Pier S. Marrocchesi

Overview of CALET activities in Italy

Main current activities:

- analysis of PASS4 flight data

- updates of MonteCarlo data sets (light and heavy nuclei, electrons)

- study of GEANT4 secondary particles production

- comparative studies of EPICS/FLUKA/GEANT4

DATA ANALYSIS results:

- proton analysis (Pier)

- helium analysis (P.Brogi)

- test beam analysis (G.Bigongiari)

- carbon and oxygen analysis (P.Maestro)

- iron analysis (C.Checchia, F.Stolzi)

- electron analysis (L.Pacini, E.Berti, S.Gonzi)

Proton analysis update   Pier

- ✧ PASS4 dataset 201511-201910 (48 months)

  - ○ energy corrected charge in CHD and IMC

  - ○ charge identification of proton and helium

  - ○ efficiencies, background rejection, subtraction of residual backgrounds, energy unfolding

  - ○ study of the main sources of systematic error

- ✧ Results: **preliminary proton spectrum**
  - ○ **preliminary study of systematic uncertainties**
 - ○ **ongoing: study of flux reduction above~ 10 TeV**
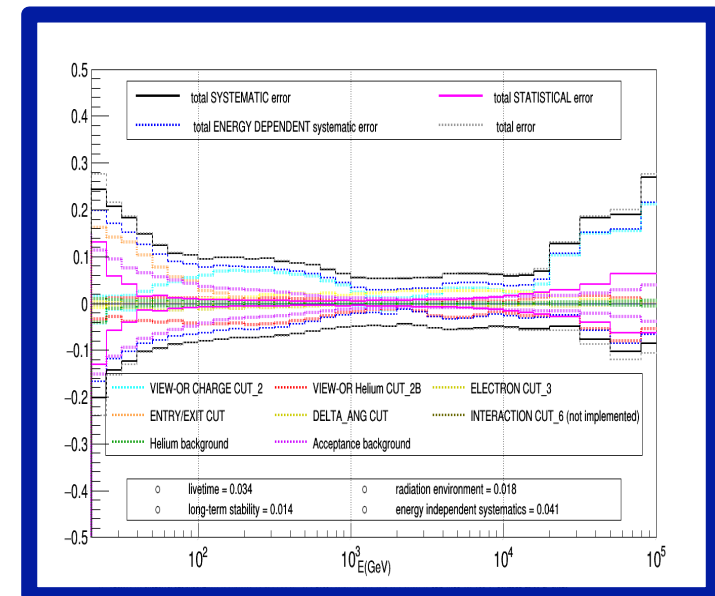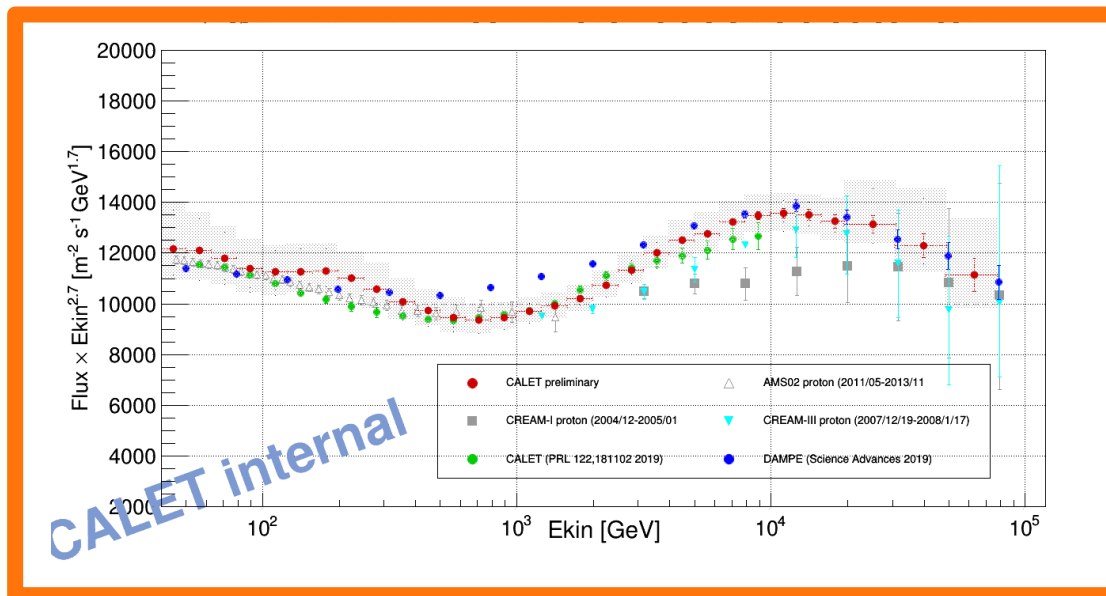
- Full statistics of PASS4-FD has been used for this analysis: 49 months from 201510 to 201910;

