Veto detector design options

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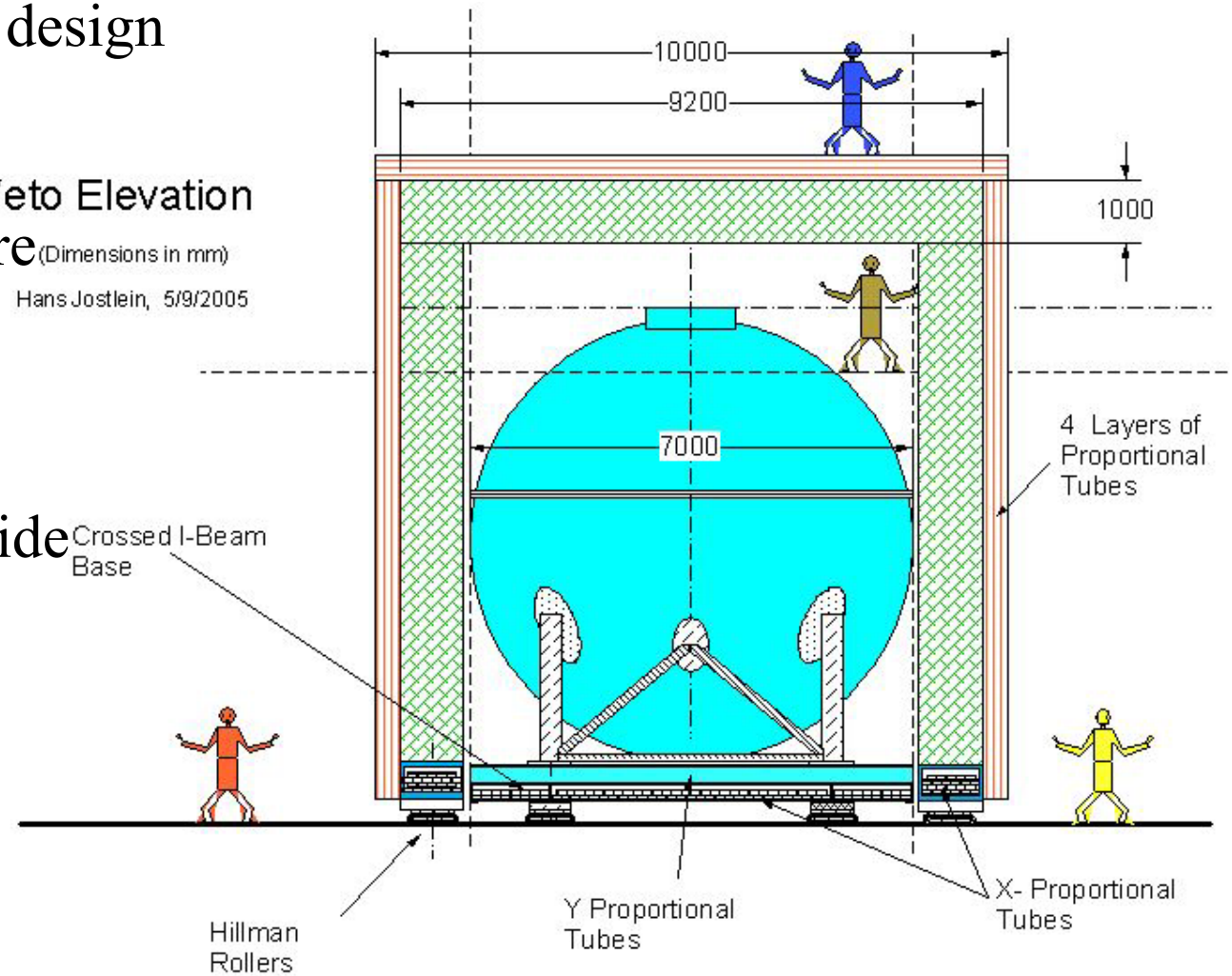
(showing work of Hans Jostlein, Jon Link, SD, Peter Fisher, and Steve Biller)

