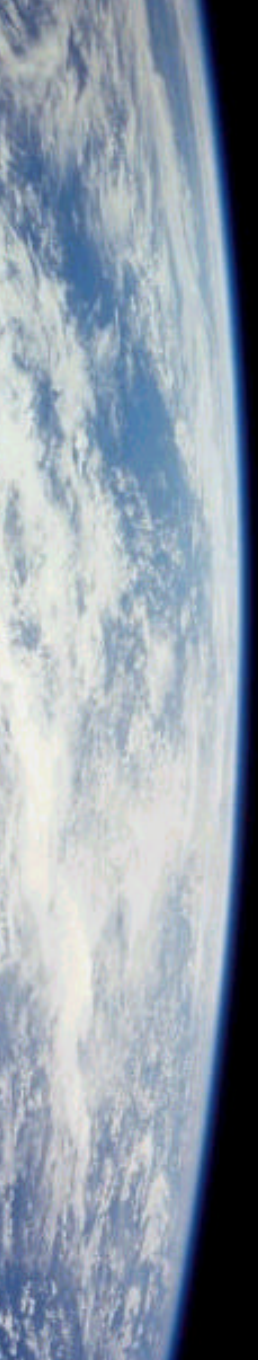

AMS RICH Monte Carlo simulation: new results

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Isotope MC simulation

- Three elements tested:
  - Z=1 - Hydrogen (p, d): 1.6 x 10^7 events ≈ 1 day
  - Z=2 - Helium (^{3}He, ^{4}He): 2.0 x 10^6 events = 1 day
  - Z=4 - Beryllium (^{9}Be, ^{10}Be): 8.5 x 10^5 events = 1 year
- Two setups tested:
  - AGL103 + NaF
  - AGL105 + NaF

Isotope MC simulation

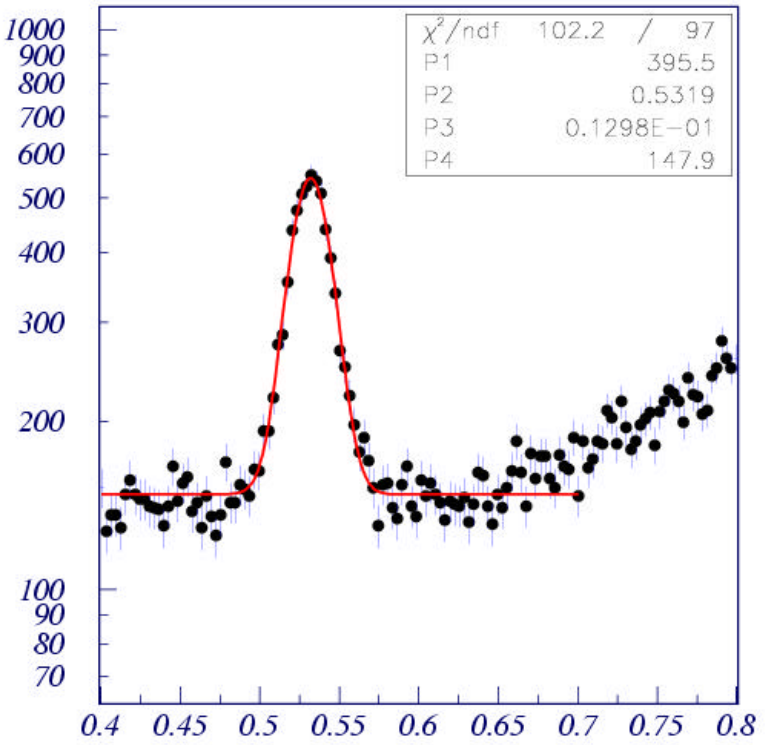
- Separate fits for AGL & NaF populations, one fit for each energy channel

- Fits performed for H to get isotopic abundances:
  - Two kinds of distribution tested:
    - ⋆ Mass distributions
    - ⋆ Inverse mass distributions → better
  - Gaussian fit performed on proton peak
  - Fit to gaussian + noise (assumed constant in peak region) performed for deuteron peak