- Same analysis already shown at TIM in Madison during the ICRC, except for:

  1) more severe requirements on tracking quality (Fit Flag == 3);
  2) optimised acceptance A1 (as defined by P. Maestro) instead of standard acceptance A;

- The effects of shower energy corrections to flux calculation has been considered and evaluated (using for the moment the corrections calculated for Fluka from G. Bigongiari from TB2015 data);
- TB2015 data analysis pointed out that any trigger correction is needed;

- Preliminary evaluation of systematic errors related to: energy shower correction, charge selection, unfolding, background subtraction, acceptance choice, trigger, live time.
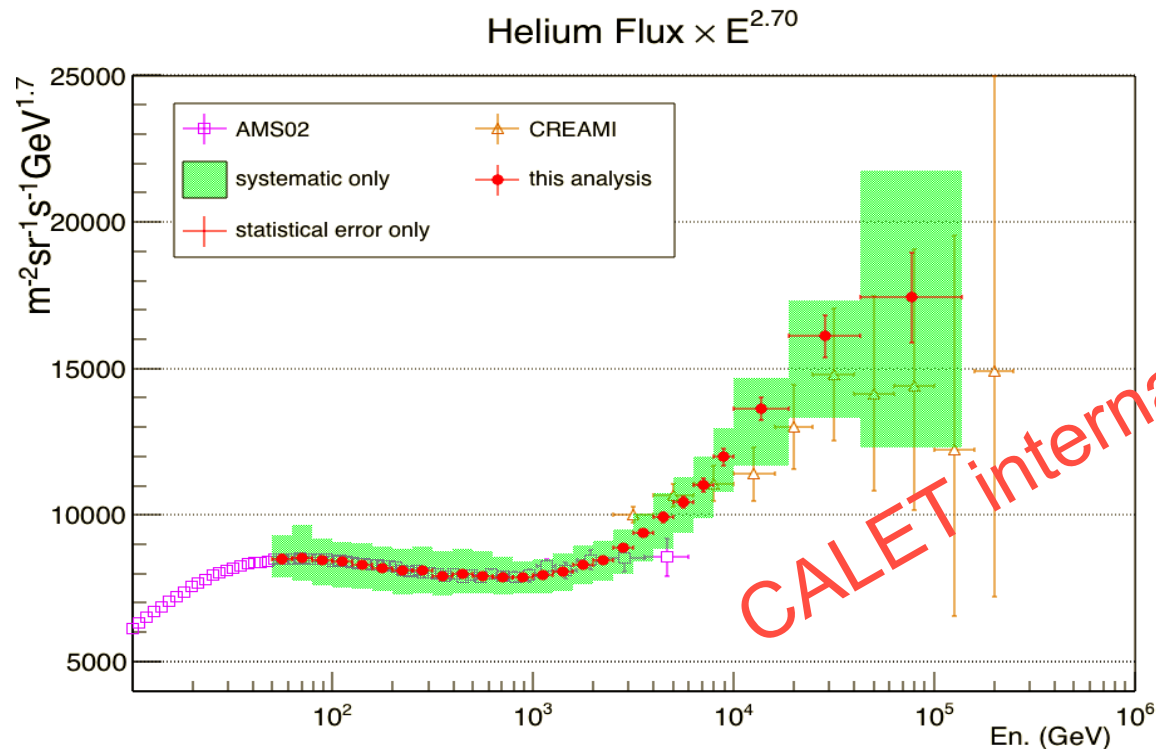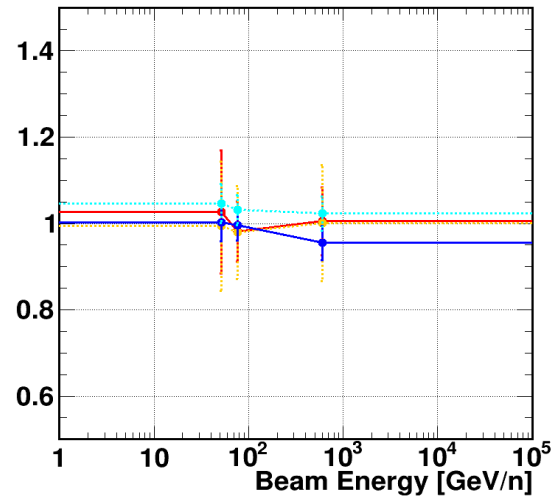
Study Trigger efficiency correction study for helium as a function of true energy (both for LE & HE trigger threshold): available beam energies: 13, 19, 150 GeV/n (Beam Test 2015 Data)

