Fermi-motion study

on-/off-shell treatment

&

three-body spectator

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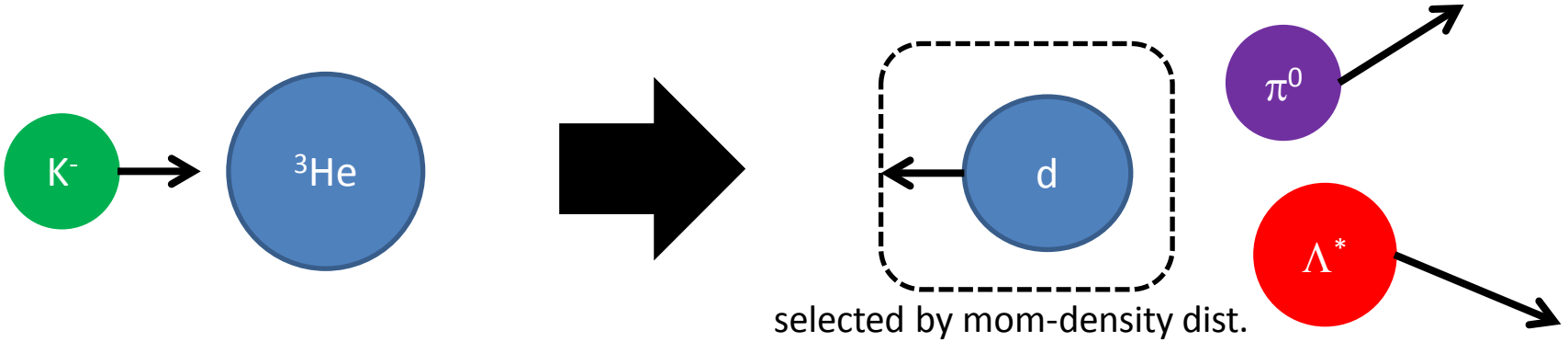
On-shell treatment

① "K^- + 3He → X + spectator(s)" reactions are generated according to phase space at once

② spectator momenta are selected by the momentum-density distribution (PRL49(1982)974).

- Angular distribution is considered at the CM-frame of the decay-particles (X) system, before the Fermi-motion selection.
- *http://ag.riken.jp/J-PARC/sakuma/weekly_meeting/K3He/K3He.pdf*



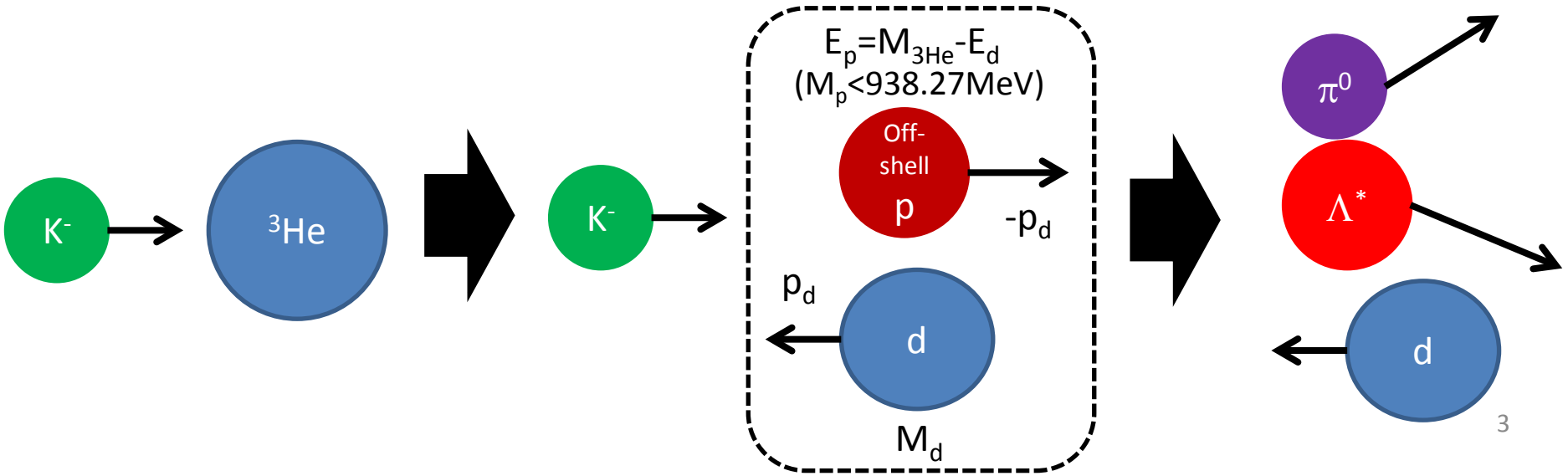
Off-shell treatment

① Spectator momentum (p_d) is generated according to the momentum distribution (PRL49(1982)974).

② Masses of the spectator deuteron and the target proton are assumed to be on-shell and off-shell, respectively

③ The "off-shell proton" and the beam K^- are reacted.

– Angular distribution is considered at the CM-frame of this system.

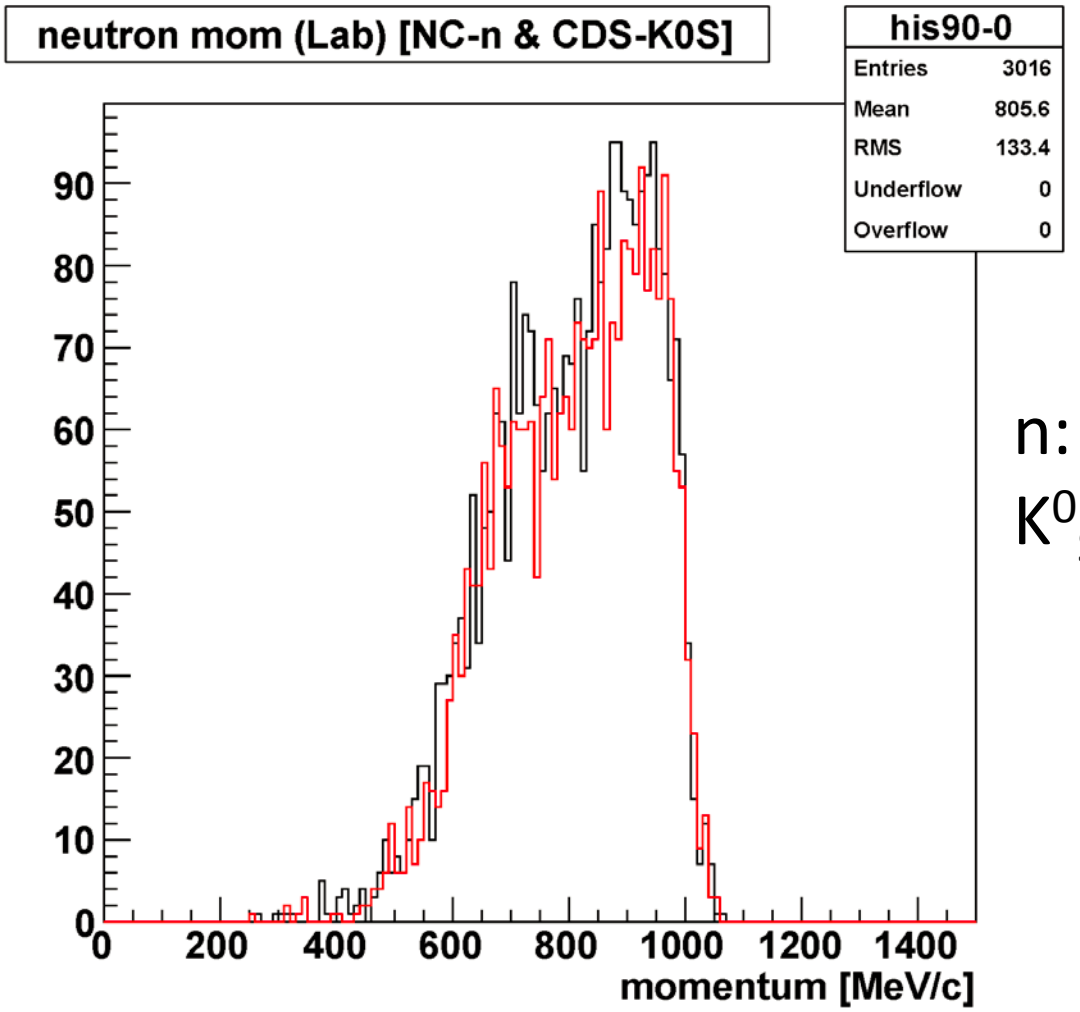


$\Lambda(1520)$ study

- $K^- + {}^3He \rightarrow \pi^0 + \Lambda(1520) + d_s$
- $\Lambda(1520) \rightarrow K^0_S + n$ only
- $K^0_S \rightarrow \pi^+ + \pi^-$ only
- 400k events are generated with each method
- "accepted" = n and $K^0_S \rightarrow \pi^+ + \pi^-$ are reached to the NC and the CDS, respectively.
  - NO any cuts are applied

