

Coincidence Algorithm

```
double Software_Shower_Sum=0.0;
//int Cherenkov_Counter=0;

int Group_0[4] = {0,1,3,2};
int Group_1[6] = {1,0,4,6,3,2};
int Group_2[6] = {2,0,1,3,9,8};
int Group_3[9] = {3,2,0,1,4,6,12,9,8};
int Group_4[6] = {4,1,5,7,6,3};
int Group_5[4] = {5,4,6,7};
int Group_6[9] = {6,3,1,4,7,5,13,12,9};
int Group_7[6] = {7,6,4,5,13,12};
int Group_8[6] = {8,2,3,9,11,10};
int Group_9[9] = {9,8,2,3,6,12,14,11,10};
int Group_10[4] = {10,8,9,11};
int Group_11[6] = {11,10,8,9,12,14};
int Group_12[9] = {12,9,3,6,7,13,15,14,11};
int Group_13[6] = {13,12,6,7,15,14};
int Group_14[6] = {14,11,9,12,13,15};
int Group_15[4] = {15,14,12,13};

int *Cherenkov_Position[16] = {Group_0,Group_1,Group_2,Group_3,Group_4,Group_5,Group_6,Group_7,Group_8,Group_9,Group_10,Group_11,Group_12,Group_13,Group_14,Group_15};
int array_size[16]={3,5,5,8,5,3,3,5,5,3,3,5,8,5,5,3};

double Cherenkov_x = 0.0;
double Cherenkov_y = 0.0;

int Data_entries = T0->GetEntries();
for (int jentry =0; jentry< Data_entries; jentry++)
{
    int Shower_test=0;
    int Shower_test_2=0;
    int Preshower_test_1=0;
    int Preshower_test_2=0;
    int Preshower_test_3=0;
    int Preshower_test_4=0;
    double Preshower_diff_1=0.0;
    double Preshower_diff_2=0.0;
    double Preshower_diff_3=0.0;
    int Single_Shower=0;
    int Shower_max=0.0;
    int Shower_id = 0;
    double Max_1=0.0;
    double _Max_2=0.0;
    vector<double> Cherenkov_sorted;
    int Channel_Fired =0;
}
```

```
for (int i=0;i<16;i++){
    //double Temp_Cer[array_size[i]];
    int temp_counter=0;
    for (int j=0;j<array_size[i];j++){
        if( (Cherenkov[i]/(Conversion[i]))>40){
            //cout<<i<<","<<j<<endl;
            temp_counter[i]++;
            //temp_counter++;
        }
    }
    //counter.push_back(temp_counter);
}

for (int k=0;k<16;k++){
    counter.push_back(temp_counter[k]);
    //cout<<k<<","<<temp_counter[k]<<endl;
}

//get the largest value in the vector ---- has to be larger than 1.....
vector<int>::iterator it;
it=max_element(counter.begin(),counter.end());
int Max_2 = *it;
int Max_2_Index = std::distance(counter.begin(),it);

int max=0;
max = *max_element(counter.begin(), counter.end());
//cout<<jentry<<","<<"max"<<","<<max<<","<<Max_2<<","<<Max_2_Index<<","<<counter.size()<<endl;

for (int k=0;k<16;k++){
    if (temp_counter[k]>1){
        Cherenkov_boolean[k]=1;
        Channel_Fired++;
    }

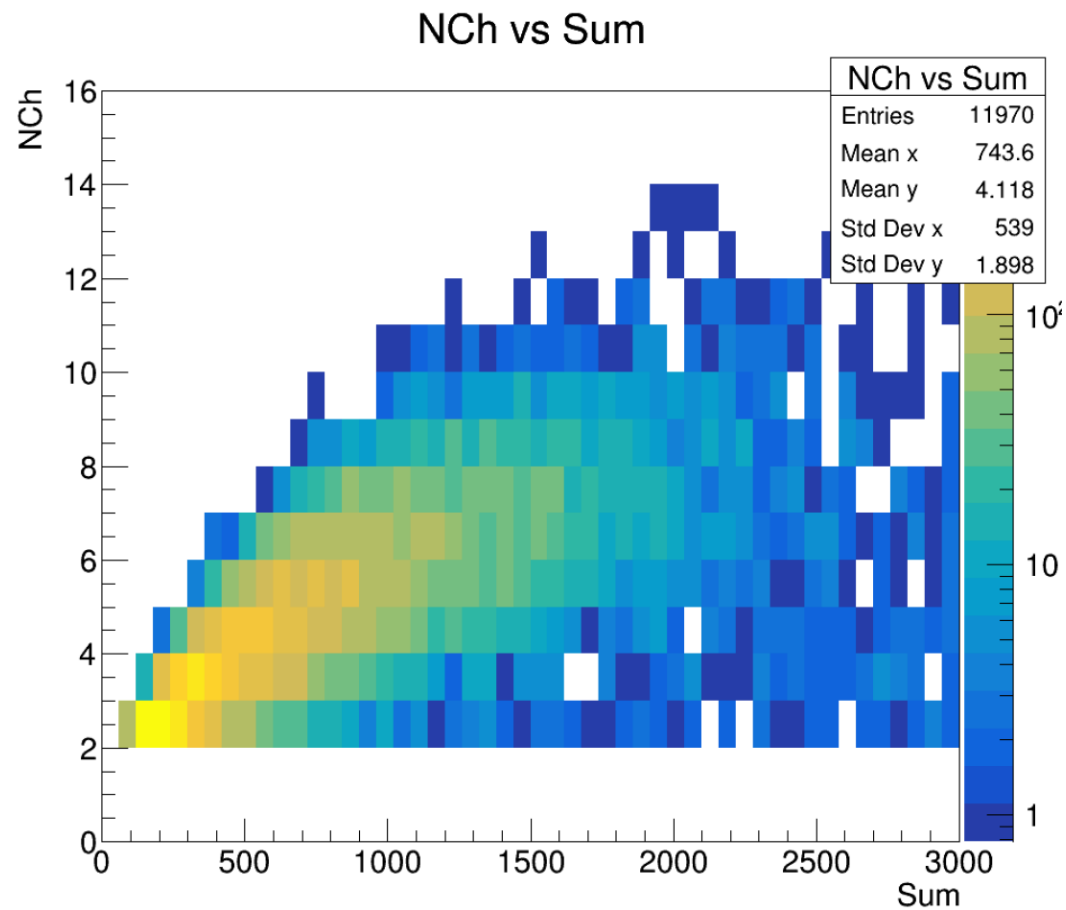
    else{
        Cherenkov_boolean[k]=0;
    }
}

int Sq_Cut_1=0;
int Sq_Cut_2=0;
int Sq_Cut_3=0;

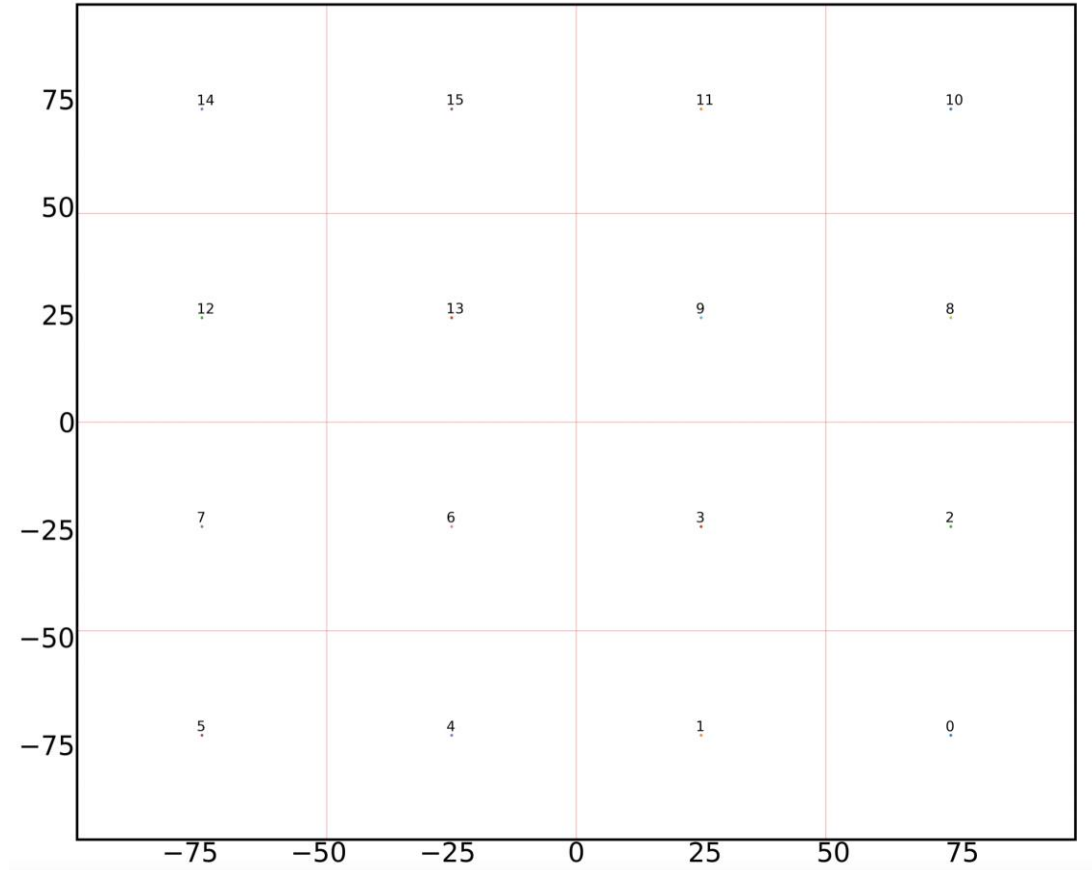
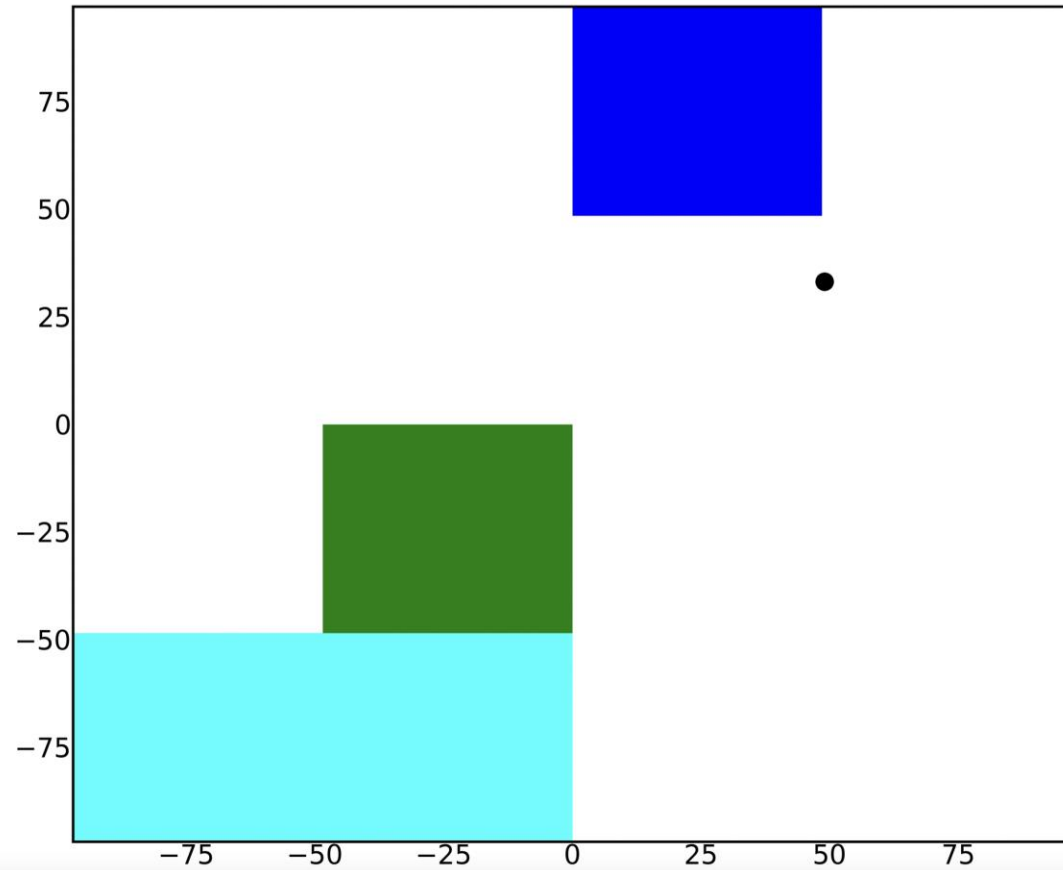
//if (Max_2>4){
if (Channel_Fired>1){
    // this means more than 1 channel fired (and more than 1 group of adjacent channels)
    for (int ch=0;ch<16;ch++)
    {
        //cout<<jentry<<","<<ch<<","<<Cherenkov_boolean[ch]<<","<<Cherenkov[ch]<<endl;
        Cherenkov_Software += Cherenkov_boolean[ch]*(Cherenkov[ch]/Conversion[ch]);
    }
    //cout<<Max_2<<","<<Cherenkov_Software<<endl;
    //Nch_Sum->Fill(Max_2,Cherenkov_Software);
    Nch_Sum->Fill(Cherenkov_Software,Channel_Fired);
}
```