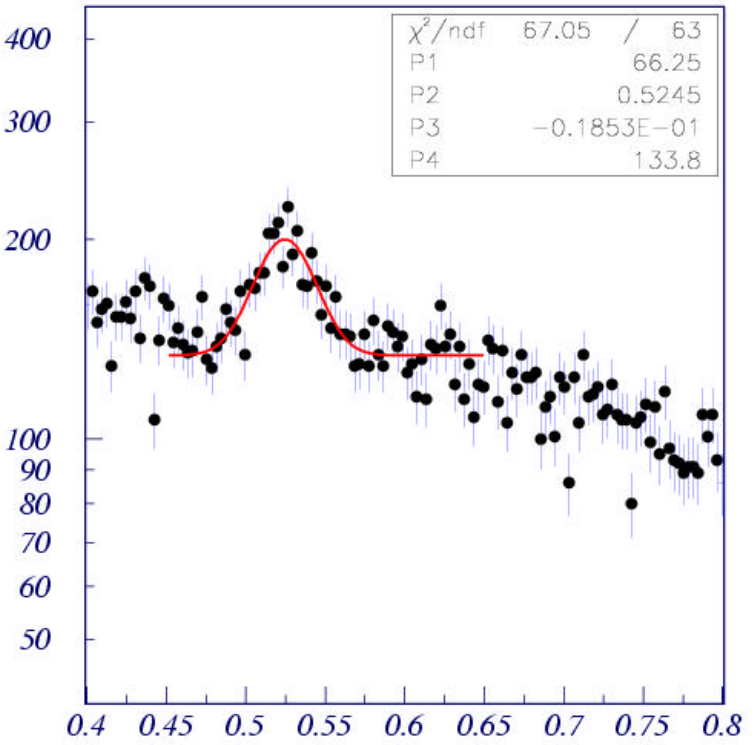
- Fits performed for He, Be: ⇒ see my talk at CERN, Oct. 2004
  - 2 gaussians in mass spectrum, fixed width ratio:
    - ⋆ $\sigma_1/\sigma_2 = m_1/m_2$

Inverse mass fits

- AGL: Clear deuteron peaks in several energy channels
- NaF: Peaks are much harder to measure



AGL 103



NaF

Inverse mass fits

- Two possible methods to calculate d/p ratio from fits:
  - Directly from gaussian integrals

