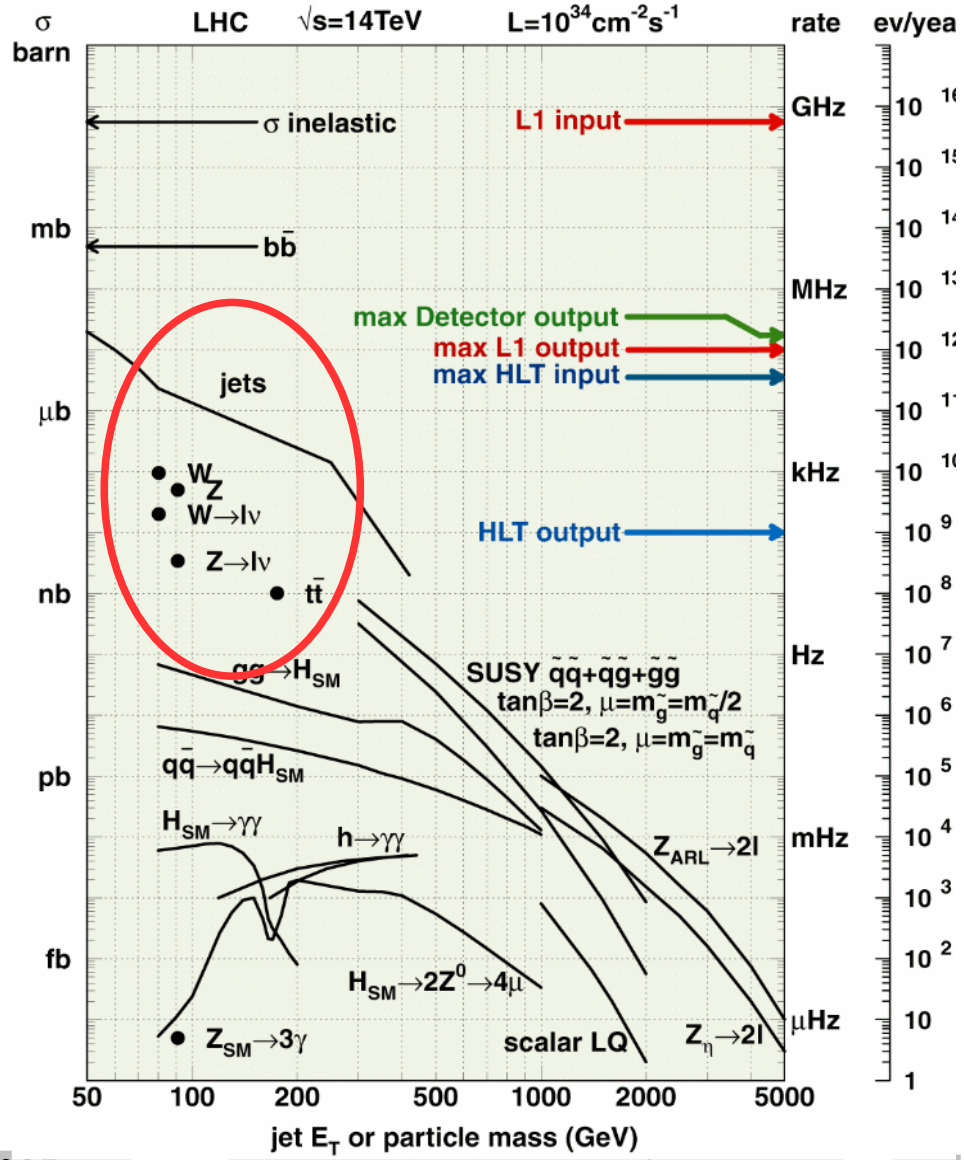
Overview with CSA07 Special

CMS Collaboration
Klaus Rabbertz
University of Karlsruhe

bmb+f - Förderschwerpunkt
Elementarteilchenphysik
Großgeräte der physikalischen Grundlagenforschung

LHC Start-up

- **Huge cross sections of SM processes:**
  - **Formerly intensively searched, now every second: W and Z bosons @ 20 Hz, 5 Hz even at start-up luminosity (10^{32})**
- **Even higher QCD process rates (dep. on p_T)**
- **For 1 fb^{-1} of integrated luminosity typical QCD reactions leave roughly 10/GeV events for → Reach:**
  - Jet p_t: ≈ 2.5 TeV
  - Zweijetmassen: ≈ 5.0 TeV
  - Prompt Photon p_t: ≈ 0.5 TeV

