EUROPEAN SPALLATION SOURCE

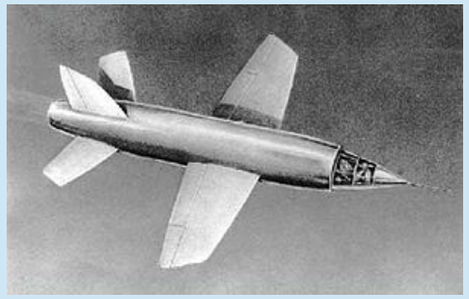
General Update on Neutron Optics Group

12th February 2013 – Neutron Optics TAP #3 Meeting

Phil Bentley

New Thinking Required

Sub-sonic

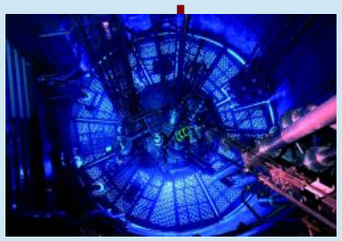


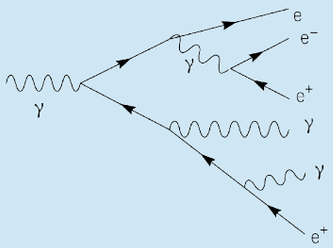
Supersonic

Space

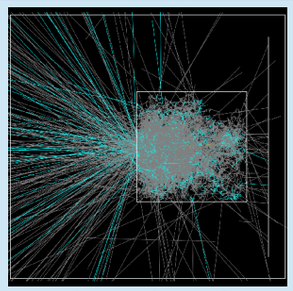
Warp drive(!)

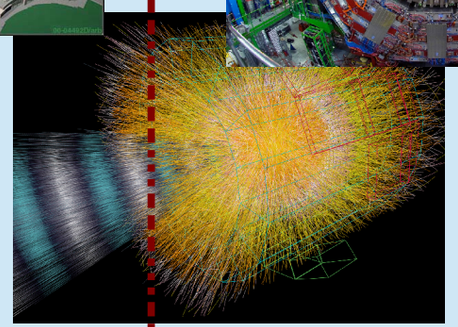
Fission (<20 MeV)



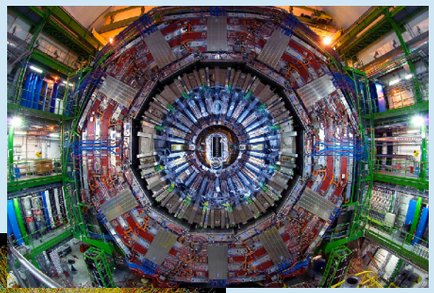


EM Showers Only
(<GeV)



