



**CMS**

**Roadmap for  
2009/2010**

Compact Muon Solenoid

**WLCG Workshop  
21.3.2009  
Prague**

Matthias Kasemann

The slide content is enclosed in a light gray border. The background features a faint, stylized diagram of the Compact Muon Solenoid (CMS) detector, showing its curved structure. The text is arranged in a clear, hierarchical manner, with the title 'CMS Roadmap for 2009/2010' being the most prominent. The event details 'WLCG Workshop 21.3.2009 Prague' and the author's name 'Matthias Kasemann' are positioned at the bottom of the content area.

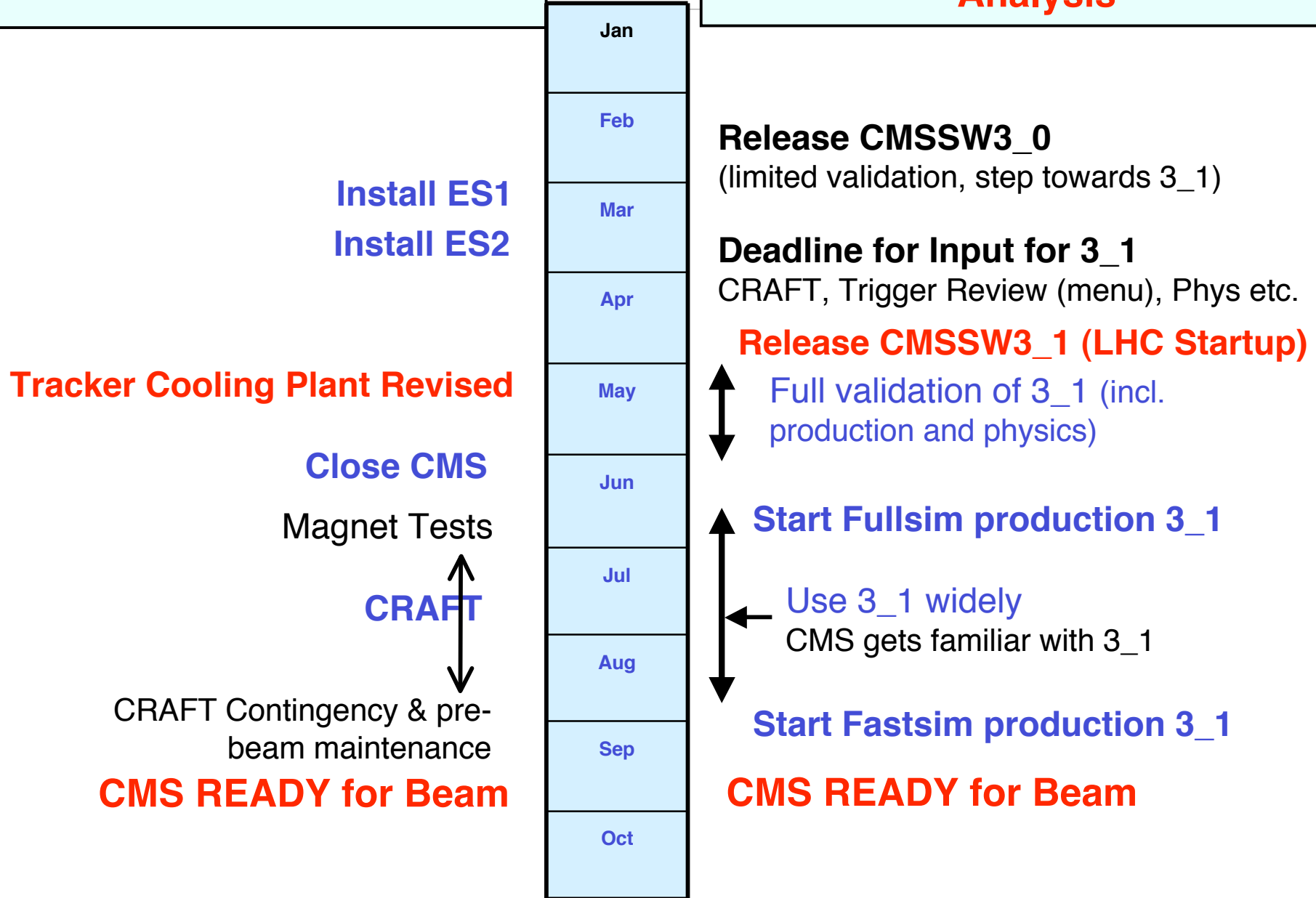
## Outline

- **CMS data taking in 2009/10**
- **Computing Infrastructure**
  - Site commissioning
- **Preparation for Data**
  - Resource planning

# 1) Maintenance & Operation

IS Sc

# 2) Software, Computing & Physics Analysis



### 3) Production & Analysis

IS Sc

### 2) Software, Computing & Physics Analysis

CruZet, CRAFT re-reco's @ T0/T1

Summer08/Fall09 MC Production & Analysis @ T2's

CMS Global Runs & Functionality & Scalability tests @T0/T1/T2

MC Production & Analysis @ T2's continues all time...

CRAFT: full CMS data taking mode

Probably CRAFT re-reco's @ T1

