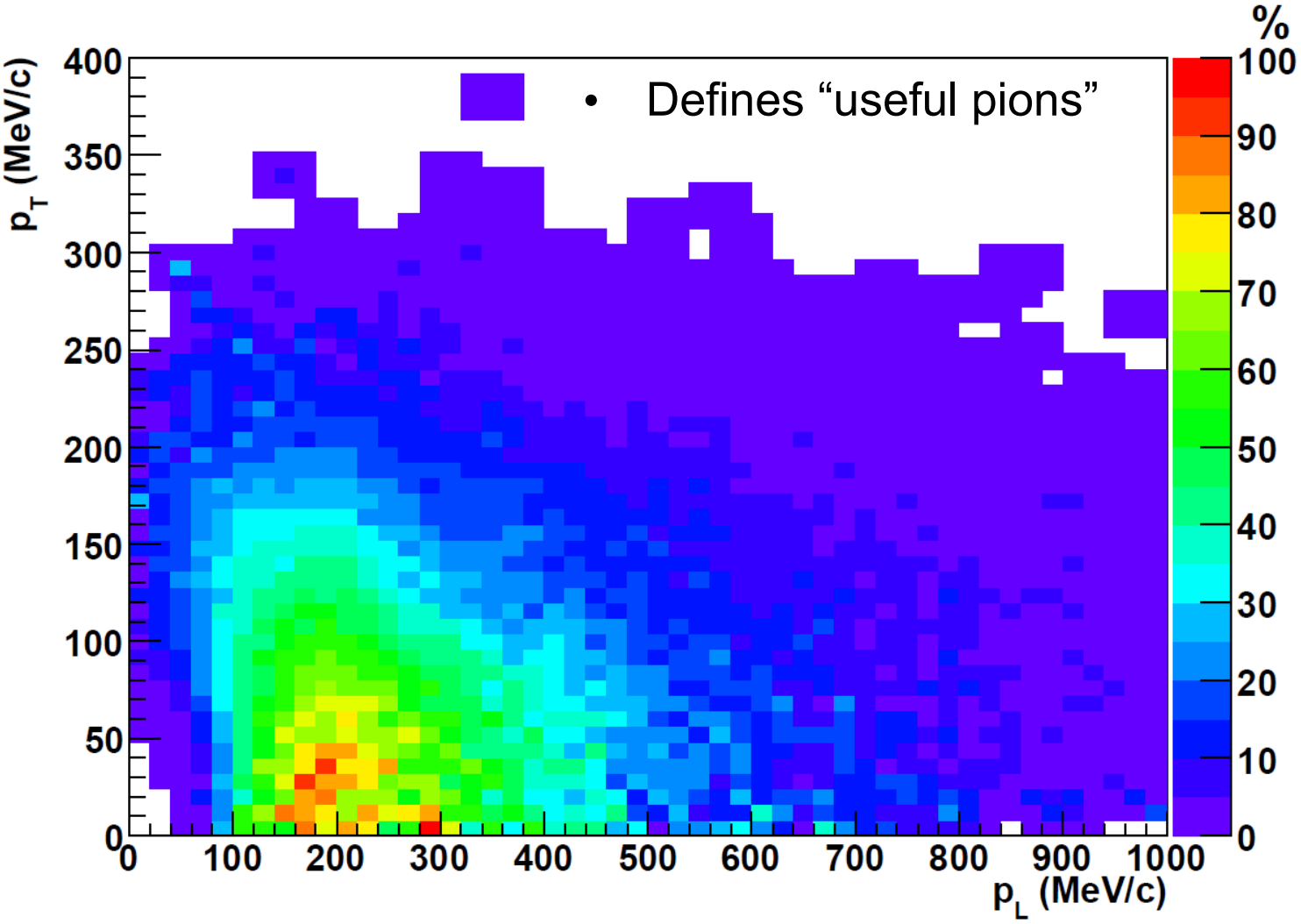
Tapered Pion Targets for the Neutrino Factory

Study using MARS15.07

Stephen Brooks / stephen.brooks@stfc.ac.uk
UKNF meeting, Daresbury Laboratory, November 2010

