ATF2 final focus background

13th ATF2 Project meeting Jan /11-13, 2012

Hayg GULER, Marc VERDERI
LLR-Ecole Polytechnique

Outline

- Which backround ?
- Background too high for nominal optics
- Reduce the backrgound ?
- Background simulation at different optics
- More measurements ?
- Conclusion and to measure list

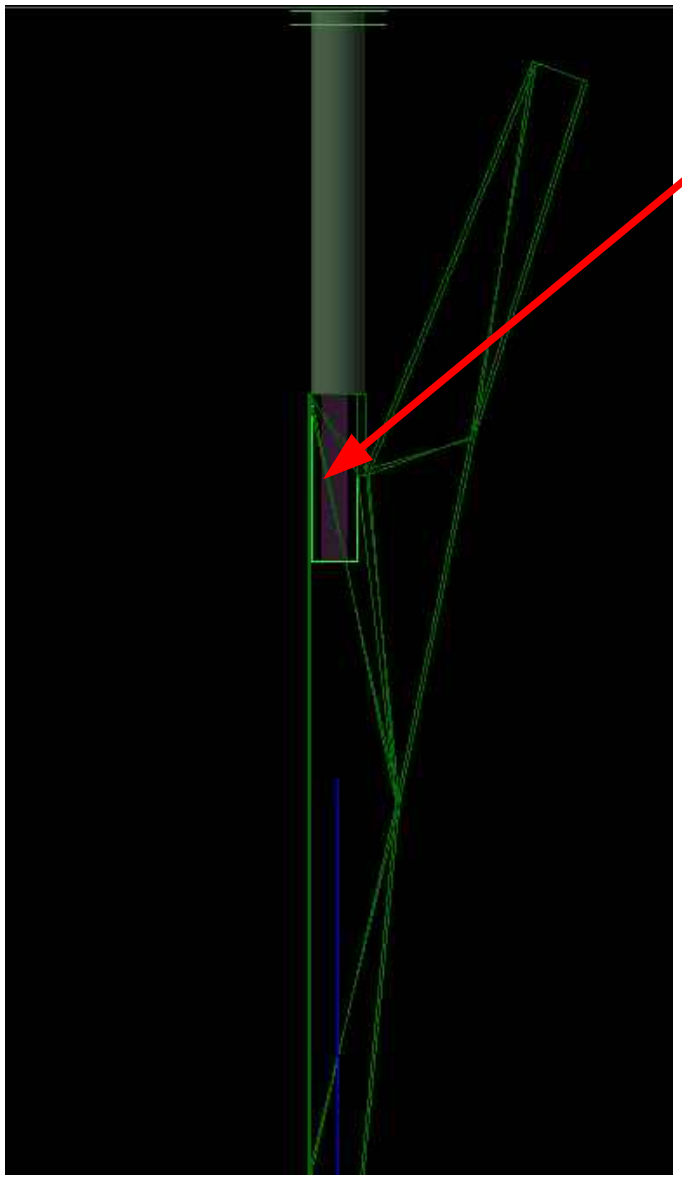
Which Background

- Shintake photon detector measures Compton photons from interference between Laser and beam.
- But, small β means large divergence, and beam hits beam pipe and bend chamber, making bremmstrahlung background.
- Photon detector collects Compton photons and bremmstrahlung which could be separated in shape (calorimeter logitudinal segmentation) but depending on background amount.

