

Specification for MEBT quadrupole alignment

P. Savage, November 28th 2013

Quad weights:

- Large quad weight: 93 kg
- Small quad weight: 62 kg

Alignment process:

- Either, off-line on mock-up rails and transported to MEBT rails as an aligned assembly.
- Or, aligned live on the MEBT rails
- Initial alignment – tape measure
- Final alignment – fiducials + theodolite
- Aligned quads on MEBT rails will not be adjusted once in-place.

Accuracy of alignment (better than):

- X: +/- 0,2mm (across beam-line)
- Y: +/- 0,2mm (up and down)
- Z: +/- 0,5mm (along beam-line)

Use of aluminium extrusions for rails if they prove to be accurate for:

- Straightness, flatness, size, slot width, slot spacing, slot parallelism
- Will be checked by:
 - Asking manufacturer for specs
 - And /or using surface plate and dial gauge + vernier callipers
- Extrusion accuracy should be < half alignment accuracy
- Stiffness must be sufficient for weight (deformation < half alignment accuracy)
- Why? Low cost, low weight, no machining required, inexpensive

Form of design:

- MEBT frames – mild steel welded assemblies with protruding dowels onto which longitudinal aluminium extrusions locate. Secured with bolts into T-slots.
- Cross member – aluminium extrusion that locates using dowels into longitudinal extrusions. Can be positioned in Z. Secured with bolts into T-slots.
- Aluminium plate – located onto cross member using dowels. Can be positioned in X. Secured with bolts into T-slots.
- Quad – will mount to aluminium plate using dowel holes provided by manufacturer and bolts.
- Designed with a 2mm gap between top of aluminium plate and bottom of quad. Gap to filled and Y adjusted using (laser cut) shims.

DOFs:

- Adjustment will be provided for Z and X.
- Y will be adjusted using shims.
- No rotation adjustment will be provided.

Next steps:

- Check whether aluminium extrusion can be used.
- Make 3D design and circulate.

Conclusion:

- The spec has been defined.
- The design has got simpler and better.
- Alignment process will be improved.
- The cost to manufacture will be reduced.
- Given the recent unexpected quote cost for the quads I will move this item down the priority list to allow time for changes.