**CMS READY for Beam full CMS data taking mode**



**Release CMSSW3\_0**  
(limited validation, step towards 3\_1)

**Deadline for Input for 3\_1**  
CRAFT, Trigger Review (menu), Phys etc.

**Release CMSSW3\_1 (LHC Startup)**

Full validation of 3\_1 (incl. production and physics)

**Start Fullsim production 3\_1**

Use 3\_1 widely  
CMS gets familiar with 3\_1

**Start Fastsim production 3\_1**

**CMS READY for Beam**



# CMS running conditions

## Data taking conditions for first run (unchanged since 2007):

- **Target trigger rate 300 Hz**
  - for low LHC duty cycle and special tests rate may be as high as 2 kHz
  - CMS will take commissioning data when LHC is off
- **Data divided in ~20 primary data sets for different physics analysis**
  - Data assigned to T1's by primary datasets
- **Nominal event size 1.5 MB,**
  - uncertain because of LHC conditions, will change for detector tests & studies
- **Target reconstruction times: 100 (200) HepSpec06.s (higher Luminosity)**
- **Detailed table of WAN and tape/disk IO bandwidth by site and workflow is in preparation**



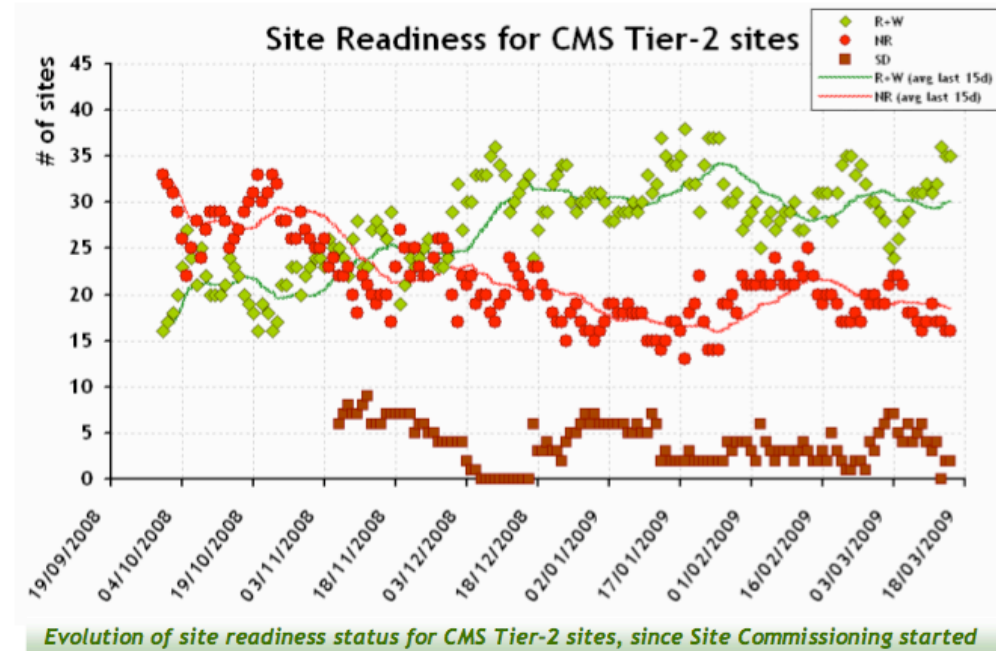
# Computing Infrastructure, Site commissioning

