

# Comparison of $Q_{VEM}^{pk}$ values getting from SdCalibrator and a local fit method, for UB and UUB

Mauricio Suárez Durán and Ioana C. Mariş

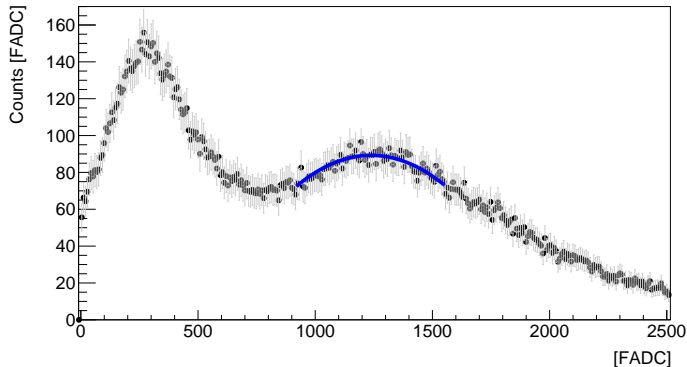
IIHE-ULB

September 30, 2021



# The current algorithm (OffLine SdCalibrator Module)

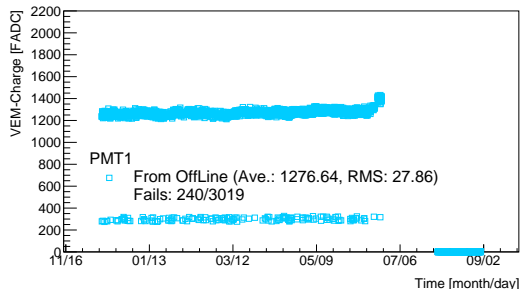
## UUB Charge histogram



Find "head-and-shoulder": from the right side of the histogram, search for local maximum (head), surrounded by drops (shoulders) with shoulder/head value ratio less than `fChargeWindowShoulderHeadRatio` (as default 0.75)

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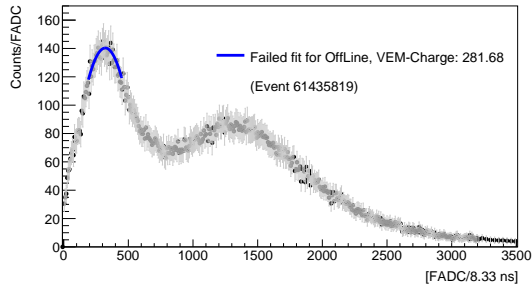
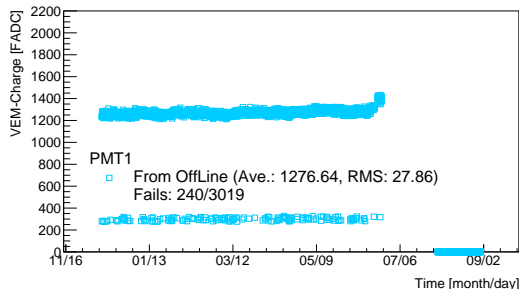
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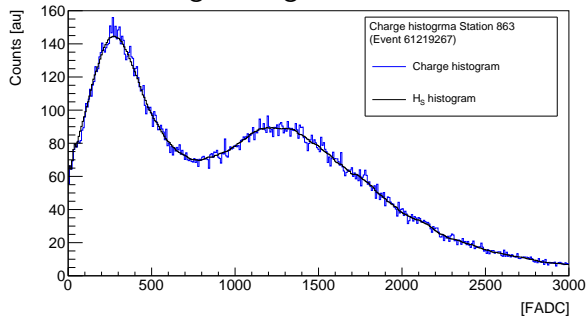
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# Obtaining initial parameters through derivatives