Background simulation

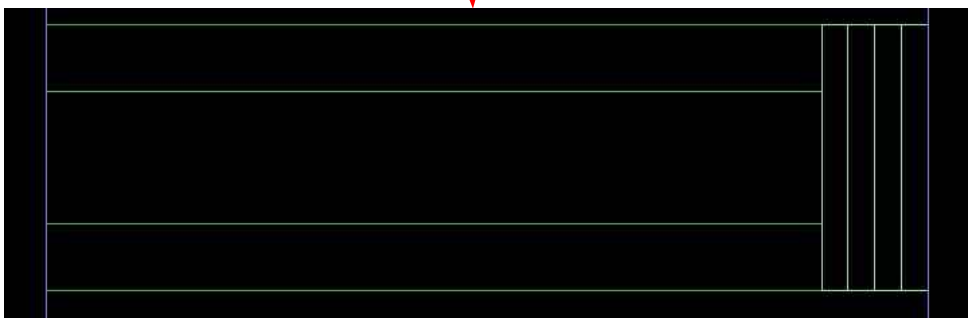
- BDSIM : Geant4 extension toolkit for beamline simulations.
  - Geometry description using LCDD file to use imported files from CAD
  - Still under developpment
- Post IP background estimation
  - Need post ip detector description
  - IP beam parameters :
    - Including beam halo parametrization

BDSIM FF simulation



New collimator

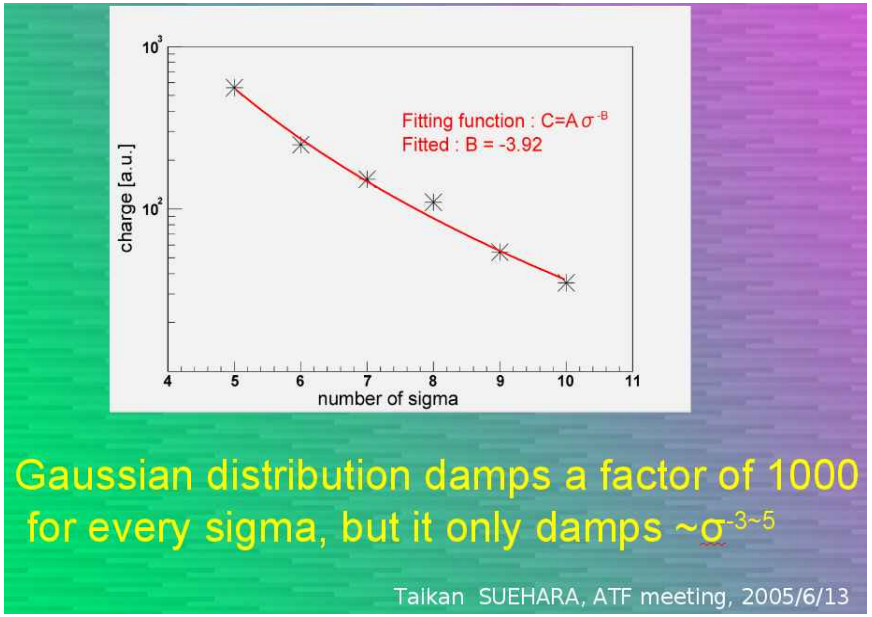
CsI Photon detector

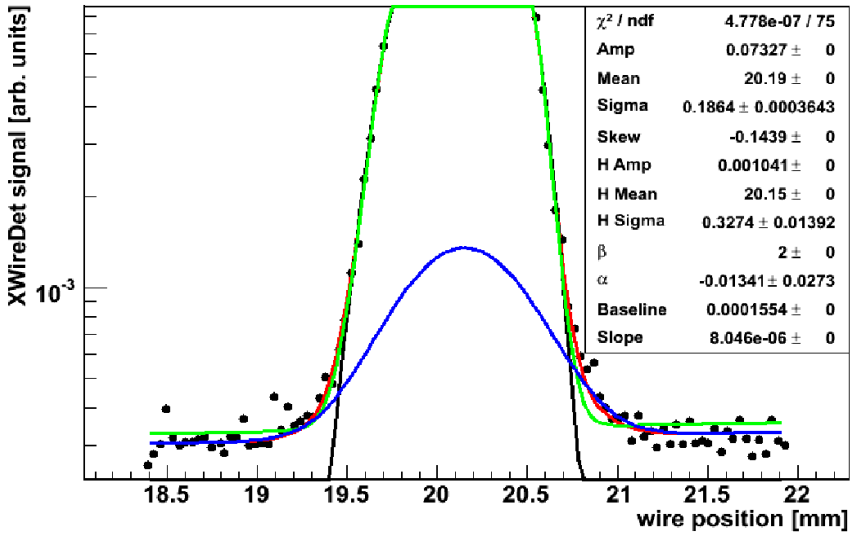


Beam parameters @ IP

- Emittance : **ε_x = 2nm , ε_y = 48pm** (end of december)
- Beta optics : **10 x** nominal beta in x and y
- Simulation procedure :
  - Decrease beta function until nominal values.
  - See the deposited energy on shintake photon detector and see losses along the beamline
    - after IP for this simulation

