Analysis of RHIC Polarimeter-2000

Osamu Jinnouchi*

The current status of the data analysis on RHIC commissioning run 2000 is reported. Detailed analysis based on the mass identification is firstly applied for this data set. The quality of the analysis procedure is confirmed by several aspects. Those are t-dependence of the cross-section, angle-dependences, and mass distributions. It is also shown that RHIC polarimeter is expected to have very low background, and little contamination of α particles. Carbon events are well separated from that of the α's, owing to the good time and energy resolutions of the detectors.

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Analysis of RHIC Polarimeter-2000 Commissioning Run

Osamu Jinnouchi (RIKEN)

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Reminder of the RUN

Detecting the recoiled Carbon (CNI region) with Si detectors installed obliquely by 45°

Measurement with CNI polarimeter

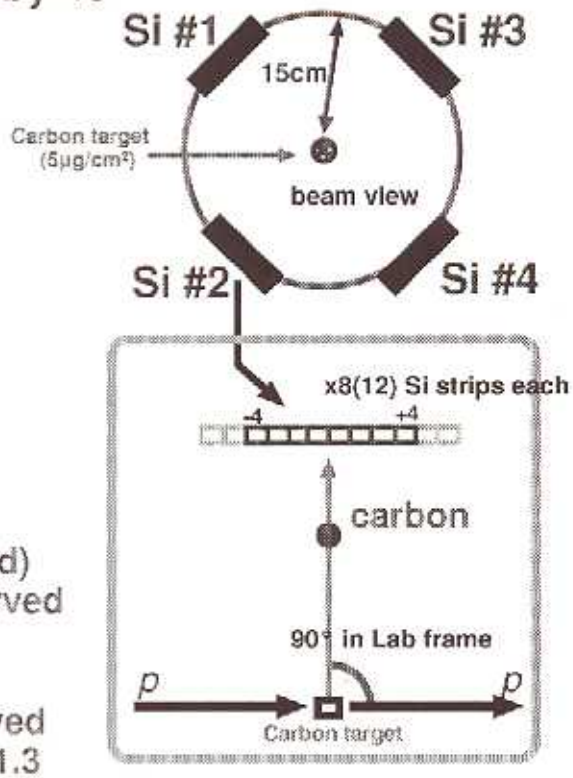
Energy & TOF

→ Identify Carbon

→ Calculate Asymmetry

What had been already understood from the fast analysis

- up and down polarization with
  - significant asymmetry size
  - clear direction
- siberian snake on (1 snake was installed)
  - horizontal spin direction was observed
- ramping up energy
  - horizontal spin rotation was observed
  - observed no asymmetry over $G\gamma \geq 61.3$



Analysis Procedure

Kinematical fit is performed with

$$T = \sqrt{\frac{M L^2}{2}} \frac{1}{\sqrt{E}}$$

Simultaneously applied for α and C

Fitting Constraints

Mc : Carbon mass 11.18GeV/c²

Mα: Alpha mass 3.73GeV/c²

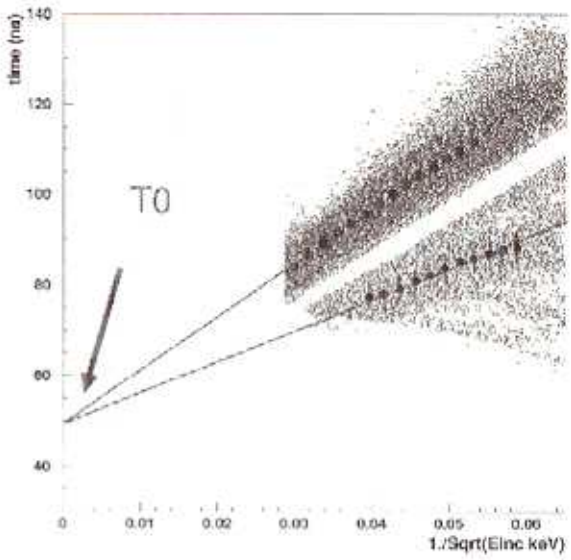
T0 : common to α and Carbon

Known parameters

Time scale, Slewing, Distance(L) ...

