

GMn/nTPE Analysis Updates

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Goal: Extract a proton detection efficiency for HCal based on the ratio of detected number of protons on HCal to expected number of protons projected by BB Cal.

$$\text{Efficiency} = (\text{Detected \# Protons}) / (\text{Expected \# Protons}) \rightarrow (\text{Yield from dx on HCal}) / (\text{Integral of } W^2 \text{ from BB Cal})$$

Cuts/Requirements:

Detected # of Protons (dx yield)

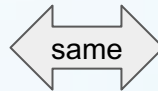
- Acceptance cut: Must land on HCal face as detected by activated HCal Cell
- # of clusters on HCal > 0
- Dy anti-cut: *before* dx projection, exclude regions on HCal x-axis that are beyond $4 \cdot dy_sigma$ from the dy_mean .
- "Best cluster" selections (min. dx & dy)

- # of Shower Clusters > 0
- # of Pre-Shower Clusters > 0
- Pre-Shower Energy > 0.15 (pion cut)
- Vertex between 0.075
- Number of GEMs hit > 4
- Single BB GEM Track
- Theta pq >= 0.04

Expected # of Protons (W^2 integral)

- Acceptance cut: Must land on HCal face as projected by BB Spectrometer for nucleon

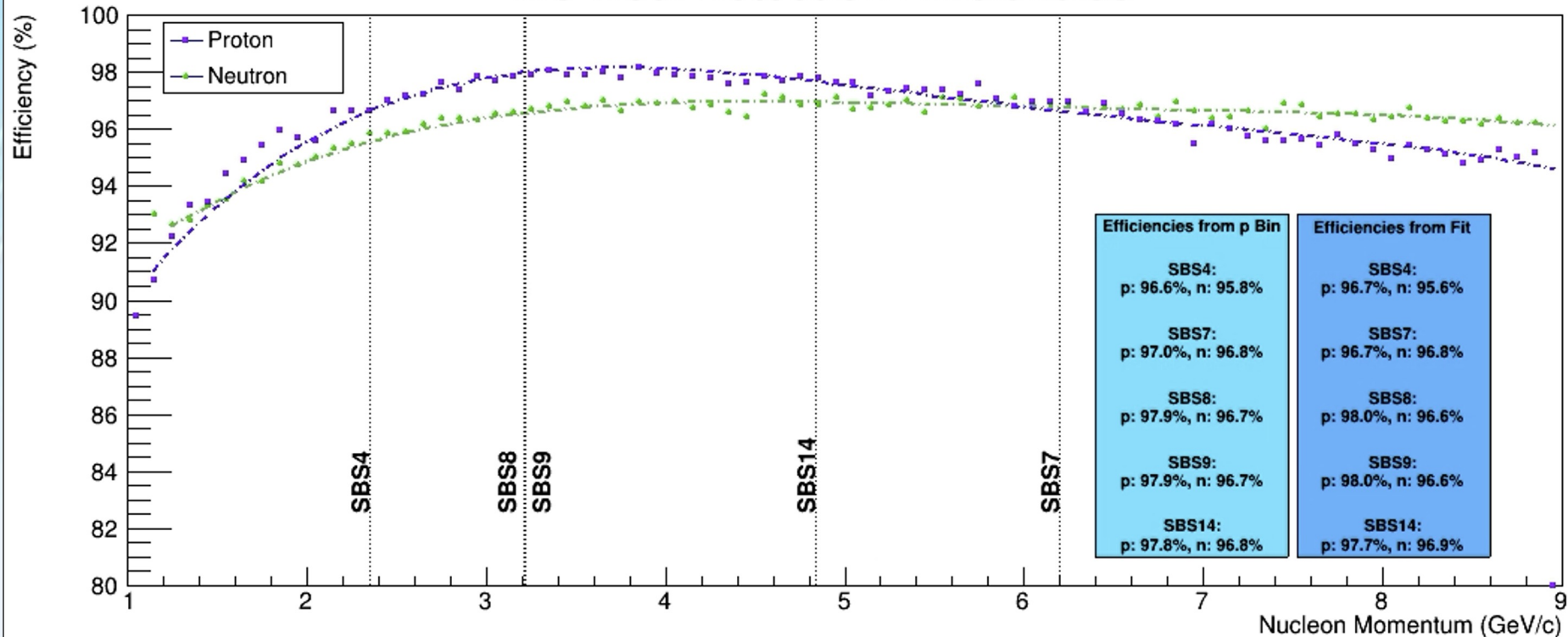
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SBS4 Data detection efficiency = $N_{dx}/N_{W\text{-squared}}$ \rightarrow **97.3766% +/- 3.37492%**