neutron mom. in $^3He(K^-,nK^0_S)X$

--- on-shell
--- off-shell



n: NC

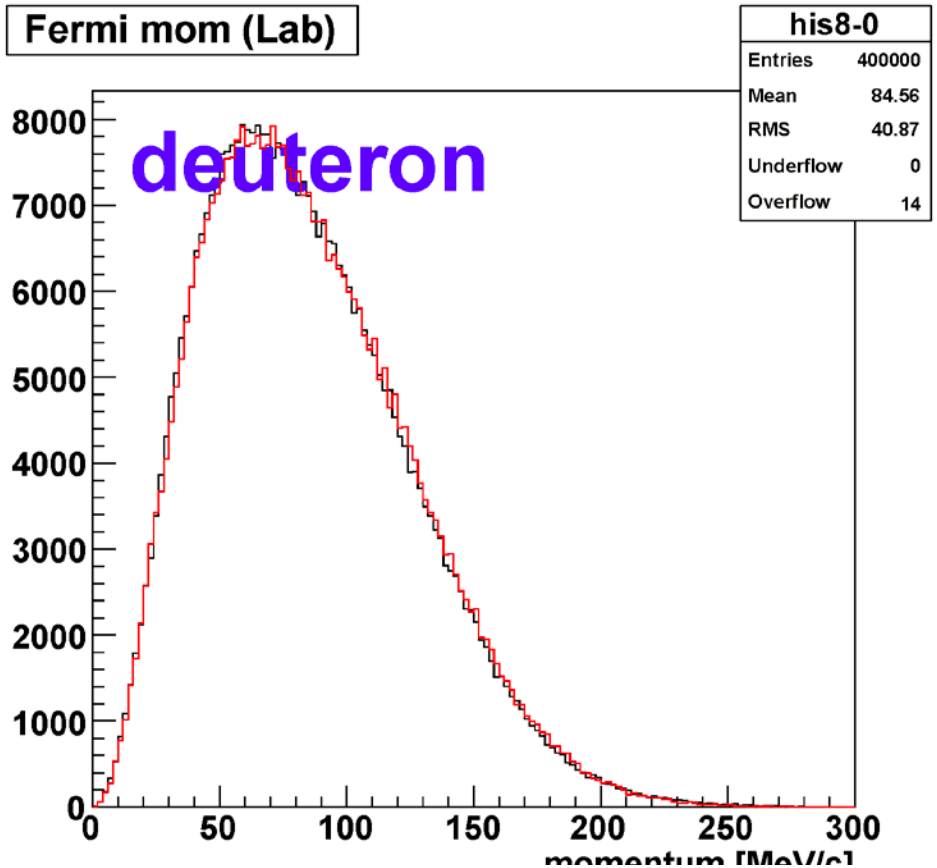
$K^0_S \rightarrow \pi^+\pi^-$: CDS

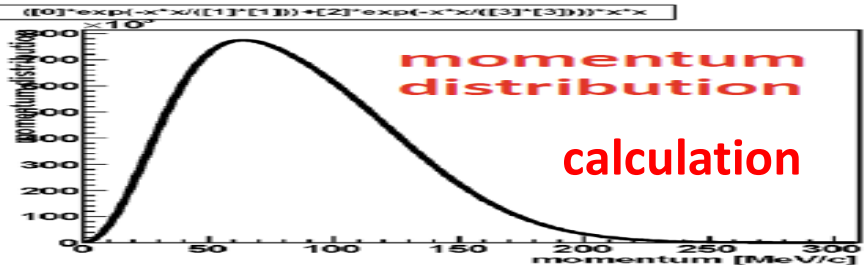
NOT so different between on- and off-shell method