Red line: HE trigger Fluka
Blue line: LE trigger Fluka
Orange dots: HE trigger Epics
Blue dots: LE trigger Epics
Dashed Red line: HE trigger from JC note
Dashed Blue line: LE trigger from JC note
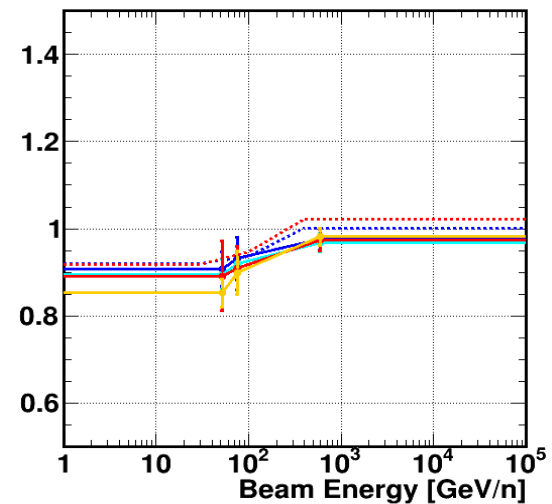
Study of Energy scale correction study for helium as a function of true energy (both for LE & HE trigger threshold): available beam energies: 13, 19, 150 GeV/n (Beam Test 2015 Data)

See presentation of
Gabriele Bigongiari

4

- ➢ Charge reconstruction

    - refined CHD/IMC charge calibration and quenching in MC (FLUKA, EPICS)
    - refined correction for CHD/IMC charge dependence on TASC energy deposits (FD, FLUKA, EPICS)

- ➢ Selection of candidate events and systematics assessment using the whole PASS4 dataset

- ➢ Results: **- C and O energy spectra**
    - C/O ratio
    - Spectral analysis