Design Requirements, Options

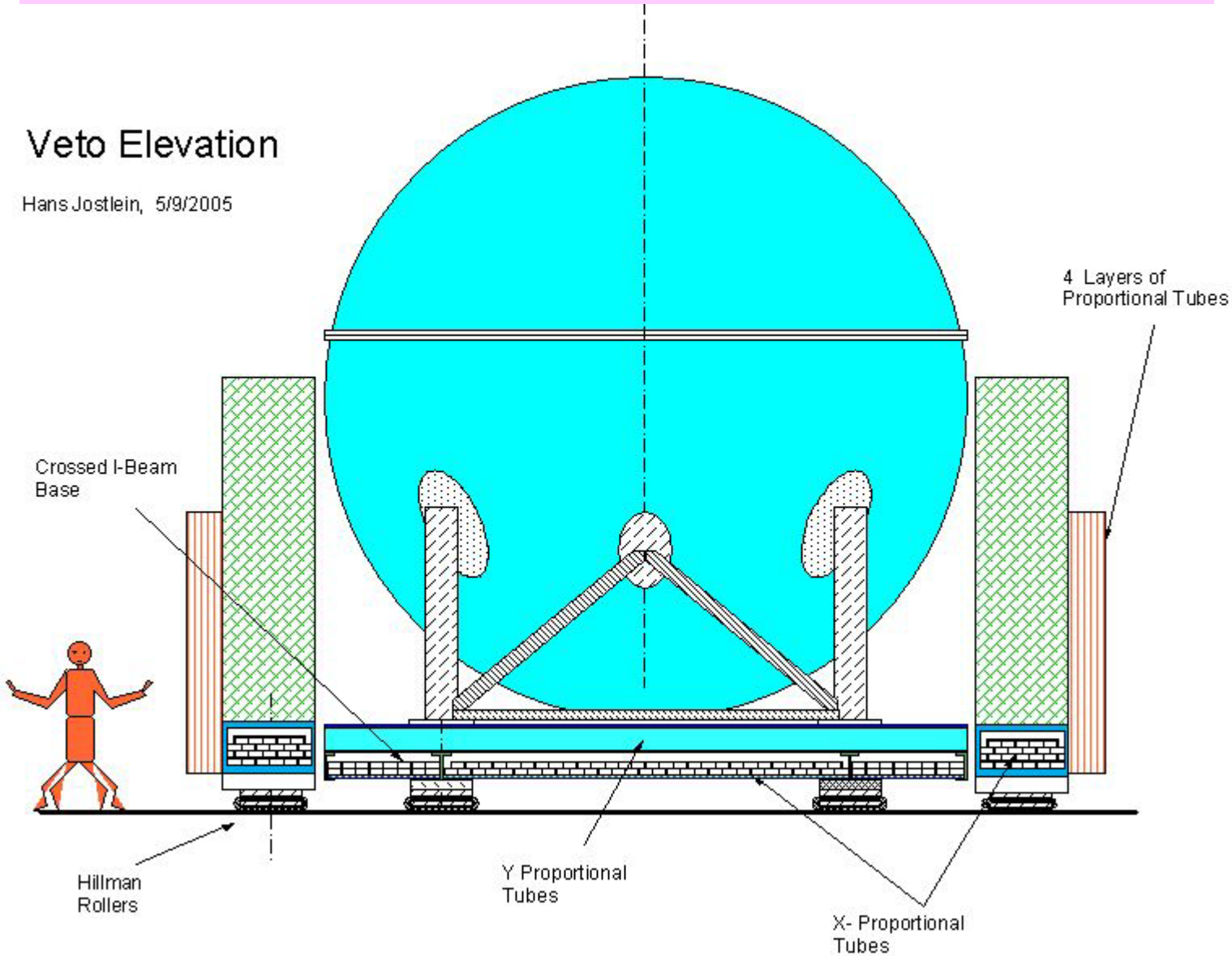
- Requirements
  - ✓Hermetic!!
  - ✓Position resolution ~20cm on all sides (mod. res. tracking)
  - ✓Access to neck to insert sources
  - ✓At least 7 attenuation lengths for neutrons
- Options
  - ➢Passive shielding
    - -1m CHESS concrete (half of weight is iron)
    - -Successful use at Cornell
    - -Requires hermetic position detectors
  - ➢Active shielding
    - -2m water or liquid scintillator
    - -Water only detects via Cerenkov (e, γ, high energy μ)
    - -Need scintillator for low energy μ, hadrons