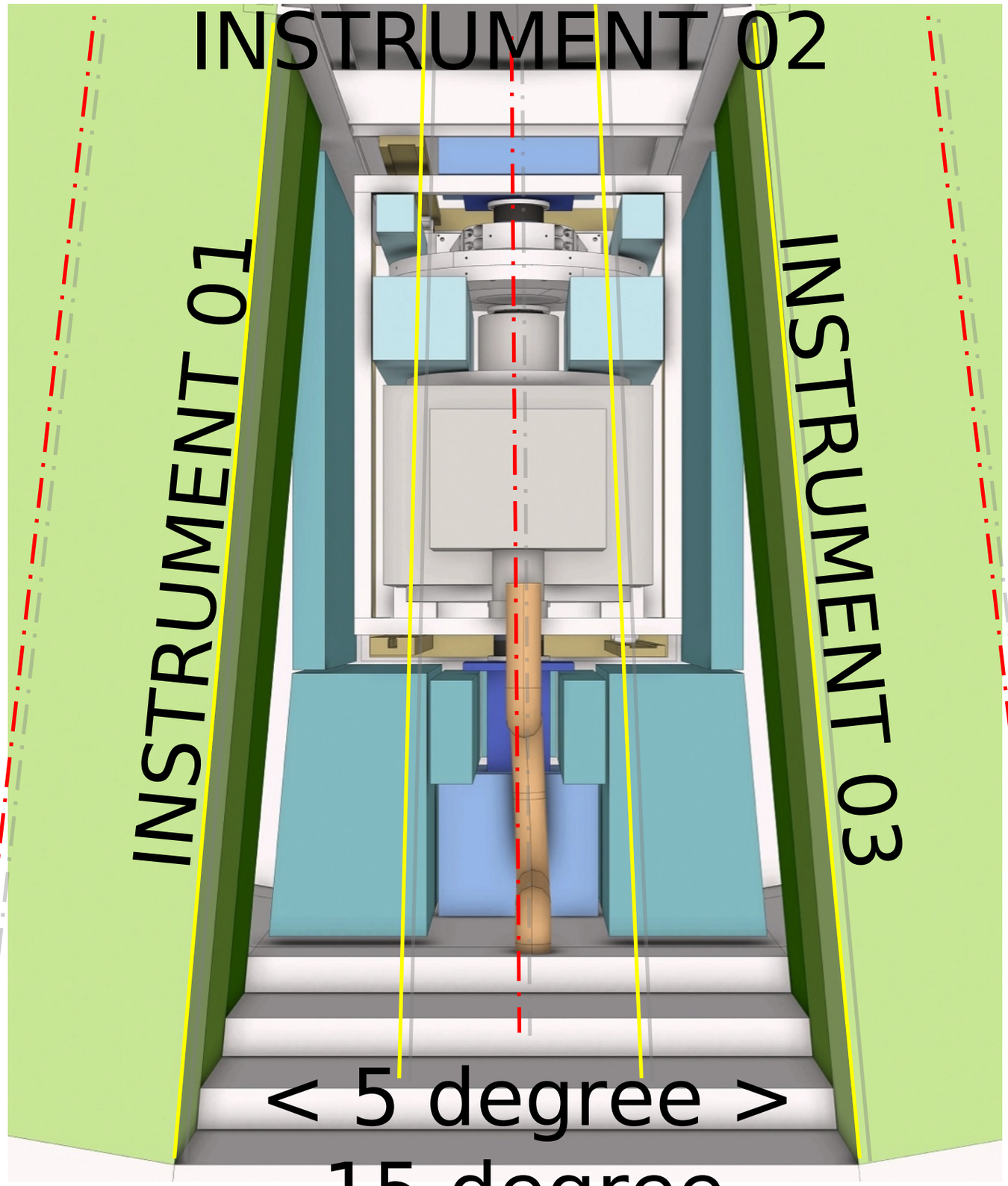


Hadronic Showers
(>~GeV)



Probing Standard Model
(Tev)

