Measurement of Beryllium isotopes in Cosmic Rays with AMS-02 experiment on the ISS

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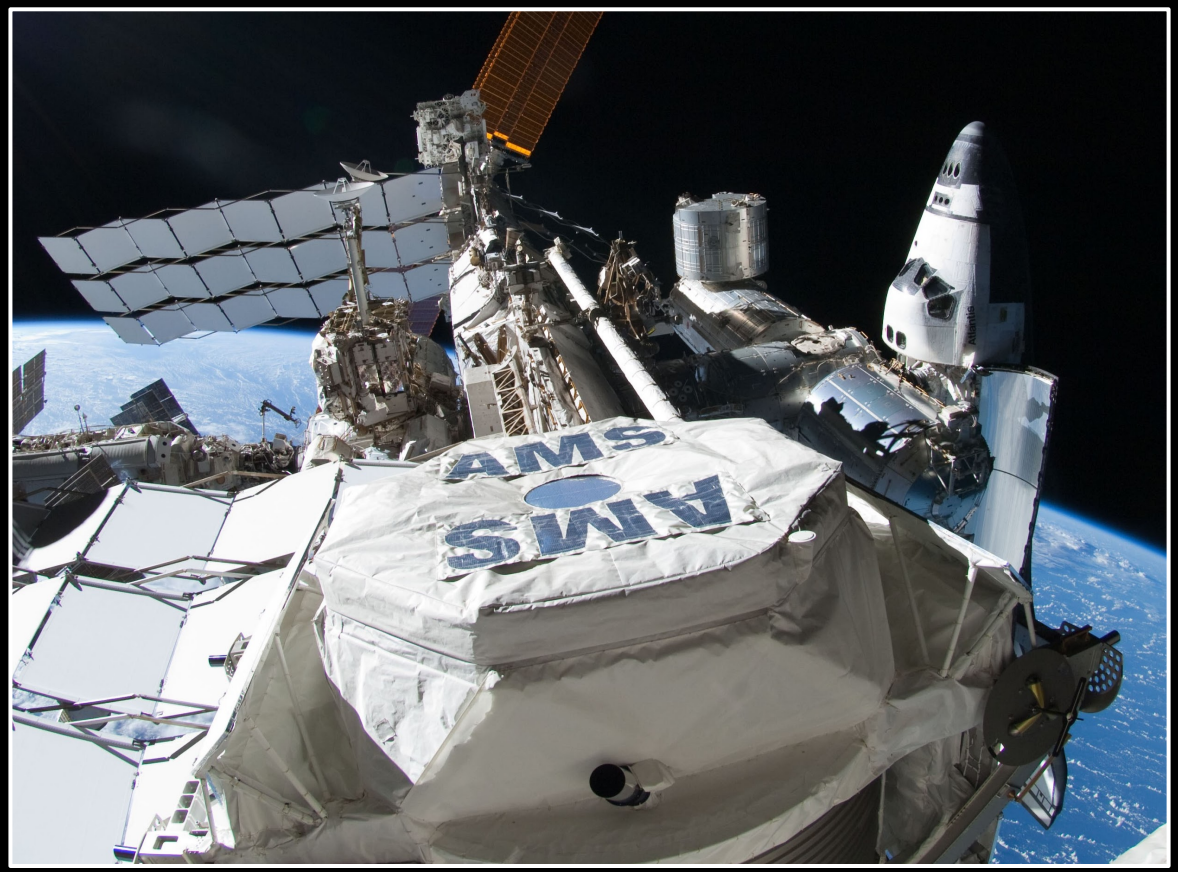
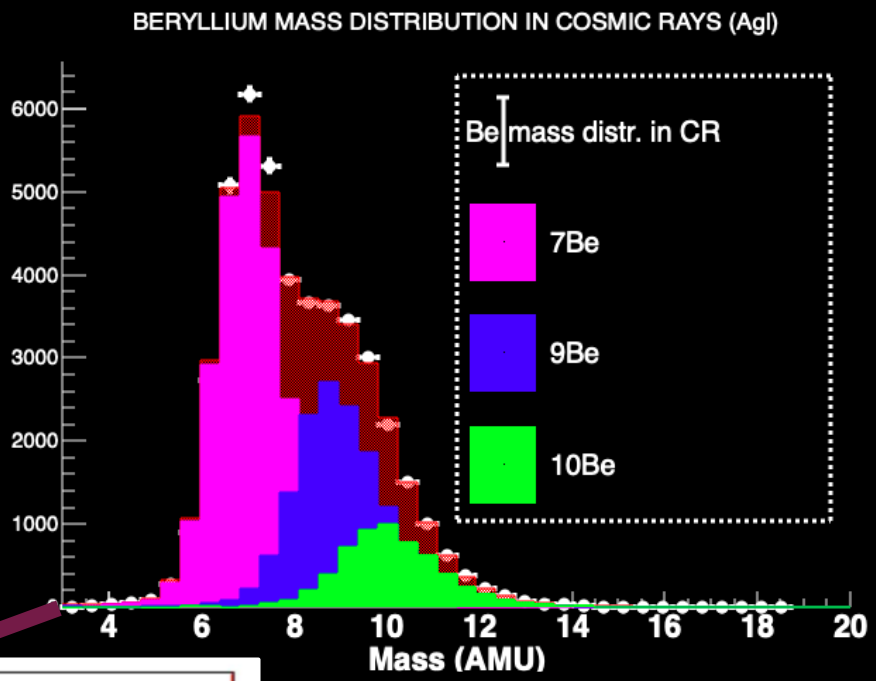
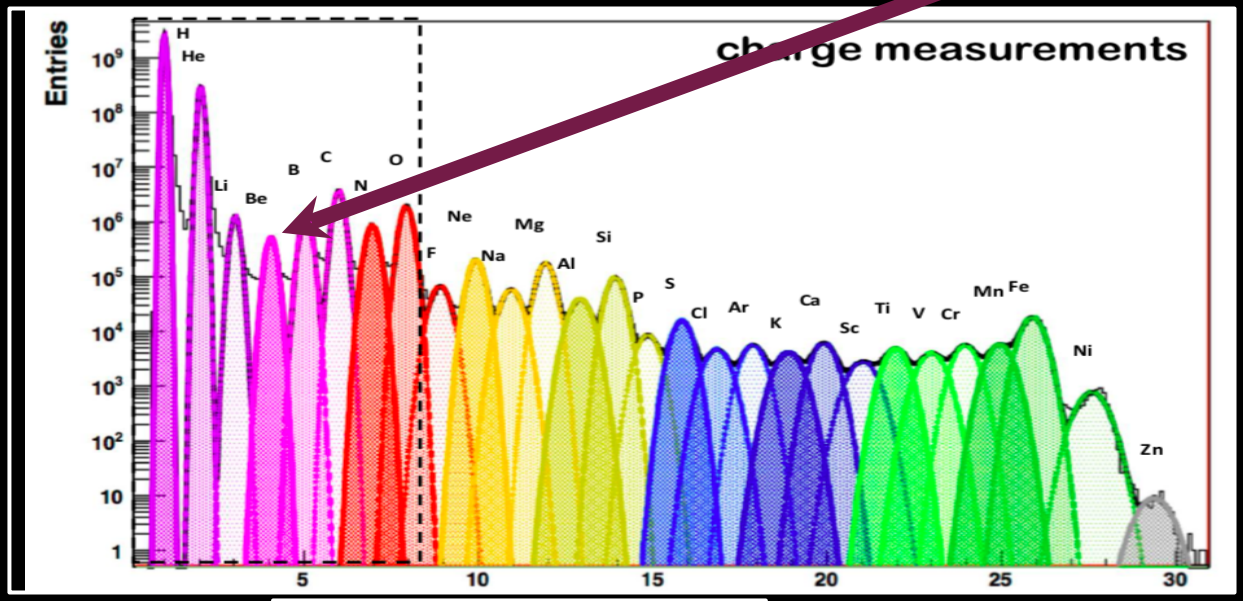
Trento Institute for Fundamental Physics and Applications