Trigger 1
+
Track within area of first
GEM +
Coincidence in Cherenkov (>1)

Reduces number of events by
~1.5



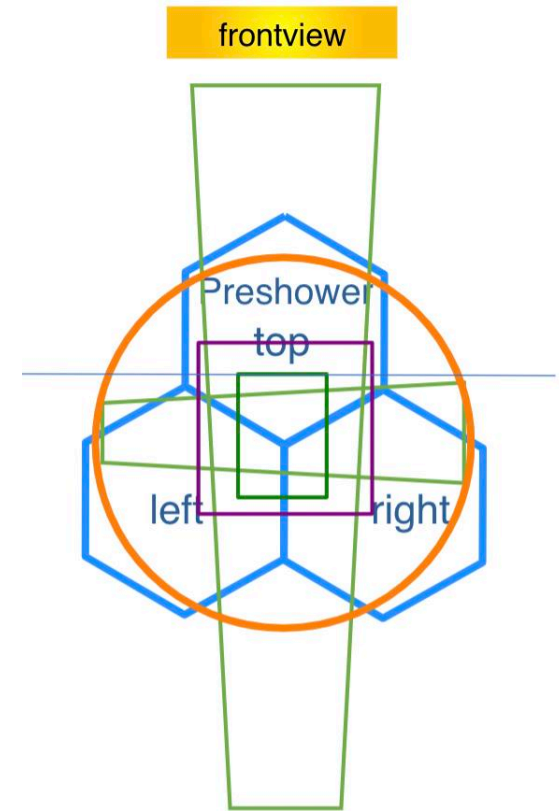
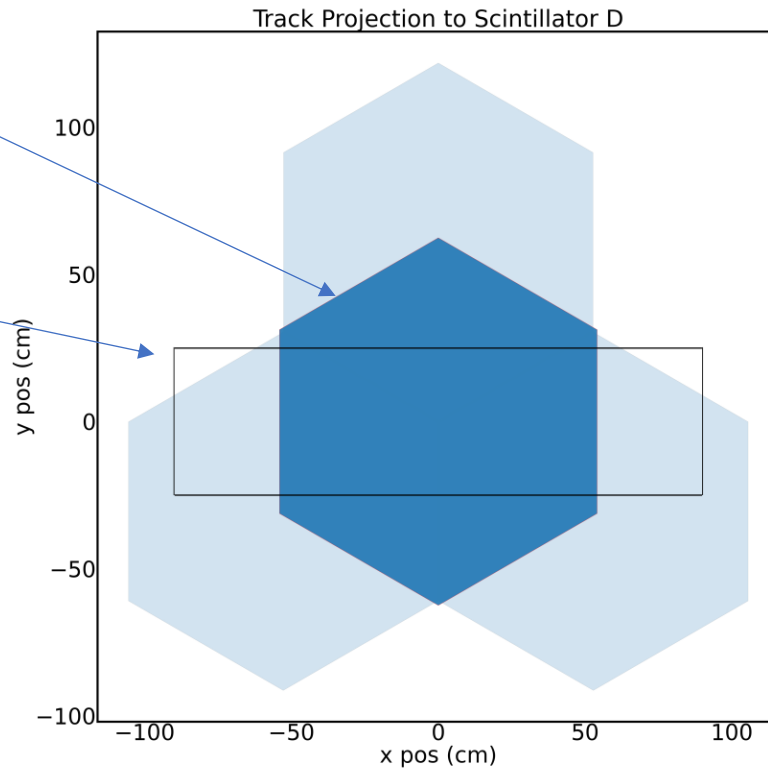
Cherenkov Coincidence



