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Feature selection techniques for CR isotope identification with the AMS-02 experiment in space.

Marta Borchellini

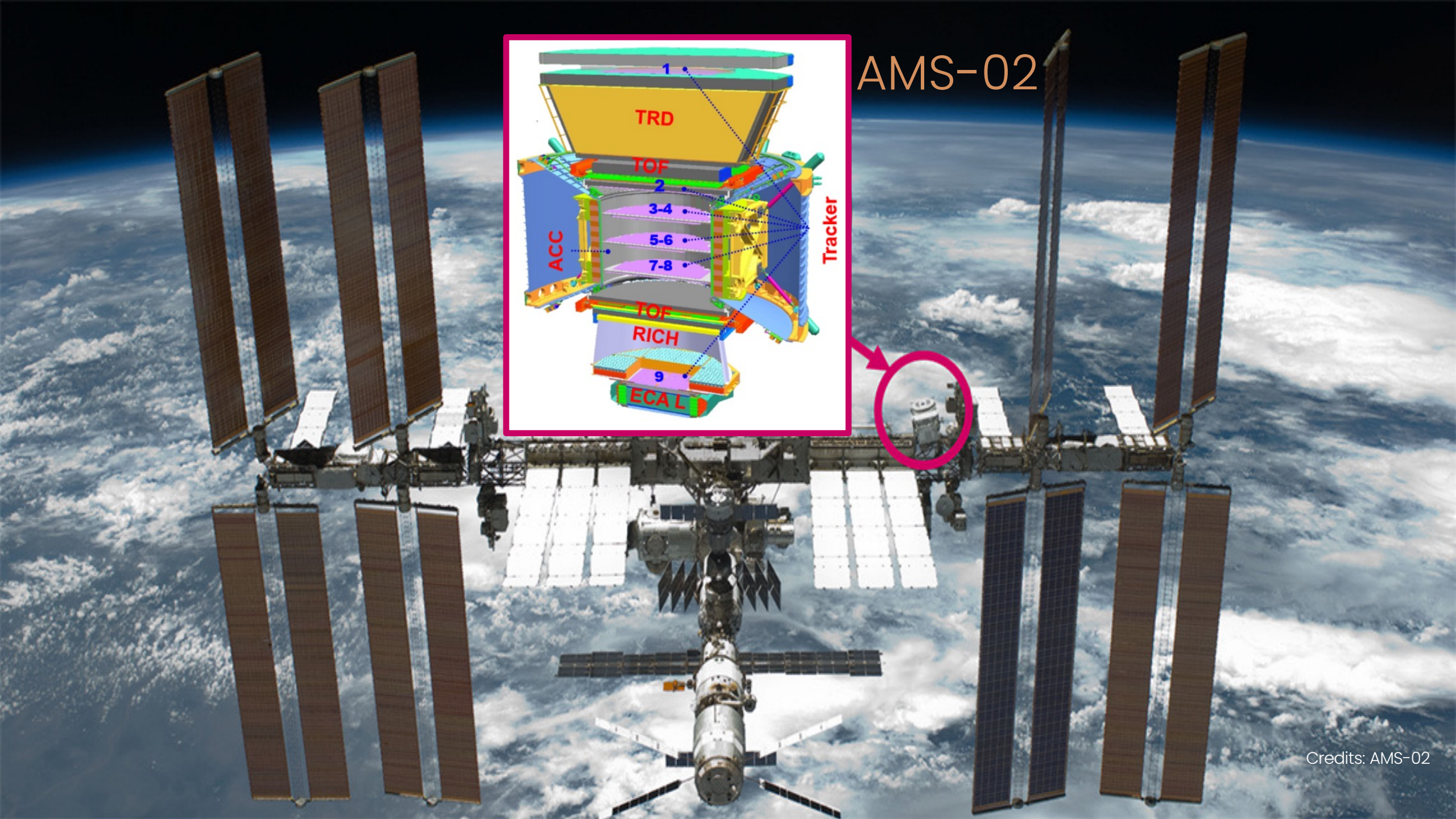
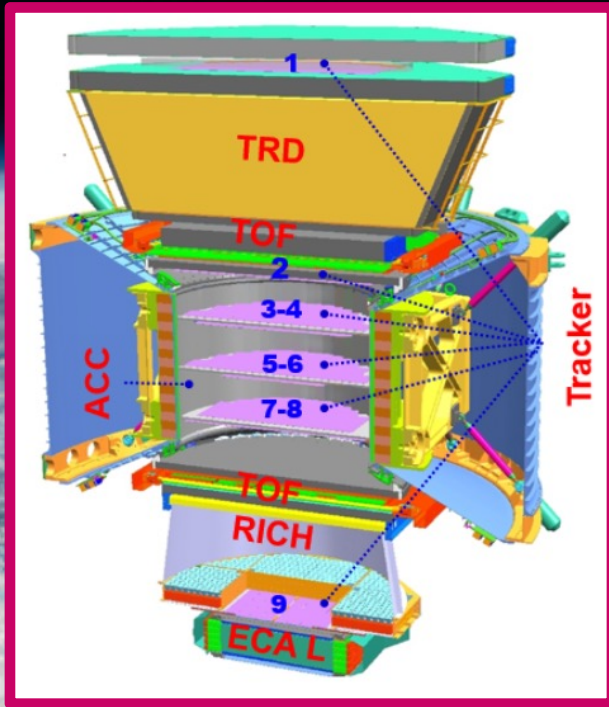
Kapteyn Astronomical Institute, RUG