Fermi Momentum

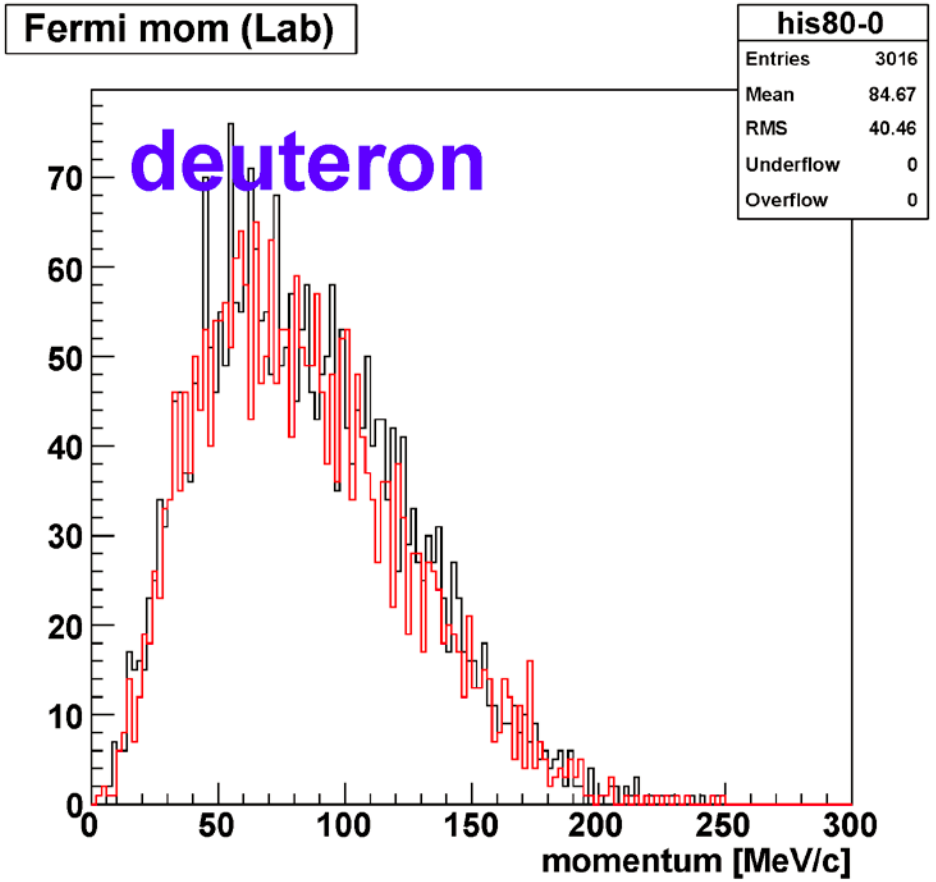
--- on-shell
--- off-shell

generated



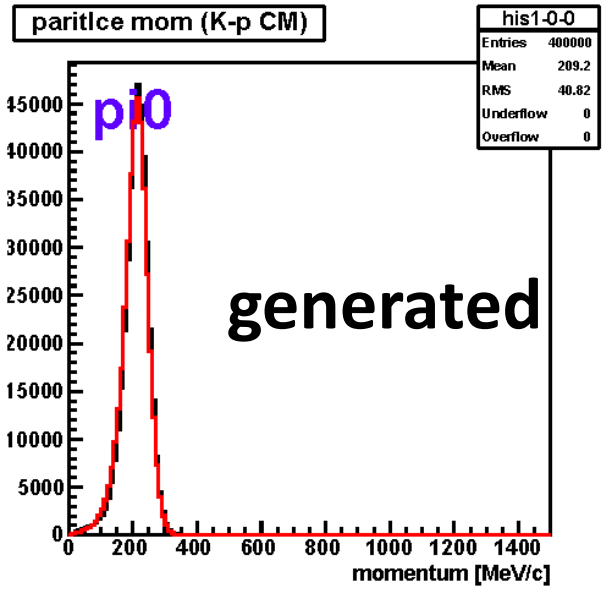


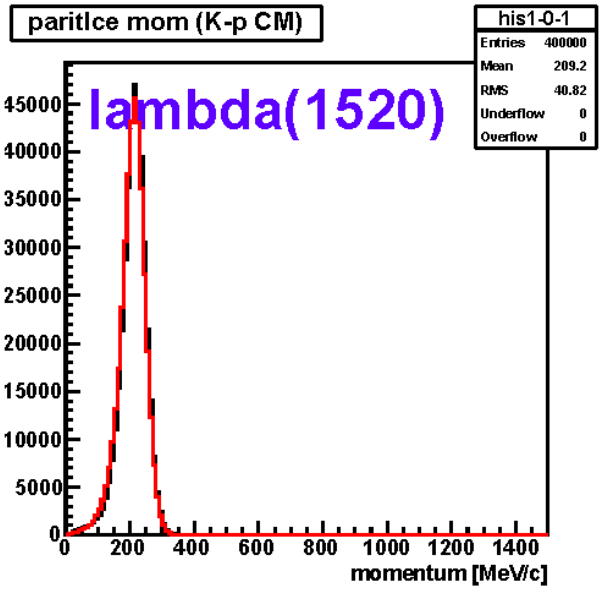
$^3He(K^-,nK^0_S)X$

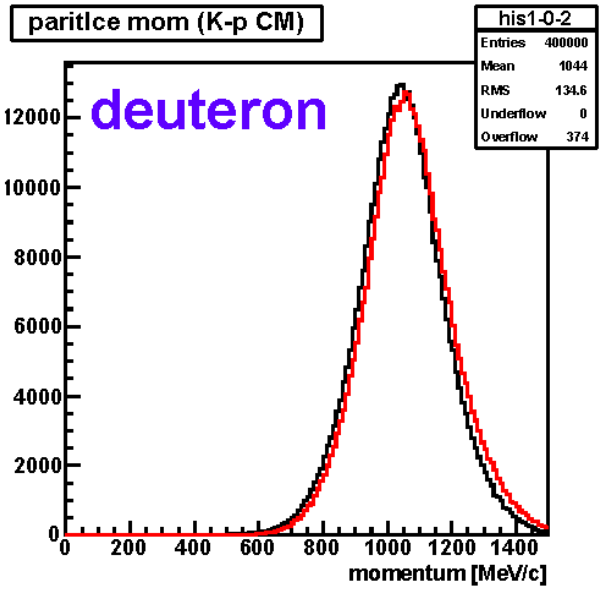


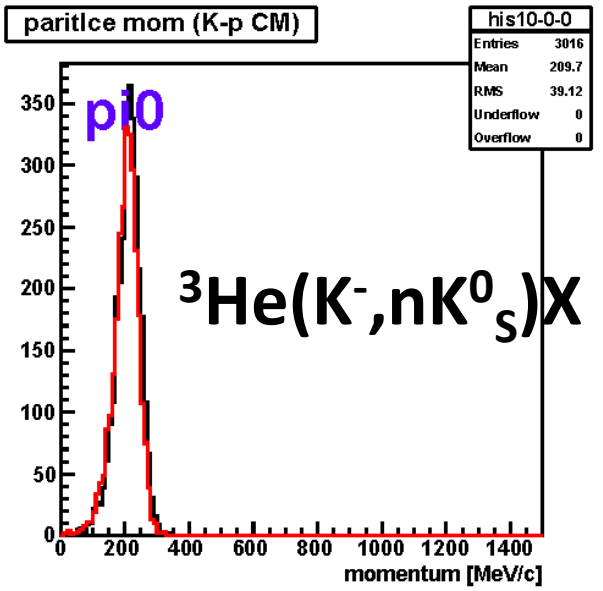
Particle Momenta @ CM

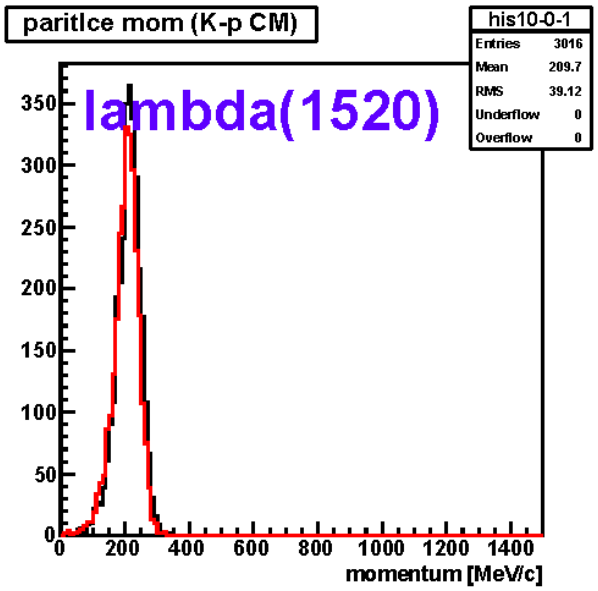
--- on-shell
--- off-shell

