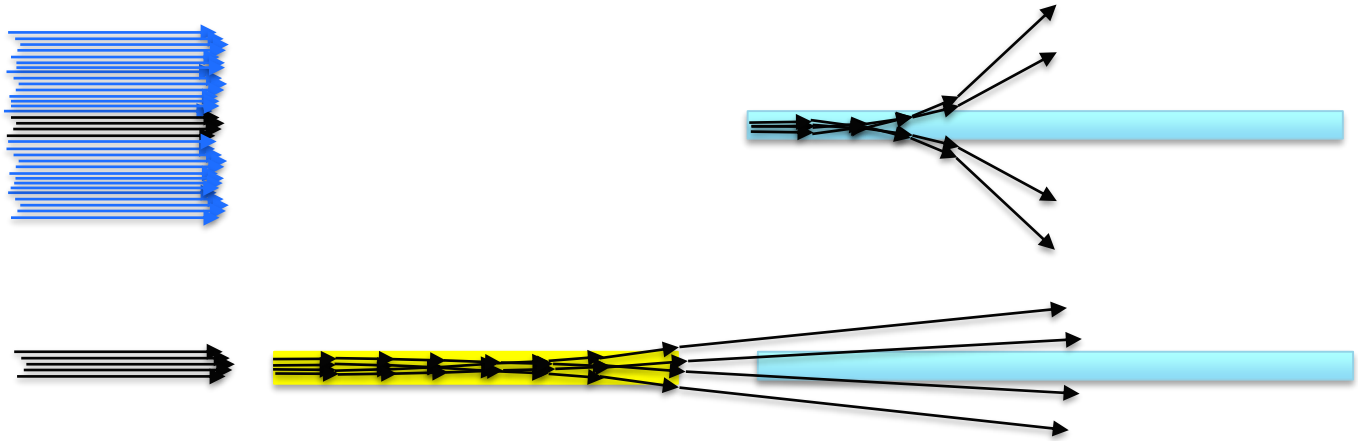
Simple Considerations for the ESS Diffuser

Vladimir Nagaslaev

2nd SE Workshop, CERN

10 November, 2017

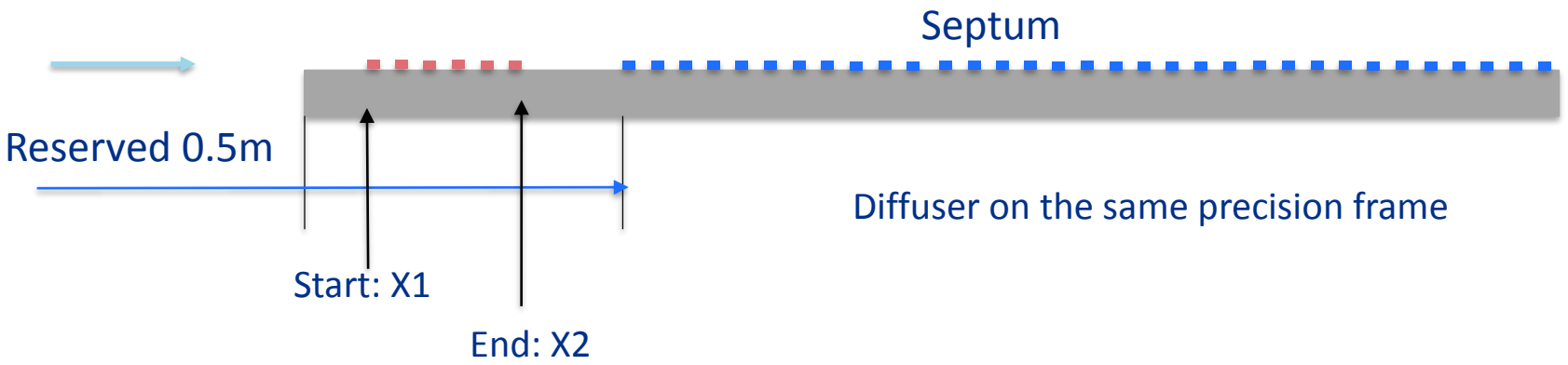
Simplest geometry for the diffuser



Pre-scattering:

- Losses predominantly occur for the small portion of the beam that passes through the septum plane at low angle
- This portion can be deflected to a small angle by the diffuser plane in front of the septum plane
- Pre-scattering must be small to not cause losses
- Works best with low density materials (e.g. Carbon, Titanium)
- Higher density foils also can be used (Mo,W)
- Effect of pre-scattering is largest for the foil septa

Simple simulations for the diffuser

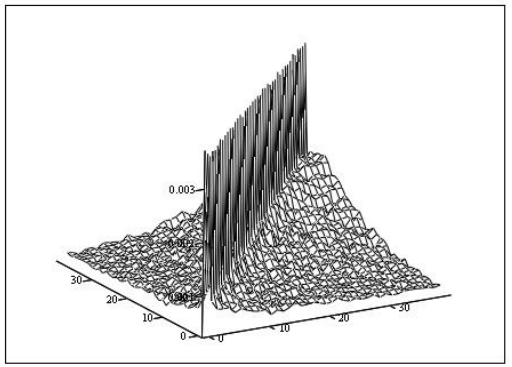


Diffuser on the same precision frame

What is an optimal diffuser geometry?

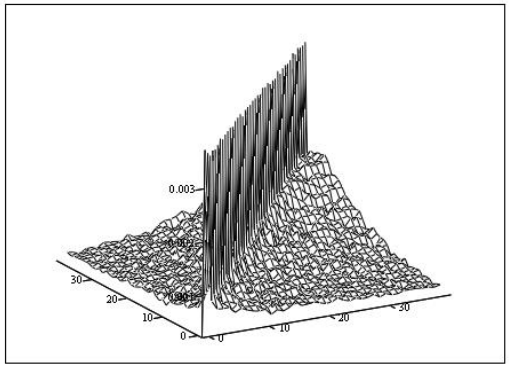
Minimizing the final RMS scattering angle:

- For every X1, X2:
- Track a beam through D and septum
- Choose D density to minimize final rms angle
- Continue scanning X1 and X2



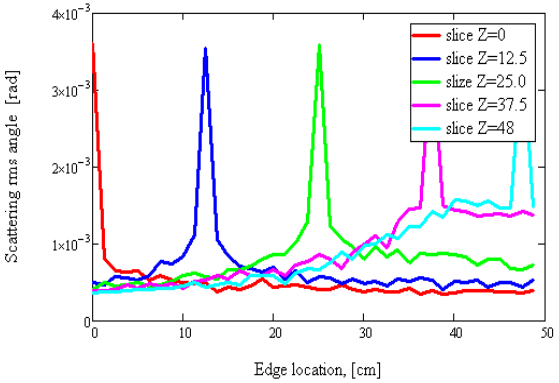
Map of scattering angle rms vs X1 and X2

Simple simulations for the diffuser



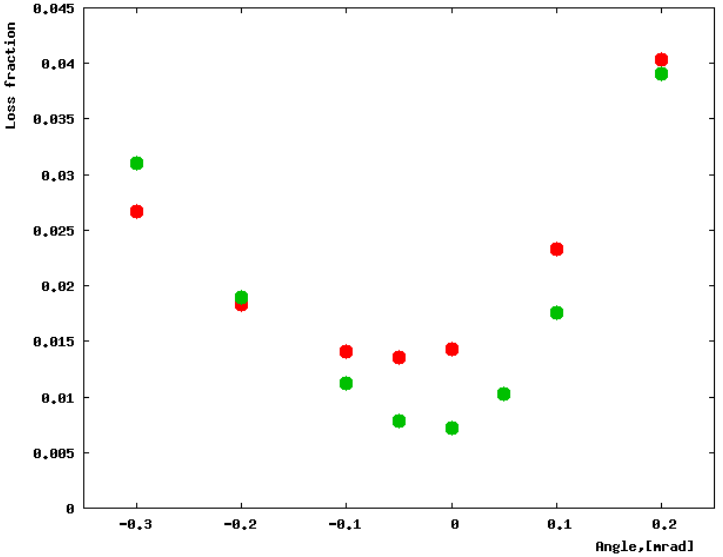
D

Map of rms angle vs X1 and X2



Slicing the map across X1 or X2

- Material is most effective at X1=0, but best is to fill the entire length*
- The minimum density is always optimal**
- High density foils work well if sparsely populated (Mo)
- Titanium foils is a good choice



50u foils, 2.6mm spacing:
Green– with diffuser; Red – without diffuser