

# Hadron Generator and Rate Update

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SIDIS Hadron Background Rate Update

- SIDIS windows rate update
- SIDIS target rate update

# HallD hadron generator (SoLID-Bggen)

- **SoLID\_Bggen-v1.0**

SOLID-Bggen event generator (HallD) -----modified by Rakitha

- $E > 3$  GeV: PYTHIA is used

- $0.15 < E < 3$  GeV: a mixture of 10 dominating exclusive processes ( $\gamma + p$ ) is used. For the single pion production differential cross sections, the SAID code is used.

- **SoLID\_Bggen-v1.1**-----modified by Jixie Zhang

- Run on the current ifarm environment.

- Beam current, target  $X_0$ ,  $\rho$ , and L for different target.

- **SoLID\_Bggen-v1.2**-----modified by Jixie Zhang

- Add window thickness to include more bremsstrahlung photons

# SIDIS target+Windows rate

$$N_{EPA}(\omega) + N_{Brem}(\omega)$$

SIDIS Rate: upstream window + target + downstream window

A. Target:  $N_{EPA}^{target}(\omega) + N_{Brem}^{target}(\omega) + N_{Brem}^{upstream}(\omega)$

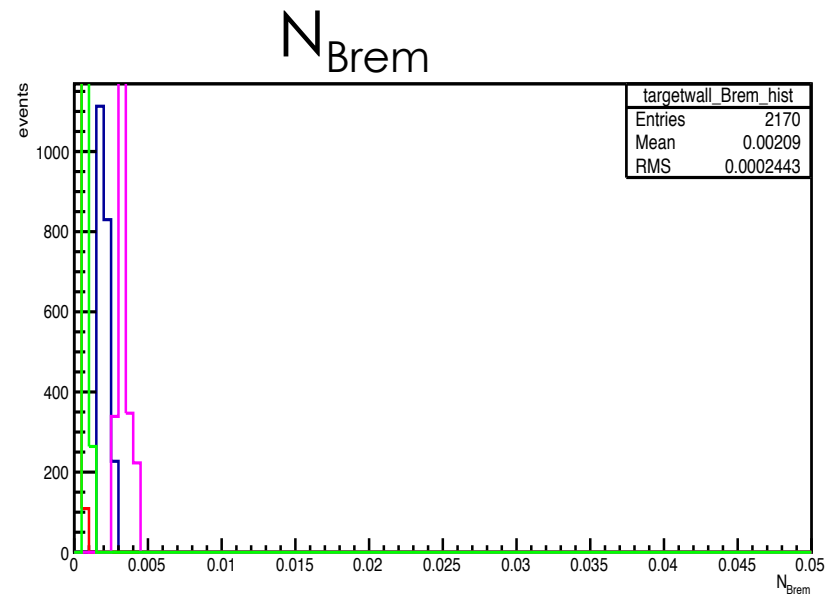
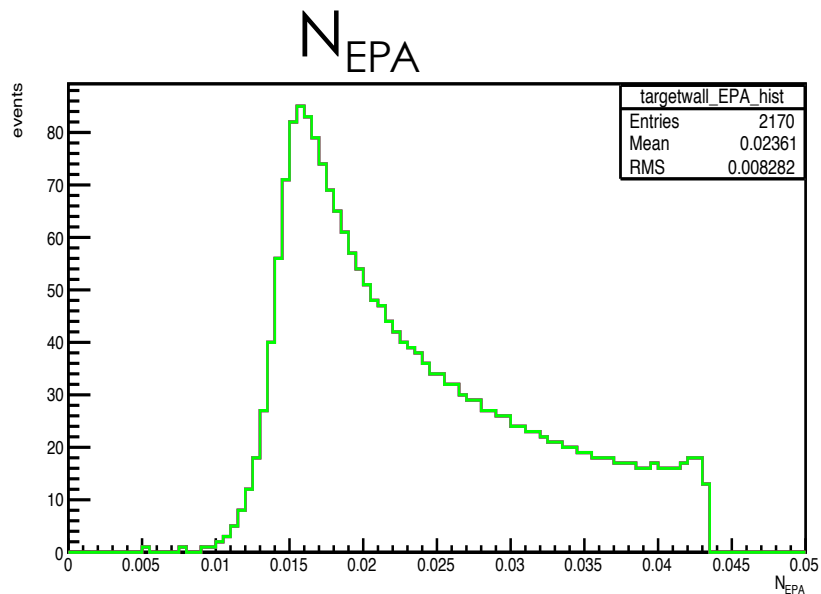
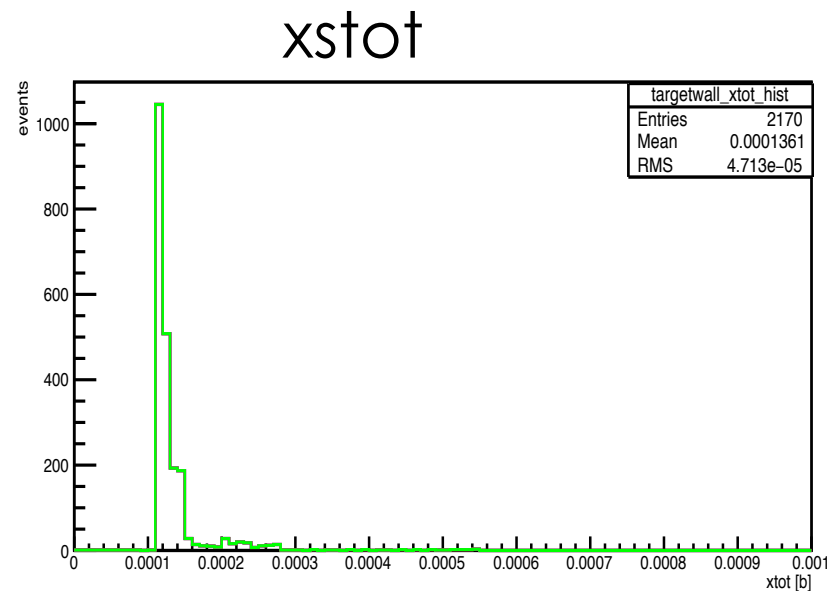
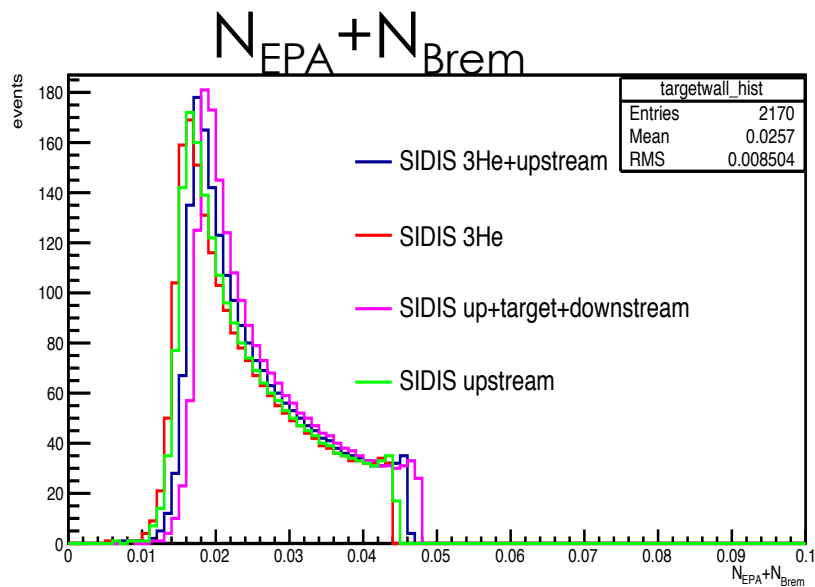
B. Downstream window:

$$N_{EPA}^{downstream}(\omega) + N_{Brem}^{downstream} + N_{Brem}^{target}(\omega) + N_{Brem}^{upstream}(\omega)$$

C. Upstream window:  $N_{EPA}^{upstream}(\omega) + N_{Brem}^{upstream}$

$$\text{SIDIS total rate} = A+B+C$$

# SoLID\_bggen-V1.2 plots



# 3He Generate Weight Comparison

	<b>SIDIS 3He</b>		
	Bggen -v1.2 kHz	Bggen-v1.1 kHz	Bggen-v1.2/ Bggen-v1.1
$\pi^+$	4.123	3.89	1.06
$\pi^-$	3.254	3.064	1.06
$\pi^0$	4.010	3.786	1.06

Weight=Rate(Hz)/Event\_counts

# SIDIS Upstream Window Generate Weight Comparison

	<b>SIDIS 3He Windows</b>		
	Bggen-v1.2 (downstream)kHz	Bggen-v1.1 (upstream) kHz	Bggen-v1.2/ Bggen-v1.1
$\pi^+$	2.341	2.148	1.09
$\pi^-$	2.388	2.191	1.09
$\pi^0$	2.563	2.36	1.09

The downstream window rate includes Bremsstrahlung part from upstream window and target.

# Single e<sup>-</sup> Trigger Rates

Rate (kHz)	FAEC		FAEC+LGC		FAEC+LGC+SPD+ <b>up</b> + <b>do</b> <b>wn</b>	
	V1.2	V1.0	V1.2	v1.0	V1.2	V1.0
$\pi^0$	565.282 (65.9)	1021.5 (116)	36.19 (22.9)	42.9 (31)	25.83 (22.1)	32.2 (29.6)
$\pi^-$	435.37	637.8	2.86	3.9	2.66 (2.08)	3.7
$\pi^+$	563.1	694	4.0	4.2	3.67 (3.13)	3.8
All hadrons no e-	2004.8	3009	62.5	63	48.1+ <b>4.2</b> + <b>4.8</b>	49.5+ <b>2.4</b> + <b>0.04</b>
<b>FAEC total</b> Only primary particle in parenthesis					<b>118.1 kHz</b>	<b>114.1 kHz</b>