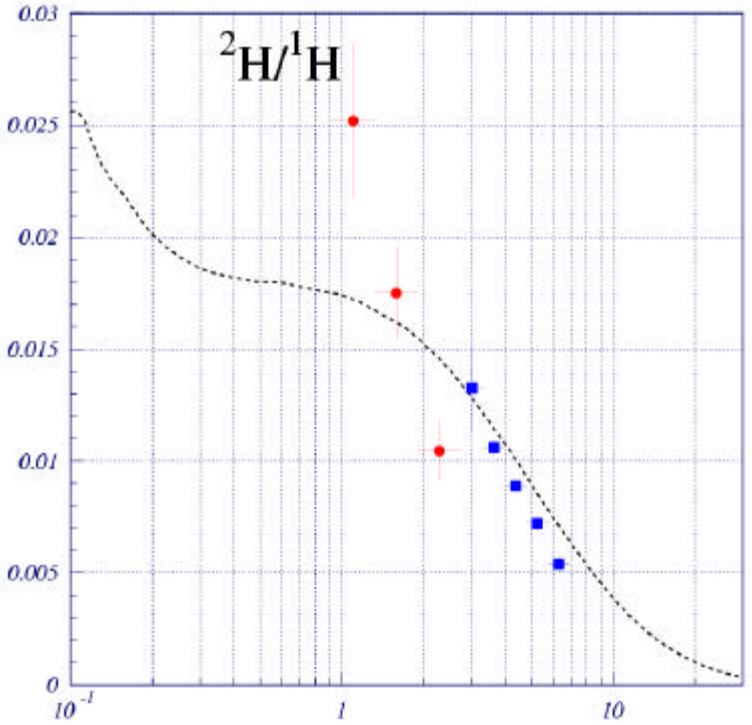
$$r = \frac{A_d}{A_p}$$

  - Using peak heights + expected σ_d/σ_p ratio

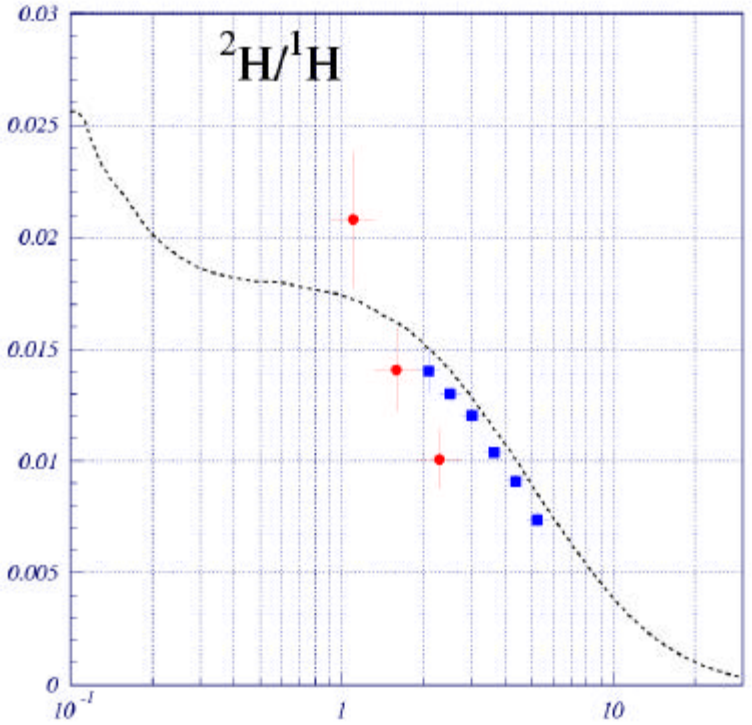
$$r = \frac{h_d}{h_p} \times \left(\frac{s_d}{s_p} \right)_{\text{exp}}$$

Inverse mass fits

- Results for d/p ratio using gaussian integrals:



AGL 103



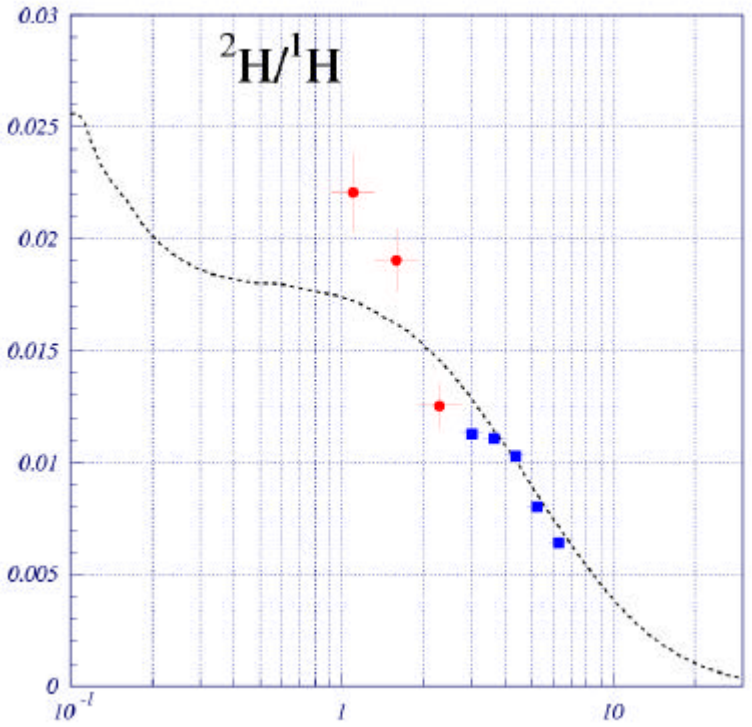
AGL 105

λ NaF

ν AGL

Inverse mass fits

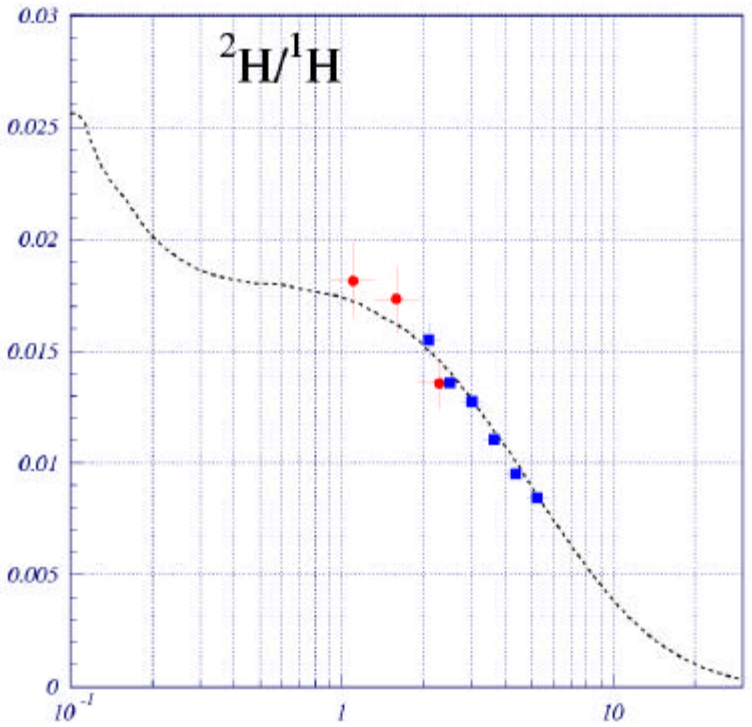
- Better results using peak heights and expected ratios in σ:



AGL 103

λ NaF

ν AGL



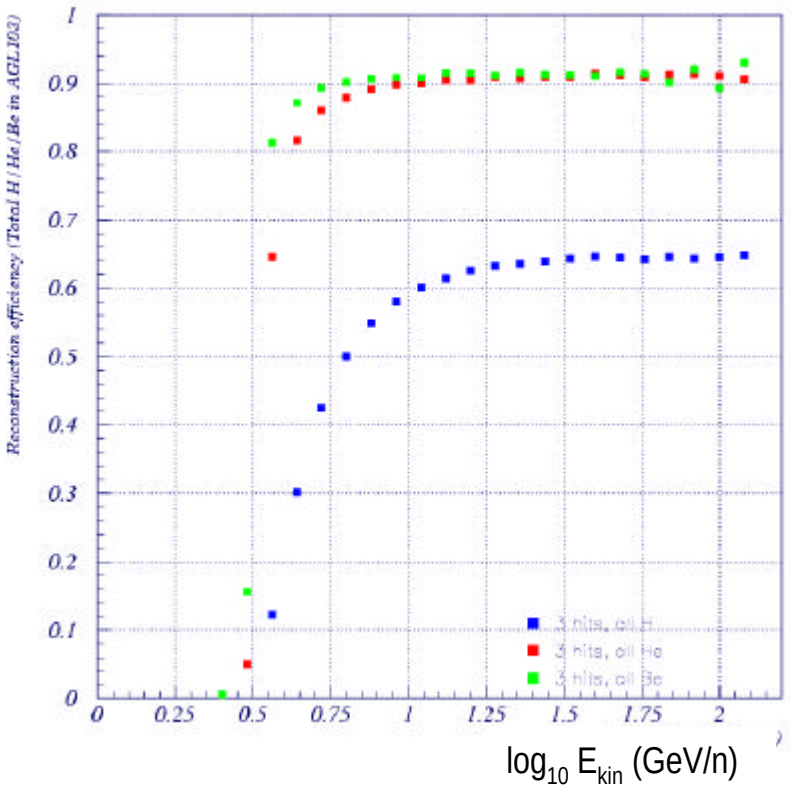
AGL 105

Reconstruction efficiencies

- Calculated from no. of reconstructed vs. simulated events in each energy channel
- All three elements studied: H, He and Be
- Efficiencies also calculated for each isotope separately, no difference found between isotopes with same E_{kin}/nucleon ($\equiv$ same β)

Reconstruction efficiencies

- AGL103 - comparison between H, He, Be:

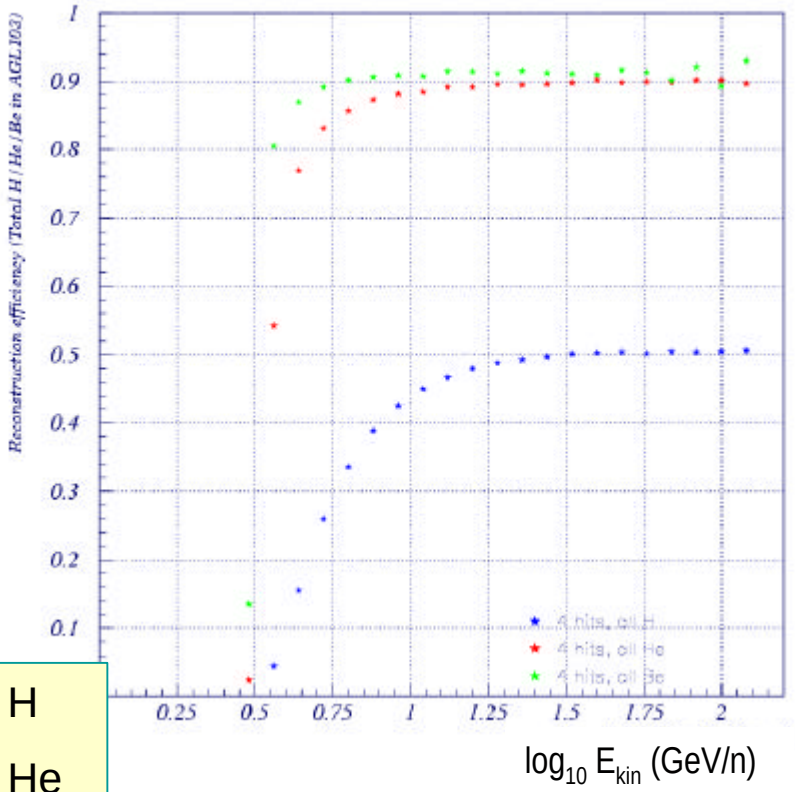


cut at 3 hits

ν H H

ν H He

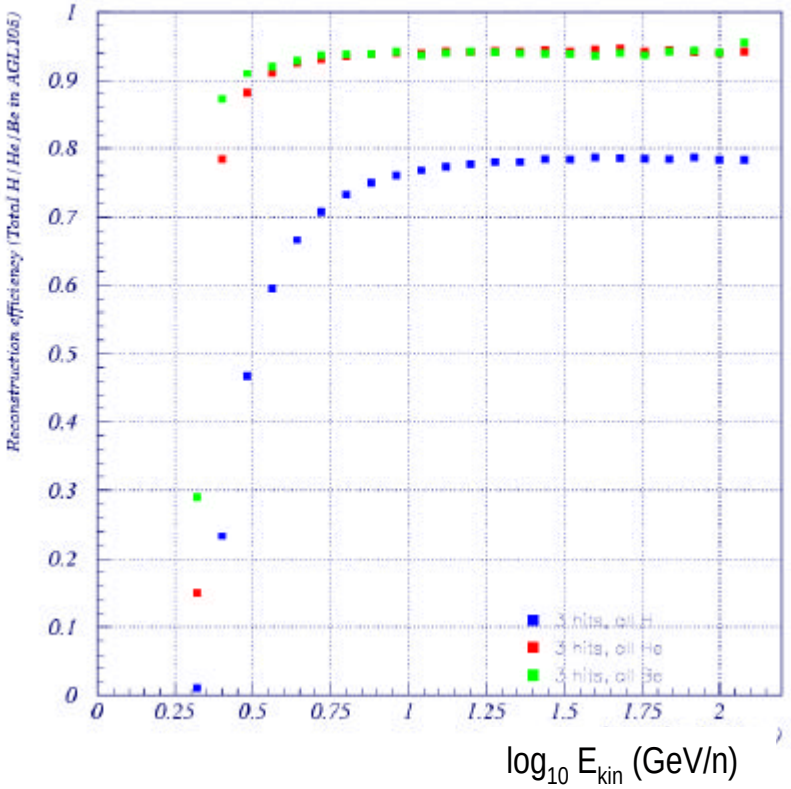
ν H Be



cut at 4 hits

Reconstruction efficiencies

- AGL105 - comparison between H, He, Be:

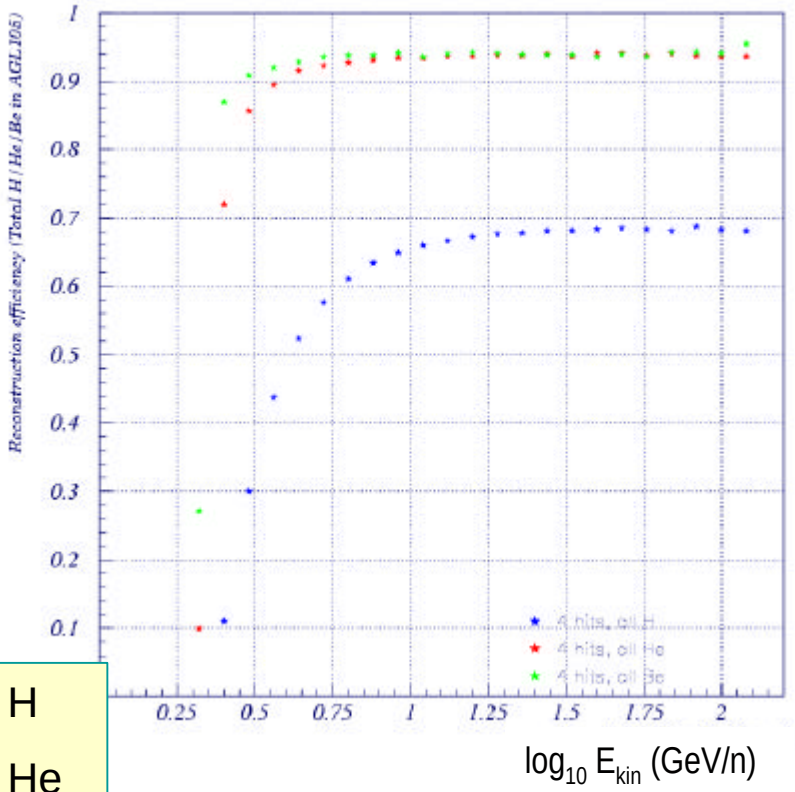


cut at 3 hits

ν H H

ν H He

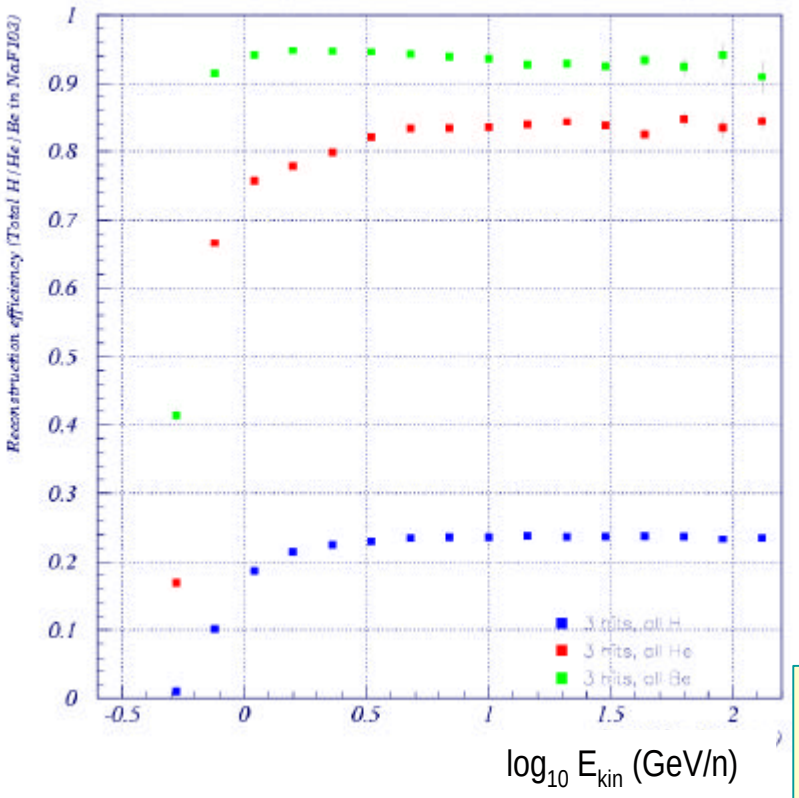
ν H Be



cut at 4 hits

Reconstruction efficiencies

- NaF - comparison between H, He, Be:

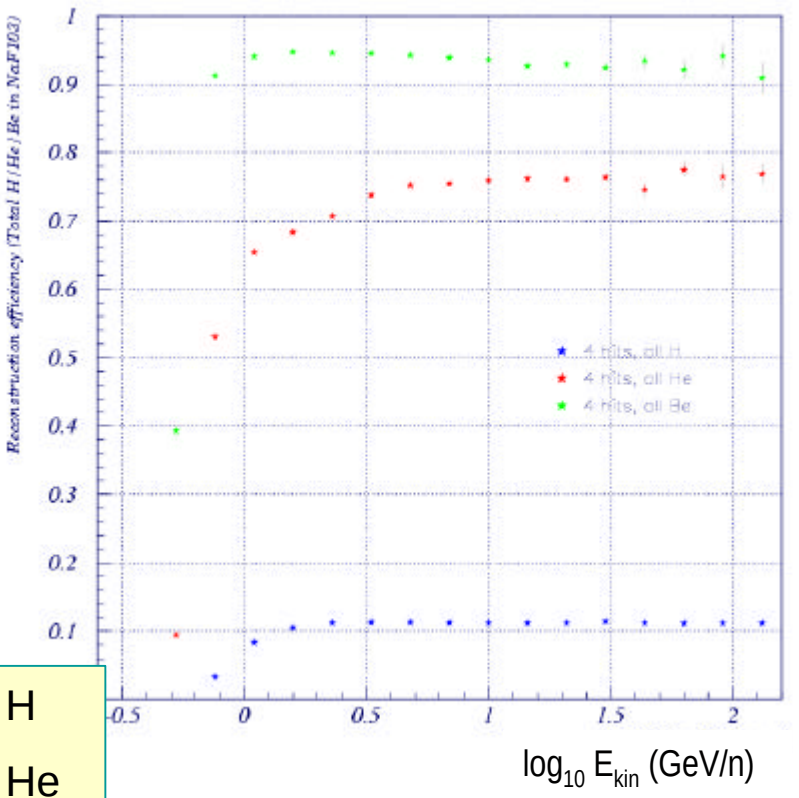


cut at 3 hits

ν H H

ν H He

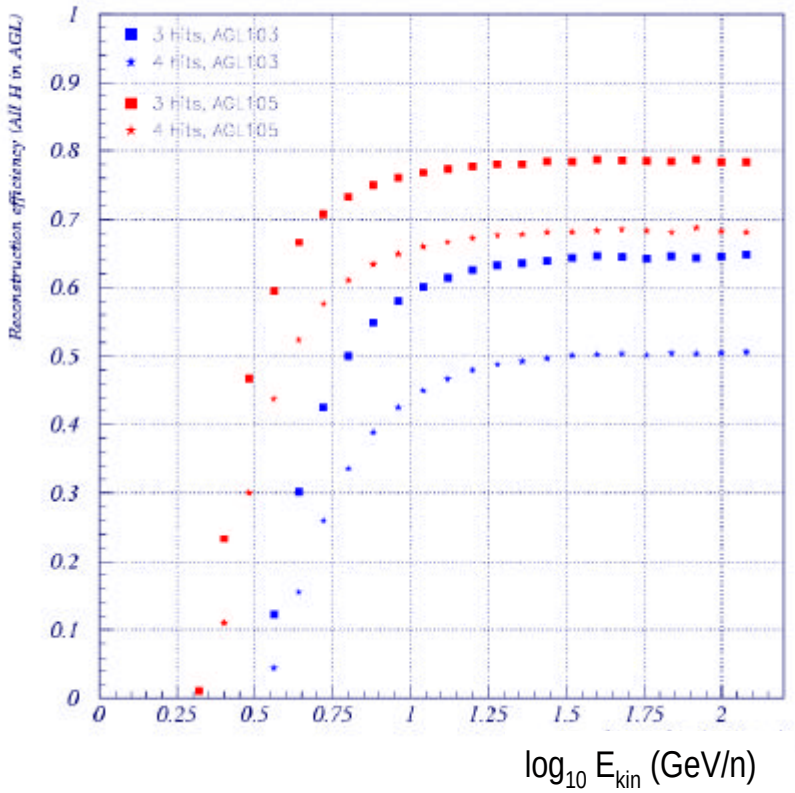
ν H Be



cut at 4 hits

Reconstruction efficiencies

- Hydrogen - comparison between AGL103, AGL105:

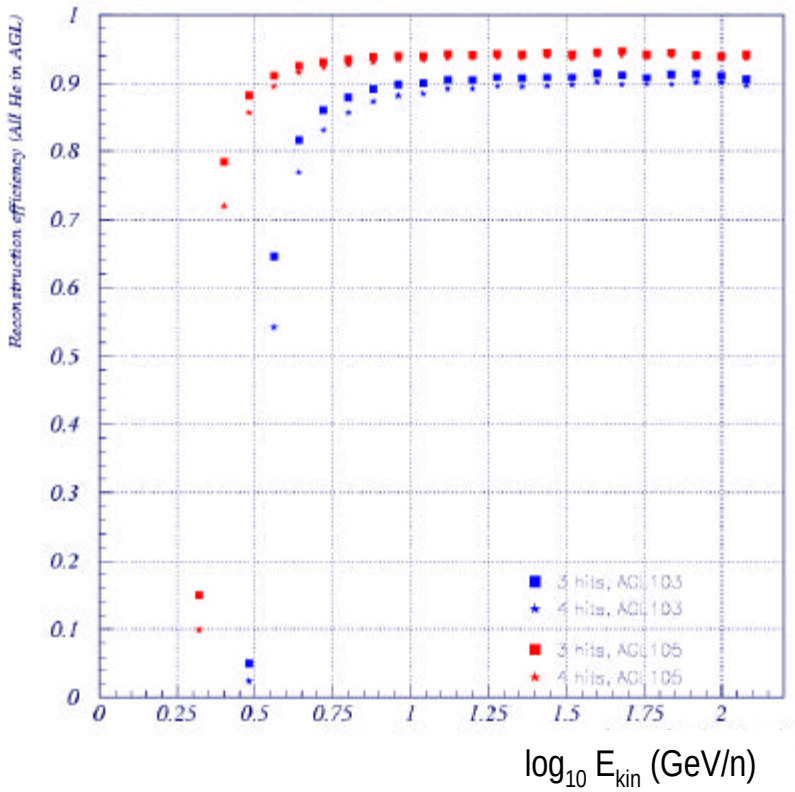


ν H AGL103

ν H AGL105

Reconstruction efficiencies

- Helium - comparison between AGL103, AGL105:

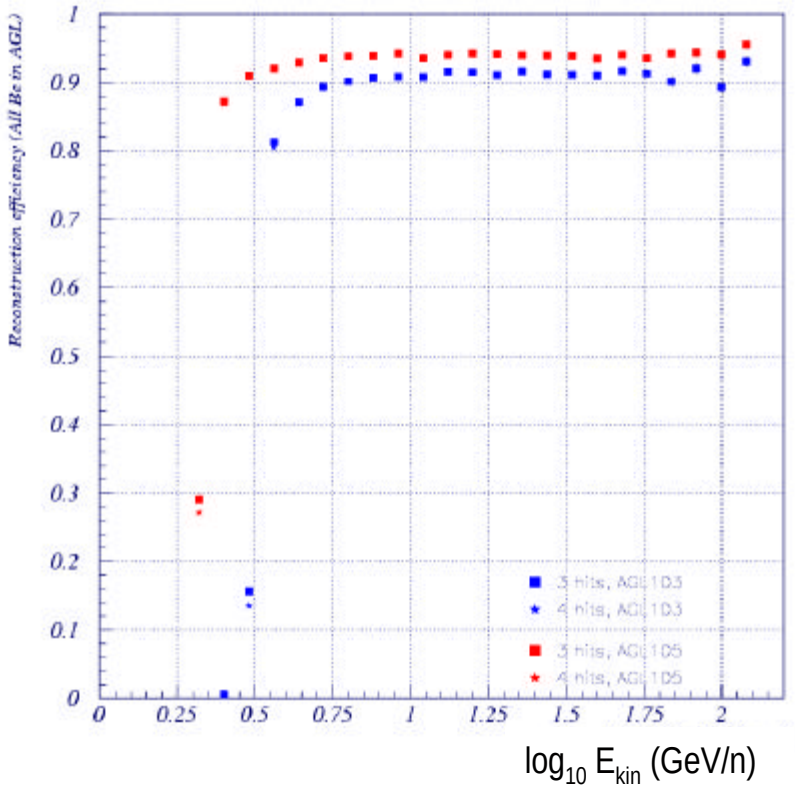


ν H AGL103

ν H AGL105

Reconstruction efficiencies

- Beryllium - comparison between AGL103, AGL105:



ν H AGL103

ν H AGL105

Reconstruction efficiencies

- Results for high E_{kin} (in %), r < 60 cm:

Isotope	Cut	AGL103	AGL105	NaF
p	3 hits	62.6	77.8	23.7
	4 hits	48.0	67.3	11.2
^{4}He	3 hits	90.6	94.2	84.1
	4 hits	89.2	93.7	76.3
^{9}Be	3 hits	91.4	94.0	92.9
	4 hits	91.3	94.0	92.9

Energy cuts

E_{kin} > 10 GeV/n (AGL)

E_{kin} > 12 GeV/n (NaF)

Reconstruction efficiencies

- Results for high E_{kin} (in %), r < 58 cm:

Isotope	Cut	AGL103	AGL105	NaF
p	3 hits	64.8	80.0	23.7
	4 hits	49.7	68.9	11.2
^{4}He	3 hits	92.7	96.2	84.1
	4 hits	91.4	95.7	76.3
^{9}Be	3 hits	93.6	96.0	92.9
	4 hits	93.5	96.0	92.9

AGL efficiency increase between 1.6% and 2.2%

Energy cuts

E_{kin} > 10 GeV/n (AGL)

E_{kin} > 12 GeV/n (NaF)

Conclusions

- Results of Monte Carlo simulation of H, He and Be events were analysed
- Isotopic separation was performed
  - Good results for $^{3}He/^{4}He$, $^{9}Be/^{10}Be$
  - Low ratio (~10^{-2}) poses a problem for deuterium, but rough measurements may be obtained from a single day of data
- Reconstruction efficiencies were determined for a large energy region
  - High efficiencies for He, Be (over 90% in AGL, over 75% for He and over 90% for Be in NaF)
  - Lower efficiencies for H (10-25% in NaF, 50-80% in AGL, depending on radiator, cuts)

Future work

- Changes in cuts to improve deuteron signal/noise ratio
- Study of reconstruction efficiency as function of angle, impact point
- To be continued...