SURVEY tested, Beam Physics Note 35

❑ MAD8 and MAD9 geometry (now) equivalent for LHC Version 6.0

Coordinates $(X, Y, Z, \Theta, \Phi, \Psi)$ compared at set of about 1100 common elements.

But all MAD9 angles $(\Theta, \Phi, \Psi) \in [-\pi, \pi]$, unlike MAD8.

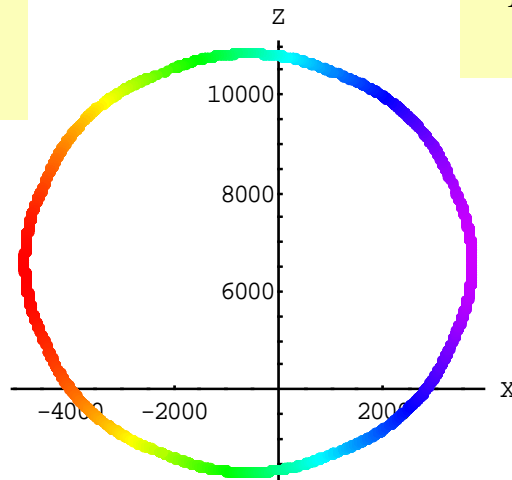Important to tilt machine out of XZ plane for this test.

Easy to repeat comparison for any other configuration (use same notebook).

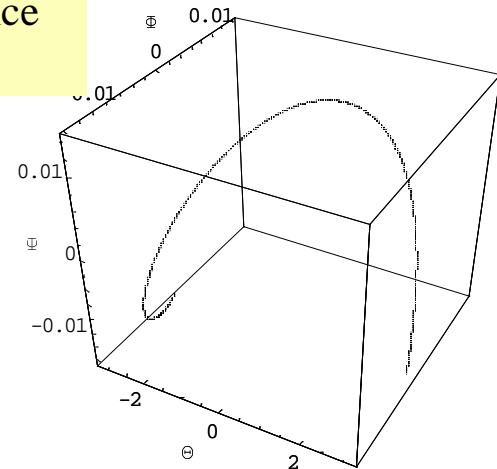❑ MAD8 SURVEY data available in **mfs** environment

Auxiliary package Mfs'MAD8Survey' available.

Manipulate and combine MAD8 SURVERY data like any other mfs object.

MAD9 survey, colour shows height Y

MAD9 local reference frame angles

Strength bounds for matching (from 11 Oct)

❑ Angeles' matching example: max value for the normalised strengths, e.g.,

```
CONSTRAINT, KQ4.L5 <  6.853E-3, WGT=1; // ->  160 T/M
```

Although p0 parameter for MAD run is 450 GeV, the maximum strength here actually allows for a beam of 7 TeV. Thus, it could be calculated as follows

```
pmax = 7000;       // maximum beam momentum in GeV/c
```

```
dBdxMaxMQY=160;  // maximum strength of MQY in Tesla/Meter
```

```
CONSTRAINT, KQ4.L5 <  dBdxMaxMQY *CLIGHT/(1.e9*pmax),
WGT=1;
```

where I introduced a maximum gradient for the MQY hardware type of whichQ4.L5 is an instance.

❑ Need named max (and, min) parameters for every hardware type

(yet another file to call ...)

and know hardware type when writing matching constraints.

❑ Past experience at LEP and LHC shows that we need a way to include excitation limits in the database and access them in a straightforward way.

MAD9 style solution

❑ much easier, logical and safer to be able to write

```
CONSTRAINT, KQ4.L5 <  (Q4.L5->dBdxMax)
*CLIGHT/(1.e9*pmax), WGT=1;
```

❑ We can add an element attribute as an afterthought

So you might try to write

```
MQY->dBdxMax = 160.;
```

which would work now. But still not satisfactory.

❑ Limits must be defined in the LHC database for the most general element type to which they apply, MQY in this example.

Not even necessary to introduce individual names like **dBdxMaxMQY** for these, provided they are included in the element definitions, e.g.,

```
MQY: Quadrupole, l=0, dBdxMax=160., dBdxMin=2.;
```

❑ This solution is general enough to cover many so-far undreamt-of attributes.

ATTLIST command will list them all.

Element Names for LHC

❑ **Meeting on 18 October 1999**

Decided to try to have both official Project Names and traditional friendlier Optics Names.

Suggested implementation of Project Names as additional string-valued element attribute in sequences generated from database. Optics Names as element names.

❑ **New proposal for implementation**

String-valued attributes not desirable. Use existing TYPE attribute instead.

❑ **Construction of Optics Names from Project Names**

Try to enunciate rules for transforming Project Names into Optics Names.

Implement resulting collection of rules, e.g., as a Mathematica function

- ⇒ Optics names not in database, but easily generated
- ⇒ Easy to check uniqueness.
- ⇒ May produce some unfamiliar, but more consistent, optics names

Can produce an exhaustive dictionary after all names have been generated.