Box design with prop tubes

- Most straightforward design
- Prop tubes 12” diam
  - ✓Use D0 design
- 2 xy layers shown here
- Minimal separation between inner det and veto
- neck access from inside veto box

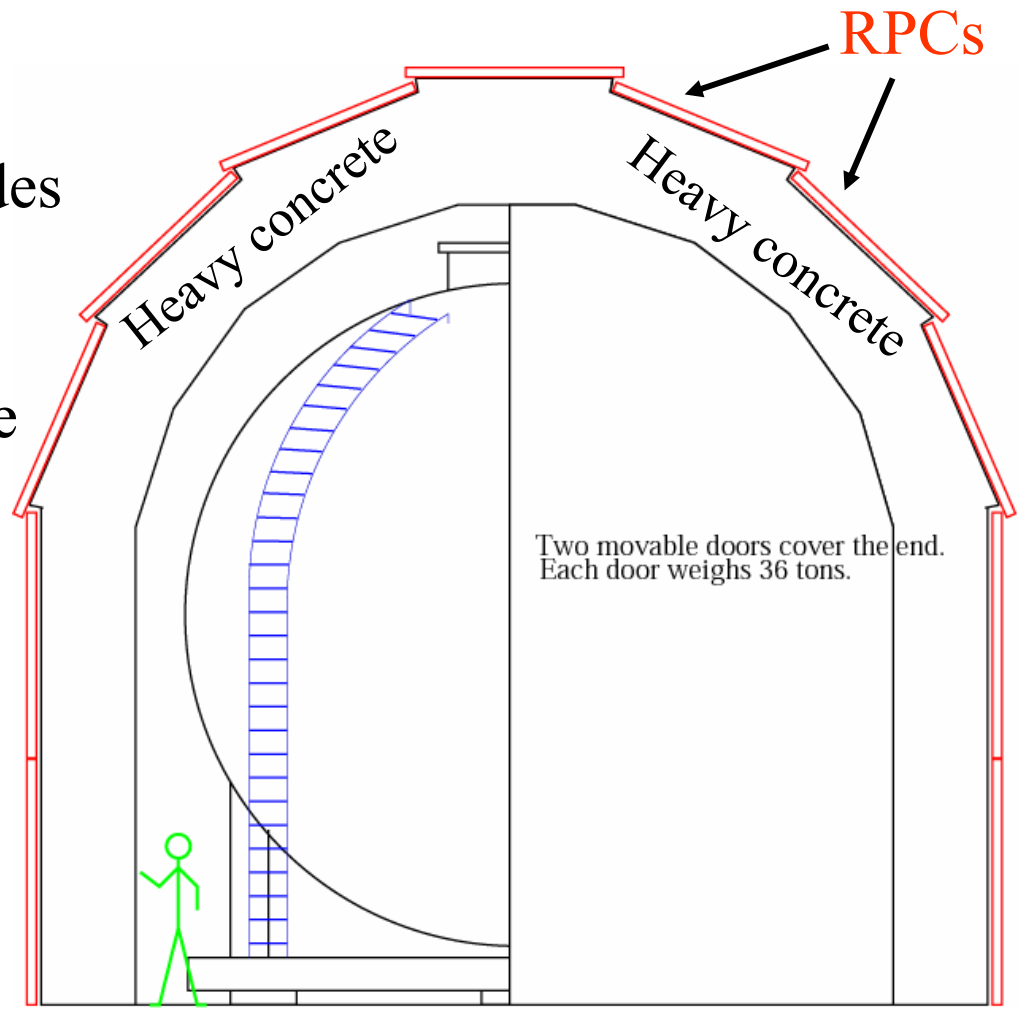


Moving the detectors



Quonset hut with RPC's

- Passive shielding
  - ✓CHESS concrete on 5 sides
  - ✓Detectors should be on 6 sides
- RPC's give suitable resolution
  - ✓Resistive plate chambers
