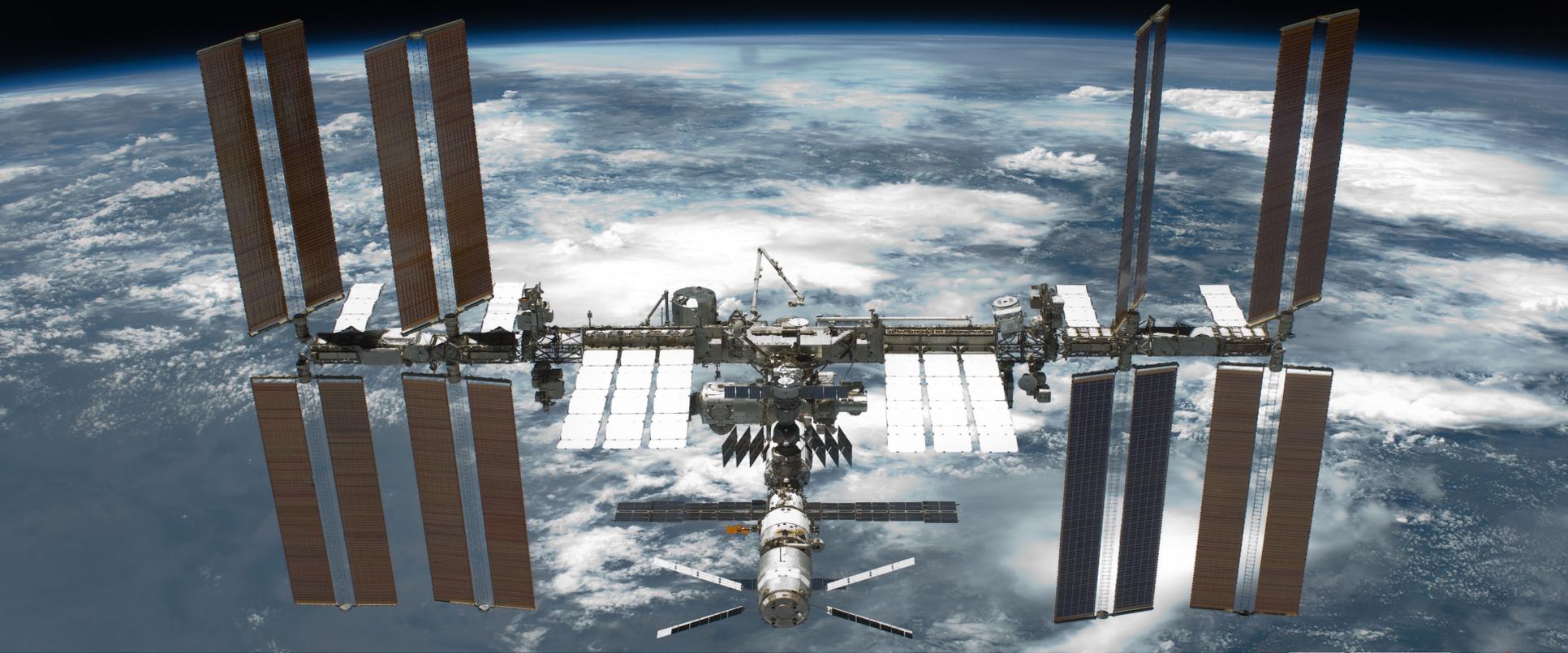


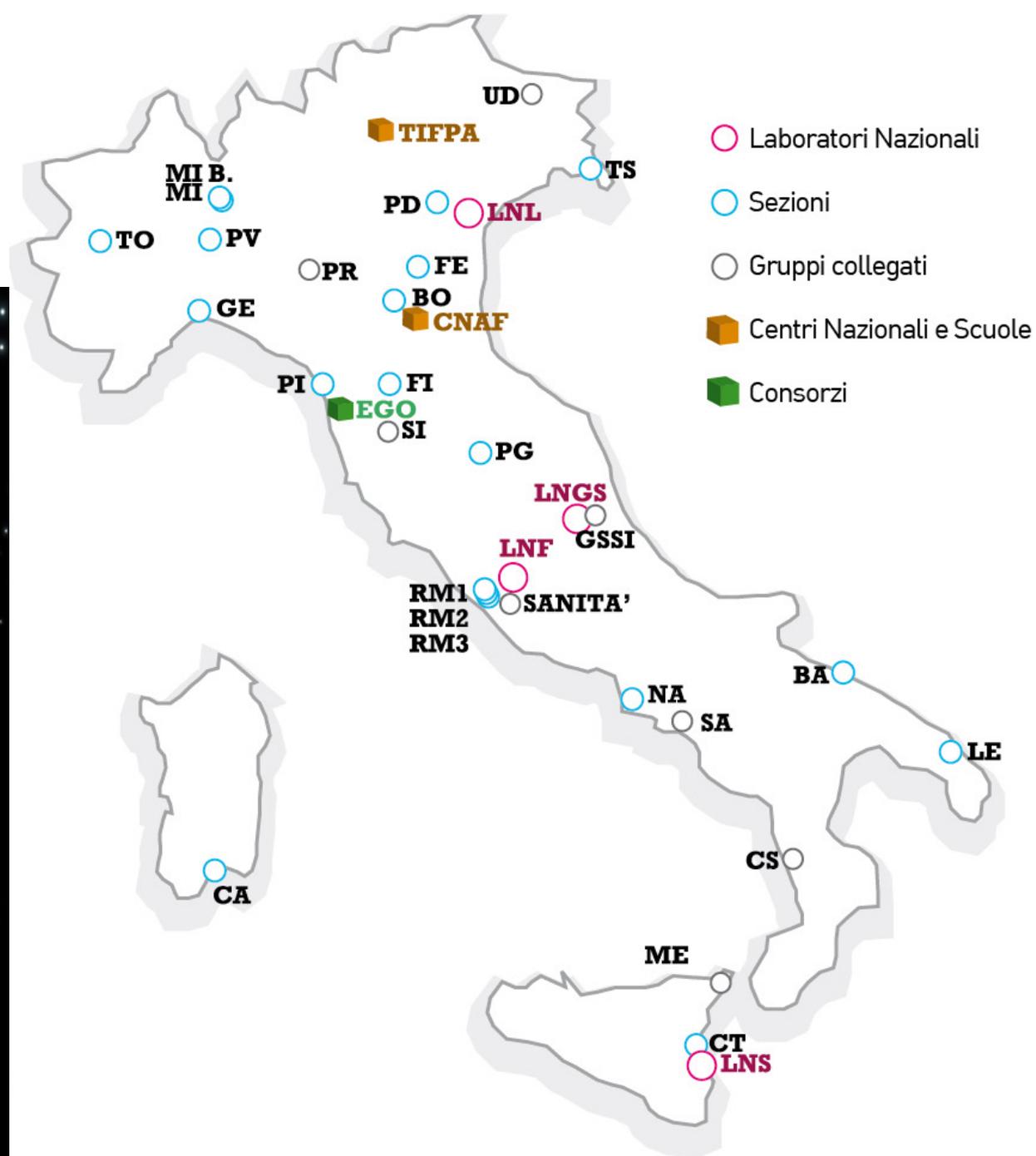
LA FISICA DELLE PARTICELLE ELEMENTARI NELLO SPAZIO: AMS-02



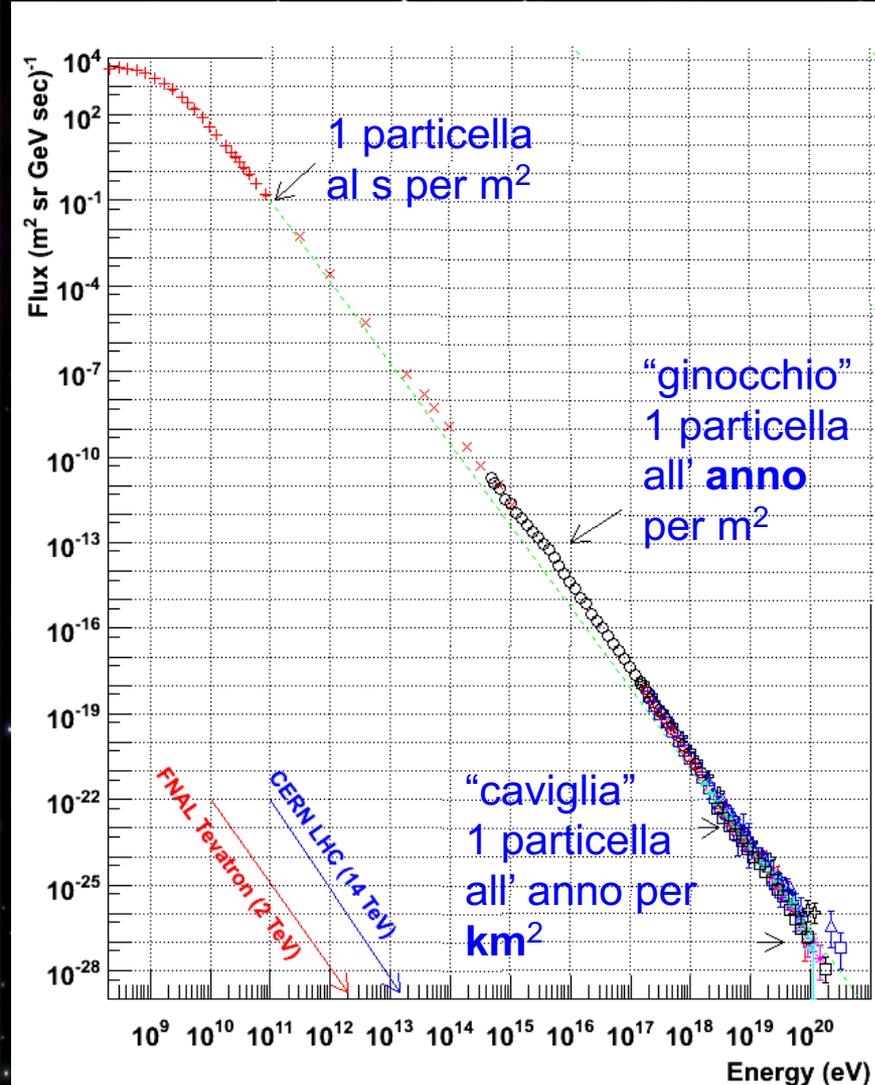
Matteo Duranti
Valerio Vagelli



Uno degli
obiettivi
scientifici
dell'INFN è lo
studio della fisica
fondamentale
tramite la misura
sperimentale dei
raggi cosmici





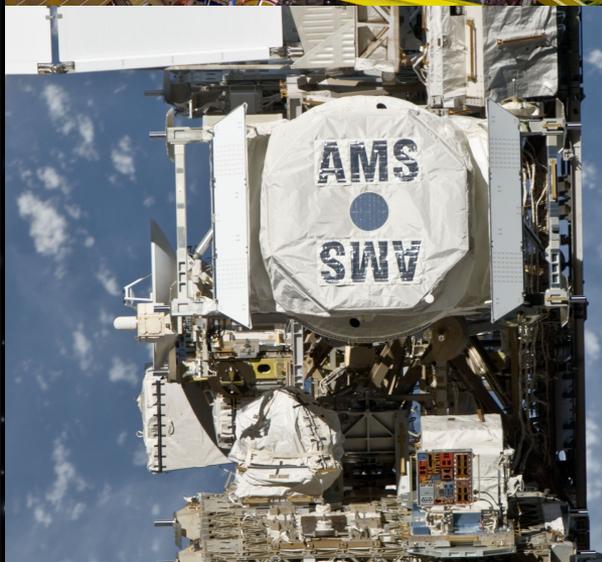


- Andamento in funzione dell'energia (i.e. “spettro”) approssimabile con una legge di potenza:

$$\Phi(E) \sim E^{-\gamma}$$

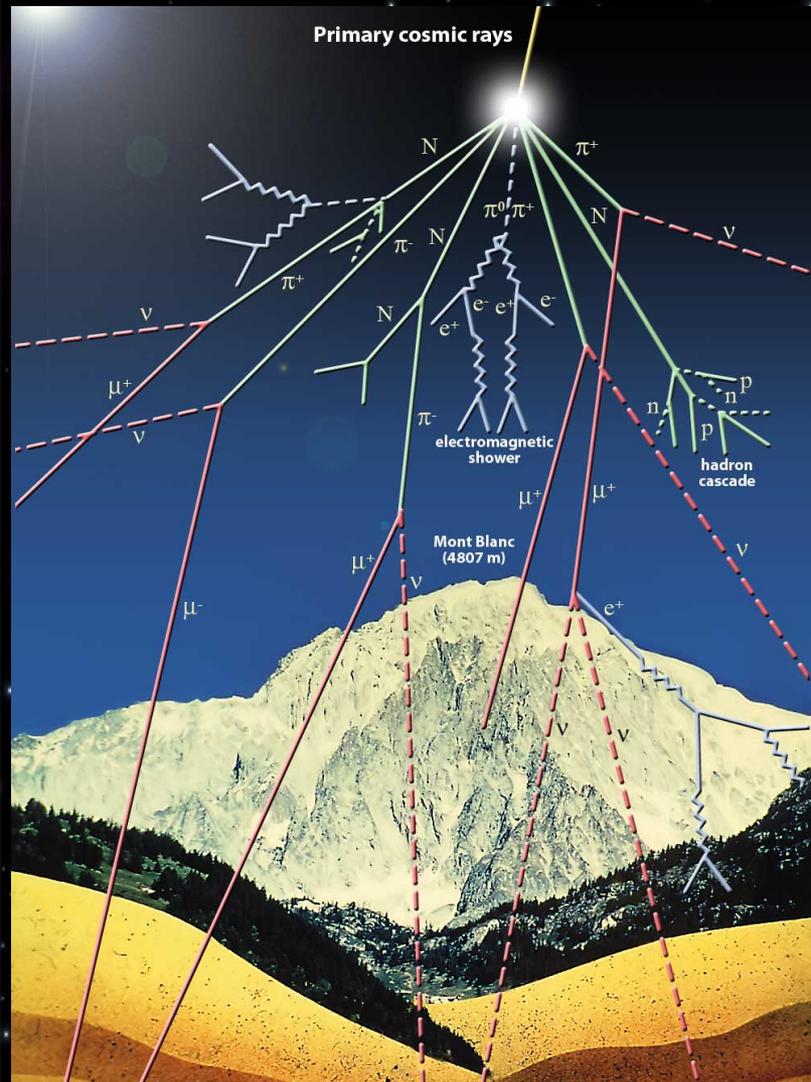
con $\gamma \sim 2.7-3$

- Composizione e abbondanze relative delle varie specie funzione dell'energia
- Energia massima (finora rivelata!) molto maggiore di quella attualmente producibile dall'uomo con acceleratori di particelle



Particle	Year	Discoverer (Nobel Prize)	Method
e^-	1897	Thomson (1906)	Discharges in gases
p	1919	Rutherford	Natural radioactivity
n	1932	Chadwick (1935)	Natural radioactivity
e^+	1933	Anderson (1936)	Cosmic Rays
μ^\pm	1937	Neddermeyer, Anderson	Cosmic Rays
π^\pm	1947	Powell (1950) , Occhialini	Cosmic Rays
K^\pm	1949	Powell (1950)	Cosmic Rays
π^0	1949	Bjorklund	Accelerator
K^0	1951	Armenteros	Cosmic Rays
Λ^0	1951	Armenteros	Cosmic Rays
Δ	1932	Anderson	Cosmic Rays
Ξ^-	1932	Armenteros	Cosmic Rays
Σ^\pm	1953	Bonetti	Cosmic Rays
p^-	1955	Chamberlain, Segre' (1959)	Accelerators
anything else	1955 \implies today	various groups	Accelerators
$m_\nu \neq 0$	2000	KAMIOKANDE	Cosmic rays

Allacciate le cinture!