- **Galactic Cosmic Rays** (CR) are charged particles reaching Earth from outside S.S.
- **Beryllium** is an extremely rare specie in CR
- We expect 3 isotopes of Be: **^{7}Be, ^{9}Be, ^{10}Be**
  - **^{7}Be** decays through e^- capture, on Earth it has a $T_{1/2}$~ 55 days, but it's stable in CR due to the low electron density of the ISM
  - **^{9}Be** is stable
  - **^{10}Be** is β-unsatble: $^{10}Be \rightarrow {}^{10}B + e^- + \nu$

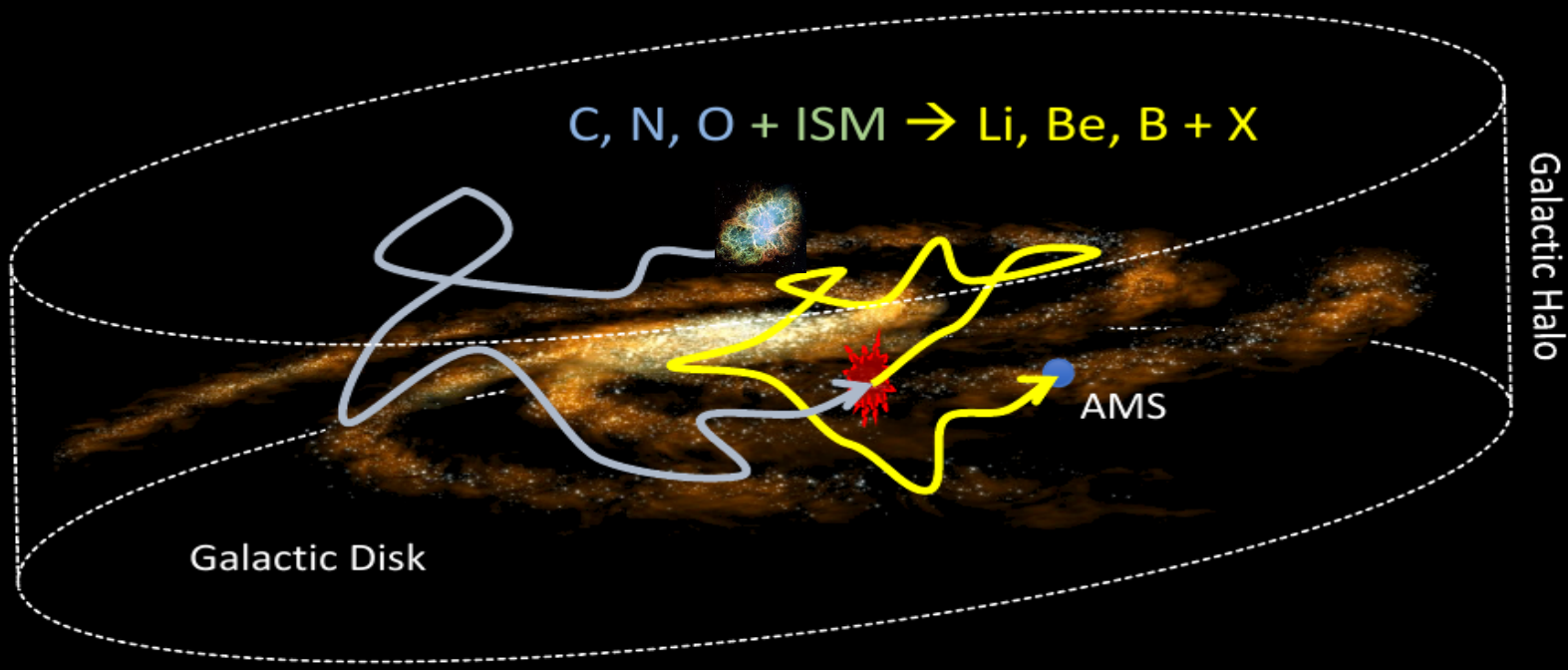




^{10}Be has a lifetime of ~1.5My, comparable with the CR containment time within the Galaxy (~100My)

Secondary nuclei in Cosmic Rays (CR)

