Expected Performances of the scintillator counters Time Of Flight system of the AMS-02 experiment

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The requirements for the TOF

- the fast trigger to the whole experiment;
- measurement of the CR time of flight with a resolution to distinguish upward from downward going particles at a level of 10^{-9} level, and electrons from antiprotons at low momentum;
- the measurement of the absolute charge in addition to the measurement done by the tracker and the rich.

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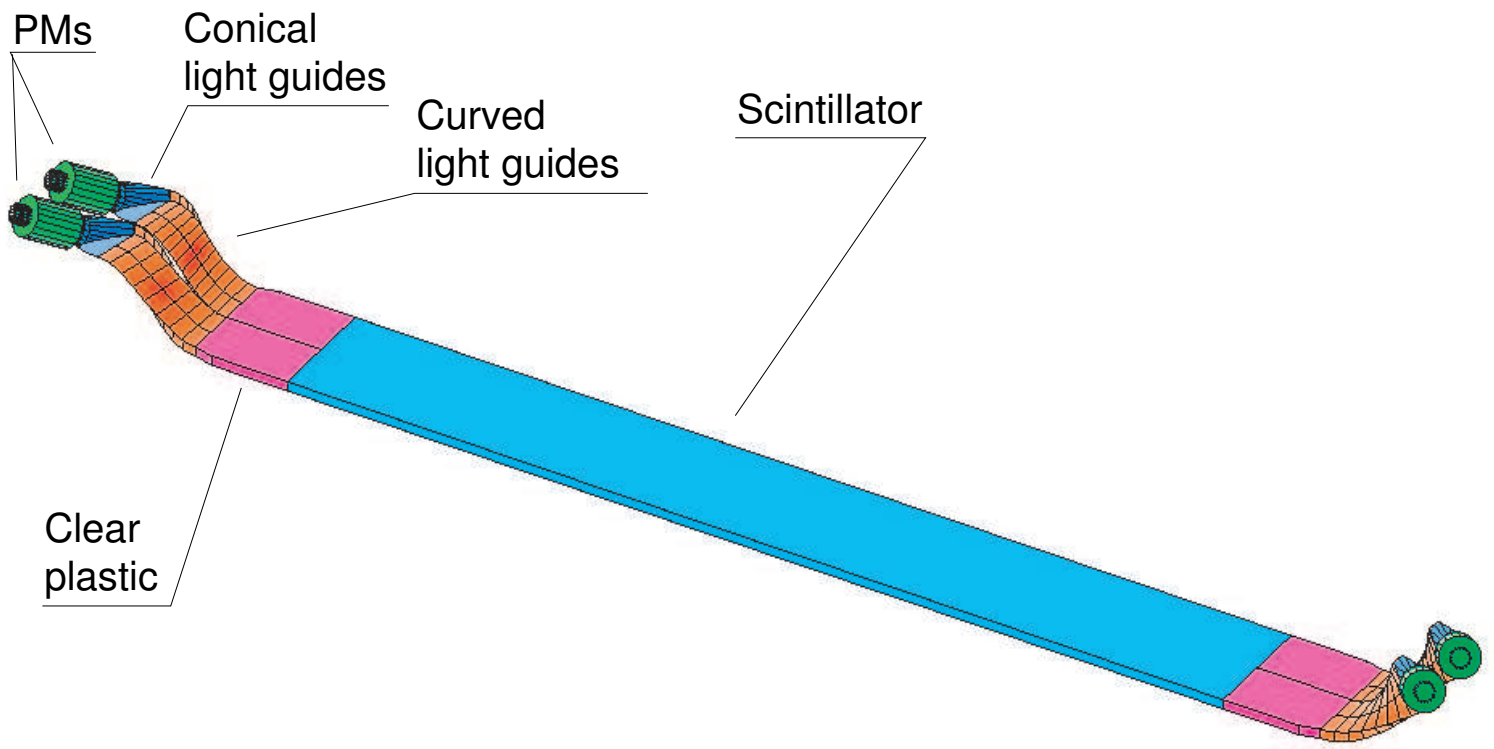
- 4 planes, each covering a circular area of $\sim 1.2\ m^2$
- 12 cm wide scintillators pads for plane ($0.5\ cm$ overlapped)
- to minimize the angle between the PM axis and $\vec{B}$ => curved and twisted light guides