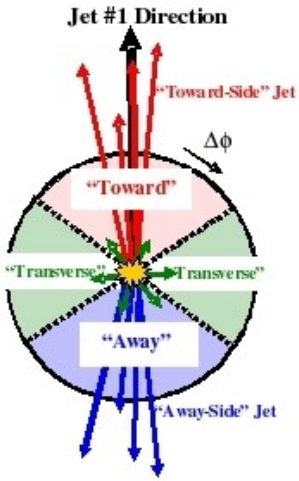


QCD and EWK Groups

- **QCD Working Groups:**
  - **QCD physics at low pT (UE, MB, ...)** See talk by F. Bechtel
  - **QCD physics at high pt (incl. Jet cross sections, ...)** See talk by A. Oehler
  - **QCD physics with photons (incl. Photons cross sections, prompt photons, ...)**
  - **PDFs (together with EWK)**
- **EWK Working Groups:** See talk by M. Thomas
  1. Inclusive W and Z production (e,μ,τ)
  2. W, Z and multi-jets
  3. Multi-boson (WW, WZ, ZZ, Wγ, Zγ)
  4. Drell-Yan
  5. PDFs from W, Z and Drell-Yan
- **Information repositories:**
  - **QCD TWiki page: https://twiki.cern.ch/twiki/bin/view/CMS/TWikiQCD**
  - **EWK Twiki page: https://twiki.cern.ch/twiki/bin/view/CMS/TWikiEWK**

