

DUNE Near Detector Transport System Update

Discussion topics

- Transport system - detector weights
- Transport system - movement devices
- Transport system - speeds/times/acceleration
- Transport system - movement considerations for KLOE

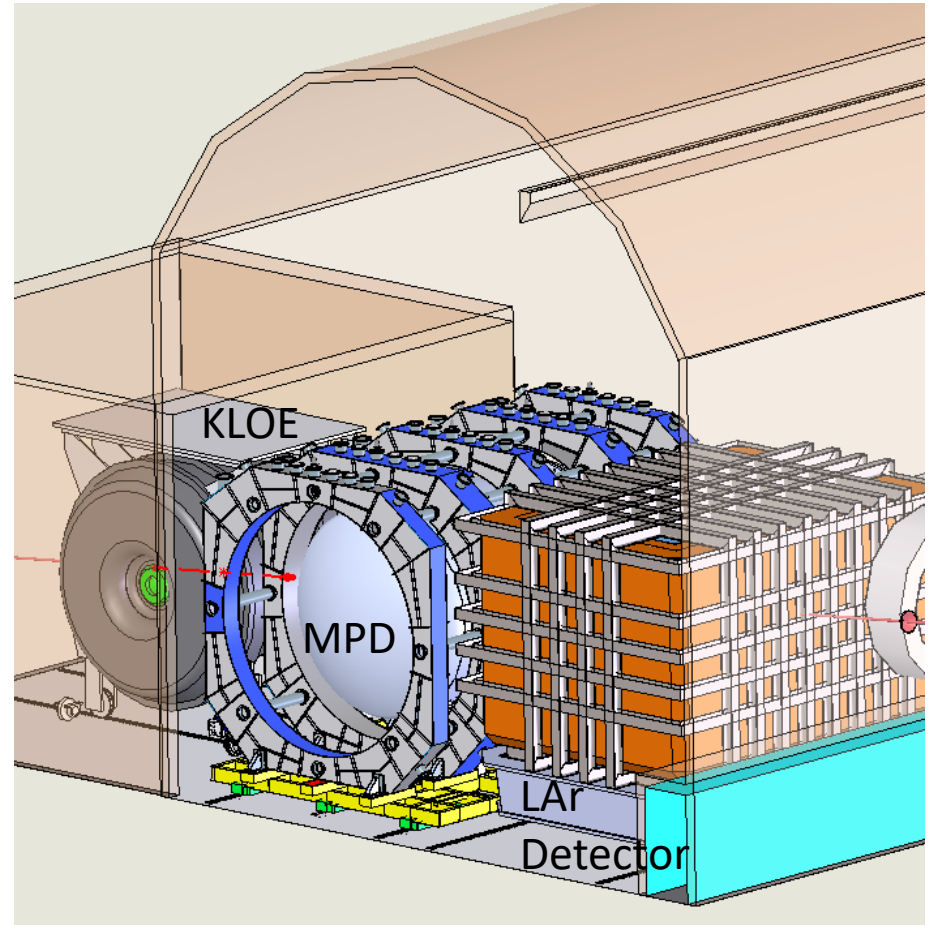


Transport system movement detector weights

Approximate loads:

- LAr detector – 900 tonne
- MPD – 800 tonne
- KLOE – 900 tonne
- 20 tonne of side reaction loads from magnets

- 20 tonne side load creates a 33 tonne unequal loading on the transport wheels. Not enough to unseat the wheels



Transport system movement plans

Use Hilman Powered rollers to move detectors



This example shows (6) 100 ton electric motorized roller assemblies moving a 400 ton test load at 1 ft/min for a nuclear waste conversion plant. Our loads are higher and speeds slower.