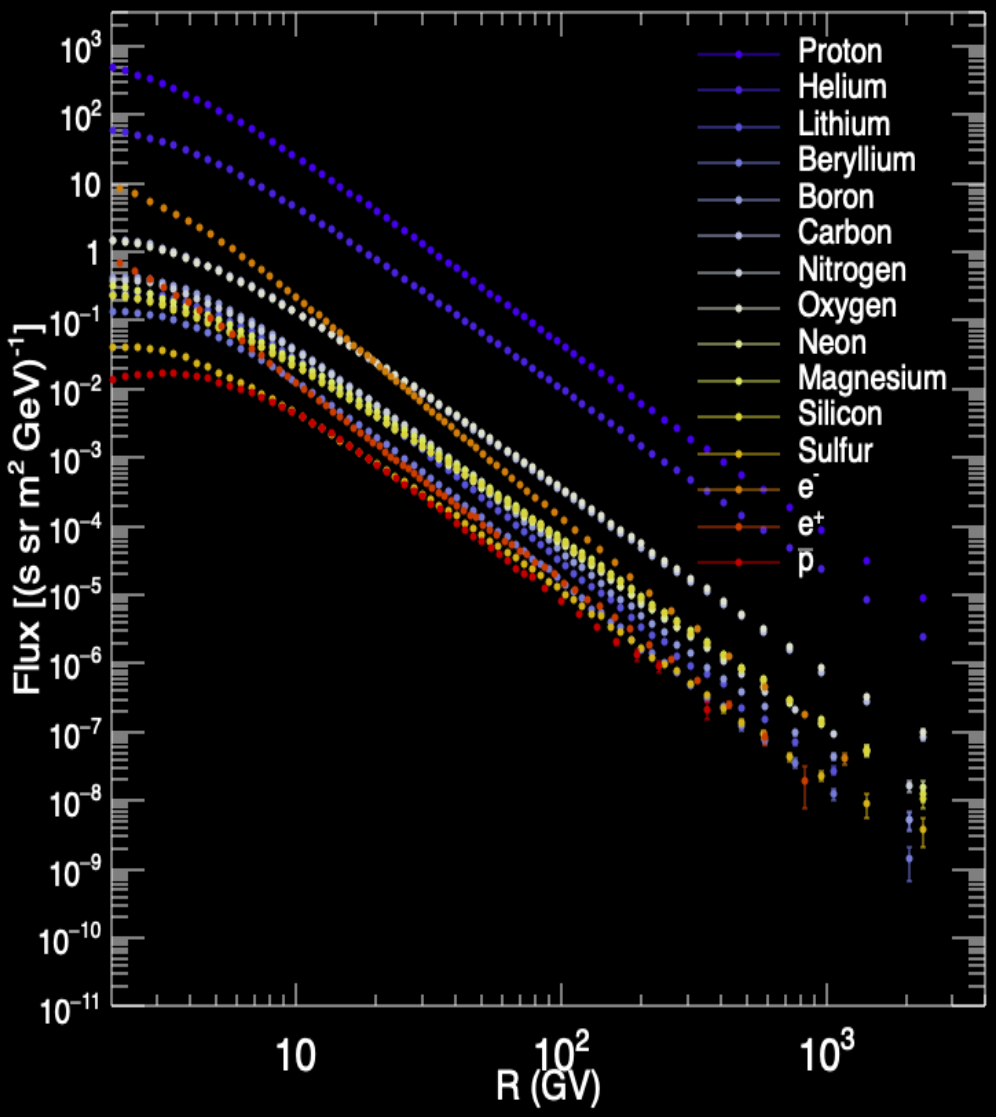
Secondary CR are produced from collisions of **primary CR** with the **interstellar medium (ISM)**

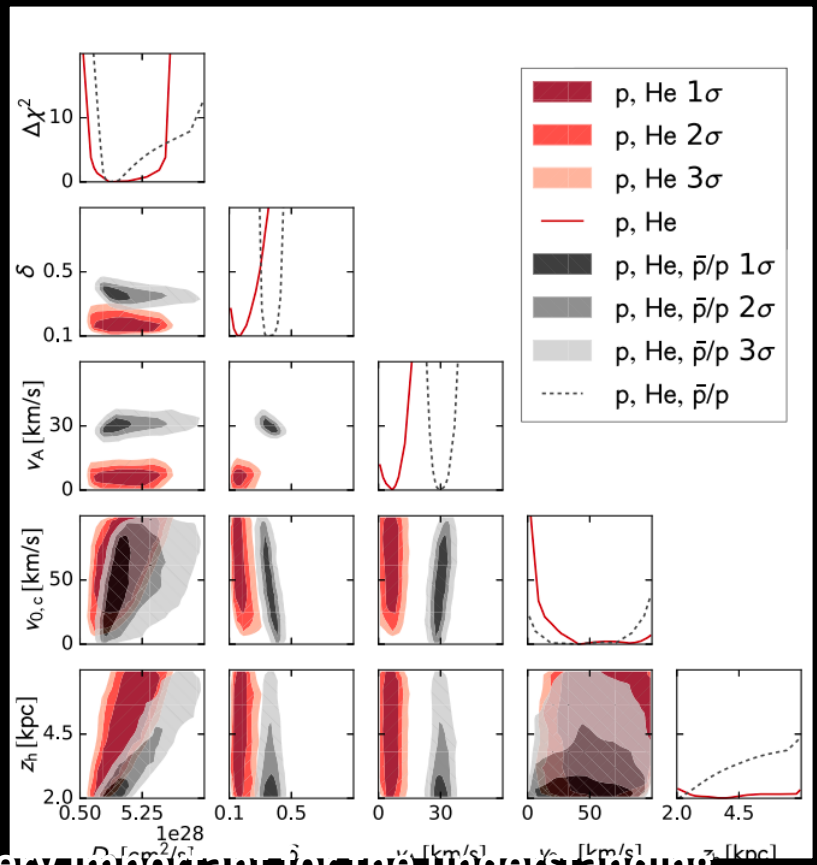


The fluxes of the secondary species are very important for the understanding of the origin and propagation of cosmic rays

- They carry information on the history of the travel and **properties of ISM**
- Most abundant species: **Li, Be, B and light isotopes (^{3}He and D)**

Secondary nuclei in Cosmic Rays (CR)