John Back's Probability Grid

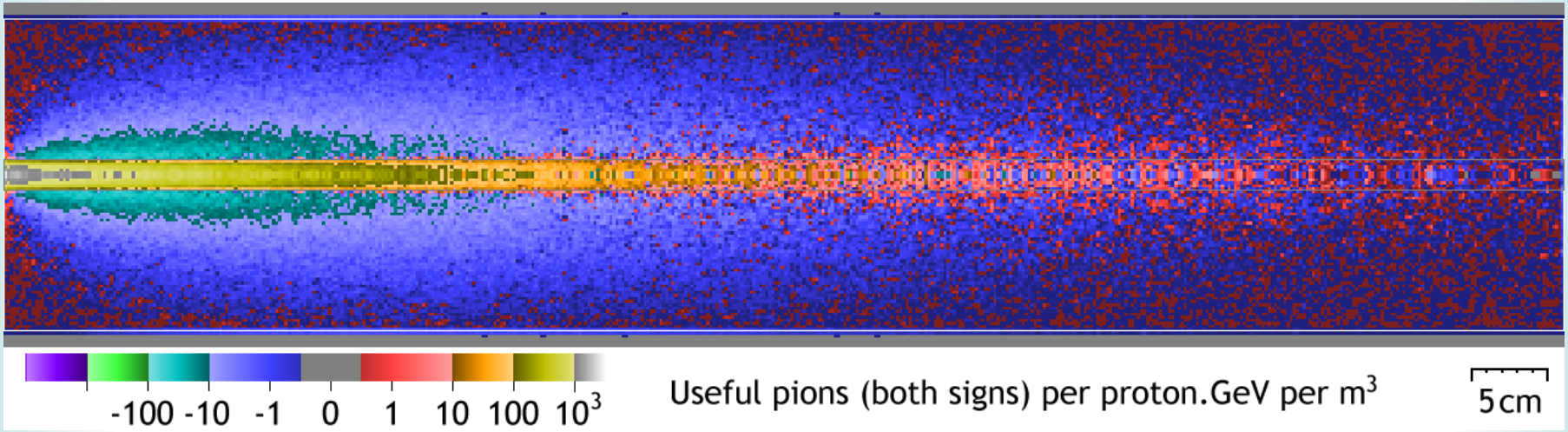


Stephen Brooks / stephen.brooks@stfc.ac.uk
UKNF meeting, Daresbury Laboratory, November 2010

