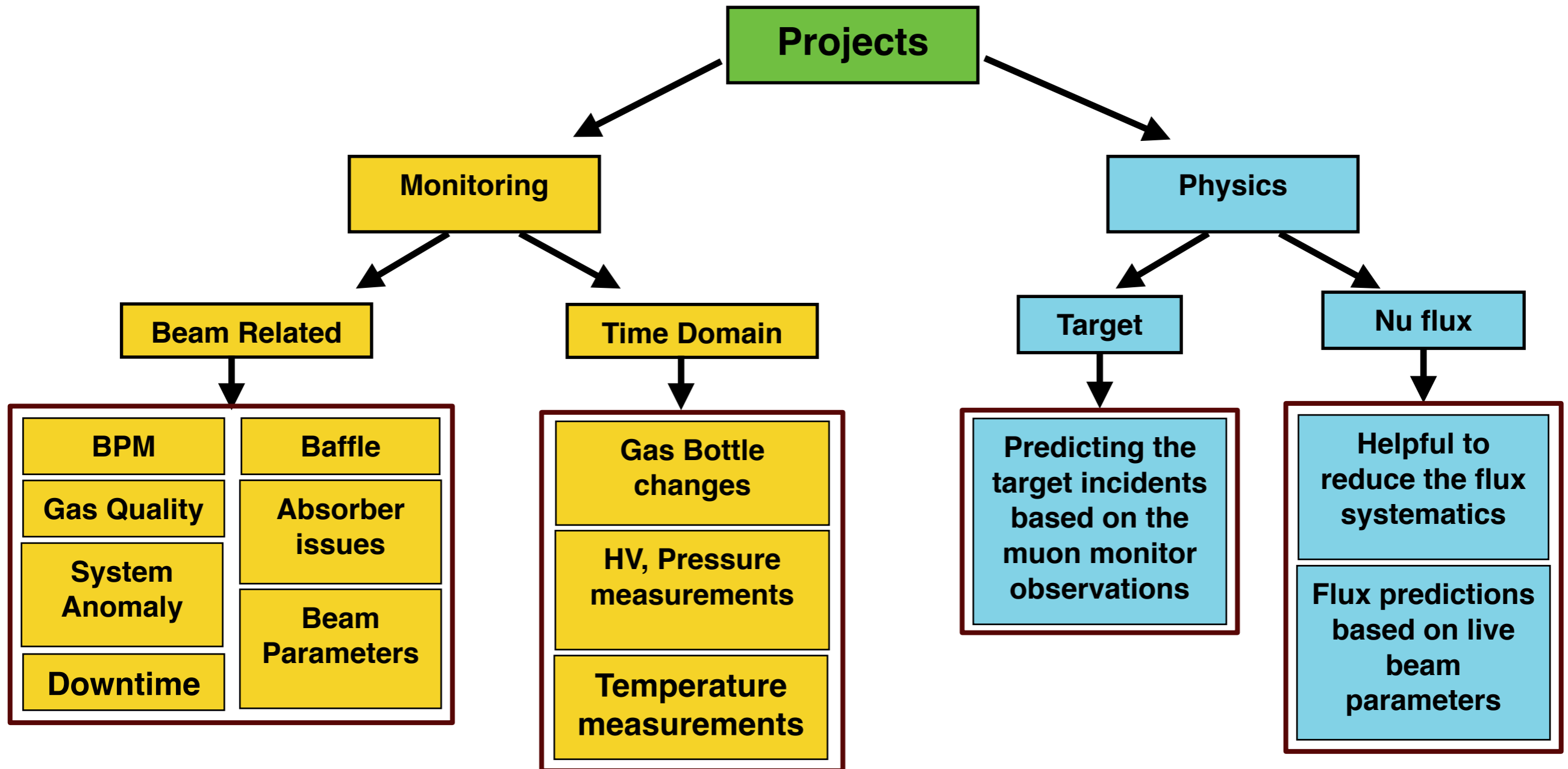


AI/ML Project Plans for NuMI beamline Data

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Flow Chart of the Project Plans



Physics Projects

1. Neutrino predictions from the muon signals

- » **Introduction:** Taking account beam parameters, horn current and muon monitor data as inputs, we might be able to predict a part of the neutrino flux spectrum or any useful physics for neutrino experiments
- » **Advantage:** ML will be able to predict the flux spill by spill and that's helpful to address the flux systematics
- » **Data:** inputs: 3xMM data + Beam Intensity + ND data?
- » **MC:** Need to have simulation data to link MM data with neutrinos
- » **NOTE:** We need to discuss this project in details to understand the possibilities

2. Target Related Issues (Geometry, Density, Missing Fins, Deterioration etc)

- » **Introduction:** We are able to catch target related changes by looking at MM#COR data. However, there are many dependencies with other parameters on MM observations. We have to look at pixel signals and untangle all other possible correlations
- » **Advantage:** ML will be able to untangle the correlations to predict the issues related to the target issues
- » **Data:** inputs: 3xMM data + ?
- » **MC:** Need to have simulation data with different target status to link the correlations of MM observations for AI

Monitoring Projects

3. Incidents or fault detections/predictions:

- » **Application:** Detecting faults like Target issues, beam related issues, horn current issues, gas bottle issues,.etc
- » **Advantage:** Identify incident and predict the incident status for experts, notify incident for related data quality managements and applications
- » **Data:** 3xMM data + beam parameters + Horn current etc?
- » **MC:** Need to have simulation data to prepare some fake incidents

4. Beam parameters prediction

- » **Application:** Addressing beam parameters status and horn current stability
- » **Advantage:** Useful for the neutrino beam predictions, beam quality predictions and NOvA data quality cur selections
- » **Data:** 3xMM data + beam parameters + Horn current etc?

5. BPM system status and issues

- » **Application:** Testing the BPM system status spill-by-spill by using an AI algorithm
- » **Advantage:** Useful to catch any individual BPM movements, failures or anomalies
- » **Data:** All BPM data

Monitoring Projects

6. Time Domain Monitoring (No need any AI/ML?)

- » **Application:** Monitoring gas bottle changes, HV, Temperature monitoring, pressure measurements , etc.
- » **Advantage:** Easy to monitor for experts, helpful to setup automated alarms and warnings, fast monitoring, reduces human workload
- » **Easy to setup this with raw data**

**Let's discuss suggestions and
plans more!**