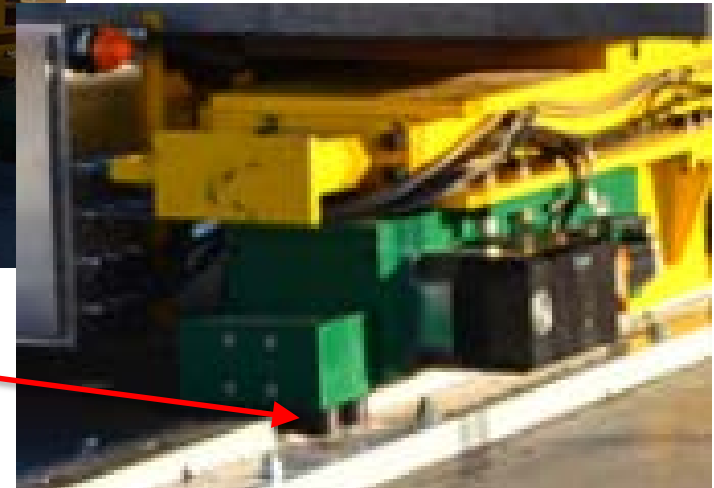


Transport system movement plans

Use Hilman Powered rollers to move detectors

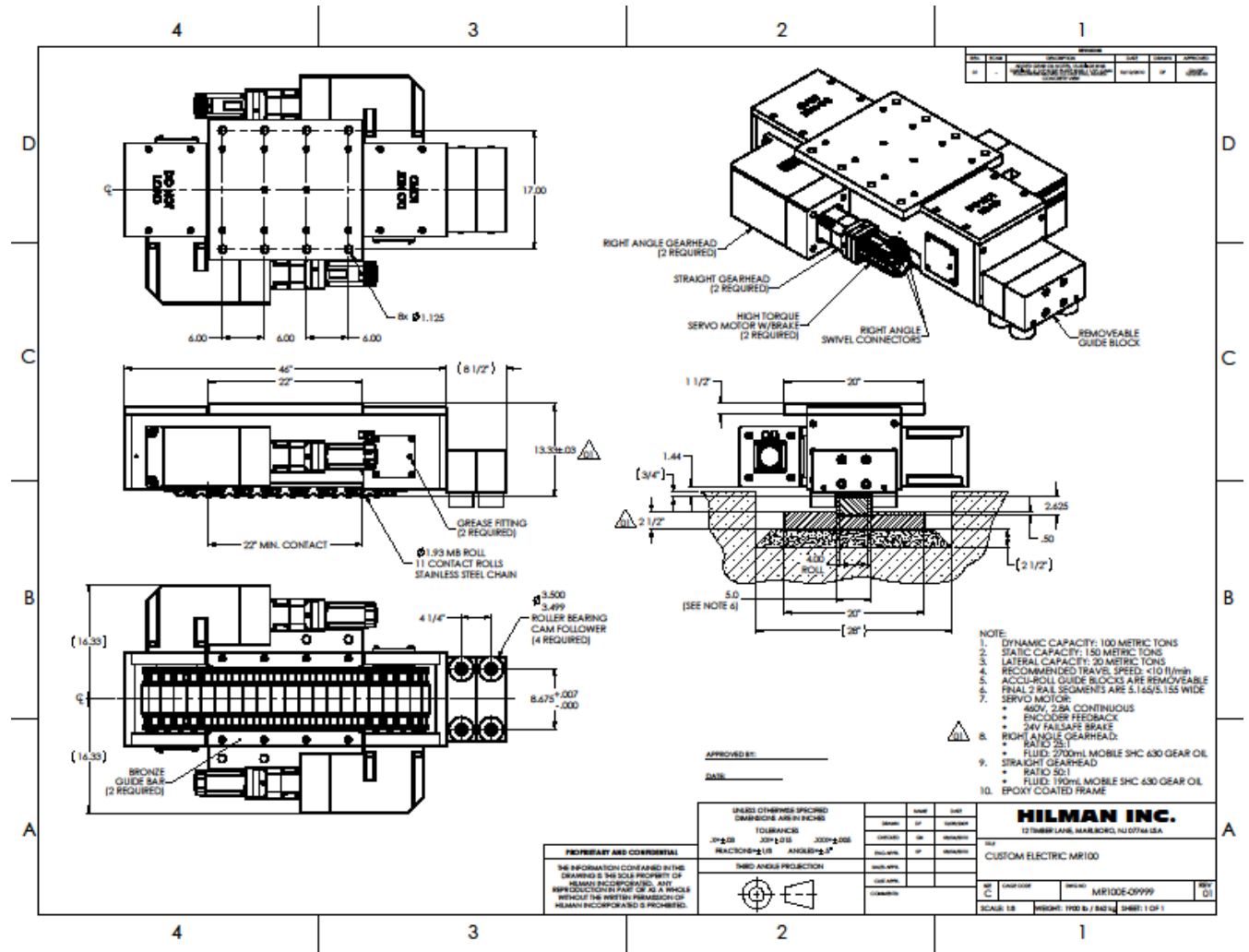


Guide rollers at the 4 corners are sufficient to handle the 20 ton side loads



Transport system movement plans

Will it fit?