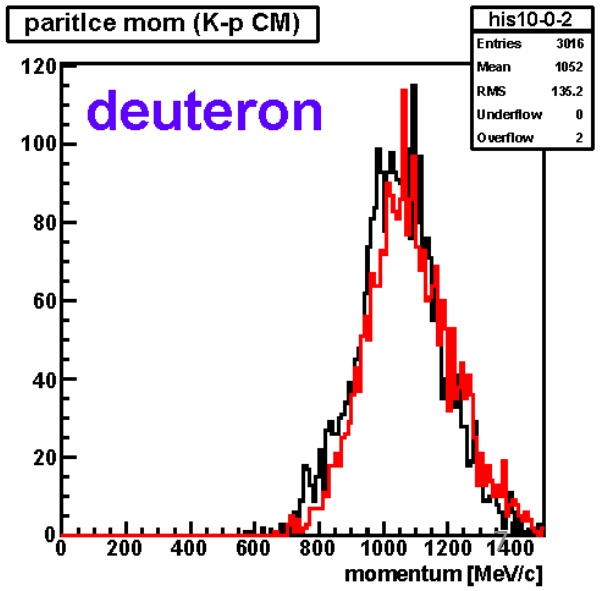






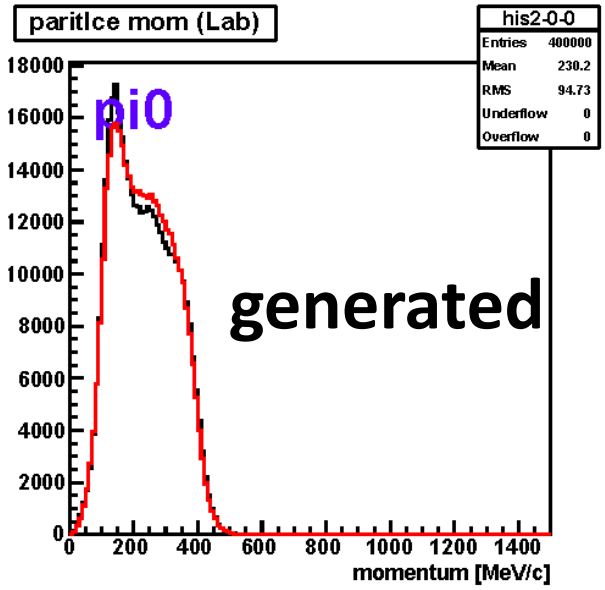


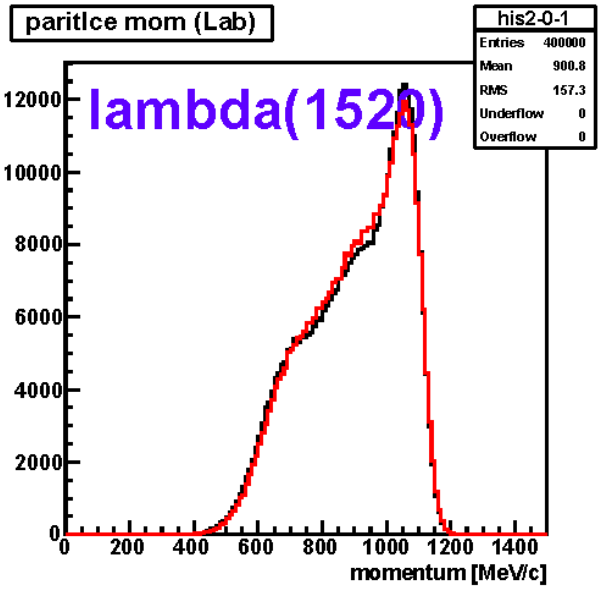


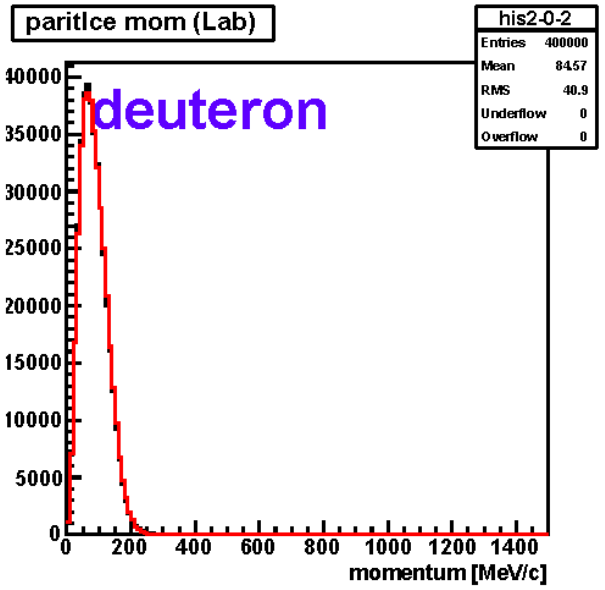


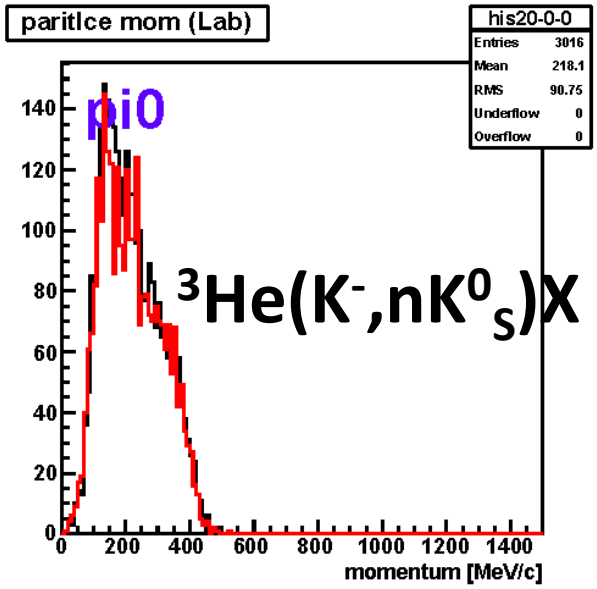
Particle Momenta @ LAB

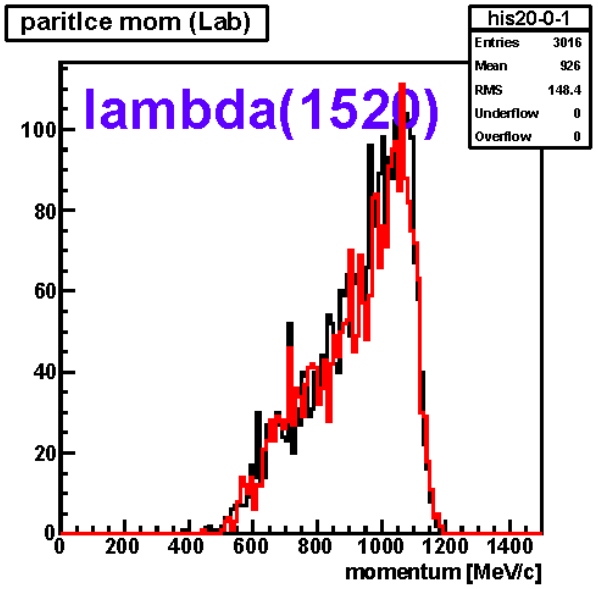
--- on-shell
--- off-shell

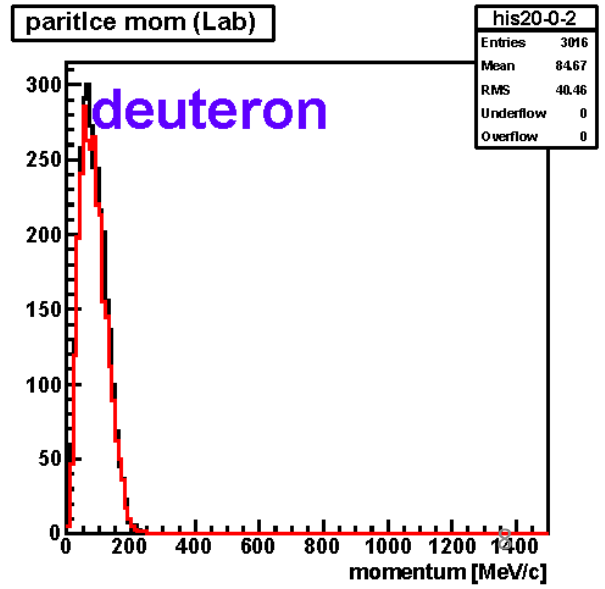






