

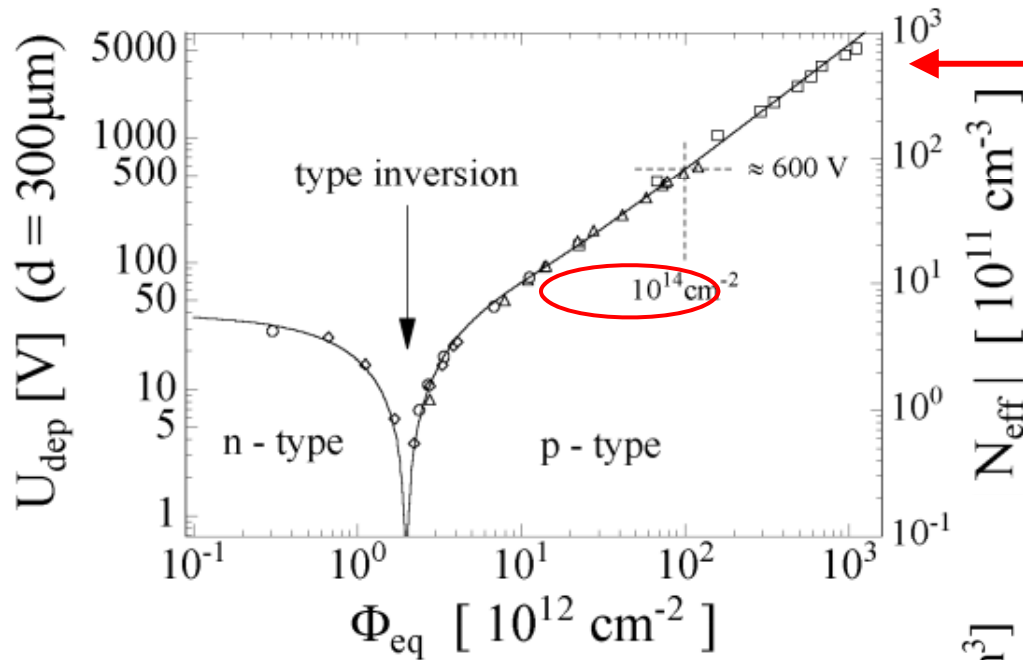


Radiation damage analysis with hadronic target materials

12. März 2009

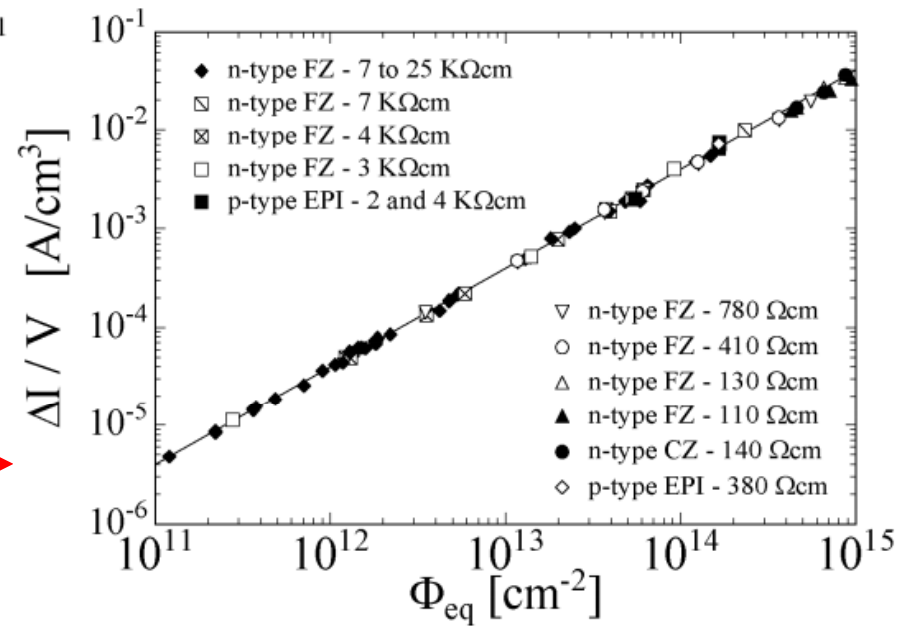
| Tobias Stockmanns

Flux dependence



Change of the full depletion voltage of silicon sensor and its absolute effective doping versus the **normalized flux**

