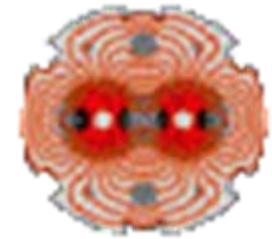


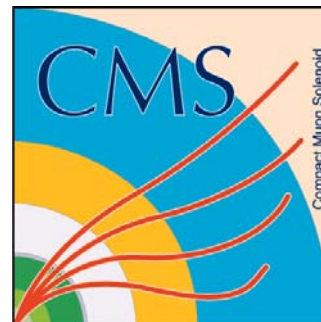


# DESY at the LHC



Klaus Mönig

On behalf of the ATLAS, CMS and the  
Grid/Tier2 communities



# A bit of History

- In Spring 2005 DESY decided to participate in the LHC experimental program
- During summer 2005 a group lead by J. Mnich evaluated the possibilities
- Both experiments (ATLAS & CMS) welcomed the participation of DESY
- In November 2005 DESY decided to join both ATLAS and CMS

# General considerations

- DESY will contribute a TIER2 centre for each experiment
- No contributions to detector hardware are foreseen for the moment
- Participating DESY physicists are meant to work 50% on LHC, 50% on other projects
- The groups start relatively small and will grow when HERA stops next year
- We profit from close collaboration with the DESY theory group (already 2 workshops on BSM (4/06) and SM (tomorrow) physics)

# The LHC schedule

- Machine closed: Aug. 07
- Collisions at 900GeV: few days in Dec. 07
- Open access: Jan. – Mar. 08
- Collisions at 14 TeV: June 08
- Possible luminosity by end 08:  
 $L = 10^{33} \text{cm}^{-2} \text{s}^{-1}$



# ATLAS

- The DESY-ATLAS group consists at present of 7 physicists and 4 PhD students
- Close collaboration with
  - IT-Hamburg and DV-Zeuthen
  - Uni Hamburg (1 Junior Professor)
  - Humboldt University Berlin
- Our tasks in ATLAS are usually common projects of DESY and the university groups
- Already 2 plenary talks at the ATLAS-D meeting in Heidelberg 9/2006

# Tasks in ATLAS

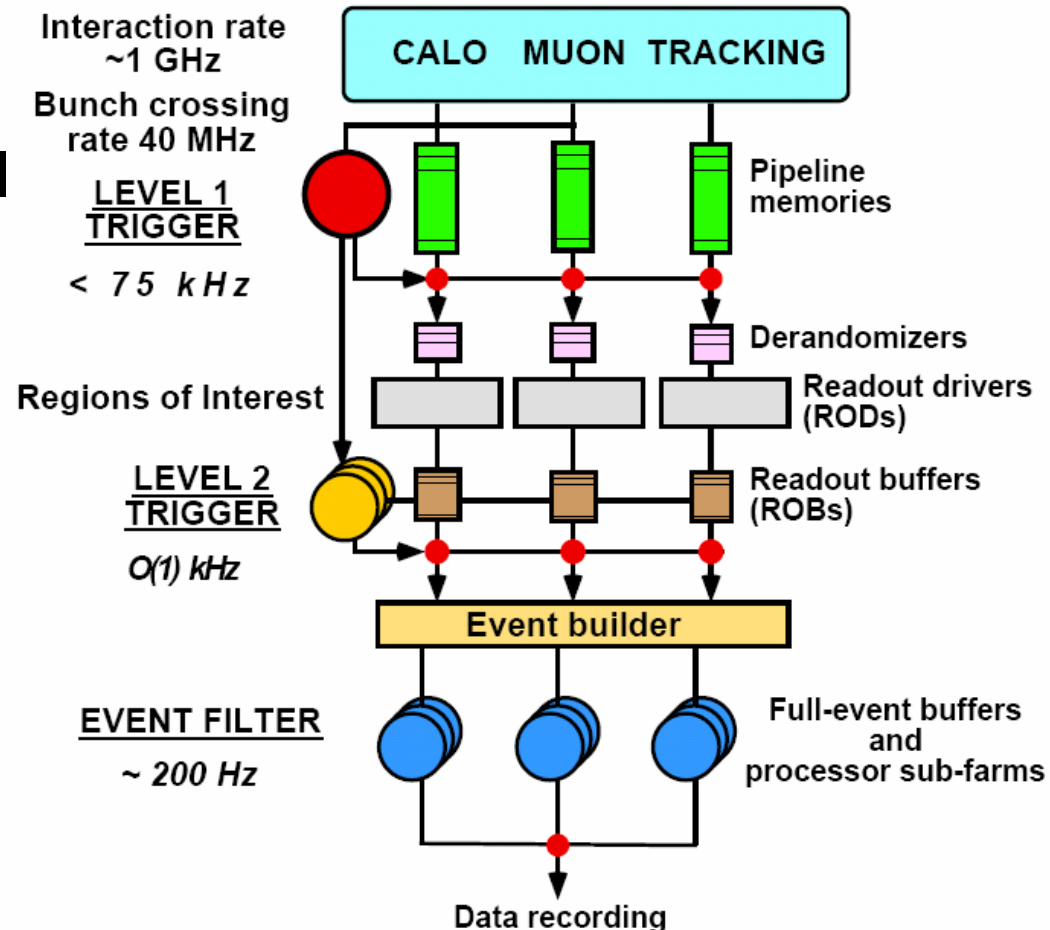
- Trigger
  - Trigger configuration
  - Simulation of the L1 central trigger processor
  - Trigger Monitoring
  - Event filter for Minimum Bias Events
- ATLAS software
  - Fast shower simulation
  - Coordination of event graphics
  - Contributions to core software