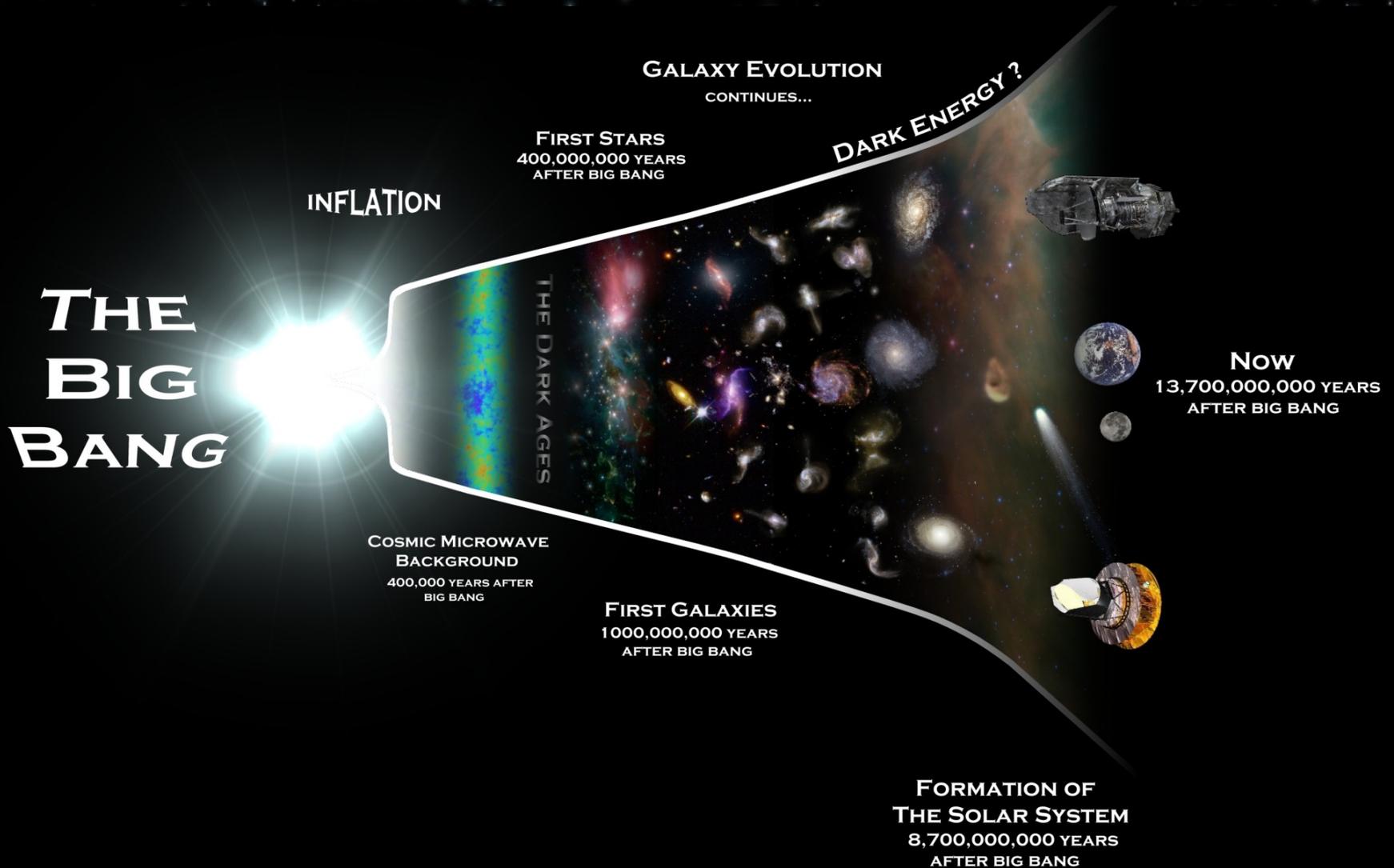
La maggior parte dei CR non raggiunge terra per via dell'interazione con l'atmosfera



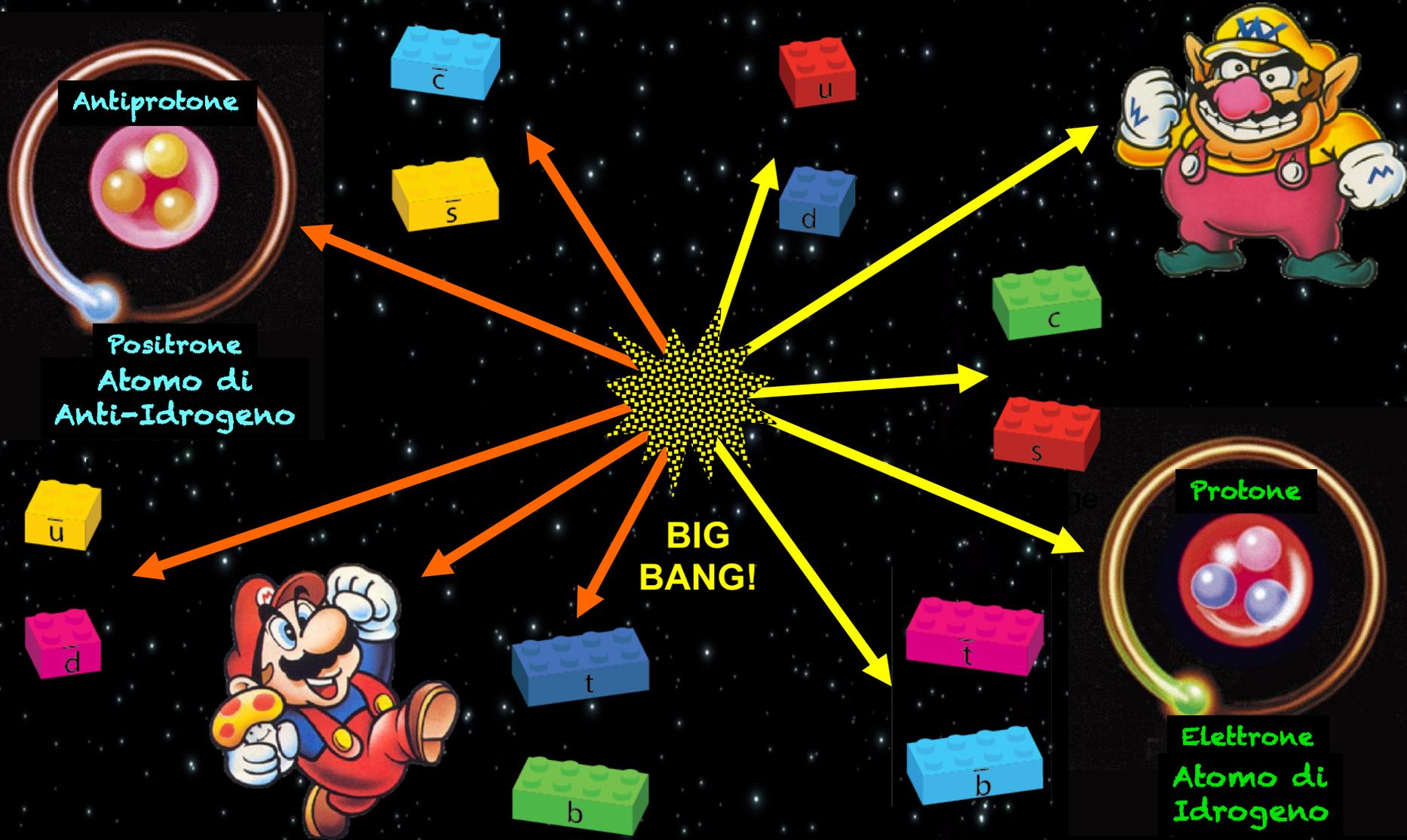
Andiamo sopra l'atmosfera (almeno sopra la troposfera, nella stratosfera, raggiungibile anche via pallone)!



Fisica delle Particelle nello spazio!

