Chapter 7 status: cosmic ray physics, multiplicities, correlations and spectra

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Chapter 7

- **Measurements of particular interest to improve hadronic models used for air shower simulations**
  - no direct test of cosmic ray property
  - but fundamental to reduce uncertainty in air shower measurements (mass composition analysis)
- **Min bias type of analysis**
  - high cross section processes (~mb)
  - need low luminosity and low pile-up (each event is relevant)
- **All experiments were contacted**
  - Similar requests
    - combined min-bias run ?

Chapter 7 Outline

- **Introduction** (D. Berge, R. Engel, T. Pierog and R. Ulrich)
  - motivations from CR physics
    - spectral feature
    - mass composition

- **Cosmic Ray and MC tuning** (D. Berge, R. Engel, T. Pierog, D. Salek and R. Ulrich)
  - relevant observables and corresponding measurements
  - comparison between EPOS LHC and QGSJETII-04
  - need for p-O beam
  - ~nb^{-1} to get ~10^8 events

Chapter 7 Outline (2)

- **LHCf** (T. Sako)
  - neutral particle energy spectra for eta>8.5
  - trigger for ATLAS experiment ?
  - accepted beam conditions (April-May 2015) :
    - 5-20 nb^{-1},N_b=40, N_p/b=10^{10}, $\mathscr{L}$=6x$10^{-28}$$cm^{-2}s^{-1}$, β*=19m

- **CMS+TOTEM** (V. Avati, K. Oesterberg, R. Ulrich, I. Katkov)
  - cross-section
  - forward charged particle multiplicity and multiplicity correlations measurements
  - energy spectra with CASTOR(+T2 ?)
  - requested beam conditions :
    - >100 nb^{-1},N_b<156, N_p/b<10^{11}, $\mathscr{L}$=6x10^{-30} $cm^{-2}s^{-1}$, β*=90m

Chapter 7 Outline (3)

- **ATLAS** (T. Martin)
  - Charged particle correlations with AFP and ALFA
  - Energy flow with proton tag
  - requested beam conditions :
    - 1 nb^{-1}, no pile up, bunch spacing=200 ns

- **LHCb** (D. Volyanskyy and P. Collins)
  - particle multiplicity
  - energy flow
  - identified particle spectra
  - fixed target collisions
  - requested beam conditions :
    - 10 nb^{-1}, no pile up, bunch spacing >50 ns

Contribution to be confirmed ???

- **ALICE**
  - people interested
  - participation to chapter 7 sent to Physics coordinator

Summary

contact : tanguy.pierog@kit.edu

Exp	σ^{-1} (nb^{-1})	Pile-up	$\mathscr{L}$ ($cm^{-2}s^{-1}$)	β^* (m)	N_b	N_p/b	bunch spacing (ns)
LHCf	5-20	<1	$6x10^{28}$	19	40	10^{10}	
TOTEM	1000	<1	10^{30}	90	<156	10^{11}	
ATLAS	1	<1					200
LHCb	10	<1					>50
CR	1	<1					

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