# Infrastructure

- DESY will provide a rack for the ATLAS-event filter (~120.000€)
- A test facility (5PCs + disks) to test trigger software in Zeuthen is being set up
- In Hamburg an offline facility (1 file server plus 2 nodes) is running
- ATLAS offline software is running in Hamburg and Zeuthen

# The ATLAS trigger

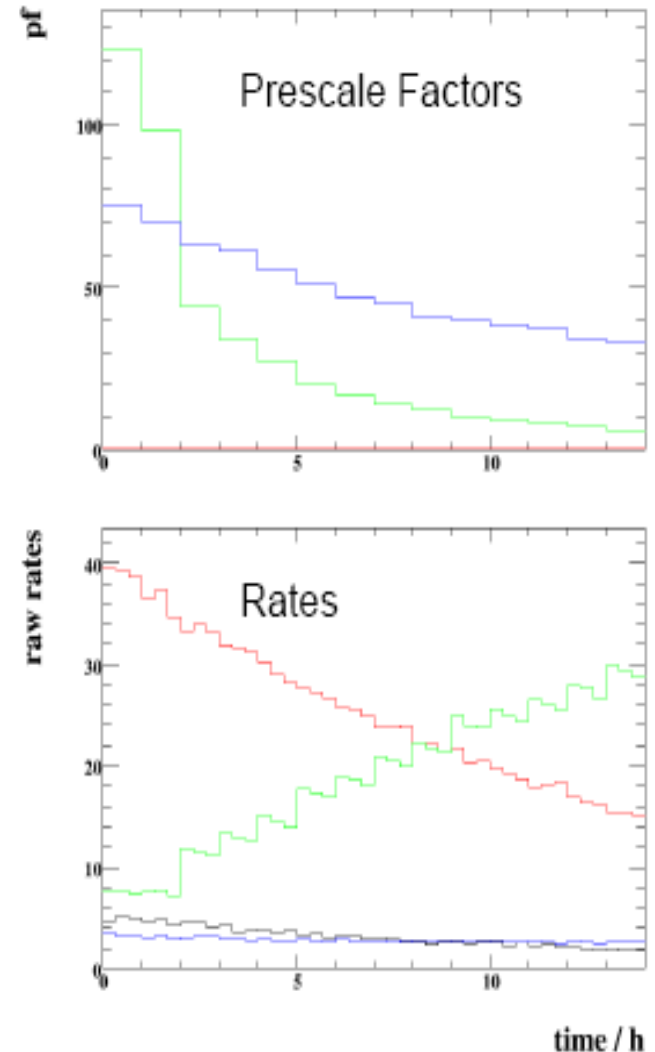
- 3 trigger levels
  - 1<sup>st</sup> level is hardware
  - 2<sup>nd</sup> and 3<sup>rd</sup> (EF) level (HLT) are software
- DESY is mainly engaged in HLT
- However also some 1<sup>st</sup> level items are treated