Simulation Setup

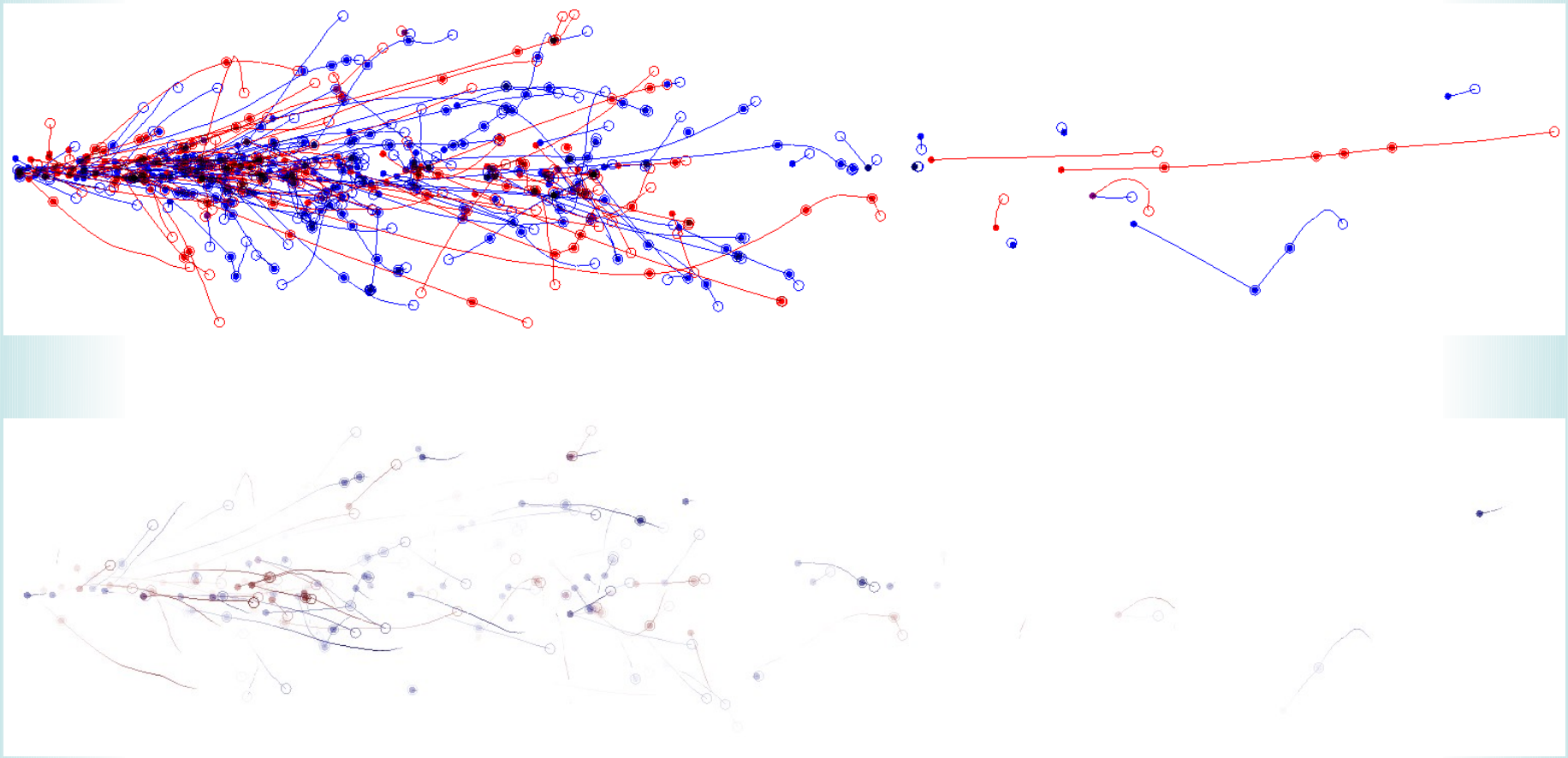
Parameter	Value
Proton energy	10 GeV
Beam distribution	Parallel, circular parabolic
Beam radius	1 cm ($r_{\max}$)
Target material	Tantalum
Magnetic field	20 T in z direction
Geometry volume	1 m$\times$10 cm radius cylinder
Geometry resolution	2 mm in z and r
Code used	MARS15.07
Hardware	100 CPU cores on SCARF
Protons simulated	10^6 (10^4 per core)