## We declare sites as Commissioned: “Ready for analysis or production activities”

- We combine available information into a single estimator.
  - Use results from Job Robot, Site-Availability-Monitoring,
  - Include scheduled downtimes
  - transfer links
- Tools are stable now
- Several months of monitoring data
- Next steps:
  - use production success in metric
  - Determine main reasons for failures
  - Automatic creation of (some) tickets
  - help sites to improve

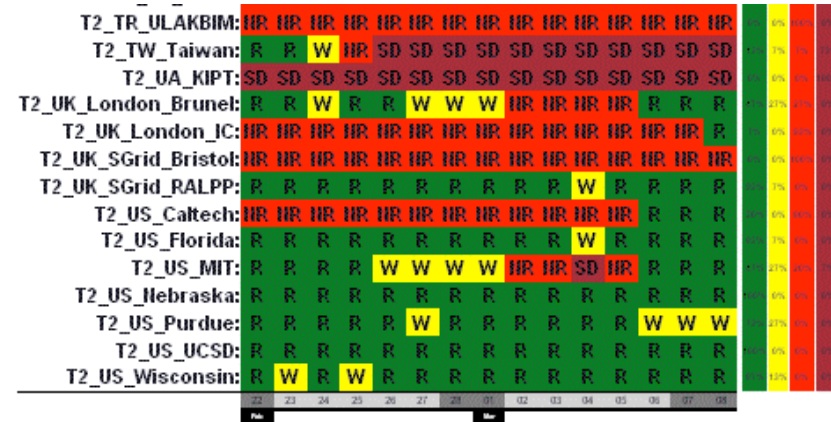
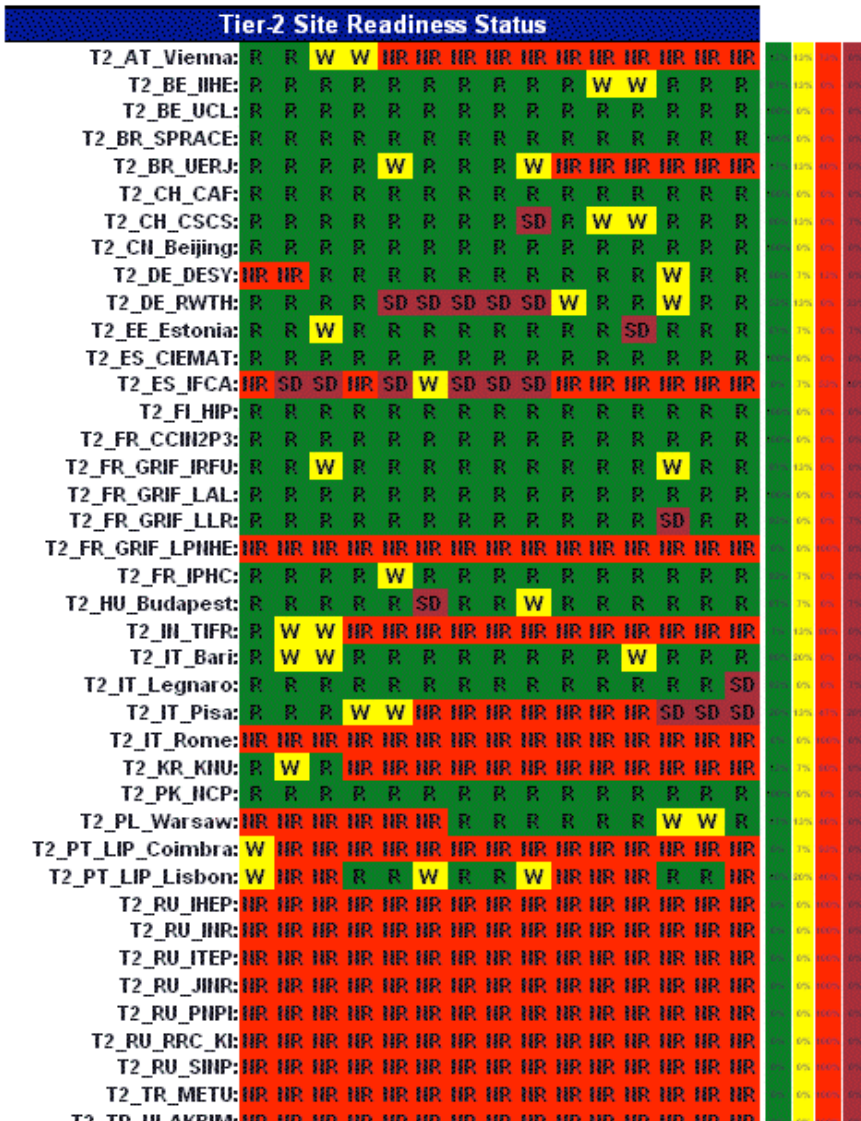
Sites have an easy way to know if CMS is finding troubles at them:

