



**EUROPEAN
SPALLATION
SOURCE**

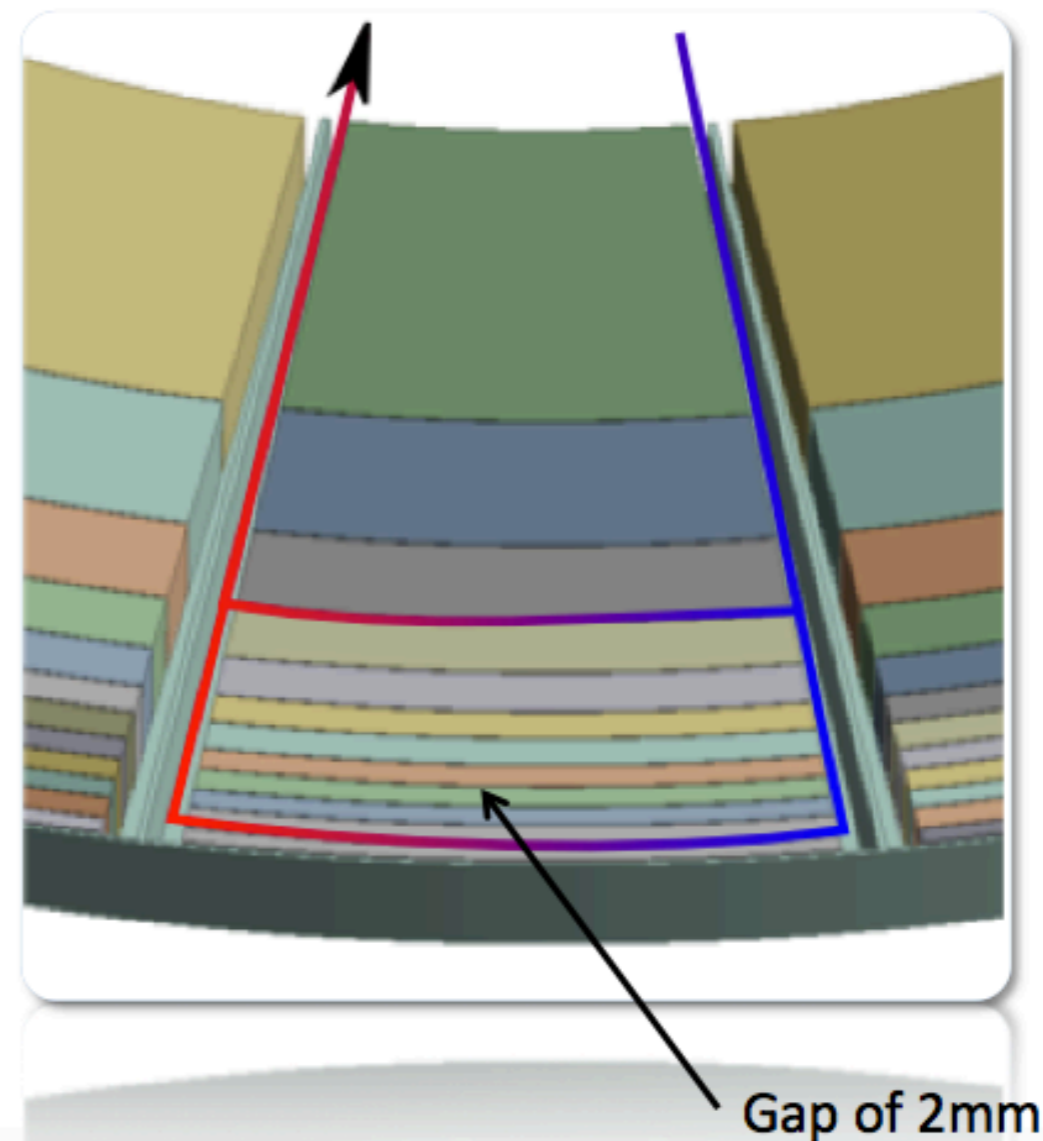
ESS Source and Concerns

SNS High Energy Shielding Meeting December 2012

Phil Bentley

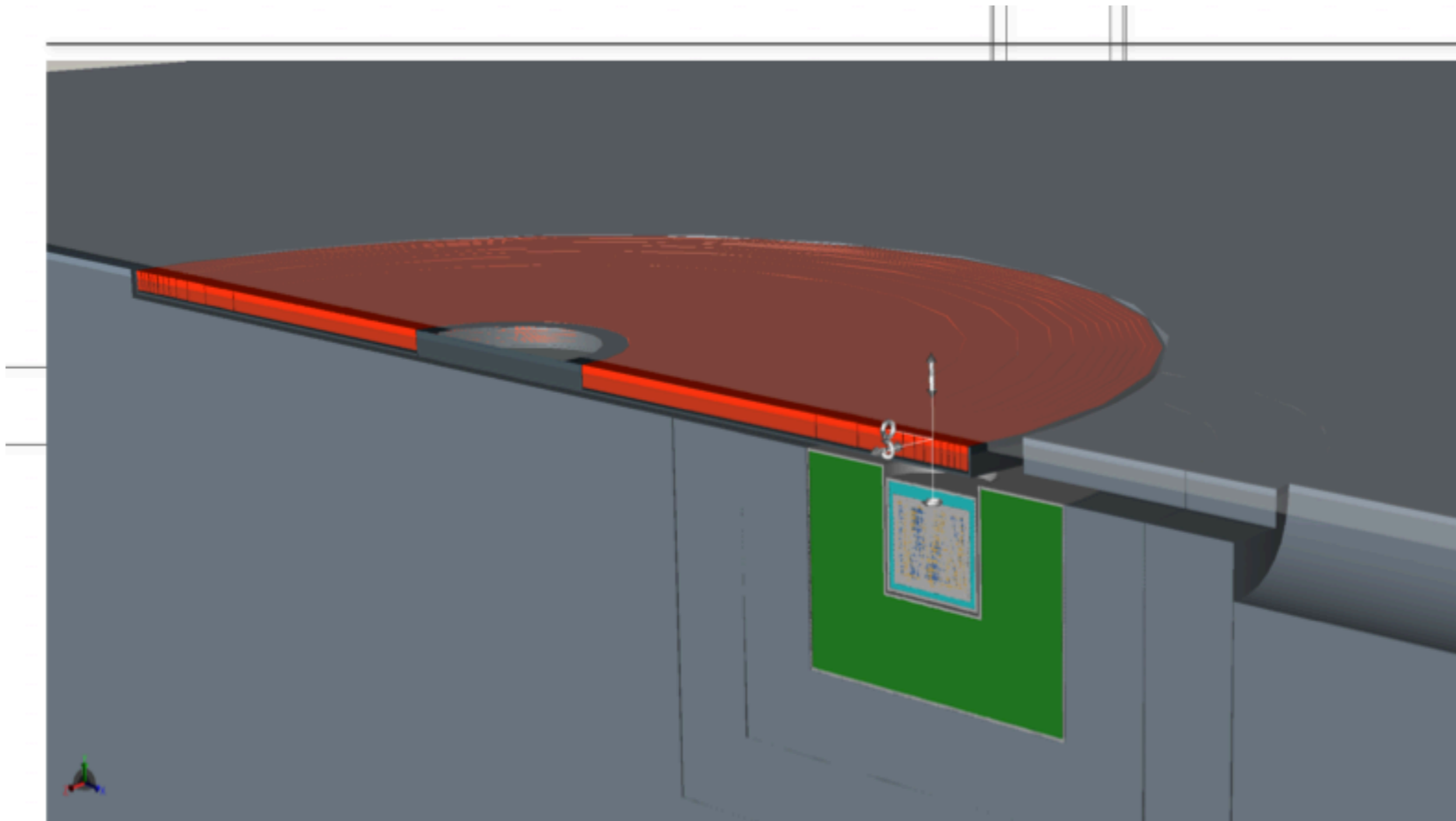
Current baseline (v2)

- Geometry
 - Flow in tangential direction
 - Cooling channel 2mm





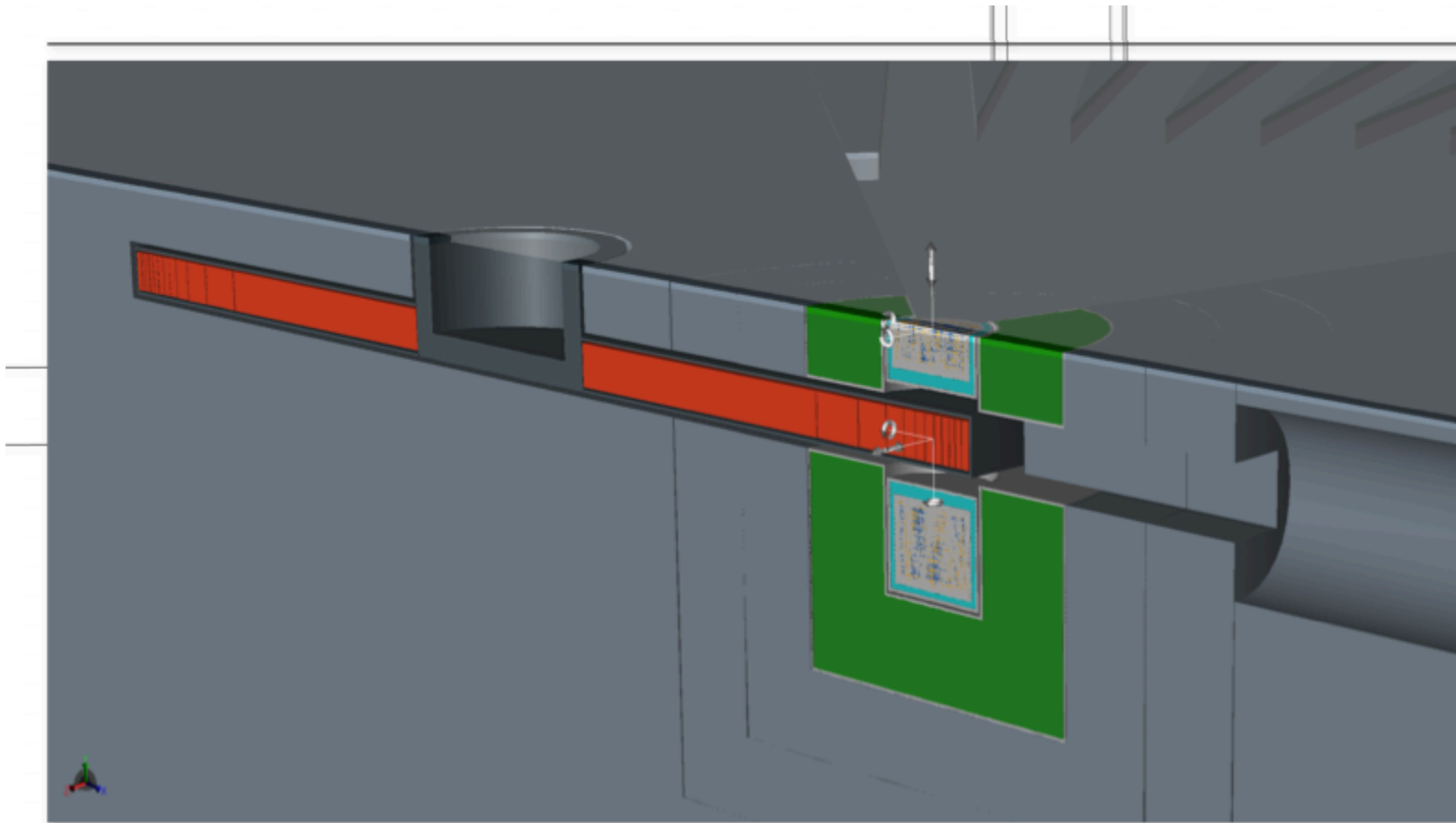
View of Assembly



Picture by MCAM 4.8 Demo Version © FDS Team | Institute of Plasma Physics | China