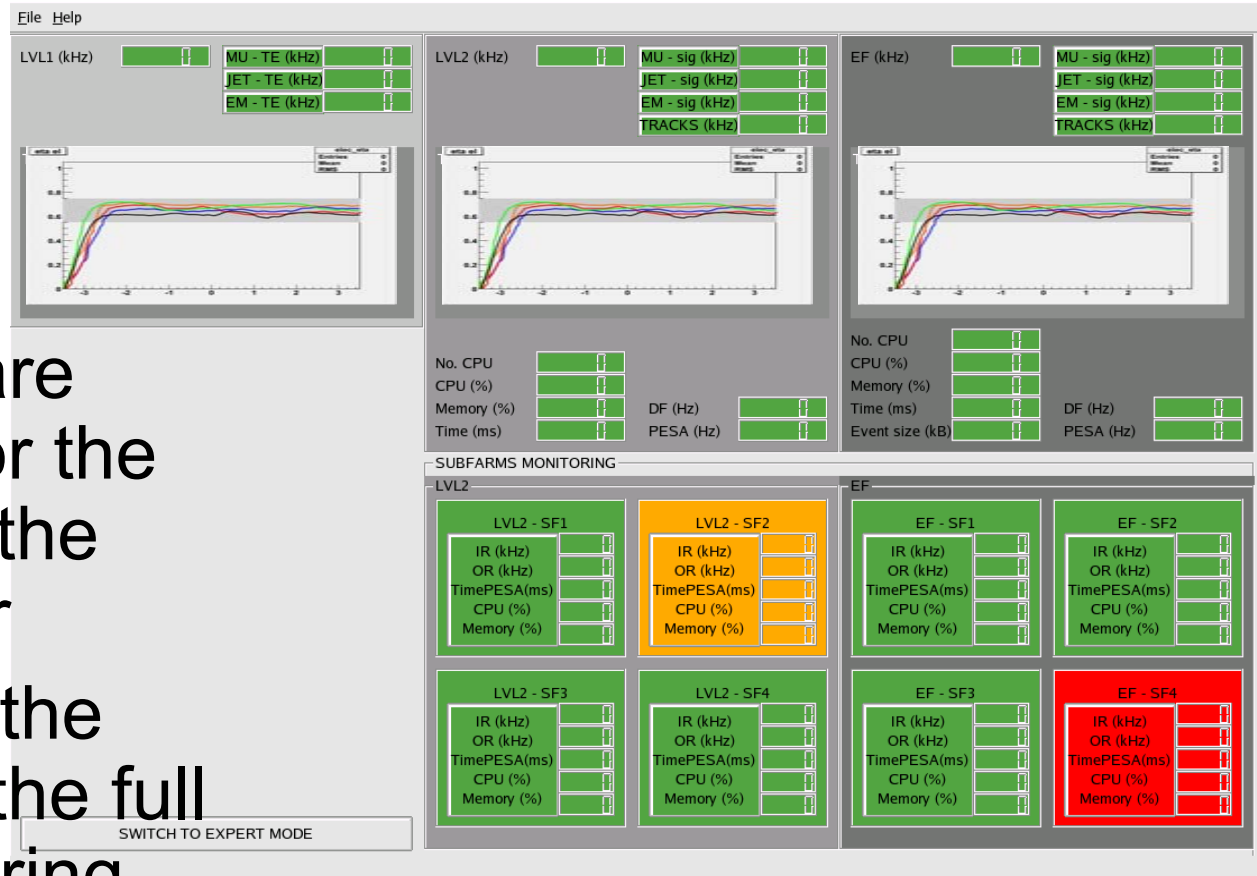
# Trigger configuration

- DESY and Uni HH contribute to the ATLAS trigger configuration
- Recent example: Automatic calculation of prescale factors during fill (nice synergy with H1 experience)
- Needs to be integrated with ATLAS online SW



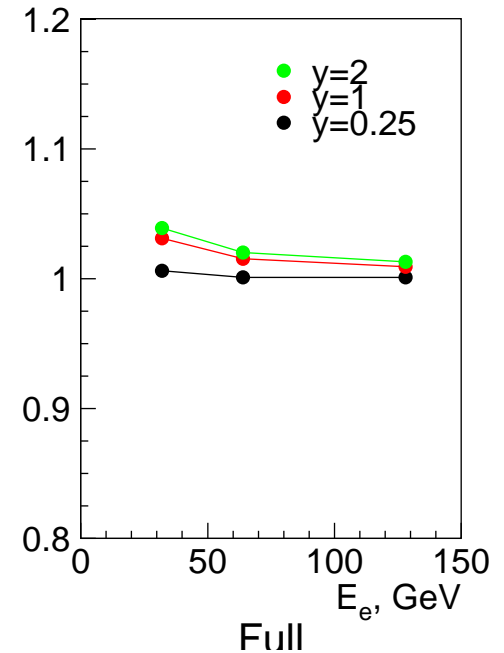
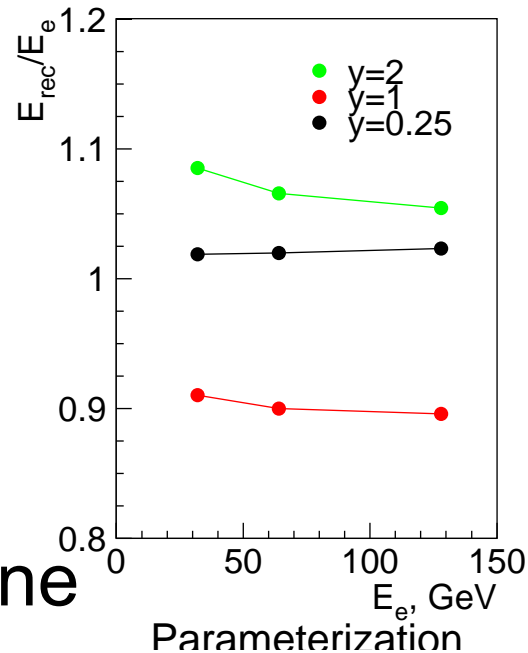
# Trigger monitoring

- DESY+HUB are responsible for the monitoring of the ATLAS trigger
- This includes the presenter for the full trigger monitoring
- First parts of the monitoring exist
- A proposal for the presenter is being discussed