- The program provides monitoring plots, XML feeds, nagios-plugin, and alerts;
- Results/problems are reported on weekly Facilities Operations meetings.





# Site Readiness: Daily History

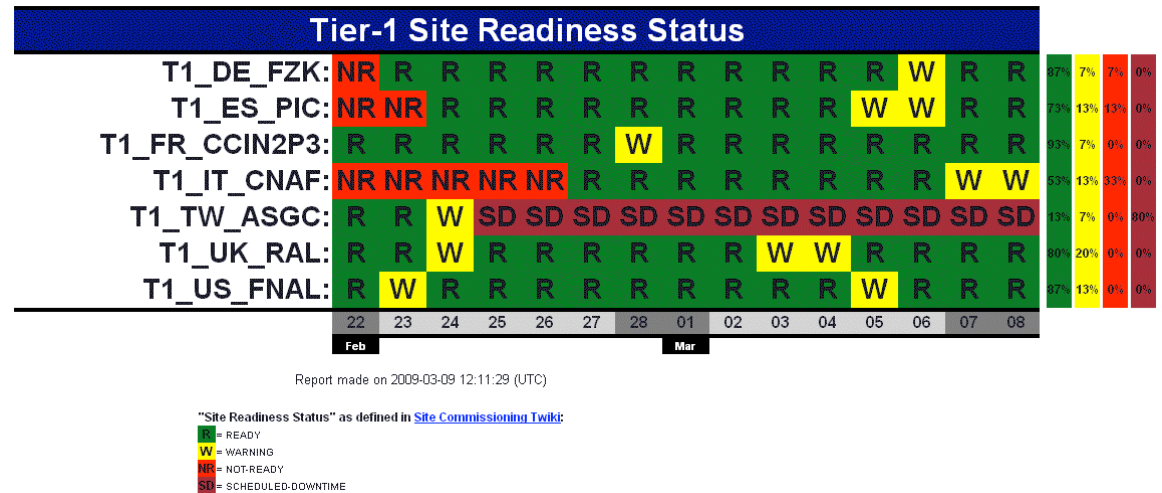


Report made on 2009-03-09 12:11:29 (UTC)

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"Site Readiness Status" as defined in [Site Commissioning Twiki](#)

- R = READY
- W = WARNING
- HR = NOT-READY
- SD = SCHEDULED DOWNTIME



Report made on 2009-03-09 12:11:29 (UTC)

"Site Readiness Status" as defined in [Site Commissioning Twiki](#)