View of Assembly

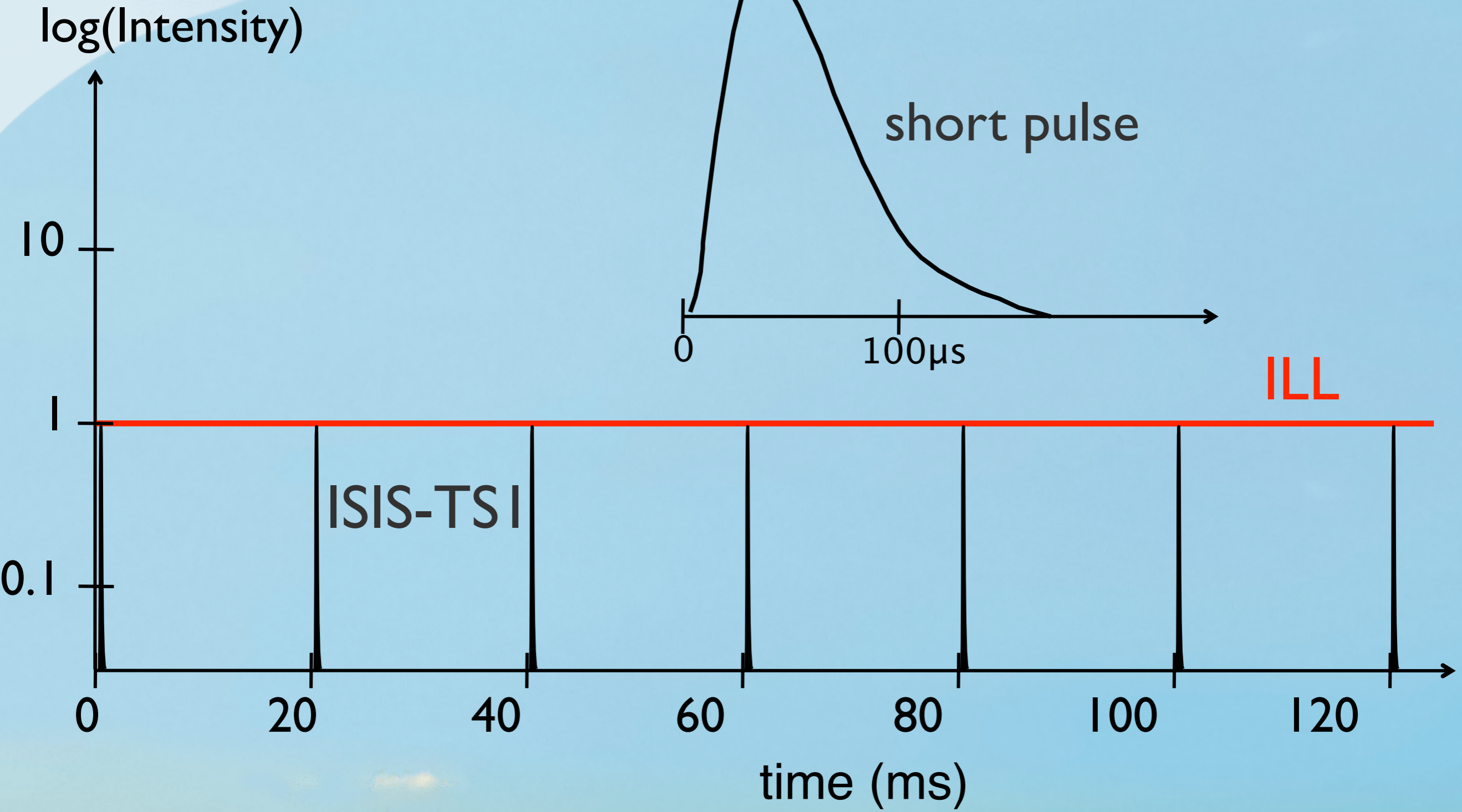


Picture by MCAM 4.8 Demo Version © FDS Team | Institute of Plasma Physics | China

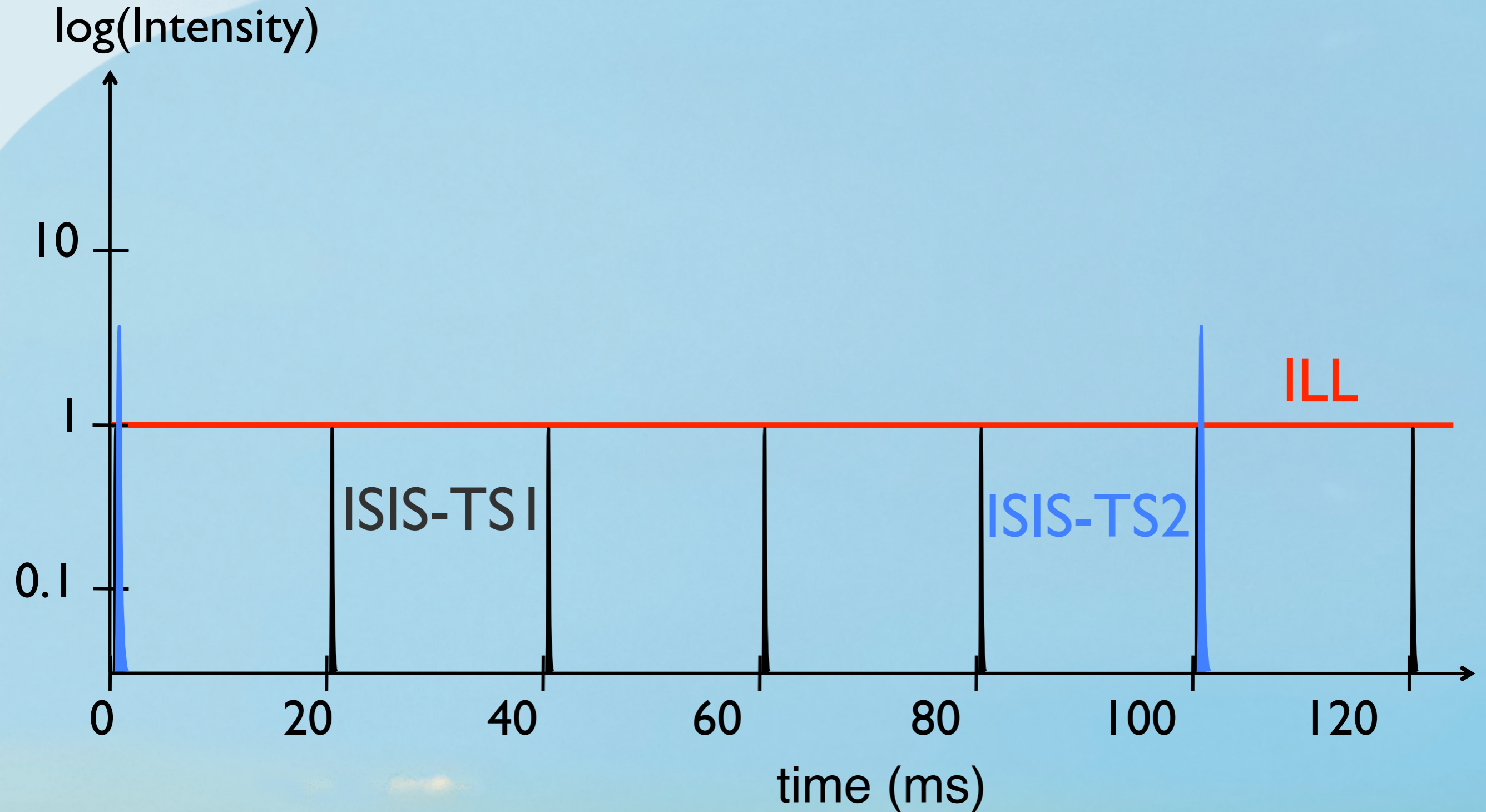


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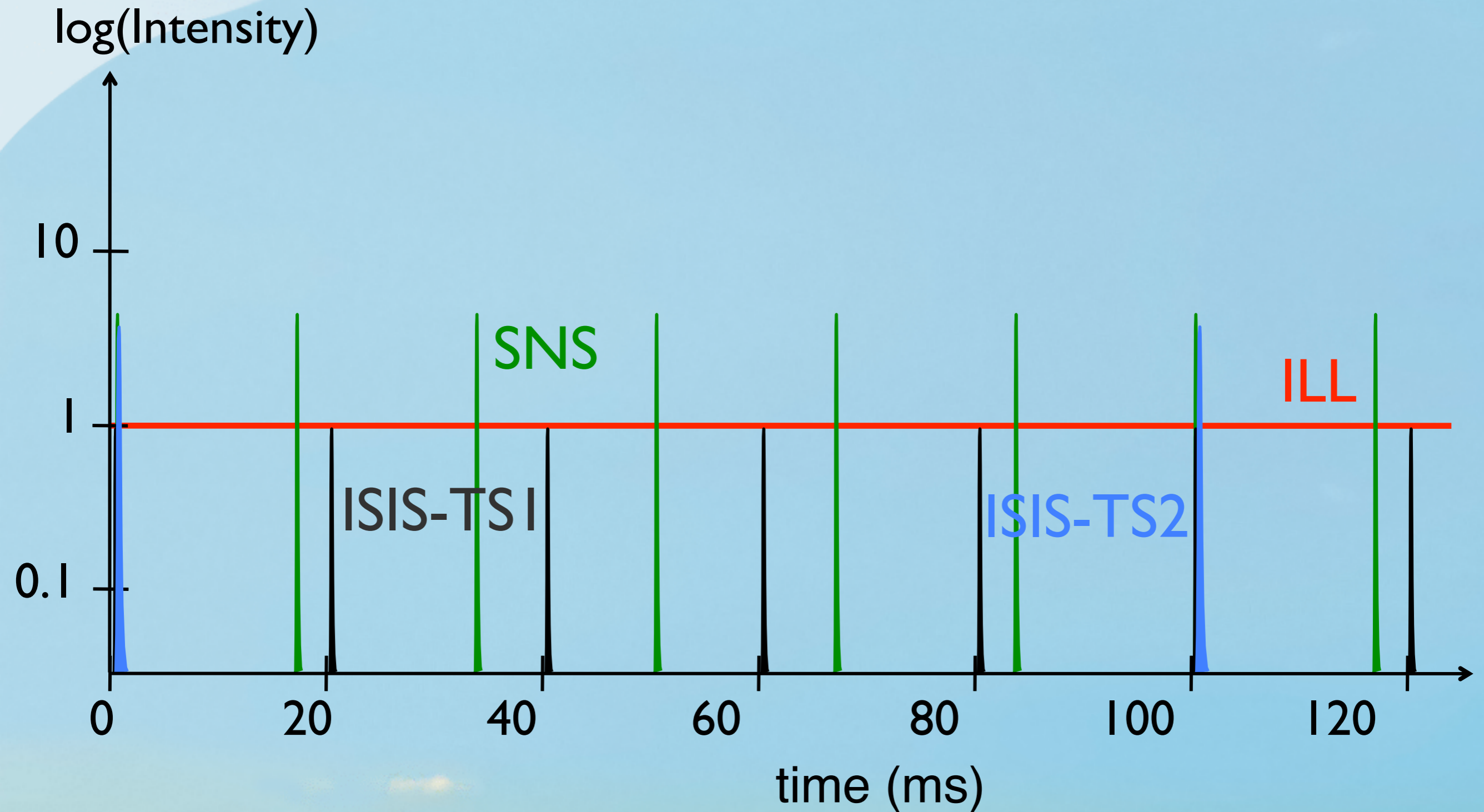
Pulsed-source time structures cold neutrons