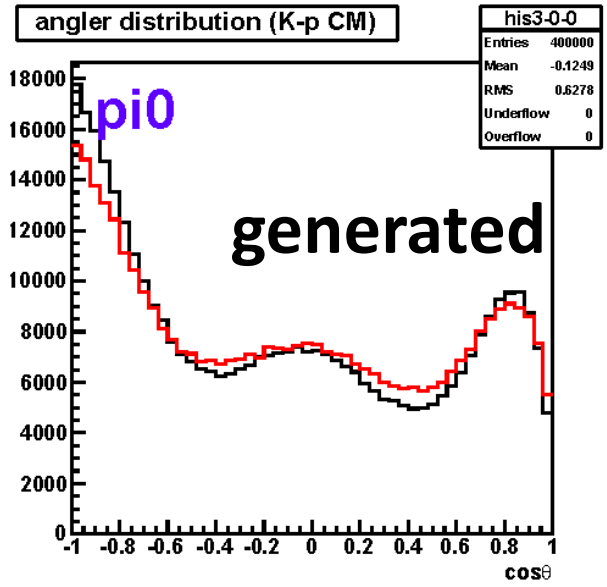


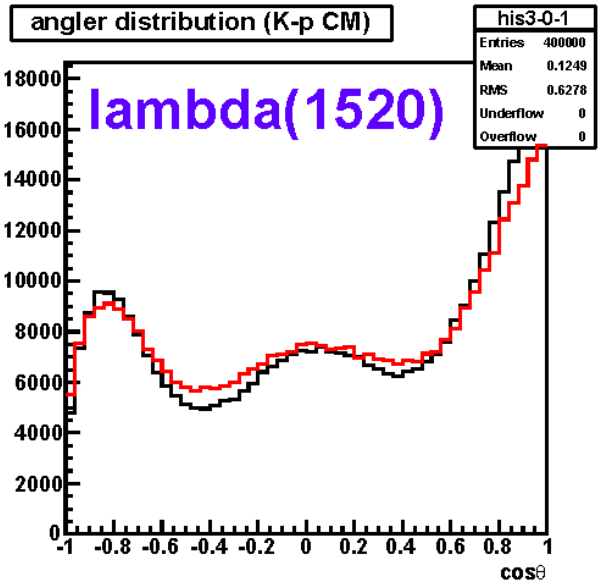


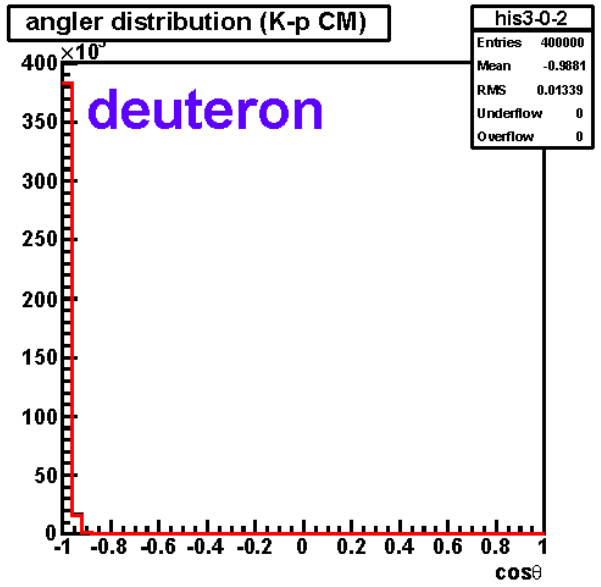


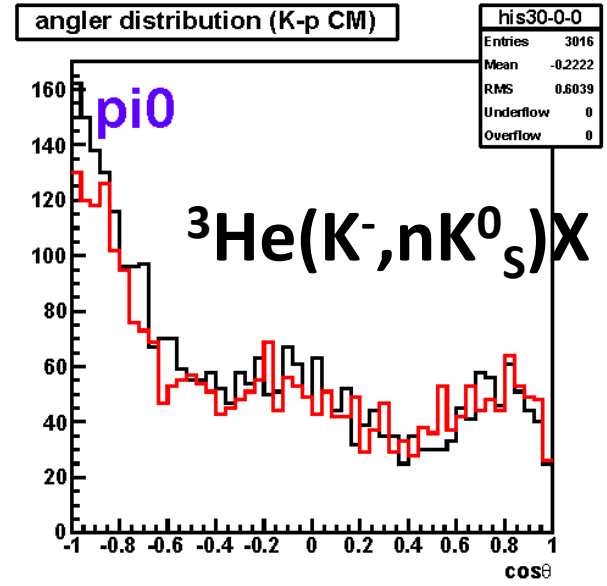
Angular Distribution @ CM

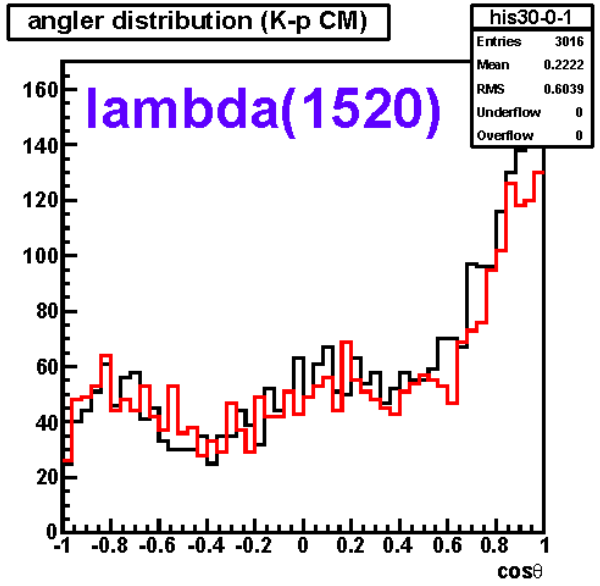
--- on-shell
--- off-shell

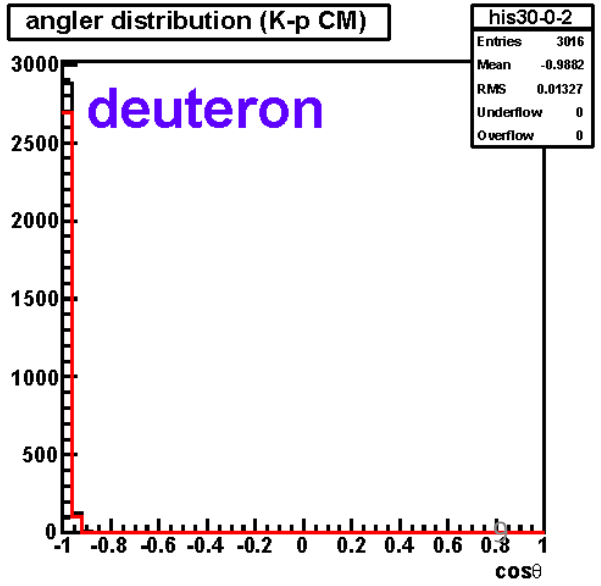






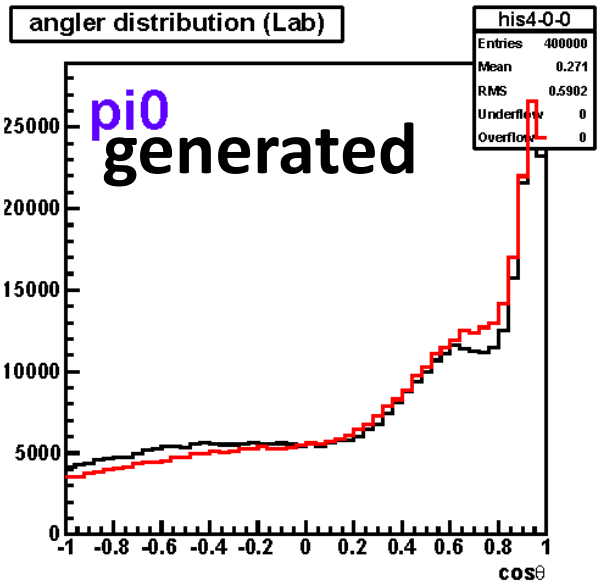


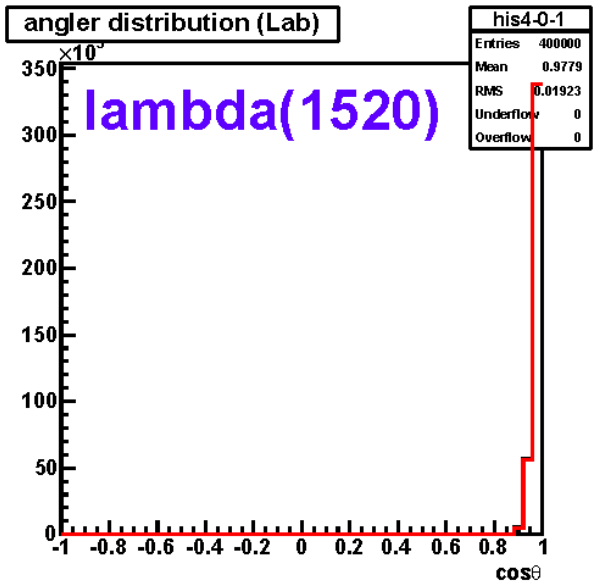


