# A Framework for Data Simulation and Analysis of the BabyCal Electromagnetic Calorimeter

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# ABOUT ME

- 26 years old
- Computer Science Engineer at UTFSM
- I am from Chile (Not this one 🌶️, but this one 🇨🇱)
- PyHEP *first-timer*

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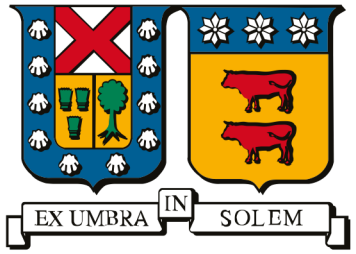
Source: ESO

# CONTEXT OF APPLICATION

## Thesis Work – Computer Clusters

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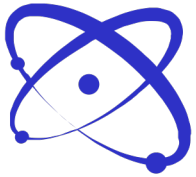

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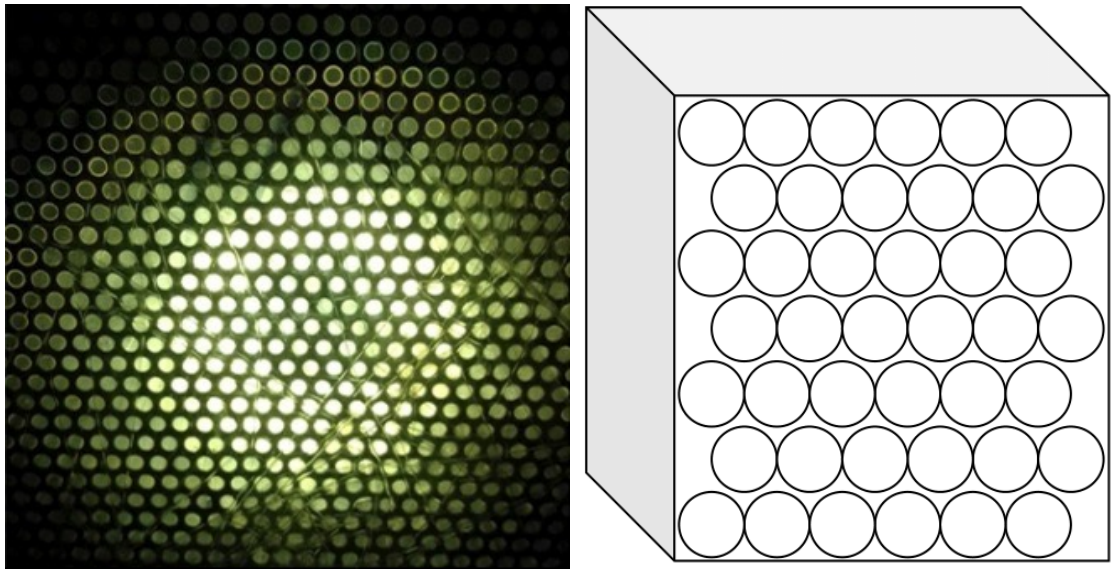
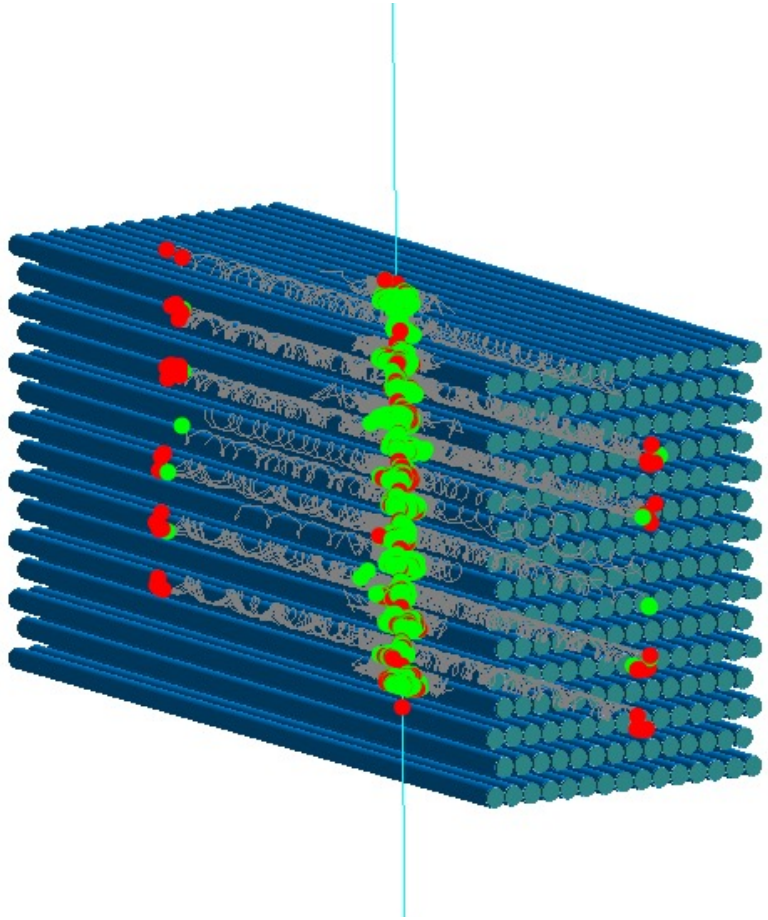
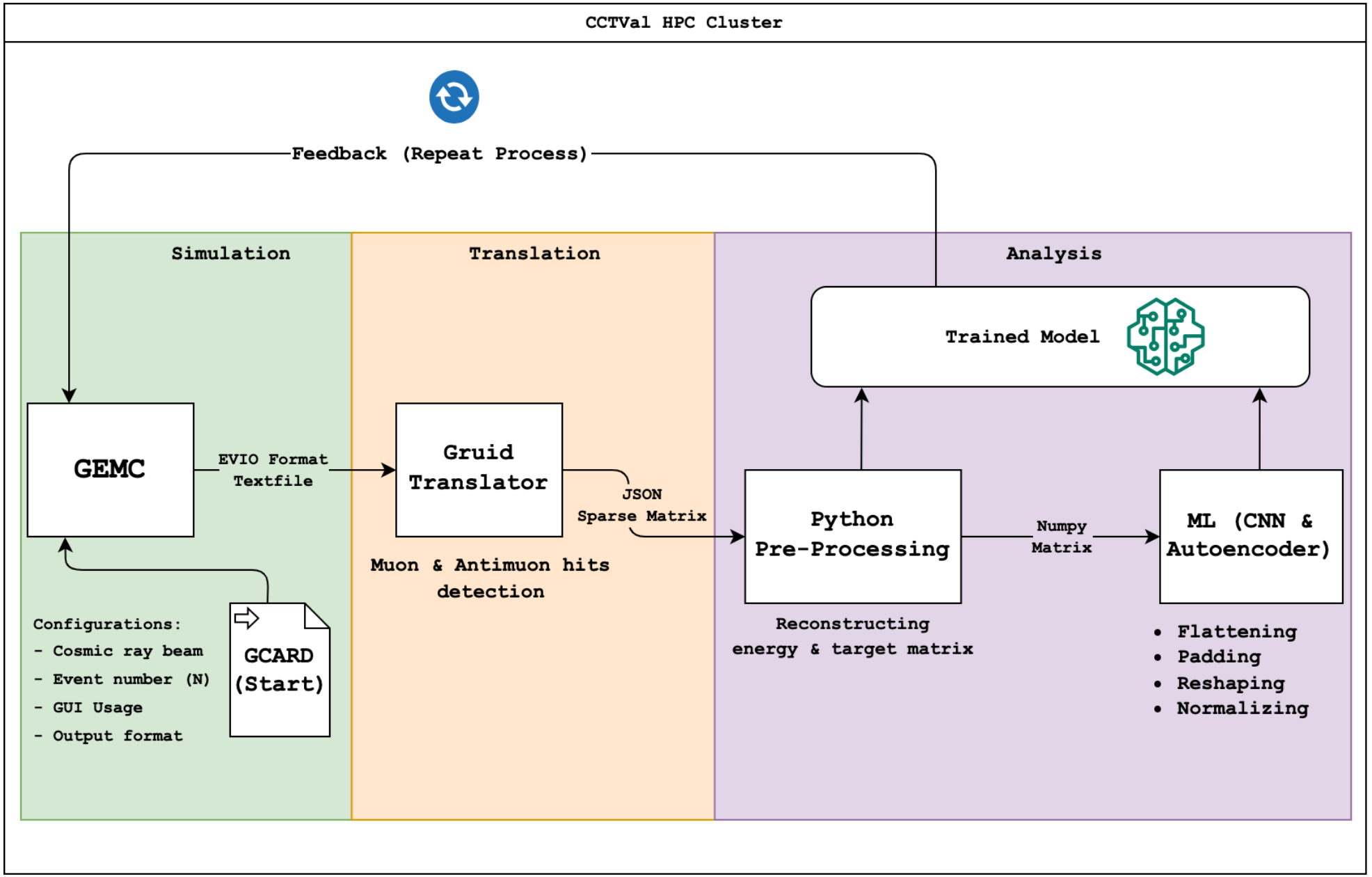
DE VALPARAÍSO