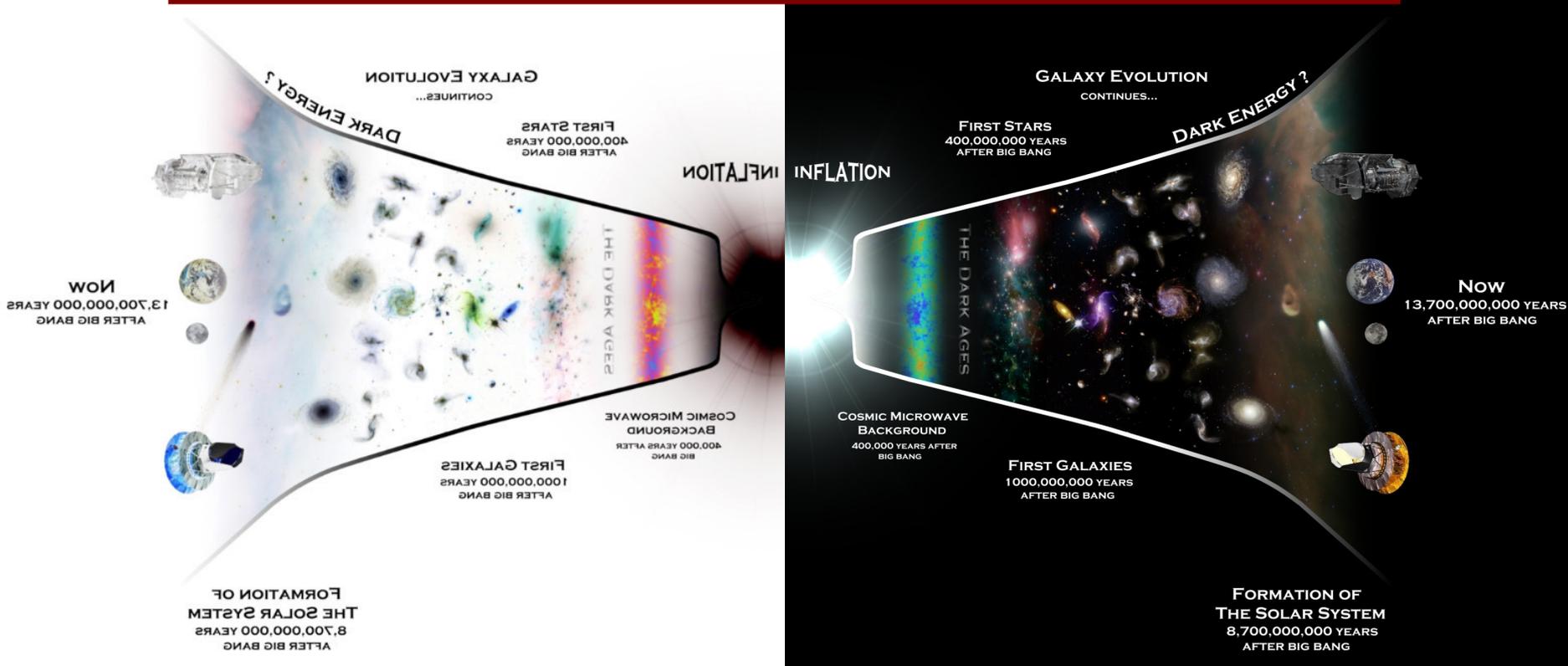


Materia & Antimateria

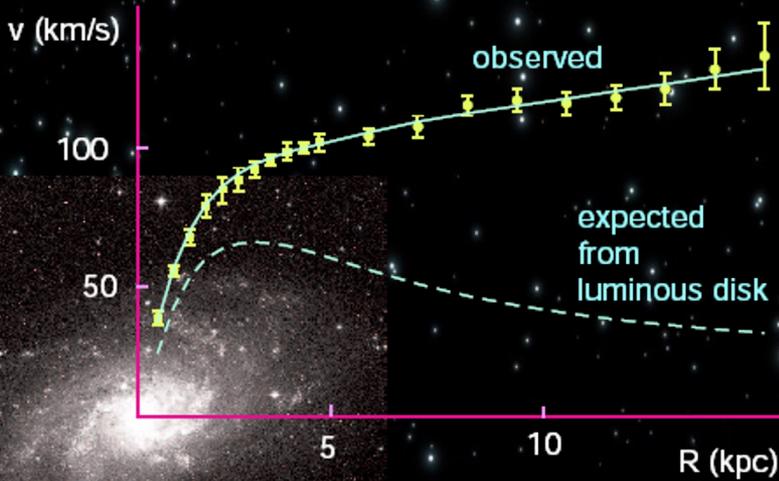


Dirac's Nobel speech

*“We must regard it rather as **an accident** that the Earth [...] contains a preponderance of negative electrons and positive protons. It is quite possible that for some stars it is the other way about.”*

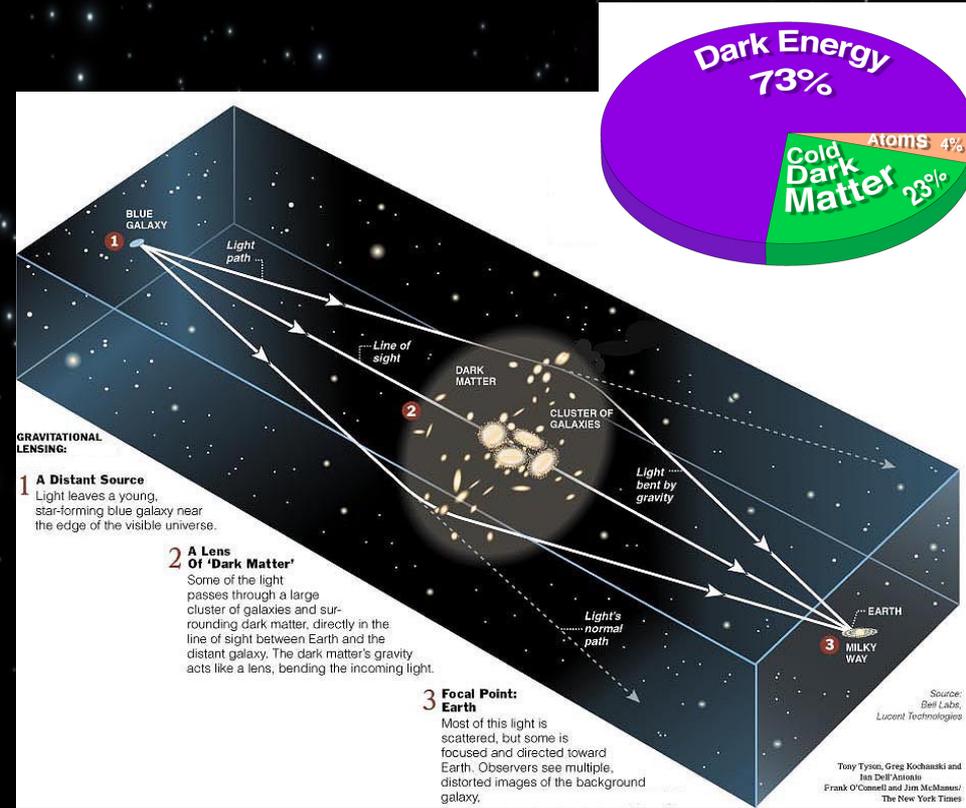


Materia Oscura (Dark Matter, DM)



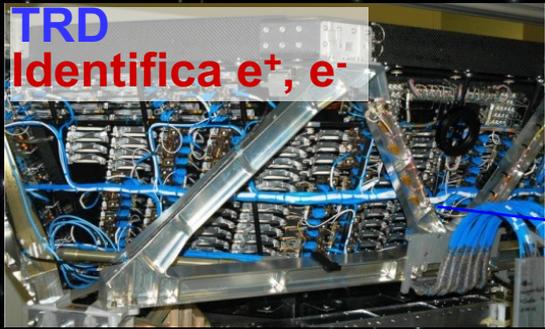
M33 rotation curve
(fig. 1)

La velocità di rotazione degli “oggetti” nelle galassie è in contraddizione con quella prevista assumendo come massa della galassia solo quella visibile

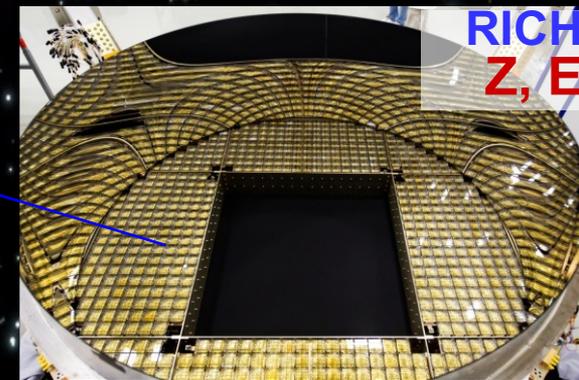
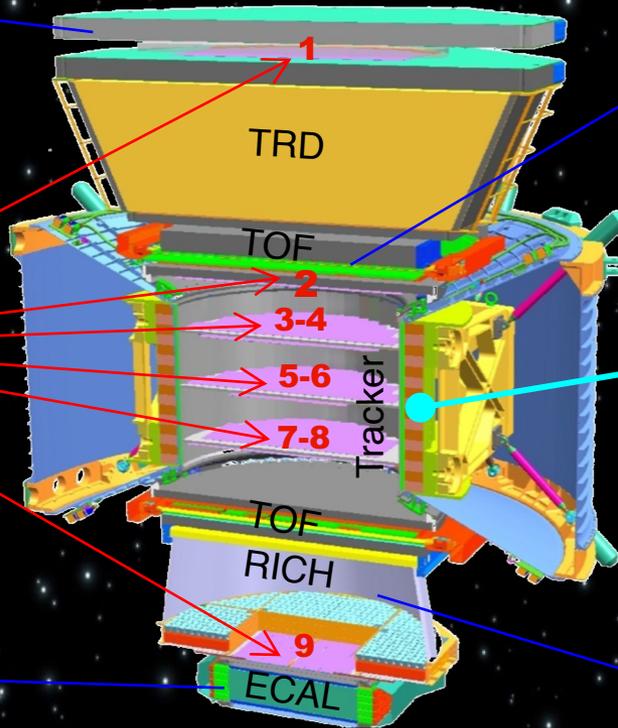