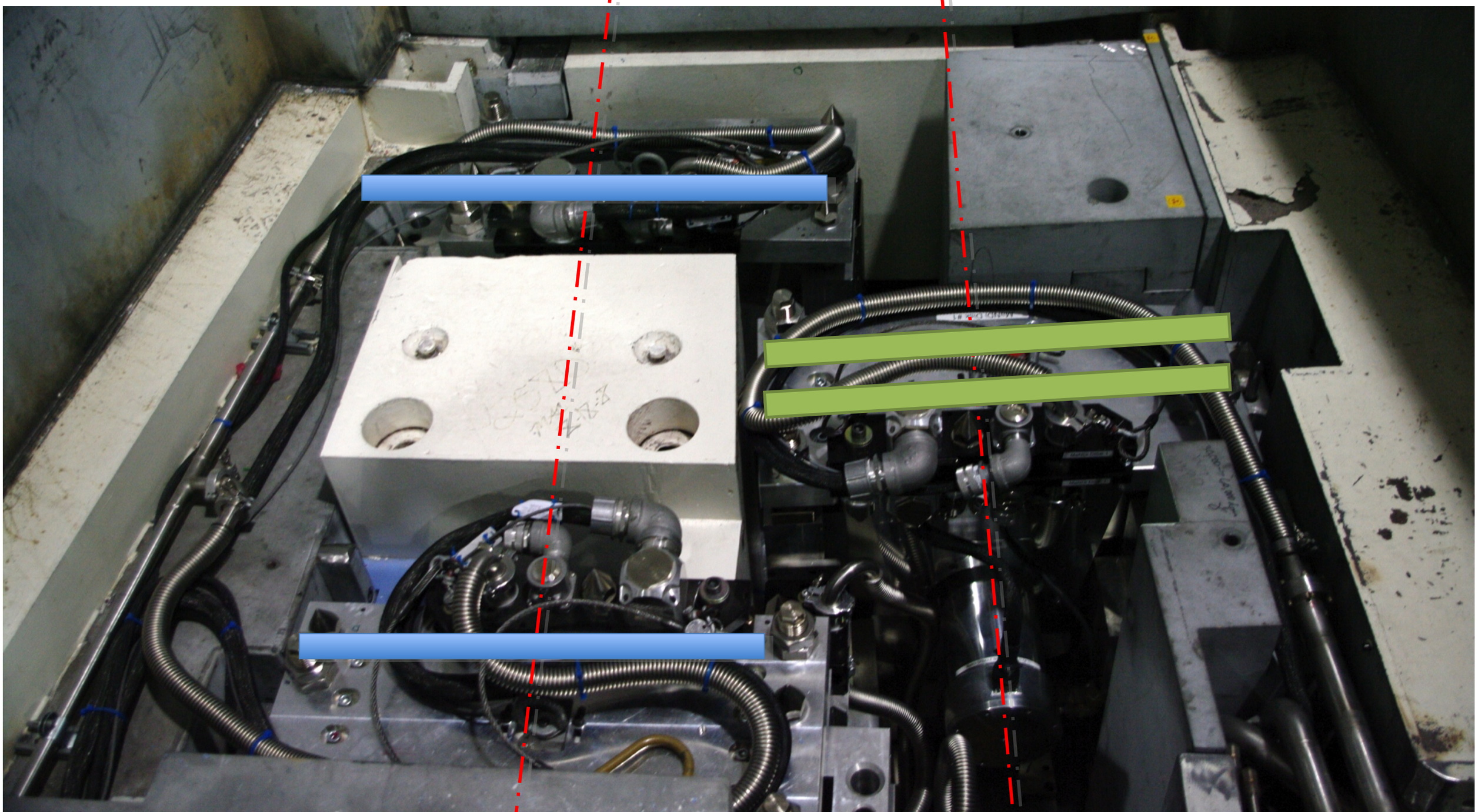
Beam spacing - preliminary conclusions



- A 10 degree slot width is the minimum to avoid staggering choppers.

- A 15 degree slot width is the minimum required to ensure instruments independence and install some lateral shielding

The real thing @ SNS
7.5 degree separation
Staggered Chopper installation



Angular Separation

- Short instruments minimum 10, ideal 15
- Medium instrument sector (60-80 m) 10 degrees
- Long instrument sector (around 150m) 5 degrees is not yet clear, somewhere between 5 and 7.5 seems feasible.
- Expect a change request in around 6 weeks time

Primary Shutter Stakeholder Consultation

- All stakeholders democratically created evaluation criteria, evaluation scores, and weighting factors to choose most important factors

- Stakeholders included neutron instrument scientists, target division, neutron optics group, instrument engineering, conventional facilities.

- Options were:
  - Primary shutter inside monolith
  - Primary shutter outside monolith
  - Service shutter (current baseline)
  - No shutter

Primary Shutter Stakeholder Consultation

- Two evaluation matrices, one for operational aspects (top), the other for project aspects (bottom)

