StandaloneGBP with FTFP_BERT
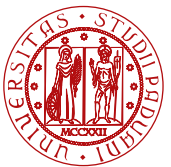
Stadalone MC sim. for the GBP with hadronic physics list

StandaloneGBP - Summary

StandaloneGBP is an alias for the master version of a standalone Geant4-based monte carlo simulation for the LUXE's gamma beam profiler detector (GBP).

- GBP implemented is composed of
  - one station (placed 11.6 m downstream the IP) composed by 2 sapphire detectors (2 cm x 2cm x 100 um each) with a 100 nm Al layer of metallization on top and back sides.
  - Detectors are separated by a 2 cm distance. Upstream detector is also referenced as det0, while the more downstream as det1.

- *StandaloneGBP* reads Compton photons tracks at the beam-pipe exit before they interact with the kapton window (50 x 50 x 0.2 mm3). These tracks are selected from the output of the LUXE Geant4-based sim. known as *lxsim*.
  - Interaction with the kapton material is simulated within the *StandaloneGBP* sim.
  - This choice was motivated by the need for an high statistics in the analysis of profile reconstruction after *signal selection* (see the Technical Note for the definition of the signal).
  - Number of Compton photons simulated = 1.7e9 *
    Number of initial tracks = (1.7e9 / 1500.0) *
    – that is, the statistics of the initial set of Compton tracks from lxsim is O(1e6) *
    *[xi=5 linearly polarized phase-0 setup was considered]

- Additional geometry (supports, motors, pcb, GBP enclosure) was not implemented in the standalone sim. Physics list used was emstandard_opt3/4.

- A preliminary analysis of the background used the *lxsim* data directly.
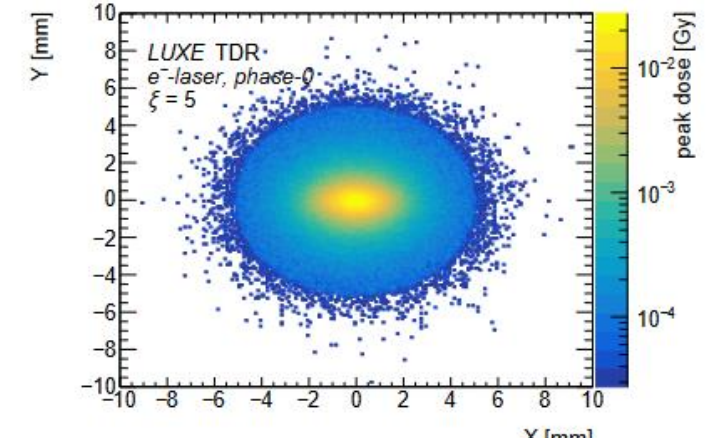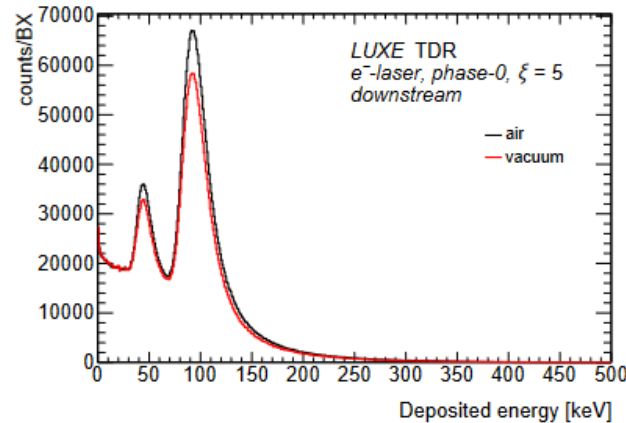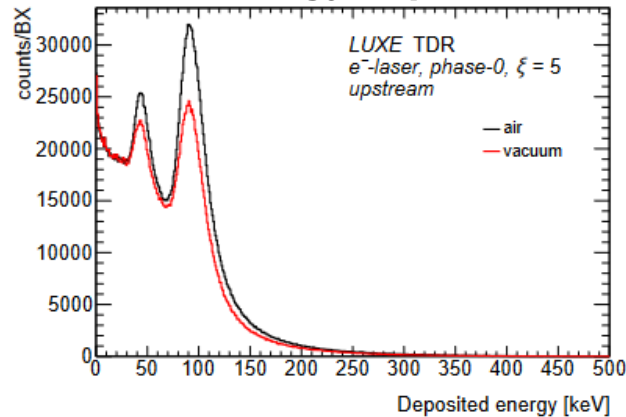
StandaloneGBP - Summary