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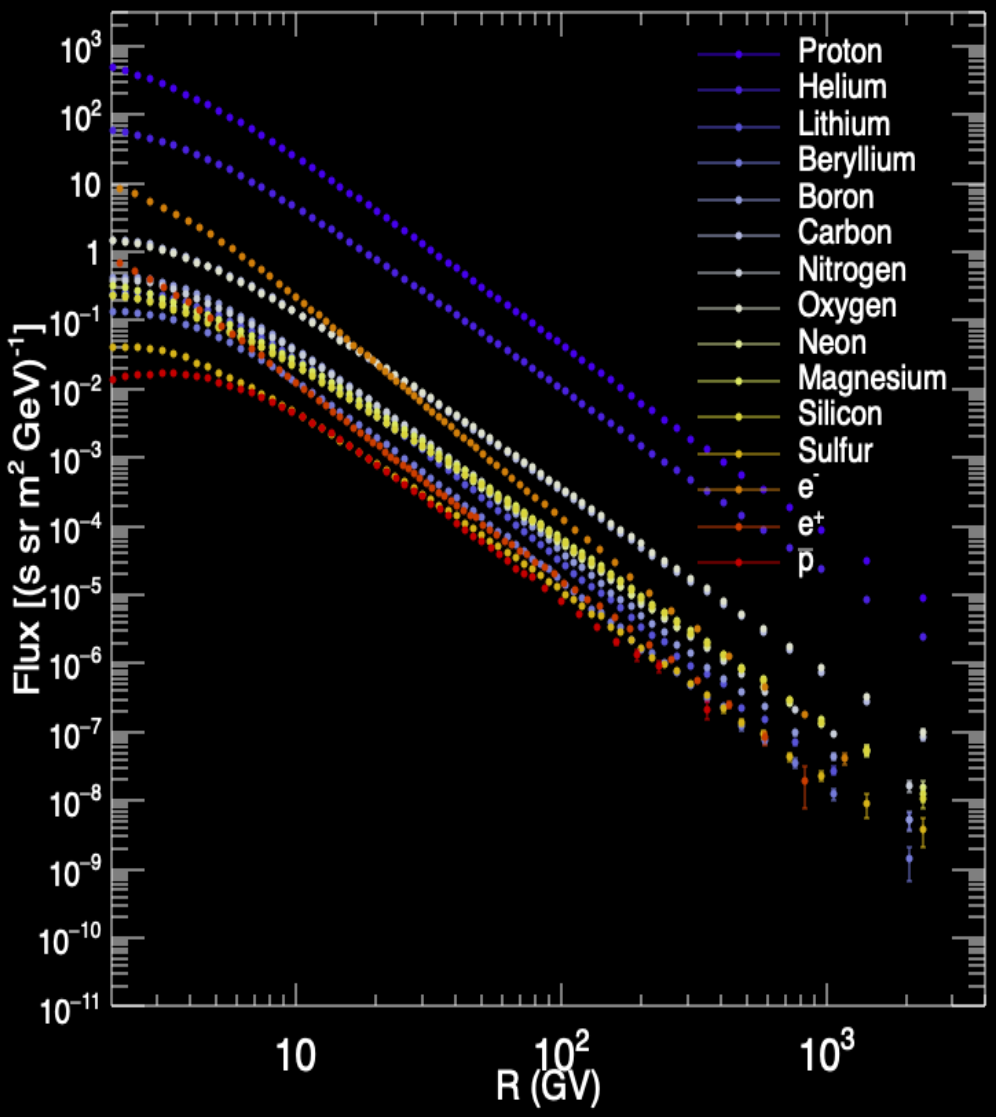

