EUROPEAN SPALLATION SOURCE

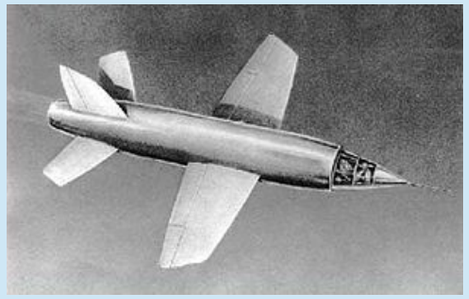
The Big Picture

12th February 2013 – Neutron Optics TAP #3 Meeting

Phil Bentley

New Thinking Required

Sub-sonic

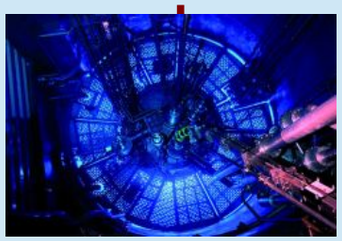


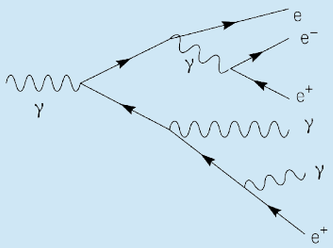
Supersonic

Space

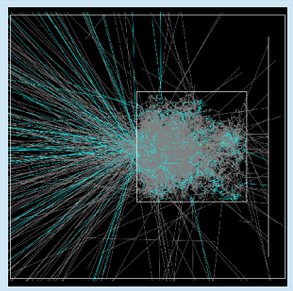
Warp drive(!)

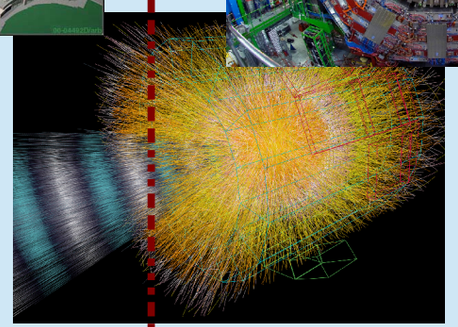
Fission (<20 MeV)



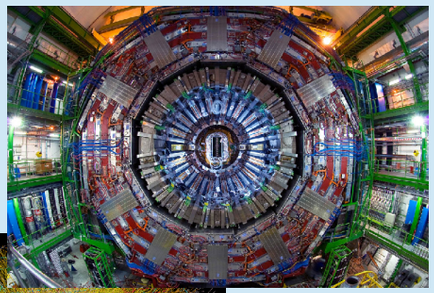


EM Showers Only
(<GeV)