C/O ratio

Carbon - Energy dependence of the spectral index
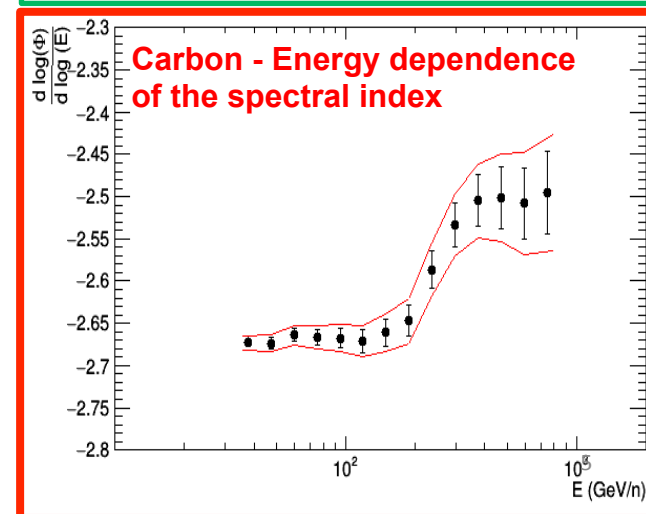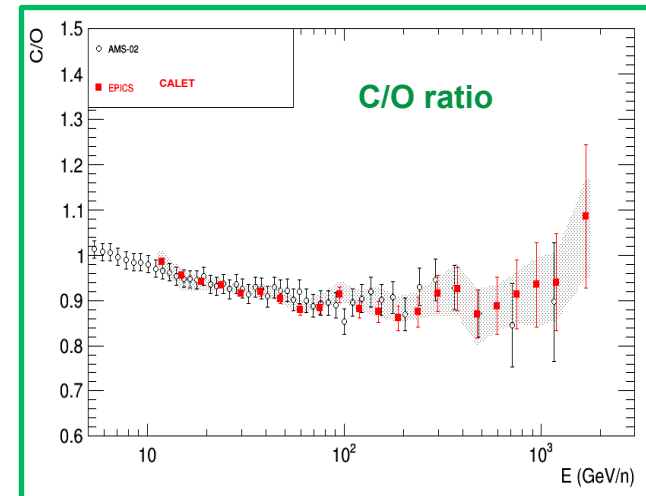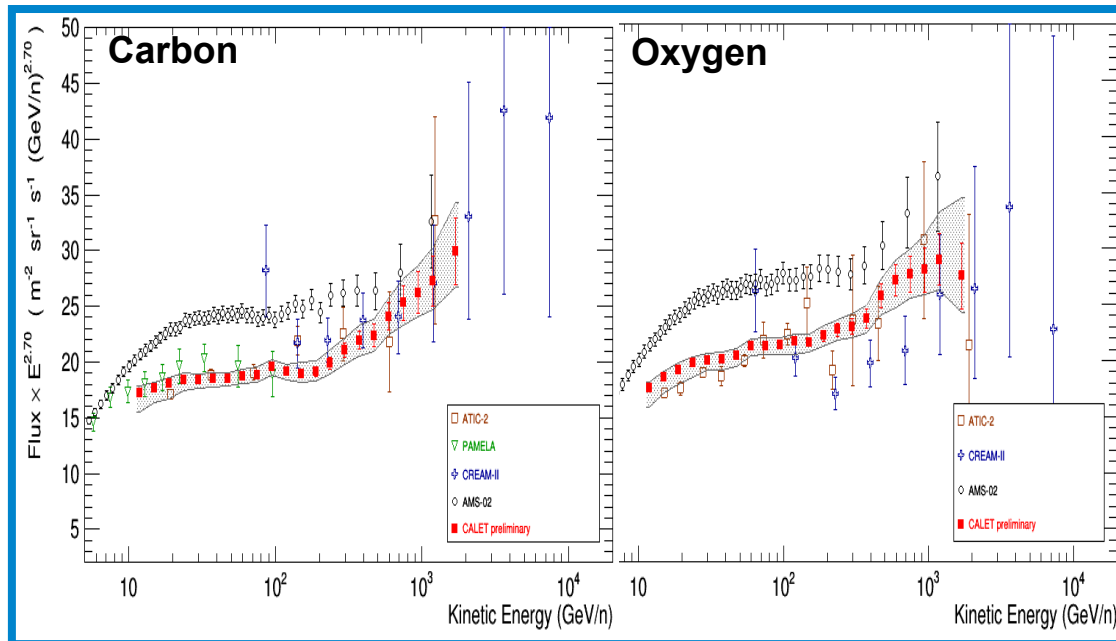
Preliminary results on IRON flux

GLOBAL EFFICIENCY with EPICS

1) Selection on MC and FD:

   C.Checchia, F.Stolzi

- High energy trigger
- KF tracking
- Reconstructed Acceptance A
- Matching of a single paddle in CHD
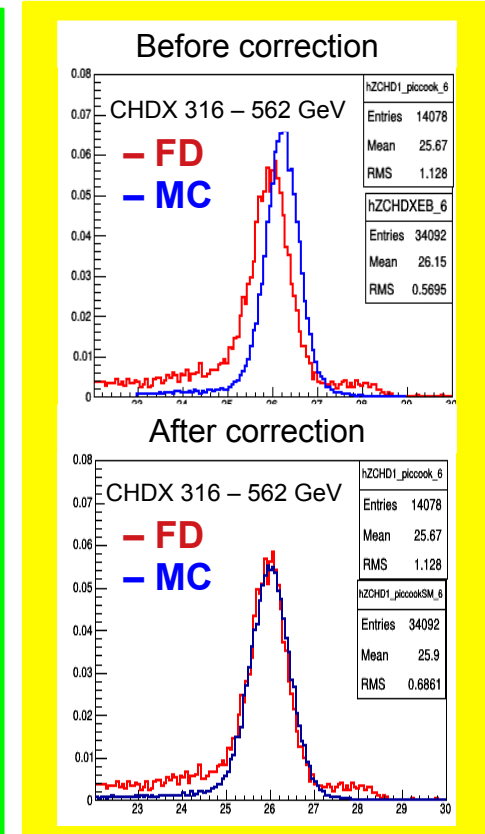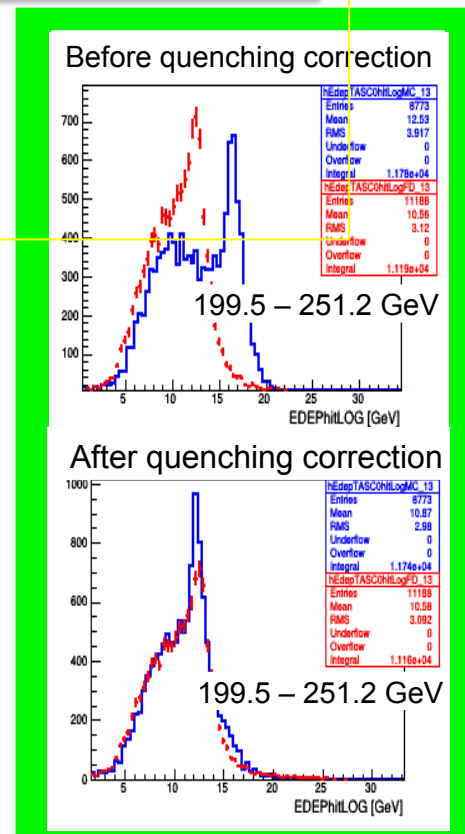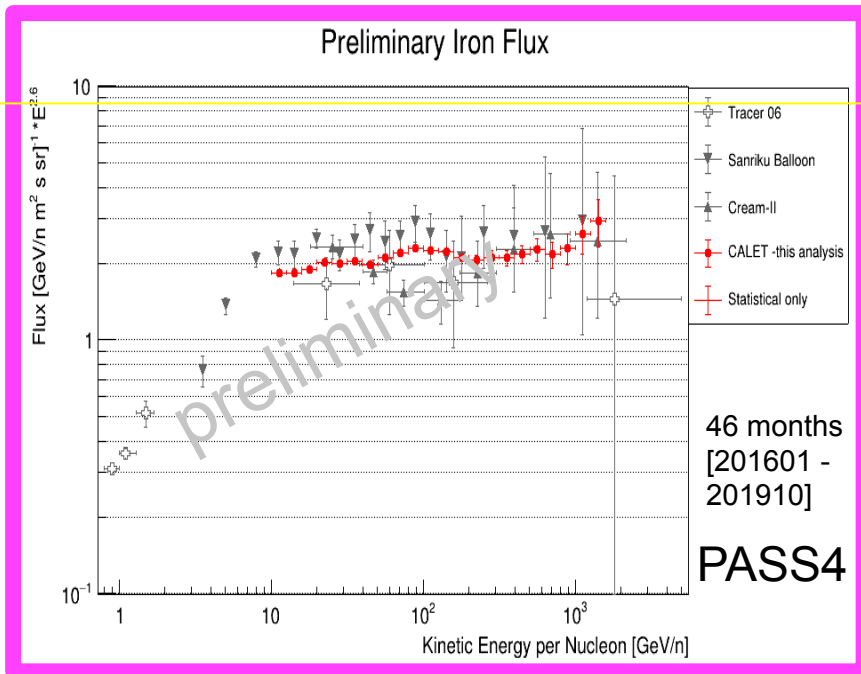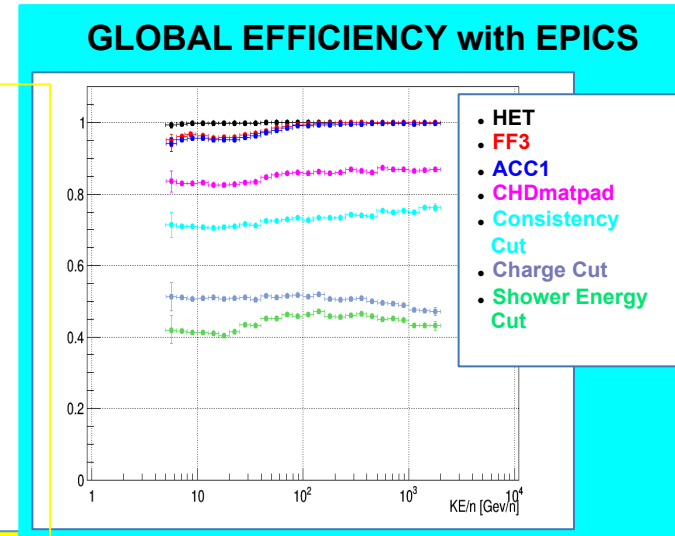- Charge Consistency Cut
- Charge selection