Beam Halo

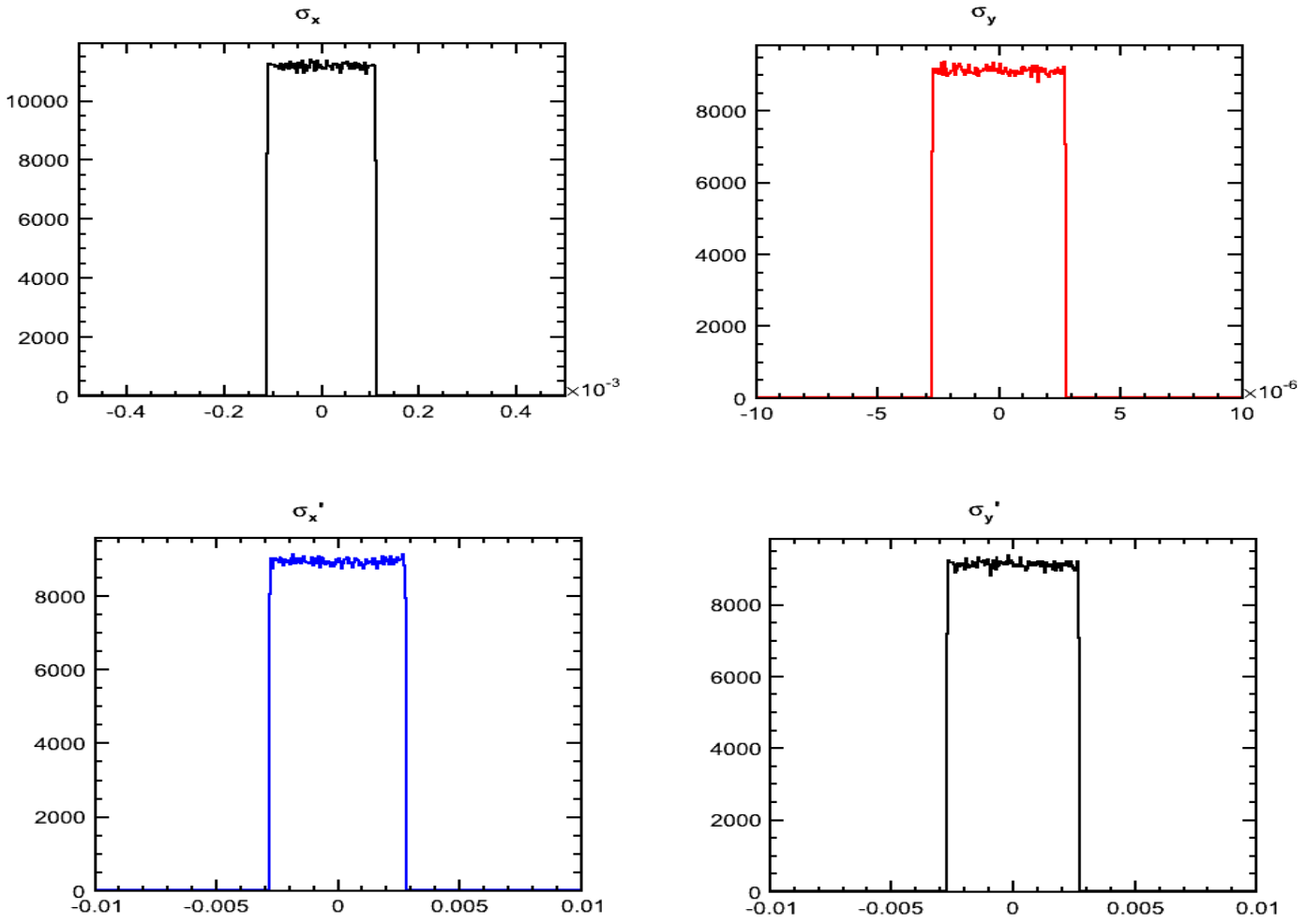




- **Many measurements at ATF :**
  - Non gaussian tails
  - Or fit with 2 Gaussians (halo is 3x larger than core)
- **Spread up to** 25(?) x σ_{core}