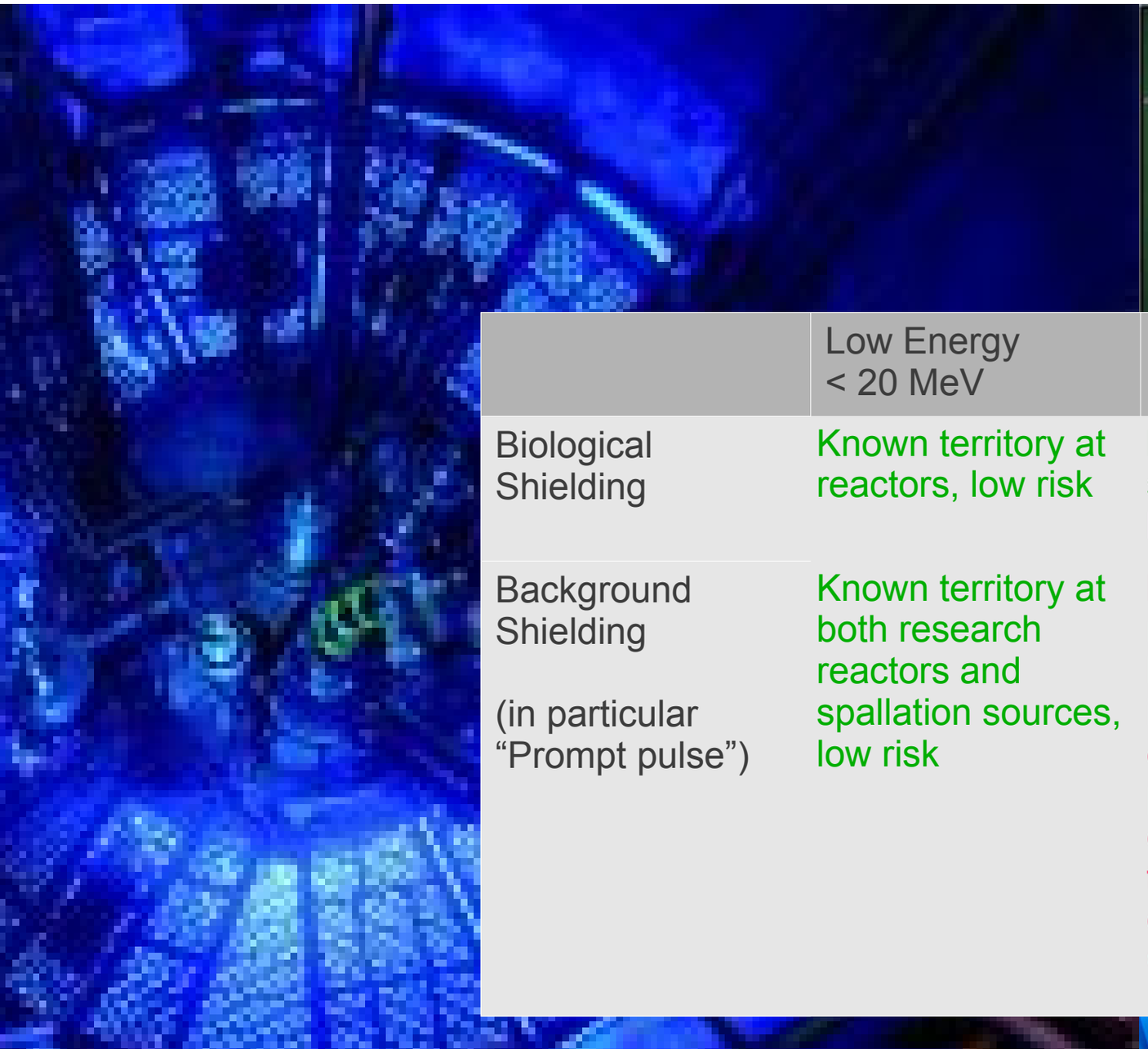
Hadronic Showers
(>~GeV)

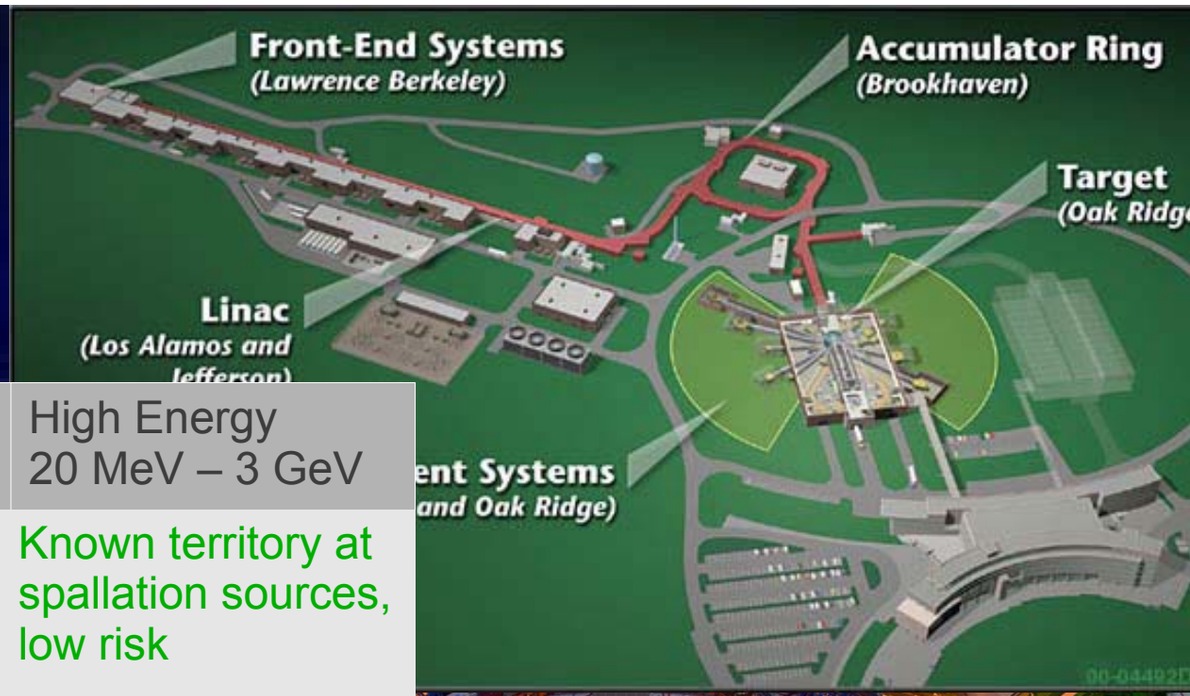


Probing Standard Model
(Tev)