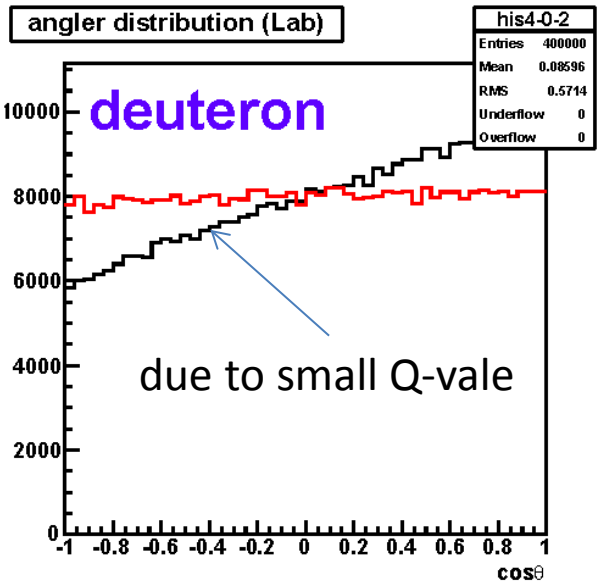


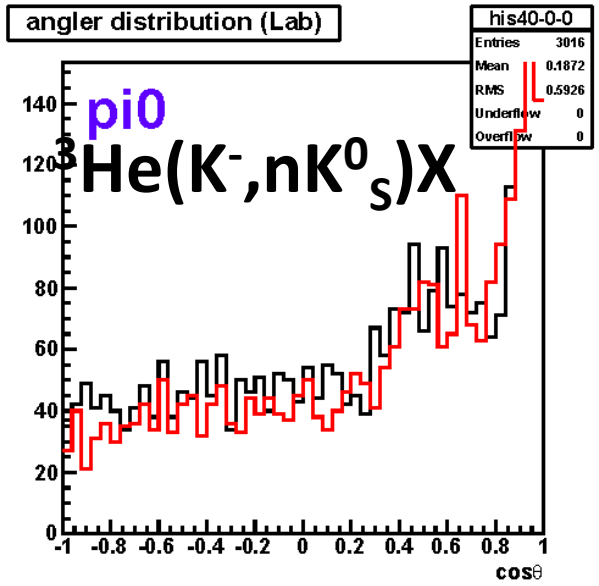
Angular Distribution @ LAB

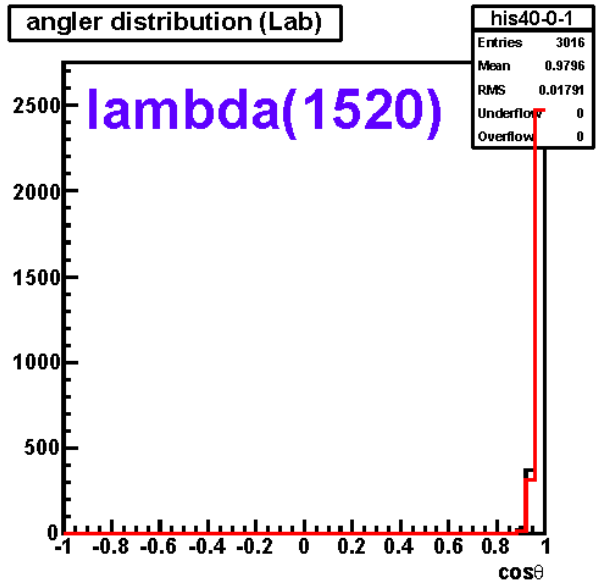
--- on-shell
--- off-shell

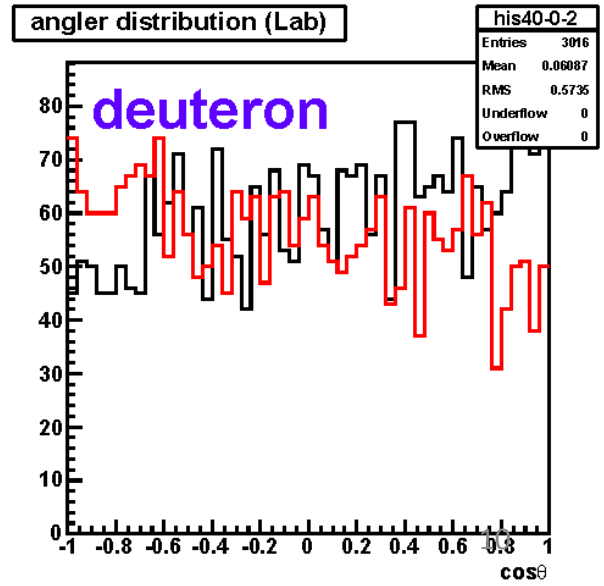






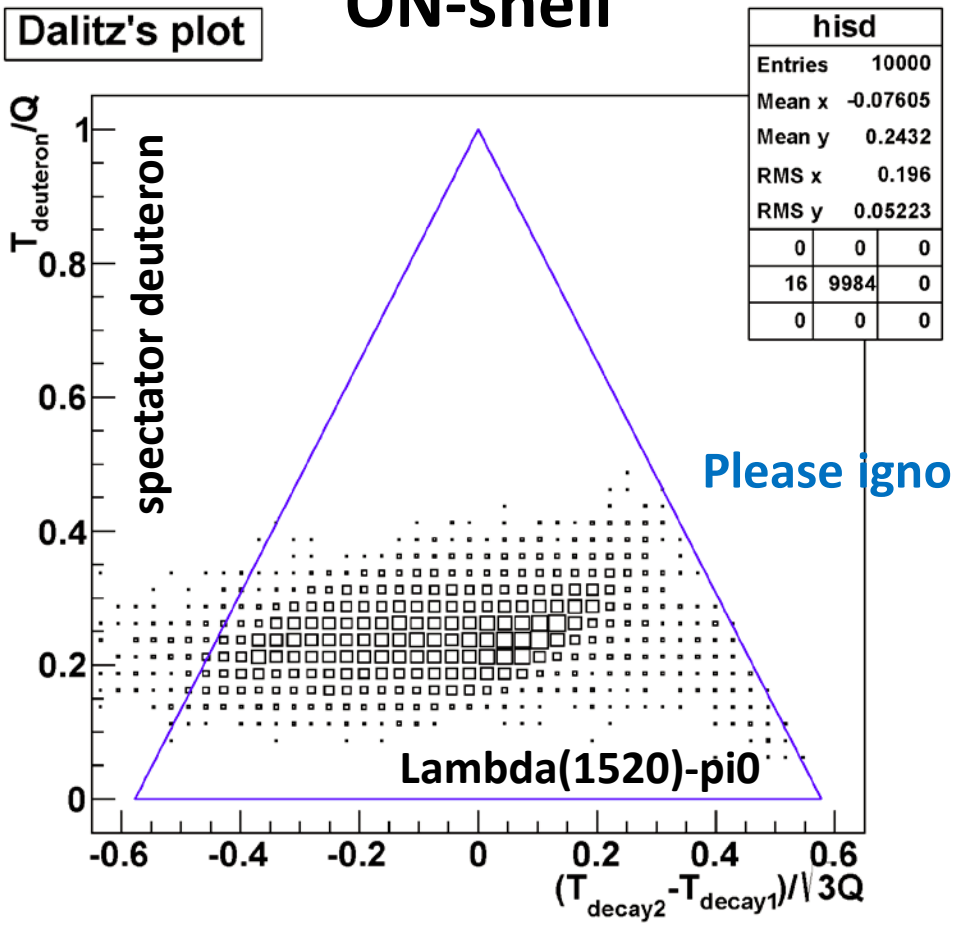




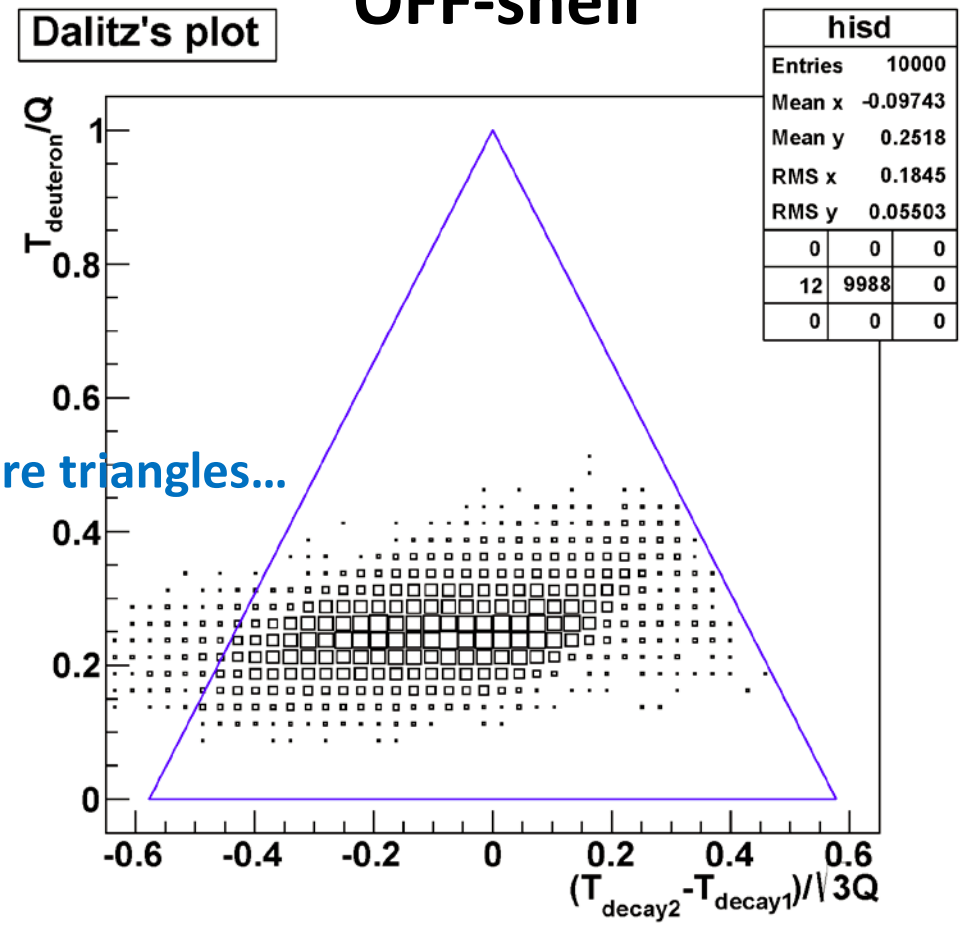


Dalitz Plot (@$CM_{K\text{-}3He}$)

