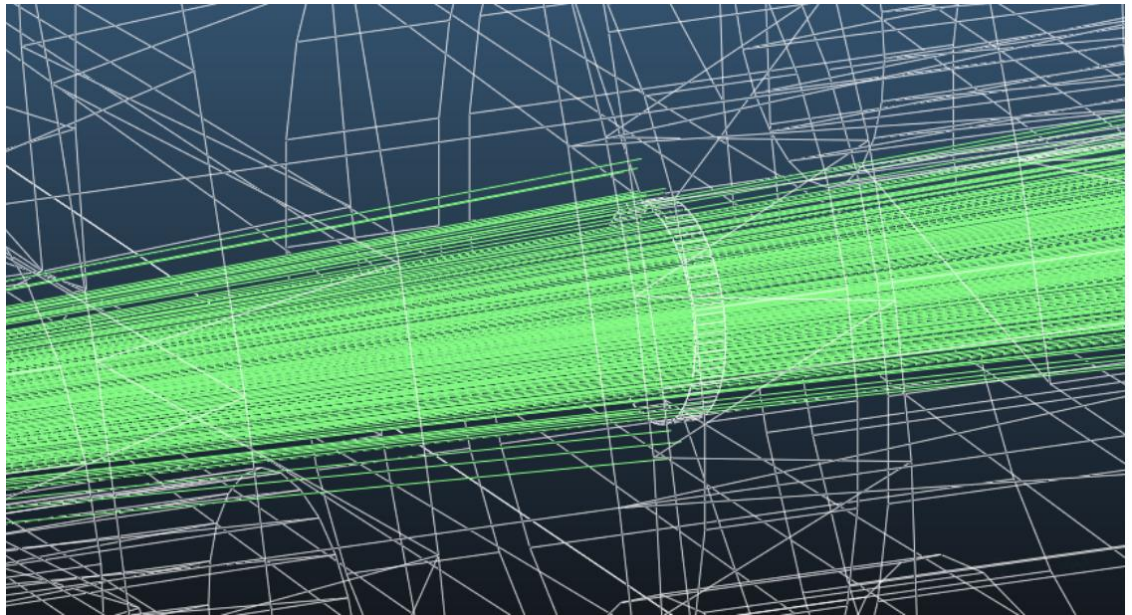
Reminder: jet uniformity determined by collimation