# Fast shower simulation

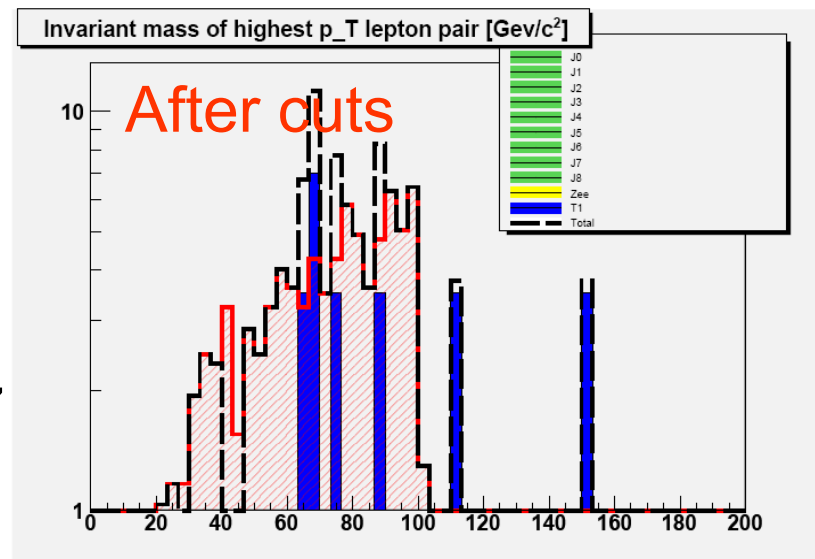
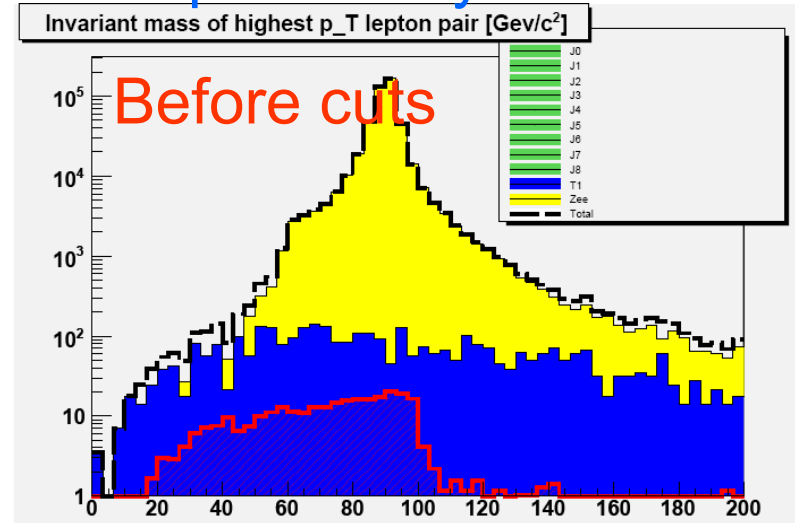
- Full simulation is very slow and fast simulation not accurate enough
- A compromise can be a fast parameterization of electromagnetic showers
- This has been pioneered by H1
- We try to inject this experience into ATLAS
- Collaboration with SLAC and Melbourne

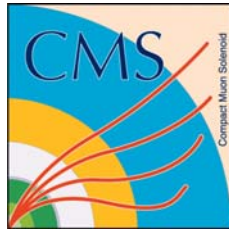


# Physics analysis

- Interest in Supersymmetry, b-physics, QCD, forward physics
- Only 1<sup>st</sup> steps up to now
- Exploit synergies with DESY theory group
- Development of an analysis framework together with CERN
- Large scale n-tuple production
- ATLAS-D physics meeting 07 in Zeuthen

## 2-lepton analysis





# CMS

- The DESY CMS group consists of 5 physicists 1 software engineer and 3 PhD students
- There is close collaboration with the Uni Hamburg group who is CMS member since a couple of years
- Areas of contribution:
  - Higher level trigger
  - Computing
  - Technical coordination (deputy technical coordinator from DESY)

# HLTSupervisor software

- CMS has a 2 level trigger
  - Level1 clocked at crossing rate (24ns), accept rate 100kHz
  - HLT is a O(2000) PC farm running filter offline software, output rate 100Hz
- HLTS requirements
  - Read trigger table from DB and store HLT tag to condDB
  - Distribute trigger table to FU before start of run
  - Collect statistics about L1 and HLT rates and efficiencies
  - Control dynamic parameters such as prescalers
- Currently concentrate to get prescaler handling working:
  - Test system setup on machines at DESY using CMS software
  - System working, with this software, since September

# Current status of HLT supervisor work

- Test system functionally complete and works
  - Needs integration with HLT development at CERN
- Next steps
  - Interface to online DB
  - Interface Level 1 information
  - Other HLTS requirements
- Address the above at the HLT workshop  
30.Oct.2006 at CERN

# CMS Computing Goals

- Computing: continuing to work towards an environment where users do not perceive that the underlying computing fabric is a distributed collection of sites.
  - Most challenging part in the distributed system: some site is always having some problem
  - Large progress in understanding and reducing the problems while working at a scale comparable to CMS running conditions
- 2006 is “Integration Year”
  - Tie the many sites with common tools into a working system
  - Coordination: Michael Ernst (DESY) and Ian Fisk (FNAL)
- 2007 will be the “Operation Year”
  - Achieve smooth operation with limited manpower, increase efficiency, complete automated failure recovery while growing by factor 2 or 3 in scale