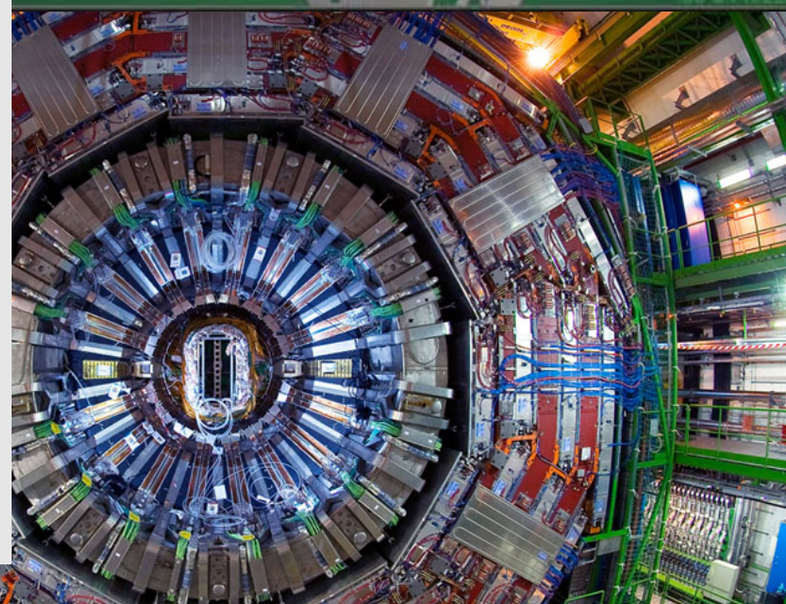
Instrument Background

- Efforts now focussed on high energy background shielding, as the other requirements are well understood





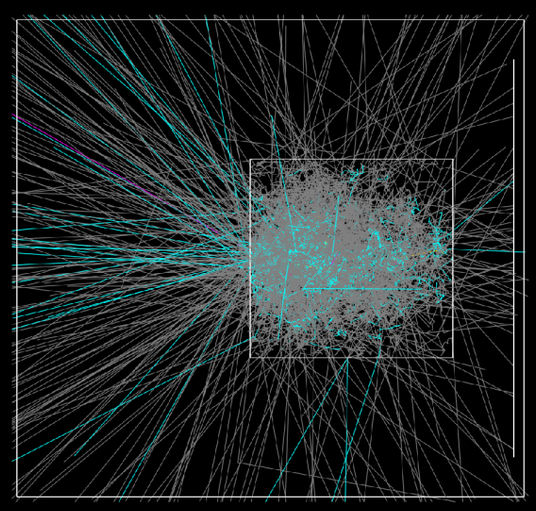
	Low Energy < 20 MeV	High Energy 20 MeV – 3 GeV
Biological Shielding	Known territory at reactors, low risk	Known territory at spallation sources, low risk
Background Shielding (in particular “Prompt pulse”)	Known territory at both research reactors and spallation sources, low risk	Existing designs at neutron facilities have proved insufficient at high energies, but potentially useful concepts exist in the physics community, e.g. CERN.