  - ✓Outside here, inside possible
  - ✓Access through doors
  - ✓Simple, cheap
  - ✓Good (and bad) experiences
  - ✓Use BELLE design updated by Adam Para



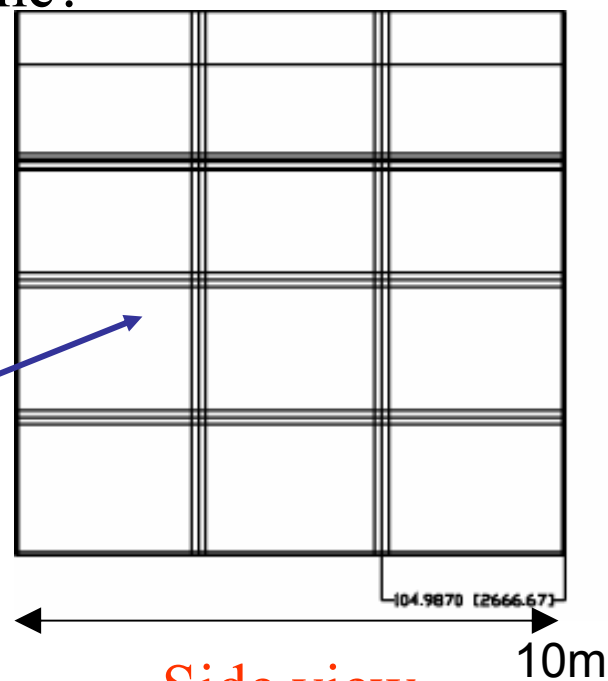
End view

Quonset hut frame (Pitt)

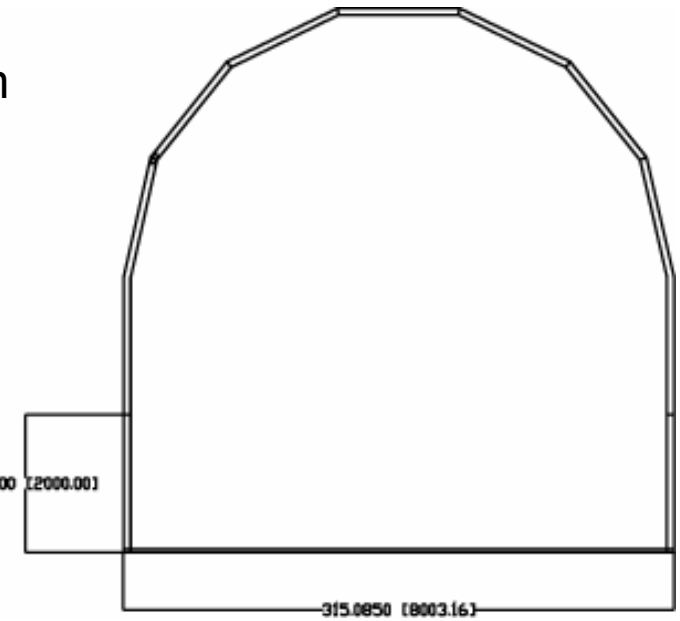
- ✓Assumes 10m of concrete not self-supporting
- ✓Combination of 4” I-beam and U-channel
- ✓Standard items, cost reasonable
- ✓Weight~3.5 tons
- ✓Strength of frame?