Projecting Tracks to the Scintillators

Scin D (side 63.5 mm)

Scin C (should be smaller of left side (35 mm) and longer on right side (50 mm))

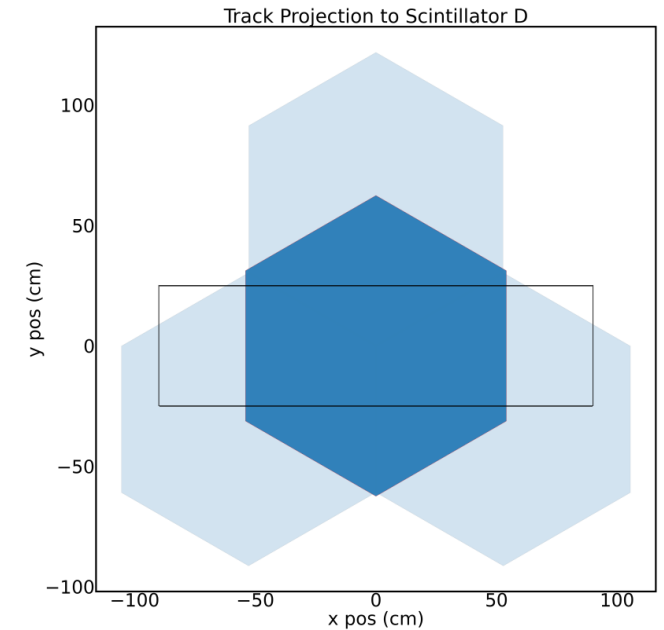
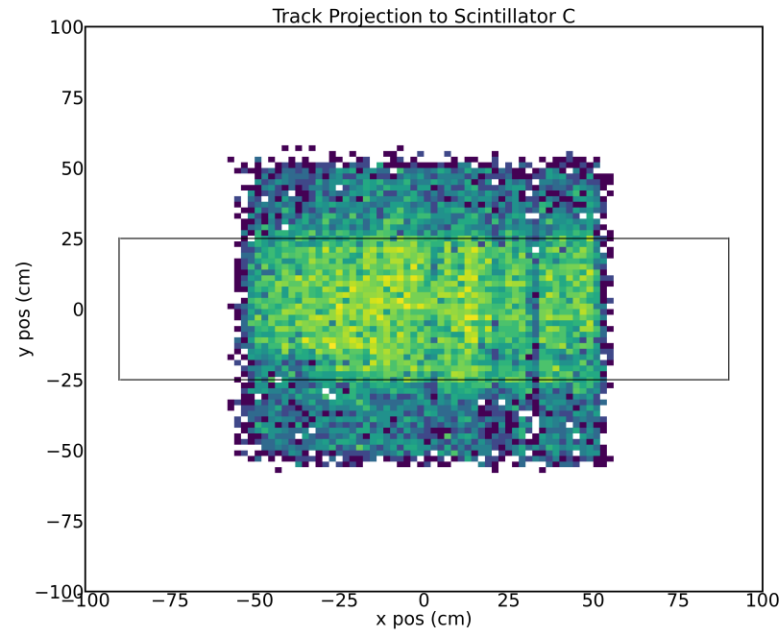


Trigger 3 (Scin C & Scin D & Shower Sum) 0.5 mip

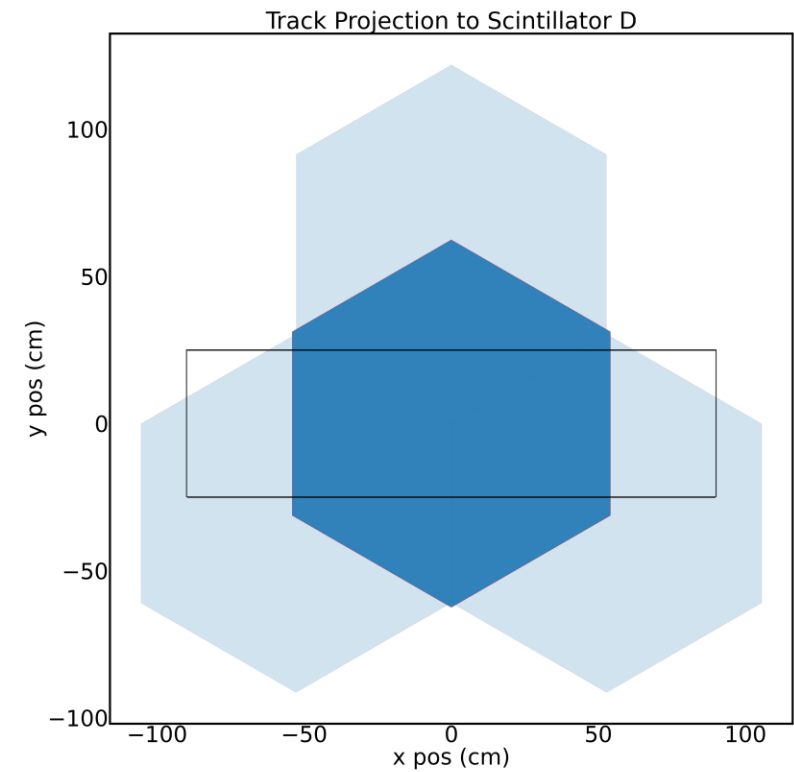
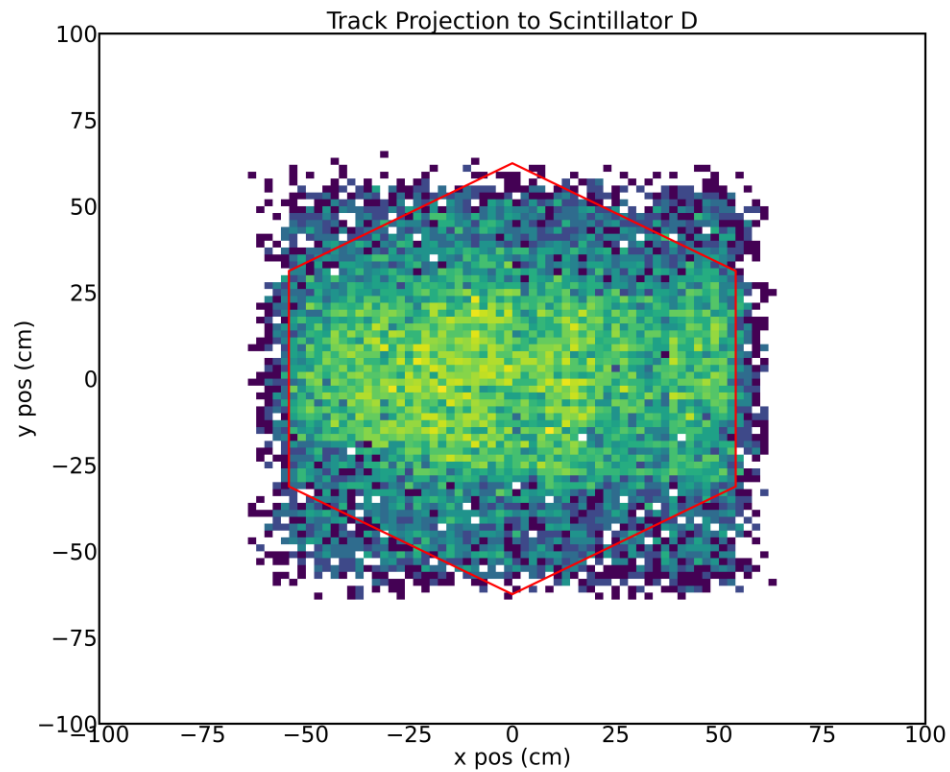
Run 4783: 10 uA

Scin C is in Trigger
Misidentified tracks?

1. Include more than one track and can search for those that pass through each detector and have the smallest chi-square
2. Search algorithm
 - Use x and y of limiting detector(s) for each trigger
 - Would be trigger dependent...