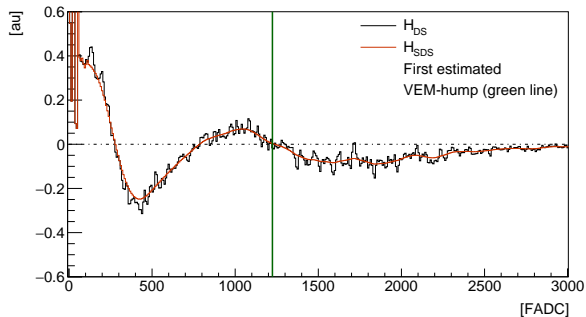
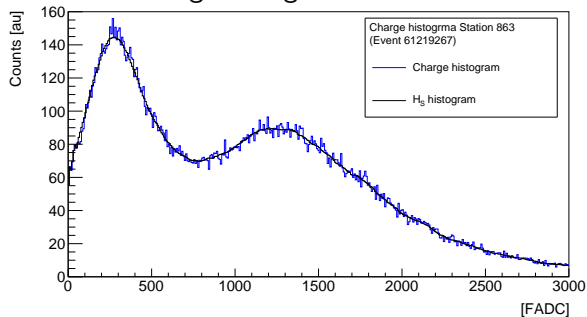
## UUB Charge histogram



1. Smoothing the histogram by 15-bin sliding window,  $H_S$

# Obtaining initial parameters through derivatives

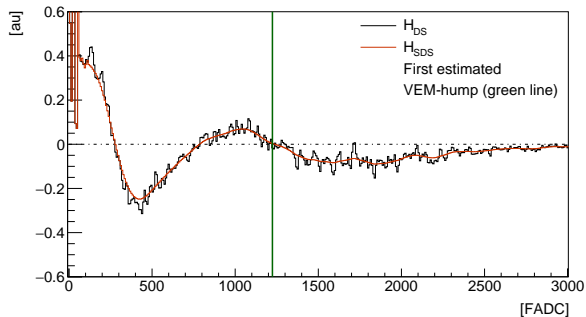
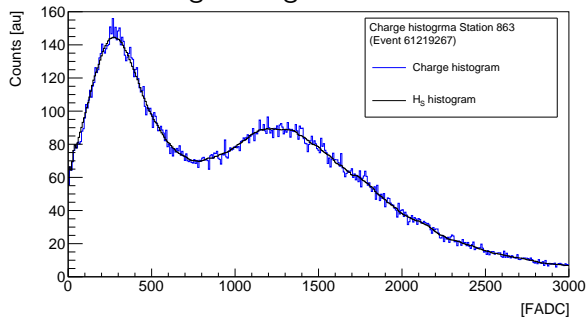
## UUB Charge histogram



1. Smoothing the histogram by 15-bin sliding window,  $H_S$
2. Obtain first derivative of the  $H_S$  ( $\frac{f(x+1)-f(x-1)}{2h}$ ),  $H_{DS}$  (black line)

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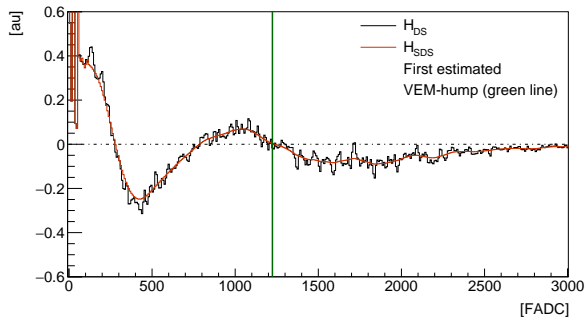
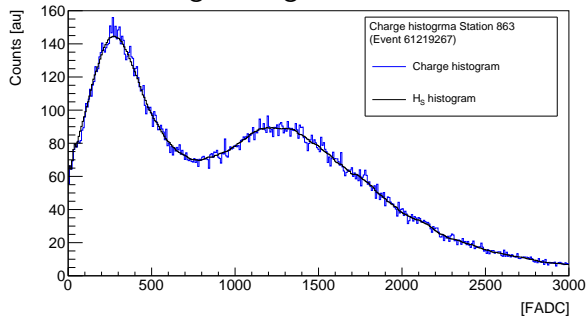
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3. Smoothing  $H_{DS}$ , obtaining  $H_{SDS}$  (red line)