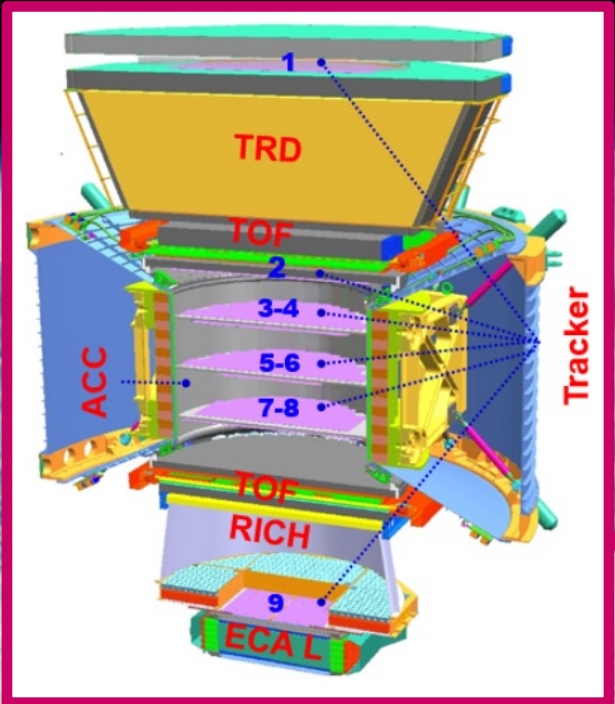
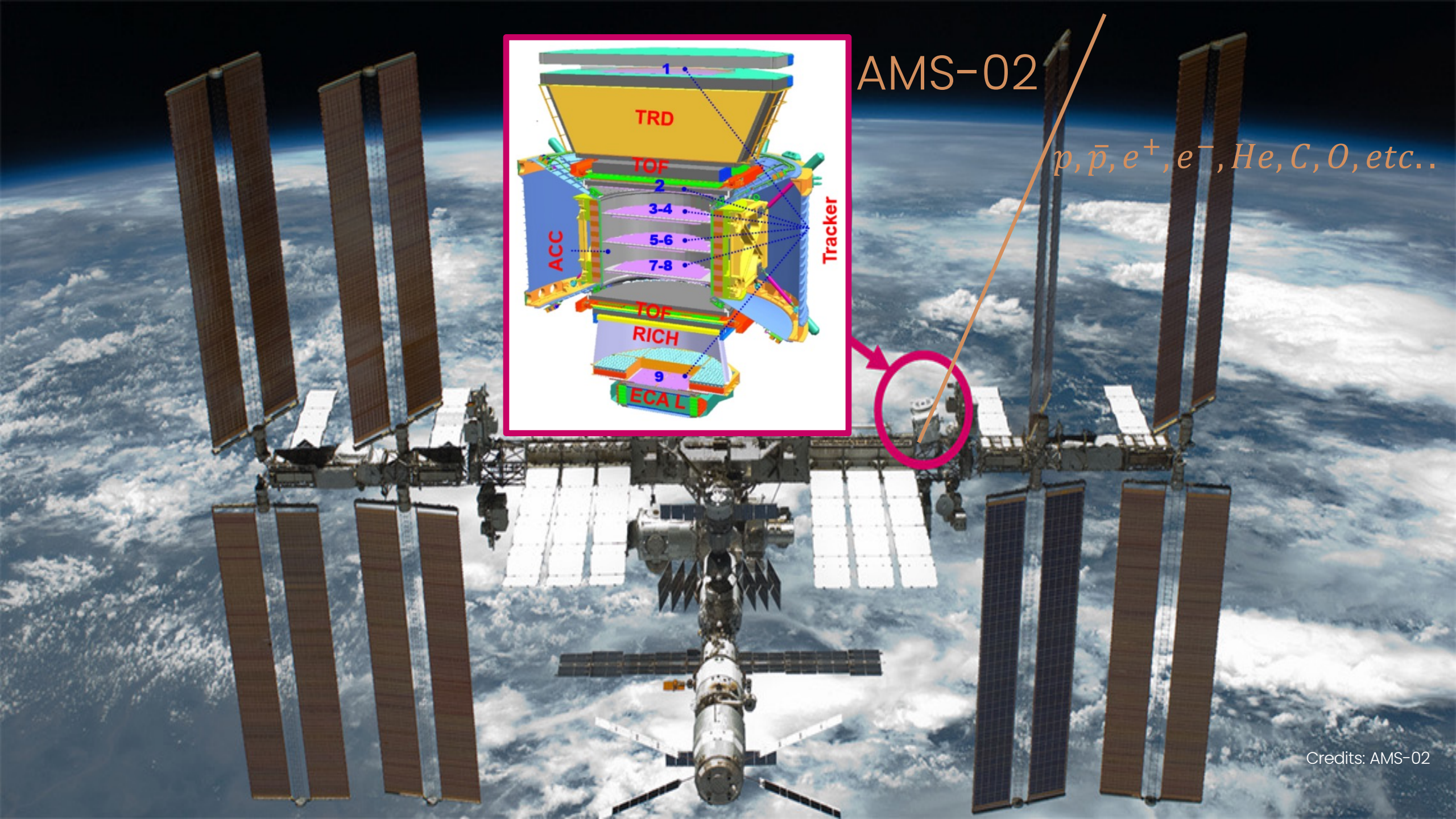
How to improve isotope
identification with AMS-02 using
Machine Learning feature
selection methods?