2m x 3.33m RPC, need

20 per xy layer



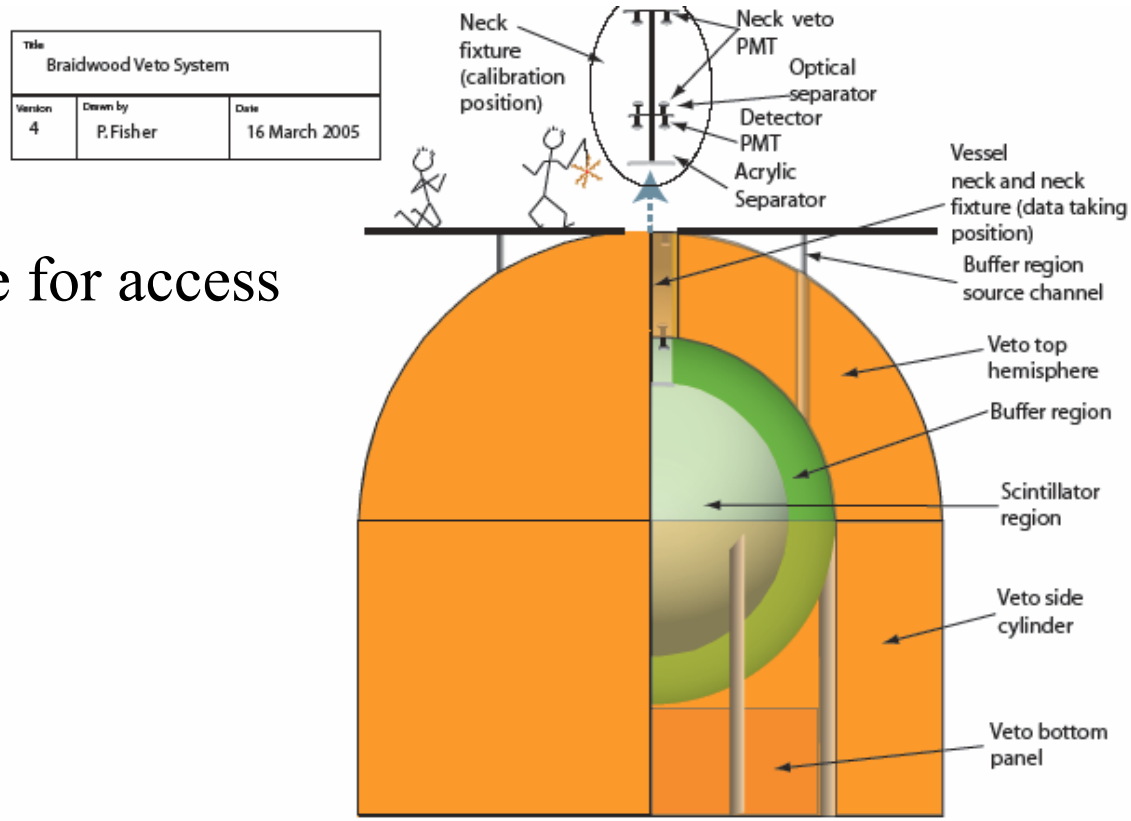
Side view



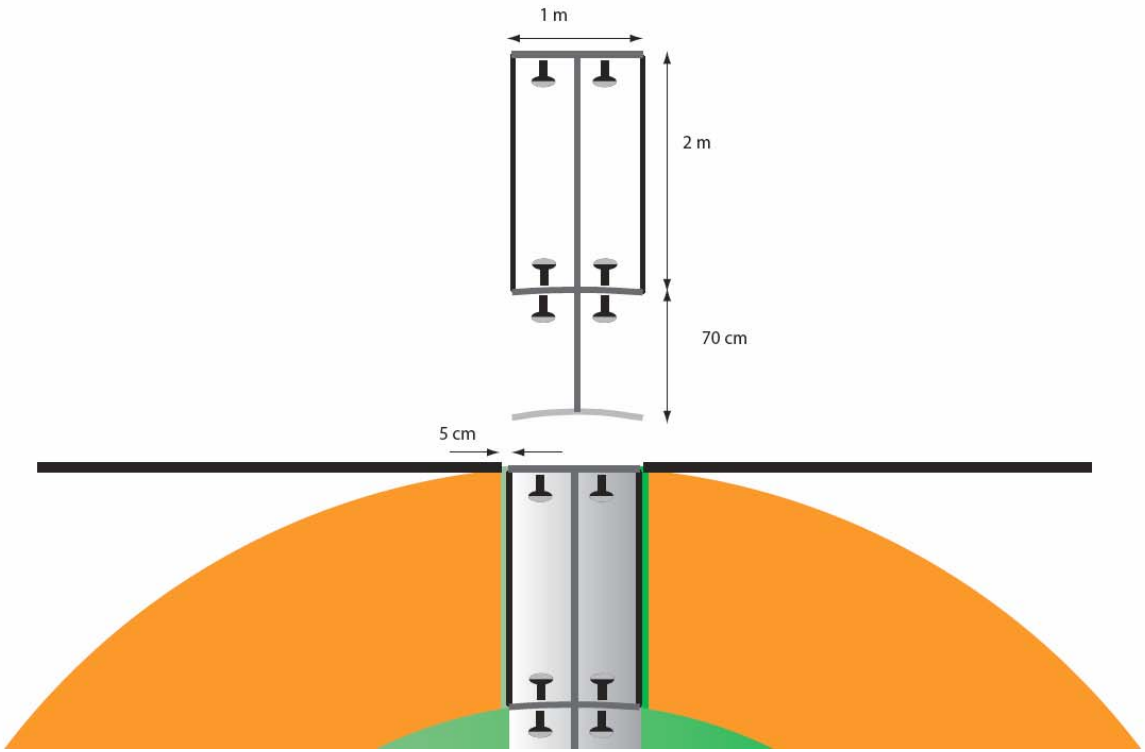
End view

Silo version of water veto

- Similar to KamLAND
- ≥2m thick
- 8 sections
- Access from top
- Need special hole for access