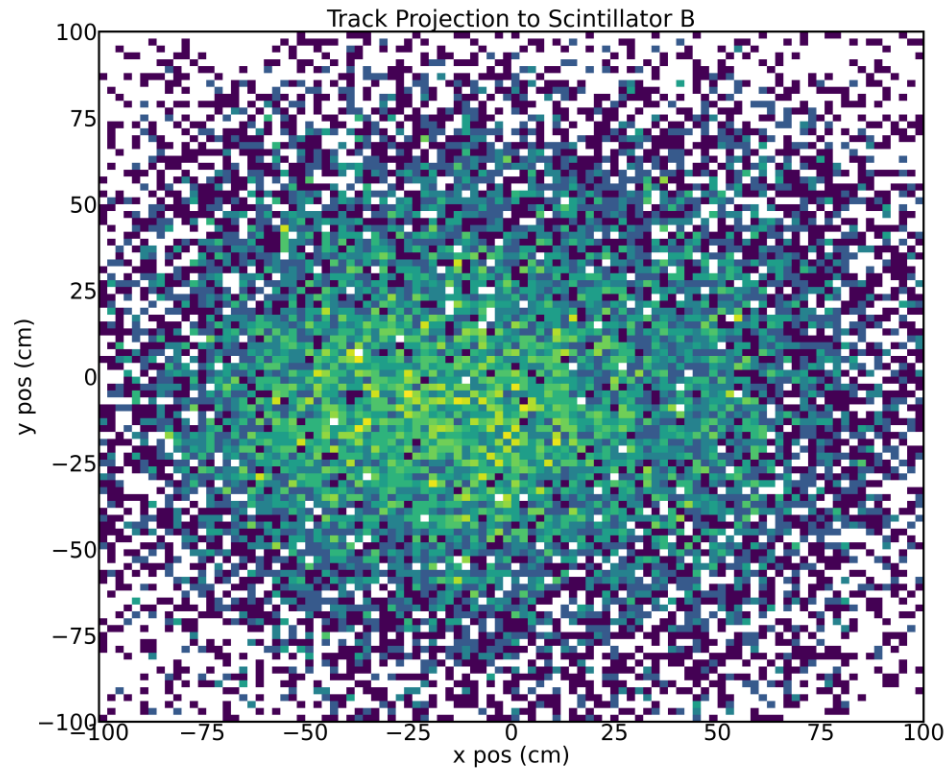


Trigger 3 (Scin C & Scin D & Shower Sum) 0.5 mip



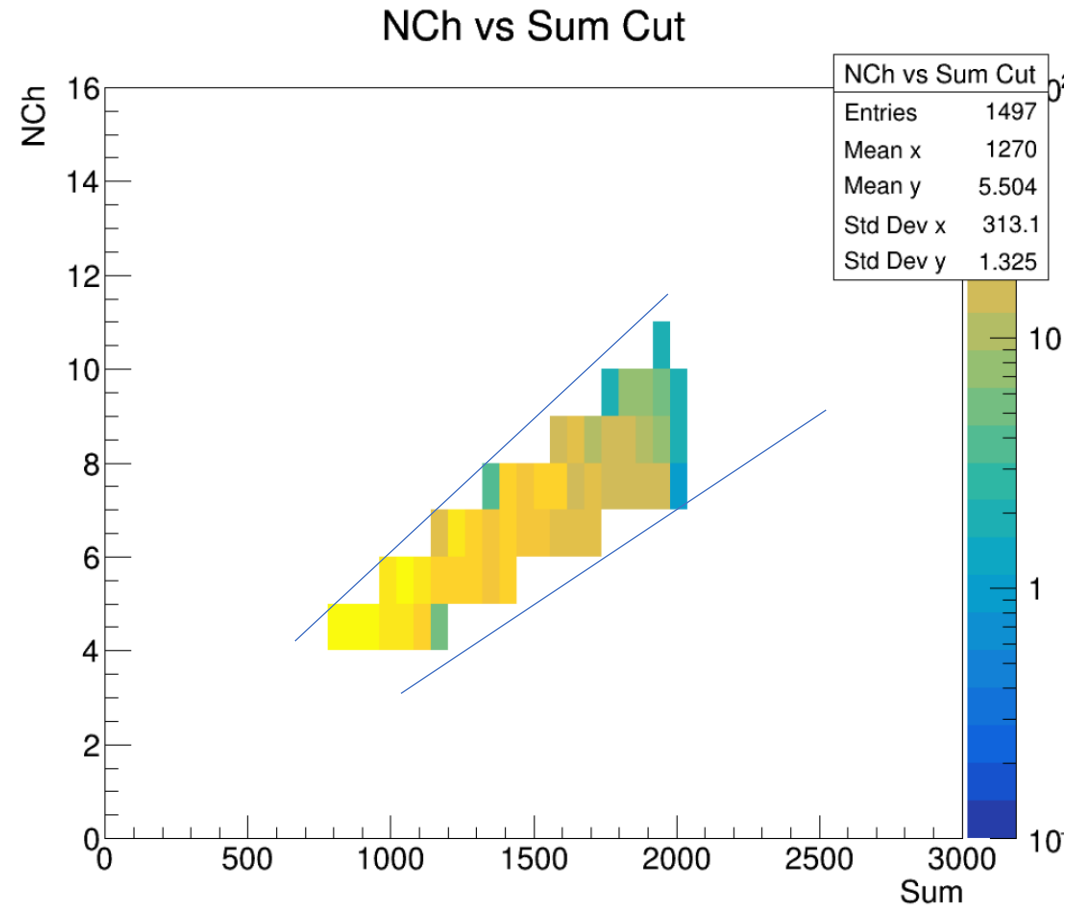
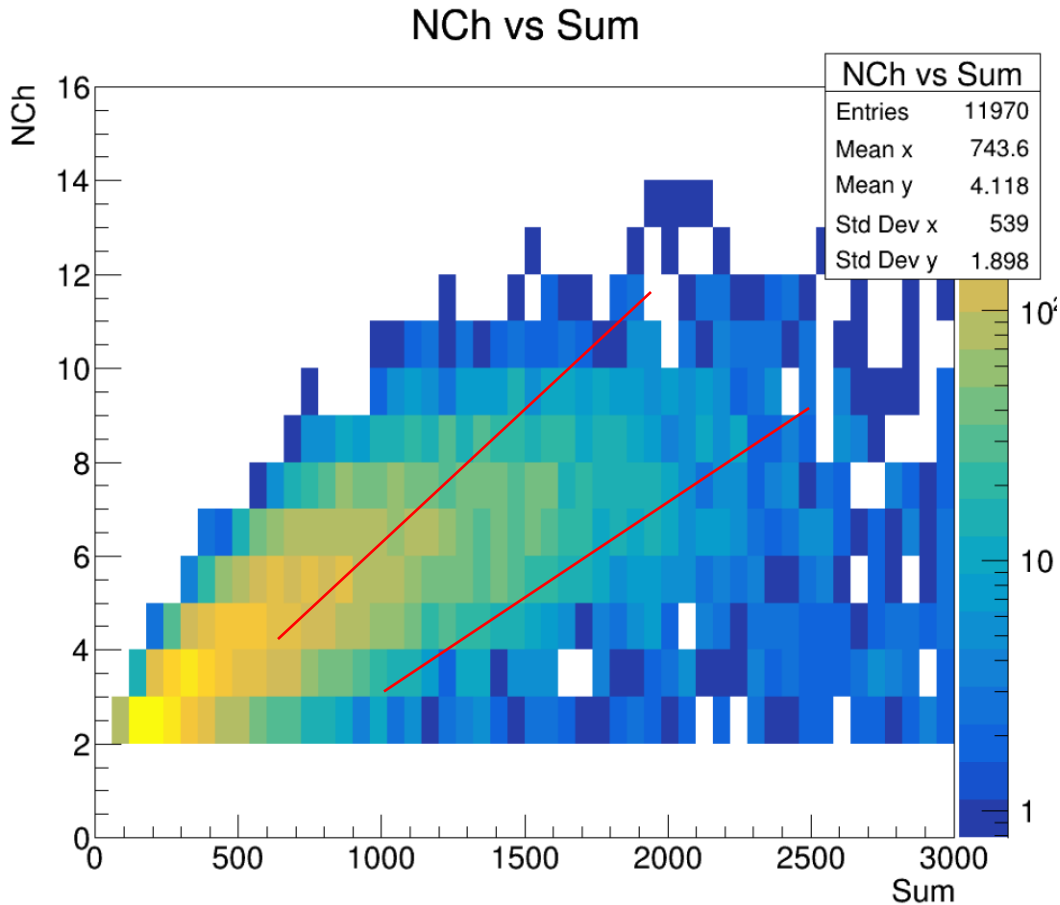
Trigger 3 (Scin C & Scin D & Shower Sum) 0.5 mip