2) Estimate of efficiencies of each cut with MC

3) Charge Correction for quenching, energy shift and smearing for Fe

4) Introduction of TASC quenching in EPICS MC

5) Preliminary Iron Flux

Preliminary Iron Flux

- Tracer 06
- Sanriku Balloon
- Cream-II
- CALET -this analysis
- Statistical only

46 months
[201601 - 201910]

PASS4

Before quenching correction

199.5 – 251.2 GeV

After quenching correction

199.5 – 251.2 GeV

Before correction

CHDX 316 – 562 GeV

FD
MC

After correction

CHDX 316 – 562 GeV

FD
MC

Electron Analysis: Eugenio Berti

The **Firenze CALET team** involved in **electron analysis** is working on **extension from Acc A** to a new acceptance

GOAL: Have a **unique analysis**, i.e. common corrections, variables and selections for all events in that acceptance

DEFINITION: **Acc E** requires events that cross CHD, *i.e.* is composed by the following fractions of the standard acceptances

(A) 100 %

(B) 100 %

(C)

(D) Only if CHD is crossed   26.4 cm   L >26.4cm   33 %
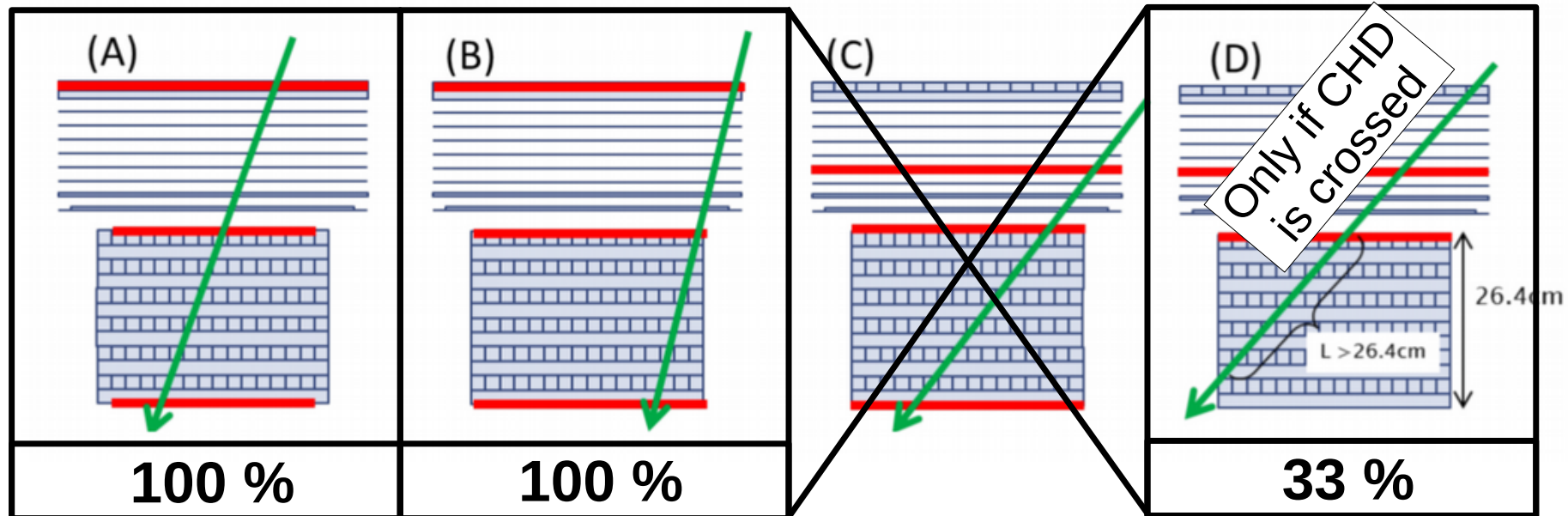
Electron Analysis: Eugenio Berti