The TOF-02 design and mechanics



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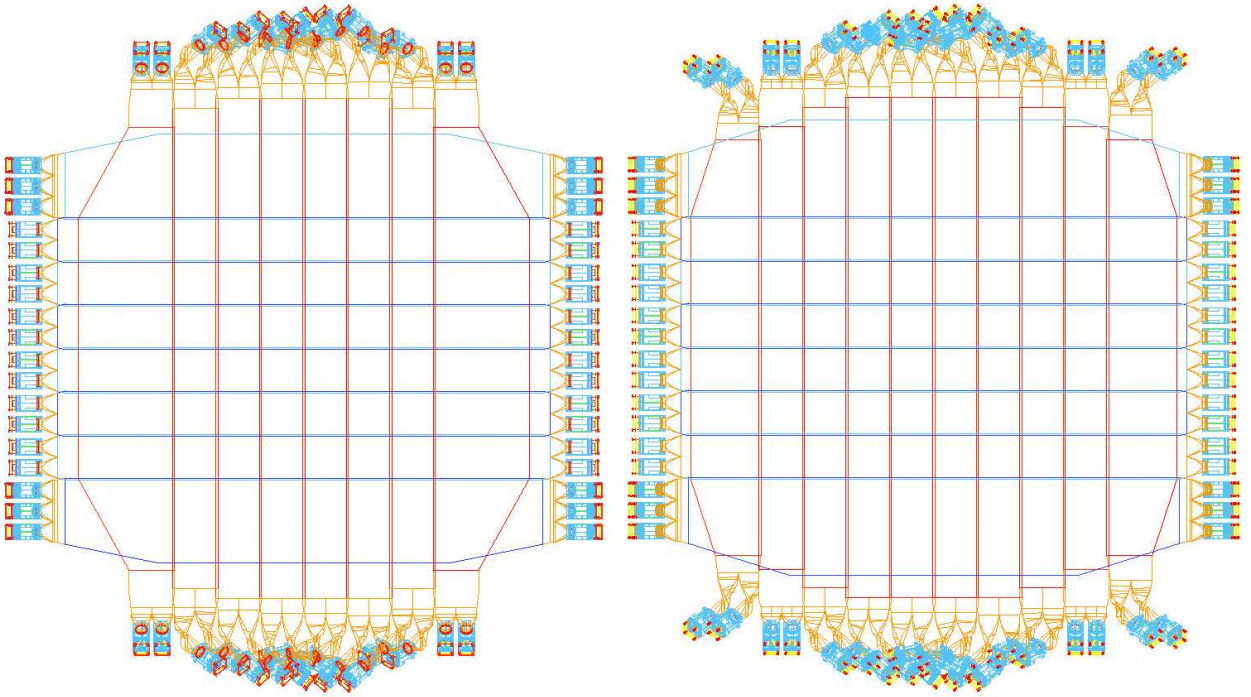