- **For simulations**, use **flat beam halo** which spreads up to 25 x σ_{core}

Used beam profile in simulations

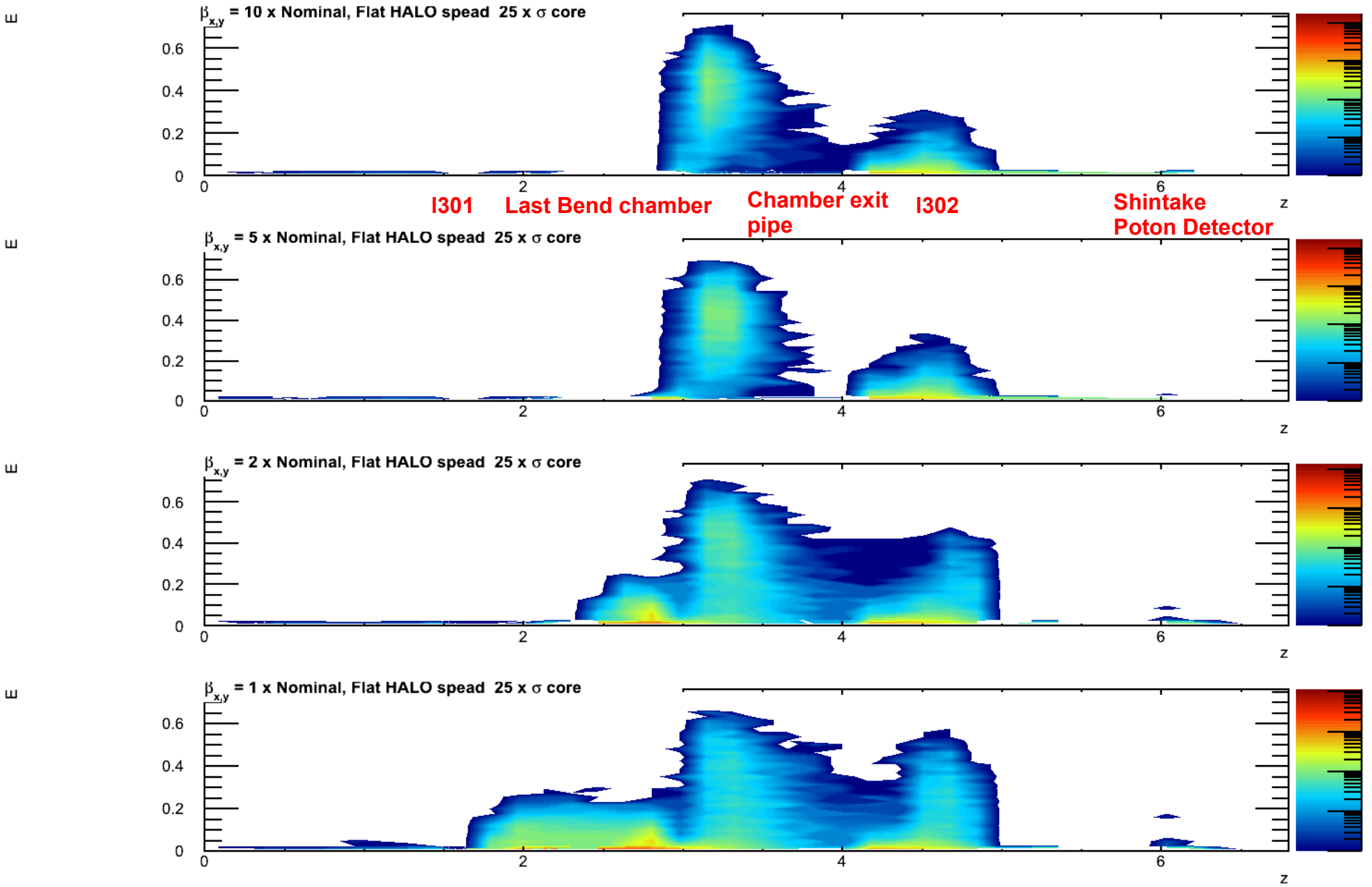
- **Use flat beam halo up to (25 and 50)x σ_{core}**