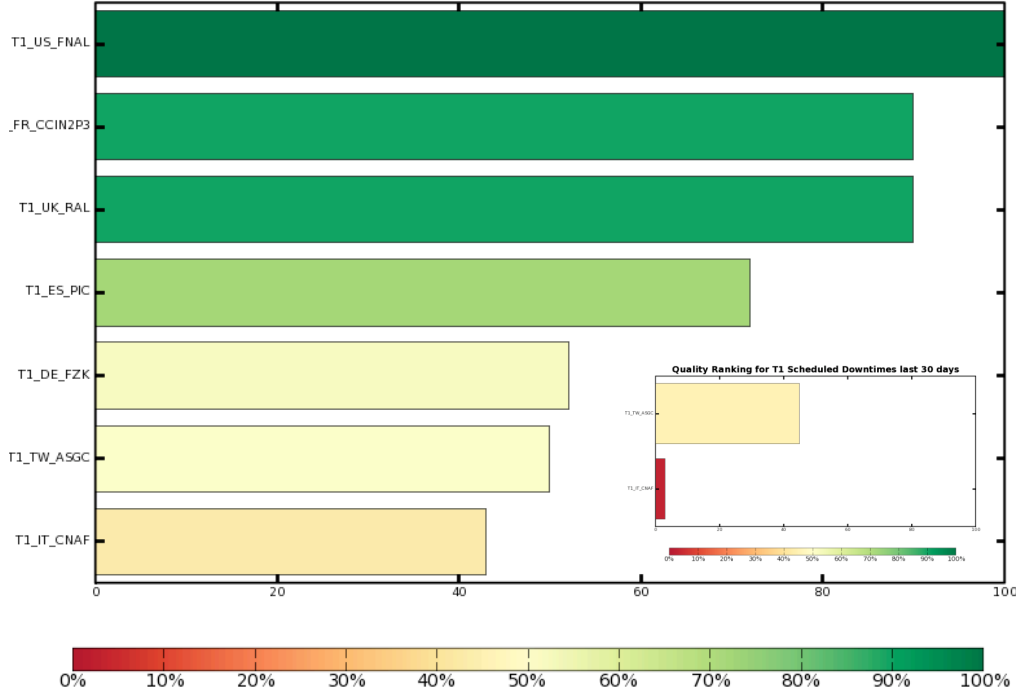
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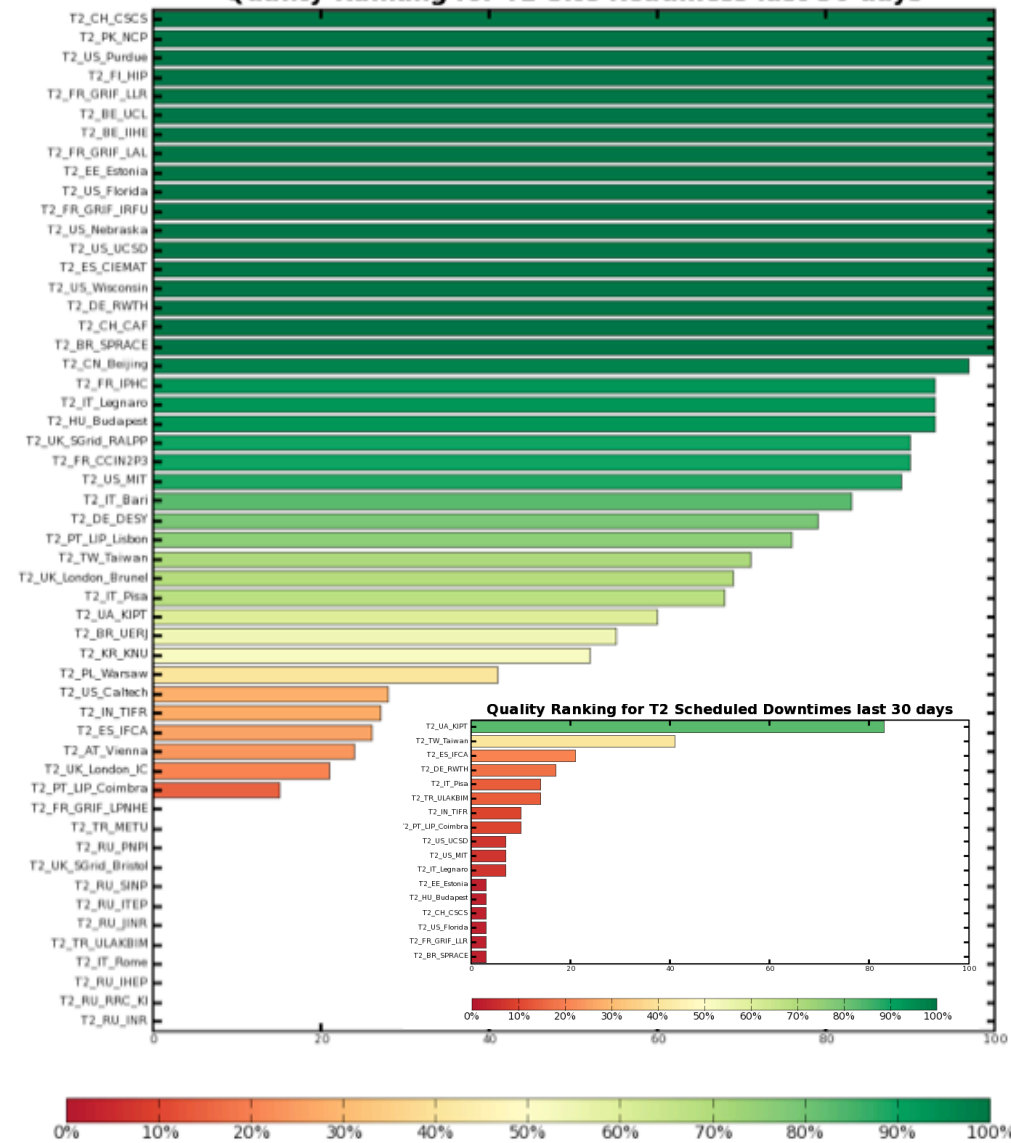
# Site Commissioning results:

<https://twiki.cern.ch/twiki/bin/view/CMS/PADASiteCommissioning#ScMon>

### Quality Ranking for T1 Site Readiness last 30 days



### Quality Ranking for T2 Site Readiness last 30 days



**Fire accident in Taiwan T1 25.2.2009:  
- down for  $\geq 1$  month**

**Results are worrisome:**

- To improve reliability Data Operations started to test T1 production at low priority permanently ('backfilling' →)

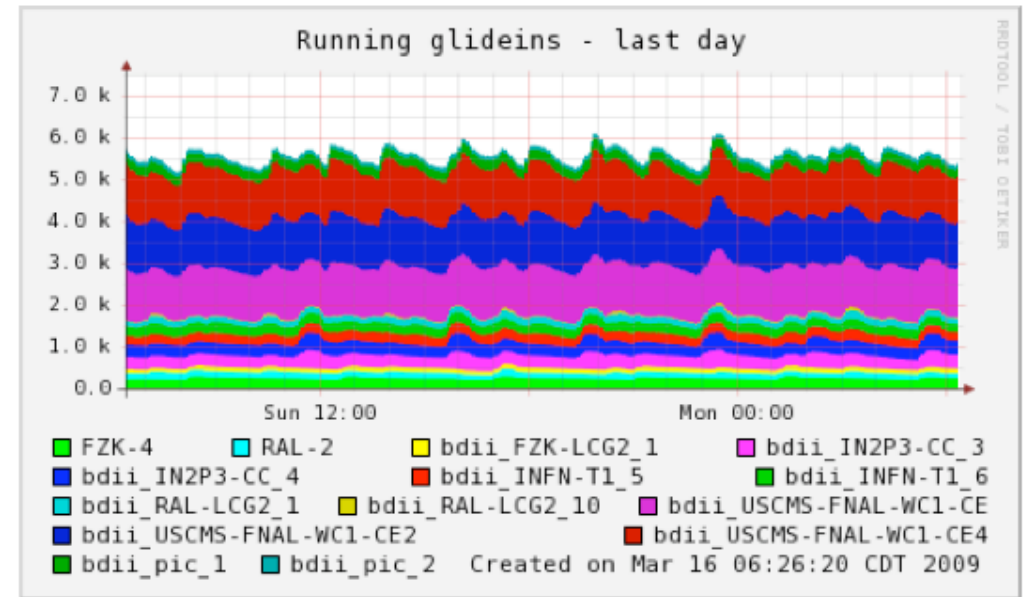


# Planning for 2009

Current Glidein Factory Status (real-time)