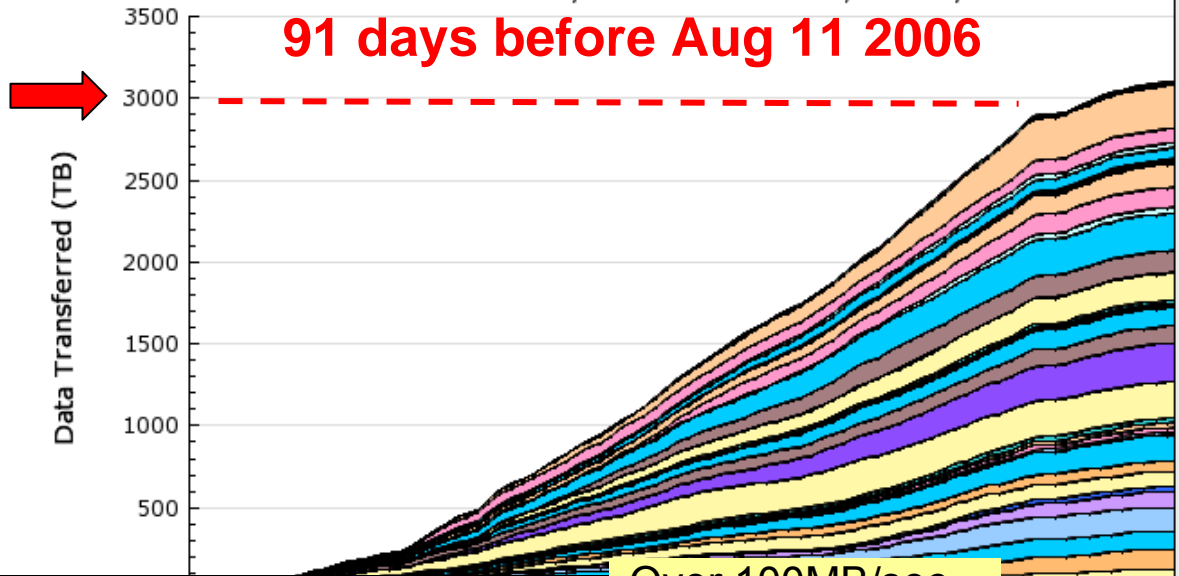


# Test Tier0-Tier1/2 transfers at 2008 rates

More than 3PB of data transferred by CMS in 3 months

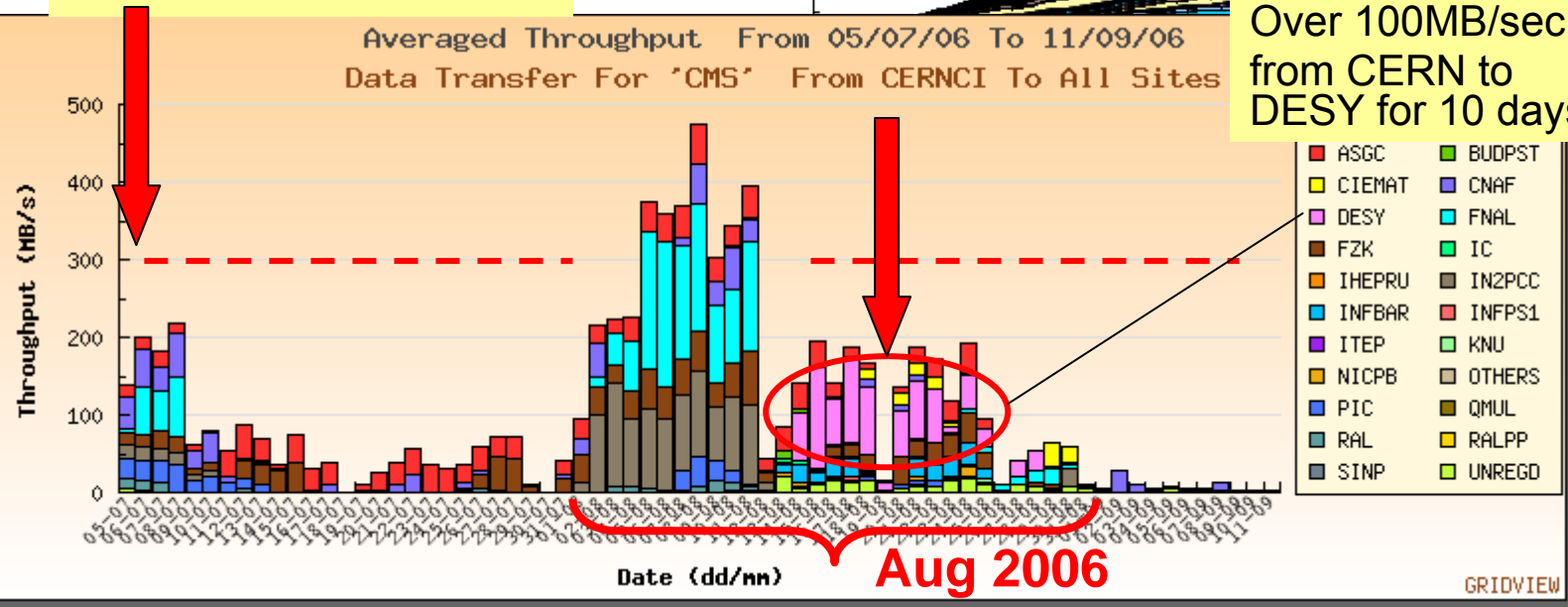
PhEDEx SC4 Data Transfers By Destinations matching