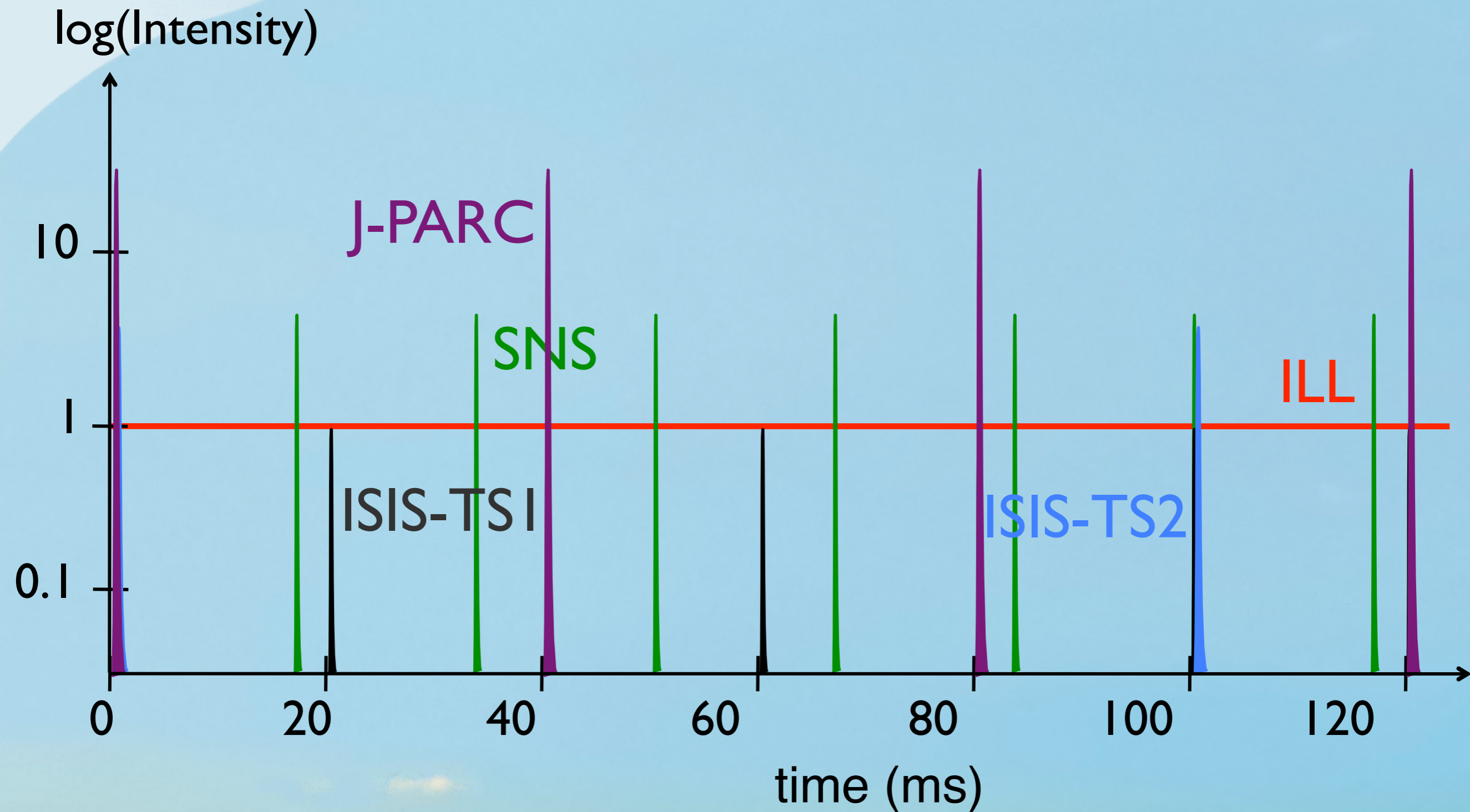
Pulsed-source time structures cold neutrons



Pulsed-source time structures cold neutrons



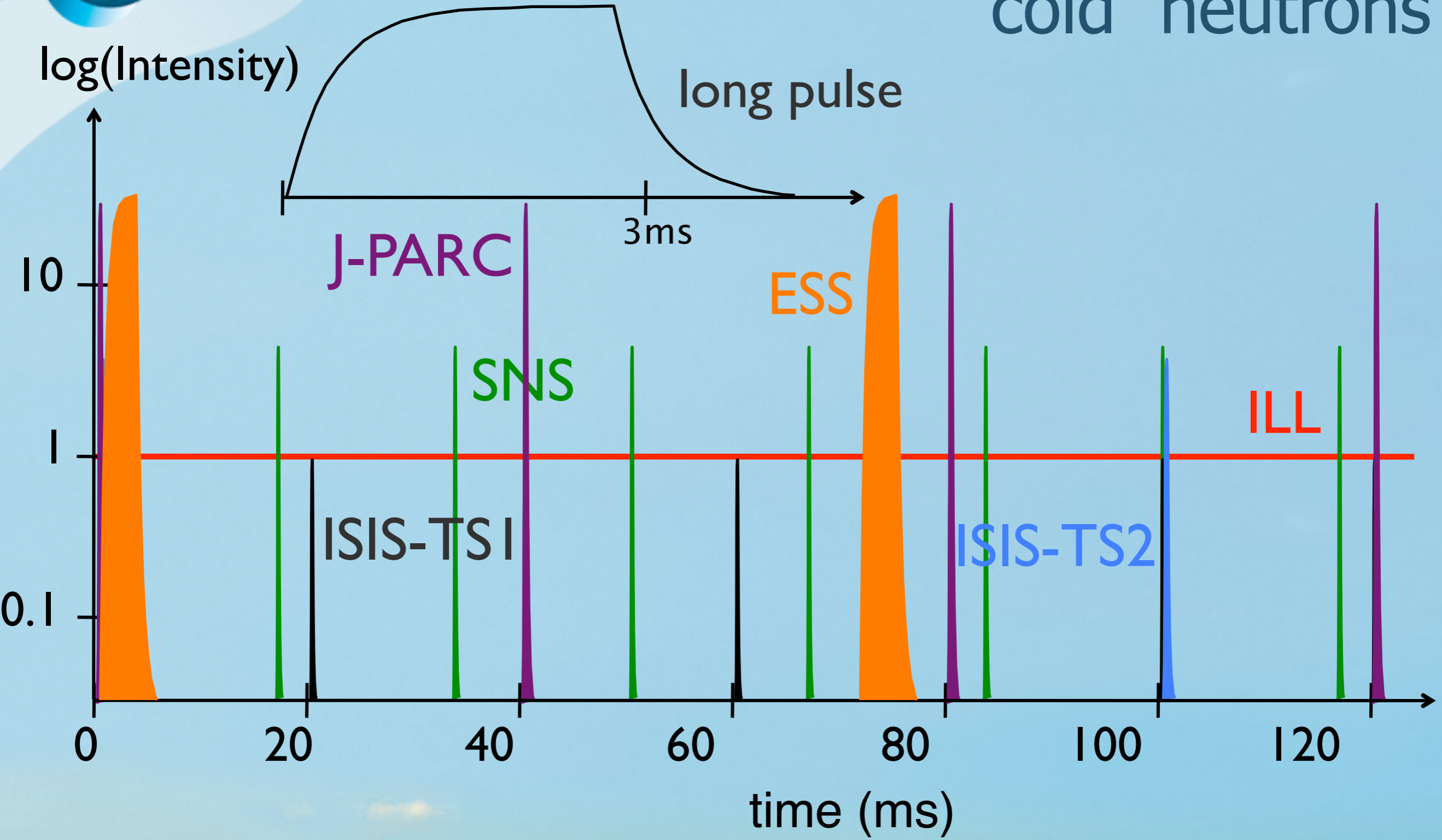
Pulsed-source time structures cold neutrons





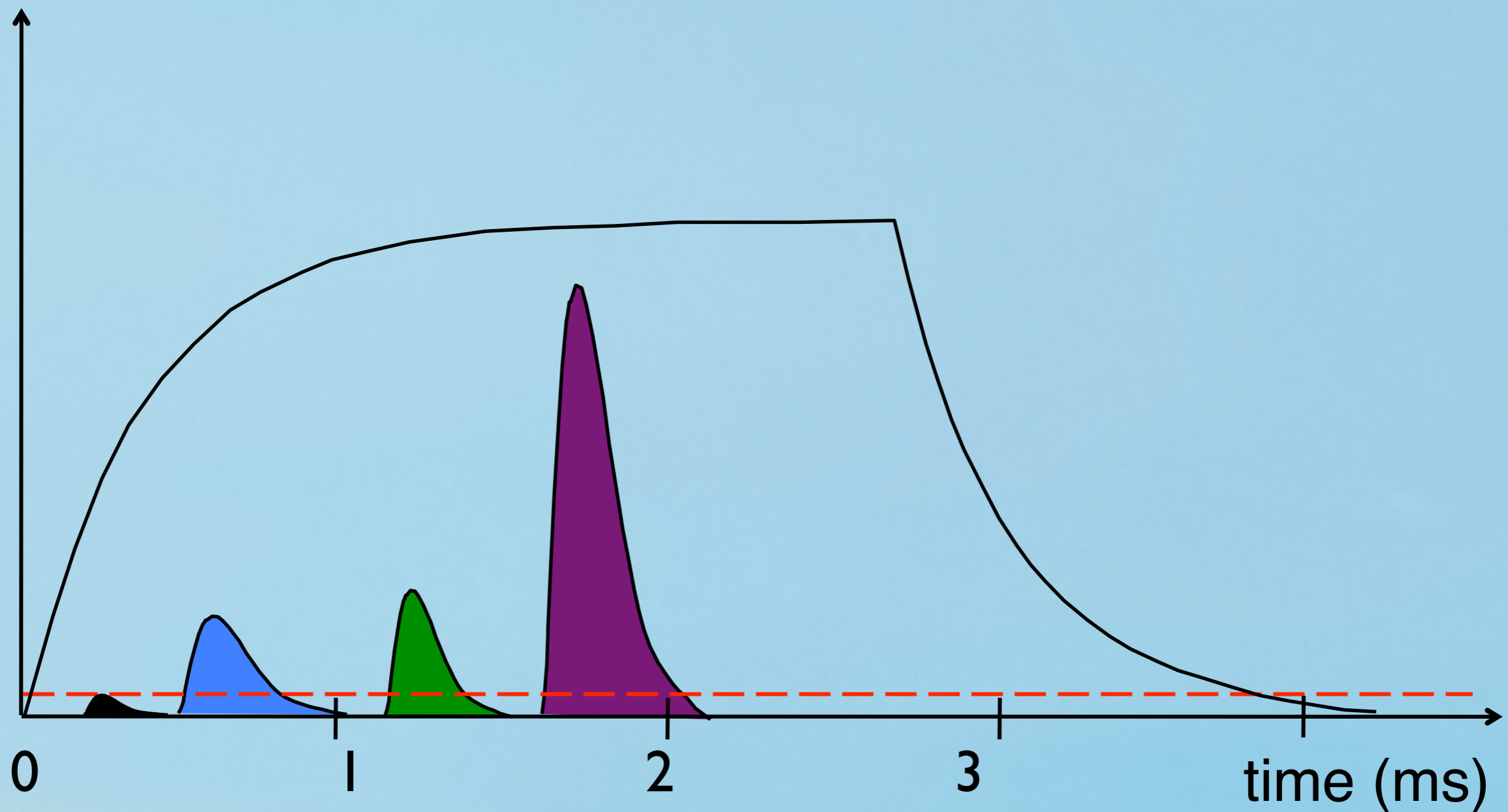
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Pulsed-source time structures cold neutrons