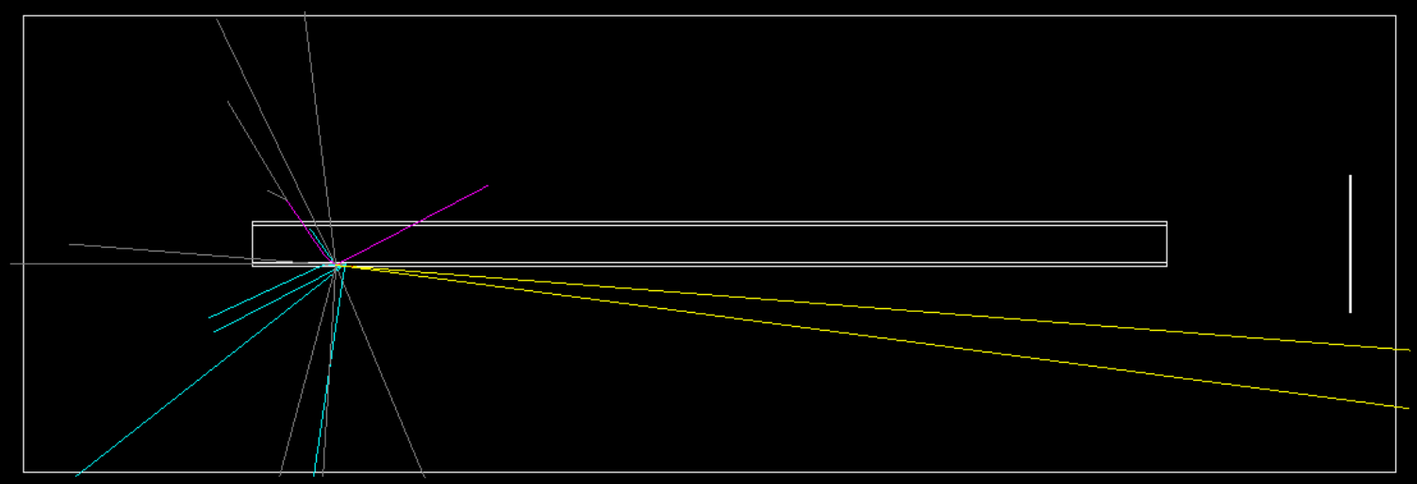


Root Cause of Prompt Pulse

- One hadron (proton, neutron or pion) interacts with another hadron
- At 100s MeV and above, this causes particle showers / spallation (our source!) but this happens not just in the source but everywhere that you get an interaction
- Subsequent particles of sufficient energy also create their own particle showers

