

Names: _____

Class: _____ Date: _____

In the table below, please record θ_x and θ_y for red and green dots. The colors indicate opposite directions from the collision point.

Table 1: θ_x

Event Number	θ_x (μrad , red dot)	θ_x (μrad , green dot)	$\Delta\theta$ (μrad , estimate)

Table 2: θ_y

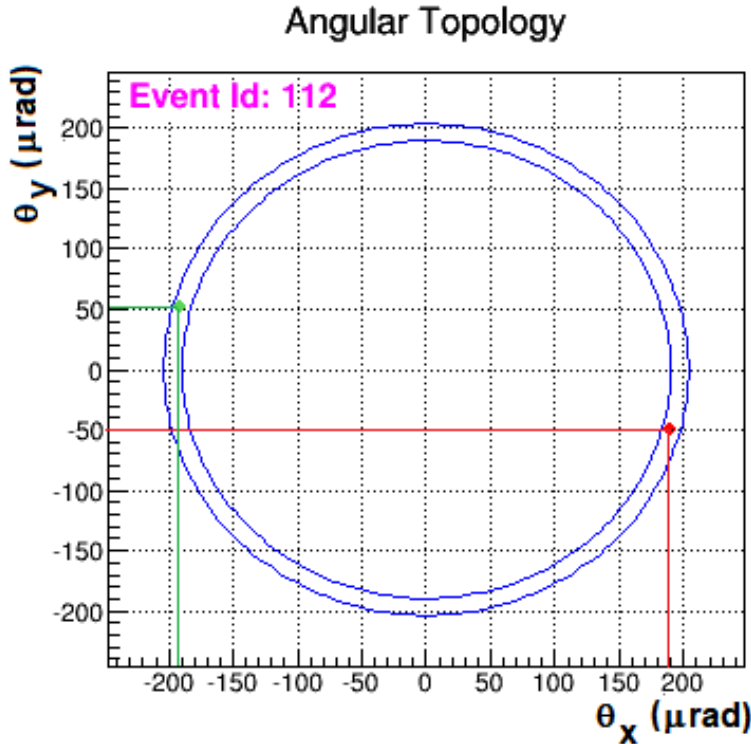
Event Number	θ_y (μrad , red dot)	θ_y (μrad , green dot)	$\Delta\theta$ (μrad , estimate)

Please check to be sure values have been transcribed properly and that the event numbers in each table are identical and in the same order. Use an additional sheet if you need more space.

An example of how to read the events is on the reverse side.

Sample TOTEM Event:

The event display shows a planar view, with the beam occupying an area in the middle; there is a gap in the detector there. The TOTEM detectors are embedded at the edges of the LHC beam pipe. Each records a “hit” where a scattered proton strikes. The red and green dots represent these hits.



This sample event shows the main features. The Event ID is 112.

We can measure θ_x and θ_y of each dot (red or green) found between the two blue rings by dropping perpendiculars, shown here as red and green lines, to the θ_x and θ_y axes. Be careful to correctly read the gradations on the axes: they are in units of 10 μrad for some events, 20 μrad for others. Here, $\theta_x = +189 \mu\text{rad}$ and $\theta_y = -50 \mu\text{rad}$ for the red dot and $\theta_x = -192 \mu\text{rad}$ and $\theta_y = +50 \mu\text{rad}$ for the green dot. The details of each event will vary.

The diameter of a dot can be estimated from the gradations and used to find the

approximate uncertainty in measurement. Looking at the width of the red dot, its θ_x value could stretch from -187 to -214 μrad , so we can take the uncertainty as $\Delta\theta_x/2 = \pm(214-187 \mu\text{rad})/2 = \pm 3.5 \mu\text{rad}$. Round to $\pm 4 \mu\text{rad}$. We can use the uncertainty on one axis on one dot as a stand-in for the whole event.

Thus we would enter this event as:

Table 1: θ_x

Event Number	θ_x (μrad , red dot)	θ_x (μrad , green dot)	$\Delta\theta$ (μrad , estimate)
112	+189	-192	4

and

Table 2: θ_y

Event Number	θ_y (μrad , red dot)	θ_y (μrad , green dot)	$\Delta\theta$ (μrad , estimate)
112	-50	+50	4