Last 91 Days at 2006-08-11 09:08, last entry 2006-08-11 GMT



Over 300MB/sec peak from CERN to Tier1's

Averaged Throughput From 05/07/06 To 11/09/06  
Data Transfer For 'CMS' From CERNCI To All Sites



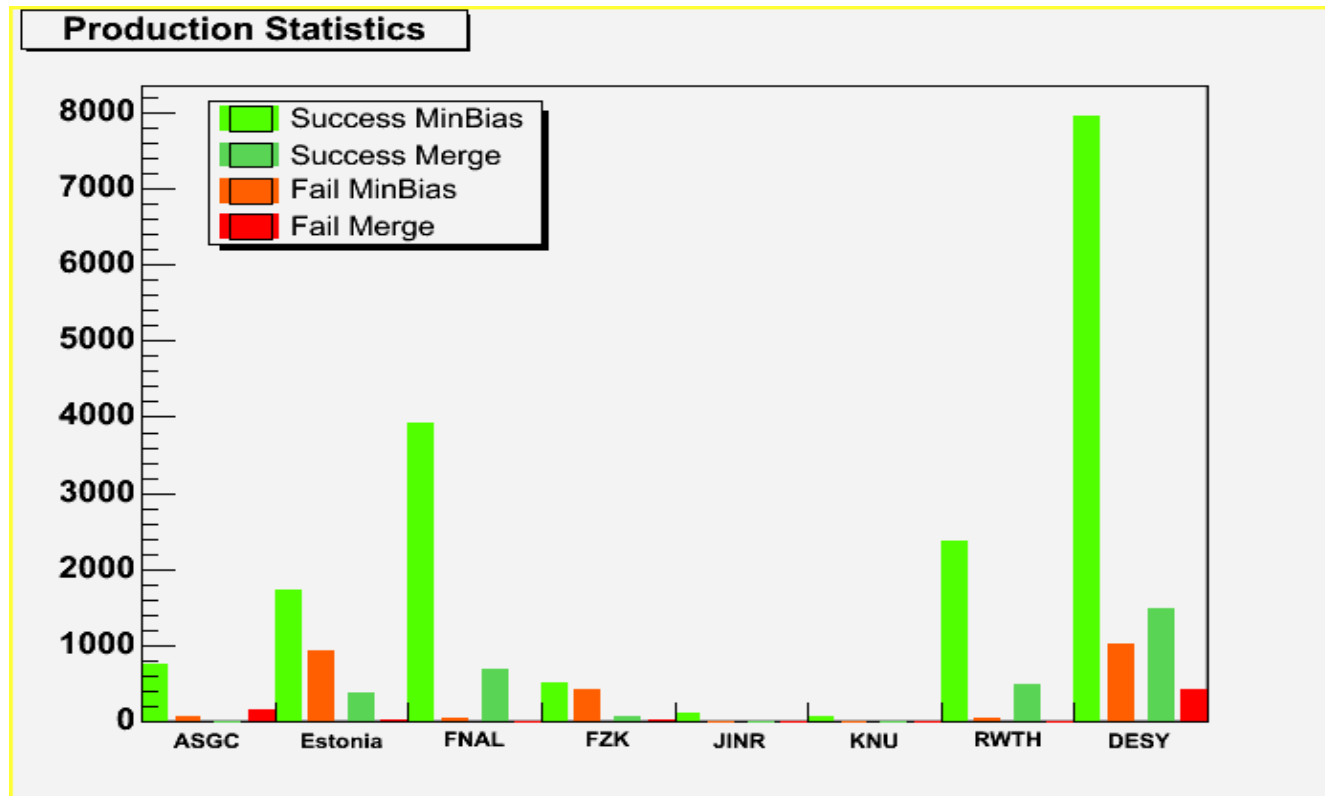
Over 100MB/sec from CERN to DESY for 10 days

# Monte-Carlo Production for Computing Software and Analysis Challenge (CSA06)

- Monte Carlo production for CSA06 started in July
- Aim (originally): produce 50M events (25M minimum bias + signal channels) to use as input for prompt reconstruction for CSA06
- 4 teams incl. Aachen/DESY managed worldwide production running exclusively on the grid
- About 60 Million of events produced in less than 2 months
  - Continue to produce 10M events per month during CSA06 and beyond