- Former results of the StandaloneGBP simulation for the signal can be found in Sec. 4.1 LUXE GBP Technical Note.
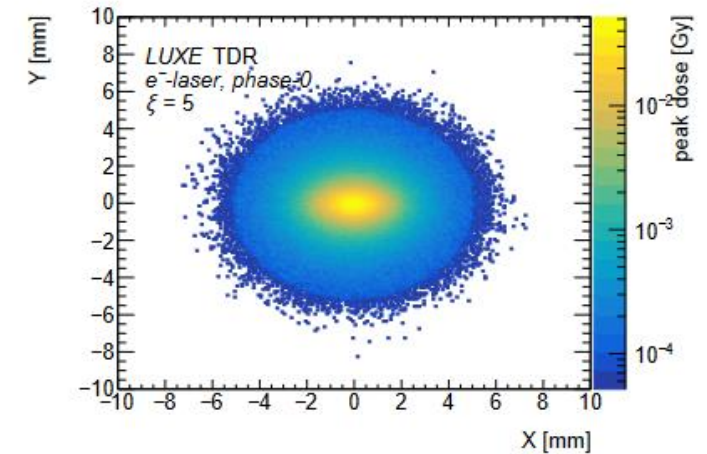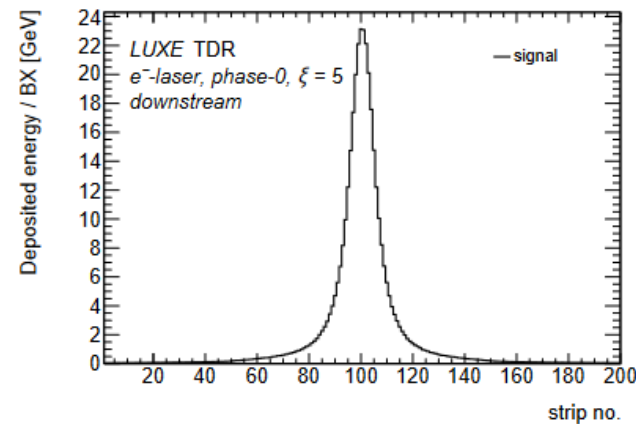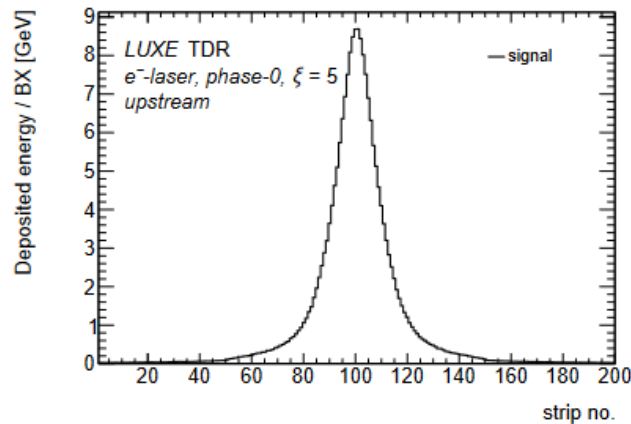 For convenience, plots are collected in this slide

Dose maps (dV=L^3, L=100um)