Flux dependence of leakage current for silicon detectors



Analysis done on the PANDA GRID

Data Challenge 02 – 17.-21. November 2008

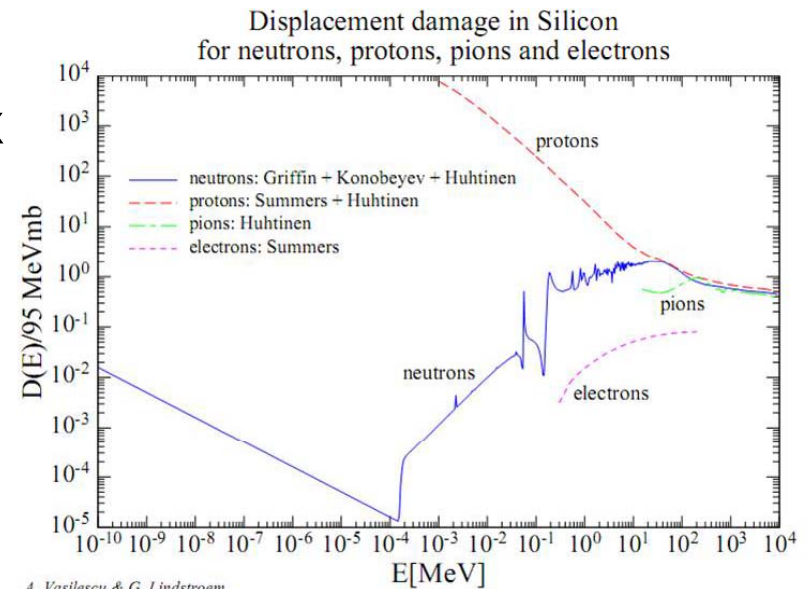
- Simulation of pbar on ^{132}Xe with different beam momenta of 2.0 – 6.2 – 15.0 GeV/c
- Full Panda detector geometry to include backscattered particles
- Modification of MVD code to “see” neutral particles

Beam momentum [GeV/c]	Simulated events
2.0	645,000
6.2	627,900
15.0	487,000

Analysis done on the PANDA GRID

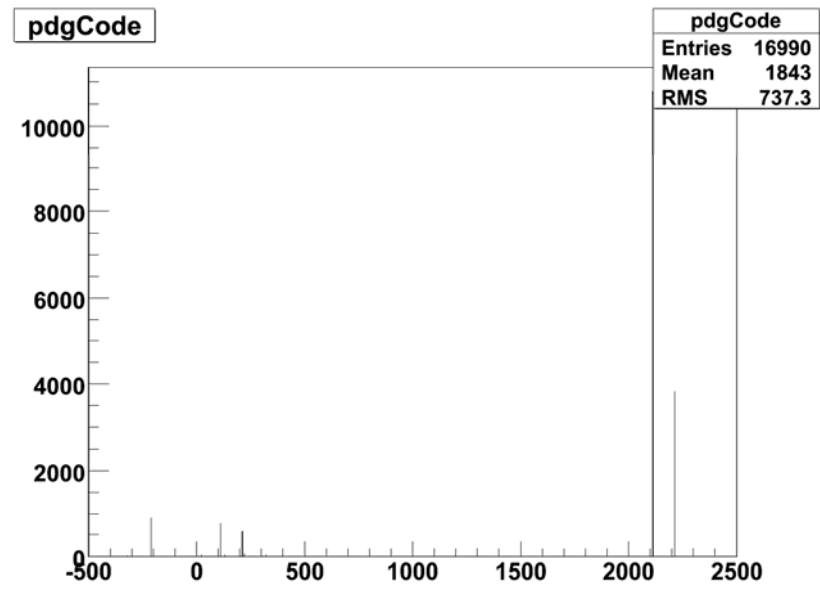
Analysis of the simulated data:

- translate the flux of the different particle types in a normalized flux of 1 MeV neutrons