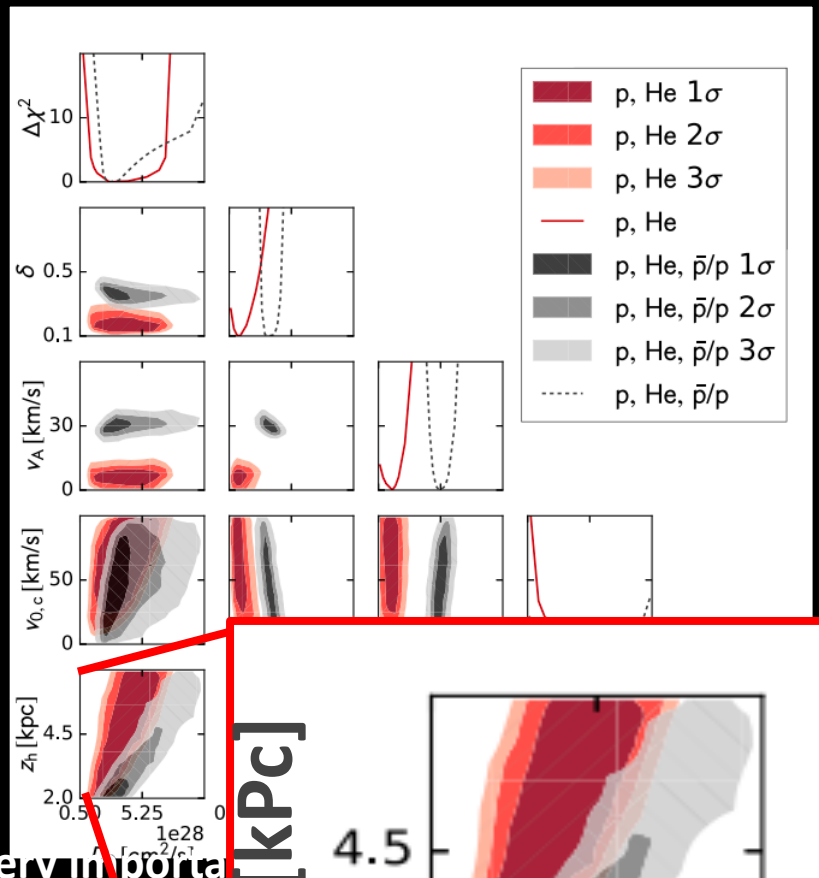

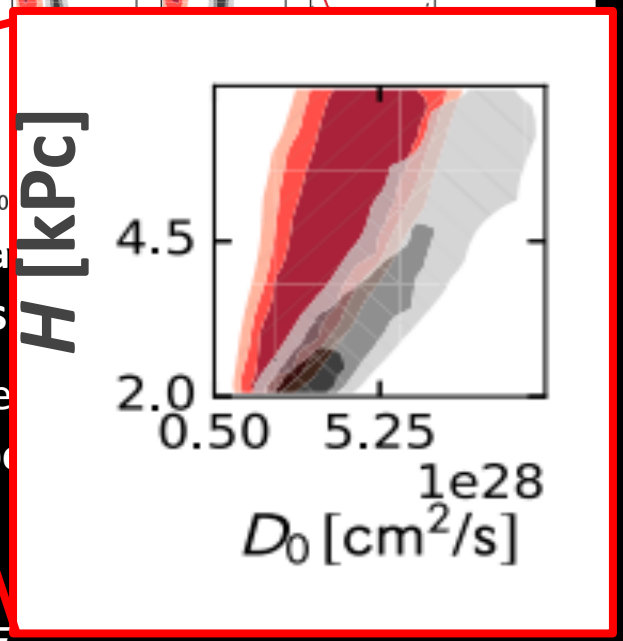

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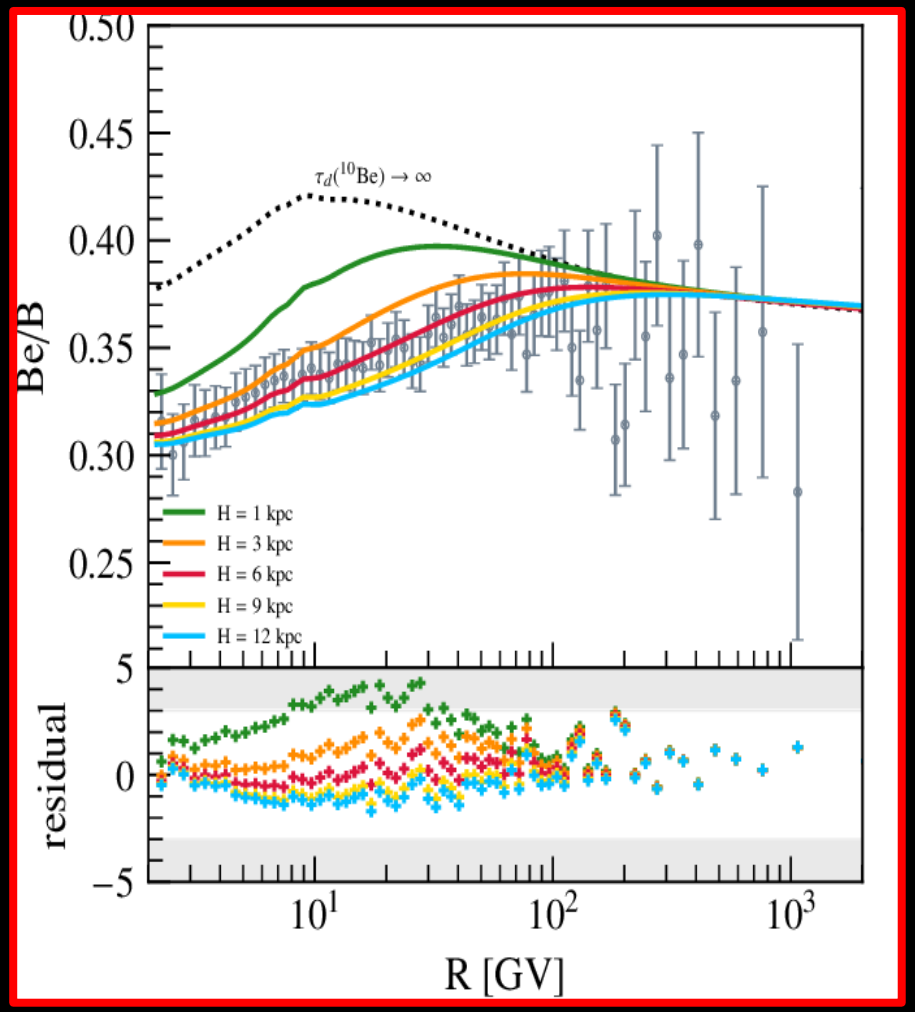
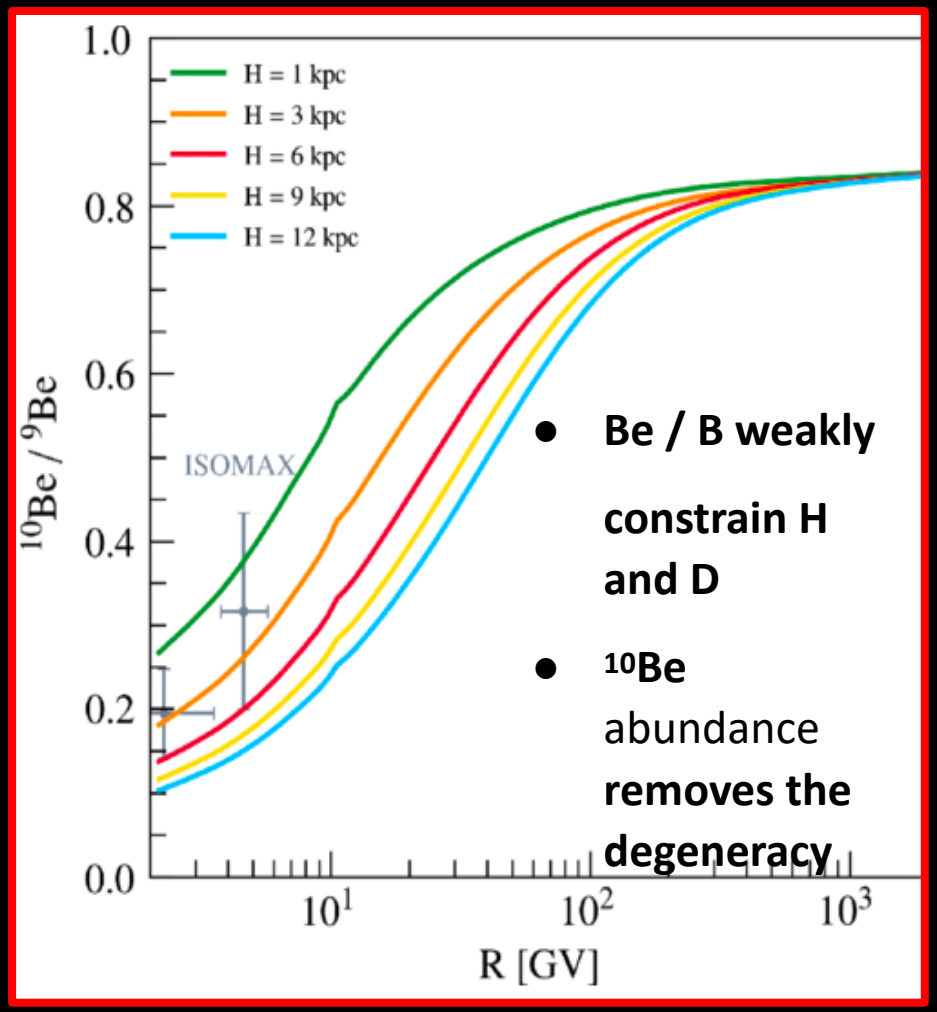
^{10}Be as a radioactive cosmic clock

