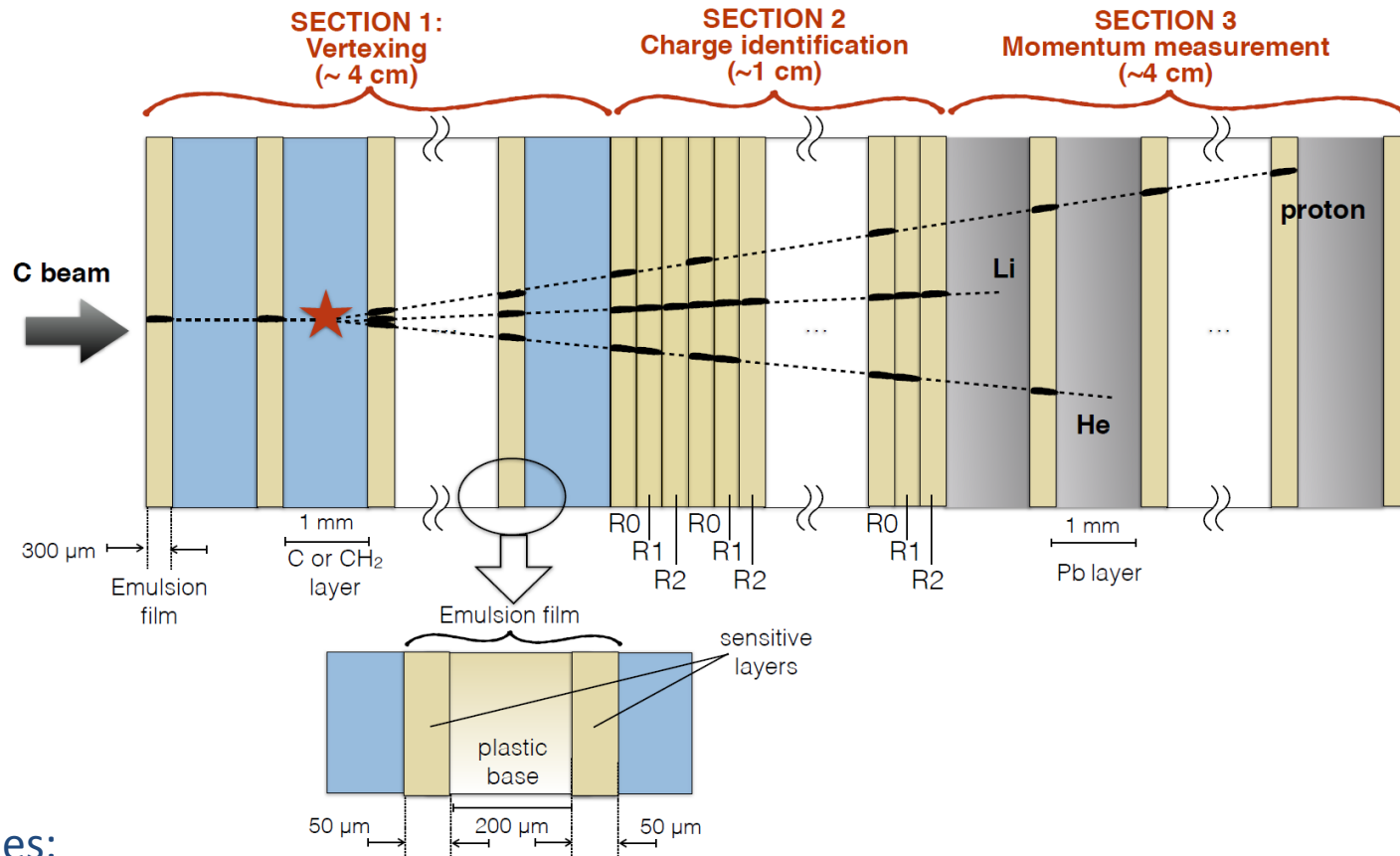# *Emulsion Cloud Chamber Spectrometer Simulation status*

