Moller Alignment step 0

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Goals

1) Define prerequisites to align the moller detector to the rest of the machine

Phase 1

From the SRD document:

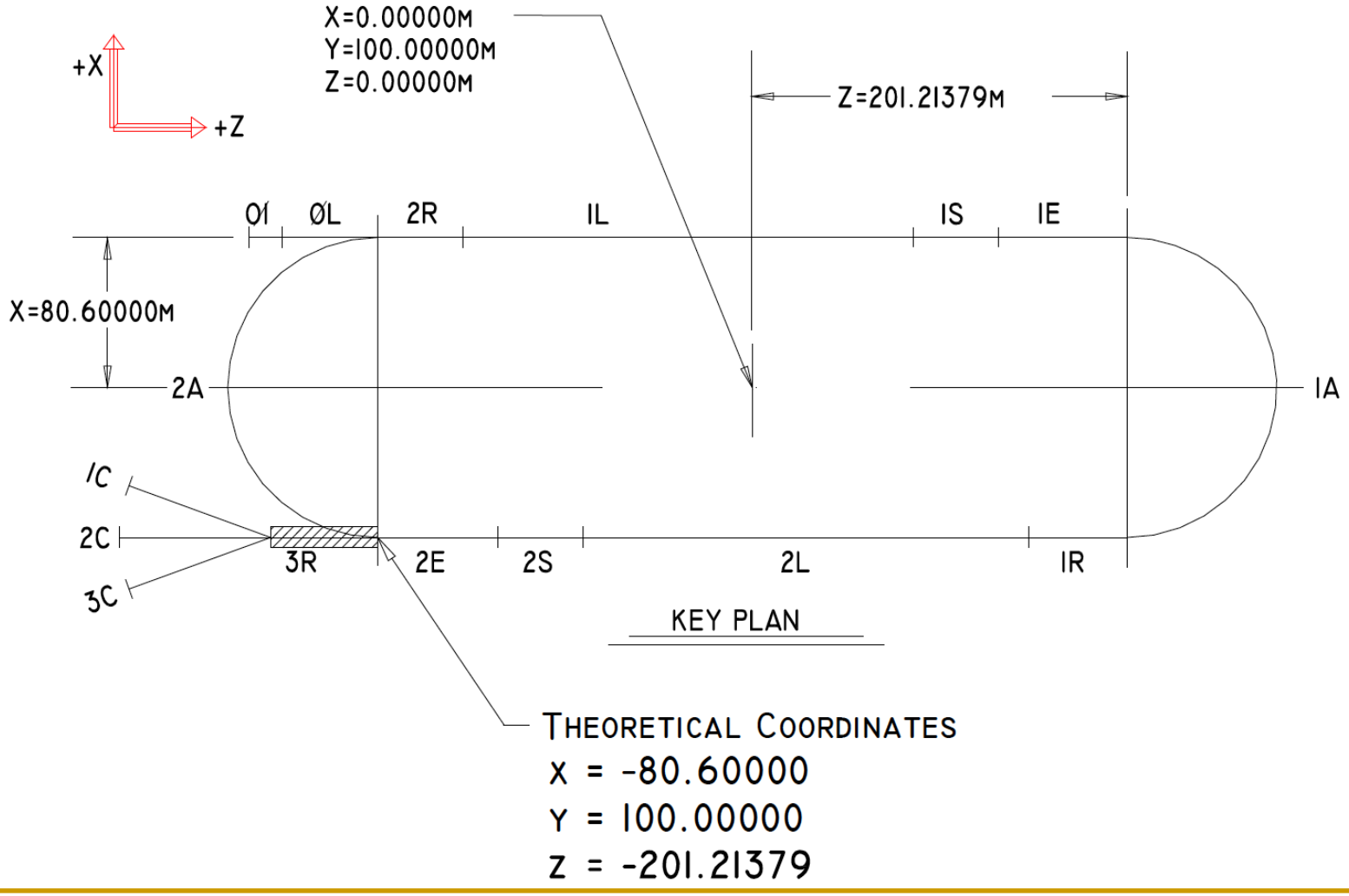
The first phase of installation, after removal of the prior experiment equipment, will be to establish the beamline axis through Hall A. This coordinate system will be referenced to existing, and if required new, monuments affixed to the walls and floor of the hall. This operation will establish the coordinate system which will be used to setting the MOLLER instrumentation positions.

What is needed prior to this ? (i.e phase 0?)

Accuracy of survey techniques (From C. Curtis)

- Laser trackers are used to relate points to each other, they have an accuracy of 30 to 40 microns .
- Monuments closests to Hall A pivot (on thick slab) show seasonal/installation variations of +/- 0.8mm
- A network of monument is used to establish a reference frame against which everything else is referenced.
- Everything is referenced to the location of the beam . Tying the detectors to this would ensure the greatest accuracy.
- How is the beam location defined?

Global accelerator reference frame



Beam location is defined by dipoles

- Alignment places your designed equipment in the physical world. Data from Physics is translated into the geodetic coordinate system, and our goal is then to place your equipment into this real space.
- We are usually involved in the actual “fiducialization” of this equipment by measuring / locating the poletips, then relating this to a series of marks, or fiducials on the outside of the equipment.
- By relating these marks to the mechanical center, we can then determine where the physicist’s designed magnetic centerline is to be placed in real space.
- This process starts with the bolt locations for the pedestals and stands which support the equipment.
- There are 4 processes to align equipment….

Alignment process

- Step 0 – Alignment's step 0 process involves the layout of the bolt patterns for the pedestals and stands. The layout is usually done to ± a few millimeters.
- Step 1 – The stands or pedestals are then aligned. Due to the crude construction of many of these stands, our alignment tolerance is done to approximately ± 3 millimeters. Typically cartridge adjusters are then placed in the stands and aligned. A typical cartridges has about 10 mm of adjustment and must account for the build up of tolerance errors.
- Step 2A – The equipment is installed on the cartridges. We do an alignment called step 2A which is done to a tolerance of ± 0.28 mm transverse to beam, and about ± 0.5 mm along beam. This allows for vacuum and other mechanical hook up.
- Step 2B – 2B alignment is our final alignment. The equipment is aligned to it's design tolerance. Alignment should be the last group to touch the equipment (in theory) and are usually the last group of people to exit the accelerator during the installation process.

Defining beam location in Hall A

- Beam location is fixed by geometry up to the pivot. Each girder is locally surveyed before installation to relate components to the quadrupole.
- Beam travels in center of dipoles and quads. From pivot to dump we can define a straight line which will define the beam location. Survey will align relative to this.
- Survey will determine if they need to add monuments to their network to achieve the required tolerances we give them.
- Everything will be referenced to that beam location.
- Survey will consult with Mechanical Engineering to define the location of the alignment targets on the equipment we want aligned.