# Obtaining initial parameters through derivatives

## UUB Charge histogram

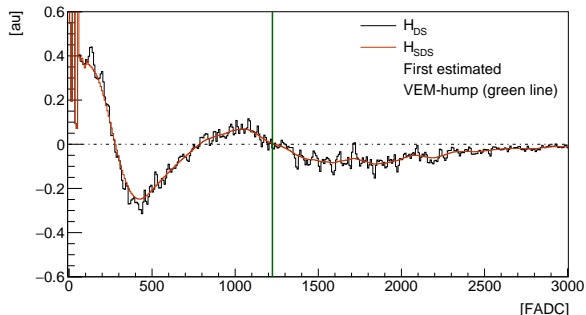
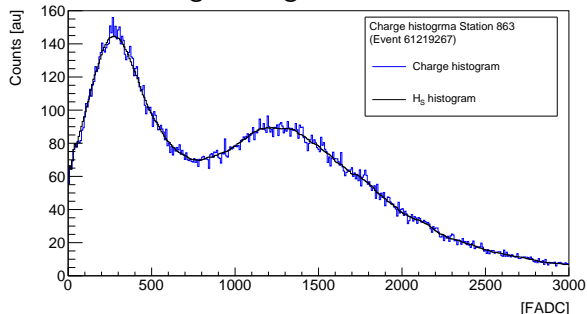


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4. Searching for the VEM hump, i.e. first bin for  $H_{SDS}$  equal to zero; from right to left.



# Obtaining initial parameters through derivatives

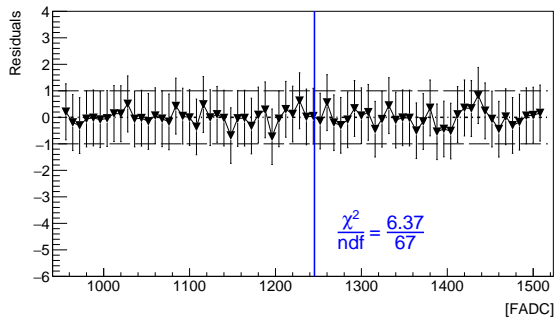
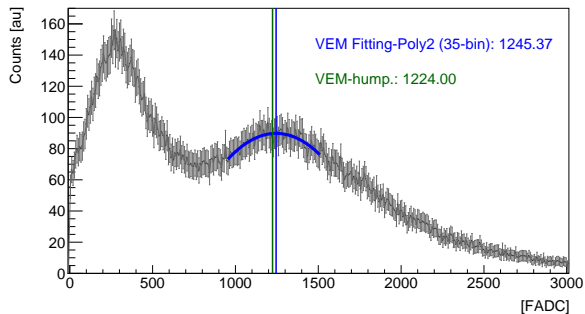
UUB Charge histogram



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3. Smoothing  $H_{DS}$ , obtaining  $H_{SDS}$  (red line)
4. Searching for the VEM hump, i.e. first bin for  $H_{SDS}$  equal to zero; from right to left.
5. Fixing the fitting range using n-bin leftward and n-bin rightward from VEM hump.

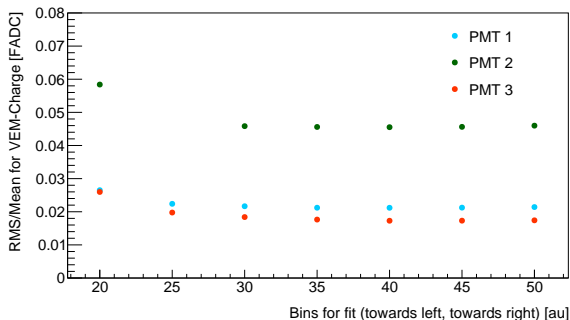
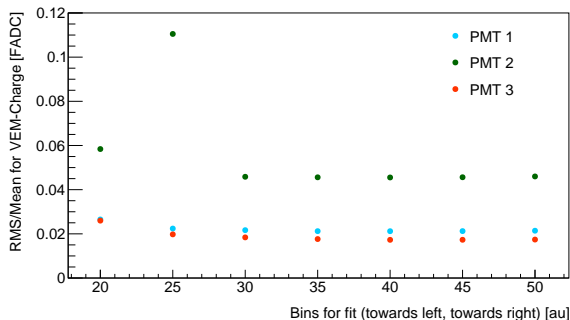
# Describing the muon hump with a second polynomial