Acceptance E is about **1.55 times** larger than Acceptance A

■ Efficiency (N_e^{cut}/N_e^{tot})
□ Background (N_p^{cut}/N_e^{cut})
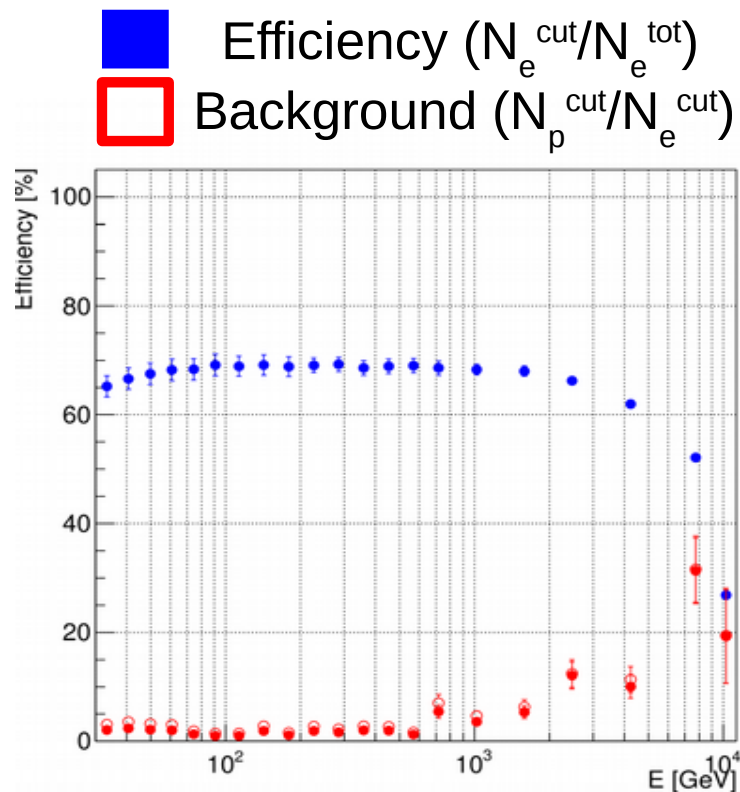
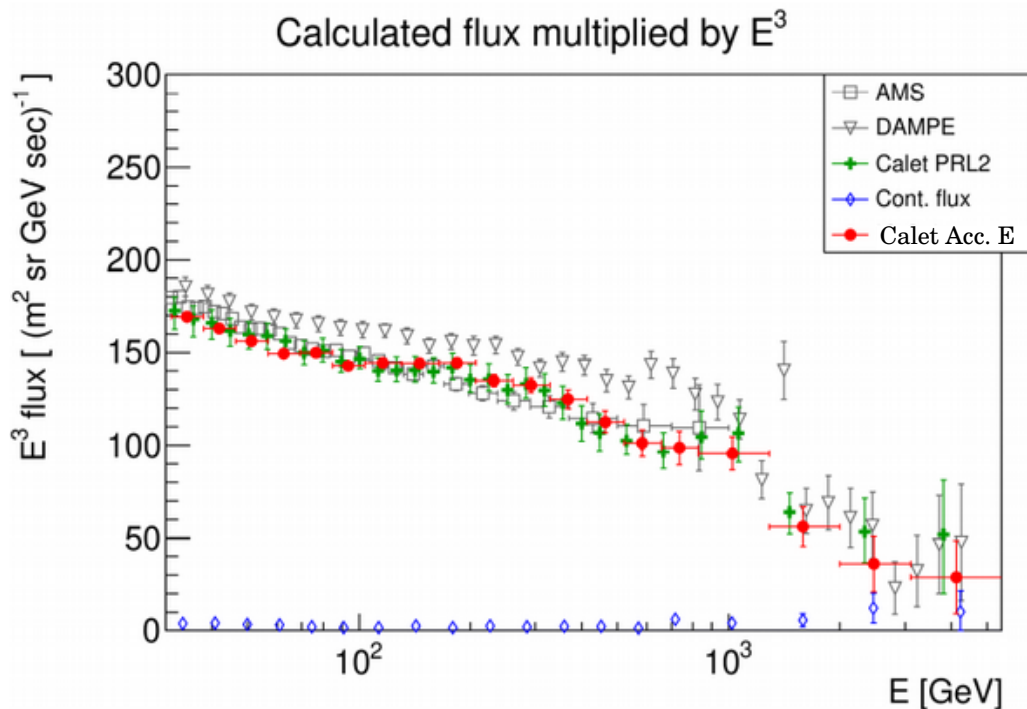|	Fraction of other acceptances
A	100%
B	100%
C	0%
D	33%

