

# Pion PID Purity and Efficiency

Plus bonus re-analysis

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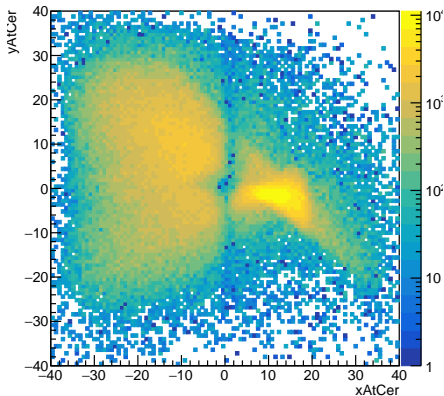
Define three data sets:

- **physics:**  $H\_cer\_npeSum > 1.5 \ \&\& \ H\_cal\_etotracknorm > 0.8 \ \&\& \ P\_aero\_npeSum > 3 \ \&\& \ MMpi < 1.01 \ \&\& \ abs(CTime\_ePiCoinTime\_ROC1) < 2.25$
- **A:**  $physics \ \&\& \ hgc\_hole$
- **B:**  $physics \ \&\& \ hgc\_hole \ \&\& \ P\_hgcer\_npeSum > 3$

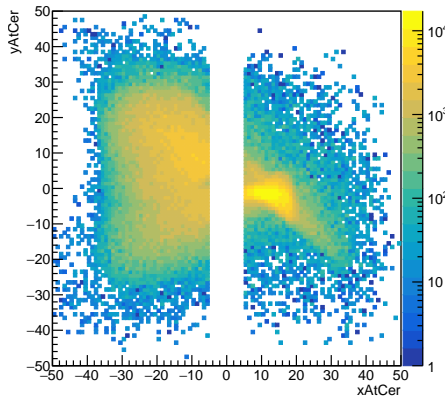
Define  $\mathbf{P} = \mathbf{B}/\mathbf{A}$ , the fraction of pion events which also pass the heavy gas cut.

$$\text{hgc\_hole} = (\text{P\_hgcer\_xAtCer} < -5 \parallel \text{P\_hgcer\_xAtCer} > 5)$$

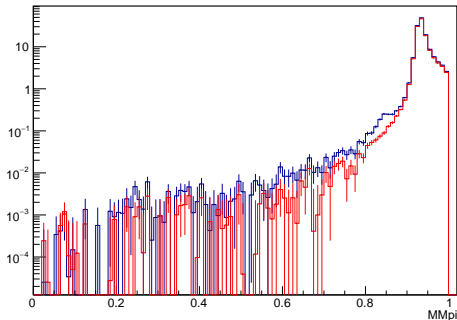
P\_hgcer\_yAtCer:P\_hgcer\_xAtCer (P\_hgcer\_npeSum)



P\_hgcer\_yAtCer:P\_hgcer\_xAtCer ((P\_hgcer\_npeSum)^(P\_hgcer\_xAtCer<5 || P\_hgcer\_xAtCer>5))



# Missing Mass with HGC



Data:  $Q^2=3.0$ ,  
W=3.14, SHMS  
center, WITH  
random and dummy  
target subtractions

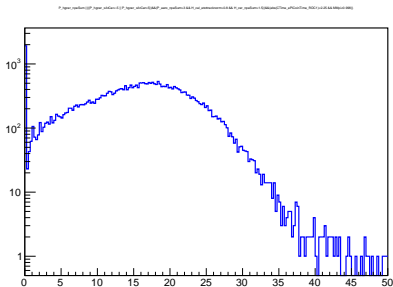
**A:** physics && hgc\_hole

**B:** physics&& hgc\_hole && P\_hgcer\_npeSum > 3

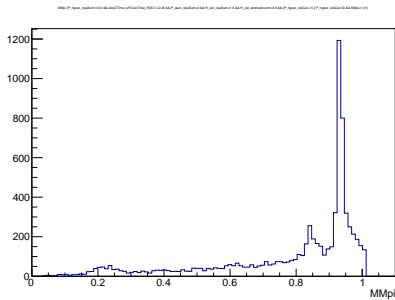
$P=B/A = 94\%$



- Proton leaktthrough? Corresponds to exactly 0.0 NPE in HGC



`P_hgcer_npeSum`  
`physics && hgc_hole`

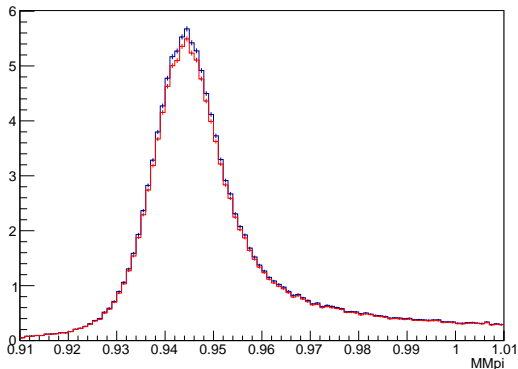


`MMpi`  
`physics && hgc_hole &&`  
`P_hgcer_npeSum == 0`

- Conclusion: need to re-do asymmetry calculation with lower missing mass cut  $MM_{\pi\pi} > 0.91$



- Also good  $\pi^+ n$  events at NPE=0.0  $\rightarrow$  remove these



Data:  $Q^2=3.0$ ,  
W=3.14, SHMS center

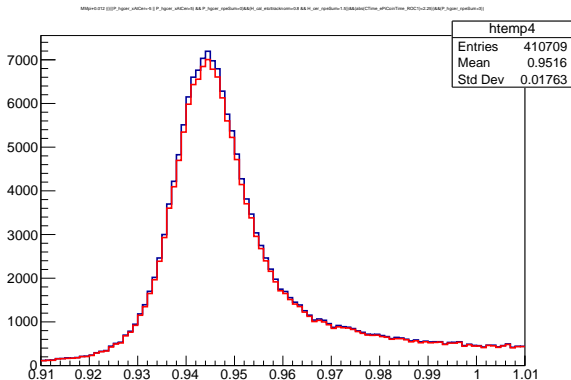
**A:** physics && hgc\_hole && P\_hgcer\_npeSum > 0

**B:** physics&& hgc\_hole && P\_hgcer\_npeSum > 3

$P=B/A = 97\%$



- Follow similar procedure: define two new data sets and divide



Data:  $Q^2=3.0$ ,  
 $W=3.14$ , SHMS center

**A:** physics && hgc\_hole && P\_hgcer\_npeSum > 3

**B:** physics - AERO && hgc\_hole && P\_hgcer\_npeSum > 3

$E=B/A = 97\%$



- $A_{LU}, \sigma_{LT'}/\sigma_0$  shift slightly once lower missing mass cut is added
- Most kinematics unchanged but mean  $-t$  per bin shifts slightly
- Figures updated
- Still need to correct supplemental material
- Paper draft to be re-circulated tomorrow





- Process for purity is flawed - this is more like an HGC efficiency
- Purity should be close to 100% due to tight missing mass cut