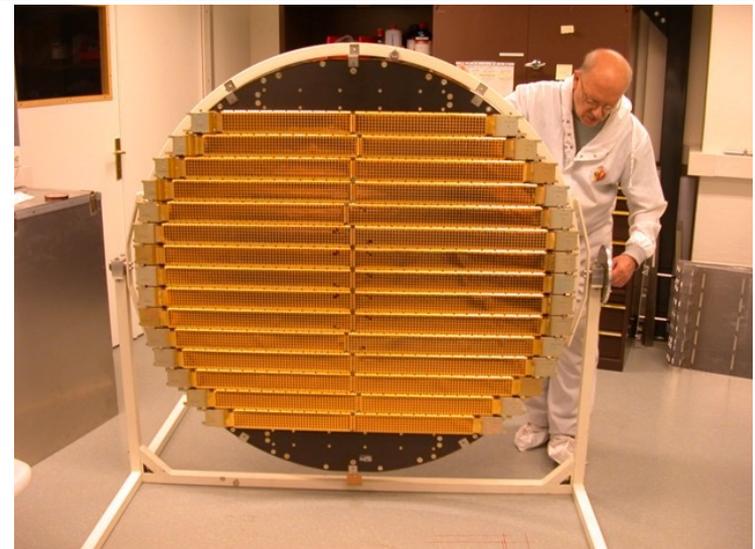
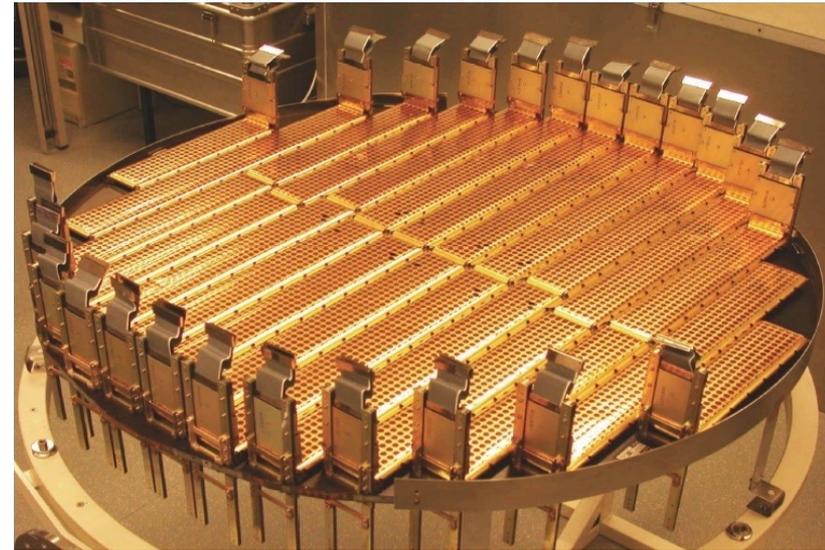
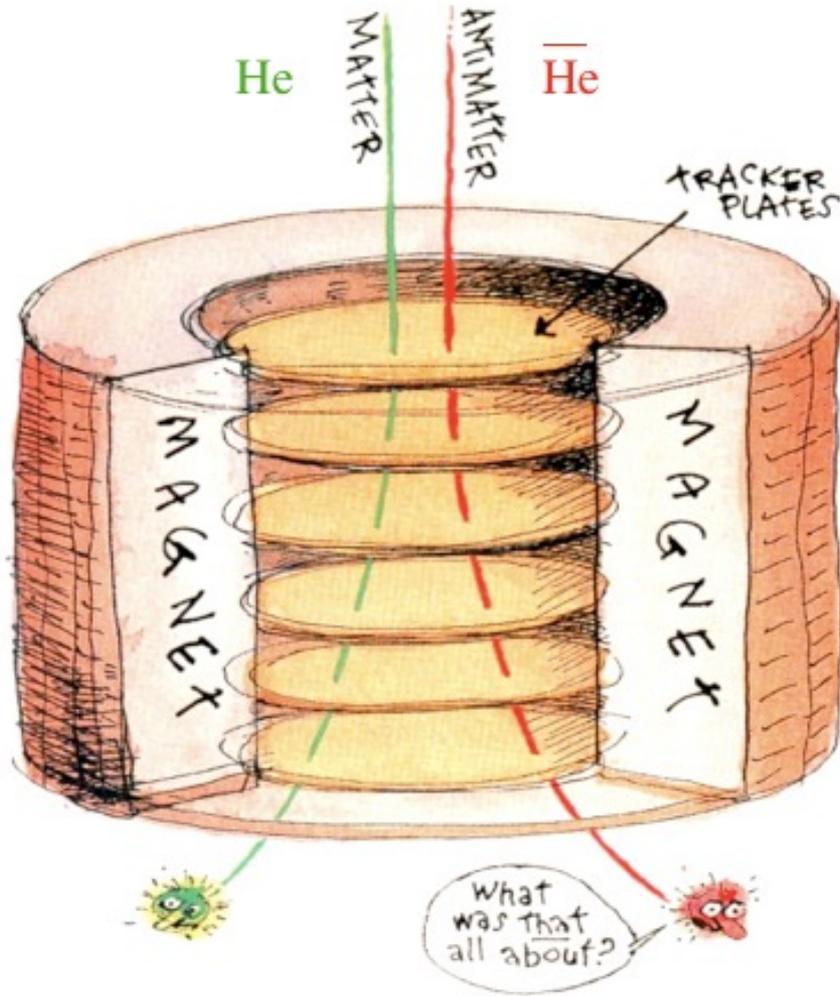
Un “agglomerato”, invisibile, di materia oscura può agire come “lente gravitazionale” e deformare l’immagine “apparente” di una sorgente luminosa

Il rivelatore AMS-02

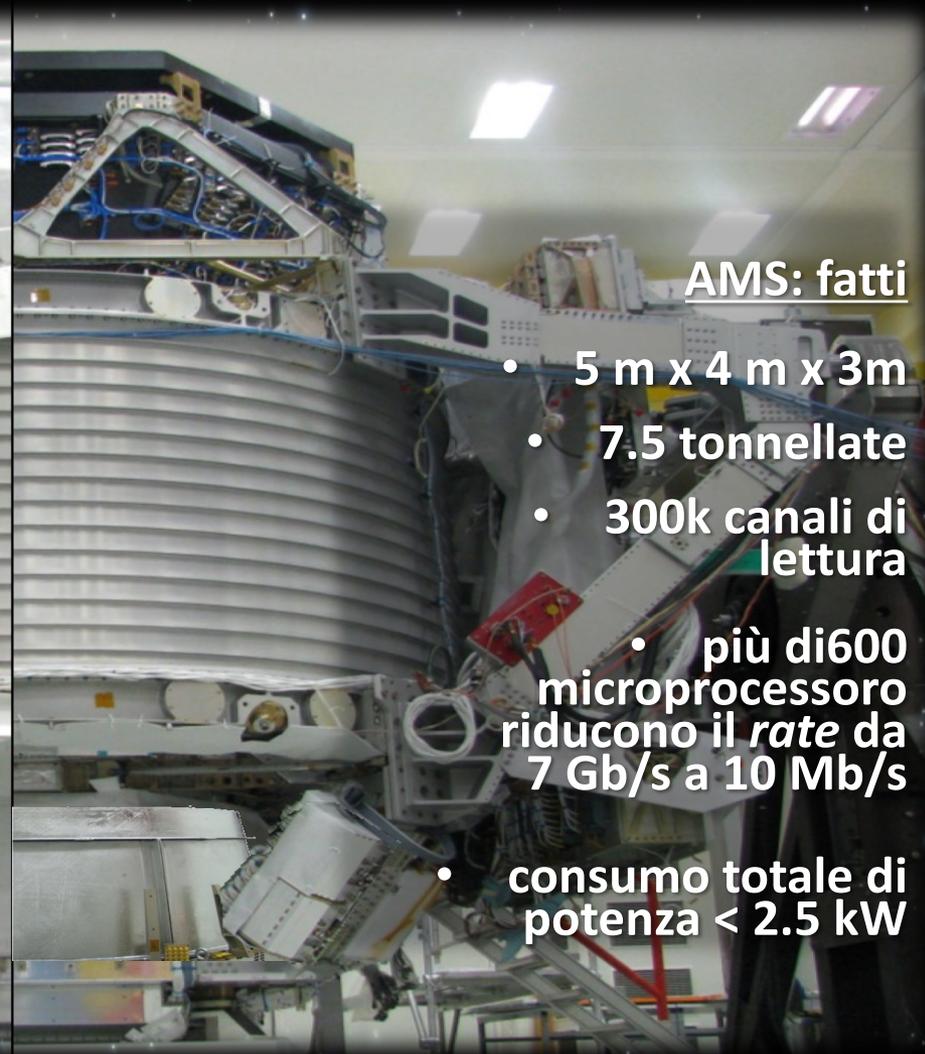
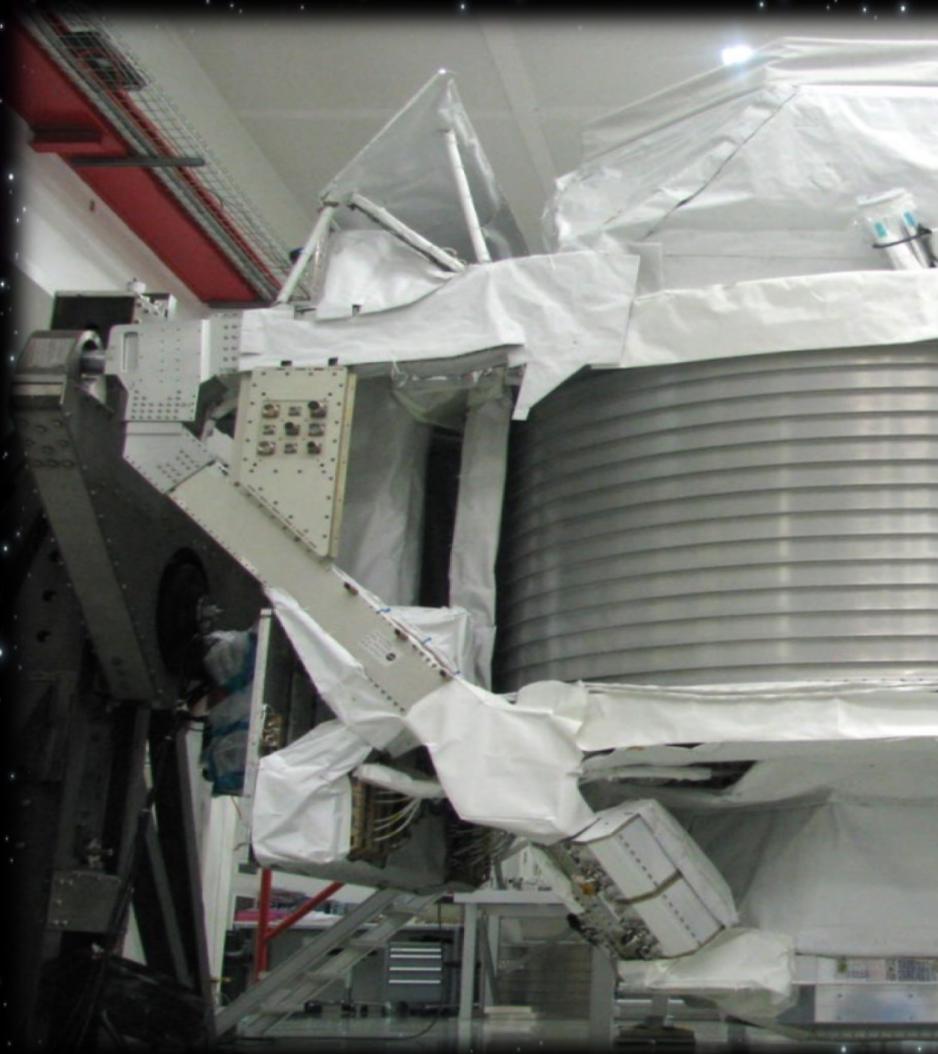