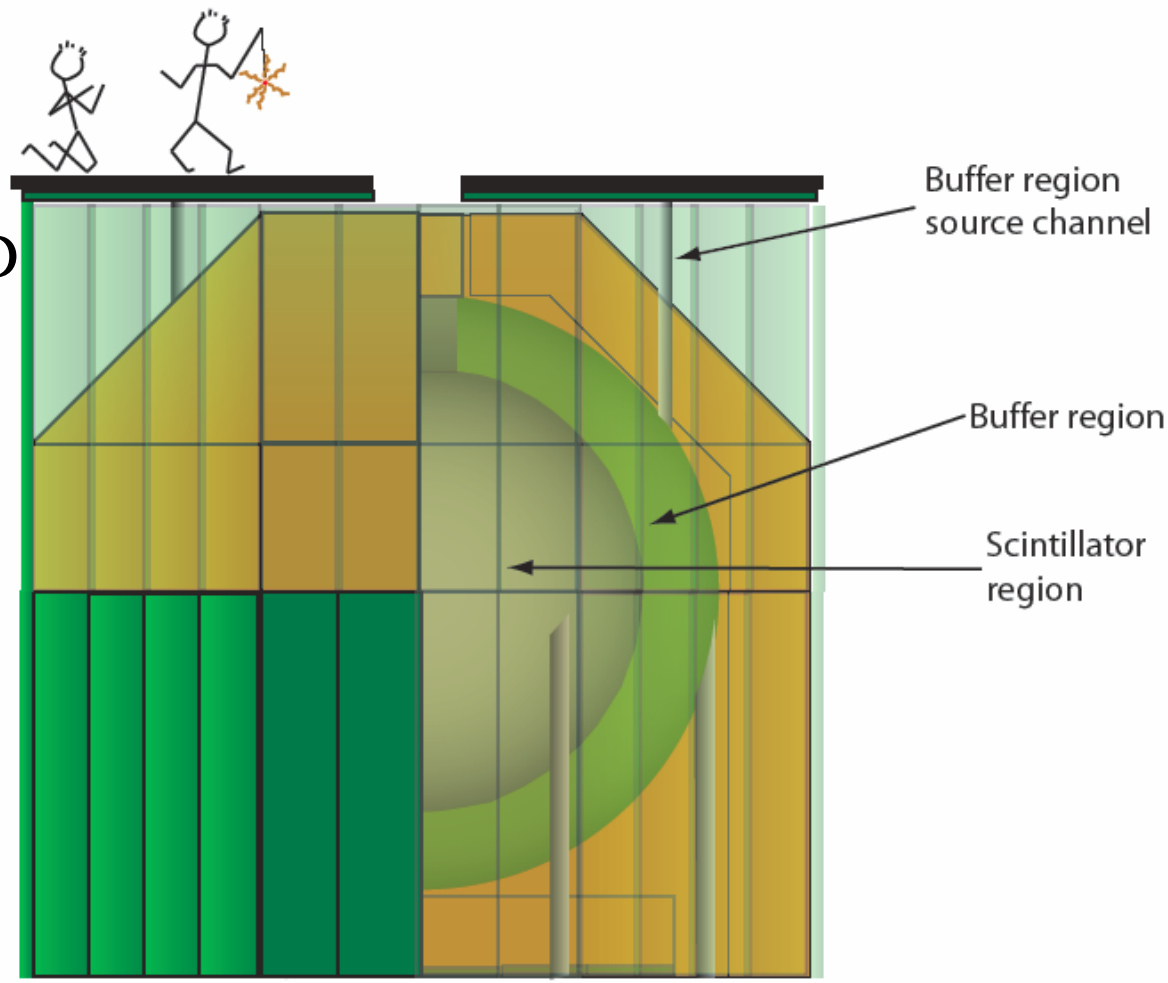


Detail of removable neck



Gazebo water veto

- Simpler than silo?
- More weight, area
- Looks like KamLAND



First cost estimates

- From Braidwood proposal or previous usage
  - RPC's from Adam Para (*1.2)
  - Prop tubes from D0
- Estimated based on similar experience
- We can stay within proposal guidelines
- Shipping cost for hematite significant
- Liquid scin very expensive

	box	box	quonset	silo	silo
	prop tubes	RPC's	RPC's	water	liq scin
	HJ	SD/JL	SD/JL	PF	PF
shielding		heavy concrete	heavy concret	water	liq scin
thickness (m)	1	1	1	2	2
weight (kton)	1.94	1.77	1.46		
cost	$229,231	$209,635	$172,721	$0	$990,000
frame	$0	$150,000	$150,000	$500,000	$500,000
detector	prop tubes	RPC	RPC	PMT	PMT
layers (each has x,y)	3	3	3	1	1
chan/layer	648	1917	1580	300	300
total area (m^2)	503	460	379		
total mass (kg)	33476	50600	41690		
position res/layer (cm)	30	20	20	15?	15?
construction cost/PMT	$245,991	$50,674	$41,751	$261,000	$261,000
readout+HV	$58,320	$103,518	$85,320	$47,000	$47,000
gas/pump	$13,997	$994	$819	$100,000	$100,000
mounting	$11,664	$10,000	$10,000	$30,000	$30,000
total det cost	$329,971	$165,185	$137,889	$438,000	$438,000
TOTAL COST	**$559,203**	**$524,820**	**$460,610**	**$938,000**	**$1,928,000**

What's next?

- Excellent progress!
- Continue to improve simulations
- Settle active vs. passive
  - ✓ Water vs. liquid scin for active
  - ✓ Inside vs. outside detectors for passive
- How much tracking is needed?
- Can we afford deadtime for each tracked muon?