A. Pastore for the ES Group

# *Overview*

-   ECC Detector structure as in CDR

-   Fluka Simulation: beam and detector set up

-   Beam particles across the ECC spectrometer

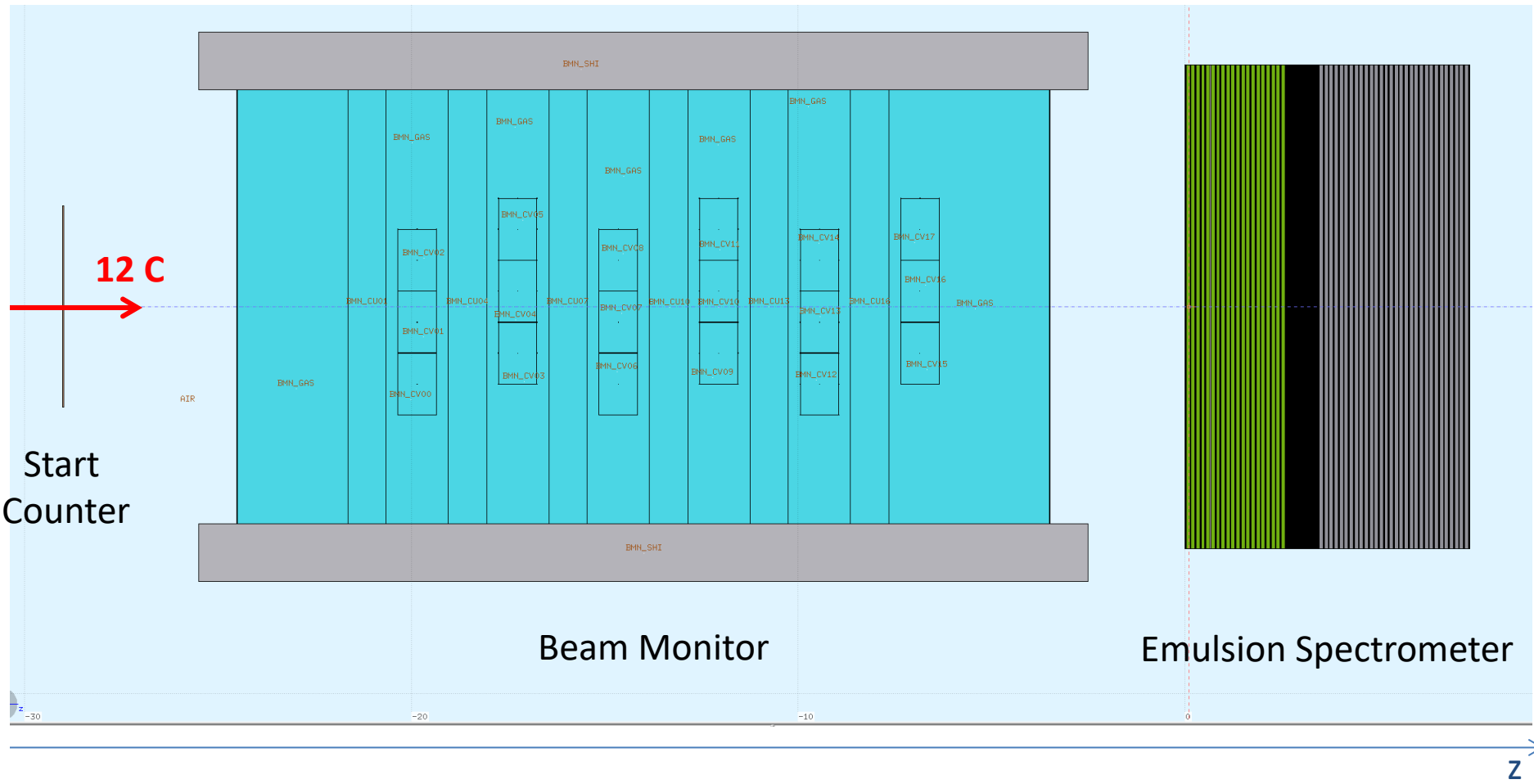-   Update on SECTION 1

-   Outlook

# ECC Detector structure as in CDR



Open issues:

- Overall thickness of SECTION 1 (CDR layout 30 cells)
- Thickness of passive layers (lead/steel) in Section 3
- Overall thickness of SECTION 3 (CDR layout 30 cells)
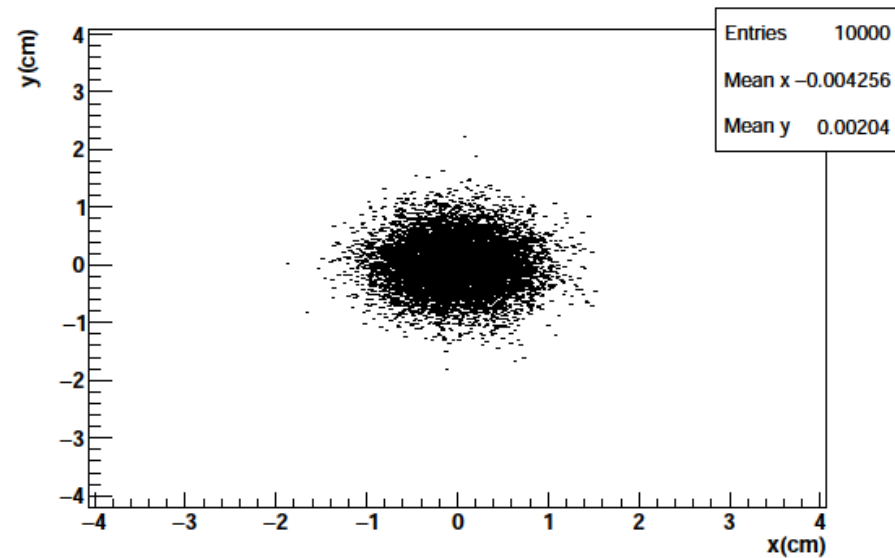
# Fluka Simulation: beam and detector set up
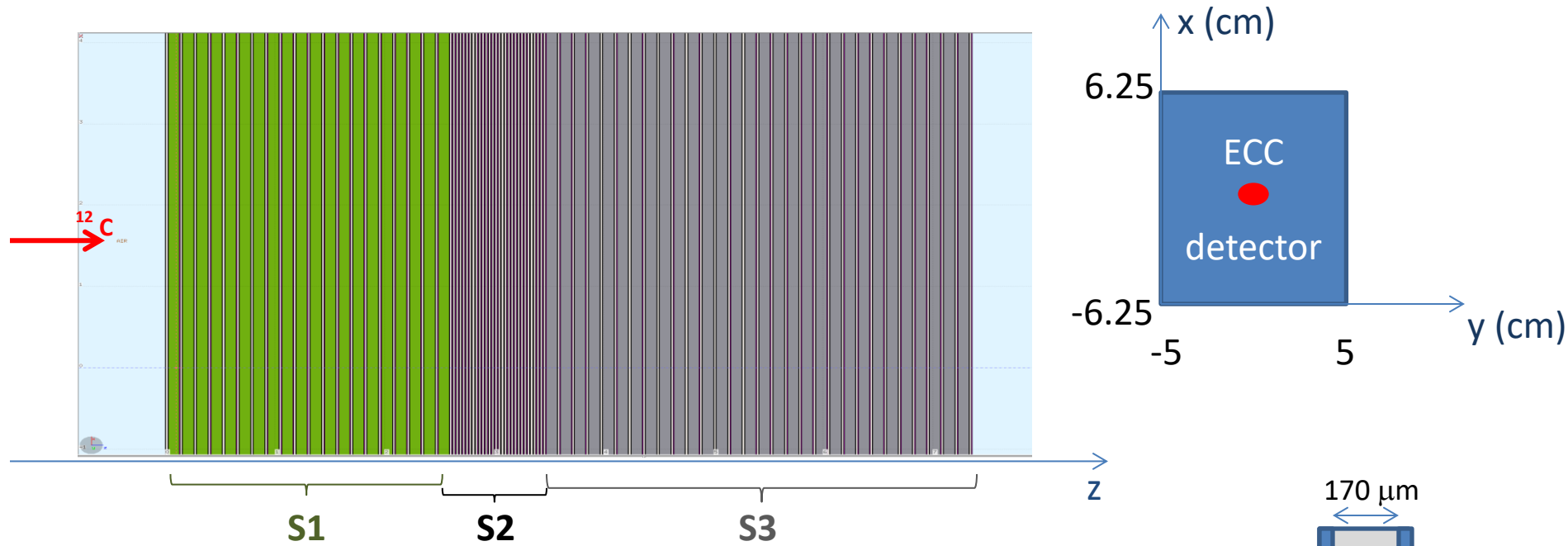
# Fluka Simulation: beam

BEAM:

$^{12}$C

$^{12}$C beam, 250 MeV/u, 10000 events
Gaussian shape,  FWHM 1 cm
@-30 cm in z coord.
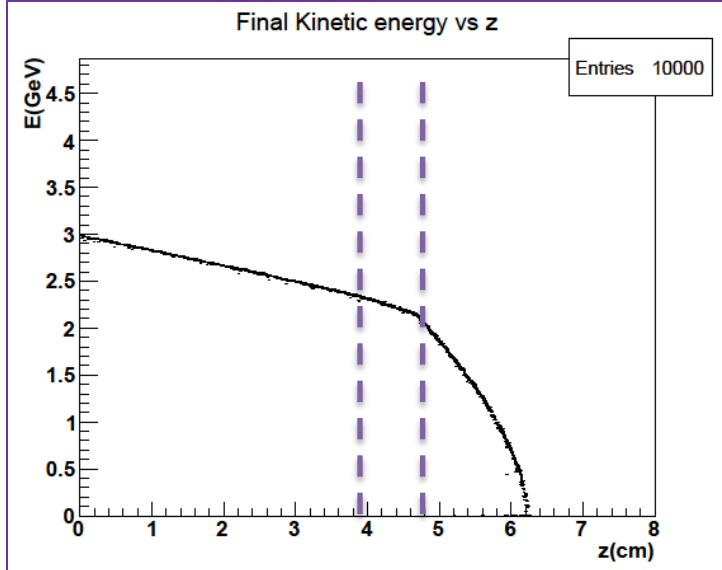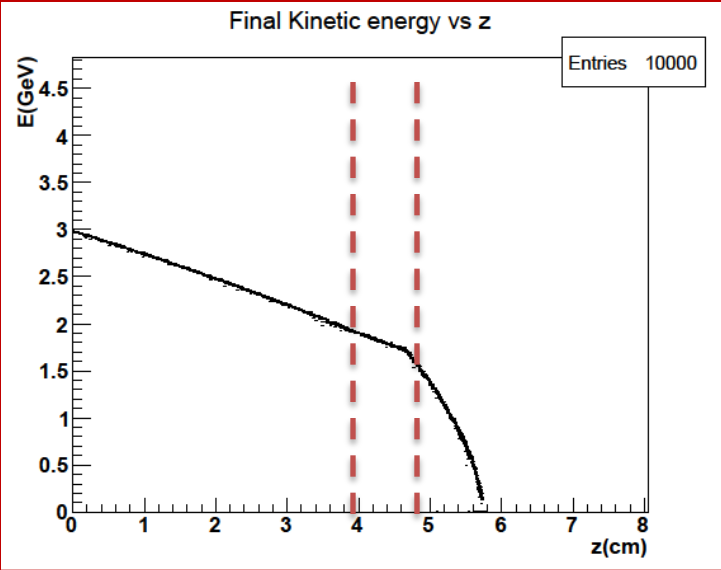
# *Fluka Simulation: ECC detector setup*



**S1: 30 target foils (C/C2H4), 1 mm-thick + 31 Emulsion films**

**S2: 27 Emulsion films**

**S3: 30 Pb plates, 1 mm-thick + 31 Emulsion films**

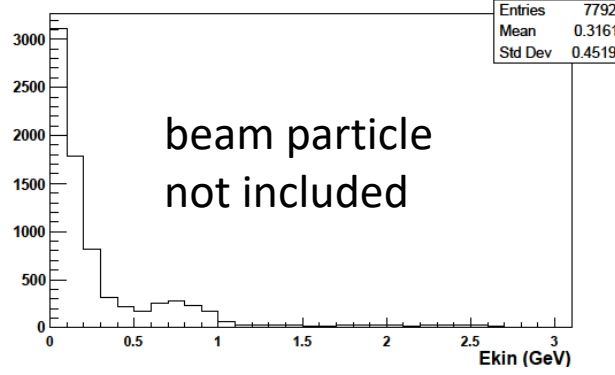# _Beam particles across the ECC spectrometer_



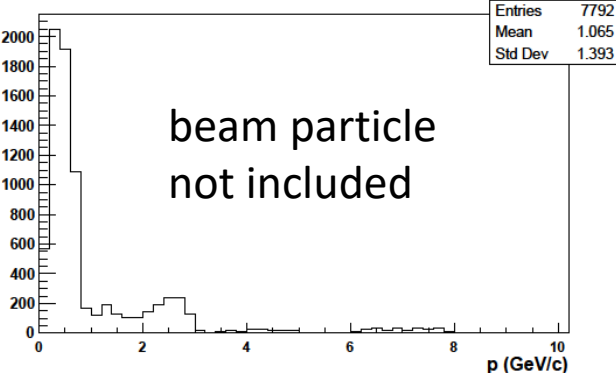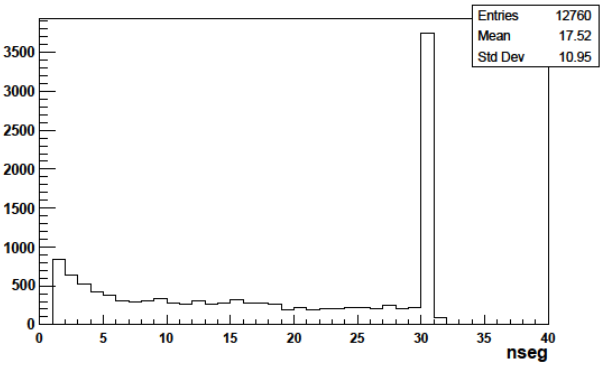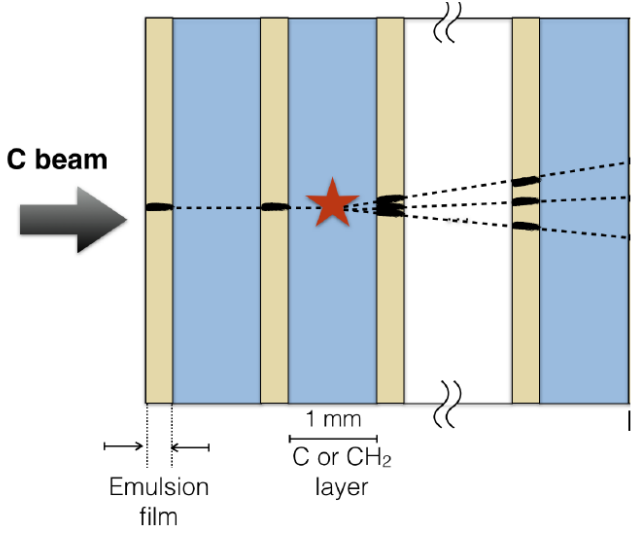n 12C abs. before ECC det.                     = 46        (0.46 +- 0.07)%
n 12C abs. in **S1** (Em.F. + **Carbon**)       = 2499    (24.99 +- 0.43)%
n 12C abs. in **S2**                             = 351      (3.51 +- 0.18)%
n 12C abs. in **S3**                             = 7104    (71.04 +- 0.45)%