Useful Pion Yield Balance



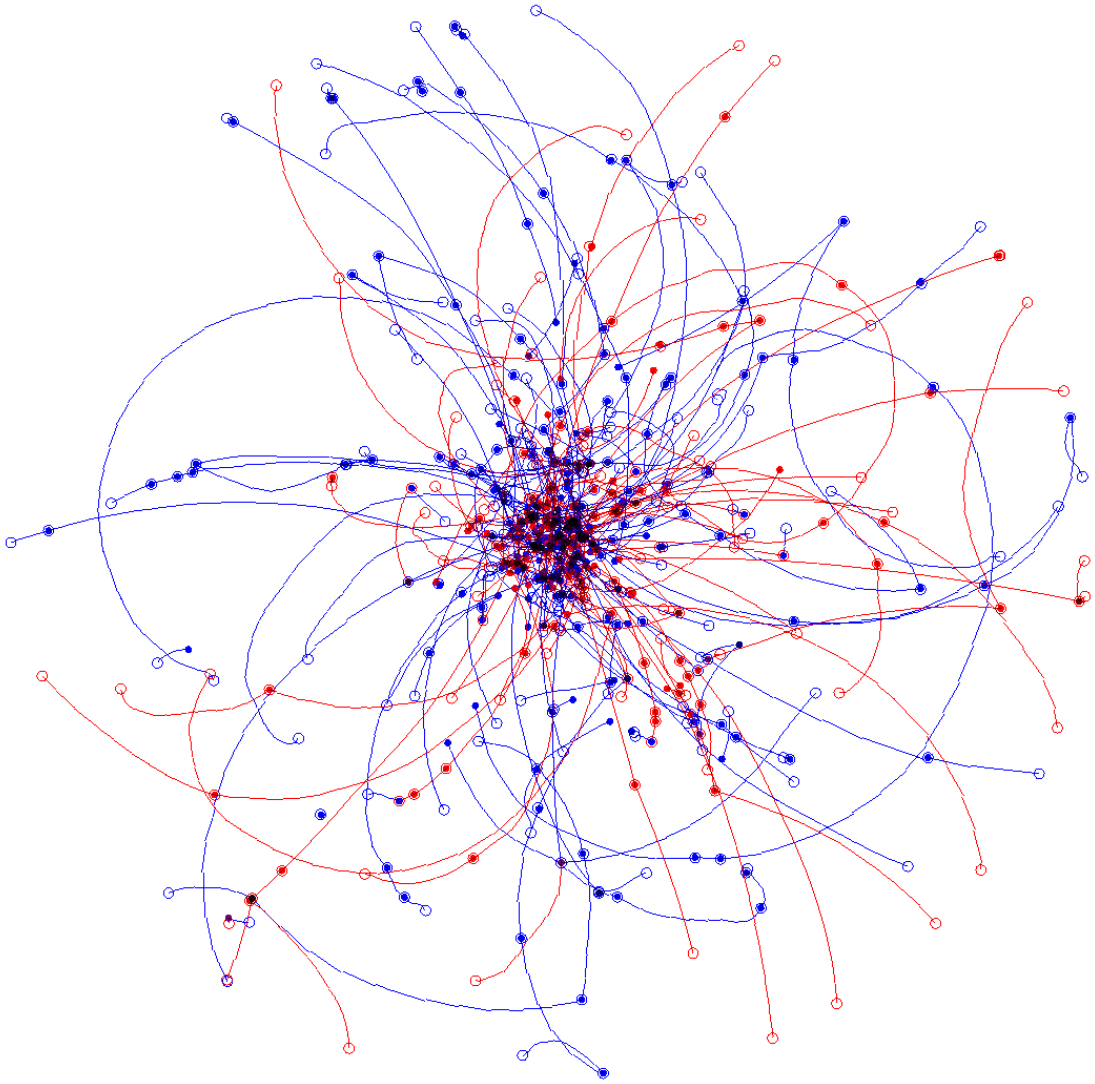
Stephen Brooks / stephen.brooks@stfc.ac.uk

Produced/Absorbed Pion Tracks



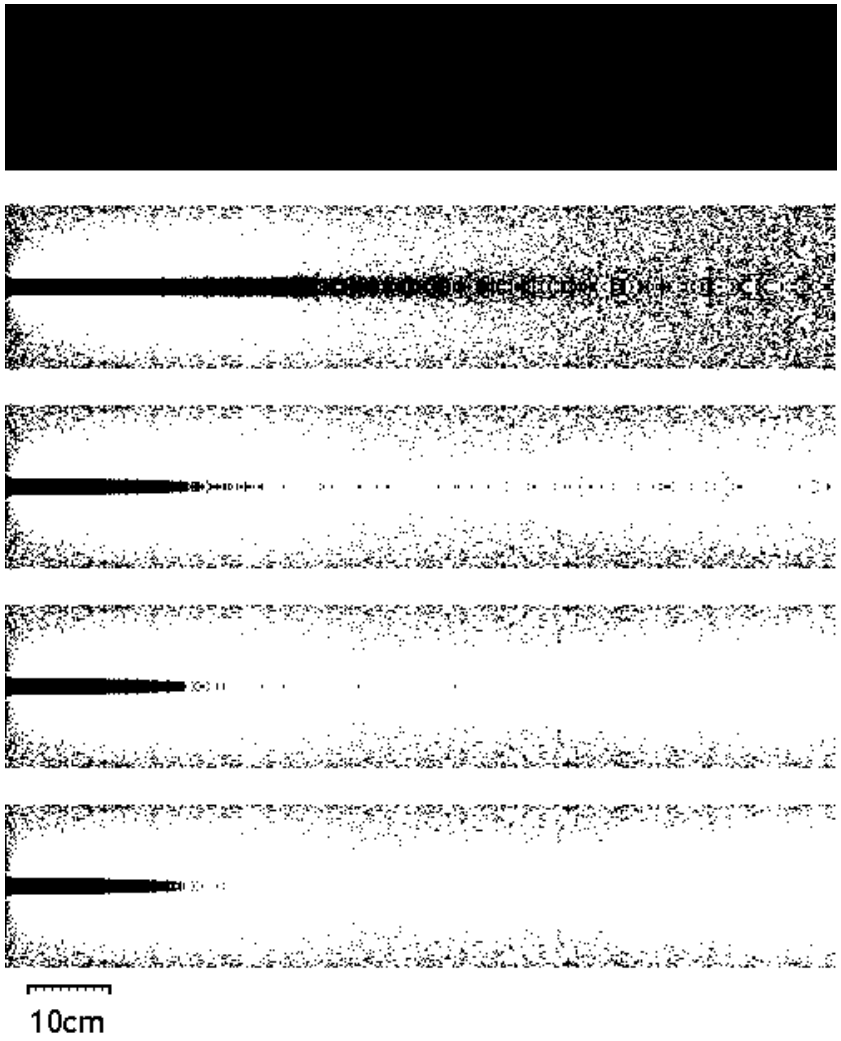
Stephen Brooks / stephen.brooks@stfc.ac.uk
UKNF meeting, Daresbury Laboratory, November 2010

