The LHCf experiment

Measurement of Photons and Neutral Pions in the Very Forward Region of LHC

- Short introduction about LHCf
- Installation of detectors inside the neutral absorbers (TANs)
- Proposed modifications to the TANs
- Cables installation between USA15 and the TAN zone
- Cooling?
- Conclusions

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Technical report: September 2005
LHCC Open session presentation: March 22nd, 2006

- Neutral pions and photons production cross section at the highest energies in the very forward region
- 7 TeV + 7 TeV → $10^{17}$ eV in the laboratory frame
- Study of atmospheric showers (Energy calibration, Nuclei identification)
- Cosmic ray physics ↔ Accelerator physics
- Data taking: beginning of LHC (see Itow-san presentation)
LHCf

(2 detectors)

2 neutral-particle absorbers (TAN)
Experimental Method:
2 independent detectors on both sides of IP1

Detector I
- Tungsten
- Scintillator
- Scintillating fibers

Detector II
- Tungsten
- Scintillator
- Silicon μstrips

INTERACTION POINT

140 m

1. Redundancy
2. Background rejection (especially beam-gas)
3. Physics single diffractive/double diffractive
ARM #1 detector

- **2 towers** (2.0×2.0 cm² and 4.0×4.0 cm²)
  - ~47 r.l. (22 × 2.1 r.l. tungsten layers)
  - 16 **scintillator layers** (3 mm thick)
- **4 pairs of scintillating fiber layers** for tracking purpose (two orthogonal directions)

Energy

Impact point ($\eta$)
ARM #2 detector

- 2 towers (2.5×2.5 cm² and 3.5×3.5 cm²)
  - 44 r.l. (22 × 2 r.l. tungsten layers)
  - 16 scintillator layers (3 mm thick)
- 4 pairs of silicon microstrip layers for tracking purpose (X and Y directions)

- Energy
- Impact point (η)

INCOMING NEUTRAL PARTICLE BEAM

silicon layers

scintillators

tungsten layers
Lateral view of ARM #2

Front scintillator: Fixed position wrt to TAN

Silicon + Tungsten + Scintillator: +/- 5 cm vertical excursion
The TAN and LHCf

box ~ (15×15×40) cm³

Maximum +/- 5 cm vertical excursion
TAN top/side view
Transverse position of detector #1 in the TAN slots
Transverse position of detector #2 in the TAN slots

projection at the TAN position of the dipole region elliptical vacuum pipe
Holes on the TAN - top face

holes for manipulator, additional scintillator and cabling purpose

Drilling will be done in March 2006!
Holes on the TAN - oblique faces

- Holes for cables fixing
- Mini-crate for electronics
- Holes for electronics box
- Possible interference with LUMI cables???

14 holes on both sides of TAN for M6 x 20mm screws

4 SPACES @ 100 = 400

50
100
180
191.52
200
300
431
331
50
131
231
300
431
331
LHCf installed
(End 2006/Beginning 2007)

LHCf manipulator
+/- 5 cm excursion

Taylor - Hobson sphere supports

The real height of the manipulator and the possible interference with the LHC alignment system (Taylor - Hobson spheres) are under consideration.
Cables installation

- Most of the control electronics and all the power supply system will be located in the USA15 Atlas control room
- 200 m distance!!!
- The cables and the optical fibers have been chosen and we are ordering them
- They will be installed in September 2006
- 2 Patch panels will be installed near the TAN (TBD?)

- Power lines
- DAQ lines (optical fibers)
- Analog signals for trigger
- Slow controls
- Cables for manipulator
Cooling

- 100 W dissipated deeply inside the TAN
- The possibility to use liquid cooling for the detector is under study, if necessary...
- Moritz Kuhn (TS/CV) is calculating the expected equilibrium temperature of LHCf
- A decision will be taken later on
Conclusions

• TANs are going to be drilled in March
• SPS test beam in Summer
• Cables will be pulled in September 2006
• LHCf Arm #1 and Arm #2 detectors will be installed inside the IP1 TANs at the end 2006 / beginning 2007
• Ready for Data Taking for the LHC startup!