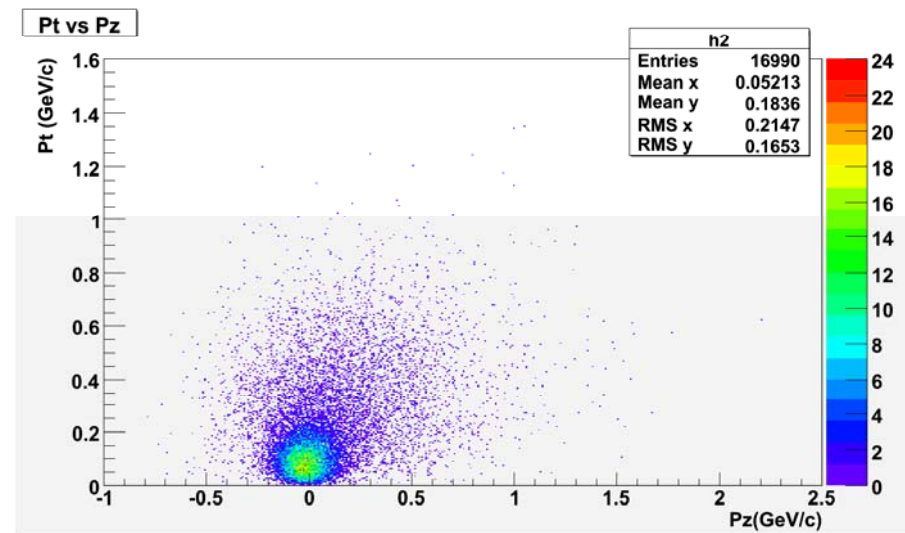
Beam momentum [GeV/c]	Simulated events	Analyzed events on the GRID	Events analyzed at desktop
2.0	645,000	420,500	0
6.2	627,900	472,700	0
15.0	487,000	390,700	215,700

Primary Particles

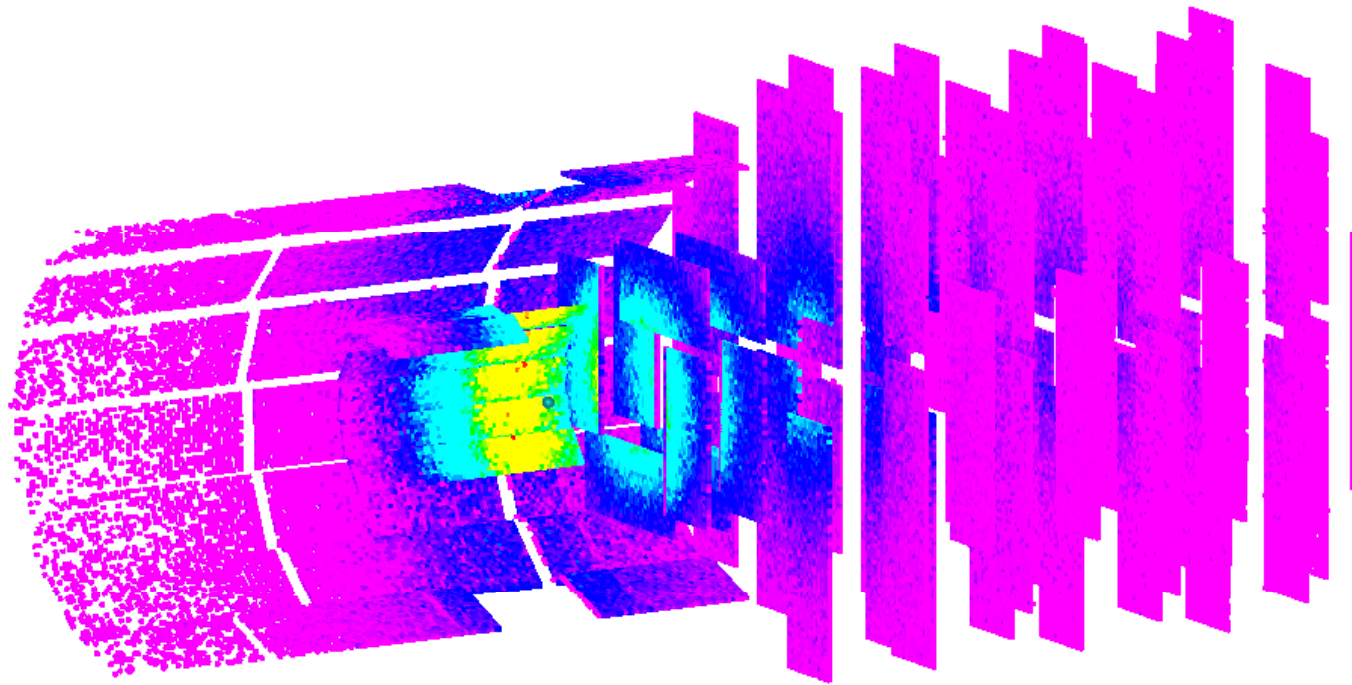


primary particles:

- neutrons, protons and pions
- ≈ 33 primaries per event
- almost spherical distribution of momentum