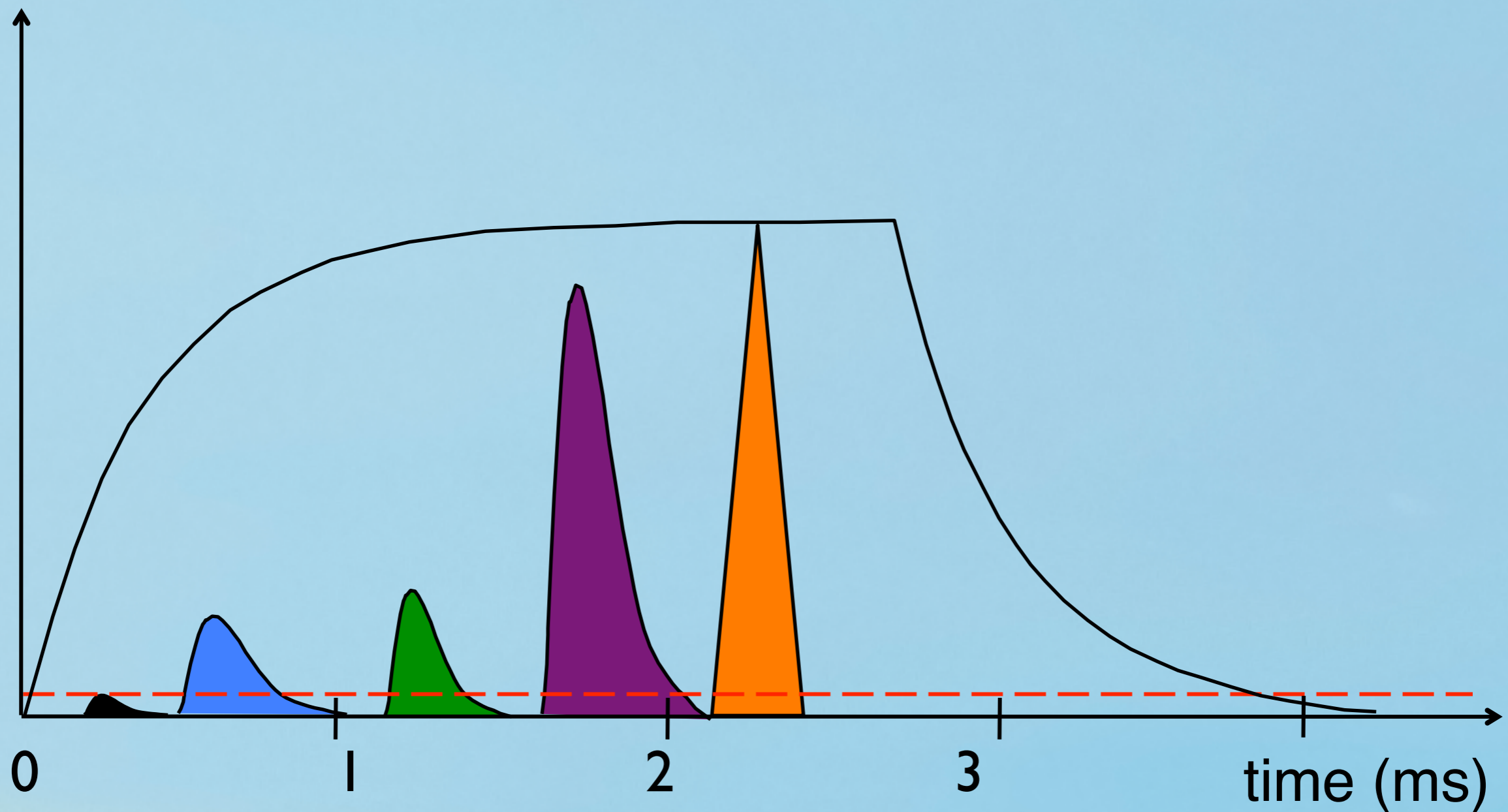
Long-Pulse Principle

Intensity



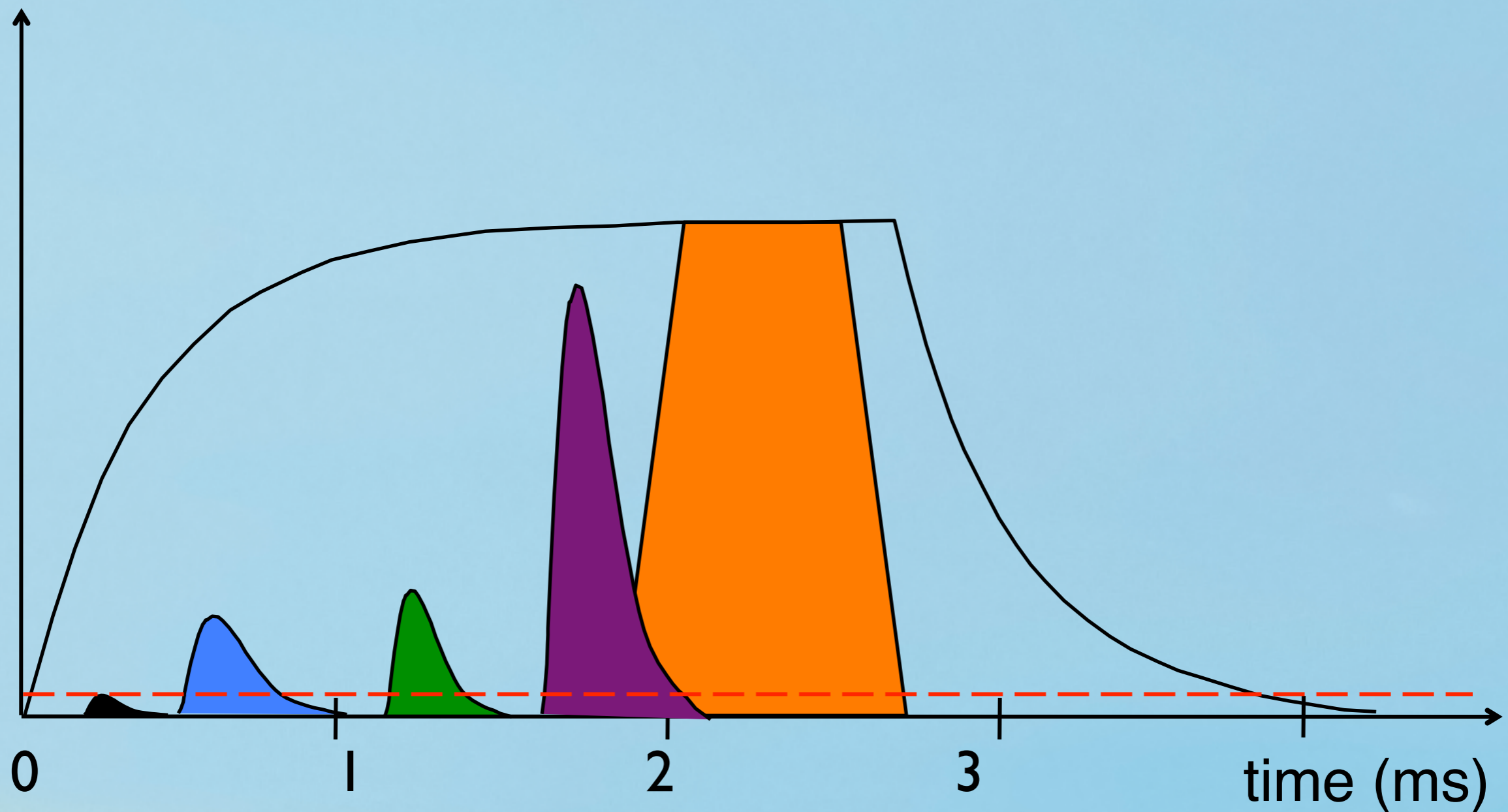
Long-Pulse Principle

Intensity



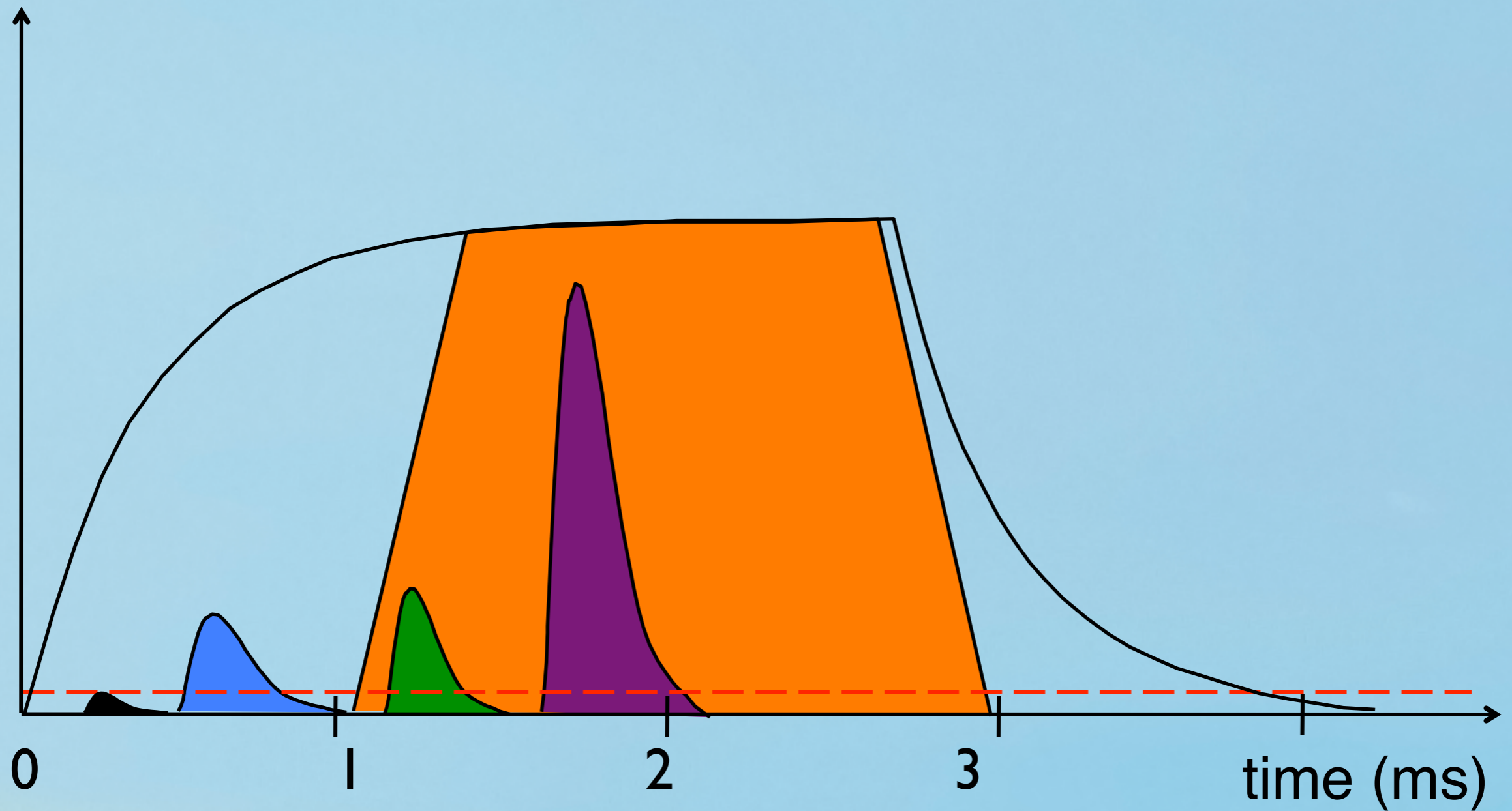