upper (left) and lower (right) TOF planes

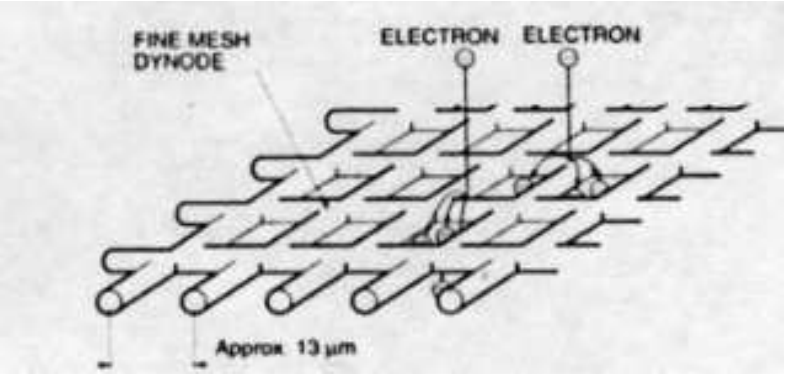
The TOF-02 design and mechanics

An exploded view
of the complete
TOF structure

The Fine Mesh PMs

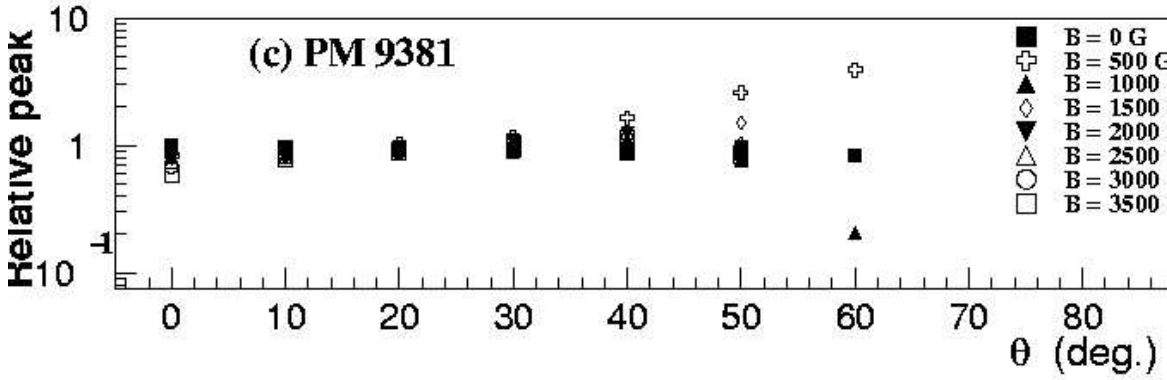
Hamamatsu
R5946

- bialkali photocathode
- 16 bialkali mesh dynodes
- max spectral response at 450nm (QE $\sim 20\%$)



The Fine Mesh PMs

magnetic field effect on PM response



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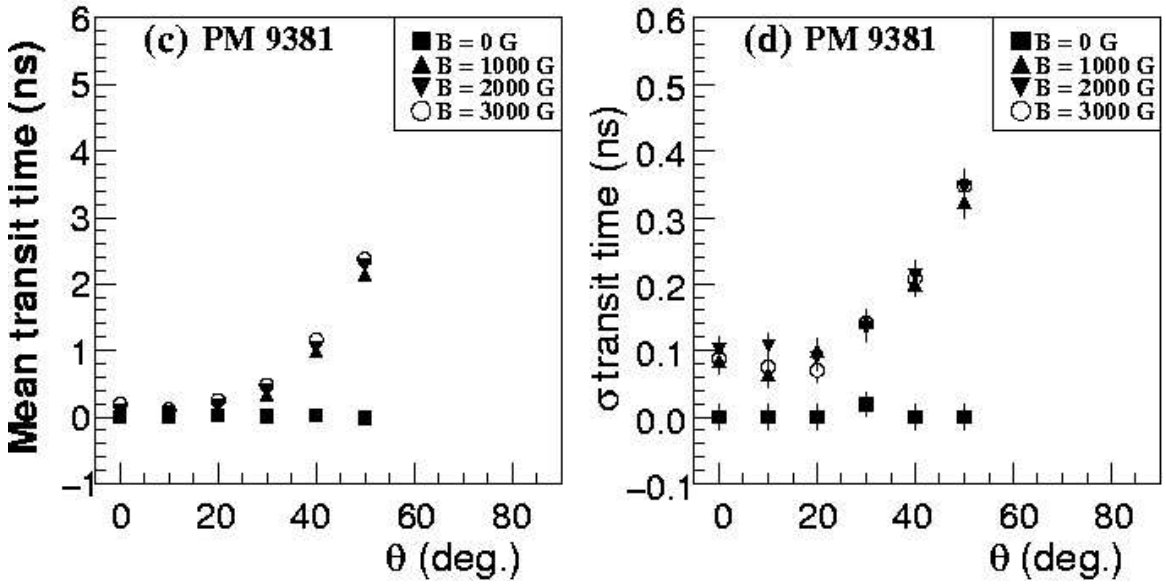
magnetic field effect on time response



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- calibration results and PMs displacement are on line (http://ams.bo.infn.it/database)

Counters and space qualification tests

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- Photostatistics *(N. of photons in the center)*
- Intrinsic time resolution *(count. sides time difference)*
- Time of flight resolution *(count. - ref. time difference)*

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- A complete counter was also tested
- Results are encouraging