- Most important factor was ease of beam port activation

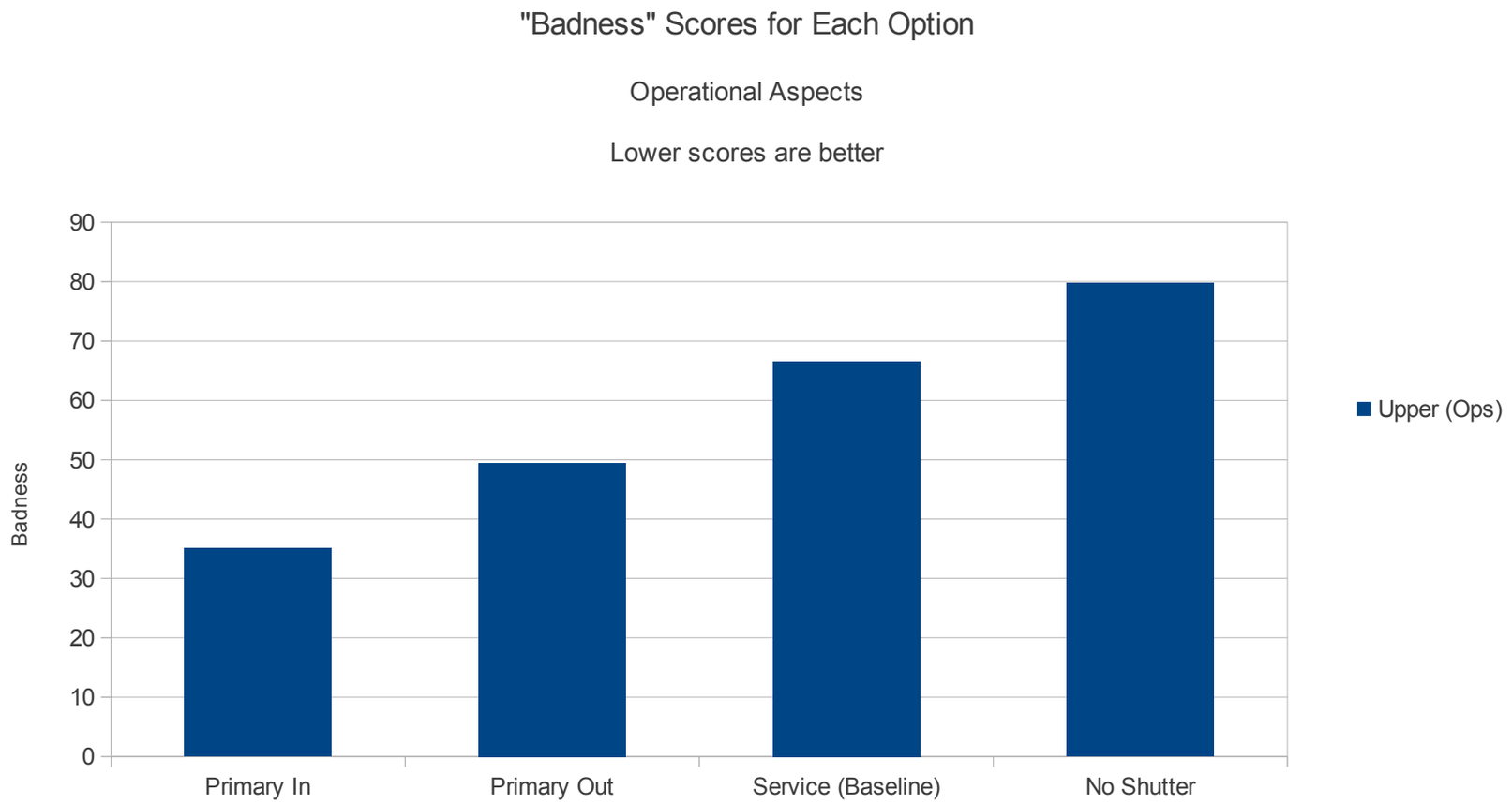
- Next most important items were normal operations with proton beam on, and complexity of the monolith

