

# HKS Data Analysis Update

Lulin Yuan/ Hampton U.

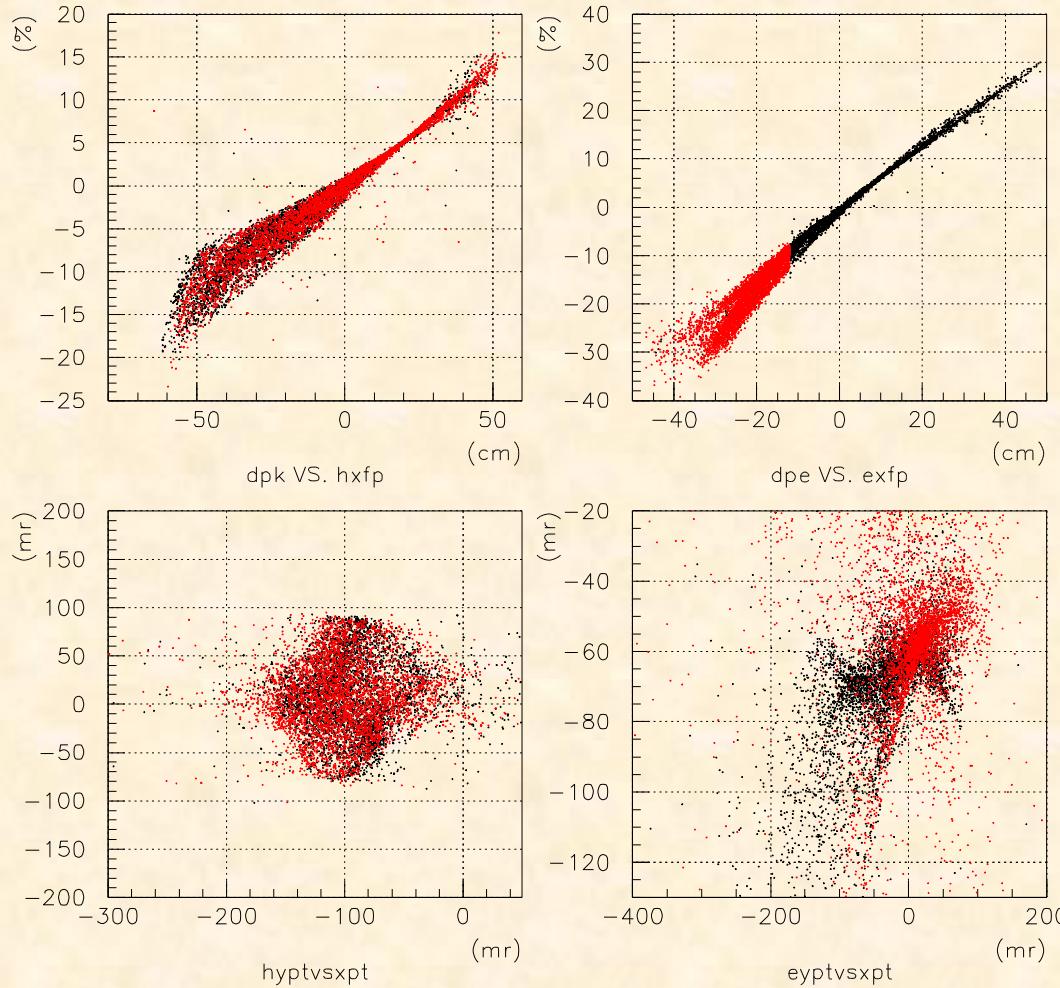
March 10, 2010

# New Round of Spectrometer Calibration

Start a new round of spectrometer calibration:

- Using updated focal plane tracking information (Seva replay)
- New target angle calibration procedure