We need to improve reliability of Tier-1/Tier-2 infrastructure

- Will use “commissioning results”
  - Track service interruptions automatically (create tickets)
  - Input to computing shifts
- Started to stress test Tier-1’s continuously
  - Maintain processing loads at the T1's
  - Classify and report any errors observed.
- We are open to coordinate with ATLAS to be active at the same time....
  - ... for a “challenge-test” as recommended by the LHCC







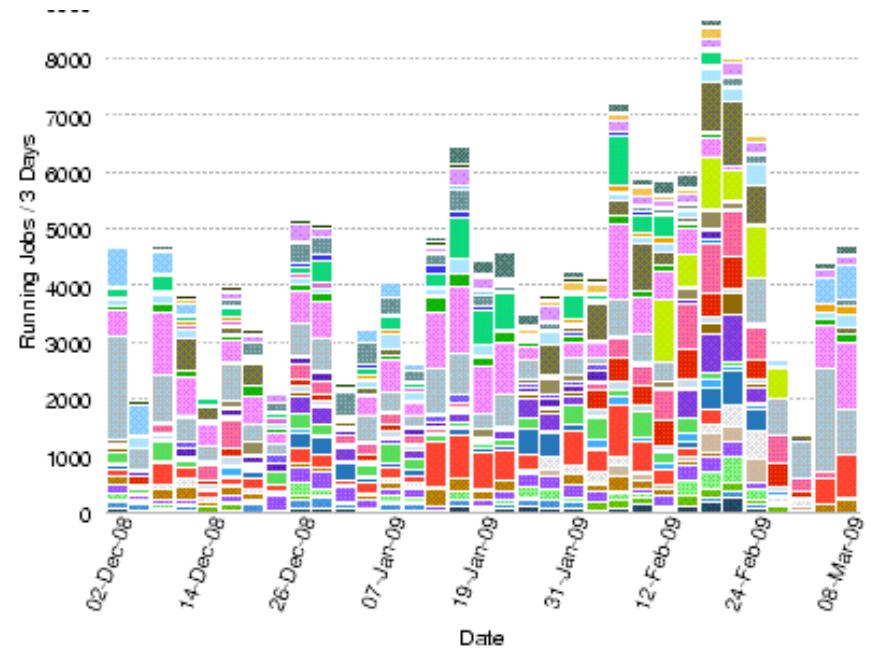
# Data Production

Re-reconstructions of CruZet & CRAFT data (~700 TB of RAW, RECO, Skims):

- Second re-reconstruction of CRAFT completed in February
- Second re-reconstruction of CruZet just completed

Large Monte Carlo production completed:

- Summer08, Fall08, Winter08,
- FullSim, FastSim, re-digitization,
- 360 different samples/bins
- **Production rate is quite good**  
(~500M FullSim / 5 months + 350M FastSim)  
**rate not limited by resources...**
- **Validation samples made available quickly**
- **Manpower intensive operation**



MC production at T2, last 3 months

Basically working, suffering from Tier-1 and Tier-2 availabilities and reliabilities.