n 12C abs. before ECC det.                     = 37        (0.37 +- 0.06)%
n 12C abs. in **S1** (Em.F. + **C2H4**)        = 1790    (17.90 +- 0.38)%
n 12C abs. in **S2**                             = 355      (3.55 +- 0.18)%
n 12C abs. in **S3**                             = 7818    (78.18 +- 0.41)%

# *Update on SECTION1*

Aim :    **Vertex detection and charged particle tracking**

Target  for S1:                    **Carbon**
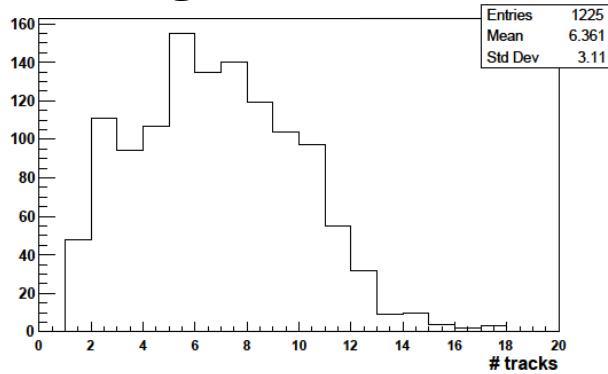Data sample :          5000   $^{12}C$ on ECC spectrometer



**C beam**

1 mm
C or $CH_2$
layer

Emulsion
film



| | | |
| --- | --- | --- |
| Entries | 12760 |
| Mean | 17.52 |
| Std Dev | 10.95 |

nseg



beam particle
not included

| | | |
| --- | --- | --- |
| Entries | 7792 |
| Mean | 1.065 |
| Std Dev | 1.393 |

p (GeV/c)



beam particle
not included

| | | |
| --- | --- | --- |
| Entries | 7792 |
| Mean | 0.3161 |
| Std Dev | 0.4519 |

Ekin (GeV)



beam particle
not included

| | | |
| --- | --- | --- |
| Entries | 7792 |
| Mean | 23.05 |
| Std Dev | 19.95 |