UUB Charge histogram



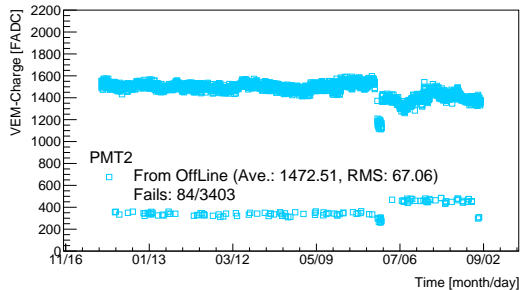
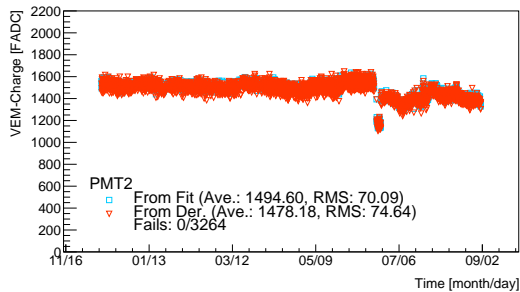
## Choosing the number of bins

1. Using the hump value from the derivative as initial parameter
2. Fixing the number of bins to the left and right with an extra condition of not reaching the valley
3. Checking the spread of the VEM values versus number of used n-bin

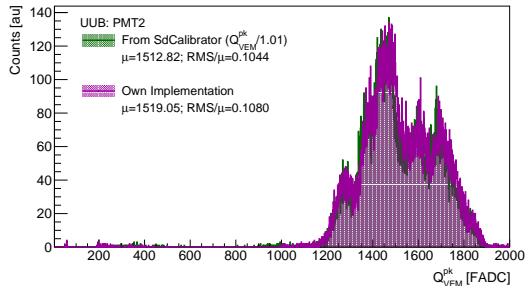
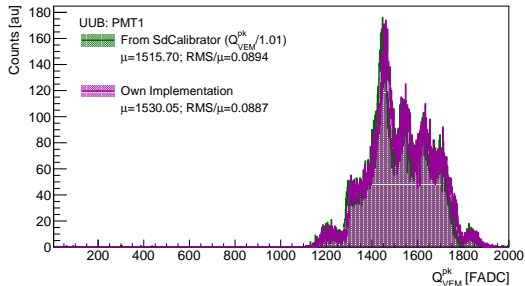
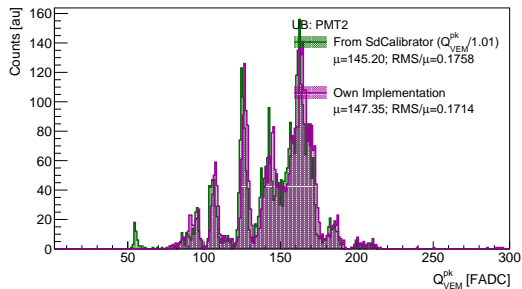
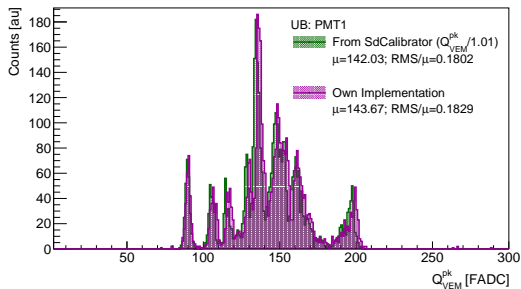


⇒ A number of about 35 bins is sufficient

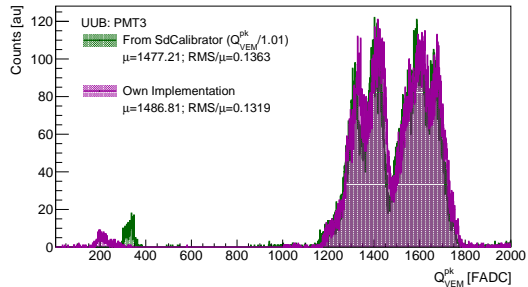
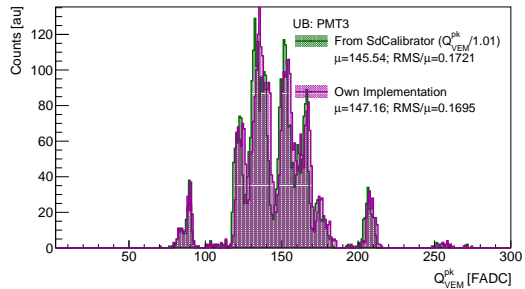
## 863 Station, UUB