Z, P sono misurate indipendentemente da Tracker, RICH, TOF e ECAL





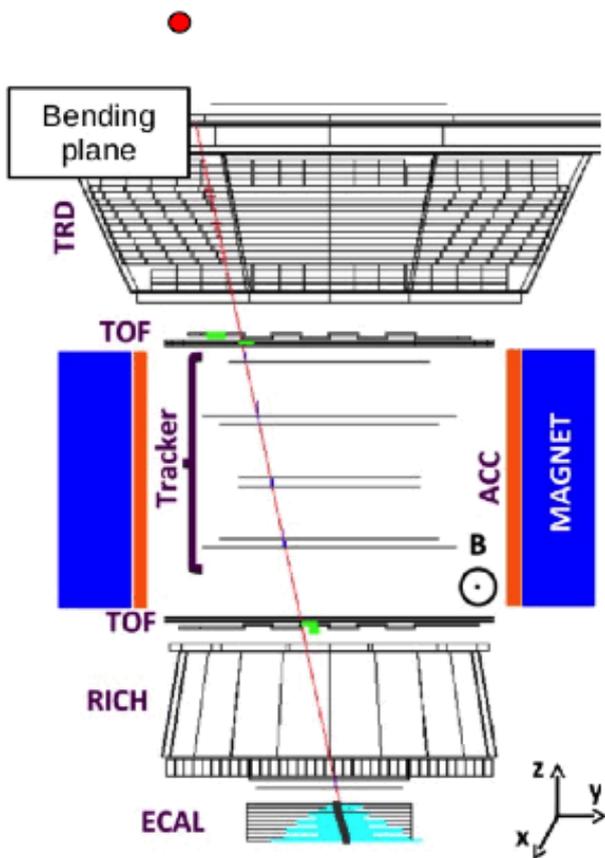
AMS-02 assemblato



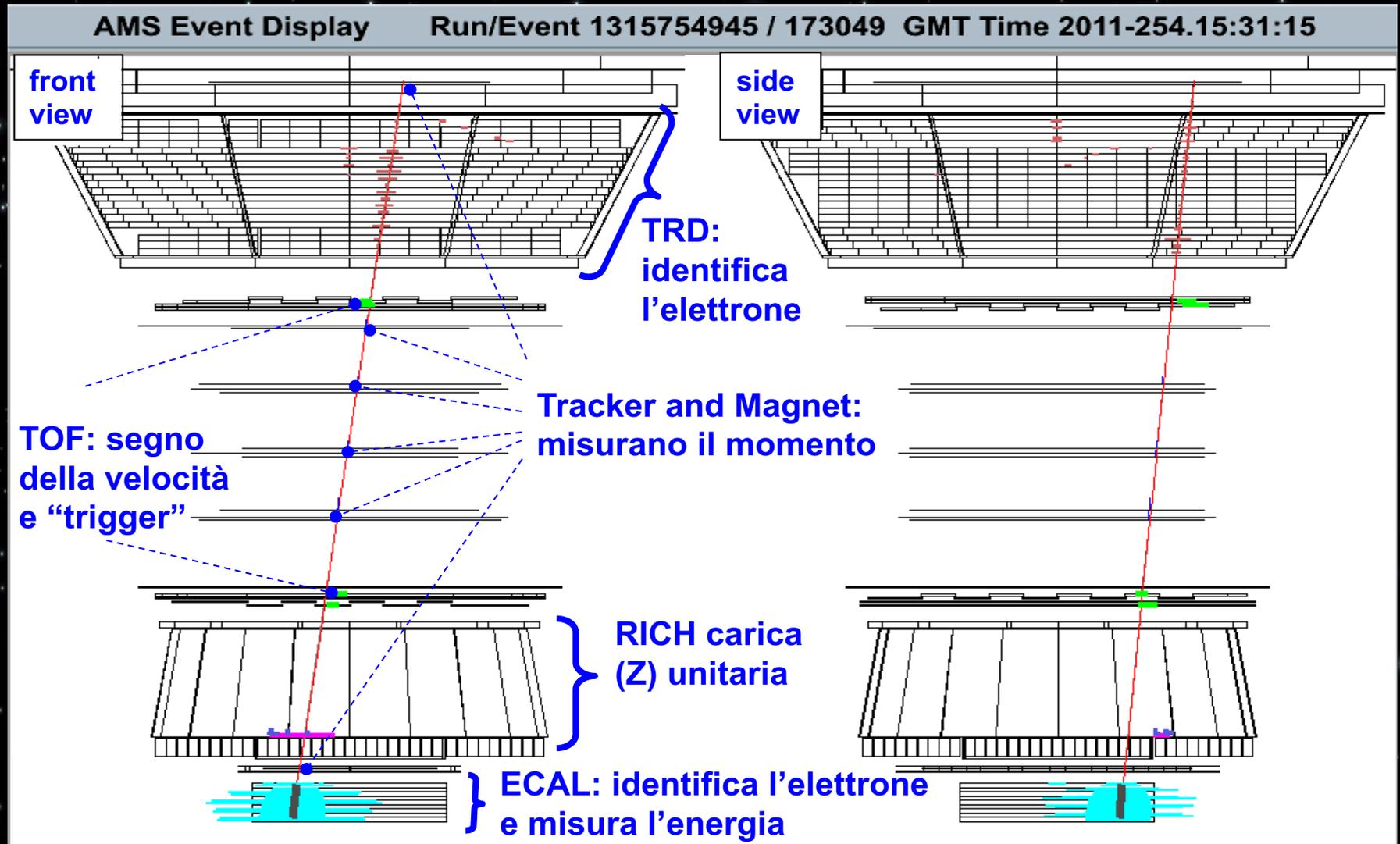
AMS: fatti

- 5 m x 4 m x 3m
- 7.5 tonnellate
- 300k canali di lettura
- più di 600 microprocessore riducono il *rate* da 7 Gb/s a 10 Mb/s
- consumo totale di potenza < 2.5 kW