θ

**Interaction vertex point**

Target for S1: **Carbon**

Data sample : 5000 $^{12}$C on ECC spectrometer

Tracks @ vertex

| Entries | 1225 |
|---|---|
| Mean | 6.361 |
| Std Dev | 3.11 |

Tracks @ vertex,
with at least 2 segments and $\theta <= 70°$

| Entries | 1184 |
|---|---|
| Mean | 5.846 |
| Std Dev | 2.746 |

Tracks @ vertex,
with at least 2 segments

| Entries | 1186 |
|---|---|
| Mean | 5.901 |
| Std Dev | 2.779 |

1/31/2018

Vtx Reco capability ≈ 96.6 %
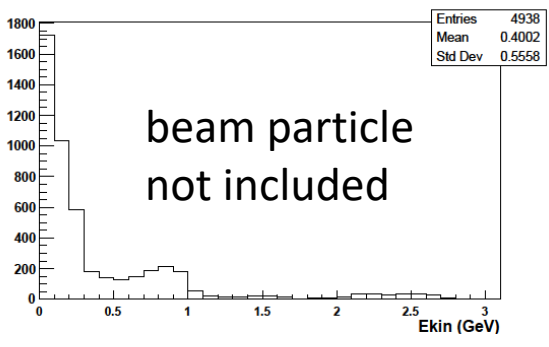
9

none cut on θ



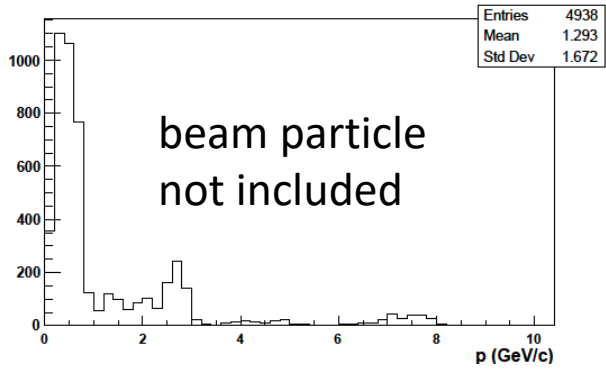Charged particles rejected (θ > 70 deg)    **≈ 1 %  of charged tracks**
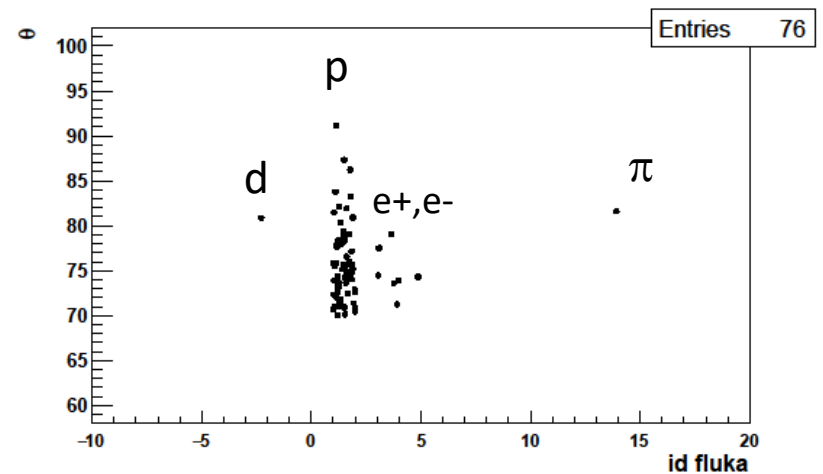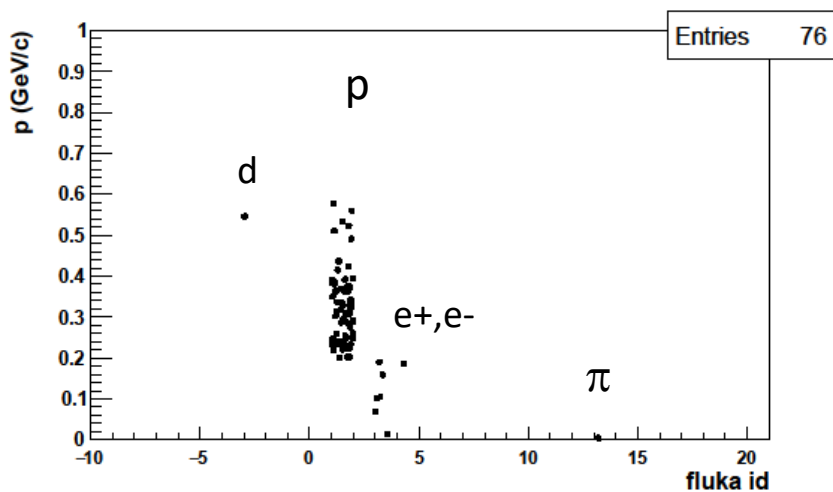
# Update on SECTION1

Aim :     **Vertex detection and charged particle tracking**

Target for S1:          **C2H4**

Data sample :       5000  $^{12}C$ on ECC spectrometer



C beam

1 mm
C or $CH_2$ layer

Emulsion film



| Entries | 9914 |
|---|---|
| Mean | 20.08 |
| Std Dev | 10.68 |

nseg



| Entries | 4938 |
|---|---|
| Mean | 1.293 |
| Std Dev | 1.672 |

beam particle not included

p (GeV/c)



| Entries | 4938 |
|---|---|
| Mean | 0.4002 |
| Std Dev | 0.5558 |

beam particle not included

Ekin (GeV)



| Entries | 4938 |
|---|---|
| Mean | 22.37 |
| Std Dev | 20.85 |

beam particle not included

θ
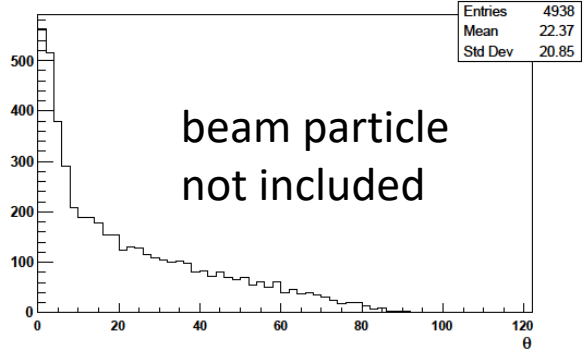
# _Interactions inside SECTION 1 : charged multiplicity_