MBUE Analysis

- **UE measurement with charged jets:**
  - **UE TWiki**

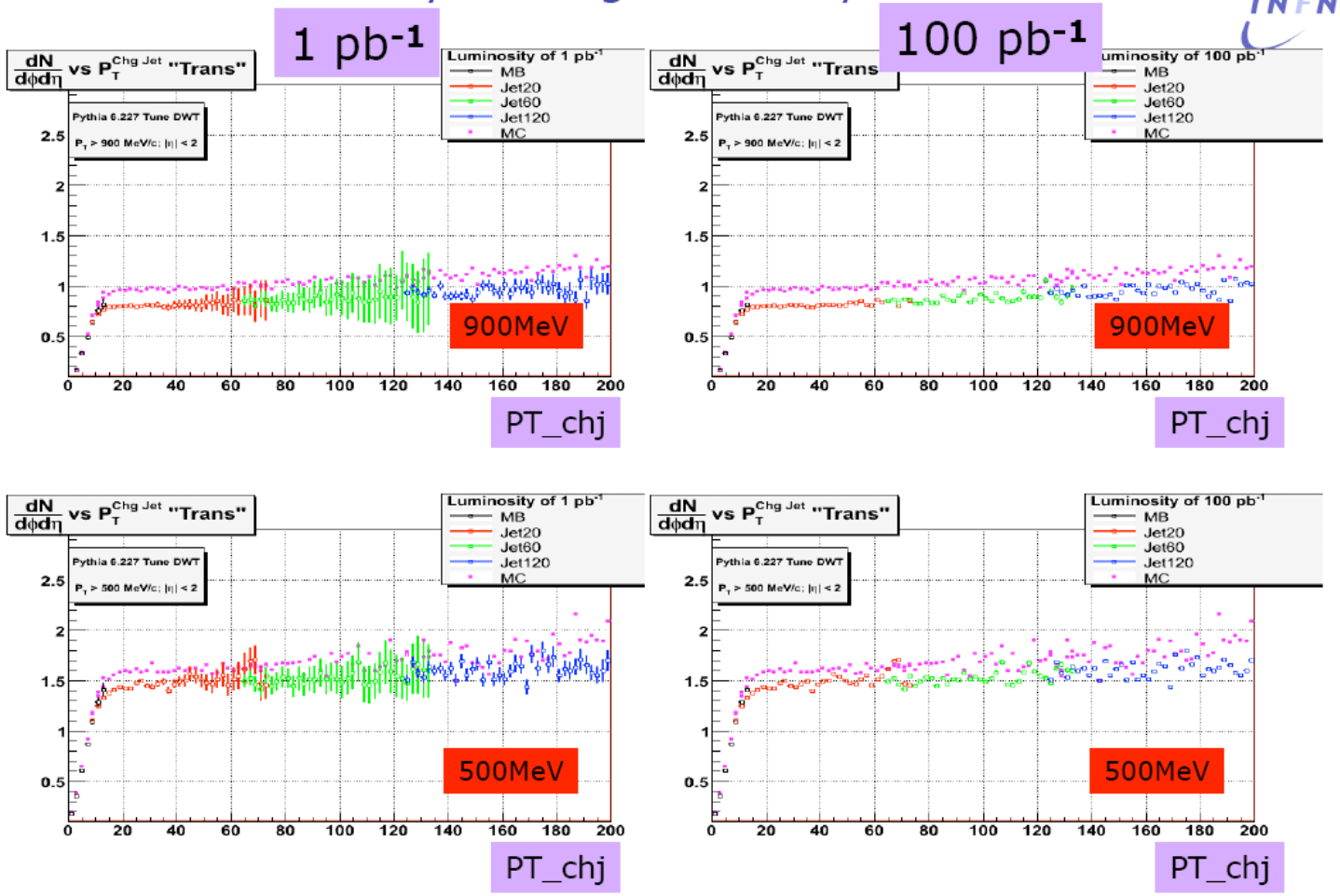


Plot à la R. Field

Paper 2007 - QCD Contribution

P. Bartalini, L. Fano, F. Ambroglini

Transverse activity - charged density



High pT Jet Analyses

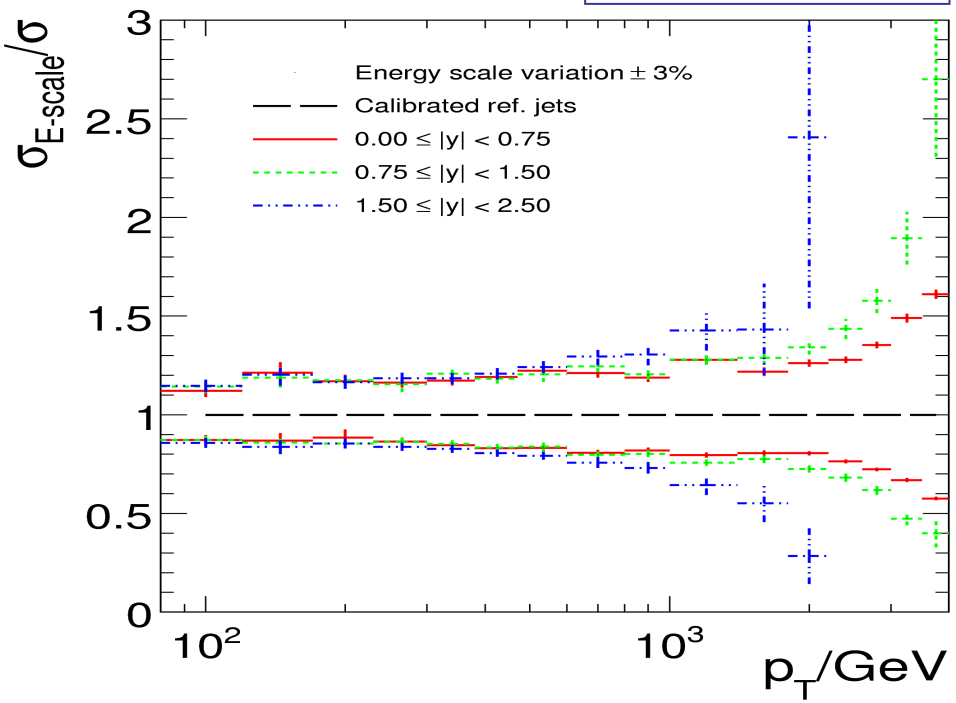
JES (±3%) syst. uncertainties in 3 ranges of rap. (kt Jets, D=1.0):