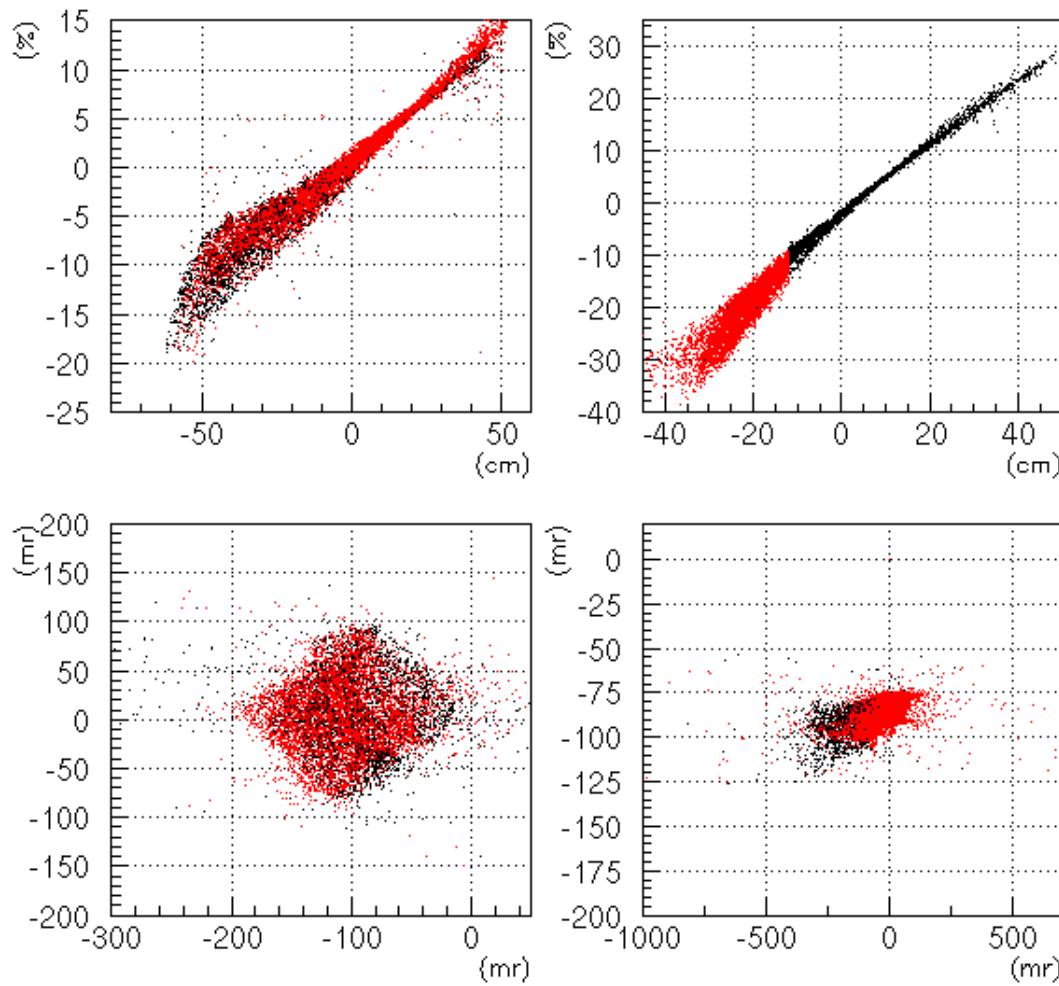
# Target Correlations (old)



