Contribution ID: **26**   Type: **not specified**

AMPEL: An analysis engine for the era of high-throughput multi-messenger observatories

Tuesday 26 March 2024 14:25 (15 minutes)

Astronomical facilities will produce an ever increasing real-time avalanche of photon, neutrino and gravitational wave detections during the coming decade. The scientific posibilites are endless, but assume efficient tools for managing information flows: Computations need to be fast and scalable, while upholding FAIR principles and allow scientific creativity. We here present the AMPEL platform as a solution to these challenges: Complex analysis schema are designed hierarchically from analysis modules, tested in a local environment and uploaded to a computer center for large scale processing. The AMPEL system ensures the scalability and reproducibility of this process, while automatically guaranteeing the provenance of each datapoint and analysis result.

I will here both introduce the AMPEl system as well as give an overview of current and future applications. An AMPEL instance hosted at DESY Zeuthen is currently processing data from the Zwicky Transient Facility, which is combined with IceCube and Ligo data for applications in multi-messenger science and cosmology. Looking ahead, the first large facility to go online will be the Vera Rubin Observatory (VRO), which will distribute real-time alerts to AMPEL as one of seven world-wide endpoints. Finally, machine learning based techniques will be essential for many science applications, and is naturally incorporated into AMPEL. We recently demonstrated this in the ELAsTiCC VRO data challenge, where the AMPEL classifiers produced the best overall ML scores.

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