Long-Pulse Principle

Intensity



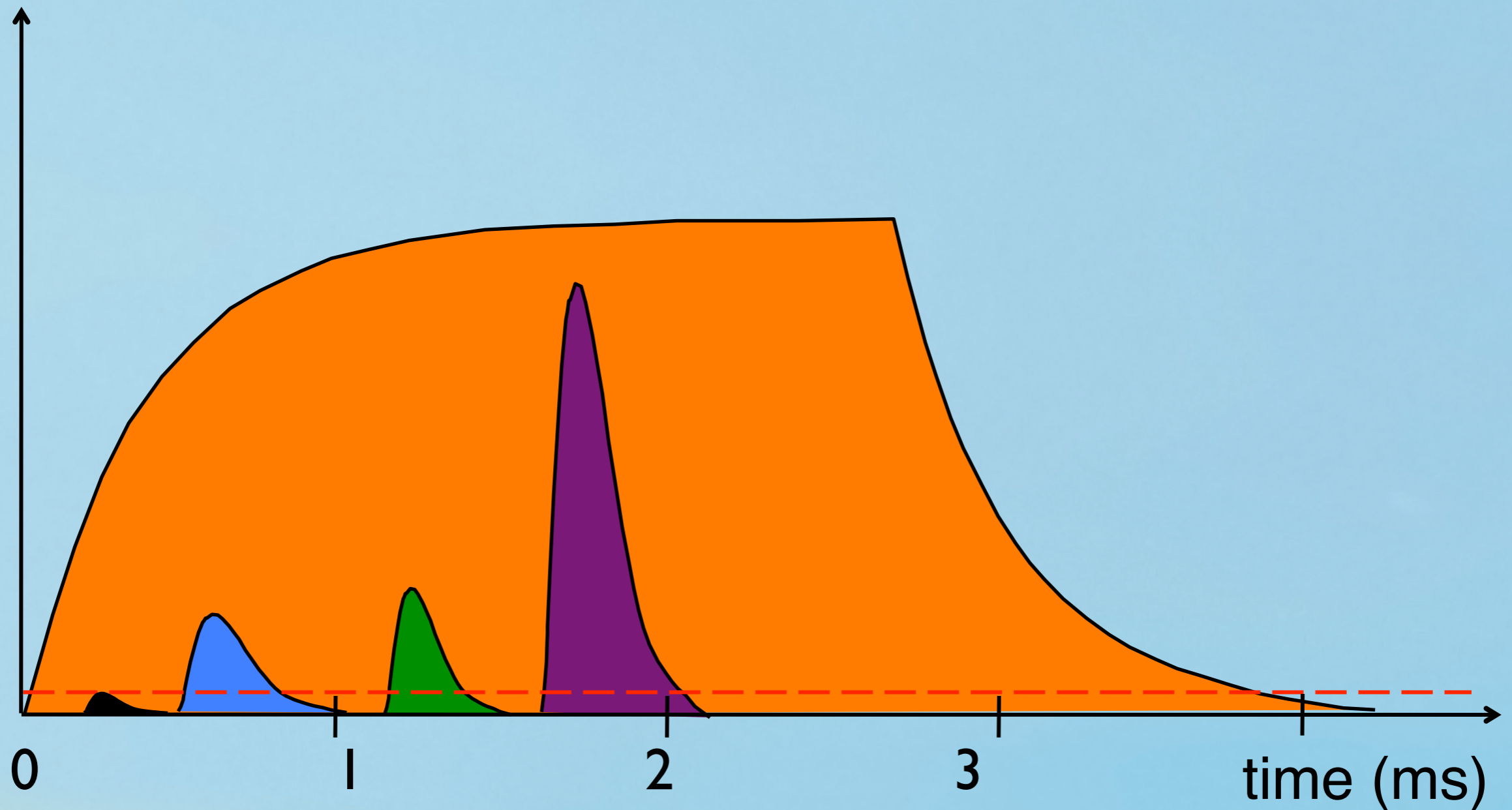
Long-Pulse Principle

Intensity



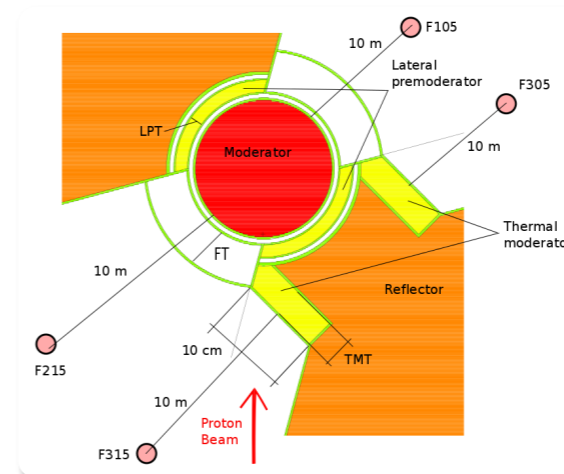
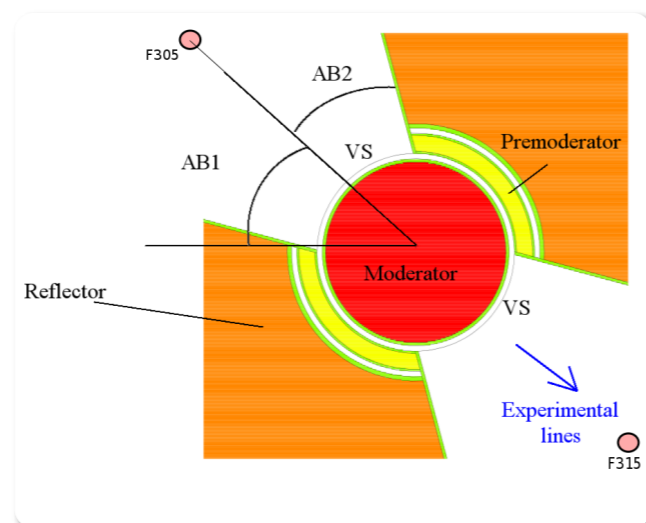
Long-Pulse Principle