SBS4 MC detection efficiency = **96.6%**

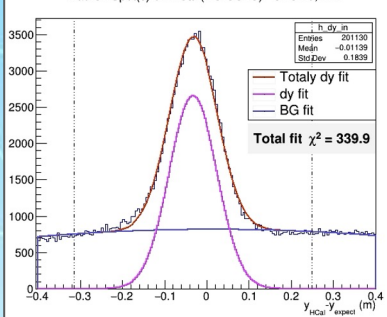
MC HCal Detection Efficiencies



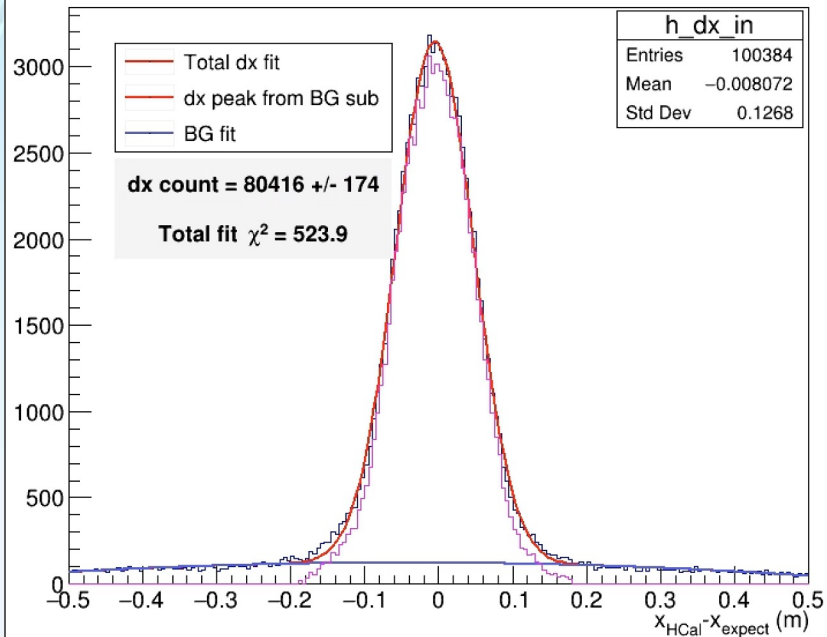
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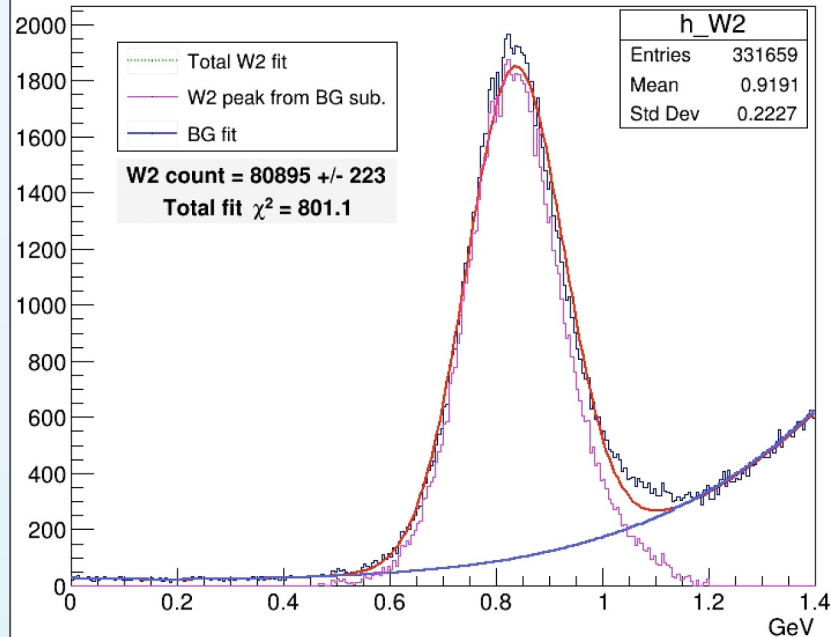
Hadron Spot(s) on HCal (NO CUTS) - SBS4 0, LH2