Target  for S1:                **C2H4**

Data sample :        5000  $^{12}$C on ECC spectrometer



Tracks @ vertex



Tracks @ vertex,
with at least 2 segments



Tracks @ vertex,
with at least 2 segments and θ <= 70°

Vtx Reco capability ≈ 97%

# Interactions inside SECTION 1: charged primary particles
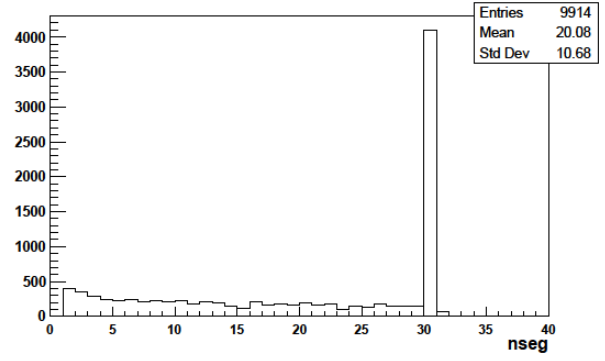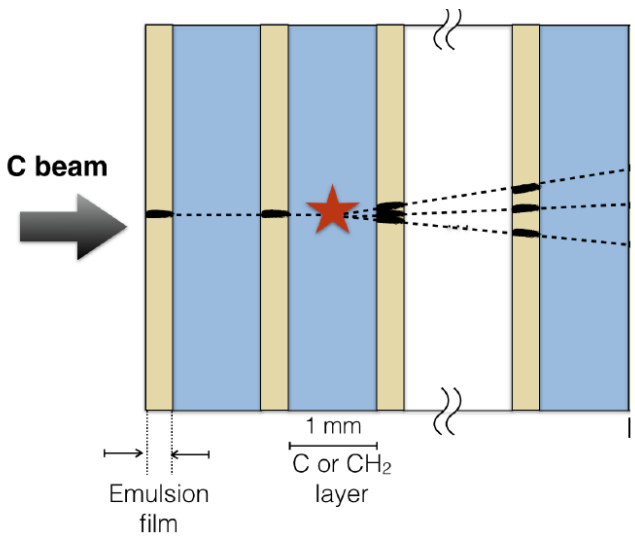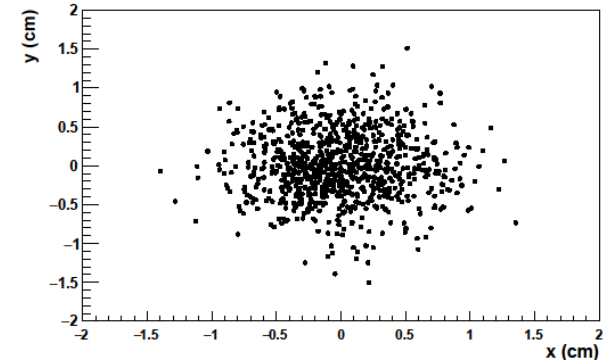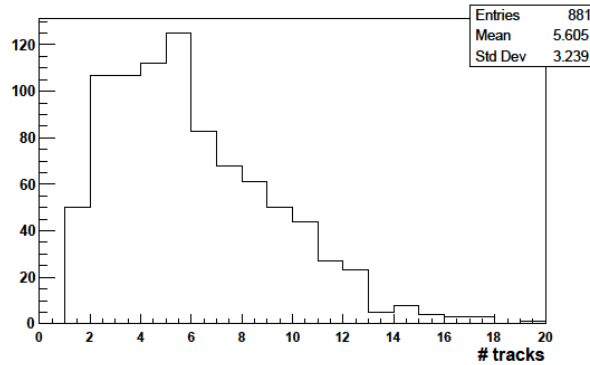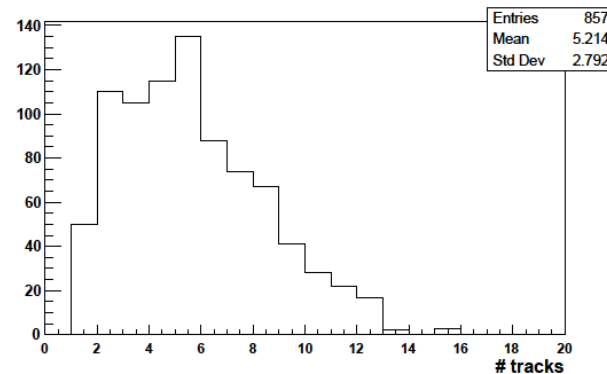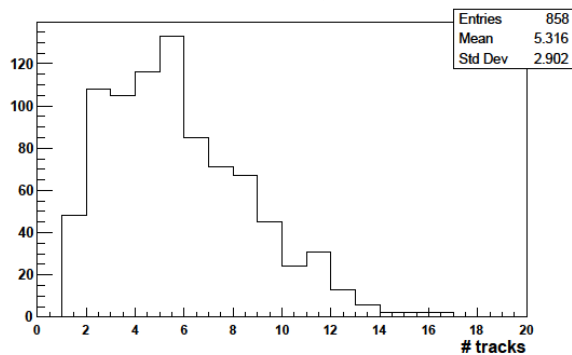