# DESY Contribution to worldwide MC Production on the Grid

Number of Jobs

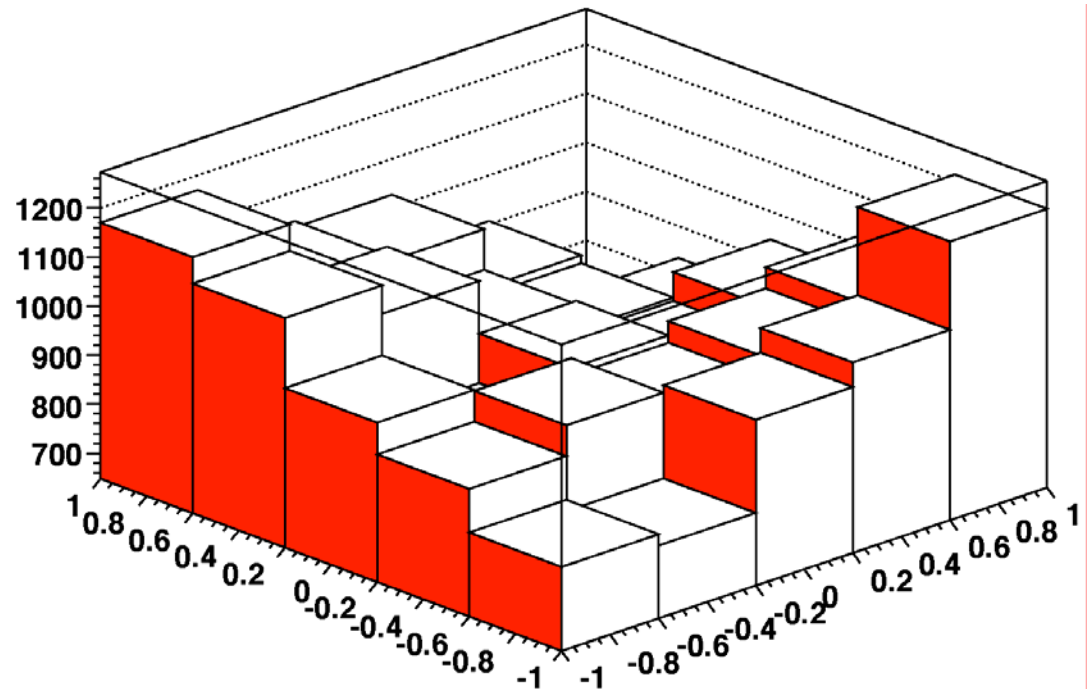


Production Sites

# Physics analysis

- J. Mnich is CMS SM convener and has edited the corresponding chapter of the physics TDR
- Main interest: top-pair production
  - tt production
  - LO/NLO comparison
  - spin correlation

Example: Spin (=decay angle) correlations are sensitive to production process (gg fusion or qqbar annihilation)



# The TIER 2 centre

- An average size TIER 2 centre for ATLAS and CMS will be the main hardware contribution to the experiments
- DESY has already substantial experience running Grid for HERA exp., Theory, IceCube and ILC.
- At present these experiments run concurrently with LHC

# Tier 2 centres for Germany

	# T2s total	Author	#T2s in Germany
Atlas	30	10%	3 T2s
CMS	25	5%	1,5 T2s

## Proposed Tier 2s in Germany:

- DESY: Federation with RWTH Aachen for 1,5 av. Tier 2 for CMS 1 av. Tier 2 for Atlas
- (MPG/LMU) & (Univ. Wuppertal/Univ. Freiburg) 1 Tier 2 each for Atlas
- N.B.: attached Tier 3's on all Tier 2's

# Revised hardware resources plan

(C=CTDR, N=New) for a average [Atlas](#) Tier 2

(Ass.: 30 Tier 2's)

	2007	2008	2009	2010	2011	2012
CPU [kSI2k]	80 N 700 C (Quast 05)	580 N 900 C (Quast 05)	900 N 900 C (Quast 05)	1720 N 1670 C	2300 N 2200 C	2900 N 2800 C
Disk [TB]	45 N 340 C (Quast 05)	260 N 340 C (Quast 05)	440 N 570 C (Quast 05)	740 N 800 C	1040 N 1140 C	1300 N 1470 C
Tape [TB] (?)						

# Revised hardware resources plan

(C=CTDR, N=New) for a average [CMS](#) Tier 2

(Ass.: 25 Tier 2's)

	2007	2008	2009	2010
CPU [kSI2k]	300 N 400 C	600 N 900 C	1000 N 1400 C	1810 N 2300 C
Disk [TB]	50 N 100 C	170 N 200 C	340 N 400 C	530 N 700 C
Tape [TB] (?)				



# Revised hardware resources plan ramp up (total for DESY)

	2007	2008	2009	2010
CPU [kSI2k]	380	1500	2300	4000
Disk [TB]	150	460	840	1440
Tape [TB] (?)				