End-on View



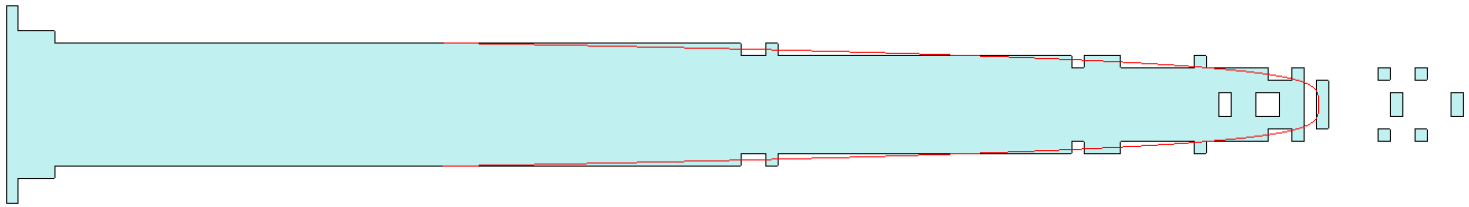
Stephen Brooks / stephen.brooks@stfc.ac.uk
UKNF meeting, Daresbury Laboratory, November 2010

Removal of Absorbing Areas



Stephen Brooks / stephen.brooks@stfc.ac.uk