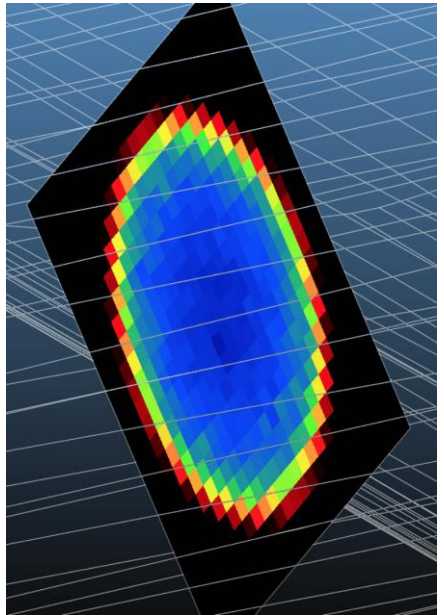
Collimated

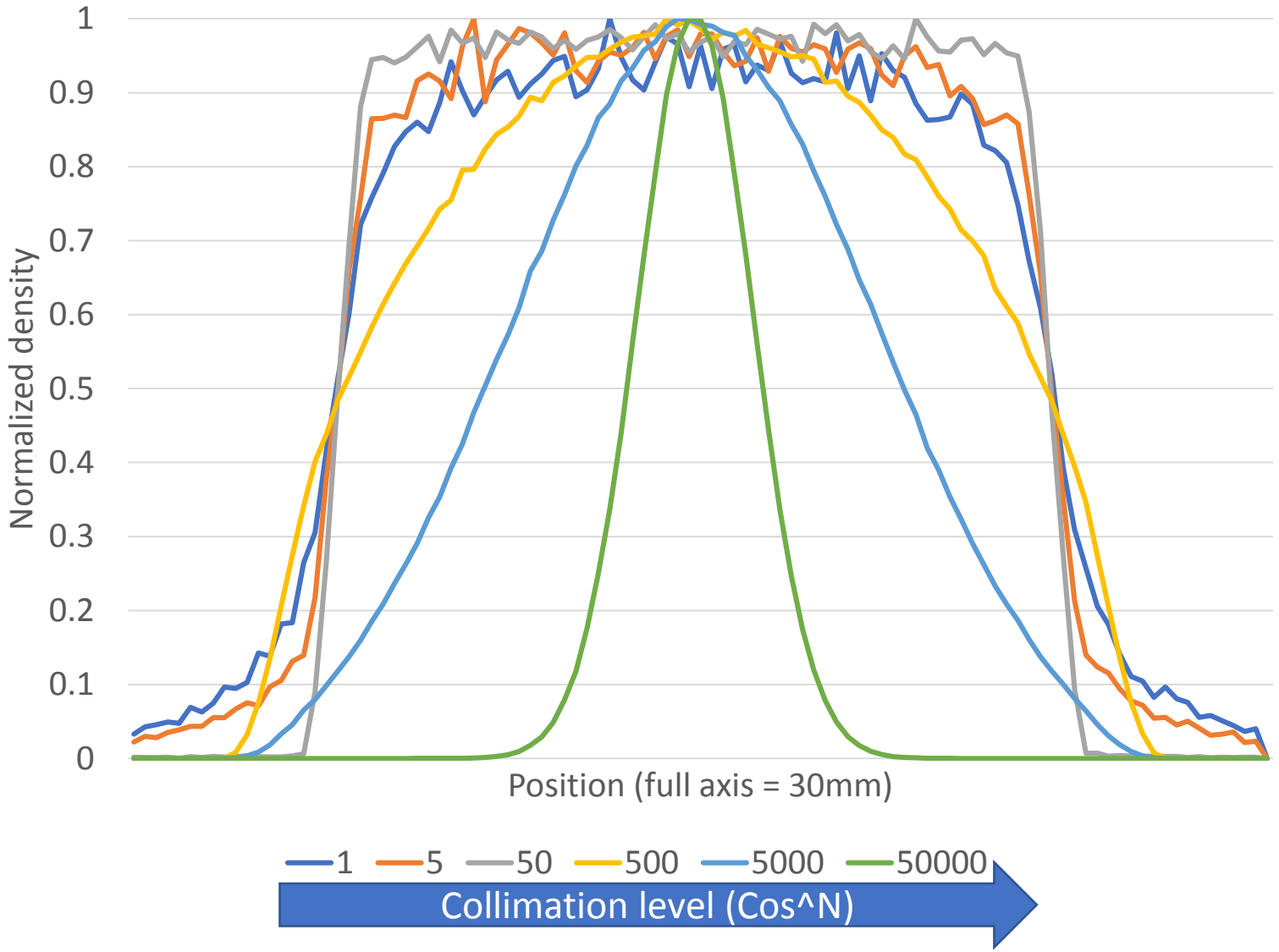