# THE BABYCAL

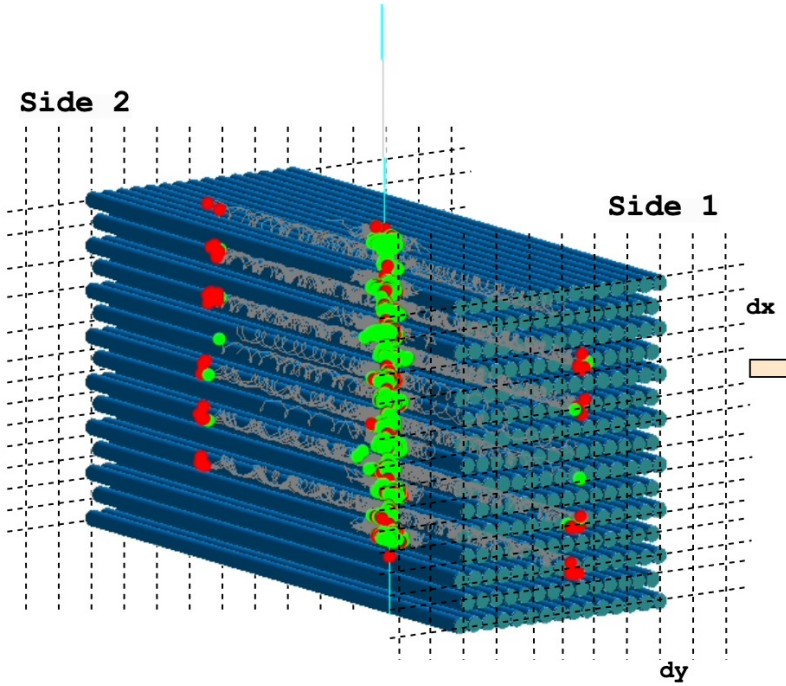


GEMC




CCTVal HPC Cluster
Feedback (Repeat Process)
Simulation
Translation
Analysis
Trained Model
GEMC
EVIO Format
Textfile
Gruid
Translator
JSON
Sparse Matrix
Python
Pre-Processing
Numpy
Matrix
ML (CNN &
Autoencoder)
Muon & Antimuon hits
detection
Reconstructing
energy & target matrix
Configurations:
- Cosmic ray beam
- Event number (N)
- GUI Usage
- Output format
GCARD
(Start)
Flattening
Padding
Reshaping
Normalizing

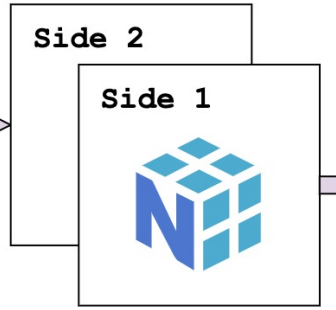
# Data Flow Diagram




Simulated BabyCal in GEMC + Gruid Translator Grid


JSON Sparse Matrix

Matrix Reconstruction with Python




Bi-Channel Numpy Matrix (Tensor)

ML

# MACHINE LEARNING FOR DATA ANALYSIS

Tasks performed to test the Framework were the following:

**Supervised Learning**

↓

Particle classification using CNN's for Muons / Antimuons

**SVGG21-Net**

**Unsupervised Learning**

↓

Data reconstruction using Autoencoders for Muons

**AE-21RecNet**

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