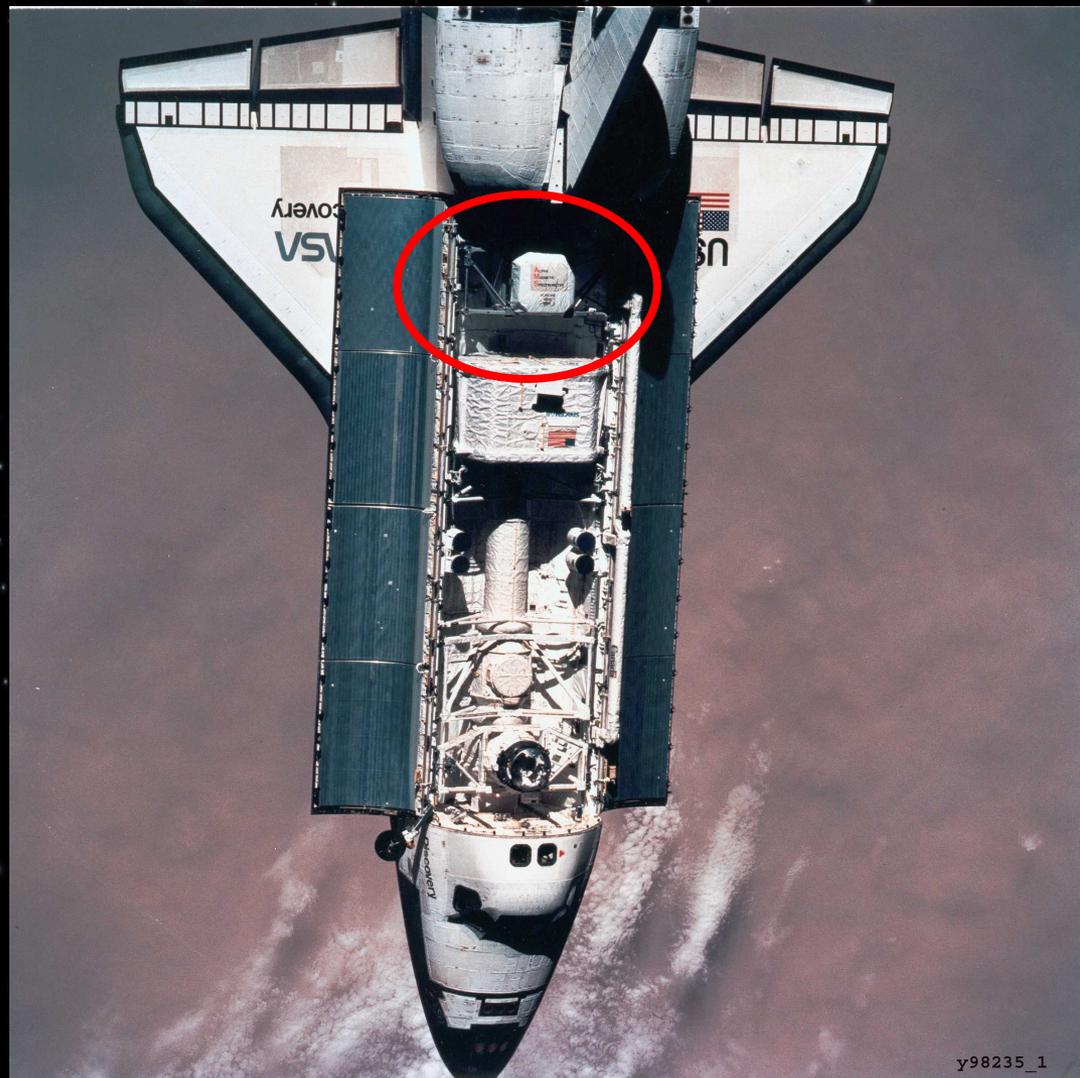
Le "foto" scattate da AMS



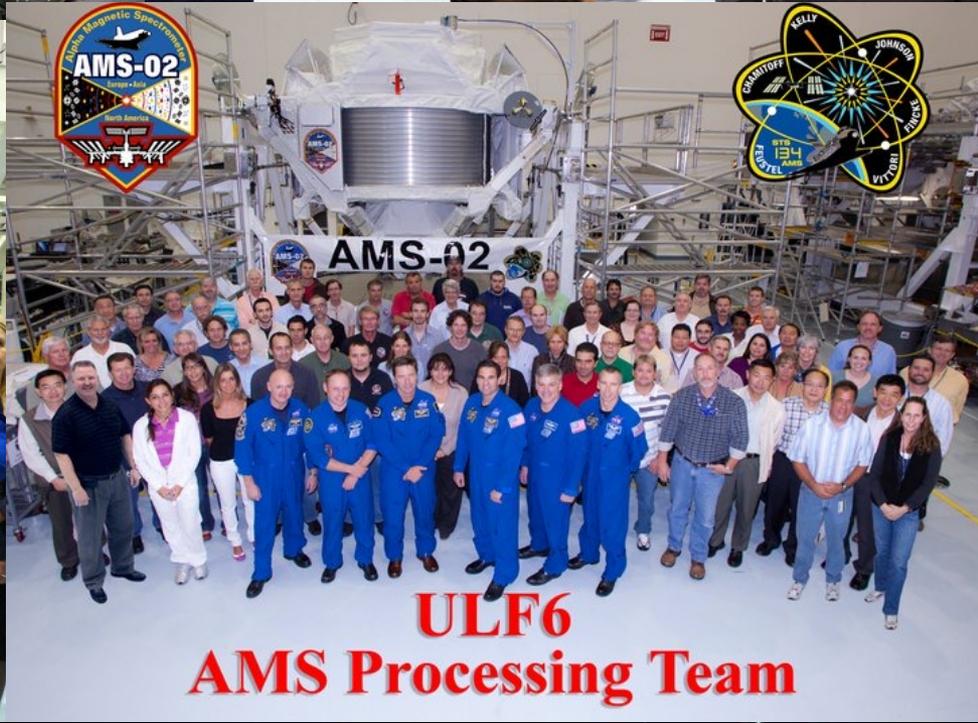
	e^-	p	He
TRD 20 layers	=====	=====	=====
TOF 4 layers	=====	=====	=====
TRK 9 layers	=====	=====	=====
RICH	=====	=====	=====
ECAL 20 layers	=====	=====	=====



- 10 giorni di presa dati in orbita:
 - 400 Km di altitudine
 - latitudini $< 51.7^\circ$
 - tutte le longitudini
- 10^8 eventi acquisiti
- risultati di fisica
(Phys. Rep. 366 (2002) 331)
 - misure di precisione dei flussi primari
 - rivelazione di particelle secondarie (quasi-trapped)
 - limite sull'antimateria a 10^{-6}



y98235_1





EVACUATION INSTRUCTIONS

EVACUATION SIGNAL: LONG BLASTS ON THE WARNING WARBLER.
LEAVE THE AREA IMMEDIATELY.
USE THE YELLOW STRIPES AS PRIMARY EVACUATION ROUTES.
USE THE RED STRIPES AS SECONDARY EVACUATION ROUTES.
DO NOT USE ELEVATORS.
DO NOT ENTER RESTRICTED AREAS.
FOLLOW ALL ADDRESS INSTRUCTIONS.
STAY WITHIN THE PERIMETER UNLESS OTHERWISE INSTRUCTED.
DO NOT CROSS THE LINE OF THE GREEN AND WHITE STRIPED.

