Sample detectors

Marco Incagli – 16/07/2014

	$\Delta E/E$ em (asymprotic)	$\Delta E/E$ had (asymptotic)	Charge Discrimination	PSF (*degrees*)	acceptance ($m^2 sr$)
Magnetic Detector	2%	40%	up to 5.6 TeV (e^+) up to 1.5 TeV ($\bar{p}$)	0.5	0.65
γ telescope	2%	40%	-	0.05	2.5
Calorimeter	1%	20%	-	0.5	6

three main points

1. charge confusion
2. nuclei
3. isotopes

1. charge confusion

- it depends on the ratio *r* between particle and antiparticle flux

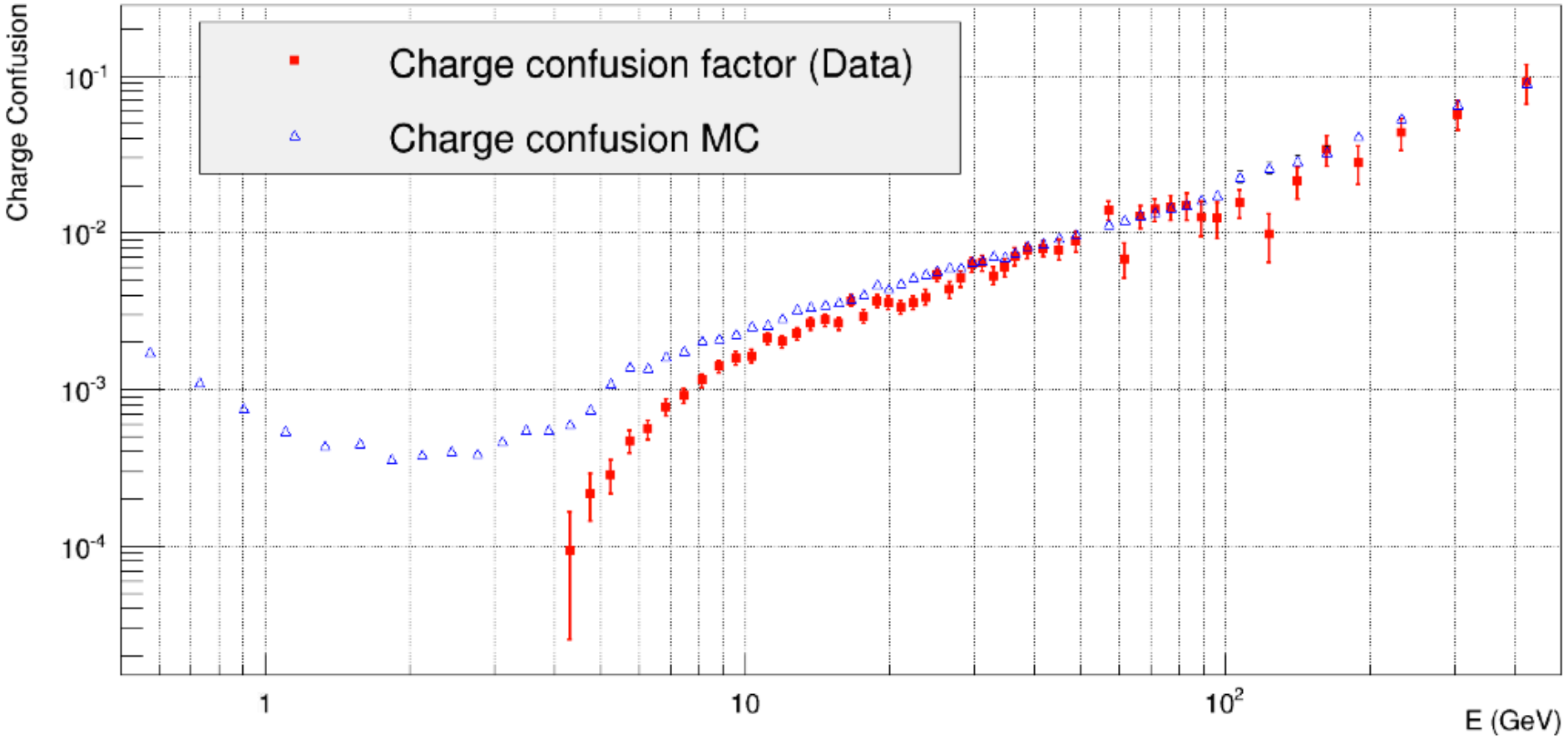
r	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
f_{CC}	0.83	0.45	0.33	0.27	0.23
R_{CC} (TeV)	5.63	3.07	2.25	1.82	1.53

- The last line is for a detector with R_{MDR} = 6.7 TeV

- The table is based on two assumptions:
  - the uncertainty on *Charge Confusion* (or *spillover*) is *10%*
  - the *maximum amount of spillover events is <10%* of the signal, i.e. *the uncertainty on the measurement due to charge confusion is <10%*
- These are somewhat arbitrary assumptions (but see next slide)

Charge confusion in AMS for positron fraction measurement

- The uncertainty in the last bin is 10% and it is dominated by *spillover effects*



difference between spillover and charge confusion

- spillover is due to finite tracker point resolution: it does not depend on the particle type;
- charge confusion has an additional contribution due to secondary hits along the track: interactions, bremmstrhalung, noise (normally less important), backsplash from calorimeter (relevant in lower layers)

2. nuclei

- Z discrimination capability not particularly related to the three categories we have identified

3. isotopes

- normally done with momentum and β measurement:

$$A = \frac{RZe}{m_n \beta c^2}\sqrt{1-\beta^2} \qquad \left(\frac{\delta A}{A}\right)^2 = \left(\gamma\frac{\delta\beta}{\beta}\right)^2 + \left(\frac{\delta R}{R}\right)^2$$

- in principle it can be done with Energy E, instead of Rigidity, but energy for nuclei is poorly determined
- Ex: Be9/Be10 needs a $\delta A/A$ of at most 5% → for $\delta\beta/\beta=10^{-2}$ it can be done up to $\gamma=5$