Zones and Scenarios		US / Shutter	In LOS	Beyond LOS	Sample Pos S	Sample Pos Curved	Weight	Weight	Score	
Installation	Protons on	4.5	1	1	1	1		6	0.75	6.375
	Protons off	4	1	1	1	1		5	0.625	5
Normal Operations	Protons on	2.75	1	1	1	1		7	0.875	5.90625
	Protons off	2.75	1	1	1	1		3	0.375	2.53125
Planned Maintenance	Protons on	7.5	1	1	1	1		2	0.25	2.875
	Protons off	3.25	1	1	1	1		2	0.25	1.8125
Unplanned Interventions	Protons on	5	1	1	1	1		6	0.75	6.75
	Protons off	4.75	1	1	1	1		2	0.25	2.1875
Obsolescence	Protons on	4.5	1	1	1	1		6	0.75	6.375
	Protons off	3.25	1	1	1	1		3	0.375	2.71875
Hot Commissioning	Protons on	3	1	1	1	1		6	0.75	5.25
	Protons off							1	0.125	0
Target External Surface Maintenance	Protons on	3.75						2	0.25	0.9375
	Protons off	3						2	0.25	0.75
										49.46875

Other Evaluation Factors									
Monolith engineering complexity	1.25						7	0.875	1.09375
Licensing complexity	3						3	0.375	1.125
Monolith cost	1.25						4	0.5	0.625
Guide hall crane cost	2.5						4	0.5	1.25
Waste quantity	2.75						3	0.375	1.03125
Shielding costs on guides/bunker	3.25						6	0.75	2.4375
Structural impact, transfer of loads	2						4	0.5	1
Ease of beam port activation operation	2						8	1	2
Total thickness of beam window material	3.5						5	0.625	2.1875
Number of beam ports available	3.5						4	0.5	1.75
									14.5