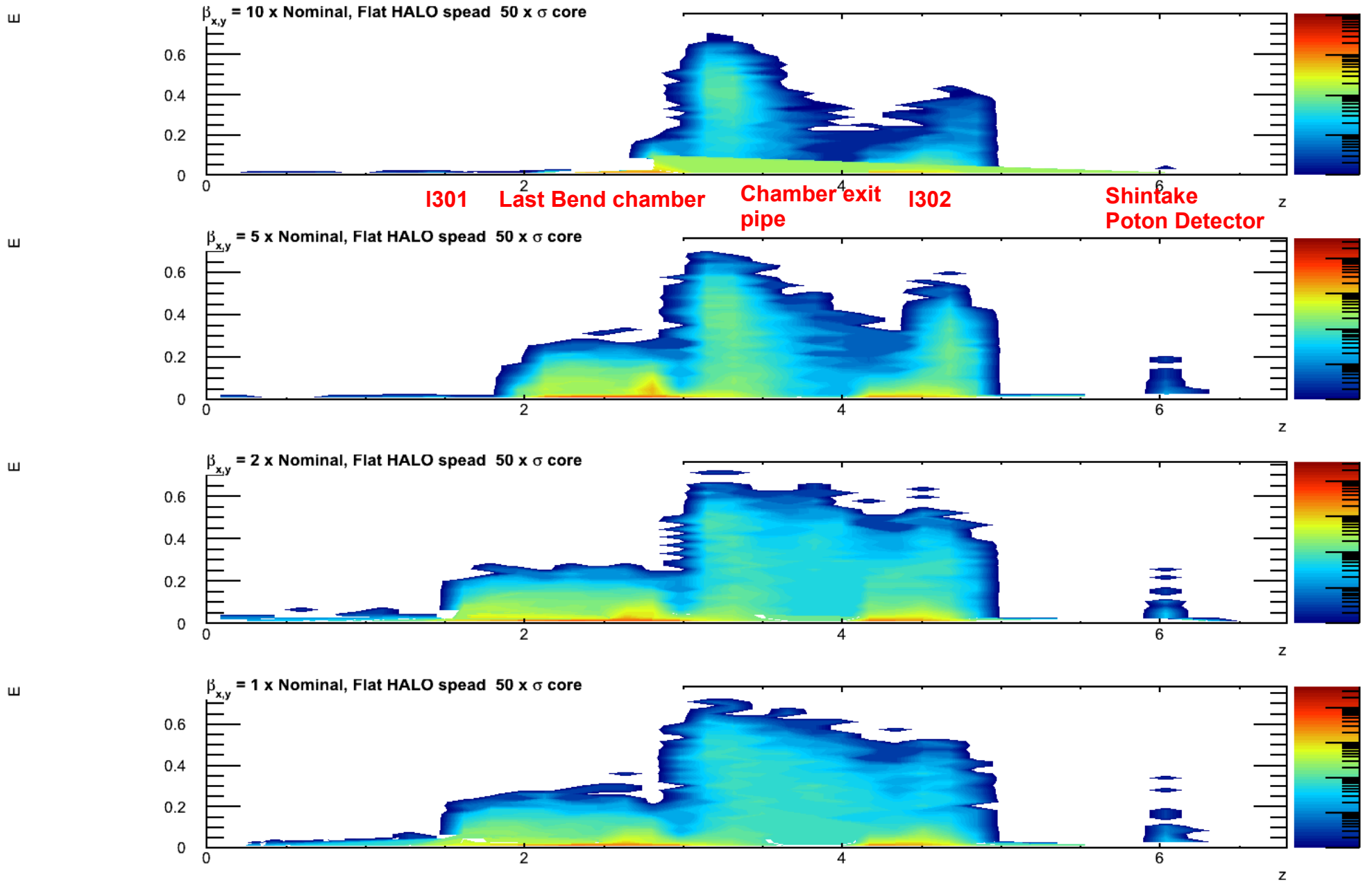
Simulation setup

- **BDSIM + FF description**
- **Values for β :** 10, 5, 2 and 1 times the nominal values
- **Beam Halo : Flat**
  - Spread until (25 and 50) x σ beam core
  - 10 000 incident electrons used for this simulation
    - HALO electrons : **~0.1%** (?) of total
  - Need to normalize the deposited energy by :
    - 10^{10} / 10^{5} / 10^{3} = 10^{2}