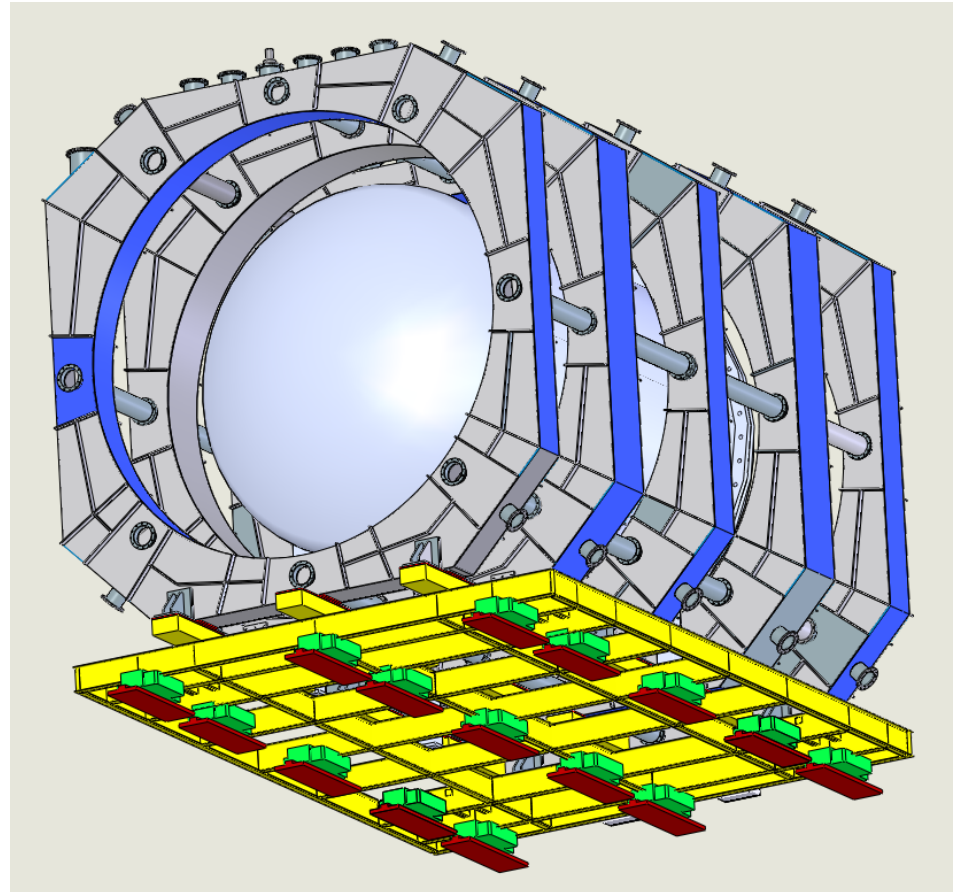
Transport system movement plans

Will it fit?

- Initial sketches look promising
- Next steps are to work with the supplier to determine more specific details
- We'll attempt to have all roller assemblies the same for all detectors

➤ Side note-

The yellow support frame is now part of the magnet design due to the magnet loads imposed during extreme operating conditions