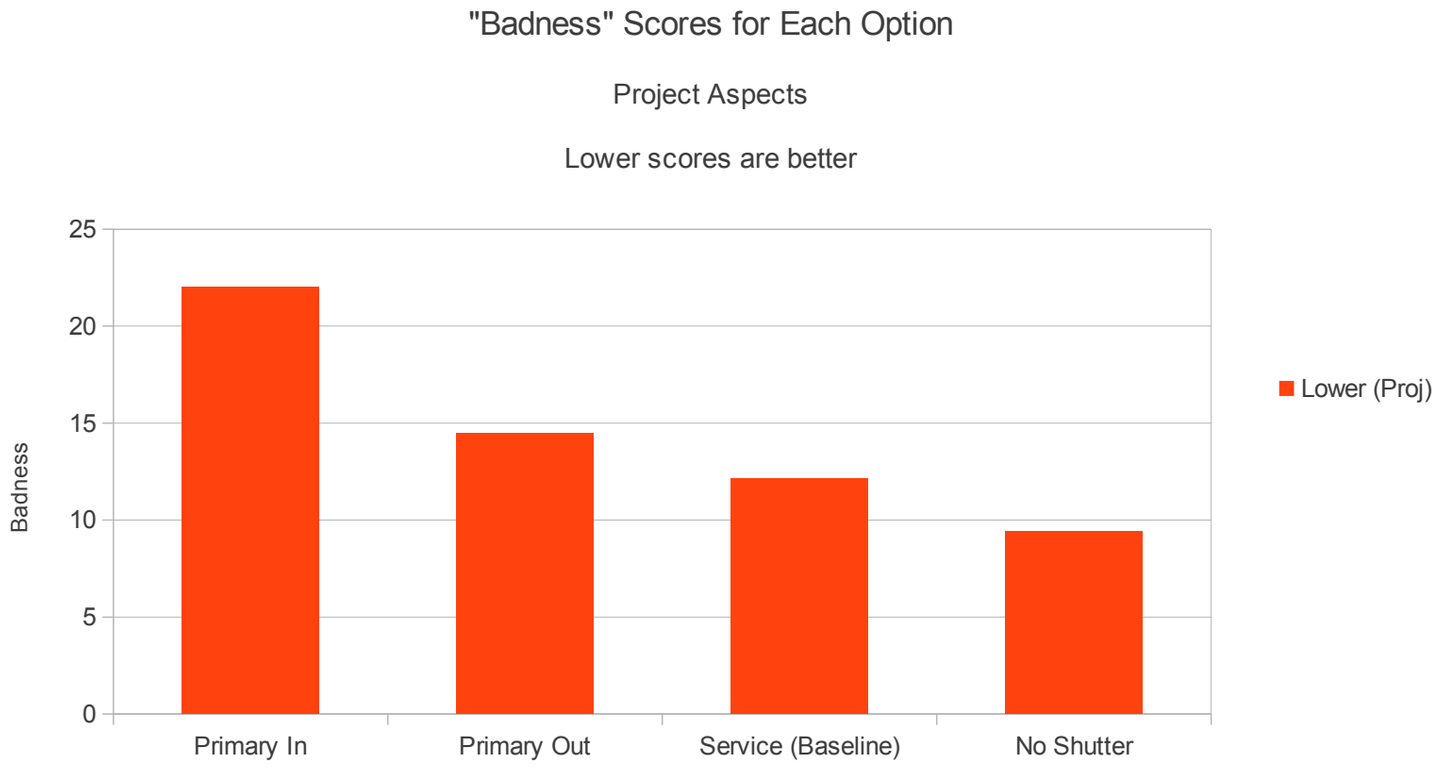
Operational Factors

- Clearly, primary shutter inside monolith is the favoured option from an operational perspective



Project Factors

- Clearly, no shutter is the favoured option from a project perspective



So What's Next?

- An ad-hoc advisory panel will be convened to review the proposed changes to the monolith design
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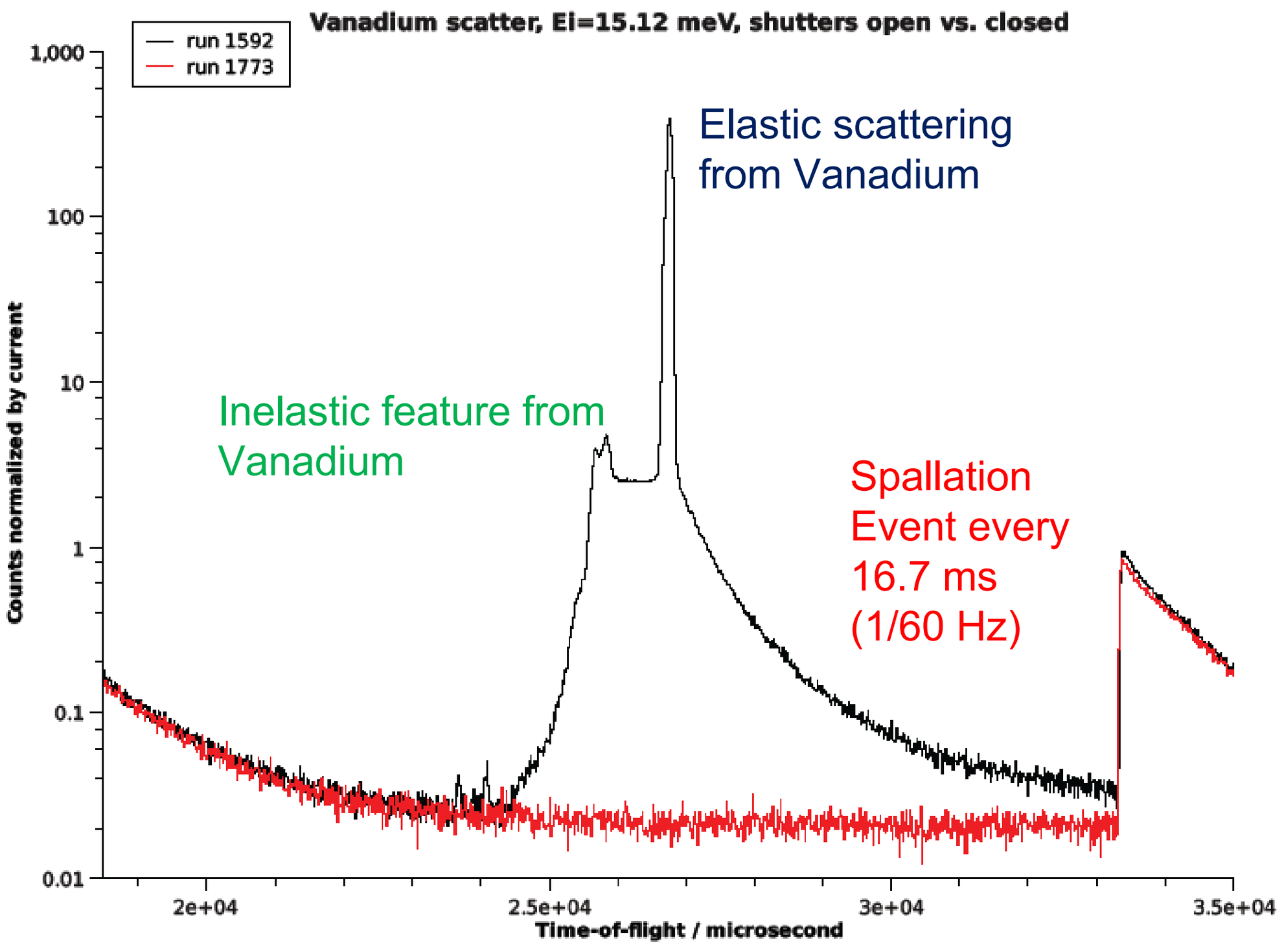
High Energy Background / Prompt Pulse