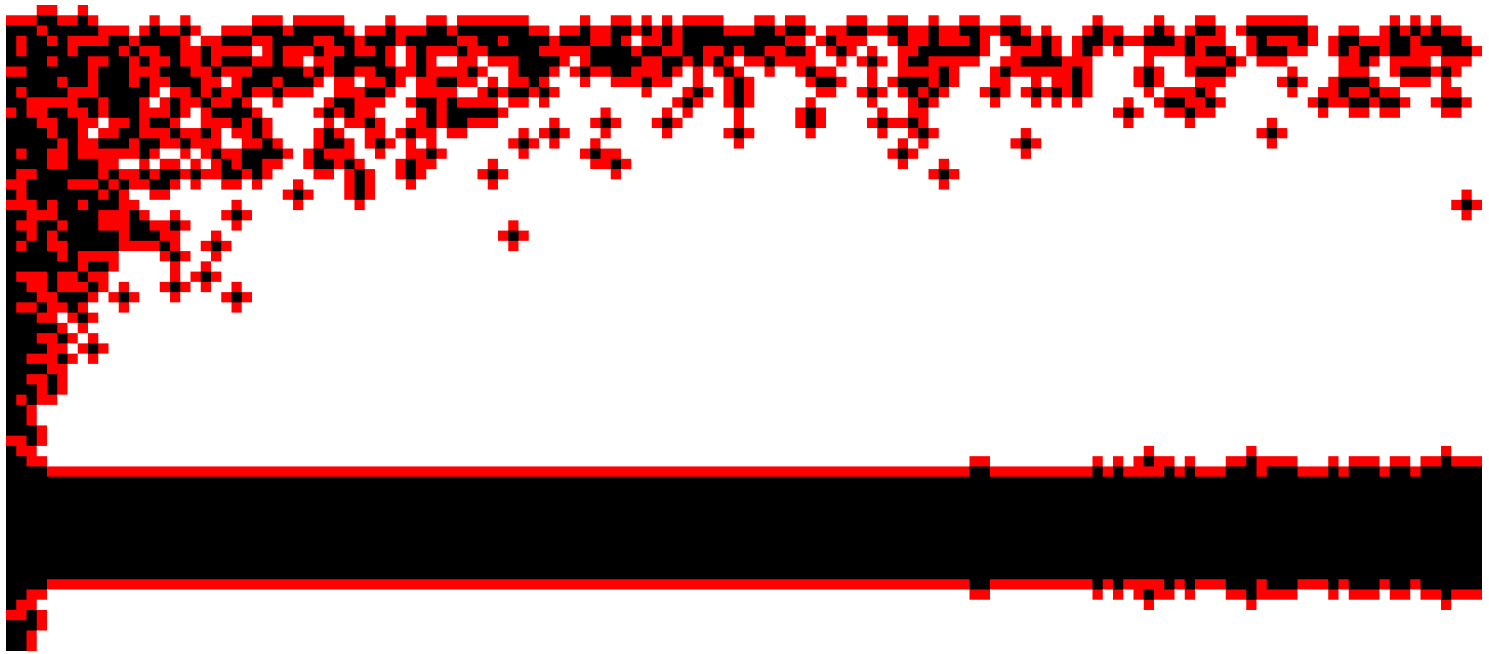
Fit to Final (4th iterate) Shape



$$r_{[\mathrm{cm}]} = \sqrt[4]{\min\{1, 1.5 - 0.07 z_{[\mathrm{cm}]}\}}$$

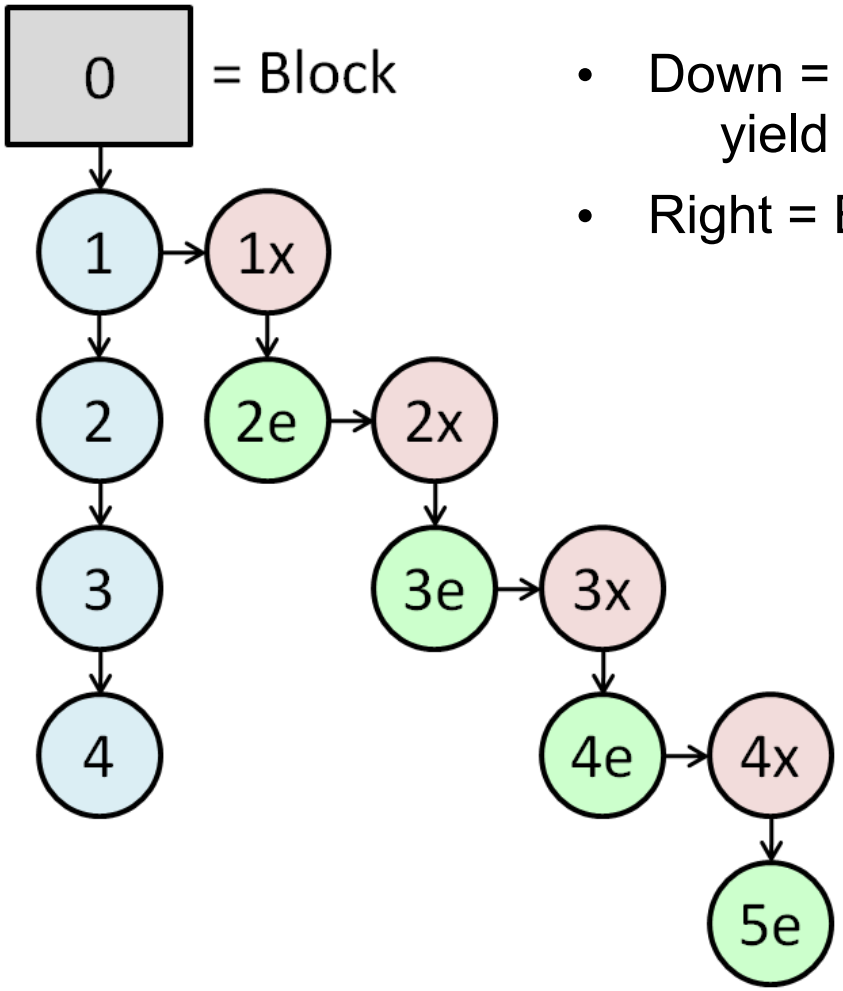
Stephen Brooks / stephen.brooks@stfc.ac.uk