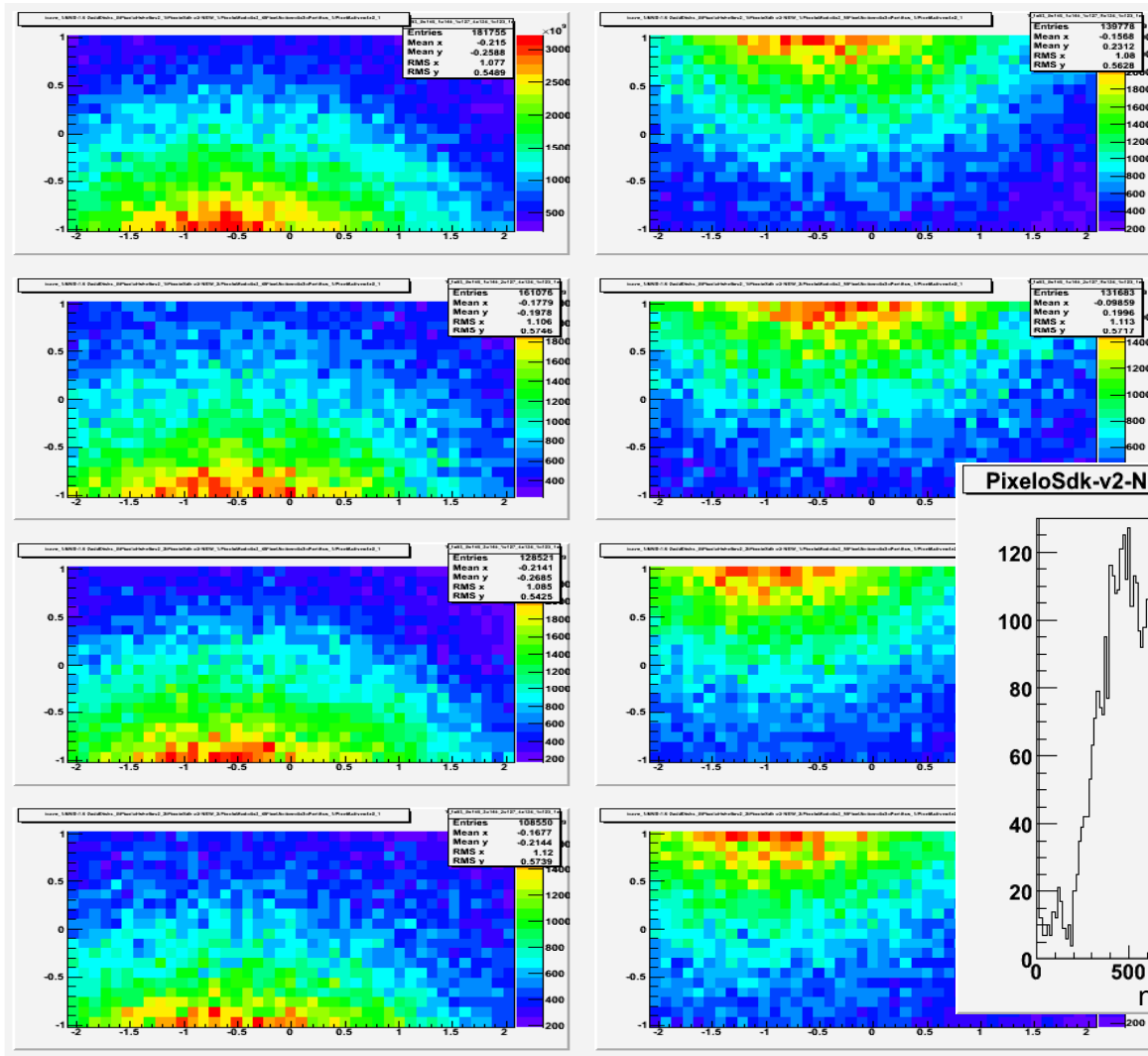


Overview of the flux distribution



Assumptions:

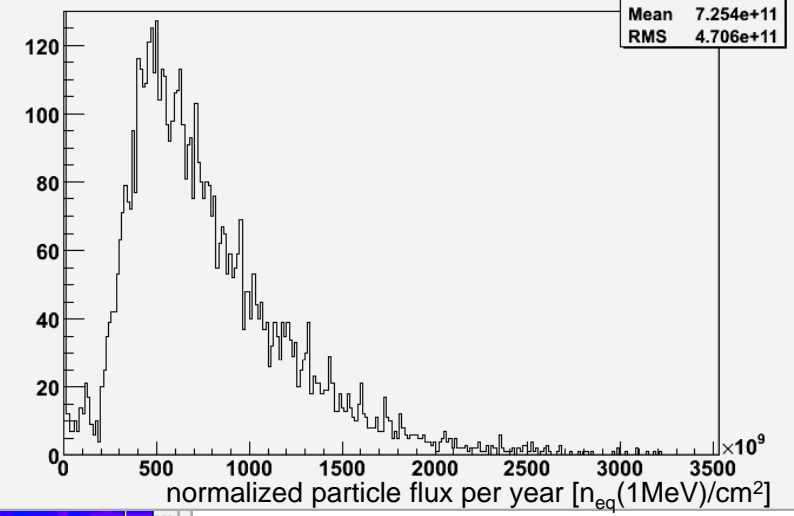
- Interaction rate of 1×10^6
- Operation time one year with 50% duty cycle