STOP

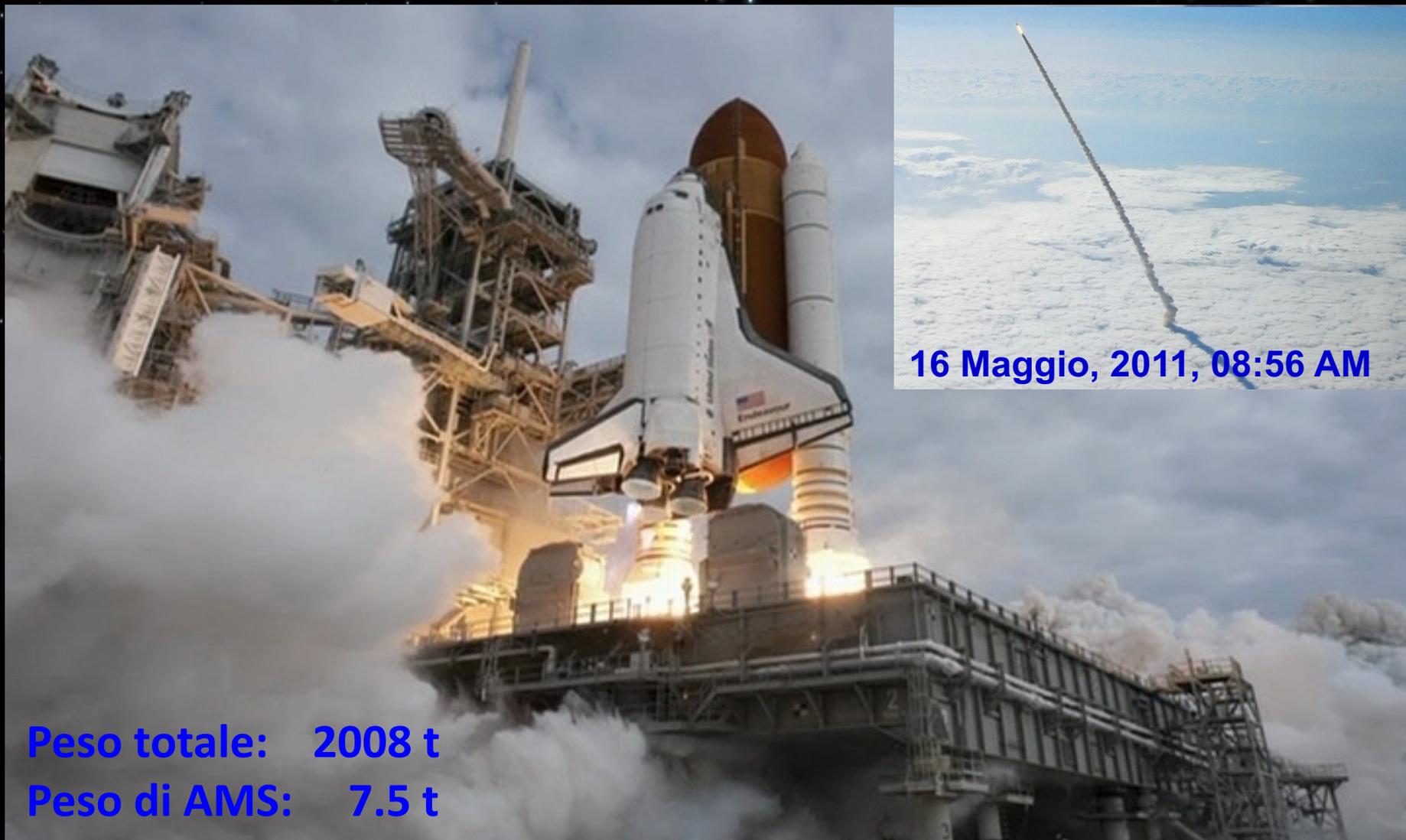
CAUTION

NOV04

NOV04



© Michele Famiglietti / AMS Collaboration

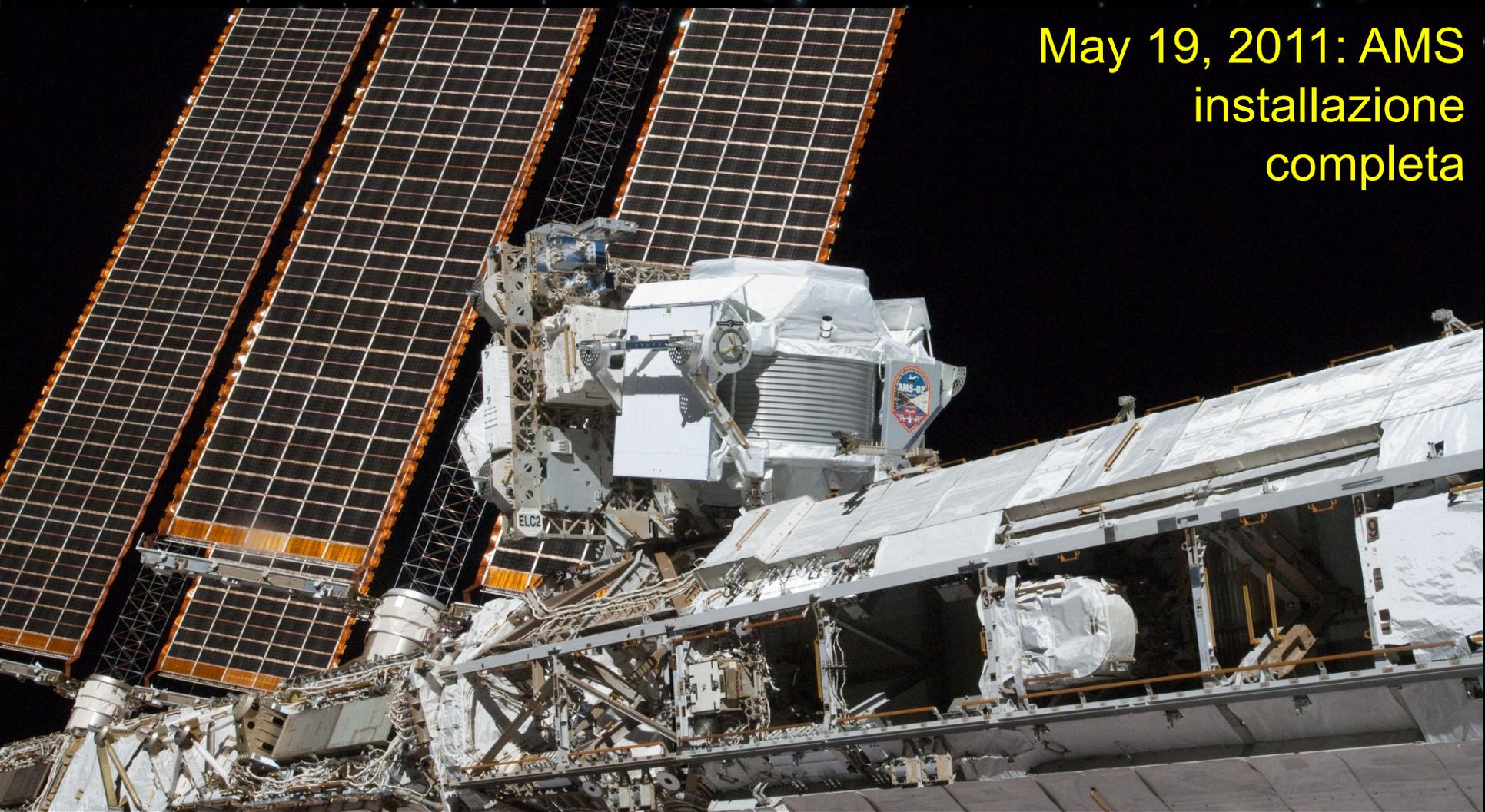


Peso totale: 2008 t
Peso di AMS: 7.5 t

Houston, JSC – 16 Maggio, 2011 @ 07:56 AM



May 19, 2011: AMS
installazione
completa



Una bella esperienza

Il gruppo del Tracker aspetta l'installazione



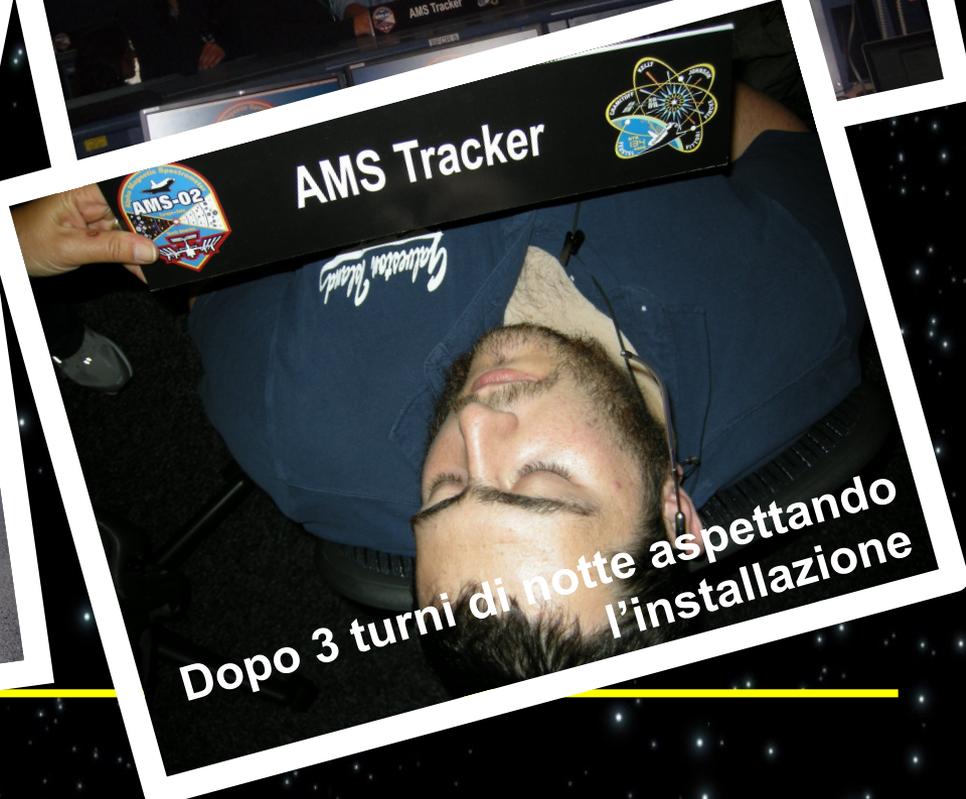
Il gruppo del Tracker aspetta il lancio



AMS-Italy con il "nostro" shuttle



Dopo 3 turni di notte aspettando l'installazione











State connessi per nuova fisica!



STS-134/ULF6
Alpha Magnetic Spectrometer Team
28 February 2011
Kennedy Space Center