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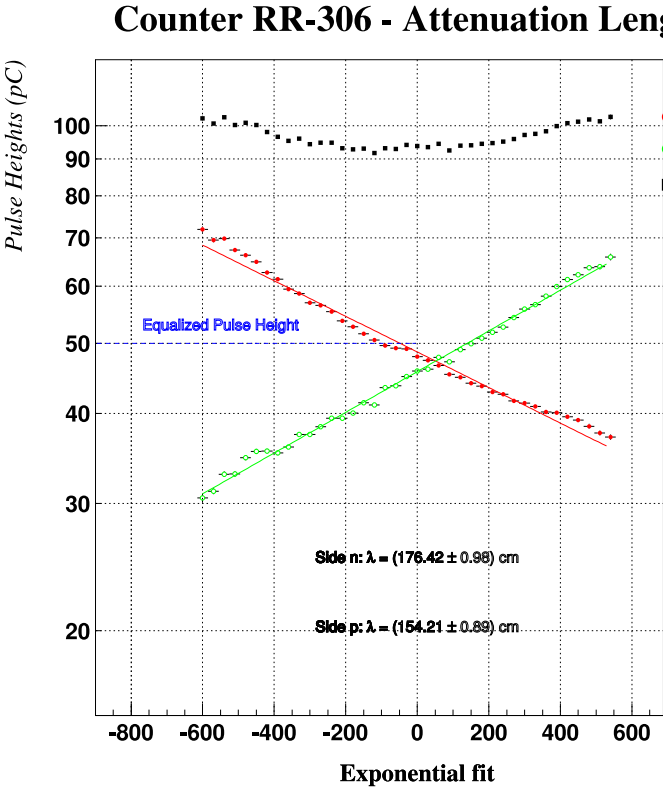
  error: $\pm 1 - 2\%$



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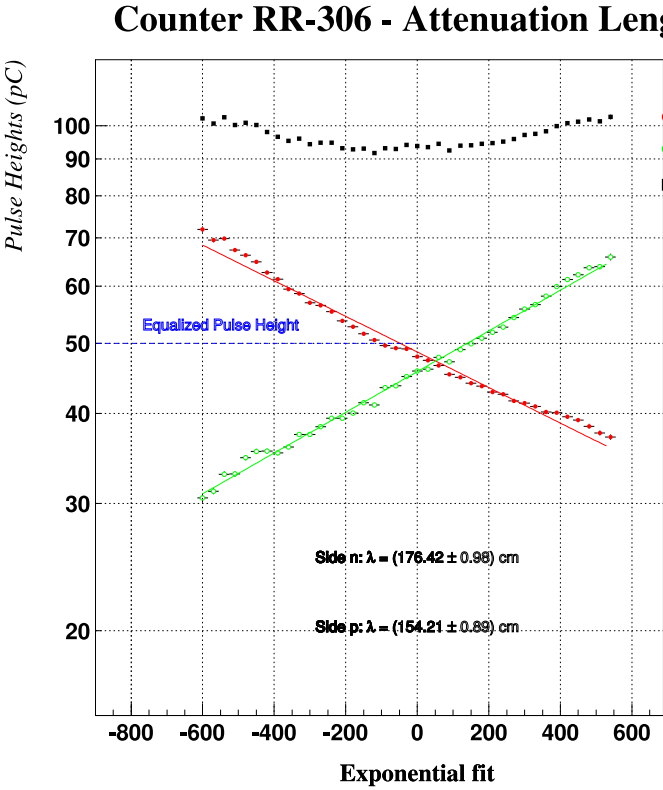

AMS-BO internal notes - http://ams.bo.infn.it/Notes

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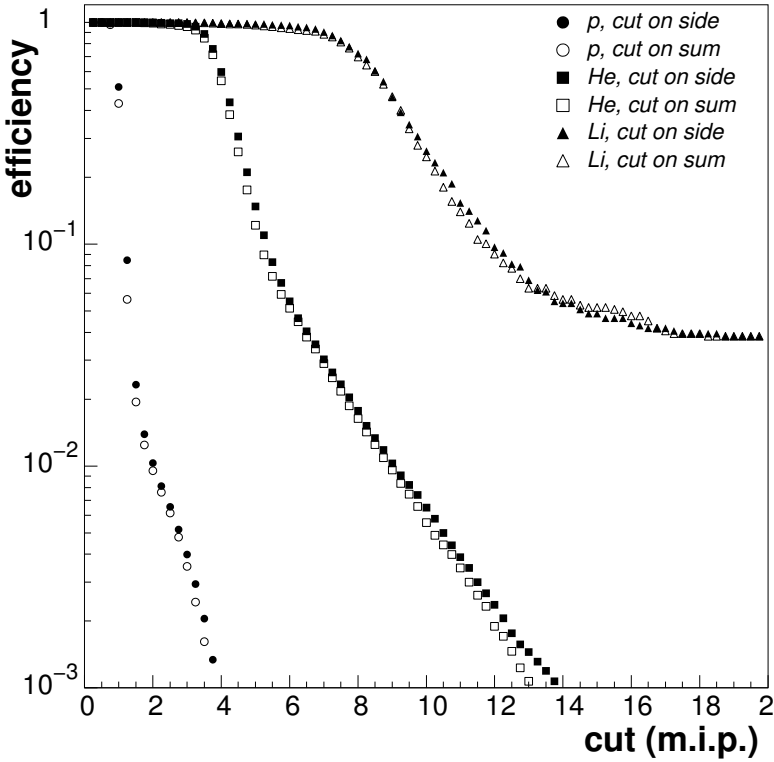
- The TOF flags CRs with $Z > 1$
- A threshold of 3.5 mip can suppress 99% of the protons without affecting eavier ions efficiency