Material Expansion Algorithm



Stephen Brooks / stephen.brooks@stfc.ac.uk
UKNF meeting, Daresbury Laboratory, November 2010

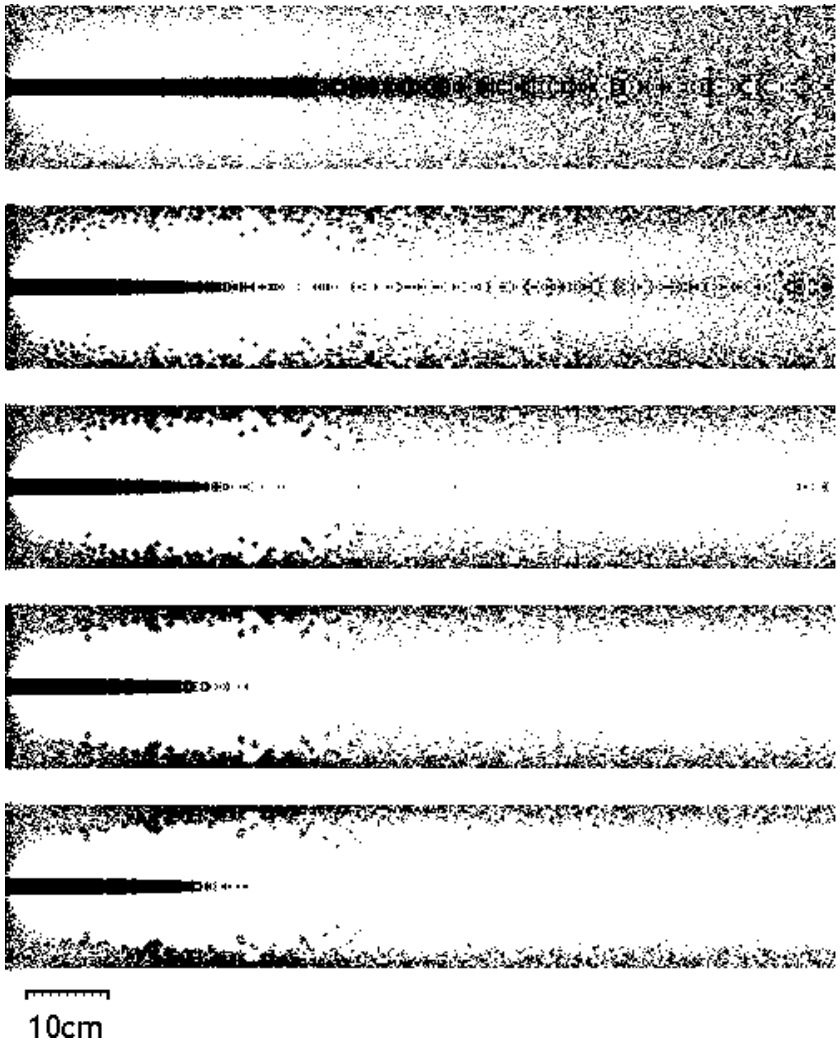
Material Shape Sequences



- Down = Remove negative yield areas
- Right = Expand material

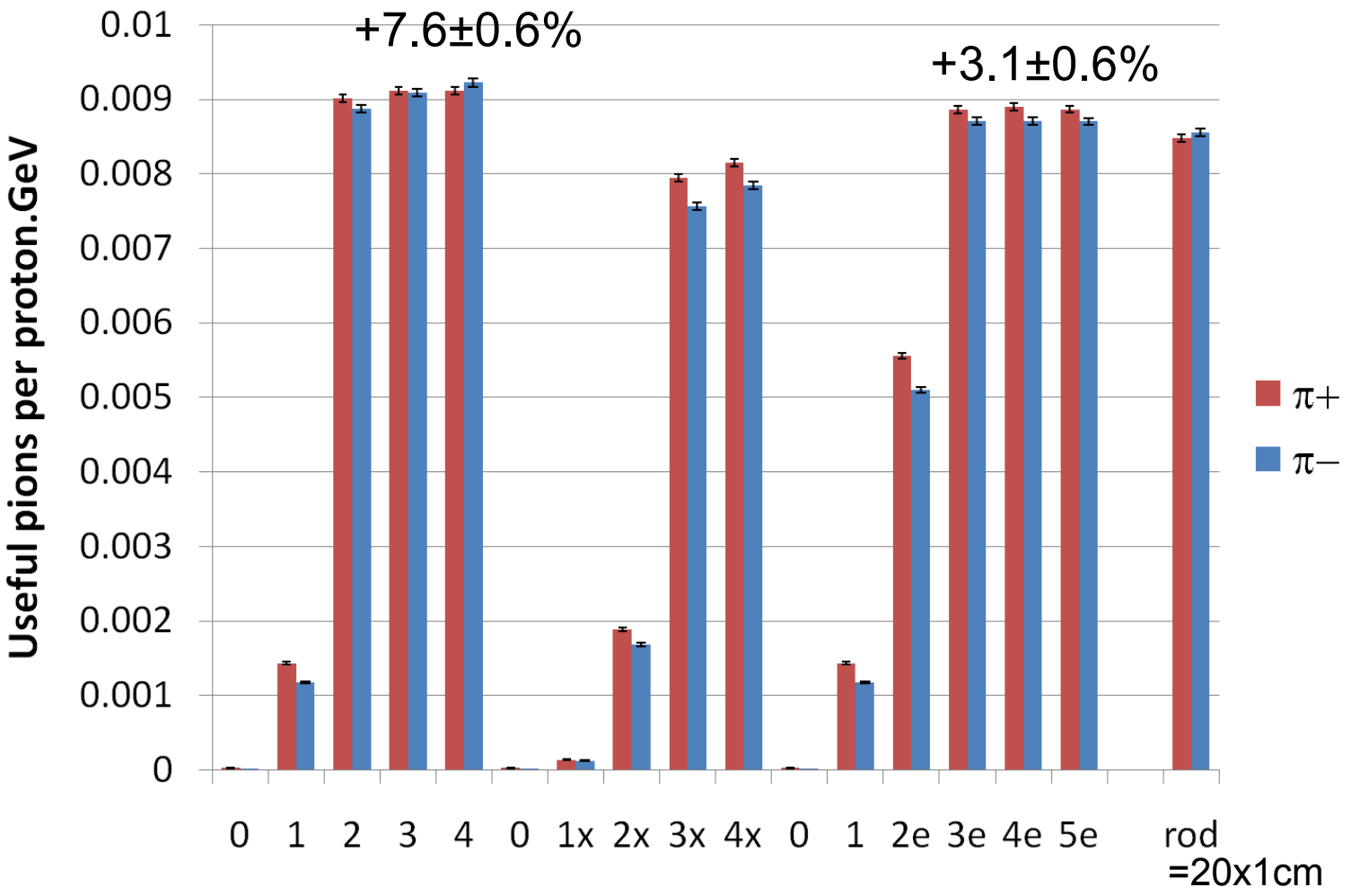
Stephen Brooks / stephen.brooks@stfc.ac.uk

Removal and Expansion



Stephen Brooks / stephen.brooks@stfc.ac.uk

Resultant Useful Pion Yields



Stephen Brooks / stephen.brooks@stfc.ac.uk
UKNF meeting, Daresbury Laboratory, November 2010

Reference

- *"Optimising Pion Production Target Shapes for the Neutrino Factory"*, S. J. Brooks, Proc. IPAC'10
- Poster and paper downloadable from http://stephenbrooks.org/ral/report/