# Planning for 2009: Computing Resources (1)

**C-TDR performance numbers were updated in 2007 based on (realistic) target values**

- **Since then performance campaign with significant improvements in CPU, memory, event sizes:**
  - Monitored with every new release during RelVal procedure
- **CMS performance numbers still within the (updated) C-TDR targets.**

**Data taking rate reviewed in ECOM in January:**

- **Reviewed justifications for increased trigger rate**

**Conclusion:**

- **The priority is to make the 300 Hz operations and data analysis stable and robust.**
- **Some parts may benefit from an increased data taking rate during special runs;**
  - **the effect on the computing resources will be minimal in this cases.**



# Strawman Luminosity Profile (S.Myers)

<http://lhc-commissioning.web.cern.ch/lhc-commissioning/luminosity/09-10-lumi-estimate.htm>

Month	Comment	Turn around time	Availability	Max number bunches	Protons/Bunch	Min beta*	Peak Luminosity $\text{cm}^{-2}\text{s}^{-1}$	Integrated Luminosity	
Oct?	1	Beam commissioning						First collisions	
Nov?	2	<a href="#">Pilot physics</a> , partial squeeze, gentle increase in bunch intensity, 40%	Long	Low	43	$3 \times 10^{10}$	4 m	$1.2 \times 10^{30}$	100 - 200 $\text{nb}^{-1}$
Dec?	3		5	40%	43	$5 \times 10^{10}$	4 m	$3.4 \times 10^{30}$	$\sim 2 \text{ pb}^{-1}$
Jan?	4	2.5% nominal beam intensity	5	40%	156	$5 \times 10^{10}$	2 m	$2.5 \times 10^{31}$	$\sim 13 \text{ pb}^{-1}$
Feb?	5		5	40%	156	$7 \times 10^{10}$	2 m	$4.9 \times 10^{31}$	$\sim 25 \text{ pb}^{-1}$
Mar?	6	9% nominal beam intensity, 75 ns	5	40%	936	$3 \times 10^{10}$	2 m	$5.1 \times 10^{31}$	$\sim 30 \text{ pb}^{-1}$
Apr?	7	15% nominal beam intensity, 75 ns	5	40%	936	$5 \times 10^{10}$	2 m	$1.4 \times 10^{32}$	$\sim 75 \text{ pb}^{-1}$
May?	8	15% nominal beam intensity, 75 ns*	5	40%	936	$5 \times 10^{10}$	2 m	$1.4 \times 10^{32}$	$\sim 75 \text{ pb}^{-1}$
Jun?	9	15% nominal beam intensity, 75 ns*	5	40%	936	$5 \times 10^{10}$	2 m	$1.4 \times 10^{32}$	$\sim 75 \text{ pb}^{-1}$
July?	10	Ions							
Aug?									
								<b>TOTAL</b>	<b><math>\sim 300 \text{ pb}^{-1}</math></b>

- \*Switching to 50 ns bunch spacing could be attempted at this stage. With  $5 \cdot 10^{10}$  protons/bunch the integrated  $L$  could be as high as  $110 \text{ pb}^{-1}/\text{month}$ .
- Implies impeccable performance of the machine.

**We (CMS) use this schedule for planning.**

**We need to consider the impact of the long length of this run.**



## Planning for 2009: Computing Resources (2)

### CMS Planning

- Assume ~nominal years of data taking according to LHC running schedule:
  - Based on proposed luminosity profile (← Chamonix WS)
  - 2009 run starts in October, ends in March
  - 2010 run starts in April

### Draft results:

- 2009 pledged results are sufficient
- For 2010 CMS requires upgrades (beyond 2009 pledges) for CPU, disk, tape at T0, T1, T2
- more detailed look is not finished

The CMS CRB will review and approve the resource requirements (April 3<sup>rd</sup>)

The C-RRB will review and approve the resources for 2010 (April 29<sup>th</sup>)



## Summary & Outlook

- **Data processing of CMS Global Runs, CRAFT is working well.**
  - Data were re-reconstructed twice with latest software and calibrations.
- **Monte Carlo production at Tier2 sites is well established.**  
(~500M FullSim / 5 months + 350M FastSim, several CMSSW versions, not resource limited)
- **Improvements of the Tier-1/Tier2 infrastructure are urgently required to reach production availability and reliability**
  - Better monitoring tools and commissioning policies are available,
  - Monitoring will also be done by computing shifts...
  - Stress testing Tier-1 sites has started
- **Combined tests with ATLAS need to be defined and scheduled.**
- **Resource requirements for 2009/10 are being re-evaluated based on LHC schedule**