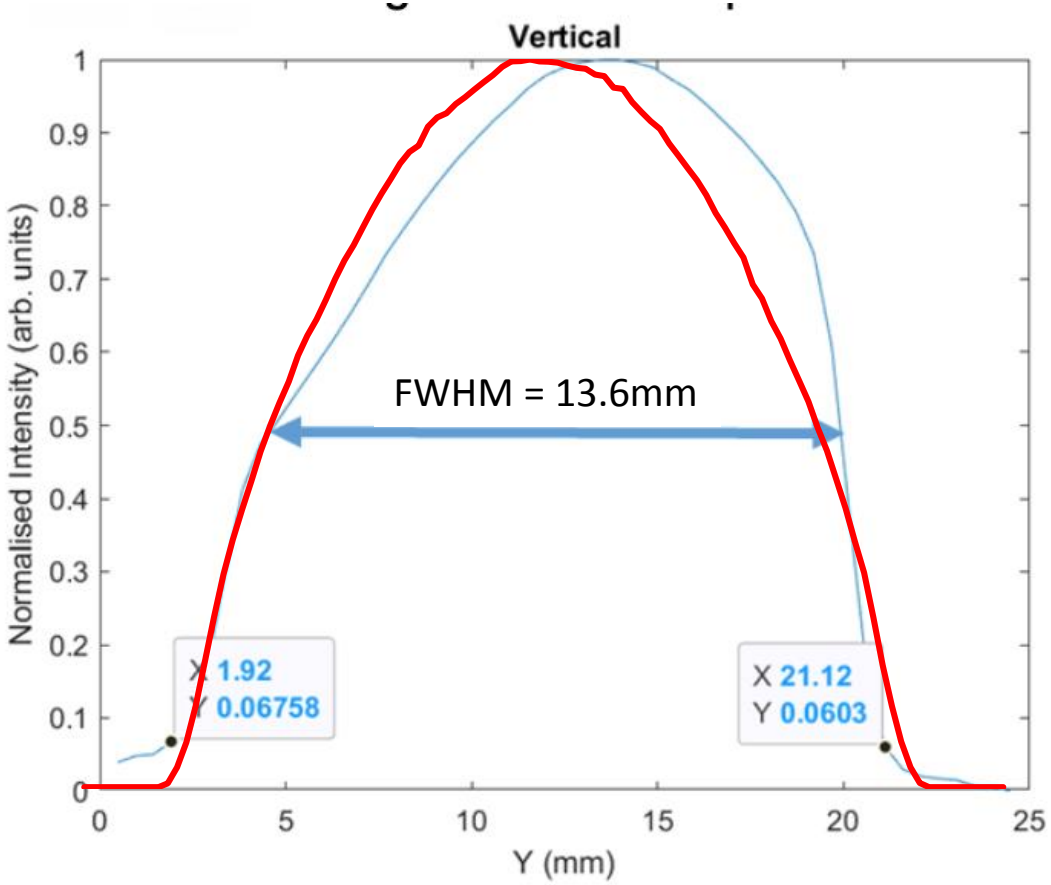


Divergent

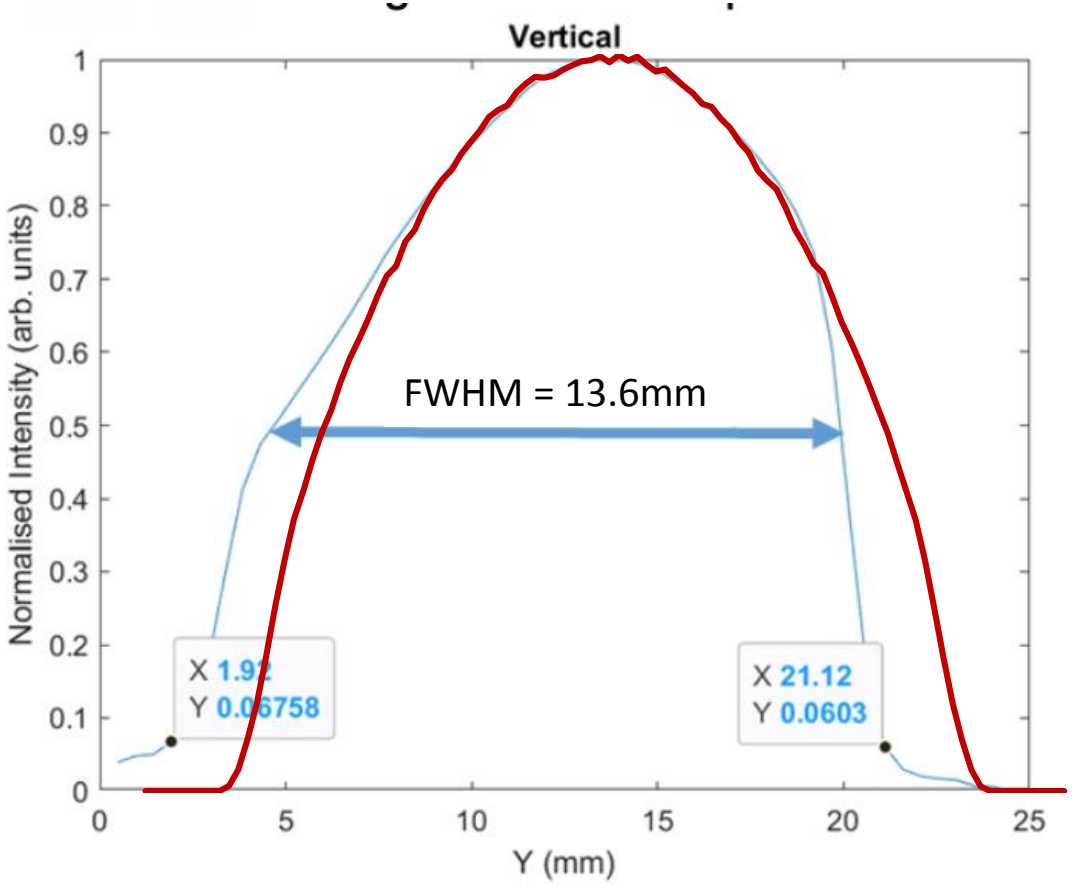





1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Normalized density
Position (full axis = 30mm)
1
5
50
500
5000
50000
Collimation level (Cos^N)