Scin B

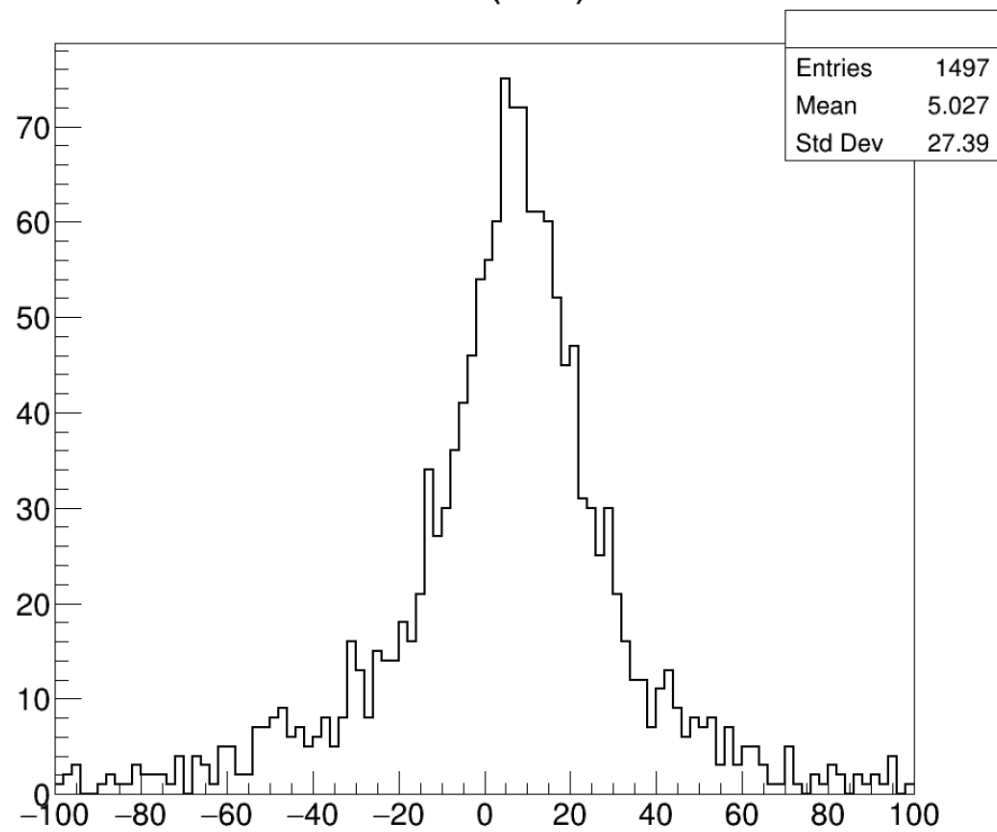


- Why is the misidentification primarily in y not (and no in x)?
- Cause of poor resolution x & y

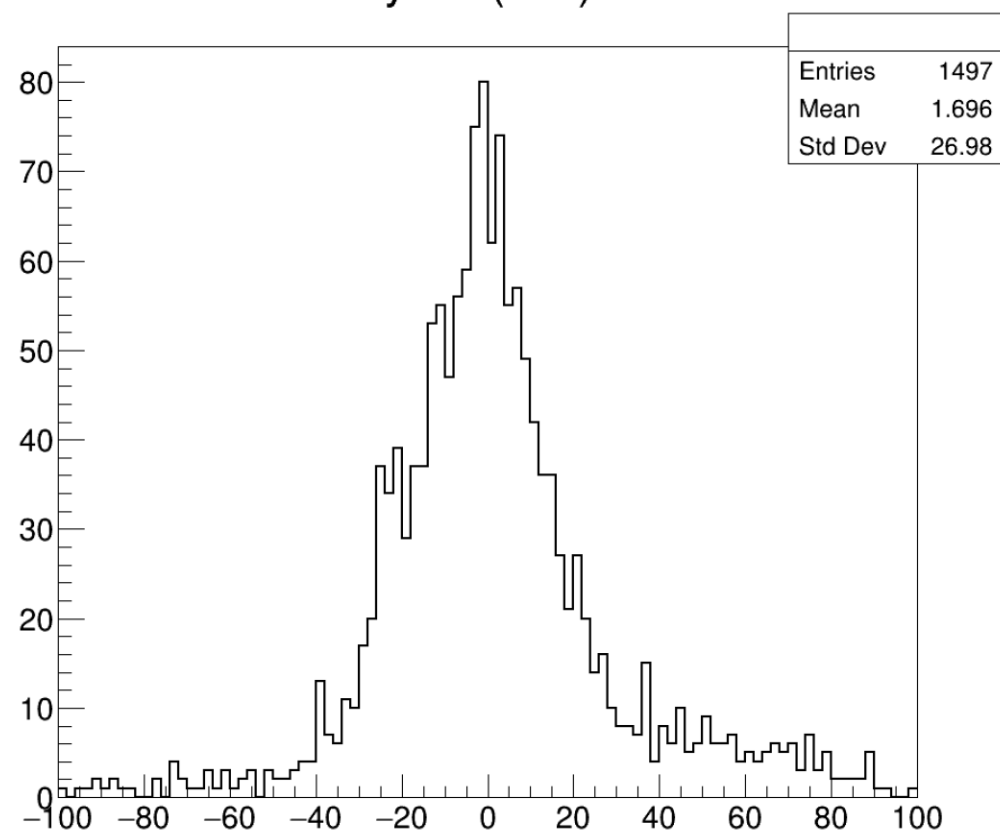
Trigger 4 (Shower Sum): Threshold 180 mV