Rate (kHz)	LAEC		LAEC+SPD+up+down	
	V1.2	V1.0	V1.2	V1.0
$\pi^0$	4.33 (0.16)	14.7	0.4 (0.16)	0.7
$\pi^-$	1.33	6.5	1.33	6.0
$\pi^+$	1.85	2.9	1.81	2.8
All hadrons no e-	10.15	36.9	4.5+3.8+2.7	17.1+7.6+0.2
LAEC total (e+background)			21.3	35

Single e:  $118.1+21.3=139.4\text{kHz}$



# Hadron Trigger Rates

h_FA (kHz)	EC		EC+SPD+up+down	
	V1.2	V1.0	V1.2	V1.0
$\pi^0$	2635	4607	414.5	548
$\pi^-$	3156	4925	2873	3971
$\pi^+$	4054	5855	3698	5151
All hadrons no e-	11640	17392	9143+2773+3430	12805+4500 +6000
LAEC total (e+background)			15454	23413

# Summary and Outlook

- Even though the bggen-v1.2 generated hadron rate is about 60% of the bggen-v1.0, the SIDIS single electron trigger rate from v1.2 is about 86% of the v-1.0.
- For the single electron trigger, the total FAEC trigger from v1.2 is similar as the v1.0, however the total LAEC trigger from v1.2 is about 60% of that from v1.0.
- The EC rates from bggen-v1.2 is less than bggen-1.0, however, EC+LGC and EC+LGC+SPD rates from two version SoLID\_bggen are very similar.
- For hadron trigger, the rate from SoLID\_bggen-v1.2 is about 67% of that from bggen-1.0. In order to get the new random coincident rate, the coincident simulation data are needed (the old files are lost).
- Need to understand that FAEC single electron trigger rates from two bggen versions are very similar even though the generated rate are quite different.

# Backup

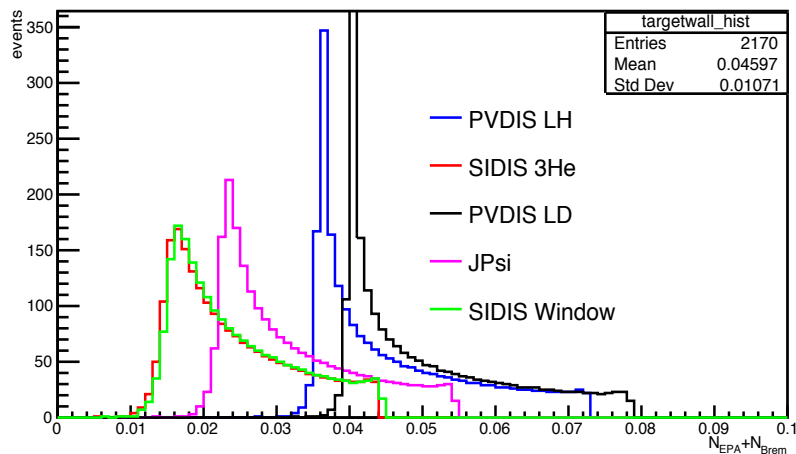
# $^3\text{He}$ Generate Weight Comparison

	<b>SIDIS <math>^3\text{He}</math></b>		
	Bggen (R) kHz	Bggen(Y) kHz	Bggen-Y/ Bggen-R
$\pi^+$	7.726	3.89	0.56
$\pi^-$	6.015	3.064	0.55
$\pi^0$	6.546	3.786	0.57

Weight=Rate(Hz)/Event\_counts

# Window Rate previous issue

“For files Rakitha made at /work/halla/solid/evgen/solid\_bggen/lund\_format/10k\_lundfiles/SIDIS\_He3 pi+ for He3 of "hallD\_pion\_p\_3He\_10k\_1.lund", the rate factor at the end of header line is 7704 pi+ for one window of "hallD\_pion\_p\_DST\_Winu\_10k\_1.lund", the same factor is 230 the ratio is  $7704/230=33$  Assuming pi+ cross section is same for neutron and proton, this ratio is only proportional to nucleon luminosity ratio nucleon luminosity ratio between 3He and one window should 1.6.” ----from Zhiwen



The rate ratio between 3He and upstream window should be about 1.6

# Problem check

Compare two methods for the following setups:

<b>Target</b>	<b>Density g/cm<sup>3</sup></b>	<b>Radiation Length g/cm<sup>2</sup></b>	<b>Length cm</b>
<b>PVDIS LH</b>	<b>0.071</b>	<b>63.22</b>	<b>40</b>
<b>PVDIS LD</b>	<b>0.169</b>	<b>125.97</b>	<b>40</b>
<b>SIDIS 3He</b>	<b>1.345e-3</b>	<b>67.42</b>	<b>40</b>
<b>SIDIS upstream Window</b>	<b>2.76</b>	<b>19.42</b>	<b>0.012</b>
<b>JPsi</b>	<b>0.071</b>	<b>63.22</b>	<b>15</b>