10 neutrons in ->





1 m thick Steel Shielding

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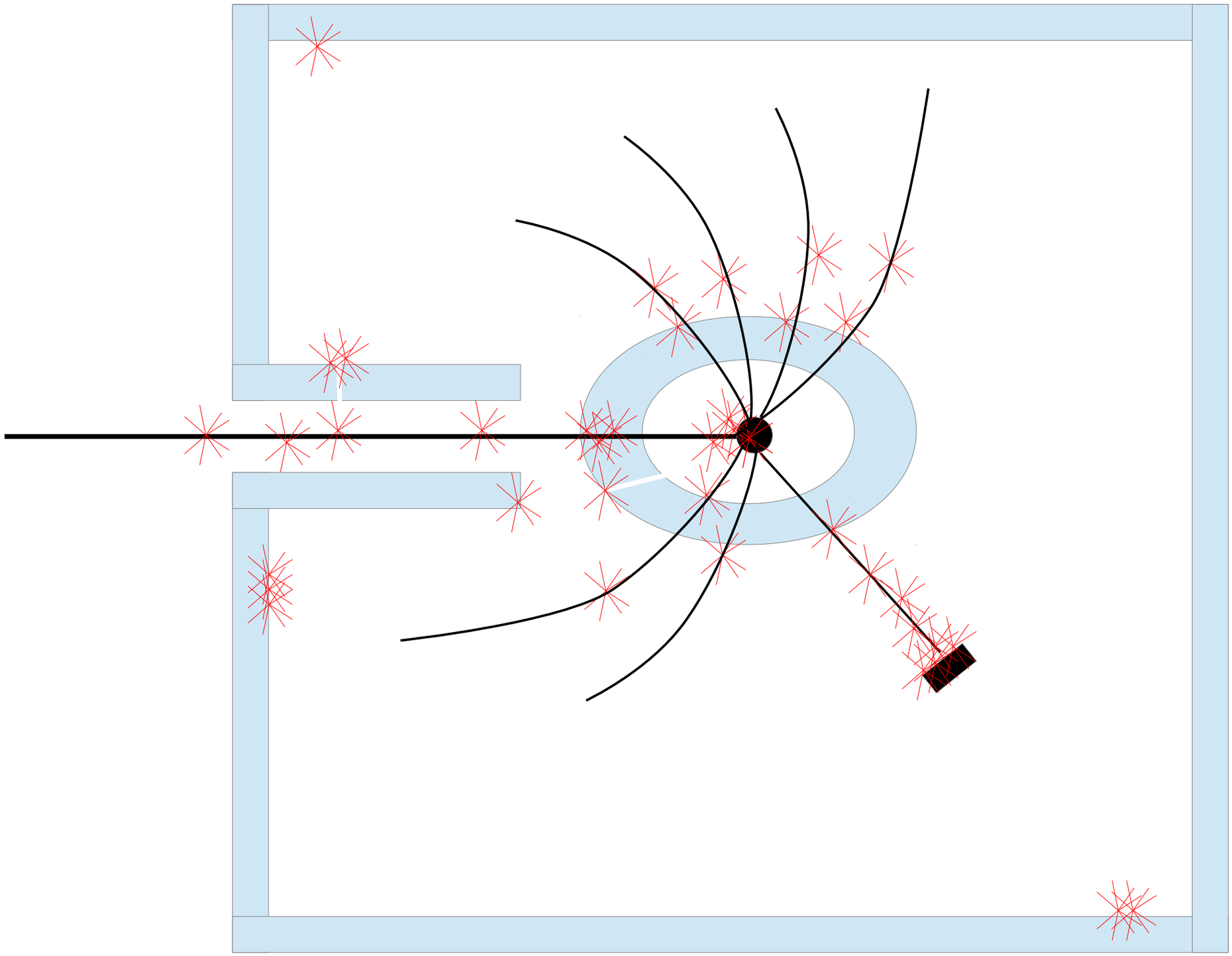
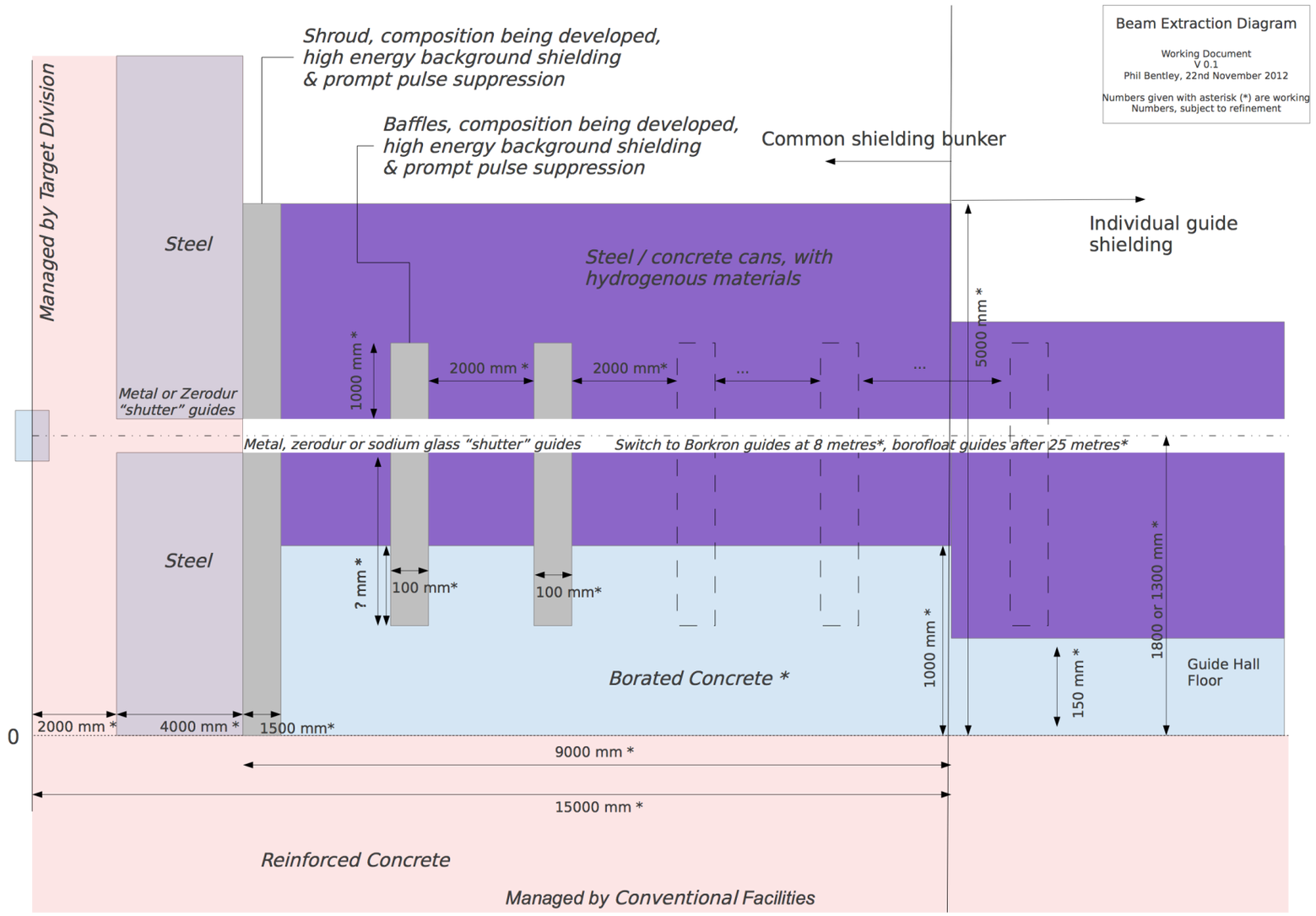