Geometric factor
642 cm^{2}sr

Larger geometric factor, still small contamination

Electron Analysis: Lorenzo Pacini

First measurement of the electron flux inside the new acc. E: result compatible with the published one.

Flux parameters:
- inside acc E
- FD from 201511 to 201807
- L2 PASS 3.1,
- EPICS MC

Ongoing study of the systematic errors:
- Selections (charge, IMC shower)
- BDT efficiency and K cut.
- Flux stability.
- Different MC models...

Simulations with the Geant4 software

We are performing some test by varying the **secondary particles production threshold** in the **subdetectors** to understand if it makes sense to process data by **optimizing the threshold** or to evaluate a **systematic error** *a posteriori*.

We are doing a **Geant4 simulation** in 11 test **regions** by changing that parameter and studying the behaviour of some **variables** used in the **electron analysis.** Results are compared with the **original configuration.**
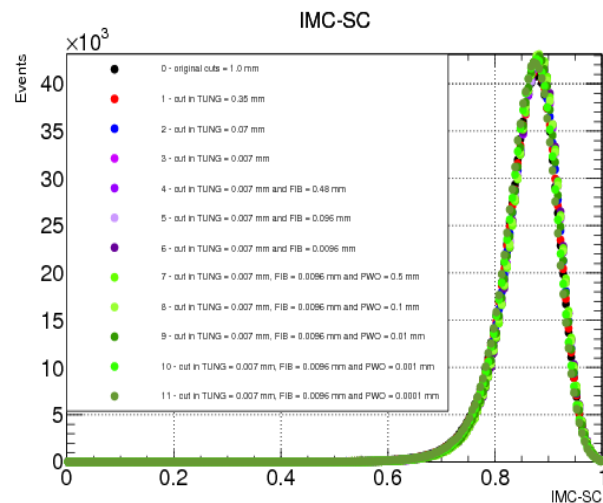
IMC Shower Concentration (IMC-SC)
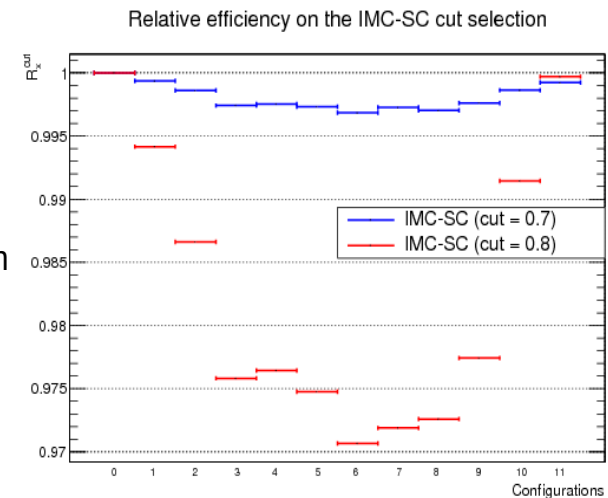
Other tests are required to understand the best way to proceed.

S. Gonzi