# The new computer room



# A full production environment @ DESY

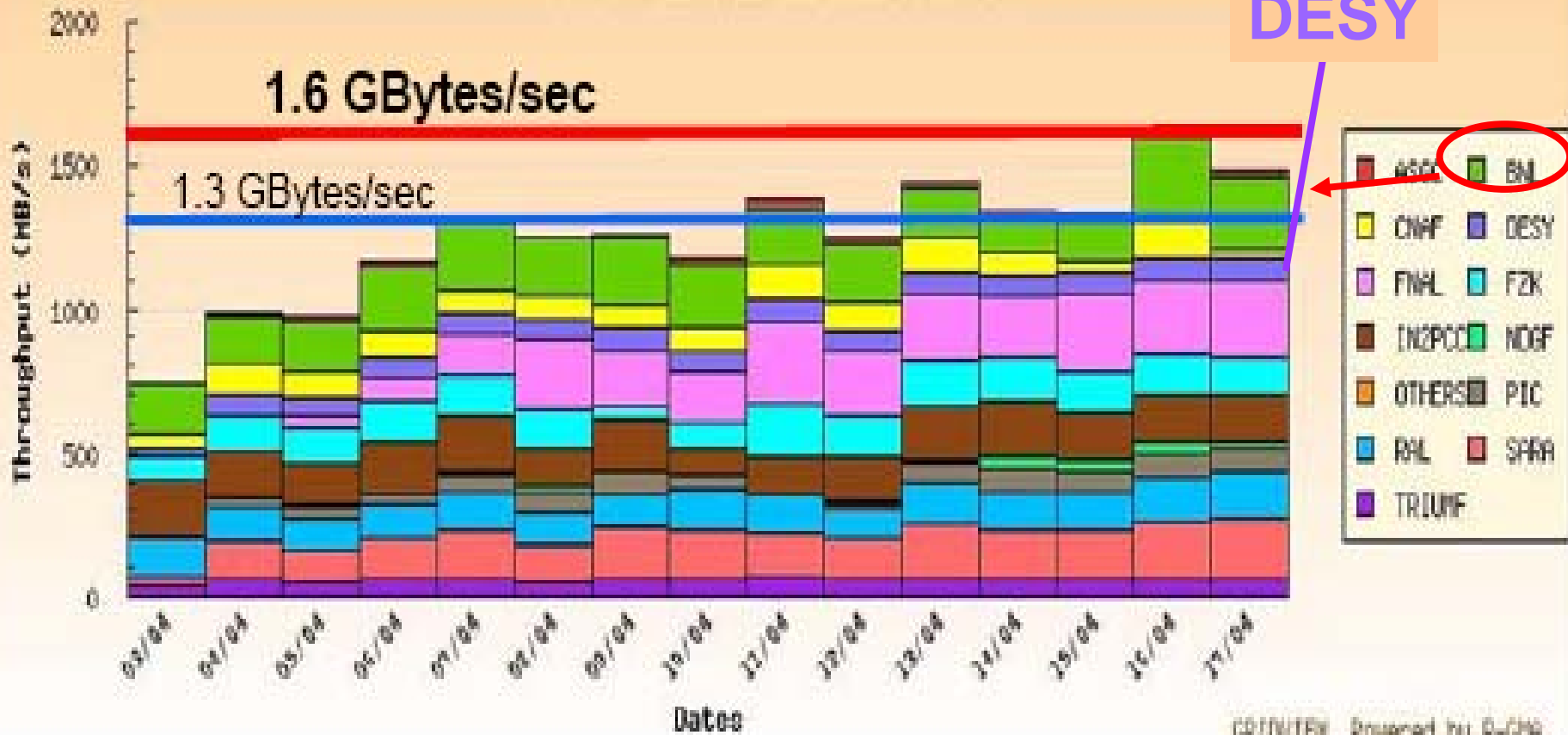
- ATLAS: 52163 Jobs/ 296.600 h (CPU wall clock)
- CMS: 125613 Jobs / 585.200 h (CPU wall clock)
- DCMS: 3715 Jobs / 14.700 h (CPU wall clock)

CPU-time used at DESY (Jan 1st – Sept. 30th)

~ 50% of the DESY grid farm (Hamburg&Zeuthen)

# Constant contribution from DESY Tier 2 (!) to datatransfer

Daily Averaged Throughput From 03/04 to 17/04  
From CERNCI to ALL SITES





# Current Tier 2 Production Environment (HH&Zeuthen)

- Hardware:
  - ~ 230 WNs ( ~700 kSpecInt),
  - Storageelement : ~100 TB disk, 1.5 PB tape
- Middleware/OS
  - Full working grid environment
  - gLite 3.0.2 / SL3.0.5
- Upgrades Q4/06:
  - 42 WNs (~ 300 kSpecInt) (external money)
  - 120 TB disk (external money)
  - 10GBit/s Link Hamburg-Zeuthen
- **Overall DESY is with the Tier 2 well on track!**

# Conclusions

- DESY joined ATLAS & CMS early this year
- We make already significant contributions to both experiments
- Also the DESY-TIER 2 is well on track
- Further strengthening of the groups is expected after HERA shutdown
- We look forward to many beautiful data to come