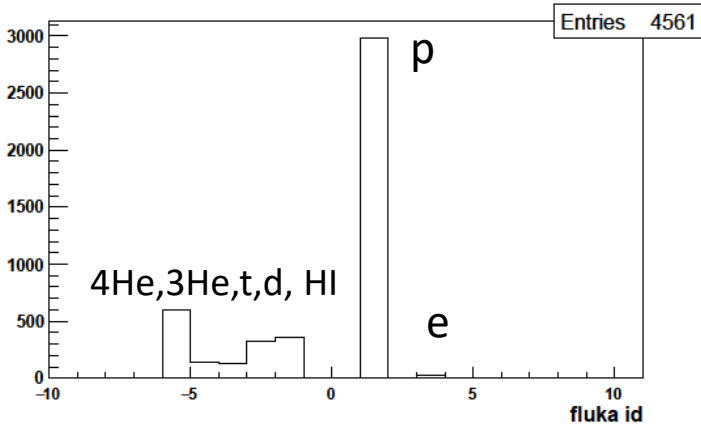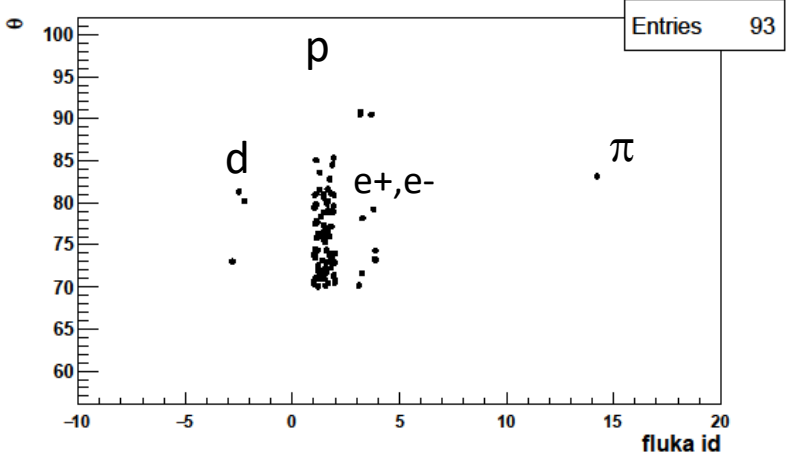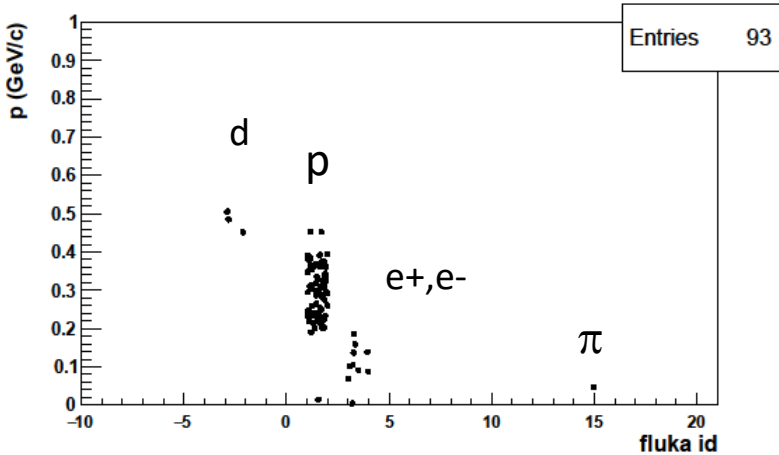
none cut on θ



Charged particles rejected (θ > 70 deg)    ≈ 2 %  of charged tracks

# *Conclusions and outlook*

- Progress in the Emulsion Spectrometer simulation introducing a first reconstruction level

- Extend the study to the full MC data sample available

- Span different E for $^{12}$C beam (fluka@CNAF re-installed?)

- Optimization of S1 geometry depends on MC studies for S2 and S3 → in the pipeline