Intensity

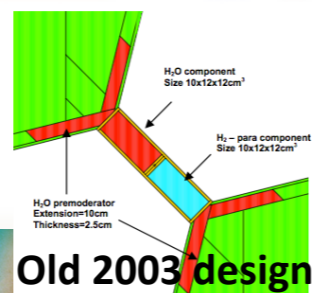


Moderator Top View

MCNPX model with and without bi-spectral extraction

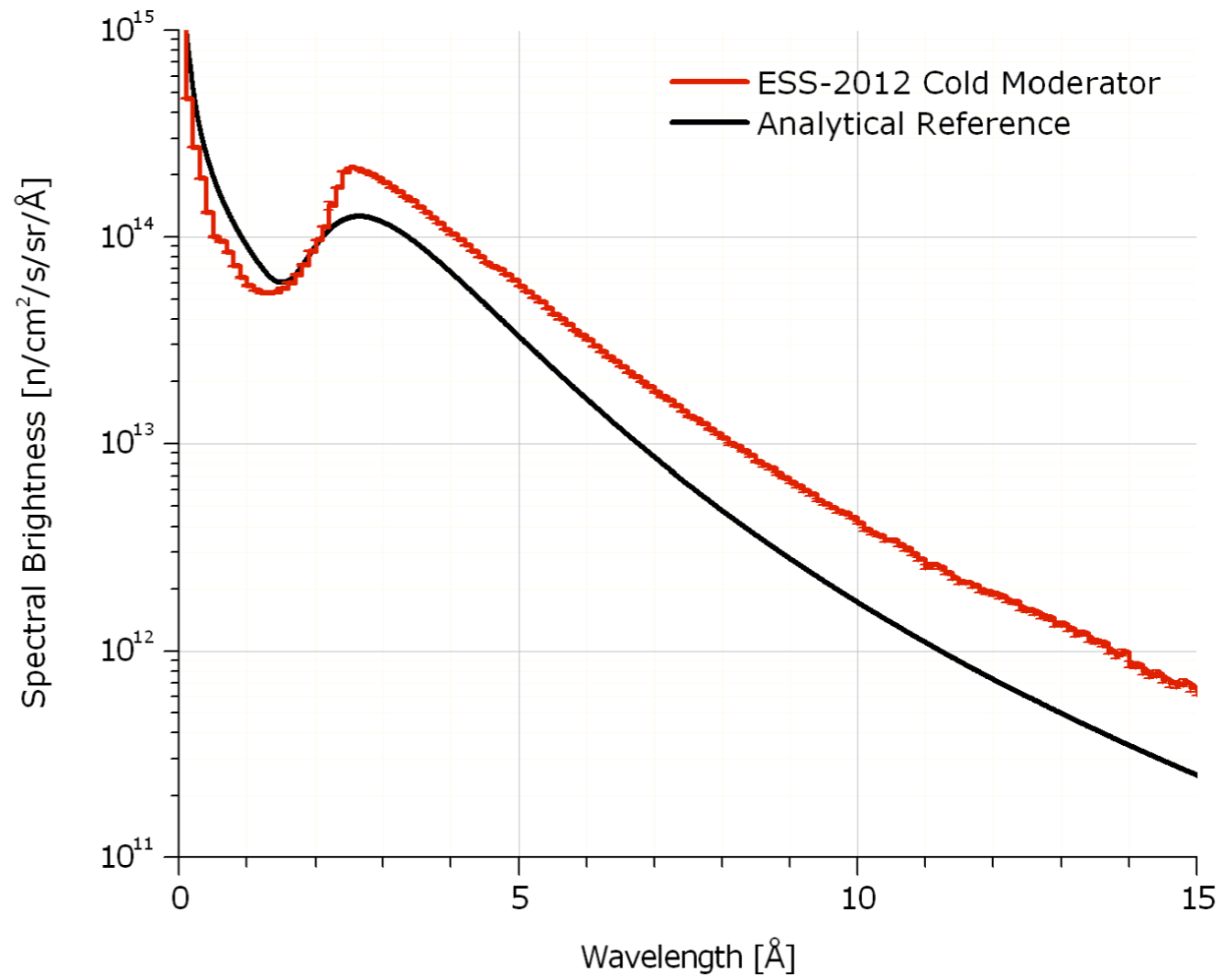


Optimization work in progress



Absolute brightness from cold moderator

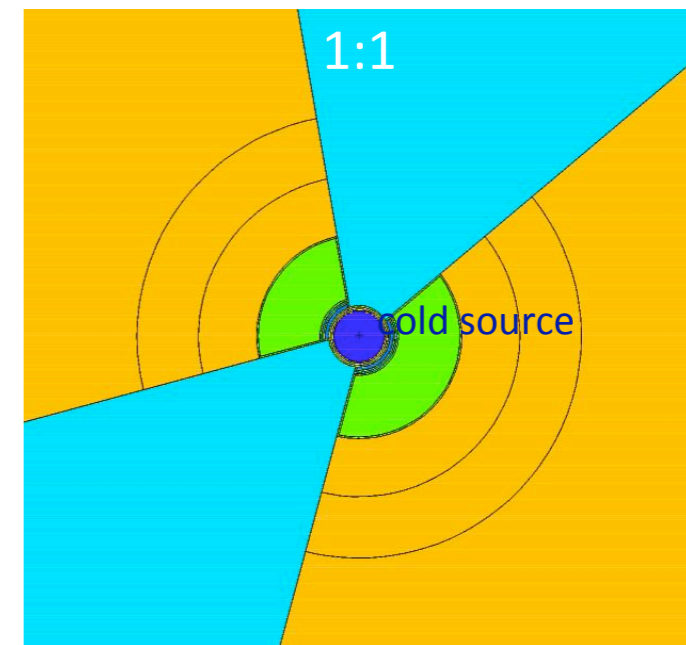
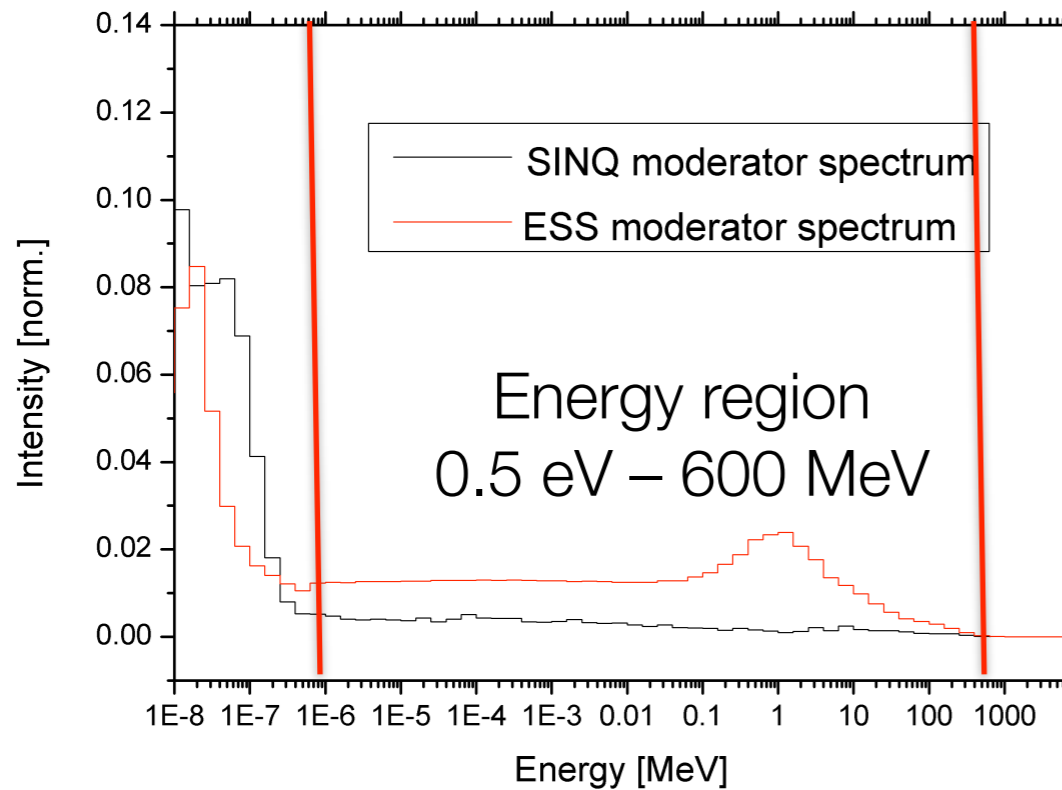
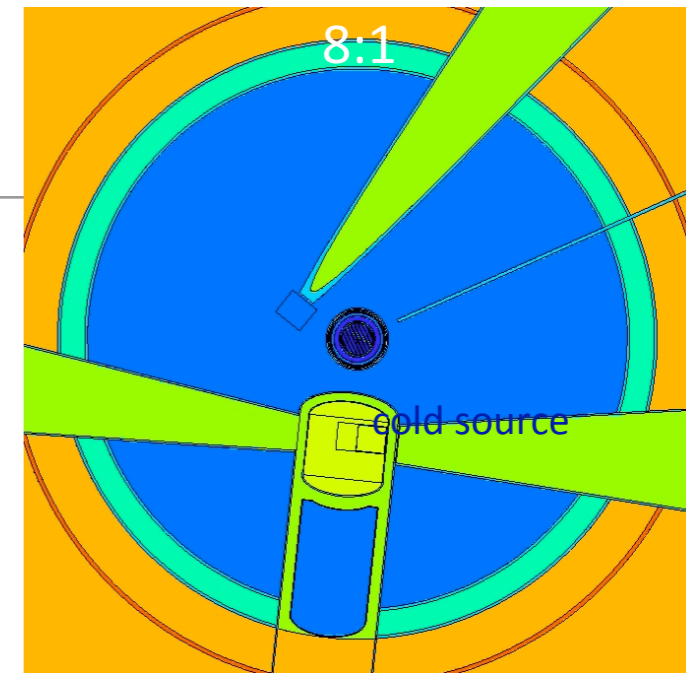
- Comparison of calculated ESS neutron brightness to the analytical reference
 - Preliminary results based on ESS baseline cold moderator
- Proton beam parameters: 2.86 ms, 14 Hz, 125 MW/pulse
- Expected systematic uncertainties of about 15% due to uncertainties
 - on the engineering design and
 - on models and libraries used in the calculation



Source description



- using the SINQ source as reference
- scaling up to the ESS (neutron flux, frequency)
- source size: 12cm x 12 cm (WxH)

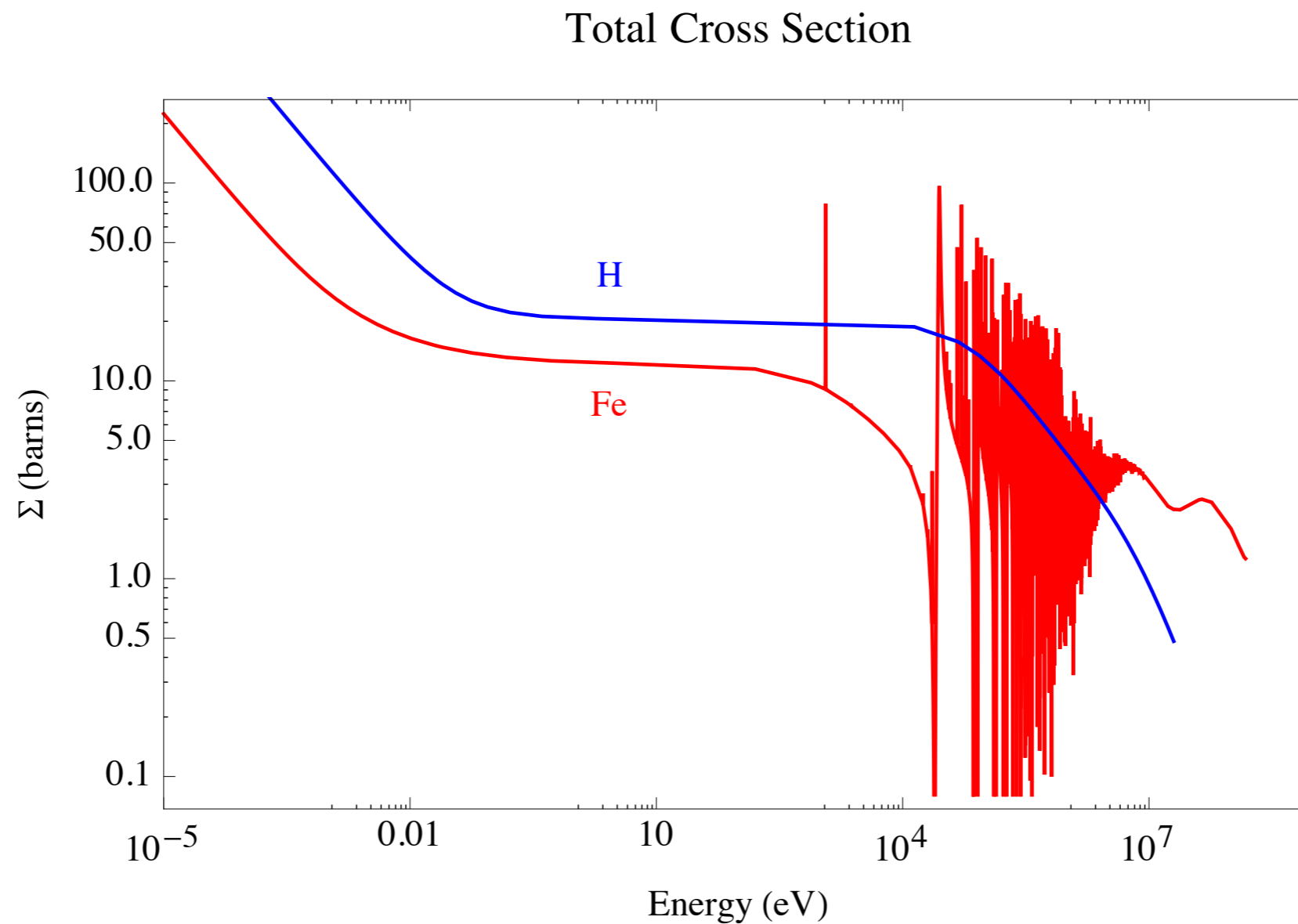


Neutron fluxes: n/cm²/peak (valid for 5 MW -> integrated flux/s is comparable to ILL flux)

Dose rates: mSv/h (intern. standard conversion factors)