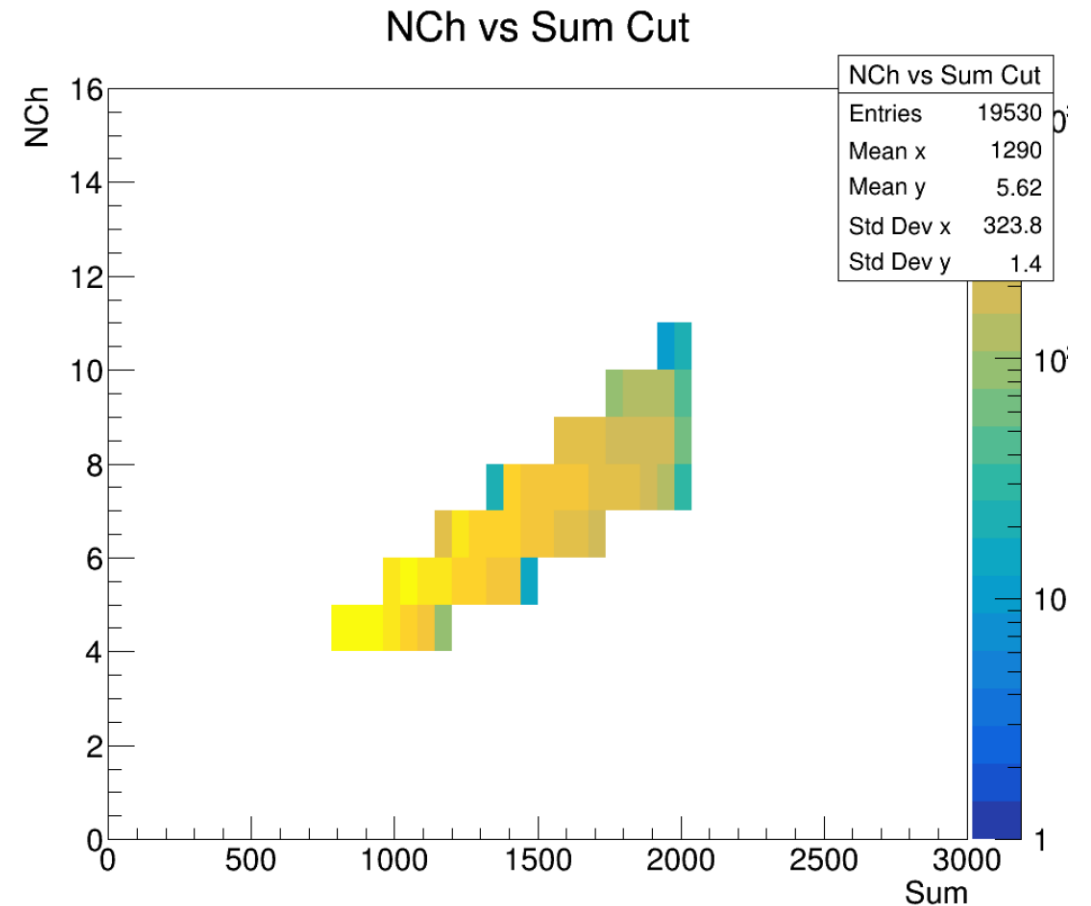
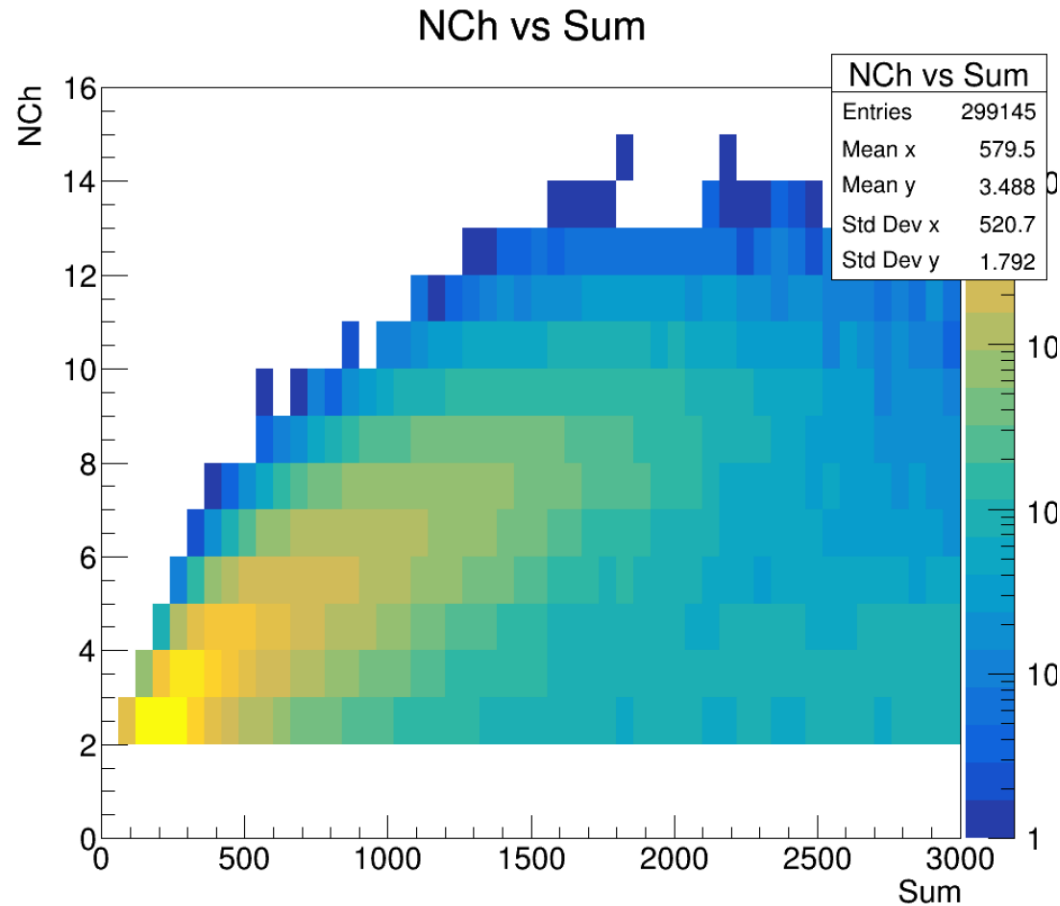
x diff (mm)



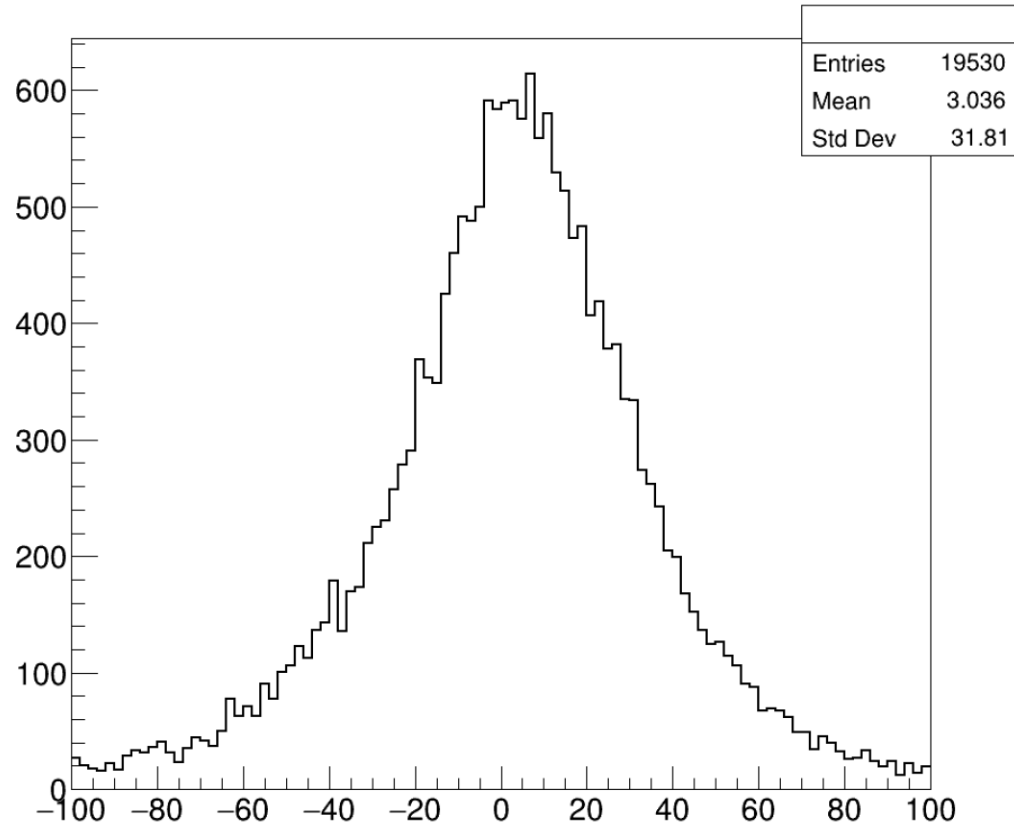
y diff (mm)



