



Desirable BCM Performance

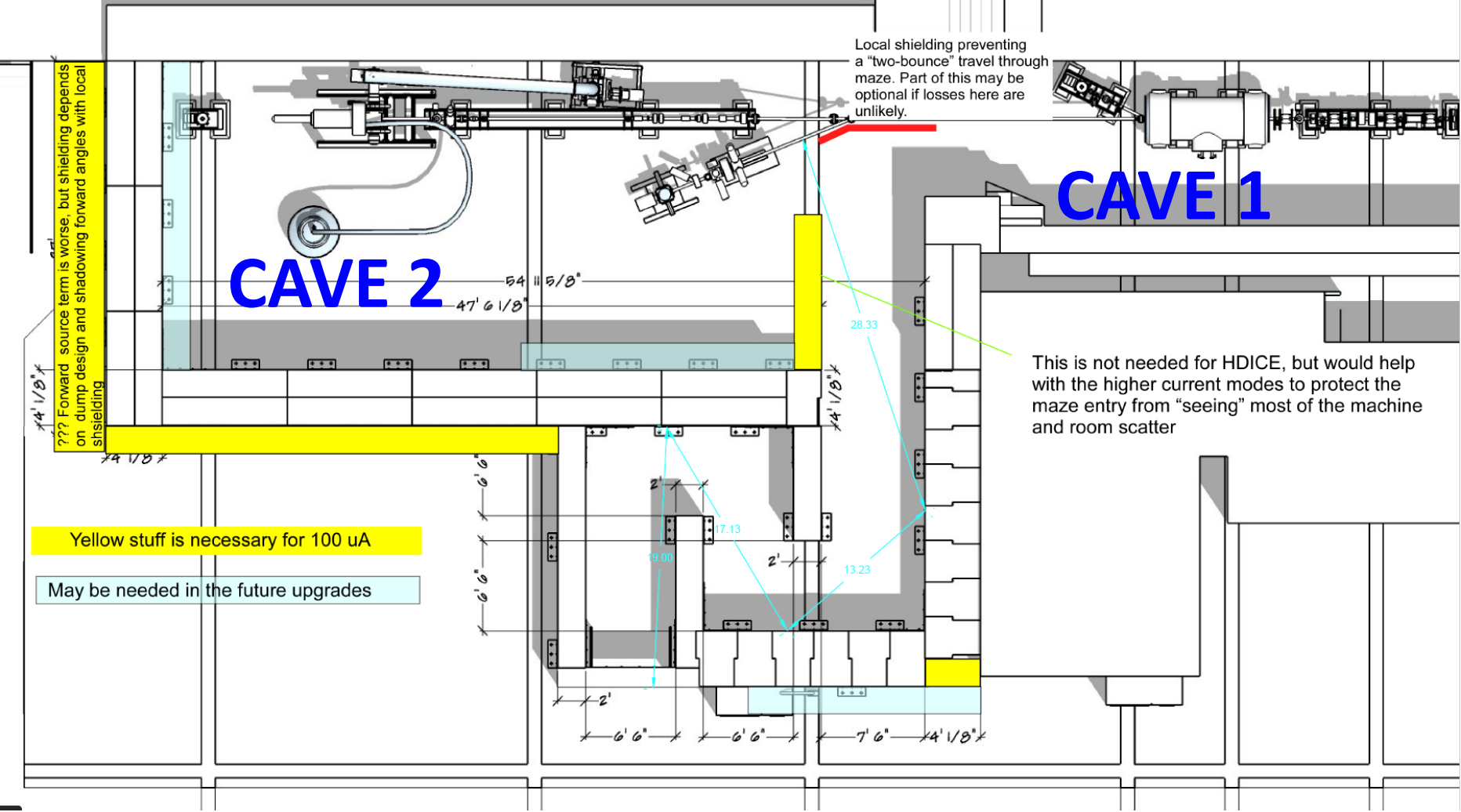
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UITF BCM discussion, October 21, 2016

Radiation Exposure Constraints

- Normal operation (per Shielding Policy)
 - < 250 mrem/y in occupied RCAs
 - < 100 mrem/y in other occupied areas (< 50 μ rem/h)
 - < 10 mrem/y at site boundary
- Max. credible accident: <15 rem per incident

Layout



Shielding Design – Phase 1

- **CAVE 2**

- HDIce operation at 10 MeV for 900 h/y
- $I_{av} = 5 \text{ nA}$ for 80% of time
- $I_{av} = 100 \text{ nA}$ for 20% of time (180 h)
- concrete shielding: 4 ft lateral and 1.75 ft roof

- **CAVE 1**

- $I_{av} = 100 \text{ } \mu\text{A}$ when not running HDIce, beam terminated in FC before Cave 2
- 55"/27" lateral and 30" roof shielding

Cave 2

TOTAL BEAM LOSS	D [mrem/h]	Note
Cave 2, 1 μ A, side	0.44	RCA
Cave 2, 1 μ A, roof	55.21	RA
Cave 2, 100 nA, side	0.044	just < RCA
Cave 2, 100 nA, roof	5.52	RA