Transport system movement speeds

Desired total travel is within 8 hours

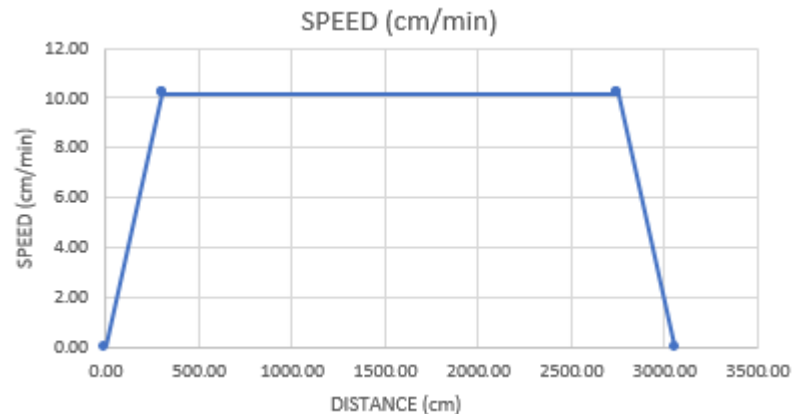
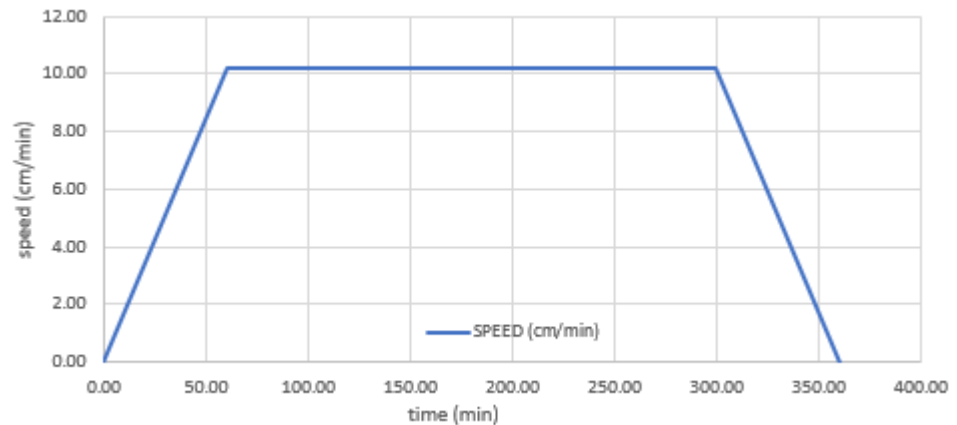
- 1 hour preparation at the beginning and at the end
- 6 hrs remains for travel time
- Average speed is 8.5cm/min over 30.5m
- 9 stops within the 30.5m are planned, actual locations to be flexible per run
- Repeatable stop locations within +/-1cm needed; +/-1mm desired
- A round trip may take 2 weeks



Transport system movement speeds

- Curves calculated using motion equations
- Speed-time-distance charts for 30.5m travel within 6 hrs
- Acceleration works out to be 0.17cm/sec^2
- Does this create sloshing? Or other issues?
- Mockups needed

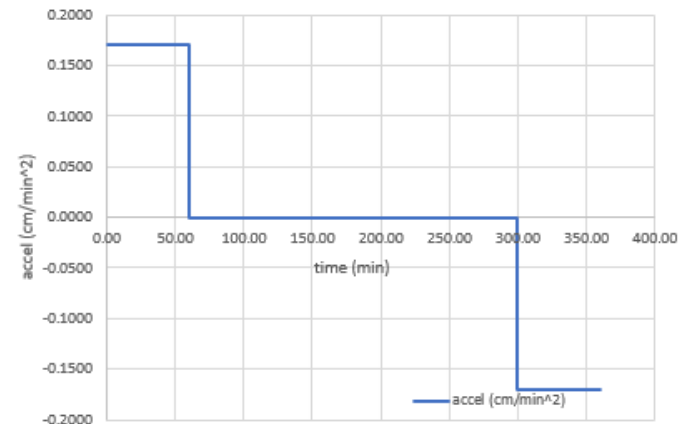
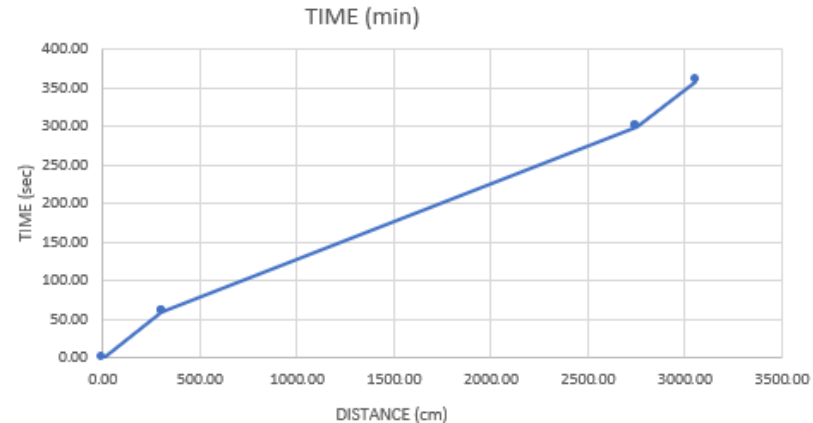
DATA POINTS							
DISTANCE (cm)	0.00	306.00	306.00	2754.00	2754.00	3060.00	DISTANCE (cm)
SPEED (cm/min)	0.00	10.20	10.20	10.20	10.20	0.00	SPEED (cm/min)
TIME (min)	0.00	60.00	60.00	300.00	300.00	360.00	TIME (min)
accel (cm/min ²)	0.1700	0.1700	0.0000	0.0000	-0.1700	-0.1700	accel (cm/min ²)