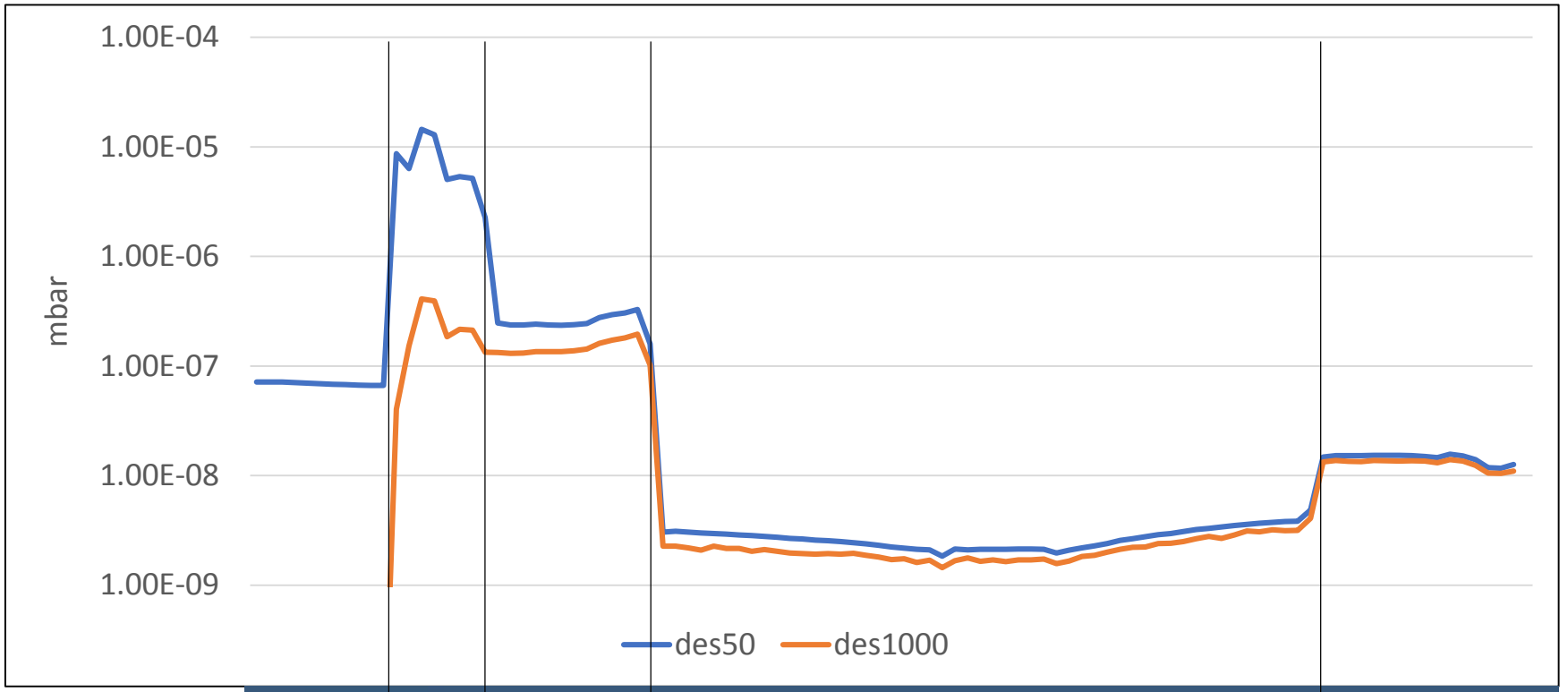


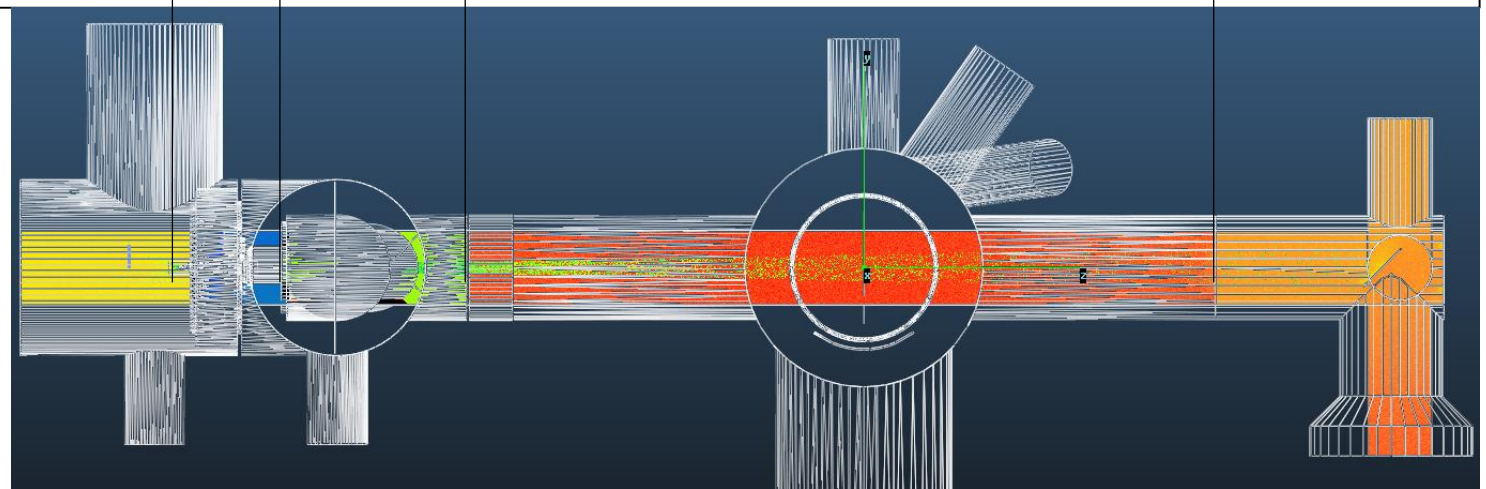
Cos^1000
fit to width



Cos^800
fit to peak

- So far, I assumed a more divergent jet at skimmer1 (Cos^50)
- Assuming collimation changes results slightly (lower BG)





Outlook

- First fit acceptable, redo after alignment
- Move from normalized to absolute densities
- Will give exact gas load, density and backgrounds for future calculations
  - Until now: scaled to 1E-9mbar background, 1E16/m3 jet density at IP