### **Activities at KTH particle physics**

R. Lafaye, on behalf of the KTH theoretical and experimental particle physics groups



### **Theoretical particle physics at KTH**

Tommy Ohlsson, Mattias Blennow, Shun Zhou, Göran Gustafsson, Johannes Bergström, Stella Riad, Marcus Carrigan. *More information on www.theophys.kth.se/tepp/* 



Mass models, RG running, mass hierarchy, CP violation



Asymmetric dark matter, sterile neutrinos, signals



UEDs, RG running, analogies to cond. mat.



Signals for extra dimensions

### **Experimental particle physics at KTH**

J. Jovicevic, E. Kuwertz, R. Lafaye, O. Larsson, B. Lund-Jensen, J. Strandberg

#### ATLAS

- □ Higgs studies in H→WW→IvIv and H→  $\gamma\gamma$
- Diphoton cross section measurement
- Supersymmetry searches with razor variables
- Operation of the Liquid Argon calorimeter presampler

#### Sileye-3/Alteino

Measurement of the radiation environment on the International Space Station





### **Higgs studies in ATLAS**

New resonance discovery announced in July 2012 (see E. Gross talk this morning)

- □ Best fit mass  $m_H = 126.0 \pm 0.4$  (stat)  $\pm 0.4$  (syst) GeV from  $H \rightarrow \gamma\gamma$  and  $H \rightarrow ZZ \rightarrow 4I$
- **Given Signal strength**  $\mu = 1.3 \pm 0.3$

\_ocal Significance [σ]

- Nothing visible outside 125 GeV peak
- Now emphasis is on the low mass region





## **Higgs studies in ATLAS at KTH**

### □ Higgs to WW

- $\Box$  KTH group is working on  $I_V I_V$  channel
- □ H → WW Confirms H→ZZ→4I and H→ $\gamma\gamma$  observations
- $\Box$  2.6  $\sigma$  excess @ 125 GeV (expected 1.9)

 $\Box$   $\mu$  = 1.5 ± 0.6





# **Higgs studies in ATLAS at KTH**

#### Higgs to 2 photons studies

- KTH group is working on Standard Model background decomposition (γγ, γj and jj)
- Used to assess photon identification and MC normalization for optimization studies
- 2x2D sideband + jet correlations
- Method developed for SM diphoton studies





### Standard Model yy cross section

#### Diphoton Standard Model production studied on 2011 ATLAS data

- □ Comparison with LO parton shower simulations and NLO/NNLO predictions
- Paper approved by ATLAS and sent to journal



## Supersymmetry in ATLAS at KTH

#### □ Searches with *razor* variables

- Default ATLAS analysis mostly based on ETmiss and HT
- **\Box** Razor variables are constructed after finding the boost where *megajets* have opposite  $p^{T}$
- Results for mSUGRA and GMSB scenarios consistent with other analysis teams
- □ First SUSY analysis to combine different final states in ATLAS (0, 1 and 2 leptons)



Exclusion plot presented here is from ATLAS standard analysis. Razor paper is not published yet.



### Hardware work in ATLAS

### Operational responsibility for the presampler

### Upgrade: Main interest is the MiniFCal

- □ Rate of ionization in the Fcal is too high at the High Luminosity LHC
  - $\Rightarrow$  Space charge will give luminosity dependent response.
- □ A possible solution: A plug in front of the FCal to lower the dose

 $\Rightarrow$  MiniFCAL

□ Main readout option: Diamond.

Probably too expensive. Other options required

- □ We will investigate a Silicon Carbide (SiC) option
- SiC as material has evolved and matured over the past years for High Power and High Voltage semiconductors. On paper it should be more radiation hard that normal Si, due to higher band gap and higher displacement threshold.



### Sileye-3/Alteino

#### ❑ Study radiation environment on the International Space Station

- Silicon strip detector
- Long duration (20 days) measurements in Zvezda, Zarya and Pirs modules of the ISS
- Measure particle abundance and Linear Energy Transfer
- Light flash correlation measurements from astronauts observations



Particle spectrum, nuclei peaks are fitted with single Gaussians (Green & Blue) Red represents multi Gaussian fit.



### **Summary/Perspectives**

#### ATLAS

- $\hfill\square$  Improve  $\mu$  measurement in H $\rightarrow$ WW channel, combine with 2011 results
- □ Update to full 2012 data. Focus on VBF and MVA analysis for the  $H \rightarrow \gamma \gamma$  channel
- □ Publish paper on Supersymmetry searches with *razor* variables. Run on 2012 data

#### Sileye-3/Alteino

- □ Continuing the data analysis
- □ Focus on the multiplicity in the detector and comparisons with Geant4 simulations