Energy Windows at High Energy



Source: some of the credible data from ENDF at Brookhaven



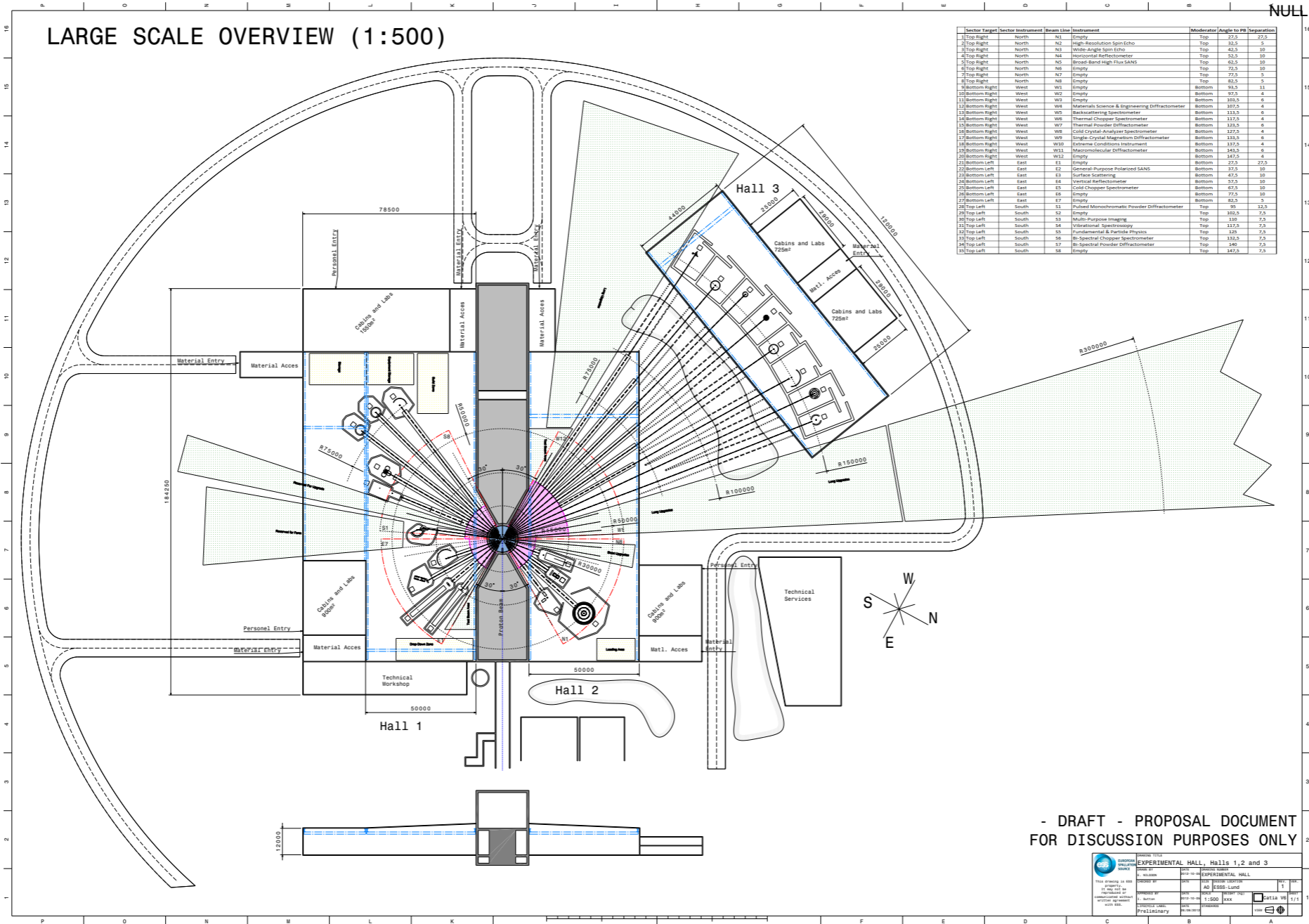
Facility Plan View

7.5°

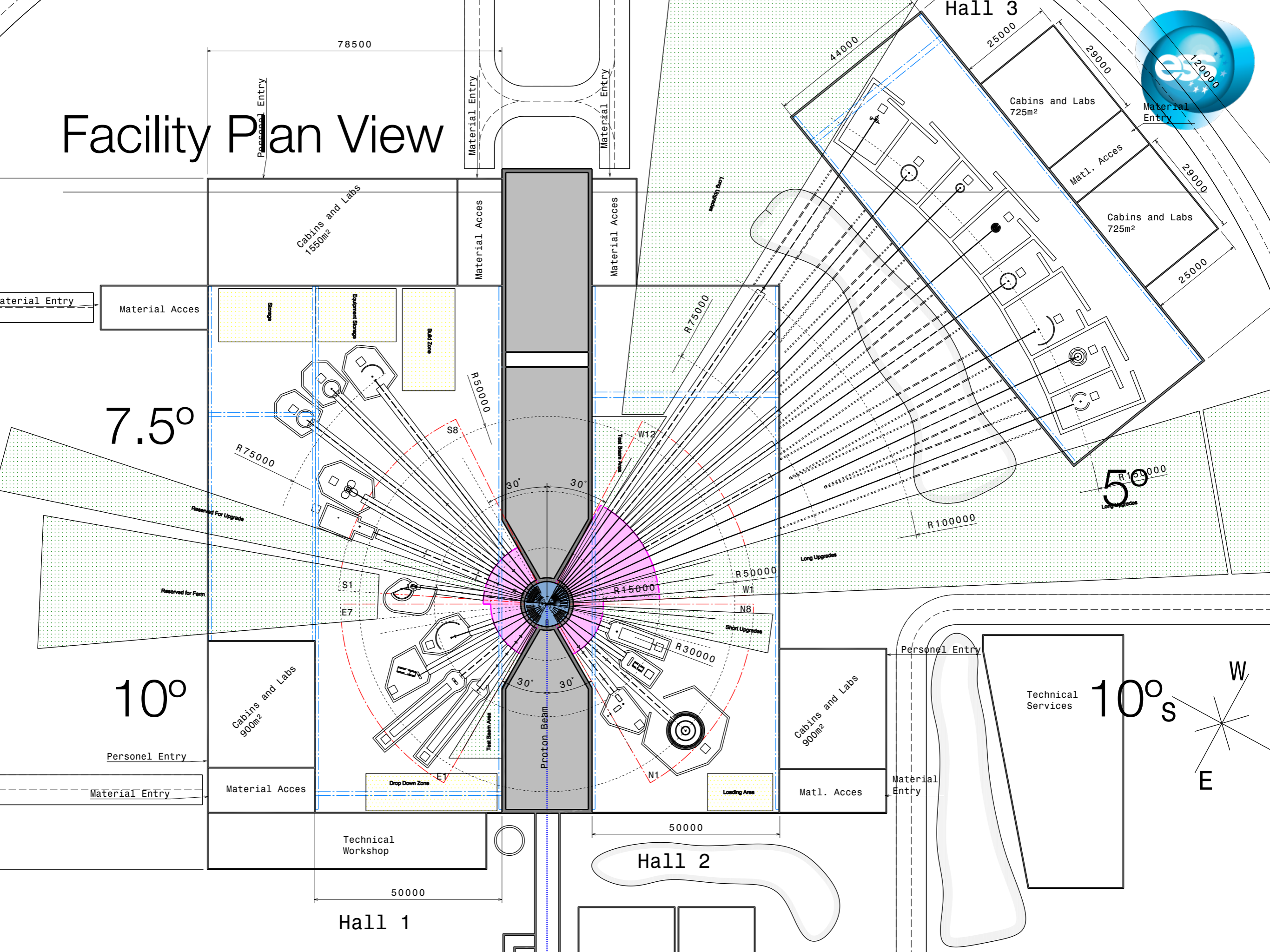
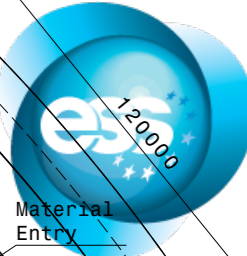
5°

10°

10°



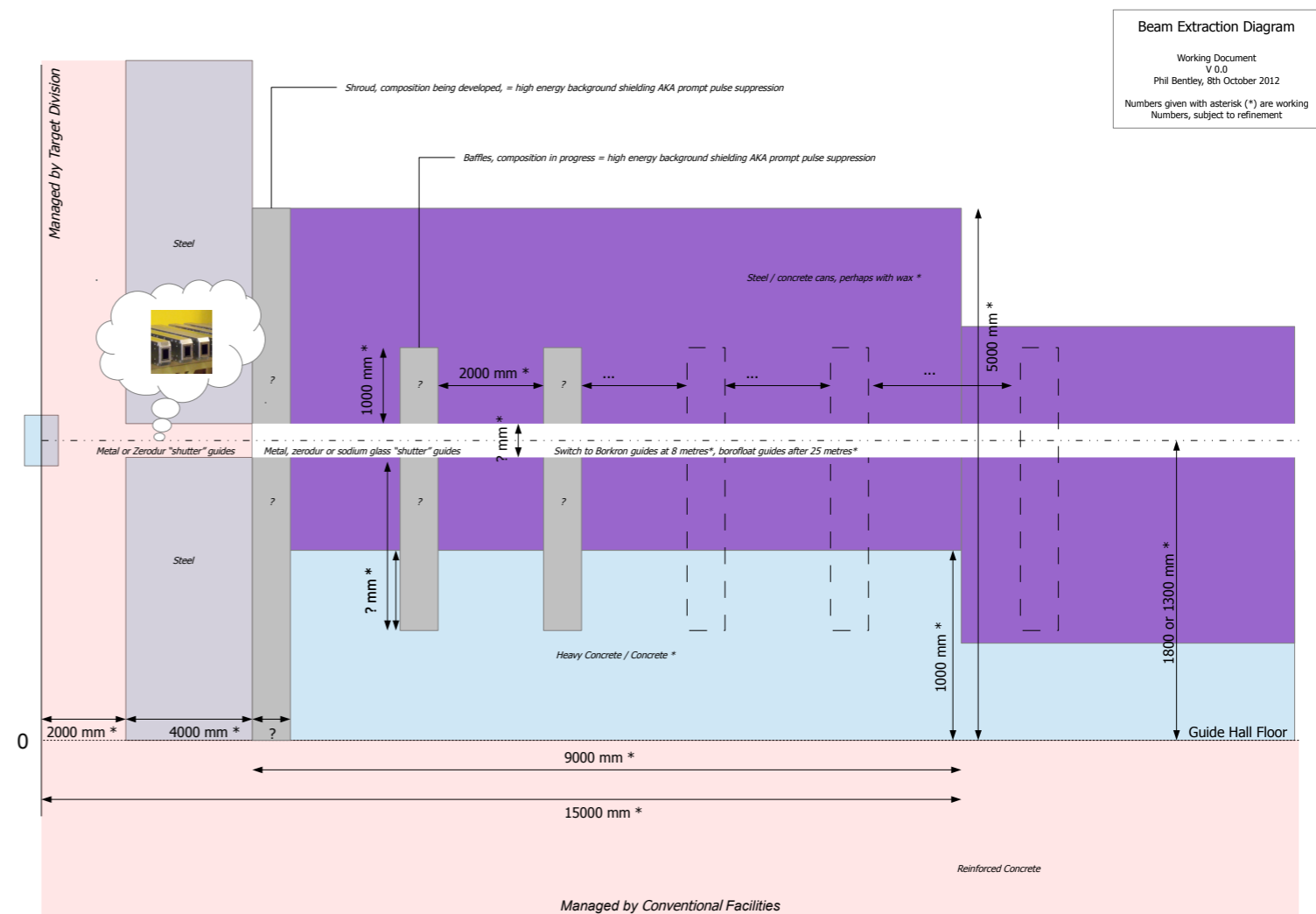
Facility Plan View





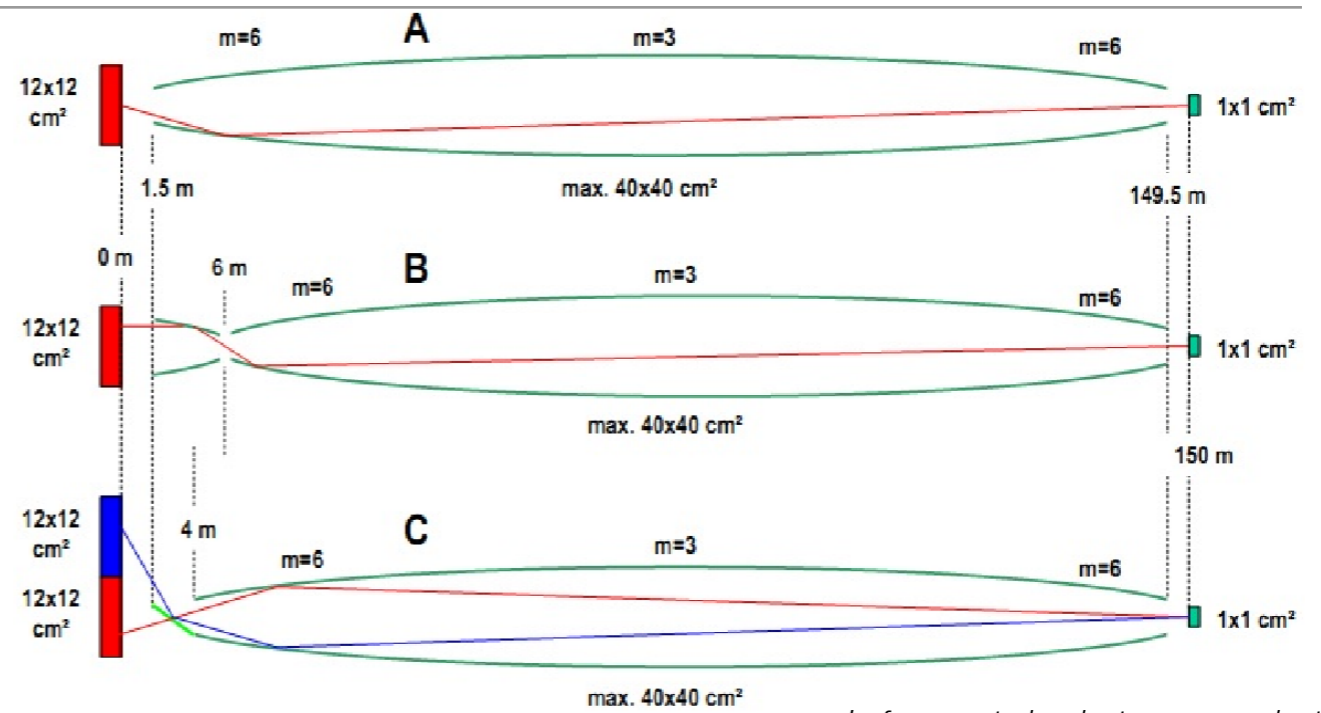
Beam Extraction Side View

- Chopper shelf like SNS
- Shroud around the monolith, less than 4 yards thick, made from copper, tungsten
- Taking new directions, in a small part of the shielding that will have big impact on the instrument backgrounds
- Natasha, Richard & Kelly will talk about the background information on this