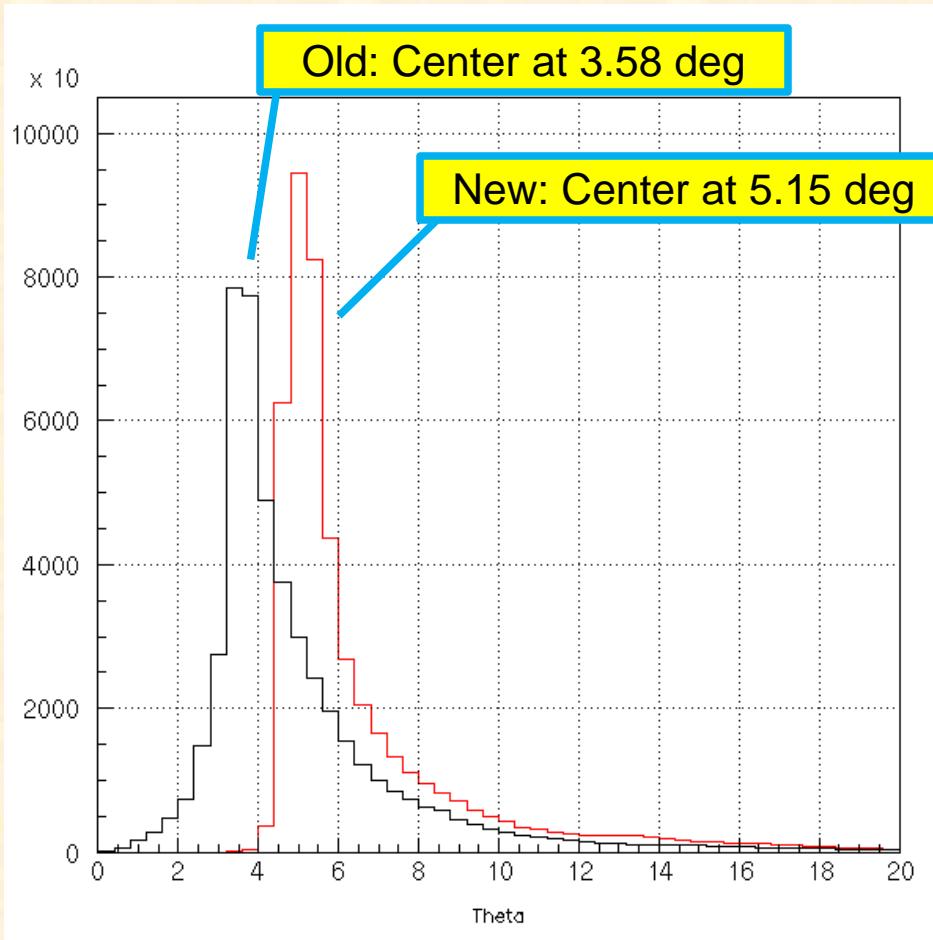
Black: Region I  
 $E_{\text{xfp}} \geq -12$