AMS-02



AMS-02





AMS-02

$p, \bar{p}, e^+, e^-, He, C, O, etc..$



RICH Background rejection

INPUT DATASET

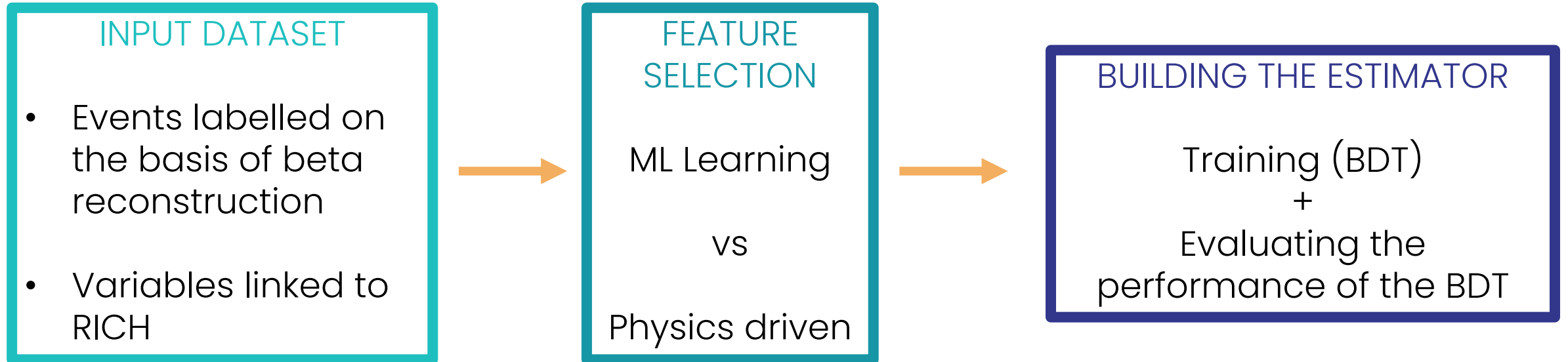
- Events labelled on the basis of beta reconstruction
- 130 features linked to RICH