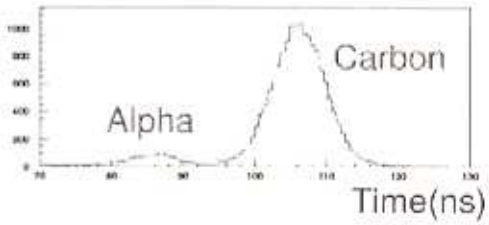
Fitting Assumptions

Dead layer width on Si surface
= 74μg/cm² (from Tandem test)



→ Mass Reconstruction (i.e. particle ID)

→ Extract Energy Scale (no direct calibration has performed)



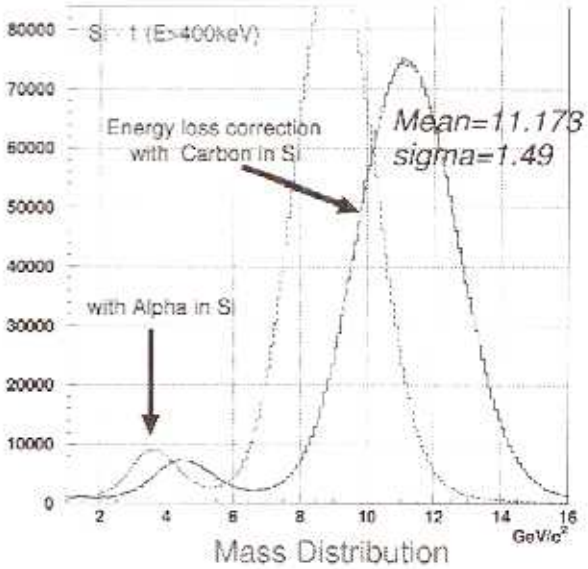
Mass Reconstruction

Alpha and Carbon mass peaks are Clearly separated

Carbon ID can be defined by Mass

flat mass cut is performed so far,

→ Should be improved as a t-dependent cut (coming soon)



Max Alpha/Carbon ratio is ~10%

Alpha Contamination within Carbon peak is estimated to be extremely small

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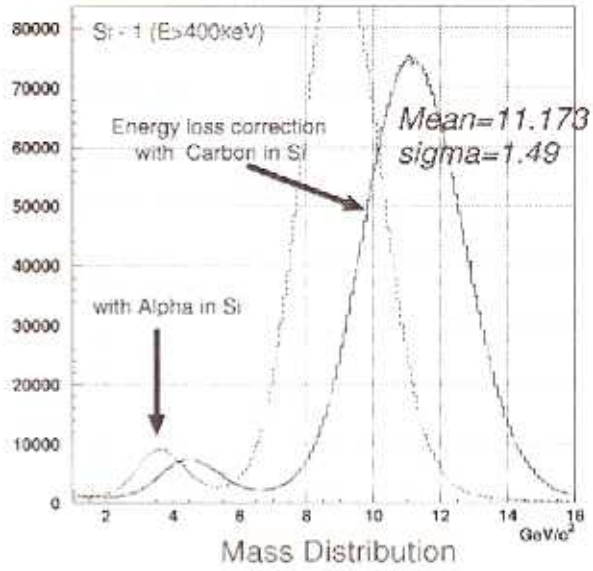


Mass Distribution

Max Alpha/Carbon ratio is ~10%

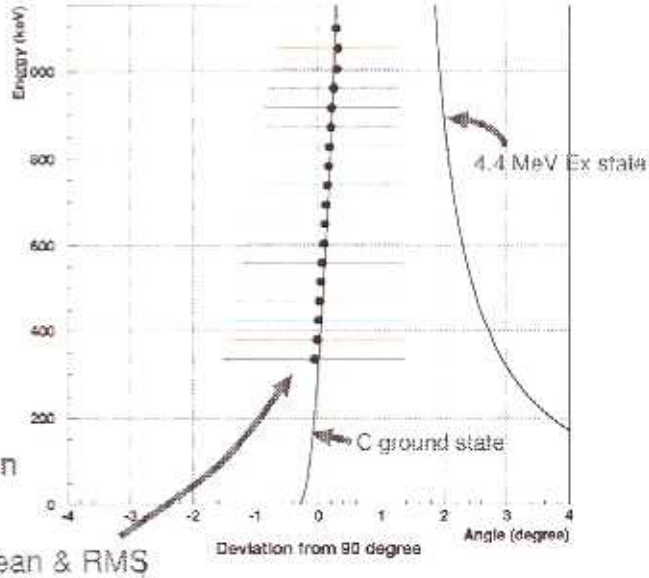
Alpha Contamination within Carbon peak is estimated to be extremely small