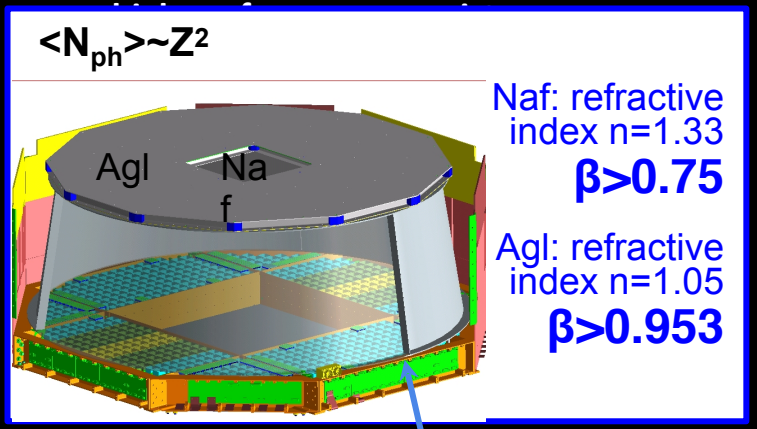


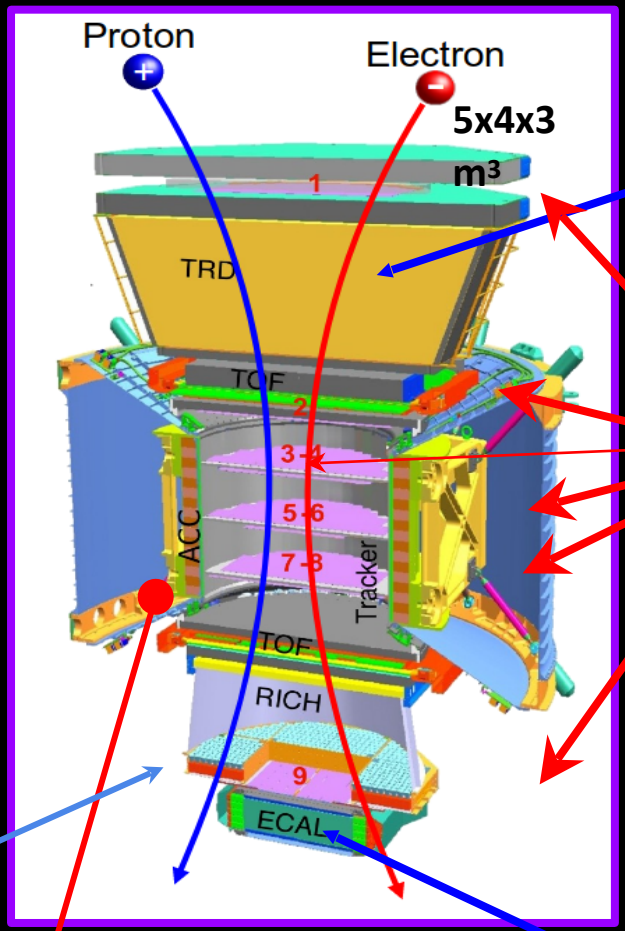


- **Be / B weakly constrain H and D**
- **^{10}Be** abundance **removes the degeneracy**

AMS02 a 7.5 tons multipurpose spectrometer in Space

- Explore energy ranges between O(1GV)-O(1TV)
- More than 127 billions events of charged particles: e^+ ,e^- , nuclei , pbar
- Precision on flux measurements at % level
- High acceptance, long duration,