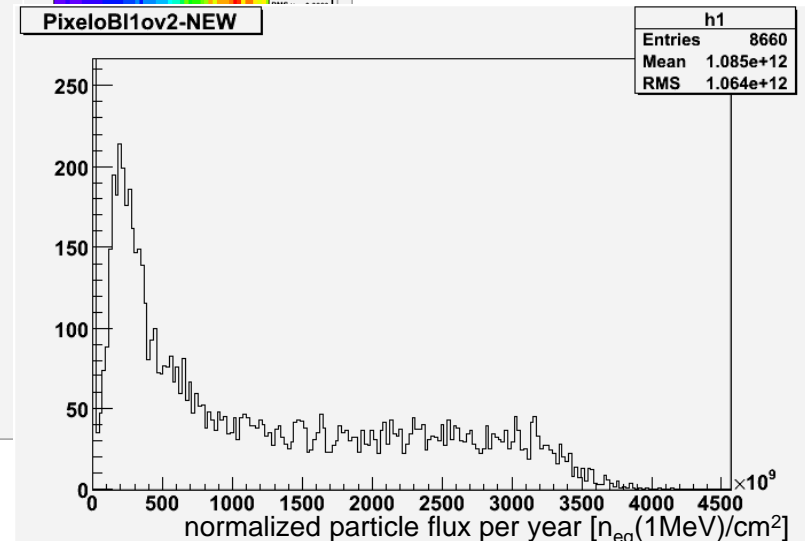
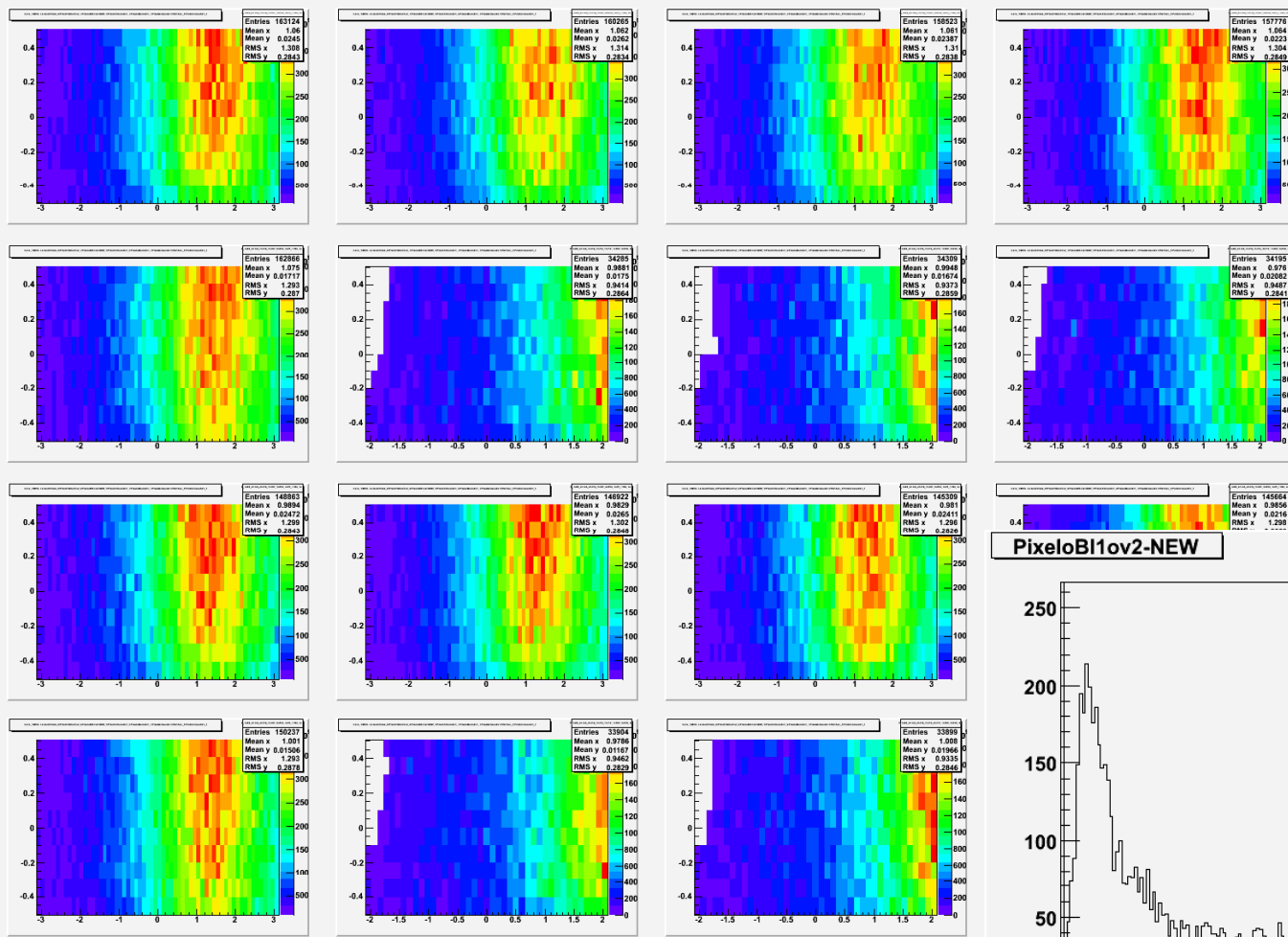
Small disks:

- maximum flux for disks
- $3.5 \times 10^{12} n_{eq}[1\text{MeV}]/\text{cm}^2$
- strong asymmetry

PixelSdk-v2-NEW



Pixel BL1



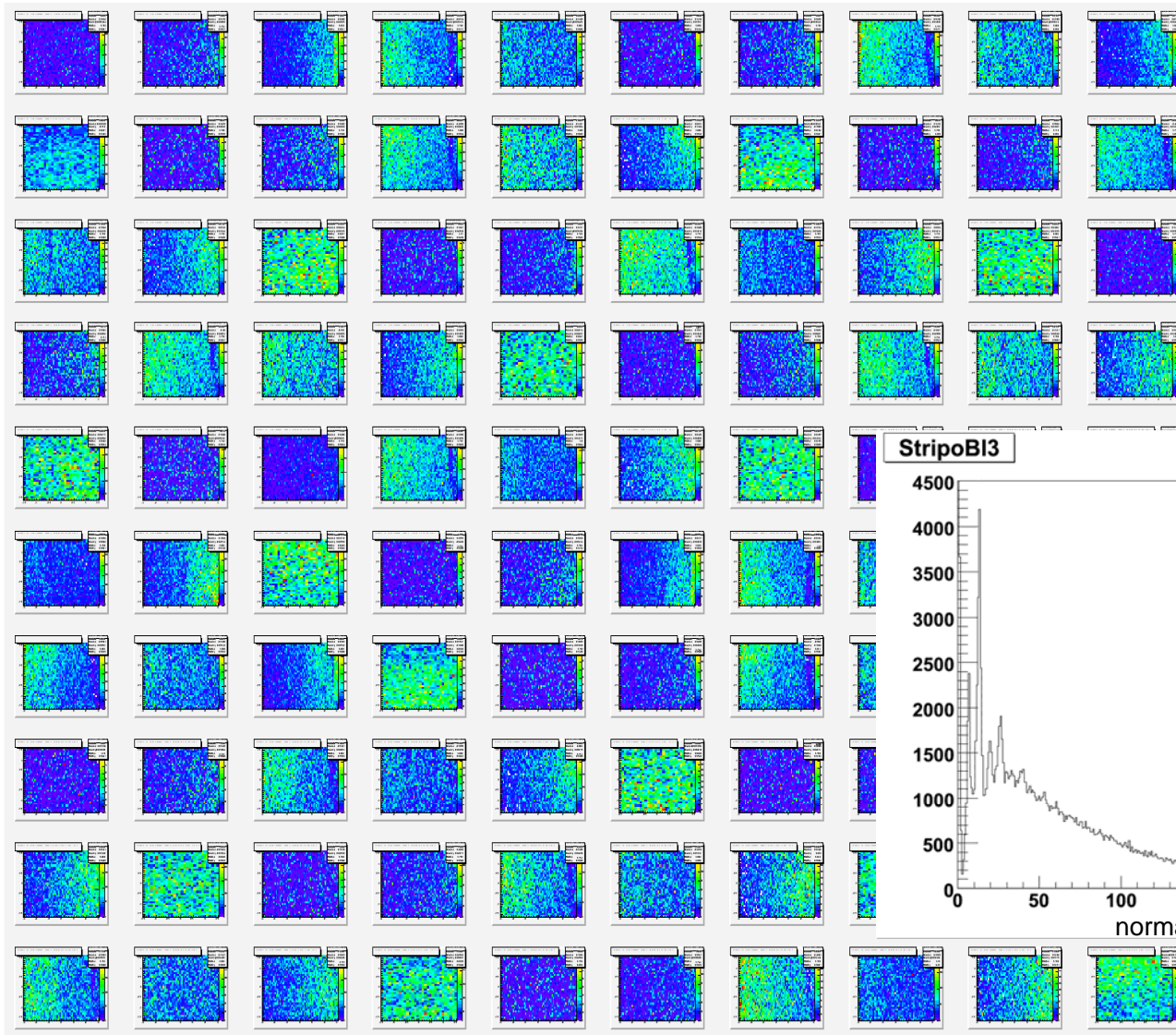
Pixel Barrel Layer 1:

- highest particle flux
- $4 \times 10^{12} \text{ n}_{\text{eq}}[1\text{MeV}]/\text{cm}^2$
- strong asymmetry

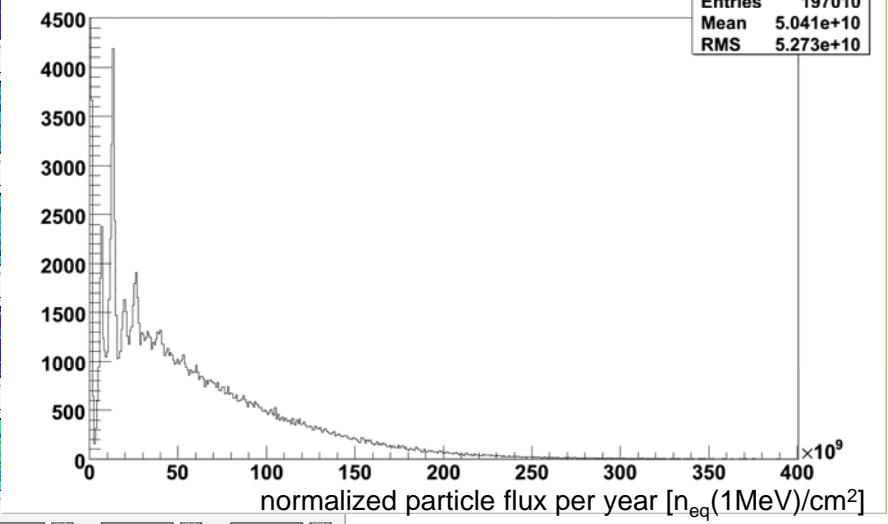
Strip BL3

Strip Barrel Layer 3:

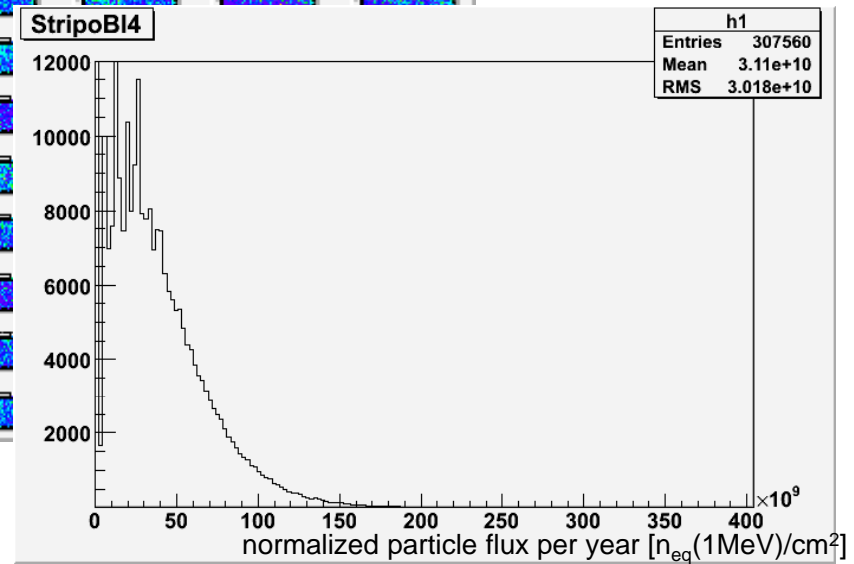
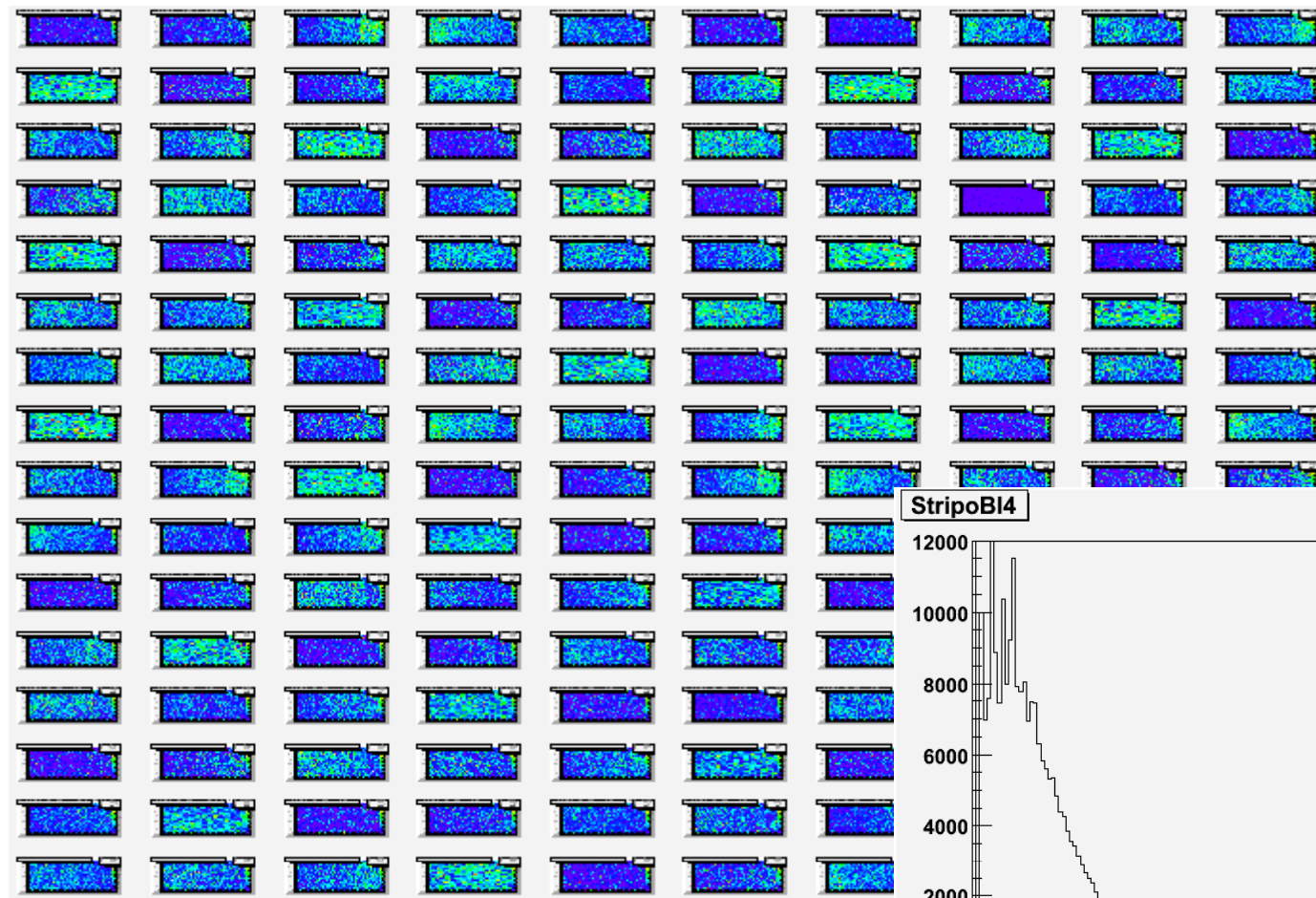
- highest flux for strips
- $4 \times 10^{11} n_{eq}[1\text{MeV}]/\text{cm}^2$



StripoBI3



Strip BL4



Summary and Outlook

- First real test of pandaGRID was successful
- Expected radiation damage from ^{132}Xe below 5×10^{12} for the pixel part and below 5×10^{11} for the strip part per year of panda operation
- Next steps:
 - analyze the remaining events to improve statistics for “cold” regions
 - look at the data with different beam momentum
 - use different target materials
 - use of FLUKA