Recoil Angle Dependence

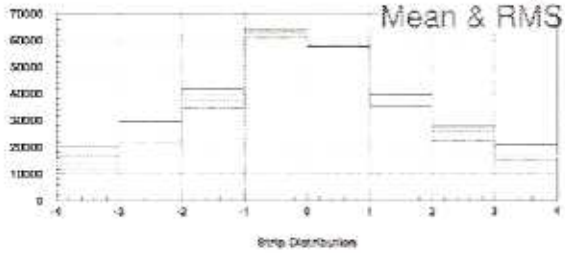
Scattering angle is estimated from strip distributions

Scattered angle distribution fits well with kinematical curve

- Deviation is -0.3°~ -0.5° (corresponds to -1.3~-0.8mm for Si geometry)
- All four Si shows same distribution



Mean & RMS



These histograms show strip distributions for different energy
The lower the wider

Asymmetry → Polarization

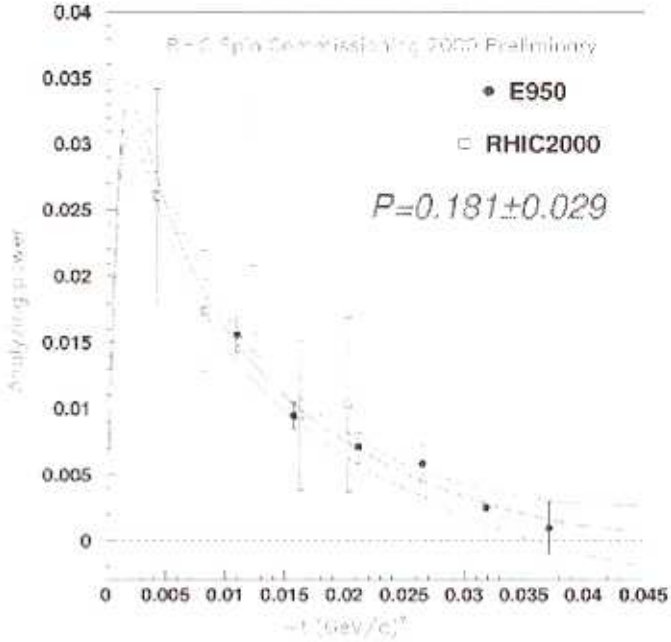
Raw asymmetry is calculated with square-root formula, with 6-bunches (⇑⇓⇑⇓⇑⇓)

$$A = \frac{\sqrt{L(\Uparrow)}\sqrt{R(\Downarrow)} - \sqrt{L(\Downarrow)}\sqrt{R(\Uparrow)}}{\sqrt{L(\Uparrow)}\sqrt{R(\Downarrow)} + \sqrt{L(\Downarrow)}\sqrt{R(\Uparrow)}}$$

Extract Polarization by fitting to E950's result,

$$P = A(t) / A_N(t)$$
$$= 0.181 \pm 0.029$$

This result is obtained with typical run set



⇨ need much more statistics

Summary & Outlook

summary

- Detailed analysis has been carried out using Mass ID
- Several features of analysis indicate that the procedure of analysis works well
  - Firstly confirmed t-dependence of cross-section
  - Angle dependence
  - Mass distribution

outlook

- Need to precisely study run depedence of
  - the spin direction during Snake runs
  - the energy dependencies of the polarization
- To extract asymmetry with Alpha (from physical interest)
  these are under progressing now
- The energy scale will be confimed by direct calibration measurement