Beam test results

Four TOF scintillators were used during ion test beam at CERN 2003

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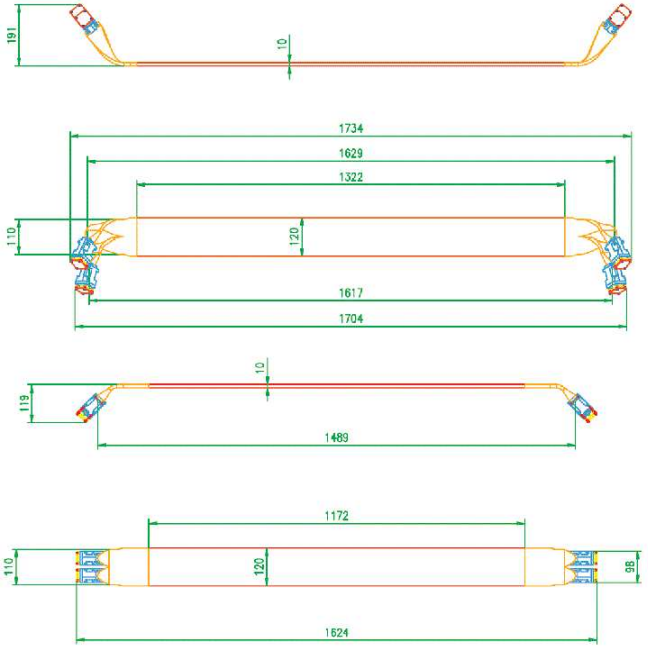
the two worst counters for guides: "C2" and "C3"



Counter C2: bended and twisted light guides.

Counter C3: bended light guides.

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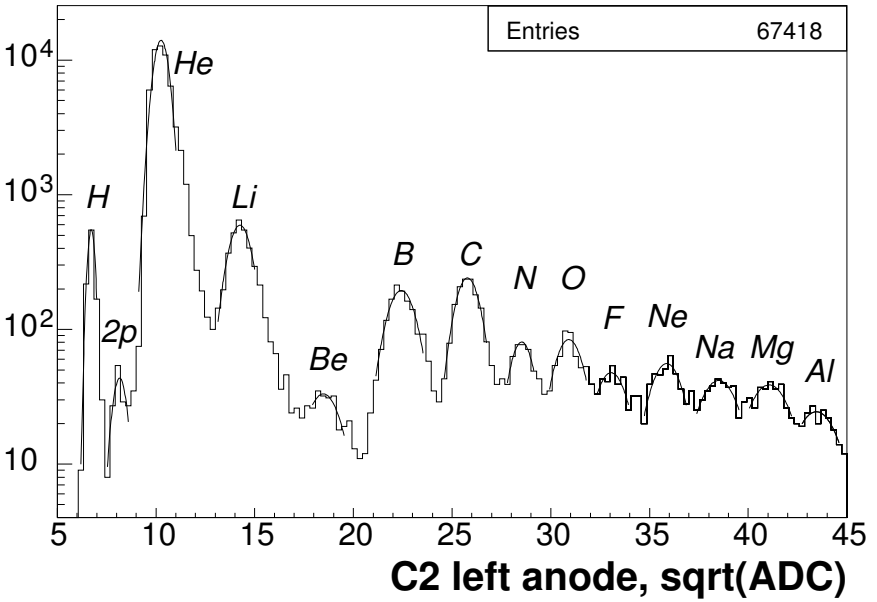
Ion charge is well measured by all counters