ON-shell



OFF-shell



Please ignore triangles…

on-shell: not flat in the phase space.

off-shell: ~ flat distribution in the phase space.

Three-Body Spectator

- **On-shell method**

  [1] Final-state particles and 2 spectators are generated in the phase space at once

  [2] $|\boldsymbol{a}+\boldsymbol{b}|$ and $|\boldsymbol{a}-\boldsymbol{b}|/f$ are selected according to the Fermi-momentum density-dist., where f is a correlation factor between $\boldsymbol{a}$ and $\boldsymbol{b}$. The f is set to "1.7" by optimizing output momentum.

- **Off-shell method [approximate method]**

  [1] $\boldsymbol{a}$ anb $\boldsymbol{b}$ are generated according to the Fermi momentum dist. Then $|\boldsymbol{a}+\boldsymbol{b}|$ is selected according to the Fermi-momentum density-dist.

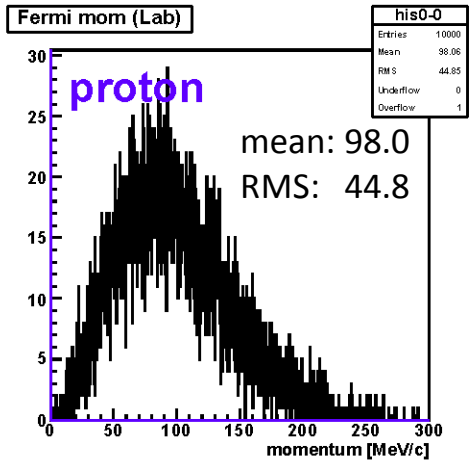
  [2] $\boldsymbol{a}$ anb $\boldsymbol{b}$ are scaled by "1.3" by optimizing output momentum.

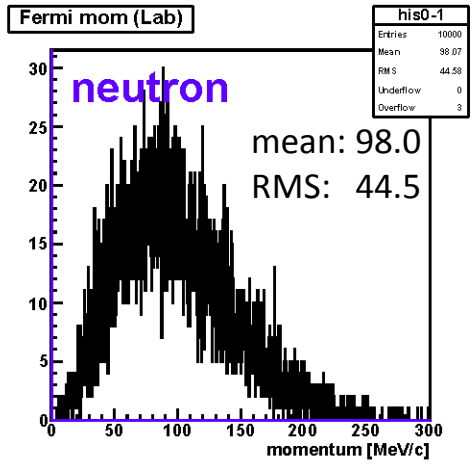
  [3] The "off-shell nucleon" and the beam K^- are reacted.

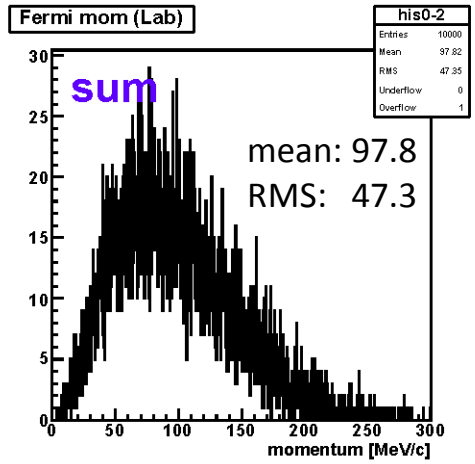
Computing time of "off-shell" is ~x30 faster than "on-shell"

Comparison of Fermi-momentum

on







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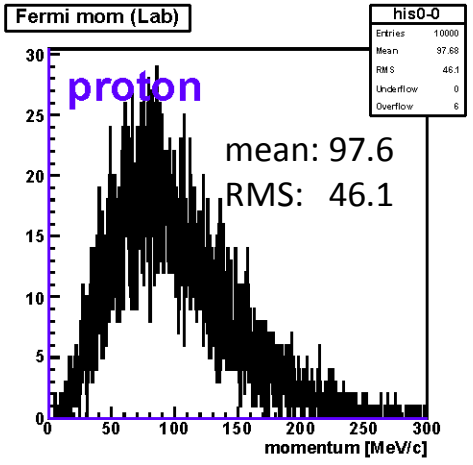
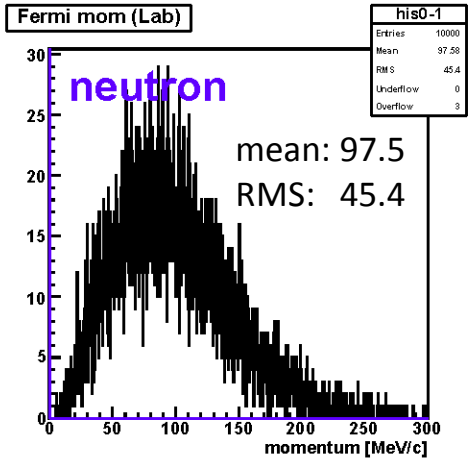
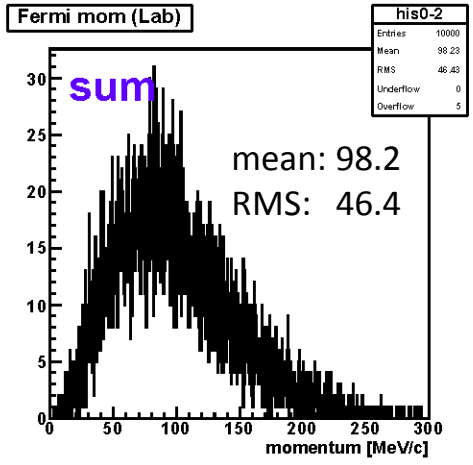
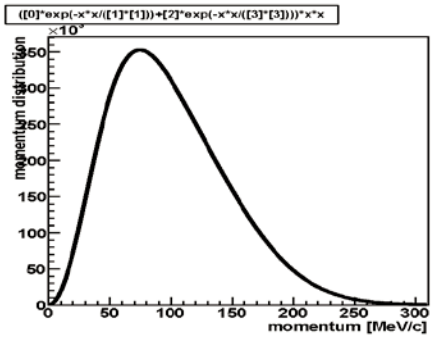
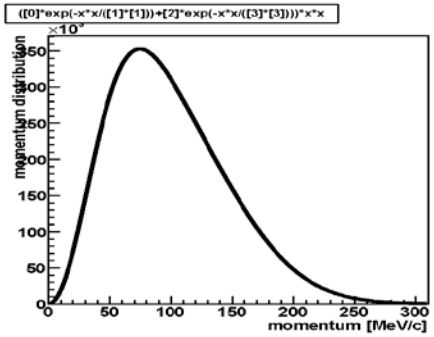