- Now have collaboration between ESS, SNS & PSI

HYSPEC data summed over all detectors



Background tail ends about 3.5 ms beyond spallation event

High Energy Background / Prompt Pulse

- Measurements are required – large survey of PSI and SNS are planned

- SNS were able to do much with heavy shutters, we are examining this option for ESS

- We still require x100 more effective shielding, shielding design and layout work to meet our objectives

- Note that this does not mean spending x100 more money or having something x100 thicker!

Angular Separation

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- Medium instrument sector (60-80 m) 10 degrees
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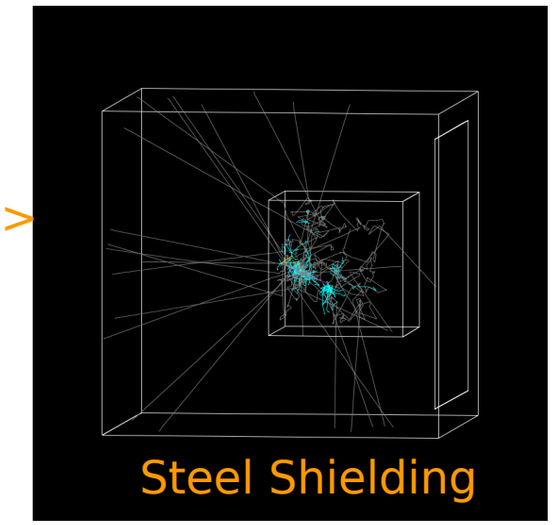
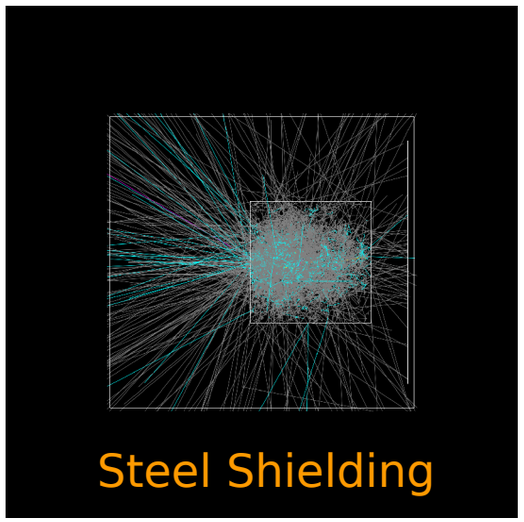
New Types of Background Shielding

- Reliable models on different materials at high energy
- New concept based on multiple materials (the data below is already old, we are much better)