Solutions

- Talk to people! Accelerator and target people. Talk to them early and find out what they are doing.
- Measure at existing facilities.
- Detailed model with at least two packages (we use GEANT4, Fluka, MCNP). Rinse and repeat.
- Eliminate designs that might leak particles in the 100 MeV region and above.
- Plan where to get rid of the high energy particles so that this occurs in a place you want it to, rather a place you don't (roof, floor, walls and inside of the instrument are not optimal!)
- Get rid of the high energy particles in a way that reduces the possibility of creating a signal that the instrument detectors can measure.
- Use the right absorbing materials. Steel and concrete are good for health physics but probably not the right tools for the whole job.

Snapshot of Current Shielding Concept

- Side view, document is evolving quickly with time



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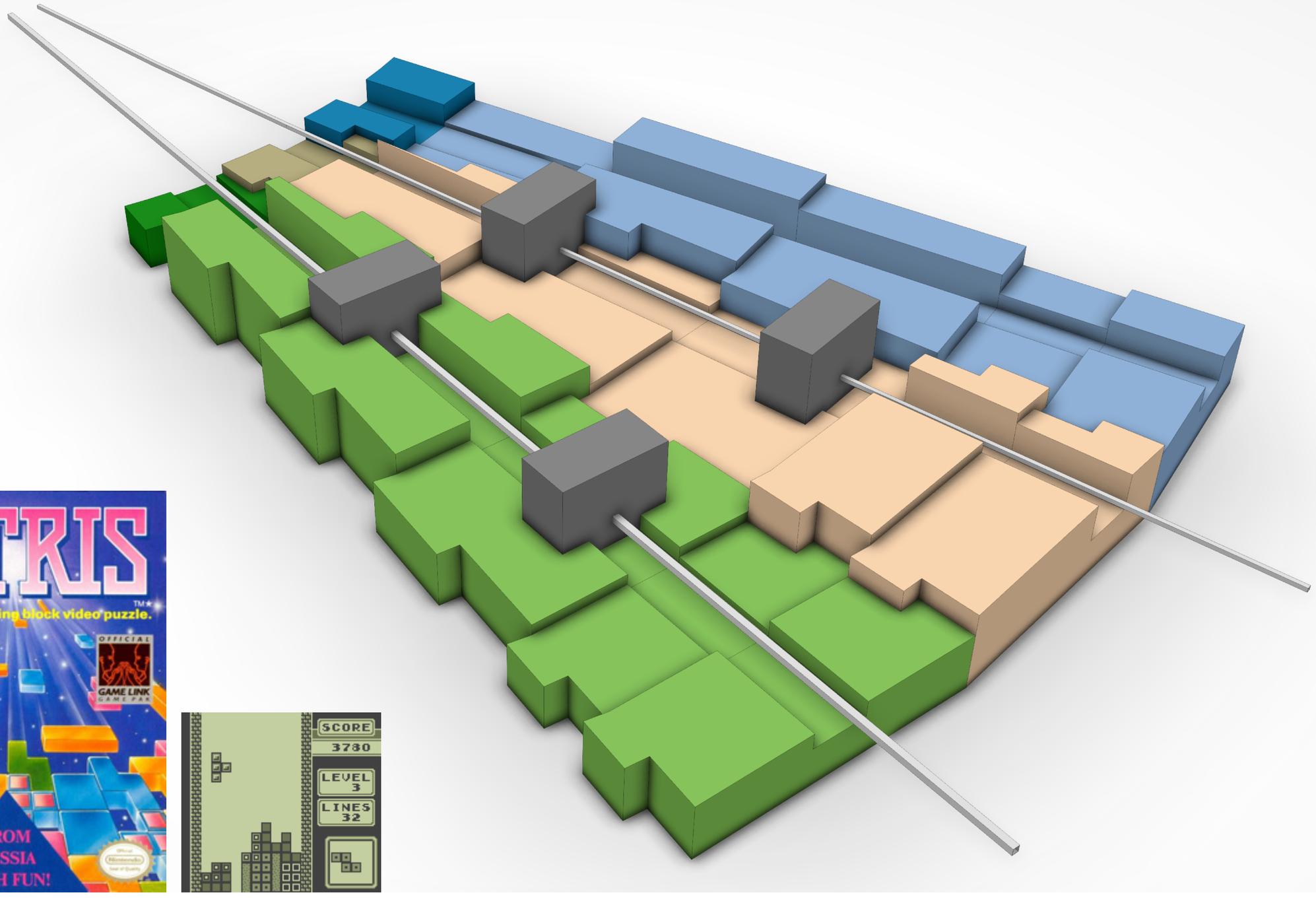

