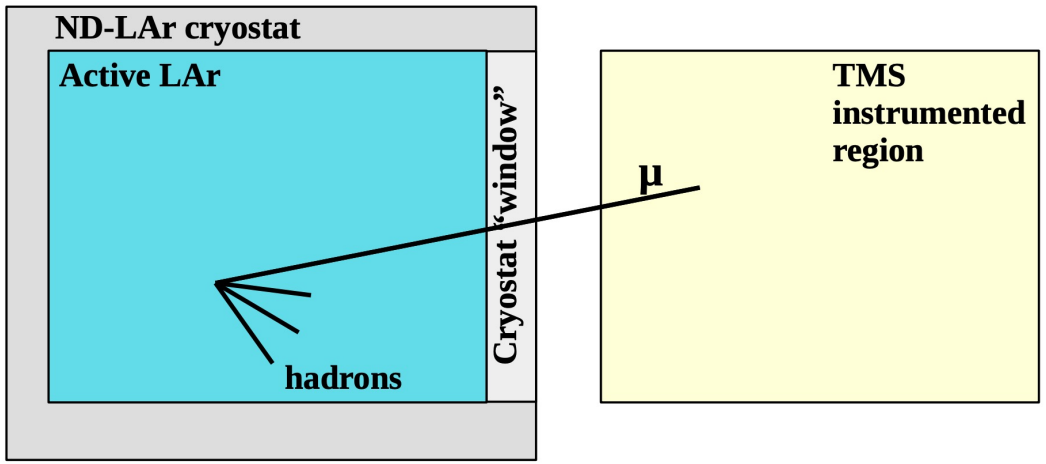
TMS Requirements

Reminder: what is "accepted"



- Hadrons contained in ND-LAr
- Muon stops in ND-LAr active volume or TMS instrumented region

I'll call these events the **ND Physics Sample**.

C. Marshall / KiYoung Jung
September 2024 Collab Meeting
"TMS Physics Requirements: Width"
(talk here)

Defined a metric based on the ND acceptance in relevant phase space, required this to be greater than 10%.

Will require a large acceptance correction, which is largely geometric.

Key points:

1. ND-LAr + TMS measurements will be systematics limited.
2. We will not measure anything perfectly.
3. How large are the corrections we need to make?
4. How well do we know them?

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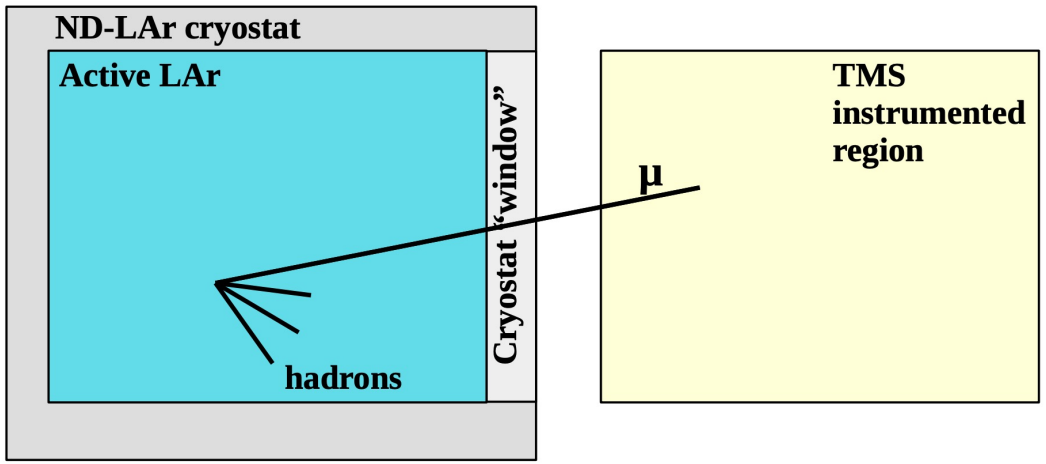

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Considerations:

Do we want to be defining requirements in an energy-dependent way?

Think about requirements as related to the bulk of the reconstructed distribution (resolution) vs. events that are will wind up in the tails (mis-reconstruction).

ND-C1.4.4	TMS spatial resolution	TMS shall have sufficient 2D spatial resolution to match ND-LAr rear-exiting μ tracks that enter the front face of TMS.	To reconstruct μ that exit NDLAr into TMS, signatures from a single μ in ND-LAr and TMS must be matched (ND-M0, ND-M7).

We don’t have a number for this. 90% for events in the ND Physics sample, above some minimum energy threshold in TMS? (e.g. 3 planes)?

This would require a 10% efficiency correction, a factor of roughly 10 smaller than the largest geometric correction we will be applying.

ND-C1.6 (proposed)	TMS Muon containment	TMS shall be capable of identifying where ND-LAr matched tracks exit TMS.	Necessary to make an accurate energy measurement. Easy in the back (last z plane) and sides (vertical strips), harder on the top and bottom. C-1.4.1

90% for events in the ND Physics sample, above some minimum energy threshold in TMS?

Purity of the reconstructed ND Physics sample should be 99%.
“Purity” here is defined to refer to top or side-entering tracks (genuinely bad reco) as opposed to tracks that stop just outside the TMS containment volume.

ND-T3.20	Noise rate	The rate of noise hits in a time slice shall be less than 0.5%.	Noise can affect tracking, leading to spurious fits and overestimates of energy.
ND-T.3.???	Plane counter efficiency?		

This is a standard metric used to describe performance of devices like TMS.

Efficiency of registering a hit for a muon that fully crosses a detector plane.

Missing hits are likely less of an issue as spurious hits:

Can cause problems in patter recognition for short tracks

Can lead to energy underestimation if at the end of the track.

95%? Dominant effect would be from gaps between modules.