Transport system movement speeds

- Curves calculated using motion equations
- Time vs distance
- Acceleration curves
- Charts for 30.5m travel within 6 hrs
- Acceleration works out to be 0.17cm/sec^2

DATA POINTS							
DISTANCE (cm)	0.00	306.00	306.00	2754.00	2754.00	3060.00	DISTANCE (cm)
SPEED (cm/min)	0.00	10.20	10.20	10.20	10.20	0.00	SPEED (cm/min)
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accel (cm/min ²)	0.1700	0.1700	0.0000	0.0000	-0.1700	-0.1700	accel (cm/min ²)

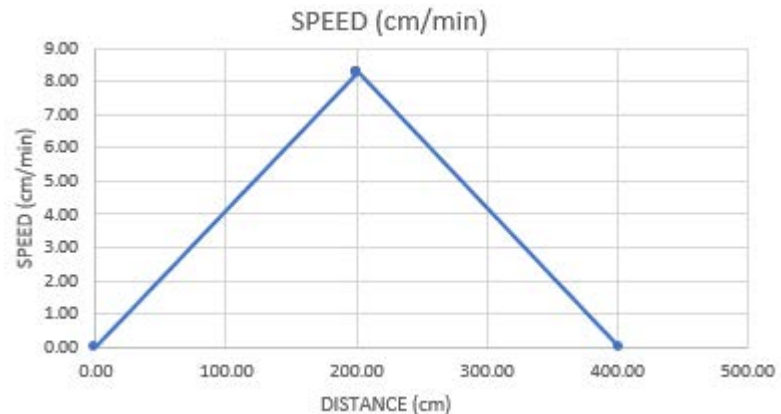
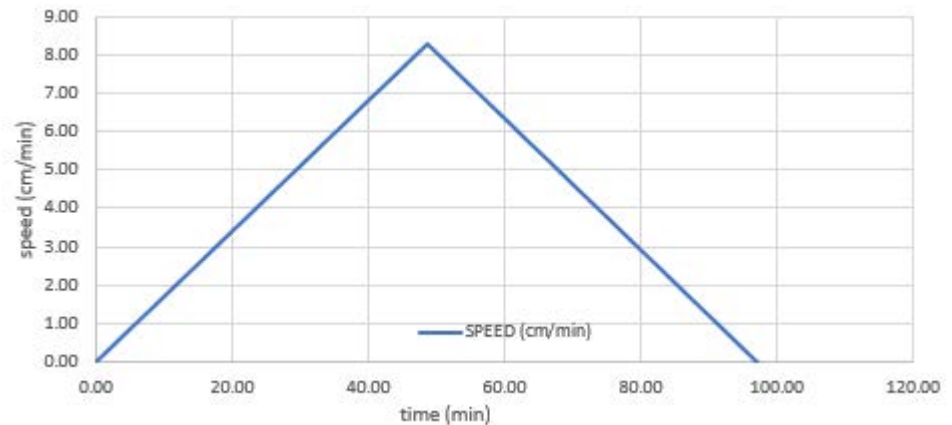


Transport system movement speeds

- Speed-time-distance charts for 4m travel within 1.6 hrs
- 9 stops along 30.5m travel. Flexible locations TBD
- Acceleration remains at 0.17cm/sec^2
- Could not obtain distance within 1 hr, but within 1.6 hrs
- Does this create sloshing? Or other issues?
- Mockups needed

DATA POINTS						
DISTANCE (cm)	0.00	200.77	200.77	200.77	200.77	401.53
SPEED (cm/min)	0.00	8.26	8.26	8.26	8.26	0.00
TIME (min)	0.00	48.60	48.60	48.60	48.60	97.20
accel (cm/min ²)	0.1700	0.1700	0.0000	0.0000	-0.1700	-0.1700

target= 400cm within 1 hr



Transport system KLOE movement plan

- KLOE movement zigs & zags around detectors
- Will need lift cylinders and pivoting rollers
- Track rail spacing needs to be equal to allow zig-zag
- Track rails to be sized for heaviest detector
- Many details yet to be worked out
- Transport speed can be faster than other detectors, TBD
- Transport system design affects the design of all detectors