TRD
Z, Identify e^+, e^-

Silicon
Tracker
Z, R

TOF
Trigger, β, Z

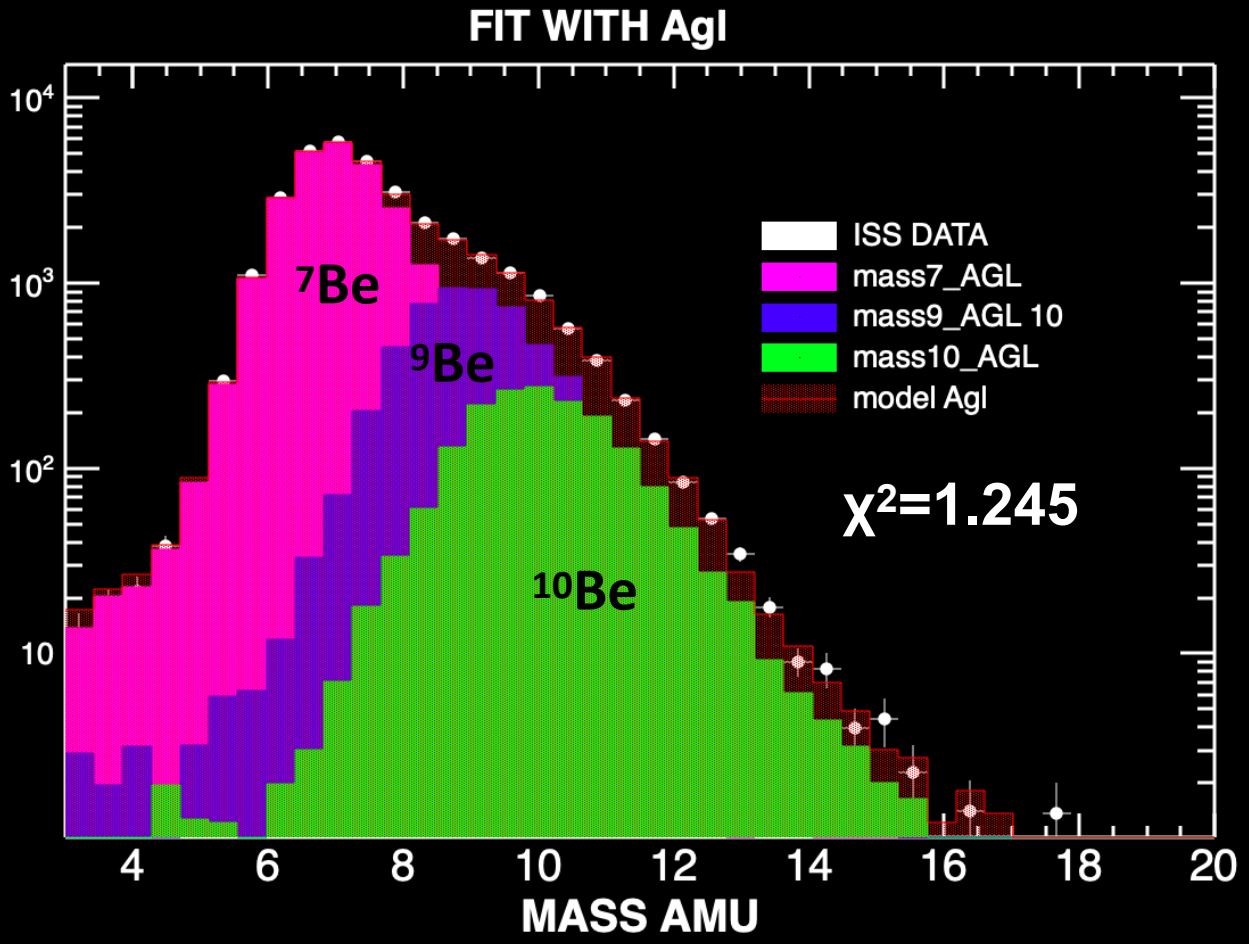
RICH
precision meas. of β, Z

ACC
Veto of side part.

