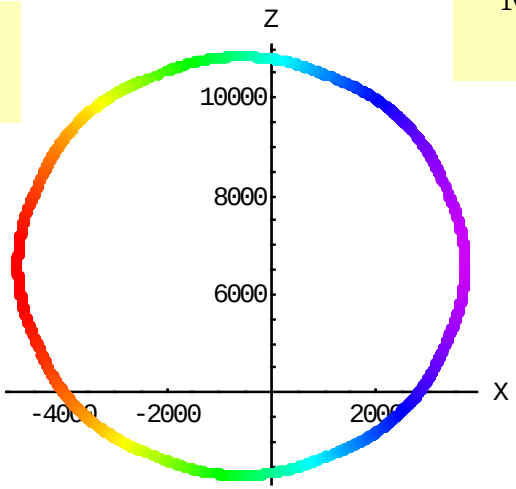
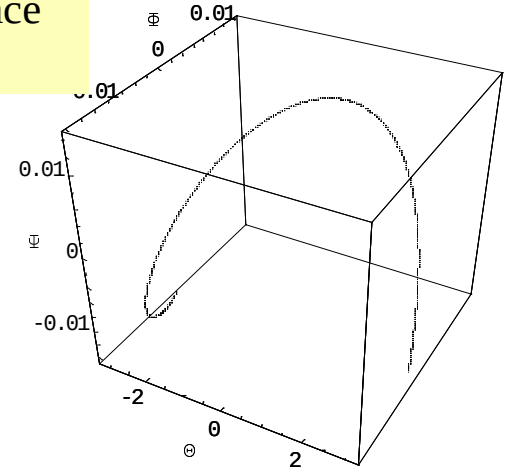
SURVEY tested, Beam Physics Note 35

- MAD8 and MAD9 geometry (now) equivalent for LHC Version 6.0
  - Coordinates (X,Y,Z,Θ,Φ,Ψ) compared at set of about 1100 common elements.
  - But all MAD9 angles (Θ,Φ,Ψ) $\in$ [-π, π], 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

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

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