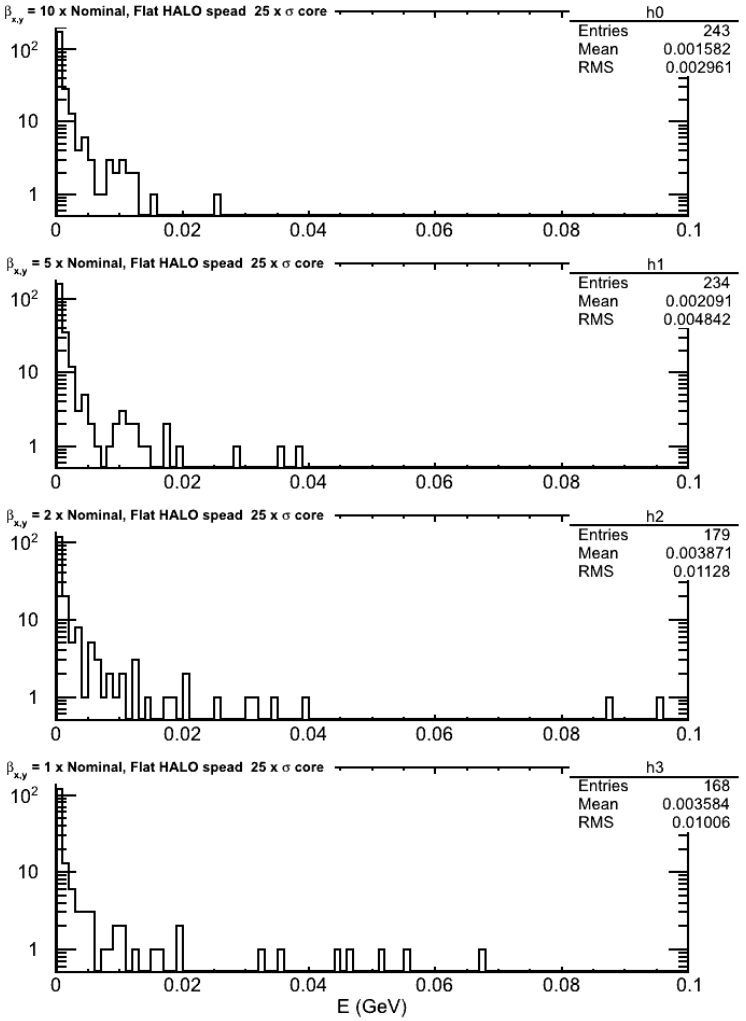
Loss Energy = f (β) 25σ Flat Halo

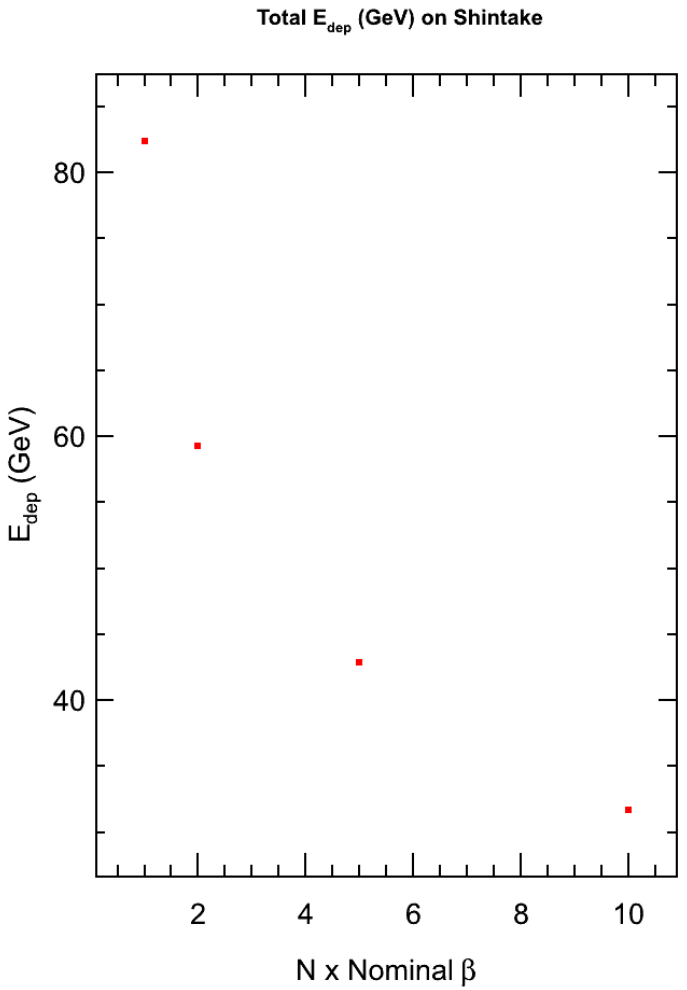


Loss Energy = f (β) 50σ Flat Halo

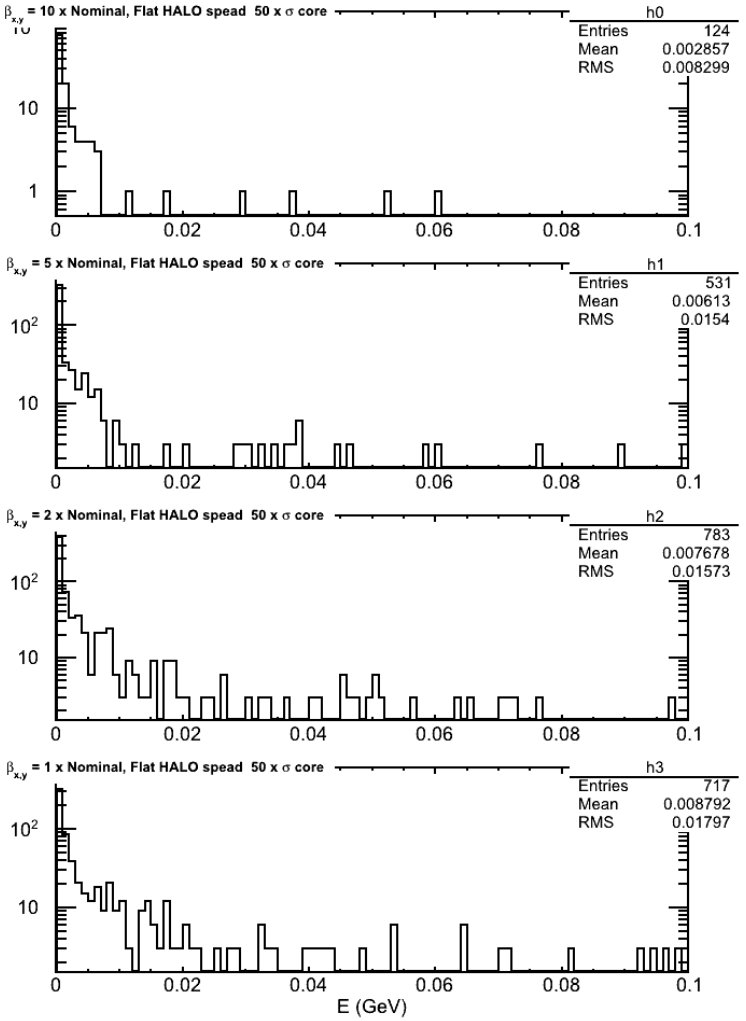


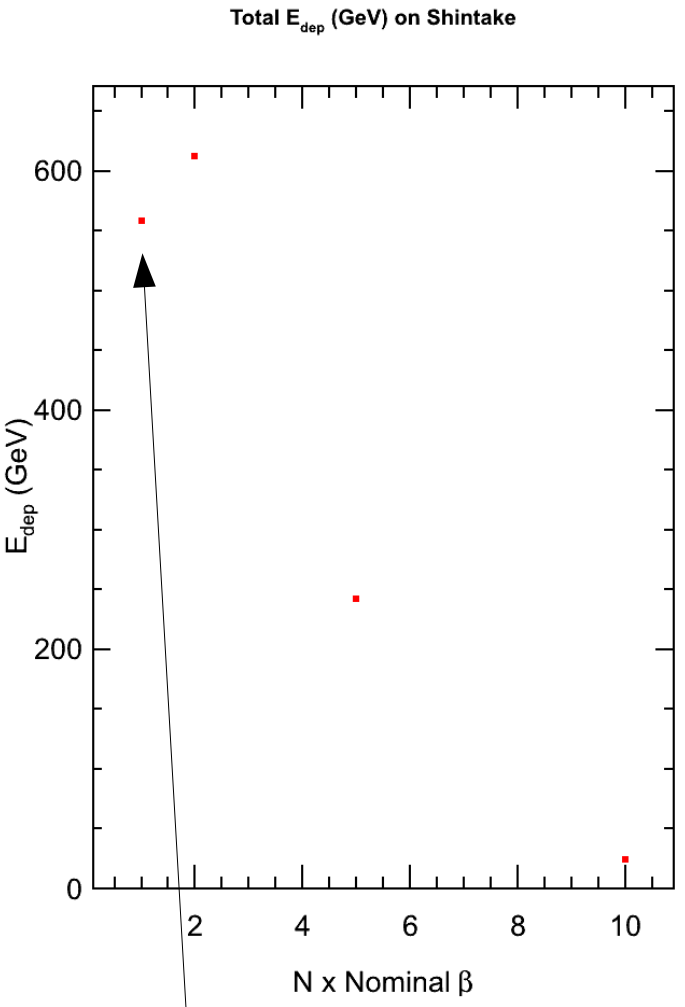
Shintake : E_{dep} = f (β), 25σ Halo





Shintake : E_{dep} = f (β), 50σ Halo





Due to losses along the beam line

Cross check the background levels

- Why ?
  - Need to understand its origins : difficult to see exact positions
  - Need to improve geormetry description inside BDSIM
- How ?
  - LLR modules in addition than shintake photon detector : placed at dedicated position.
  - PLIC
  - Combined background measurement and analysis
    - Timing
    - Long term analysis
    - Map the background origins (too optimistic ?)

Conclusion

- BDSIM simulation showed expected results concerning background at low β
  - Maximum seen at 2xβ should be confirmed by going to even lower β
- BDSIM simulation of the FF is still on going
  - Beam dump not included inside the simulaton in order to save computing time for unwanted background
  - Non biasing needed, so far
  - Plan to extrack background at other places
    - For LLR modules
    - In order to **cross check and benchmark and improve** BDSIM
- Could also include entire beam line
  - MAD description
  - But need good material description (magnets, holes inside the quads etc ..)
  - Beam description : More beam halo measurement ?