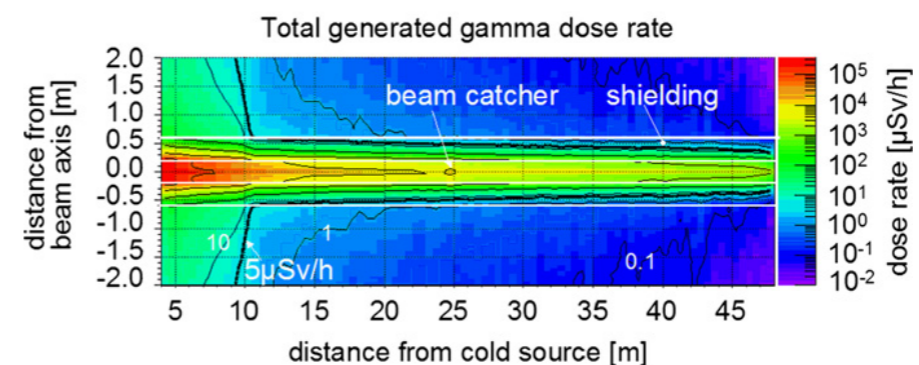
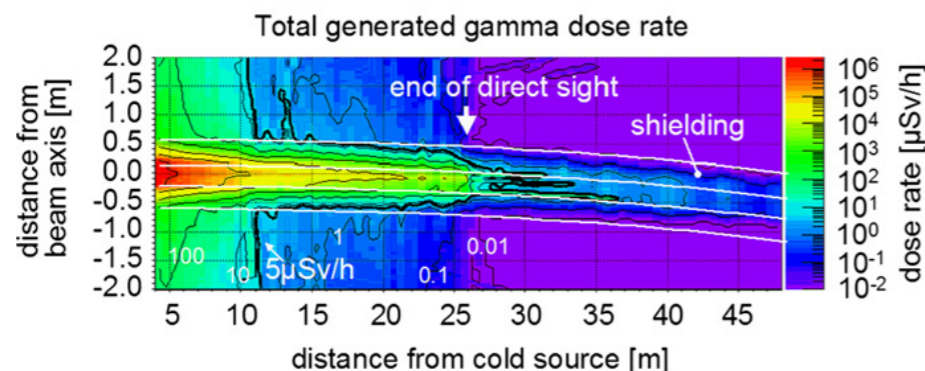
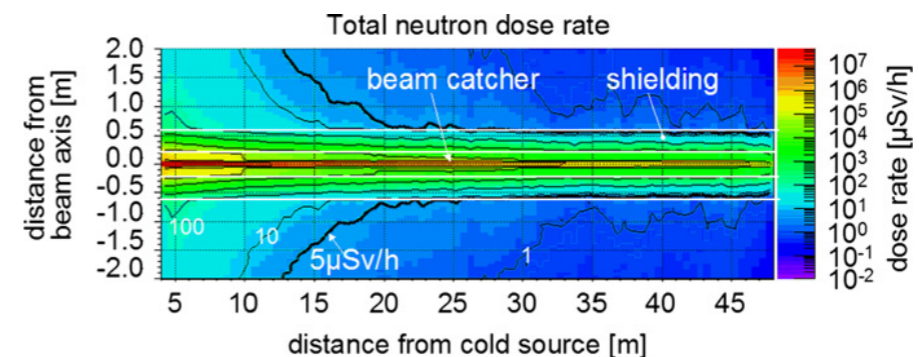
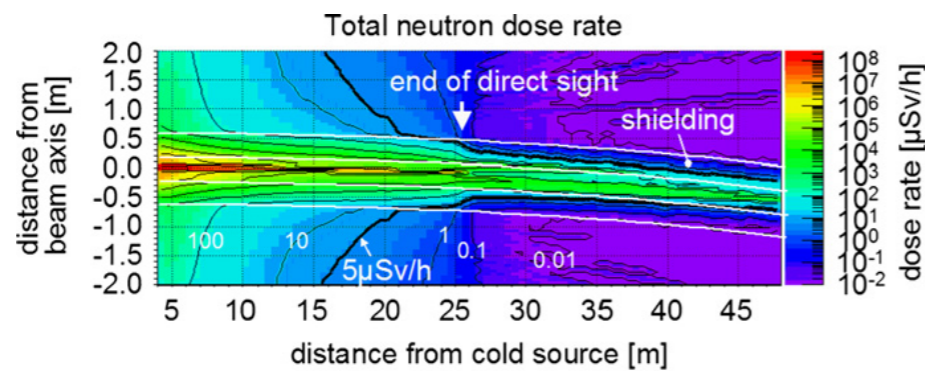


Technical Issues for Extraction & Shielding

- Eye-of-the-needle solutions
- Curved guides (no straight ellipses)
- Double line of sight

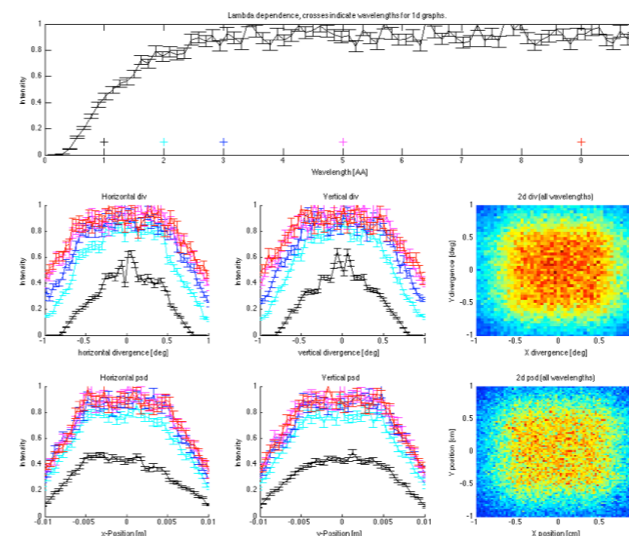
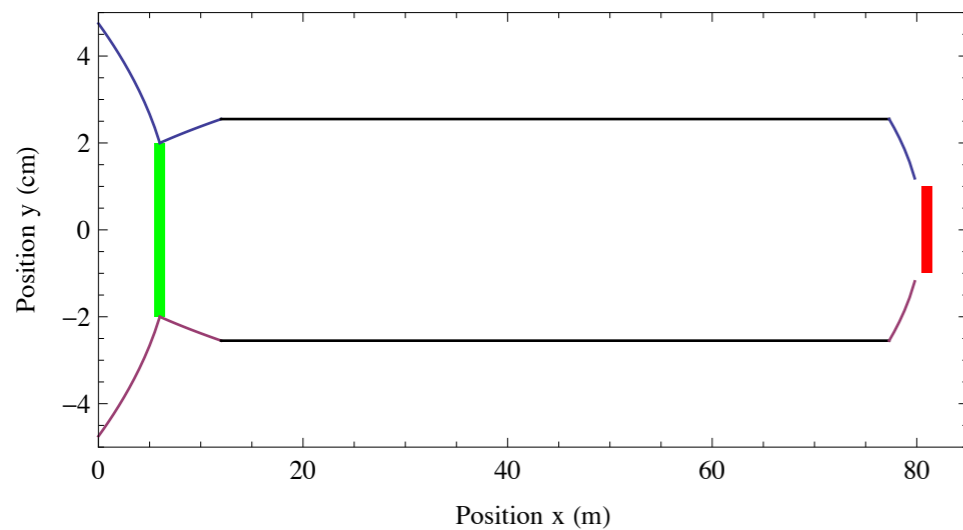
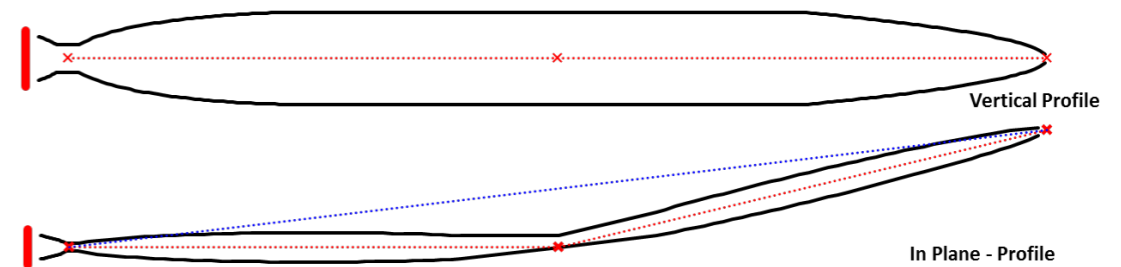
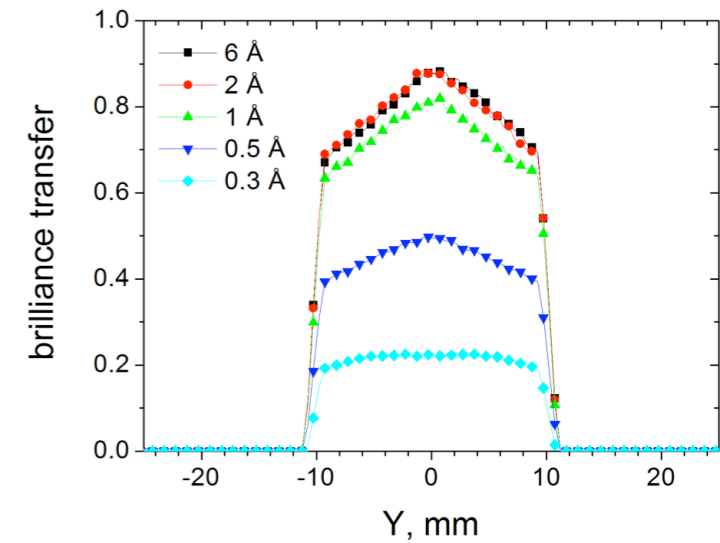
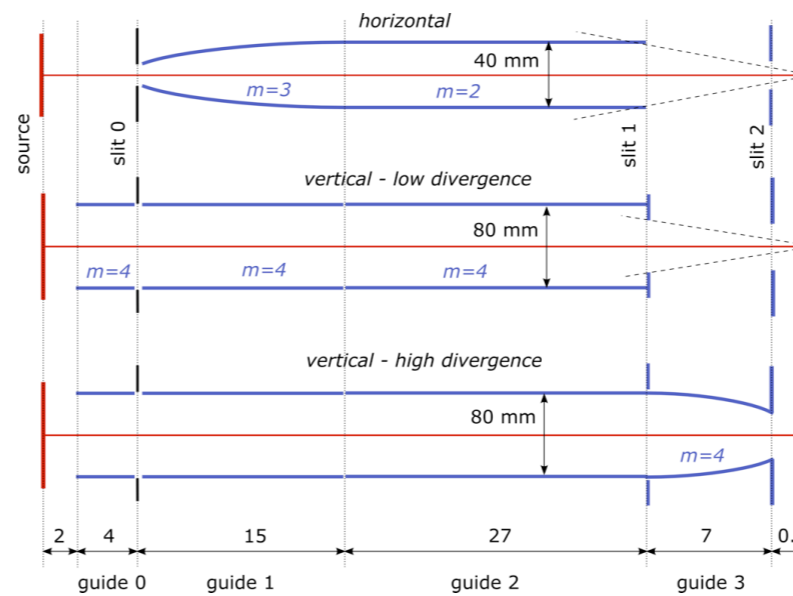


Lefmann et al, private communication



Converging Guide Geometry Concept

- Work in Prague, Berlin, Copenhagen and Lund all agree very well





Rules of Engagement

- Very happy to have free flow of information
- Throw rocks at our ideas and tell us what you think will and will not work
- We will tell you everything we are thinking and modelling on these problems
- We can provide equipment, help with measurements, modelling, and testing, to help SNS and PSI, and at the same time together we can improve existing and future sources
- Design goal: 100x reduction in the size of the “prompt pulse” on the spectrometers