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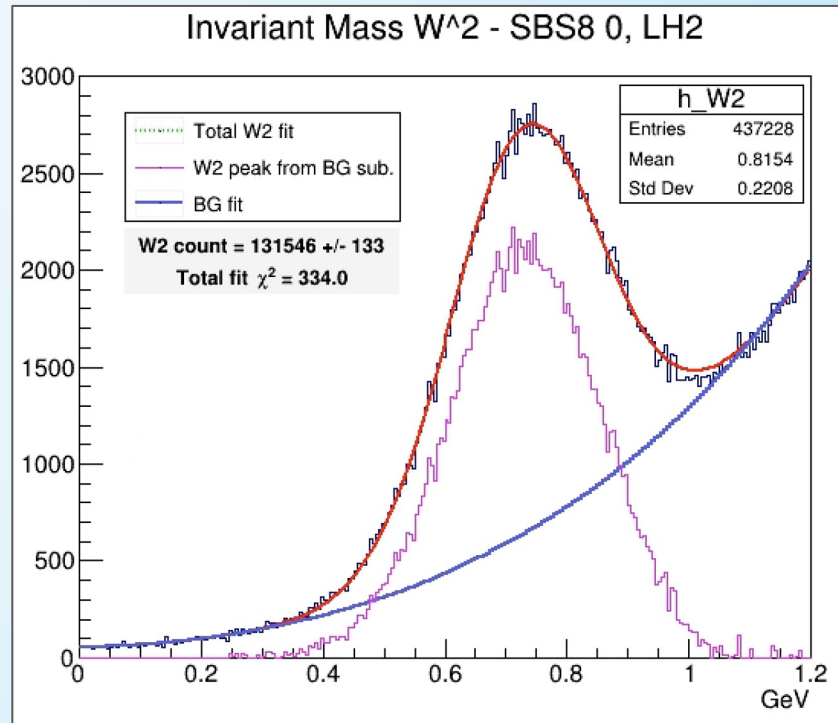
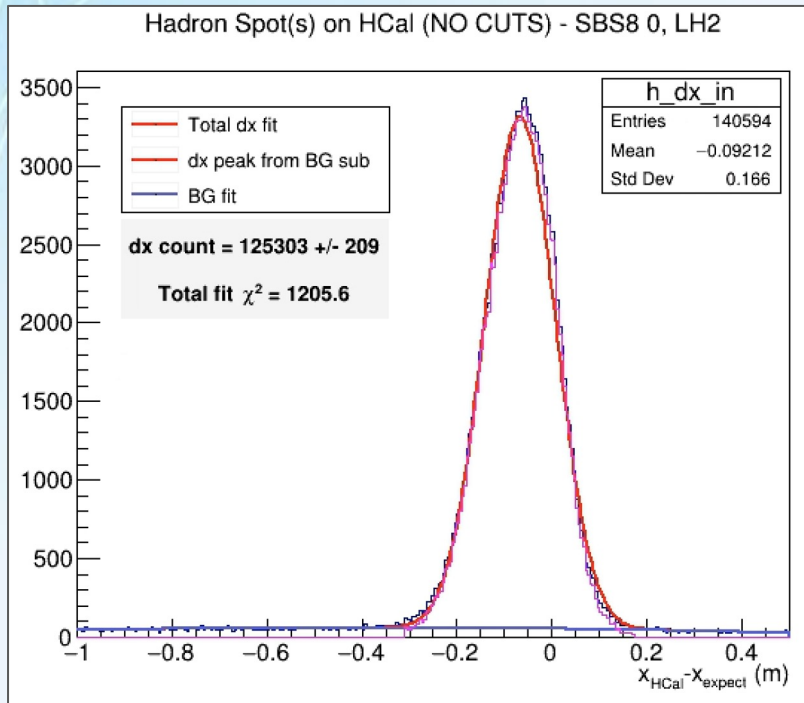
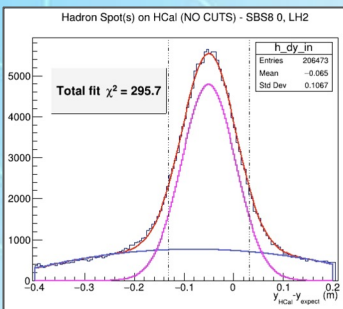


Invariant Mass W^2 - SBS4 0, LH2



SBS8 Data HCal Detection Efficiencies

SBS Data detection efficiency = $N_{dx}/N_{W\text{-squared}}$ \rightarrow **96.3466% +/- 1.89023%**



Summary of Detection Efficiencies

Monte Carlo HCal Detection Efficiencies		From Data	
SBS4	96.6%	SBS4	97.4% +/- 3.4%
SBS8	97.9%	SBS8	96.3% +/- 1.89%
SBS9	98.0%	---	---

Current “Issues” and Looking Ahead

❁ MC, Momentum and Optics Calibrations for SBS7 and SBS11

- 🌸 Already calibrated: SBS4, SBS8, SBS9 and SBS14
- 🌸 Encountered problems....
- 🌸 Updated to simc version of g4sbs and need to learn the machinery/settings
- 🌸 Using previous .mac files results in weird issues...

```
*      Row      * bb.tr.vz[ *  
*****  
*          0 *    1e+38 *  
*          1 *          *  
*          2 *          *  
*          3 *    1e+38 *  
*          4 *    1e+38 *
```

❁ Reiterate through MC simulations

- 🌸 Updating this requires a full (re)run-through of simulations and related outputs
- 🌸 Rerun my analysis scripts for QE Data & MC comparisons with SIMC

❁ Implement extraction analysis code

- 🌸 Everything in place to extract GMn and subsequently nTPE
- 🌸 Preliminary extraction only but creates initial machinery moving forward

Comparing MC HCal Detection Efficiency Calculations