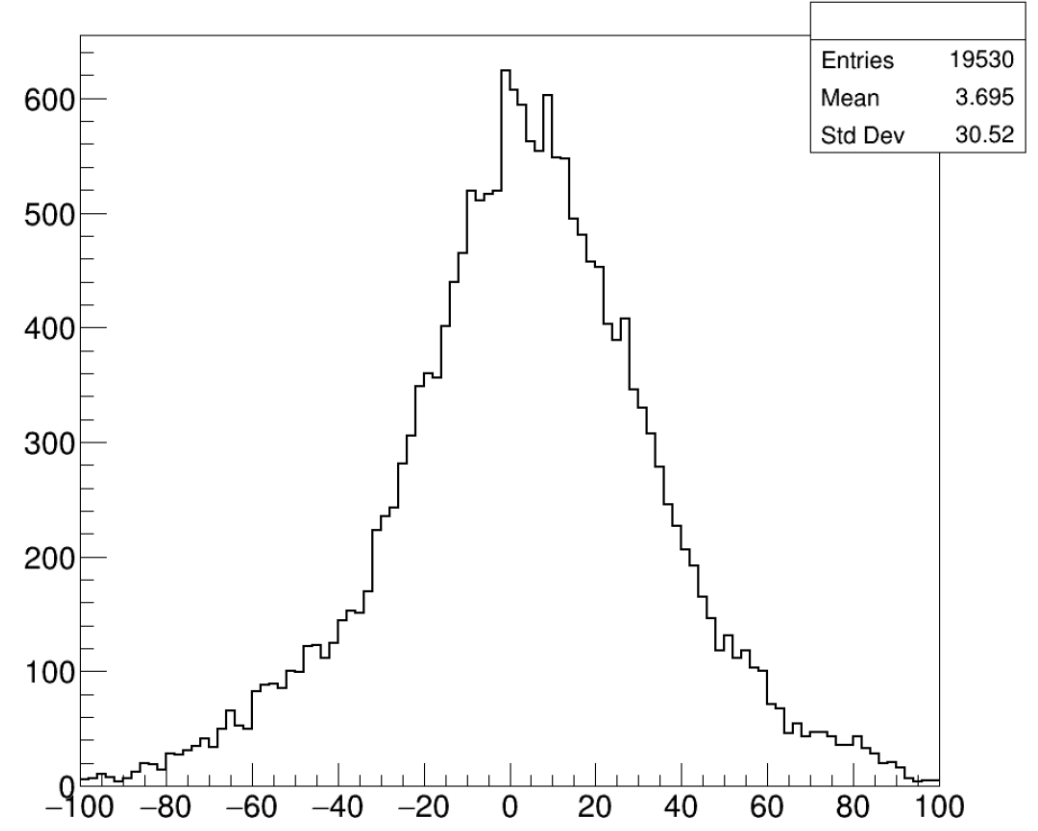
Same 2D Cut for Trigger 3

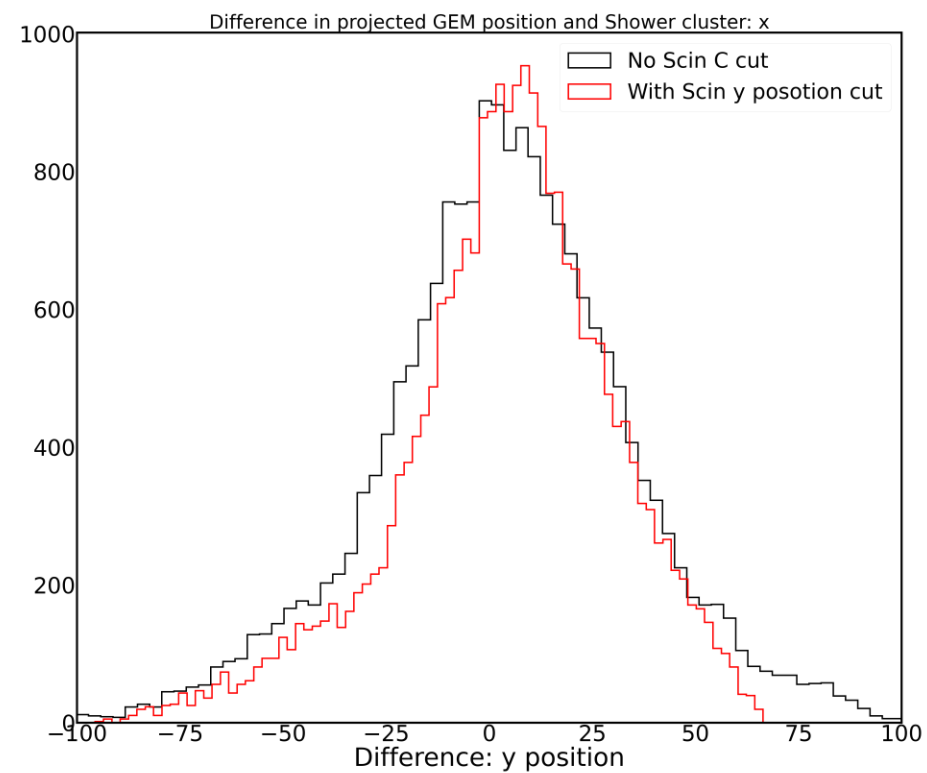
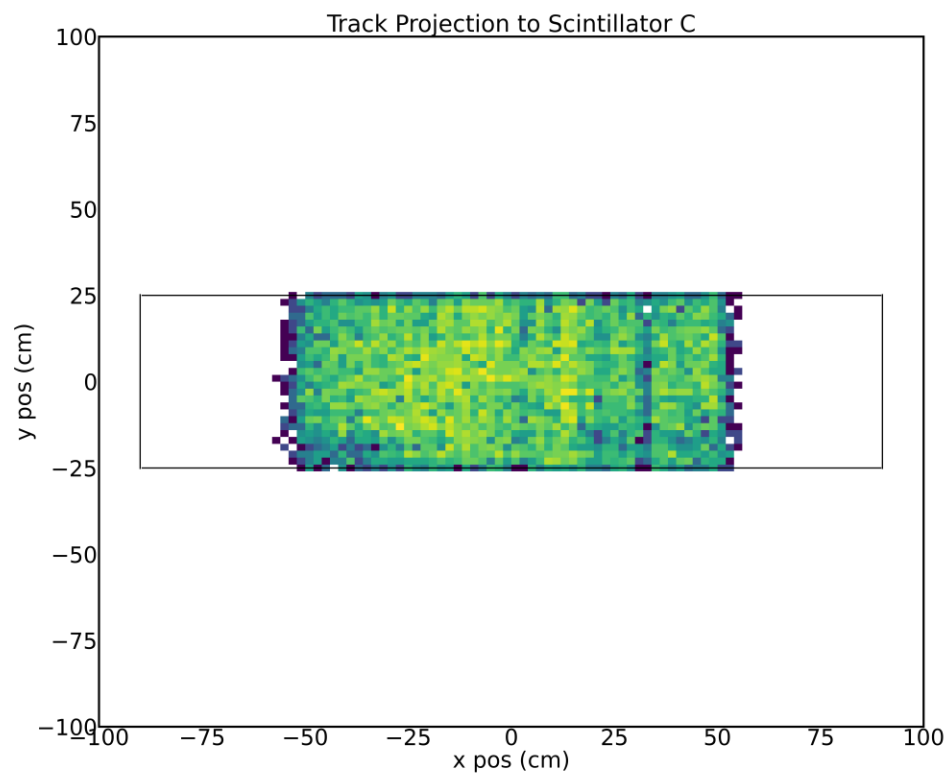


x diff (mm)



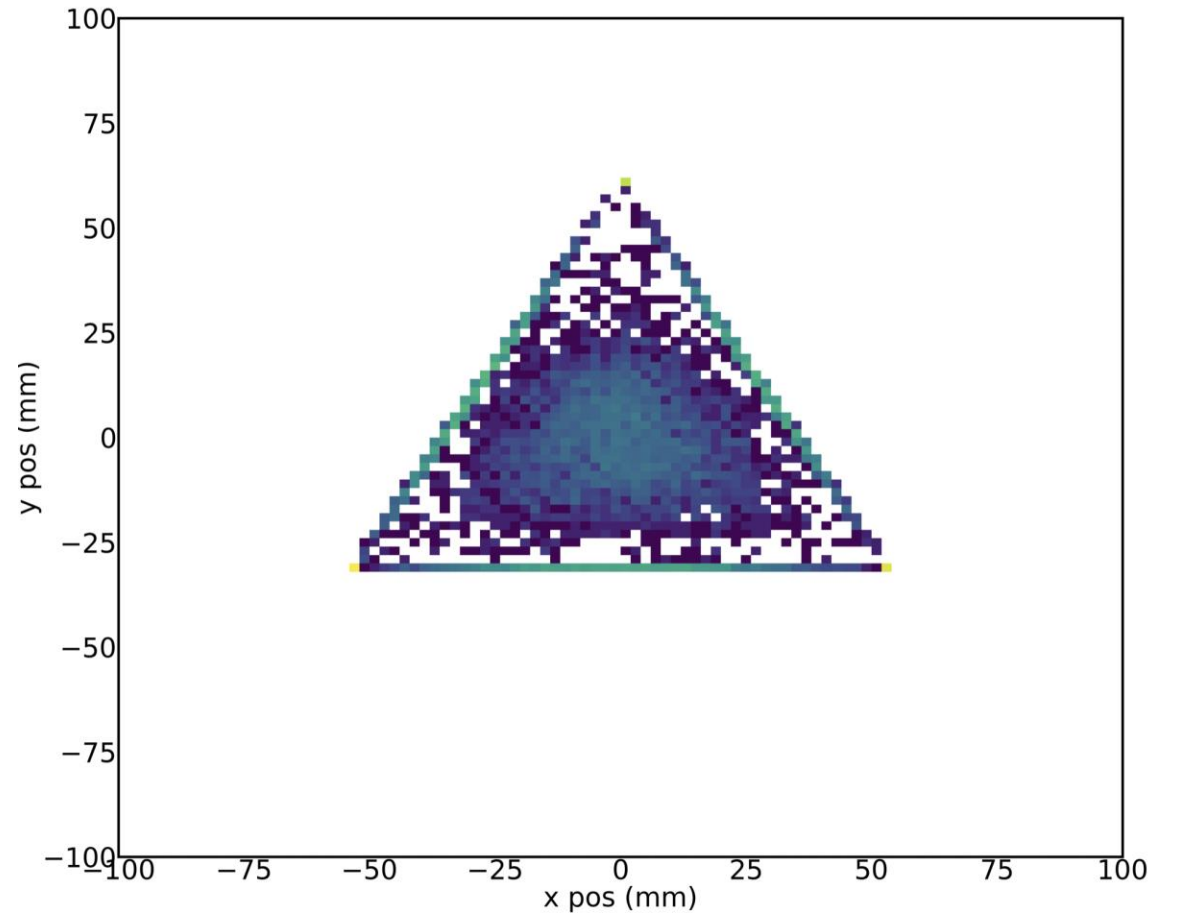
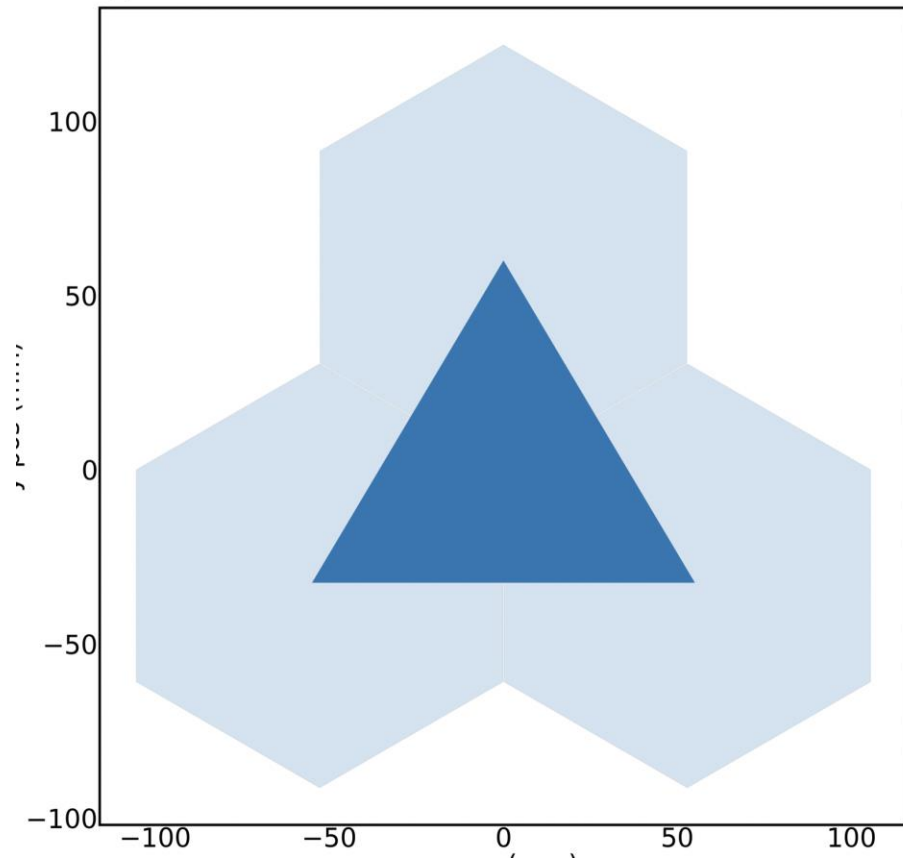
y diff (mm)