Red: Region II  
 $E_{\text{xfp}} < -12$

## Target Correlations (new)



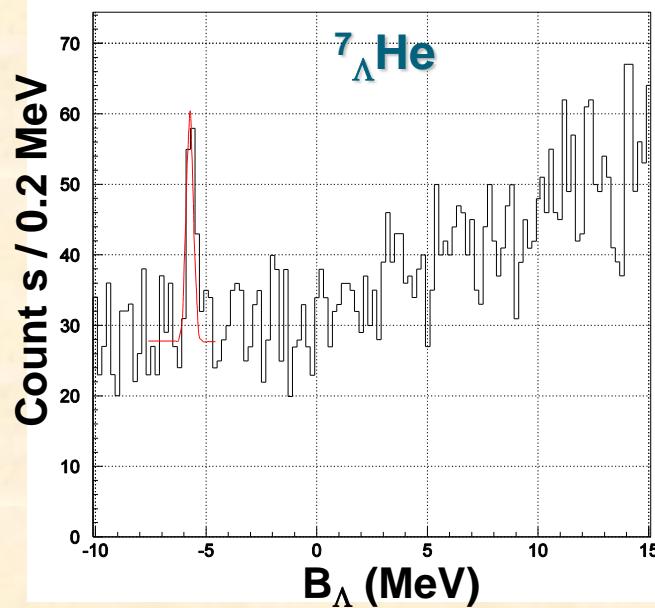
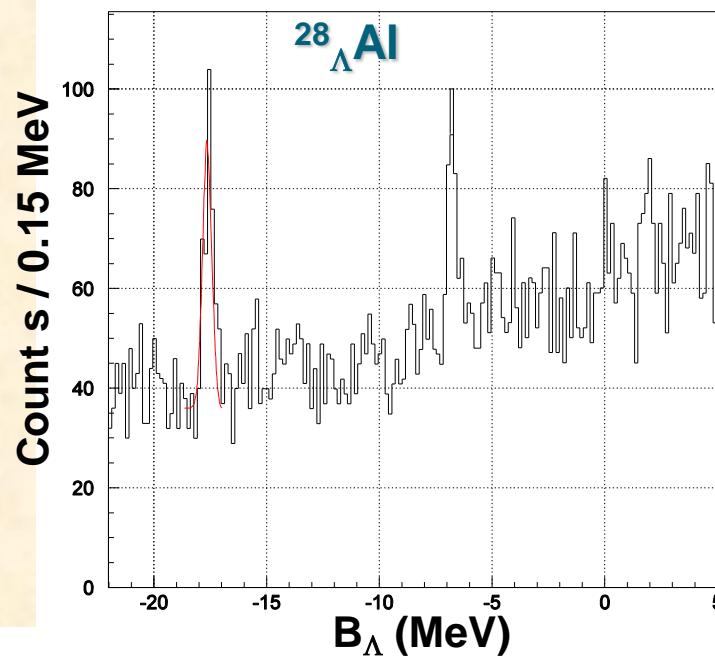
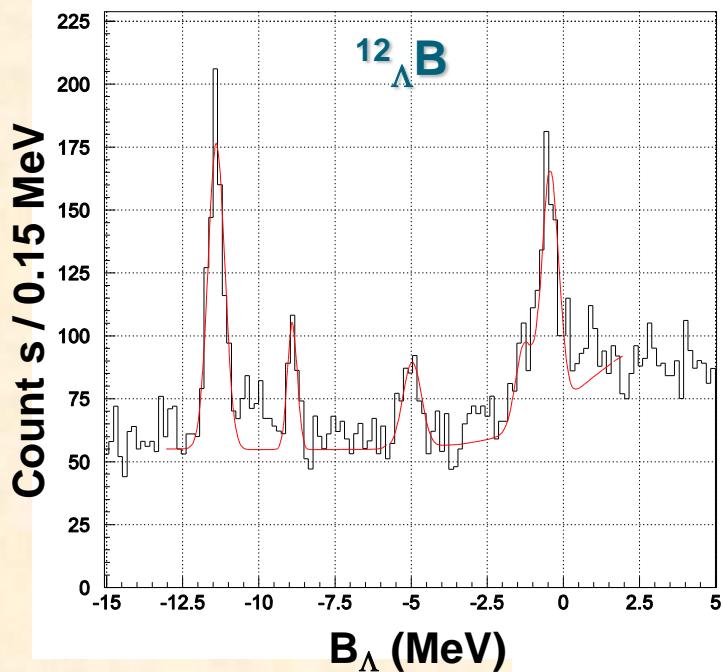
# Theta Angle at Target



New and old tune: 1.57 degree offset in target theta angle

→ 140 keV increase in  $\Lambda, \Sigma$  separation.