Spectrum of energy depositions

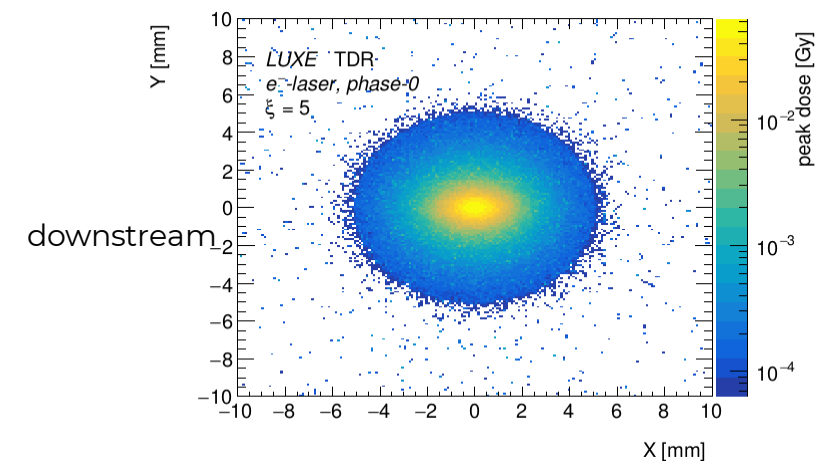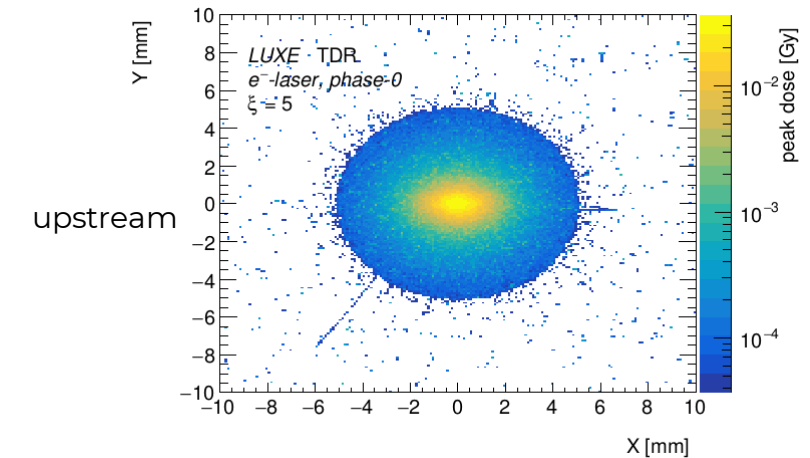**Energy deposited in the strips (bin size 100um)**

Results with FTFP_BERT

Results of the simulation with FTFP_BERT (hadronic) physics list are collected here

- Total energy deposited in the detectors, energy deposited per strip, peak dose are affected

Dose maps (dV=L^3, L=100um)

upstream

Physics list Values: det0 (det1)	emstandard_opt3	FTFP_BERT	Variation with respect to em
Tot. E.dep. / BX [GeV]	204.2 (376.4)	273.4 (446.6)	> 34% (19%)
Max e.dep / strip / BX [GeV]	8.8 (23.8)	11.5 (27.5)	> 31% (15%)
Peak dose / BX [Gy]	0.028 (0.052)	0.036 (0.063)	> 32 % (21%)

Energy deposited in the strips (bin size 100um)

upstream

downstream
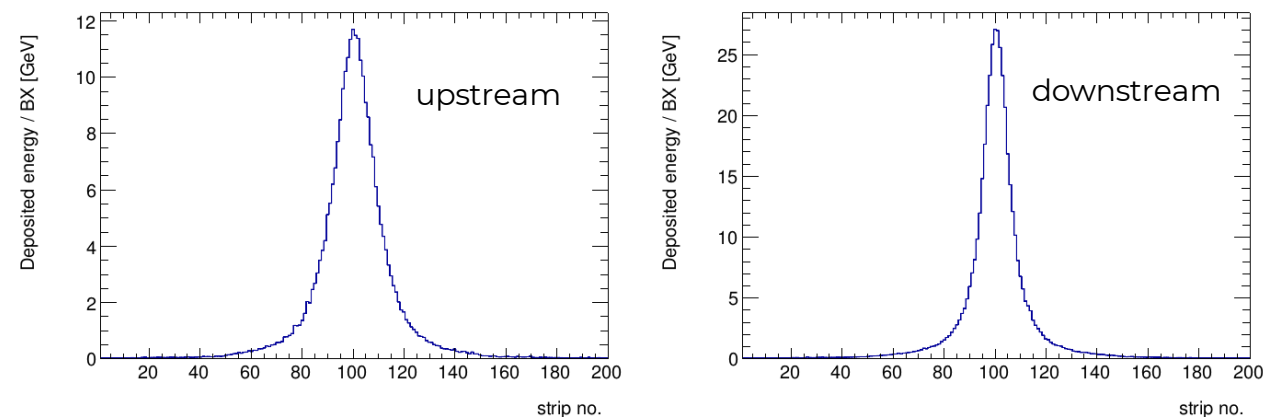
downstream

Conclusions

- Energy deposited in the detector when using the FTFP_BERT hadronic physics is 30% and 20% higher upstream and downstream respectively, with respec to the emstandard simulation
  - Peak dose, charge, e.dep/strip scales accordingly.

- Main conclusions drawn in the GBP Technical Note – i.e. peak dose/charge, etc. – are still valid.

Update
  - *StandaloneGBP* master code was updated to support multi-threading (MT)