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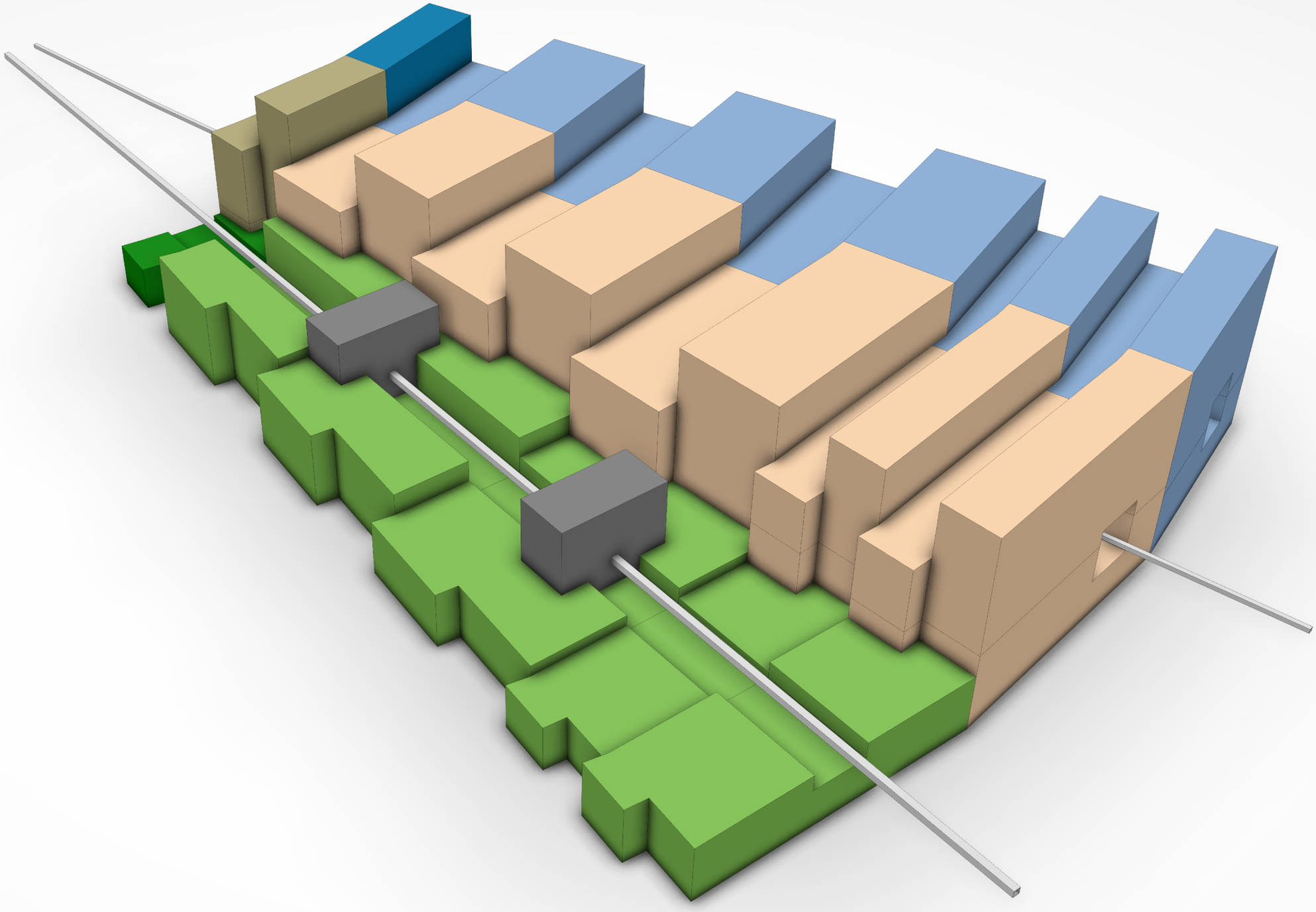

