

# Photon Fast Simulation

PDFastSimGAN module

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Dec. 2020

# PDFastSimGAN module: PDFastSimGAN\_module.cc

- Checked into `larsim\PhotonPropagation`
- Photon fast simulation based on a **computable graph** produced from TensorFlow
- The interface is similar as PDFastSimPVS or PDFastSimPAR modules
- A **Tool** is developed to load the computable **Graph**

```
PDFastSimGAN:
{
  {
    module_type:      "PDFastSimGAN"
    SimulationLabel:  "IonAndScint"
    DoSlowComponent:  true
    ScintTimeTool:    @local::ScintTimeLAr
    TFLoaderTool:
    {
      tool_type:      TFLoaderGAN
      ModelName:      "./models/graph.pb"
      InputsName:     "input_input"
      OutputName:     "output/Sigmoid"
    }
  }
}
```

```
PDFastSimPAR:
{
  {
    module_type:      "PDFastSimPAR"
    SimulationLabel:  "IonAndScint"
    DoSlowComponent:  true
    ScintTimeTool:    @local::ScintTimeLAr
  }
}
```

# Computable Graph

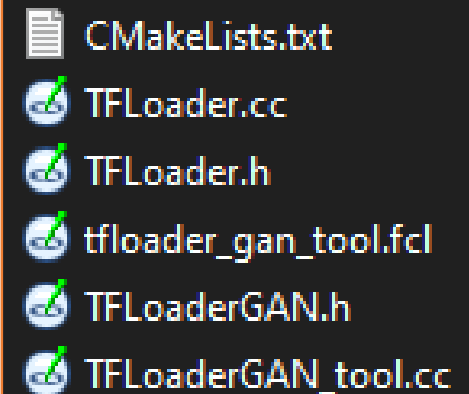
- Will check into **related products**, such as **dunetpc**
- Made based on different geometry and optical detector configuration
- Training samples built from photon full simulation
- Trained and produced using **TensorFlow 1.12**
- Processed in Python script

**No requirement from Larsoft**

# TFLoader Tool

- Checked into **larsim\PhotonPropagation\TFLoaderTools**
- Used to load the computable graph and generate “photon visibilities” for each step
- Need to call **TensorFlow (1.12) API**

```
#include "tensorflow/core/public/session.h"  
#include "tensorflow/core/platform/env.h"
```



A file explorer view showing the contents of the TFLoaderTools directory. The files listed are:

- CMakeLists.txt
- TFLoader.cc
- TFLoader.h
- tfloader\_gan\_tool.fcl
- TFLoaderGAN.h
- TFLoaderGAN\_tool.cc

# Requirement: Update CMakeLists.txt

Add

```
include_directories( $ENV{TensorFlow_INC}/abs1 )
```

to **CMakeLists.txt** wherever **session.h** is included.

Related case: [Support #22504](#)

Issue during compiling:

- It works when I checked out **larsim + dunetpc**
- It does not work when I checked out only **larsim**

```
if(( DEFINED ENV{TensorFlow_DIR} ) AND ( DEFINED ENV{TRTIS_CLIENTS_DIR} ))
  # find tensorflow library
  find_ups_product( protobuf )
  find_ups_product( tensorflow )
  find_ups_product( trtis_clients )
  find_ups_product( larrecodnn v1_00_00 )
  cet_find_library(TensorFlow NAMES tensorflow-core PATHS ENV TensorFlow_LIB NO_DEFAULT_PATH )
  cet_find_library(protobuf NAMES protobuf PATHS ENV PROTOBUF_LIB NO_DEFAULT_PATH )
endif()
```

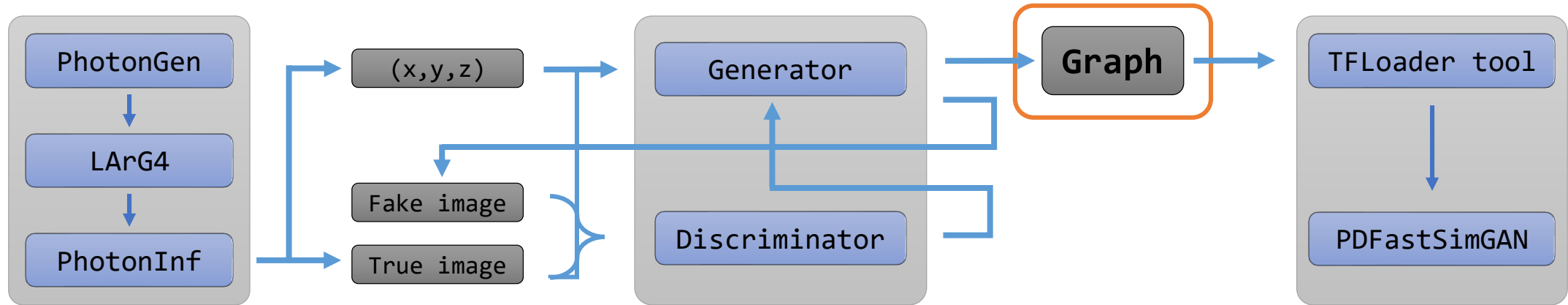
from **dunetpc CMakeLists.txt**

# Computable Graph based on GAN

Photon Full Simulation  
LArSoft  
C++

Computable Graph Production  
GAN  
Python Script

Photon Fast Simulation  
LArSoft  
C++



2 days for photon full simulation

1 day for data processing, network training and graph producing

Similar performance as existing fast simulation modules

**The Graph**

- Gives the visibility of photons on OpDets like a **library**
- Works in the way like the **parameterized function**