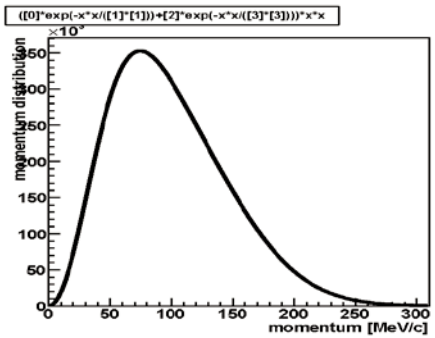




cal





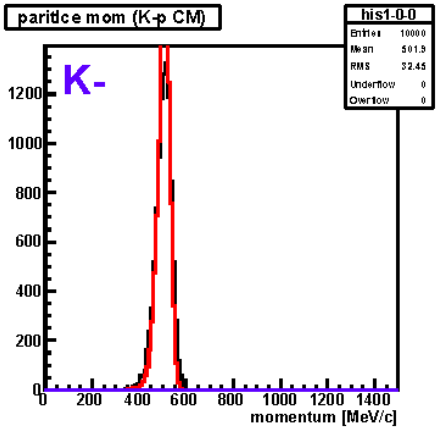


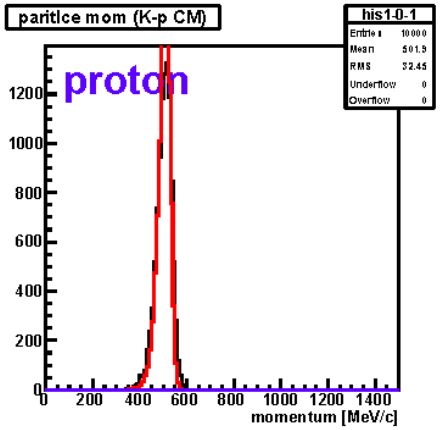
K-p elastic (momentum)

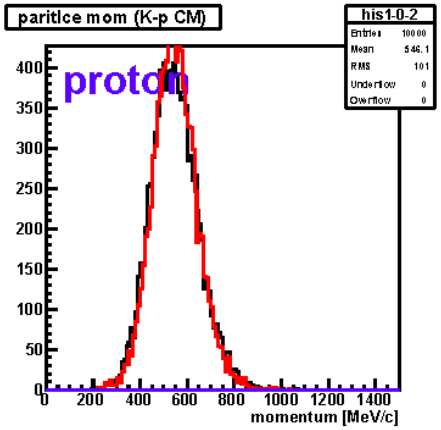
--- on-shell
--- off-shell

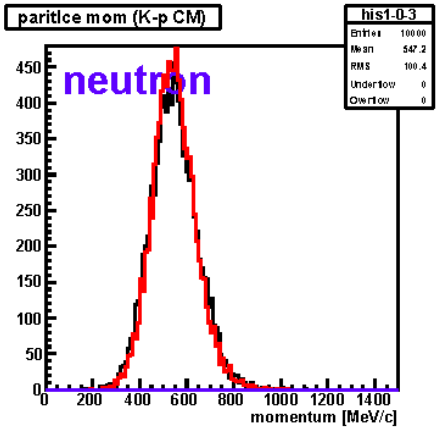
Comparison of 2-methods for 3-body spec. [Generated only]

@CM

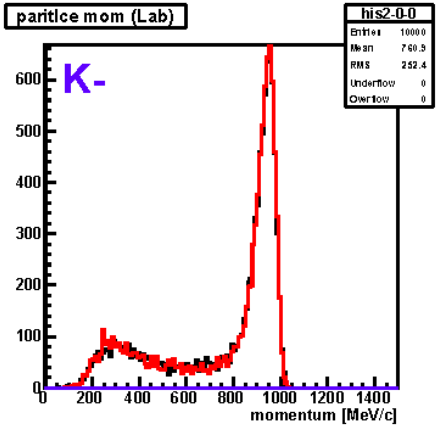


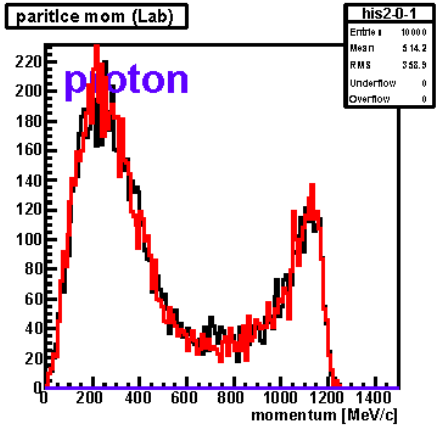


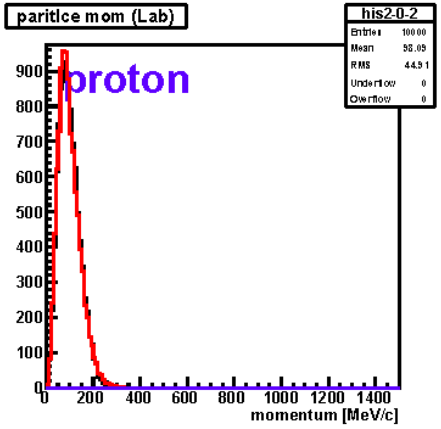


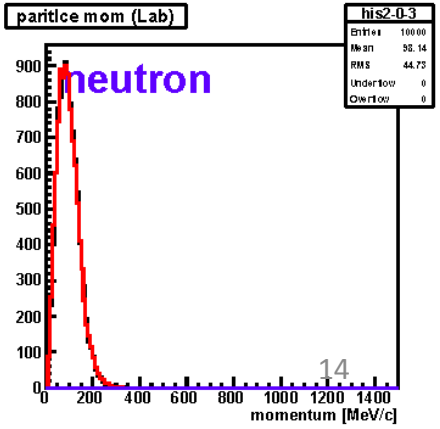


@LAB







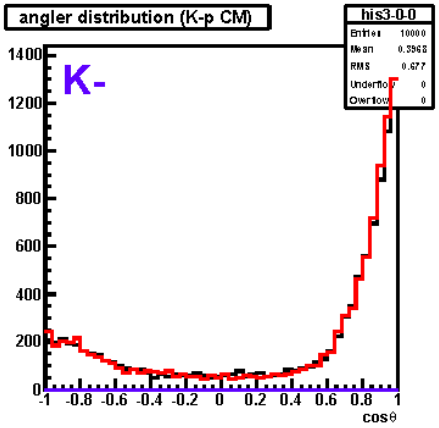


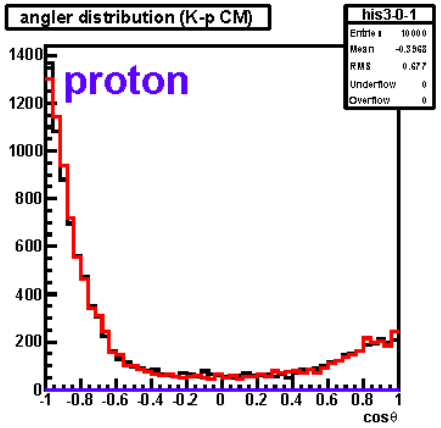
K-p elastic (angular dist.)

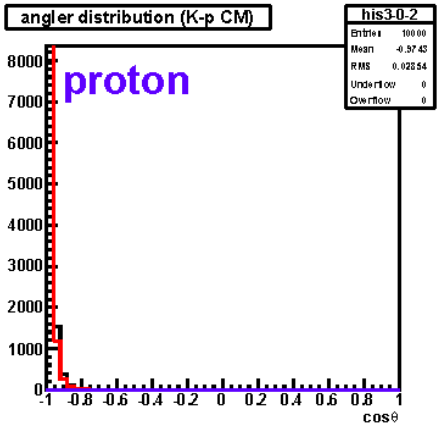
--- on-shell
--- off-shell

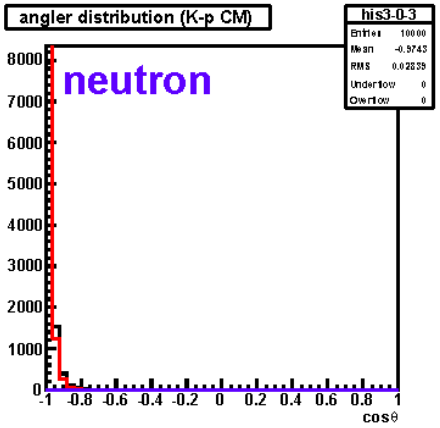
Comparison of 2-methods for 3-body spec. [Generated only]

@CM









@LAB

due to difference of boost value