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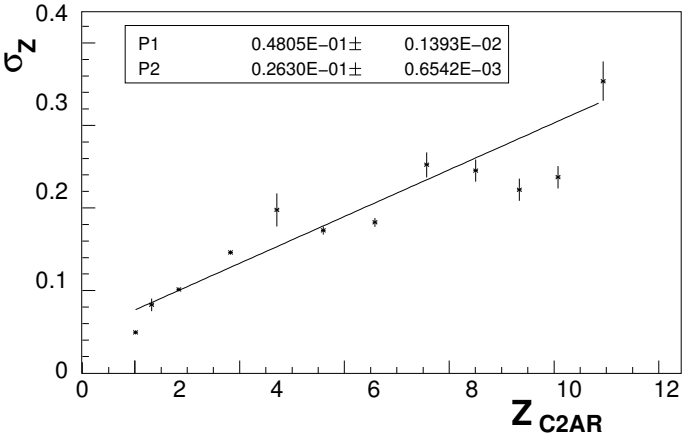
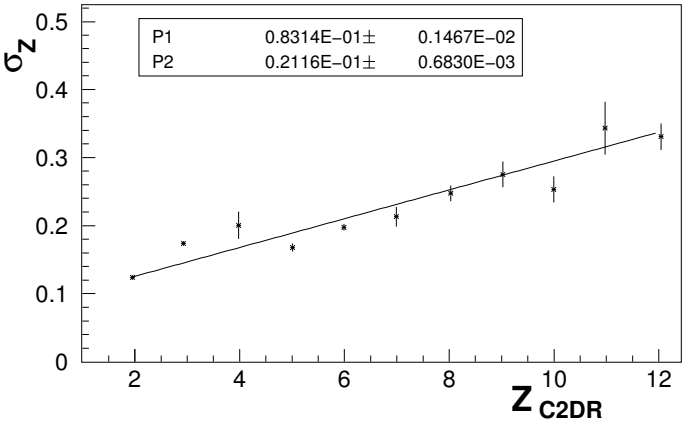
charge resolution for anodes and dynodes is computed





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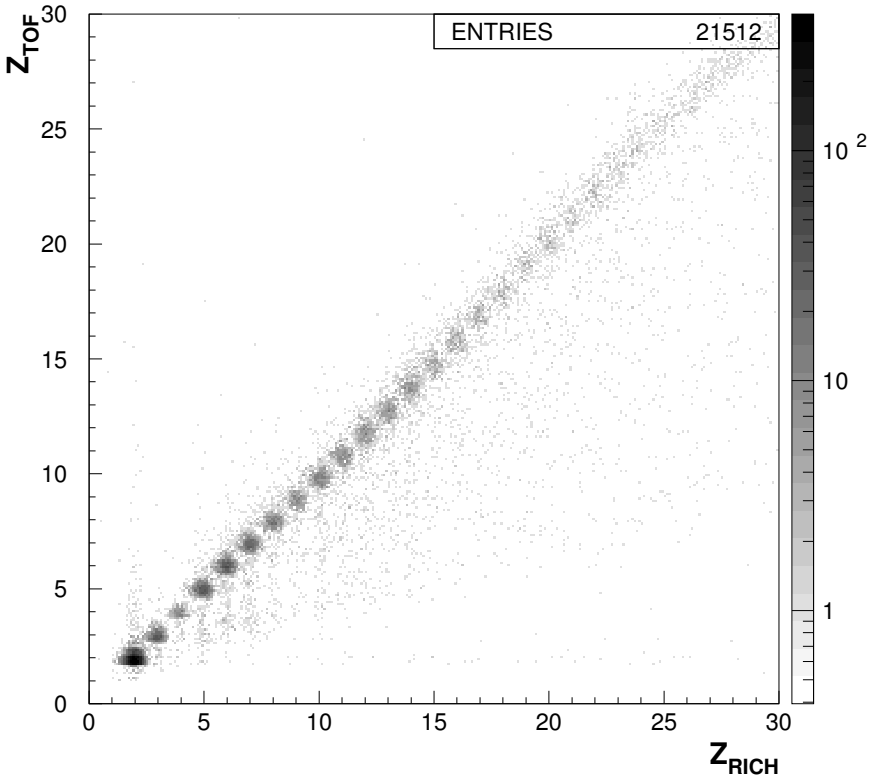
the TOF data are compared with RICH measurements



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- The TOF system can operate from -40° to $+50^{\circ}$ Celsius without major problems
- The trigger acceptance allows to suppress 99% of the proton flux at level-1 trigger
- From the last beam test results it can be inferred a counter intr. time res. of $\sim 150\ ps$

(TOF web page $\longrightarrow$ http://ams.bo.infn.it/)