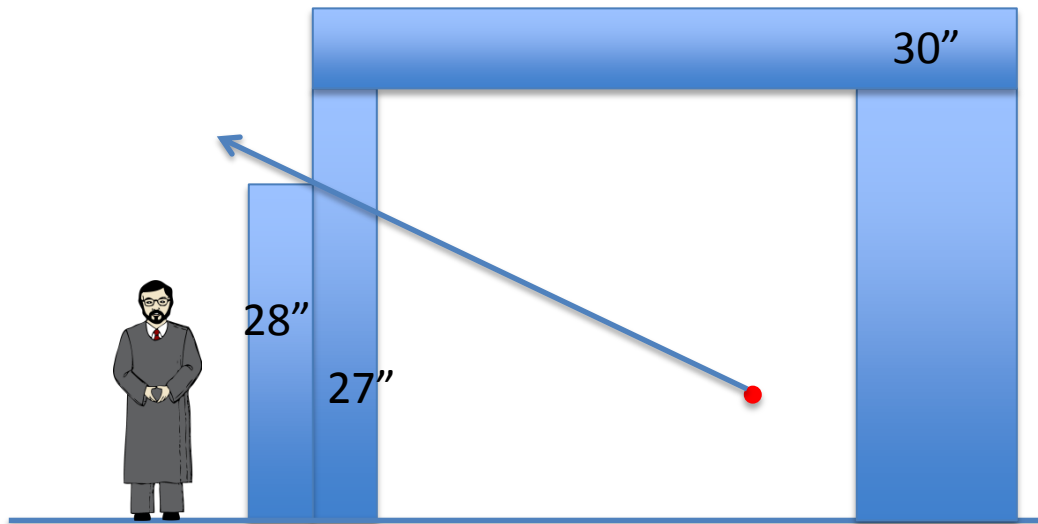
- If total losses above are very unlikely, how can we justify a lower loss assumption?
- A loss of 200 nA may be tolerated, considering HDIce will run only 900 h/y
- **BCM should reliably catch $I_{av} > 200$ nA within ≤ 2 minutes**

Cave 1

- Cave 1 shielding as is; $I_{av} = 100 \mu\text{A}$ is desired in cave 1
- Cave 2 has **4 ft** forward and lateral concrete shielding, with a **1.75 ft** thick roof
- Beam ends in a well shielded FARC at 42" beam height

Cave 1 at 100 μ A

CAVE 1	Dose rate [mrem/h]	Note
Side 100% loss	41	RA
Side 1% loss	0.4	RCA
High Side 1% loss	26	RA

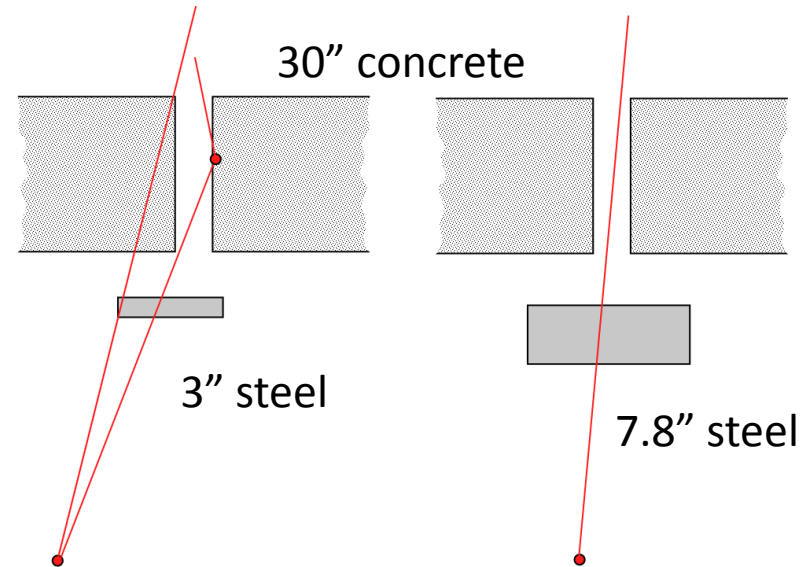


Thinner wall may be an issue for stairs (and ground due to skyshine).

Cable penetrations under west wall must be filled with grout or similar

Cave 1 at 100 μA

CAVE 1	Dose rate [mrem/h]
Roof 100% loss	2973
Roof 1%	30
Penet* 100%	40621
Penet* 1%	406
* with current 3.25" Fe shield	



Penetrations are above the beamline – about 8" of steel is needed for same attenuation as the 30" concrete slab.

Roof will have to be inaccessible; Depending on results of measurements, full 100 μA may not be feasible at 10 MeV;
Existing BCM would catch a 1% loss (1 μA)

Summary

- Side shielding can (just) handle a full 100 nA loss continuously, if we forget skyshine
- Short episodes of higher beam loss can be tolerated as mis-steering, providing they are reliably terminated in < 2 min
- **Recommendation:** BCM should reliably detect beam loss of 200 nA at most