$0.00 \le |y| < 0.75$

$0.75 \le |y| < 1.50$

$1.50 \le |y| < 2.00$

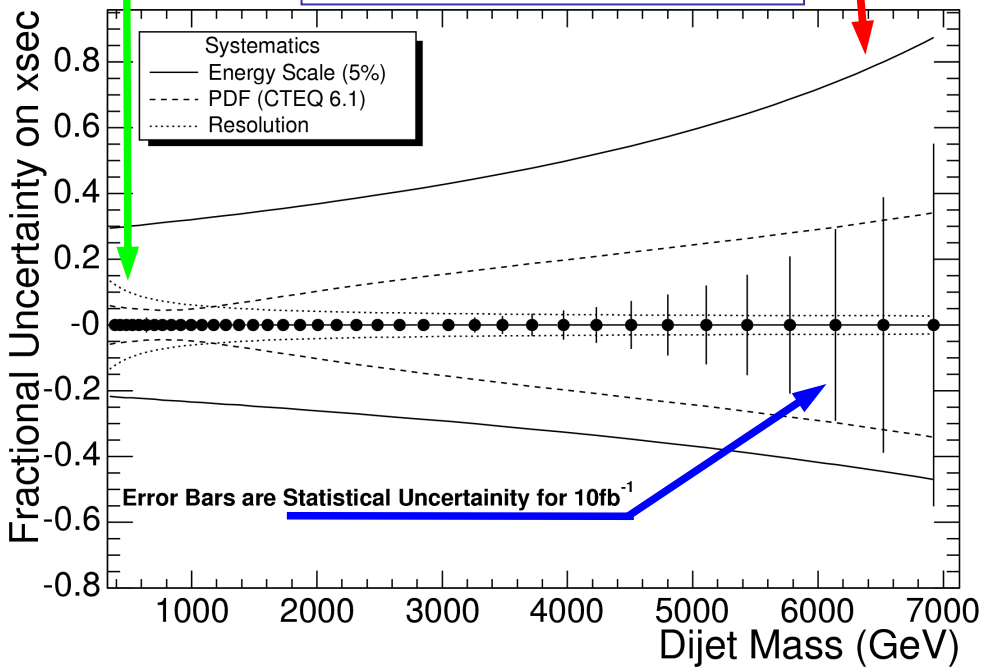
A. Oehler, KR



Syst. uncertainties to dijet mass (It. Cone, R=0.5):

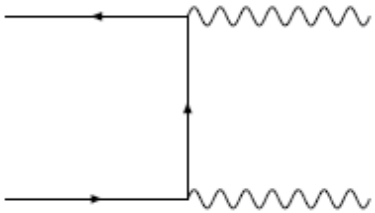
- Abs. jet energy scale (±5%)
- PDFs (CTEQ6.1)
- Calorimeter smearing