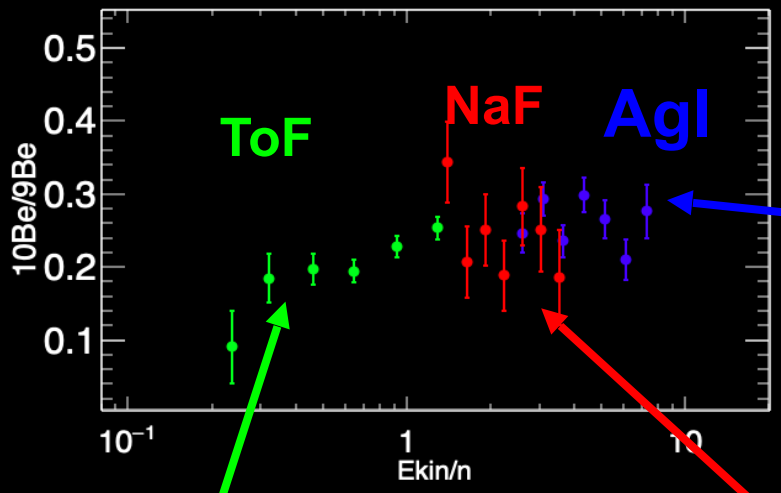
ECAL
E of e^+, e^-, γ

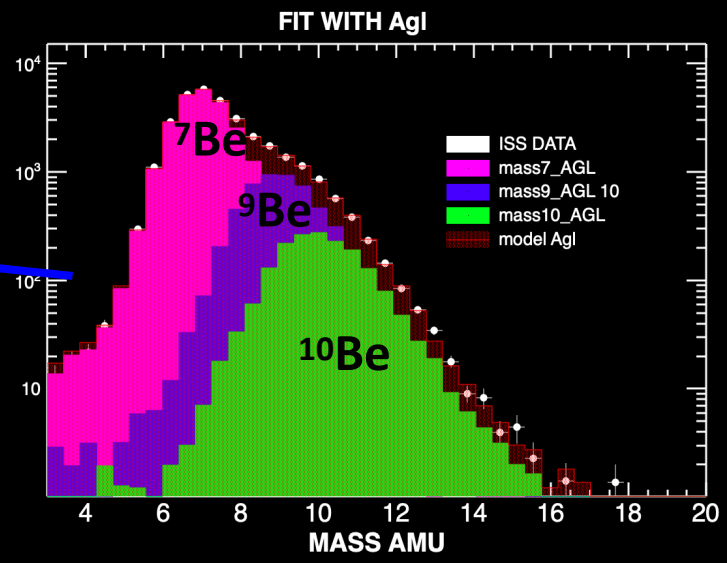
Measurement of the mass with AMS-02

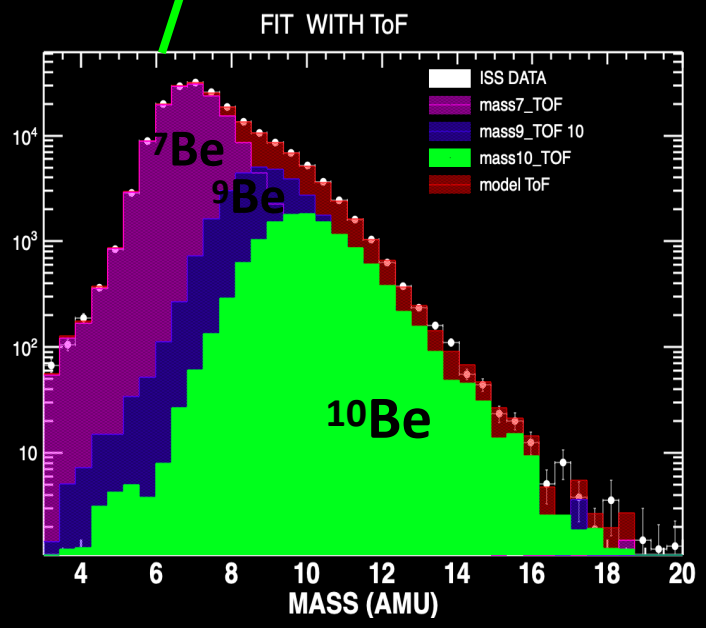
$$M[GeV] = \frac{Rq}{\gamma\beta}$$

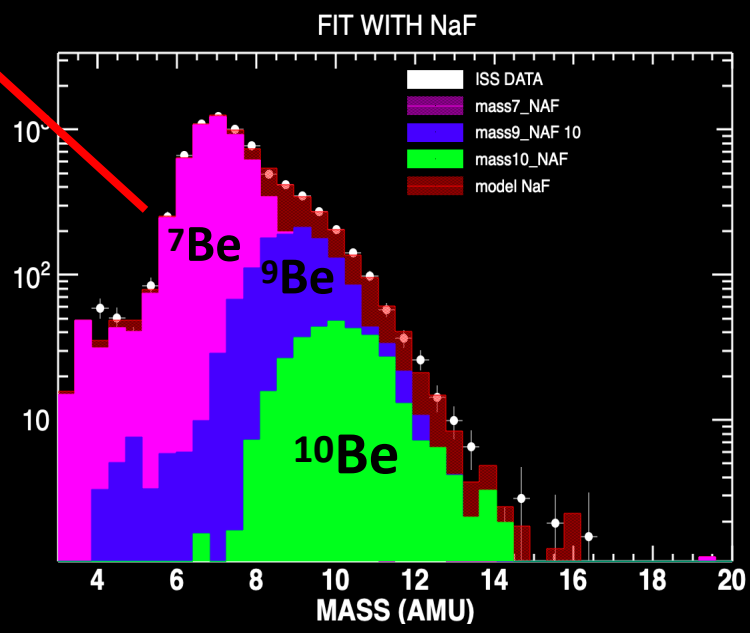


Mass measurement in 3 different ranges of β

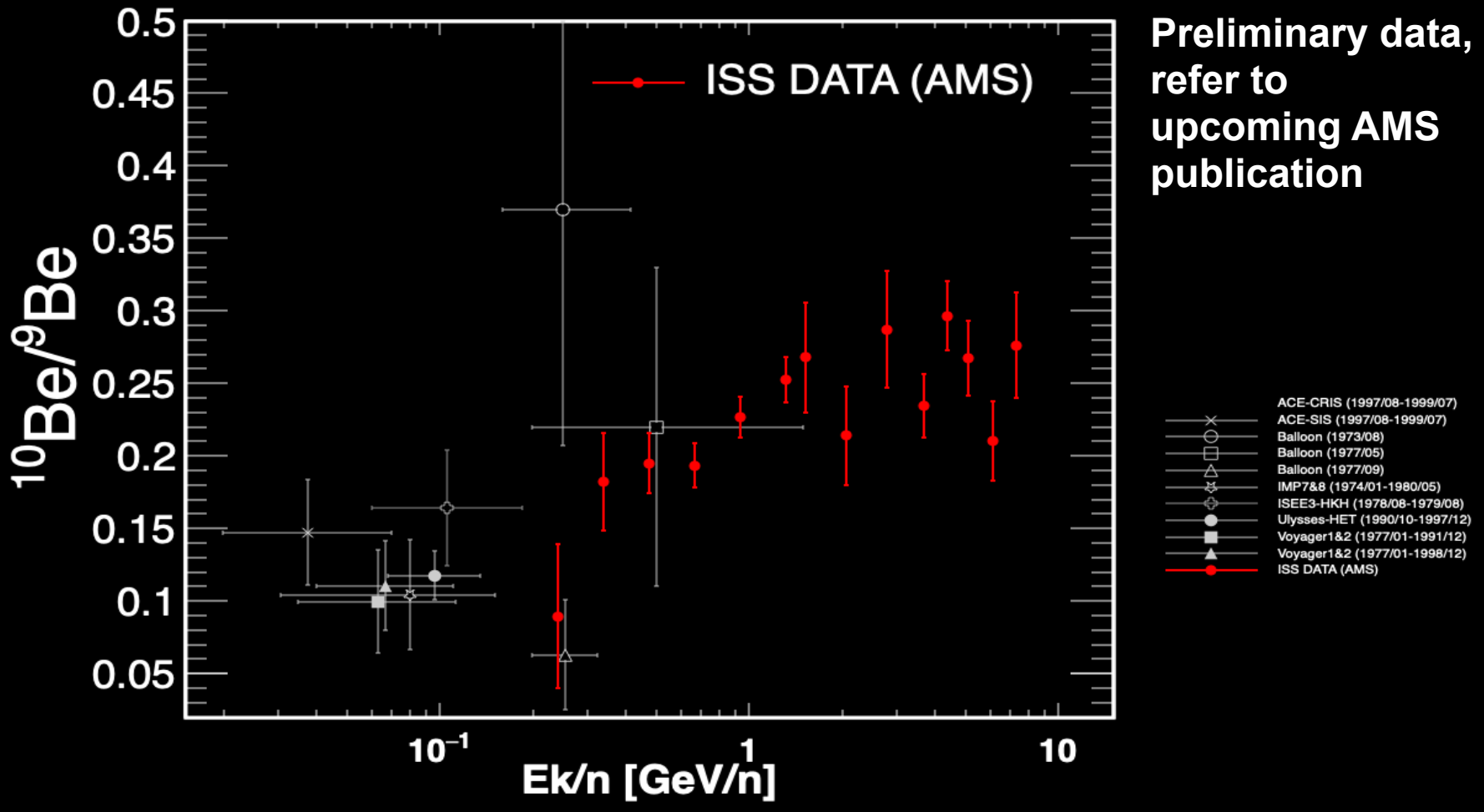








Measurement of $^{10}Be/^{9}Be$ flux ratio



Preliminary data, refer to upcoming AMS publication

Conclusions

- The measurement of ^{10}Be is fundamental for a detailed knowledge of the CR propagation parameters
- AMS-02 is able to measure Be isotopic composition up to 10GeV/n with a good sensitivity
- A preliminary estimation of $^{10}Be/^{9}Be$ ratio of was carried out extending previous knowledge of one order of magnitude in energy

Next goal:

Assessment of systematic errors as those coming from fragmentation of heavier CR nuclei inside the detectors and study of time dependence at low rigidities