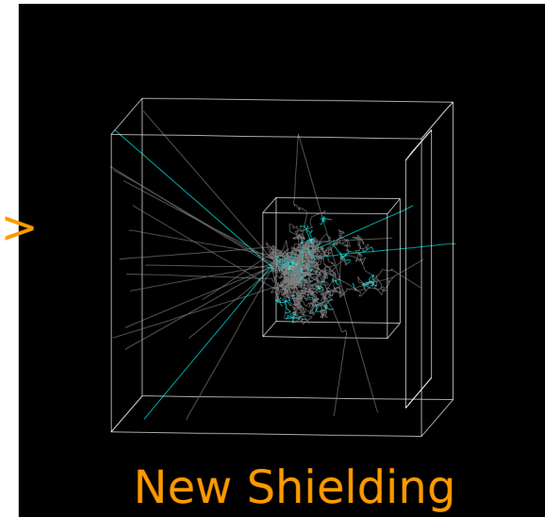
1 neutron in ->



10 neutrons in ->



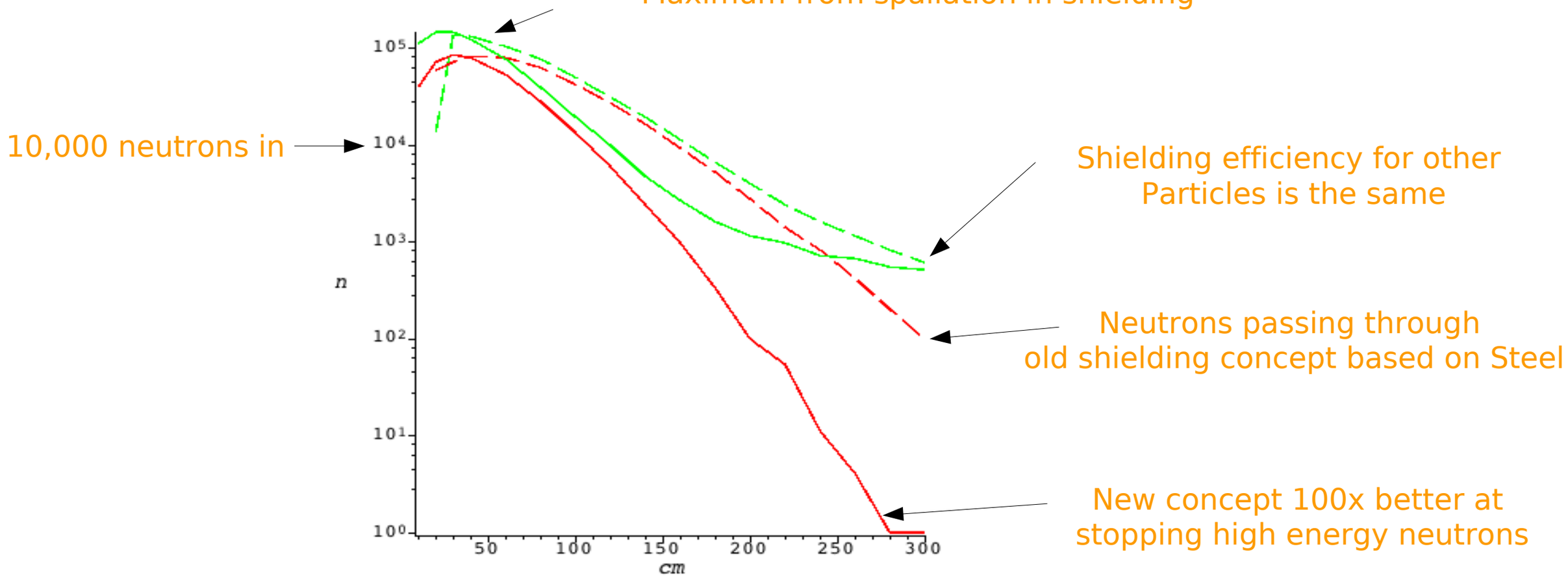
1 neutron in ->



10 neutrons in ->

New Types of Background Shielding

- Reliable models on different materials at high energy
- Setting up collaboration with SNS, PSI right now (hence Phil Bentley absence)



In Summary

- Some changes will probably be required for the beam extraction compared to the baseline design

- We will probably request changes to shutter specifications and installation method, to be reviewed by the TAP and a specialist ad-hoc committee

- Timescale for changes: March/April