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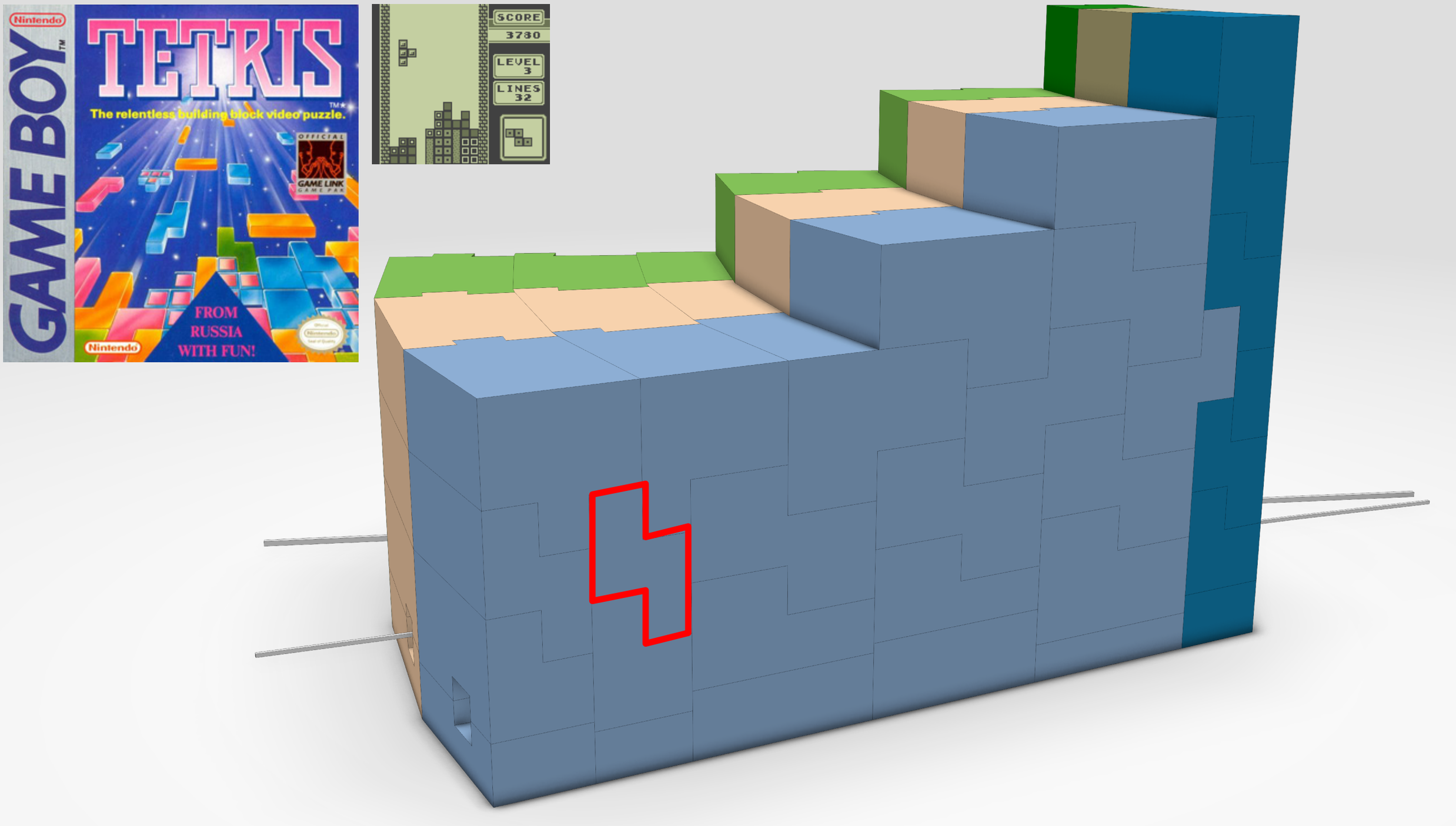

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