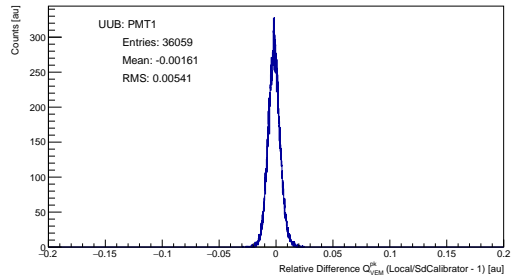
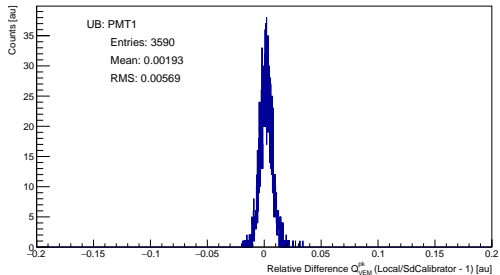
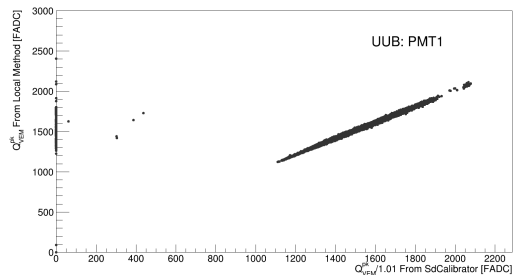
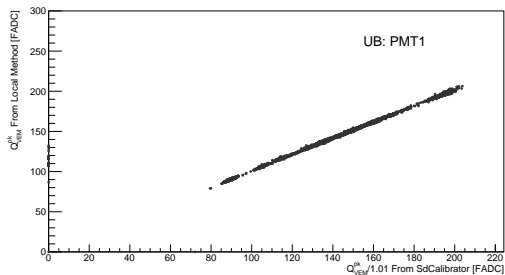
## Distribution for all UUB Stations (August, 2019, 2020, 2021)



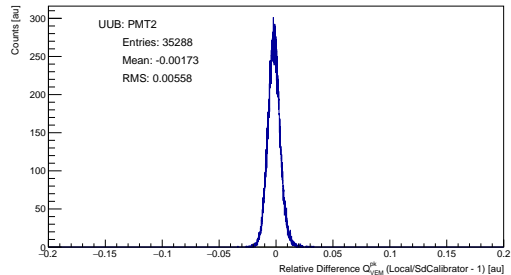
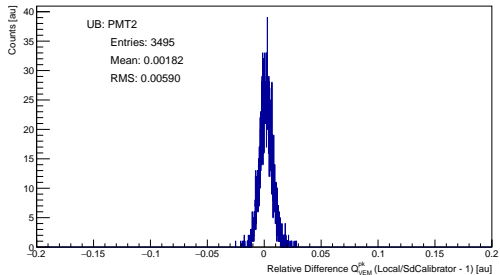
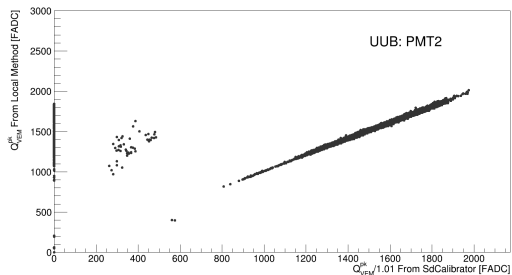
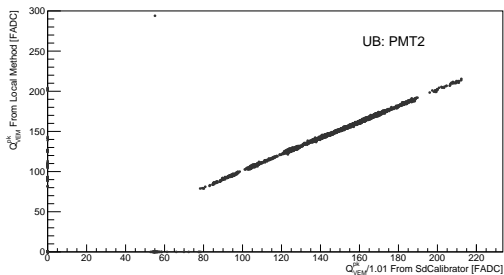
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# Relative difference for $Q_{VEM}^{pk}$ , UUB



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