# Current Spectra



# Summary of the spectra

Summary of the Finalized Spectroscopy						
State	B <sub>A</sub> (MeV)	E <sub>x</sub> (MeV)	Width σ (MeV)	Sys. Error (Kin.) (keV)	Sys. Error (Opt.) (keV)	Stat. Error (keV)
Λ	-0.001		0.752	±75	±31	±24
Σ <sup>0</sup>	B <sub>Σ</sub> = -0.054		0.780	±55	±22	±59
<sup>12</sup> <sub>A</sub> B (g.s.)	-11.559	0.000	0.198	±97	±50	±13
<sup>12</sup> <sub>A</sub> B (1st C.E.)	-8.758	2.801	0.188	±93	±50	±37
<sup>12</sup> <sub>A</sub> B (2nd C.E.)	-5.239	6.320	0.241	±91	±50	±67
<sup>12</sup> <sub>A</sub> B (p centroid)	-0.359	11.200	0.218	±90	±50	±20
<sup>28</sup> <sub>A</sub> Al (g.s.)	-17.820	0.000	0.179	±125	±50	±27
<sup>28</sup> <sub>A</sub> Al (p centroid)	-6.912	10.910	0.202	±101	±50	±33
<sup>28</sup> <sub>A</sub> Al (d centroid)	1.360	19.180	0.246	±92	±50	±42
<sup>7</sup> <sub>A</sub> He (g.s.)	-5.727	0.000	0.198	±94	±50	±41
<sup>9</sup> <sub>A</sub> Li (g.s.)	-5.634	0.000	0.193*	±94	±50	±184
<sup>9</sup> <sub>A</sub> Li (1st Ex.)	-4.348	1.296	0.192*	±93	±50	±147
<sup>9</sup> <sub>A</sub> Li (2nd Ex.)	-3.94	1.694	0.192*	±93	±50	±147
<sup>9</sup> <sub>A</sub> Li (3rd Ex.)	-2.670	2.964	0.277*	±91	±50	±123

\* The width of these peaks are effected by the statistics and background, but the binding energy values seemed stable within the statistical errors.

## Summary of the Spectra (new)

HN	States	$E_{Bind}$ (old)	$E_{Bind}$ (new)	$E_{Ex}$	Width( $\sigma$ )	Kin Err	Opt Err	Stat Err
$\Lambda$		-0.001 ( $\Delta M$ )	-0.059( $\Delta M$ )		0.959	34	31	34
$\Sigma^0$		-0.054 ( $\Delta M$ )	-0.054( $\Delta M$ )		1.018	20	22	20
$^{12}\Lambda$ B	GS	-11.559	-11.376	0	0.284	35	50	19
	PS1		-1.252	10.124	0.284	35	50	27
	PS2	-0.359	-0.380	10.996	0.284	35	50	11
	CE1	-8.758	-8.837	2.539	0.169	35	50	22
	CE2	-5.239	-4.957	6.419	0.304	35	50	24
$^{28}\Lambda$ Al	GS	-17.82	-17.57	0	0.230	35	50	12
	PS	-6.912	-6.836	10.73	0.217	35	50	17
	DS	1.360	1.830	19.40	0.172	35	50	70
$^7\Lambda$ He	GS	-5.727	-5.653	0	0.190	34	50	26

## New Estimation of Error from Kinematics

Kinematics error resulted from the fitting errors for the  $\Lambda$  and  $\Sigma$  peaks

According to error propagation rule:

$$\varepsilon_m^2 = \left( \frac{\partial m}{\partial E_0} \right)^2 \varepsilon_E^2 + \left( \frac{\partial m}{\partial P_k} \right)^2 \varepsilon_{P_k}^2 + \left( \frac{\partial m}{\partial P_e} \right)^2 \varepsilon_{P_e}^2$$

$$\varepsilon_{Lamda} = 34 \text{ keV}, \varepsilon_{Sigma} = 20 \text{ keV} \rightarrow \varepsilon_E \approx \varepsilon_{P_k} \approx \varepsilon_{P_e} \approx 20 \text{ keV}$$

## Compare with Hall A Result

HN	States	$E_{Bind}$ (old)	$E_{Bind}$ (new)	$E_{Ex}$	$E_{Ex}$ (HallA)	Width( $\sigma$ )	Width( $\sigma$ )(HallA)
$^{12}_{\Lambda}B$	GS	-11.559	-11.376	0	0	0.284	0.489
	PS1		-1.252	10.124	9.54	0.284	0.396
	PS2	-0.359	-0.380	10.996	10.93	0.284	0.285
	CE1	-8.758	-8.837	2.539	2.65	0.169	0.404
	CE2	-5.239	-4.957	6.419	5.92	0.304	0.481