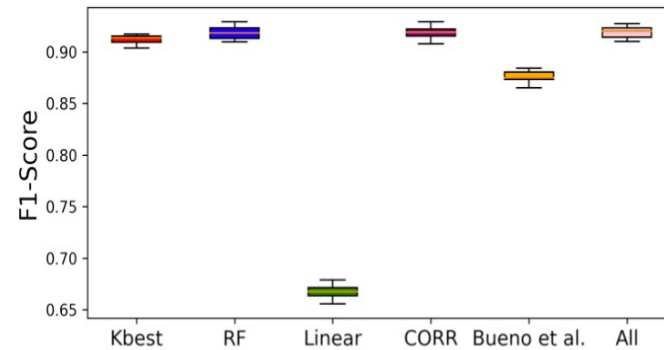
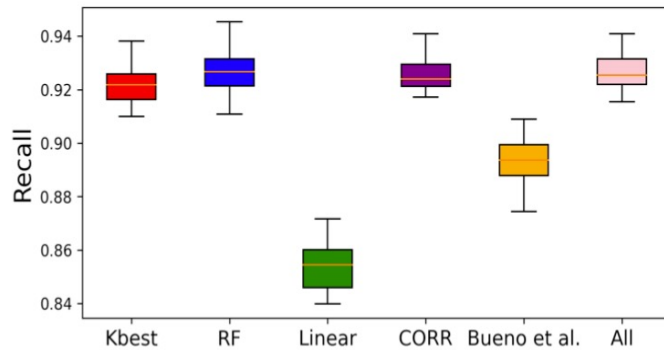
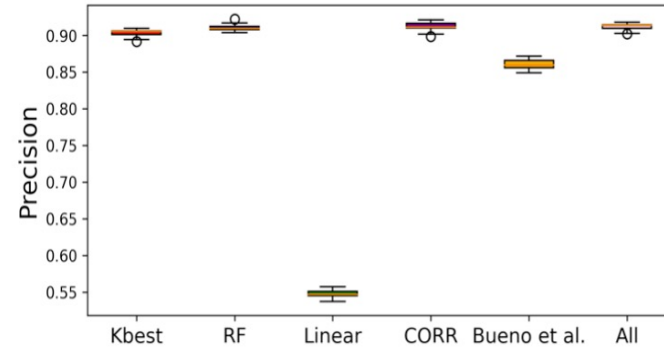
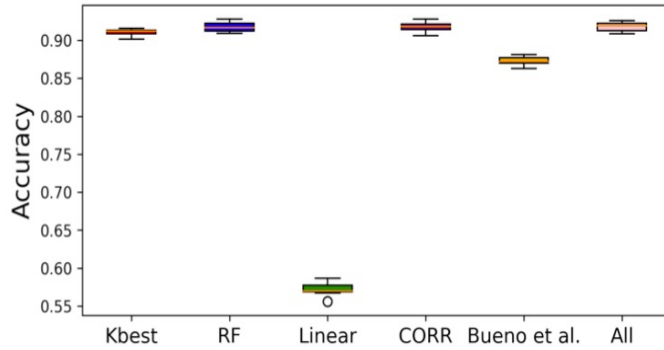
BUILDING THE ESTIMATOR

Training (BDT)
+
Evaluating the performance of the BDT

RICH Background rejection



Results



- Almost every ML algorithm performs better than the physics-driven method (Bueno et al.)
- Random Forest allows for 90% background rejection and 92% signal efficiency
- With the Random Forest technique is possible to achieve similar outcomes compared to All while reducing overfitting risks and slightly decreasing training time

Borchiellini et al., Particles 2024, 7(2), 417-434

Thank you!

If you want to know more:

M. Borchellini, L. Mano, F. Barão, M. Vecchi. 2024. "Feature Selection Techniques for CR Isotope Identification with the AMS-02 Experiment in Space», *Particles* 7, no. 2: 417-434.
<https://doi.org/10.3390/particles7020024>

Or come to the poster session tomorrow!