Normalized **red** to match height of **black**

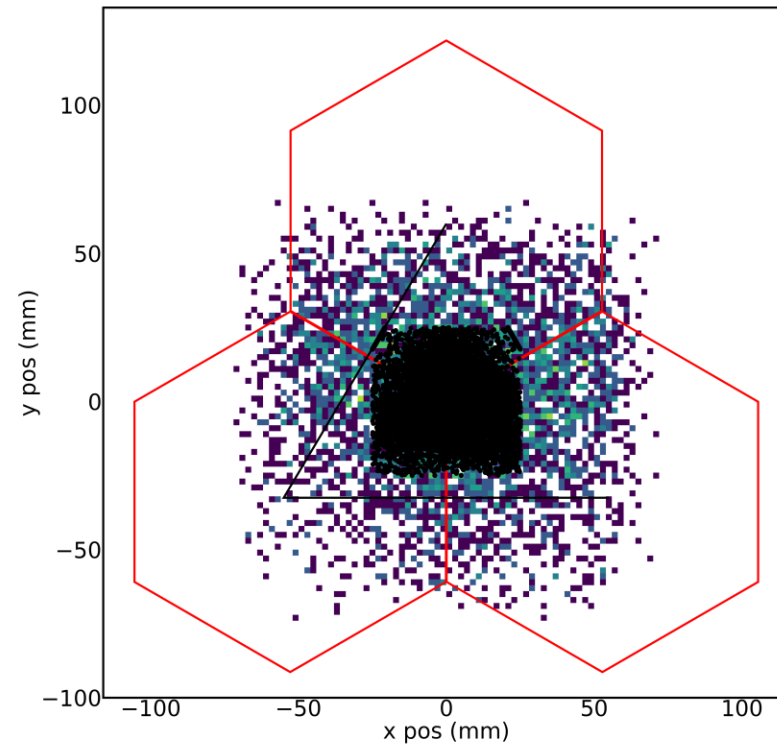
Shower Cluster



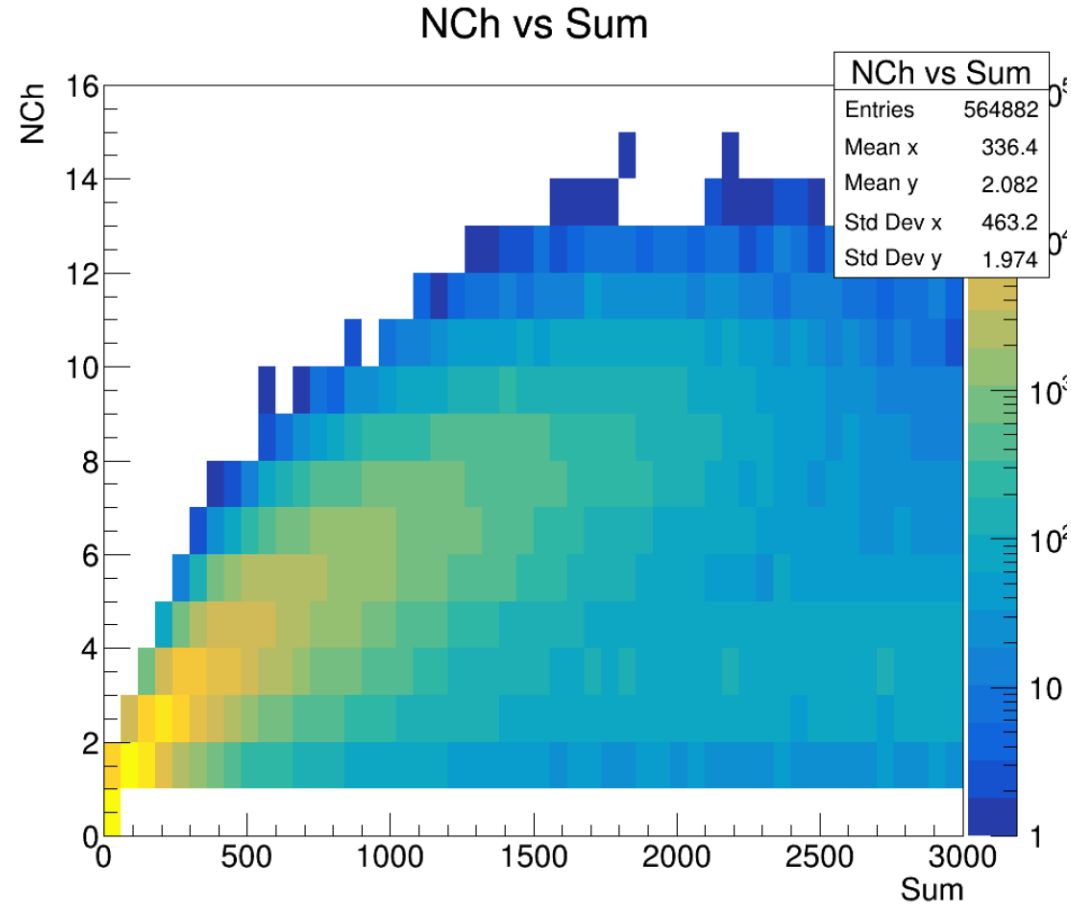
Trigger 4 (Shower Sum Threshold: 180 mV)

Run 4783

- Cherenkov coincidence cut
- Shower Cluster < 25
- Small response in Scin B



Trigger 3 (Scin C & Scin D & Shower Sum) 0.5 mip



Difference in shower cluster and track projection (\sim Pions): Cherenkov Sum <100