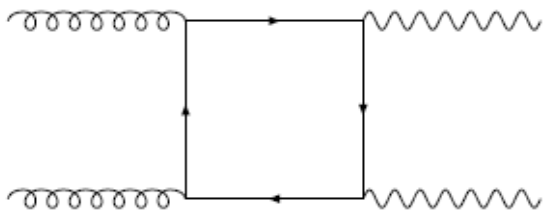
R. Harris, D. Mason



Di-Photon Analysis

Di-photon analysis

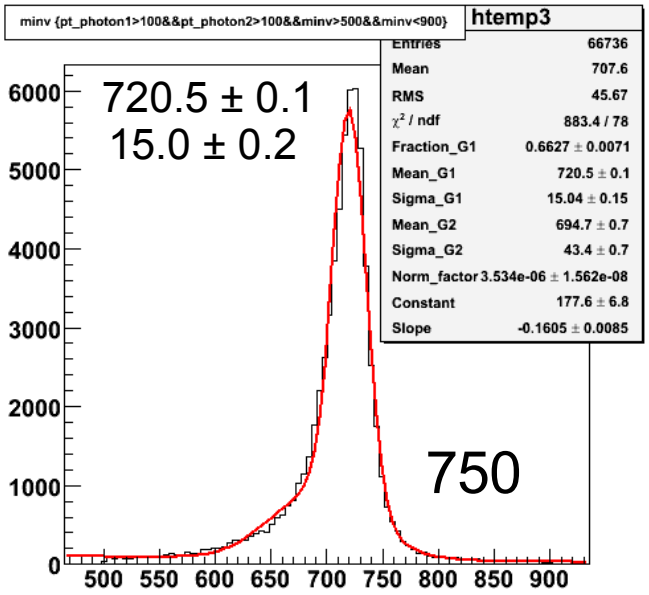


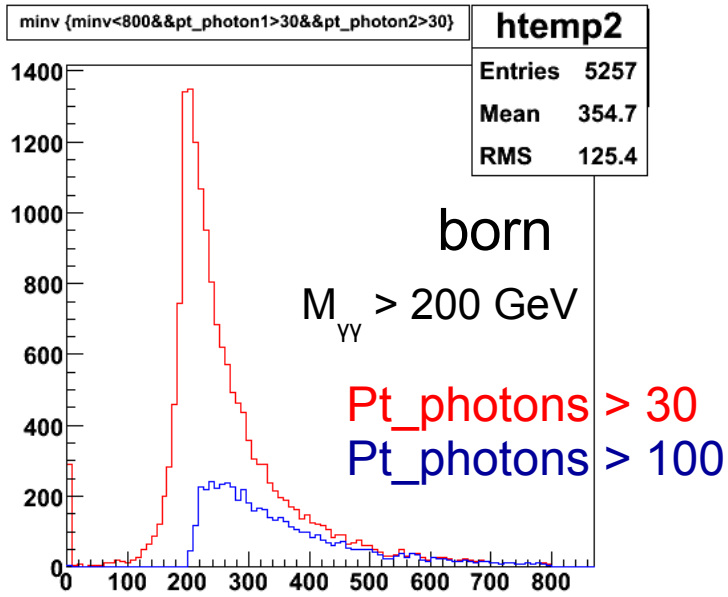


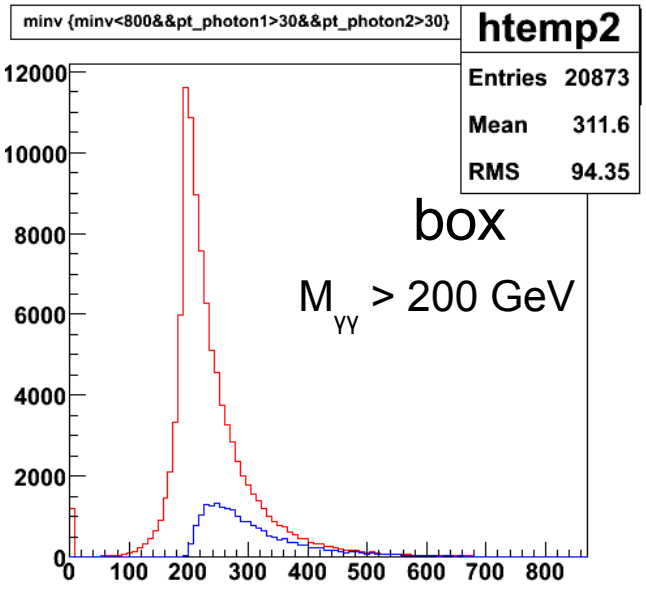
BSM signal:
Randall-Sundrum I, G→γγ

Not to scale!

QCD di-photon irreducible background







$M_{\gamma\gamma}$/GeV

Still need energy correction

V. Litvin, T. Orimoto

CSA07 Soup

From the CSA07 Cocktail page, 27.09.2007:
In total > 130M events produced!
This is more than the originally foreseen 100 M. Thanks to the production team!

Sample description	Binned	Total # of evts	Cross section	Filter eff.	cfg	Additional Notes
Min bias	--	20M	80 mb	1	cfg	
QCD di-jets	21 pt hat bins	25M	Details	~1	cfg	
Photon + jets	10 pt hat bins	5M	Details	1	cfg	
b/c -onia (Muon final states)	2 pthat bins	4M	Details	~ 1% - 50%	cfg	
Drell Yan all decays	2 mass bins	6M	Details	1	cfg	+ 2M extra mumu stats for DPG
Electron/Muon enriched samples	2 or 4 lepton pt bins ?	20M + 20M(**)	Details	0.08%	cfg	
W/Z+jet samples	#jet bins + pt bins	20M + 10M(**)	Details	see below	see below	
tt+jet samples	#jet bins	1.6M	Details	see below	see below	

Employed CMSSW versions:
* CMSSW_1_4_X for GEN-SIM
* CMSSW_1_5_X for DIGI-RECO (pre-production) and CMSSW_1_6_X for the full DIGI-RECO during the CSA07

Note: The very high pt datasets of QCD di-jets and Photon+jets were produced but only small part is kept in CSA07 Soup. The other part goes to CSA07 Signal.

CSA07 Signal

Another 50 M events! For the complete list see the CSA07 Signal page.
Small extract:
- New QCD production with Alpgen for n jets and photon + n jets

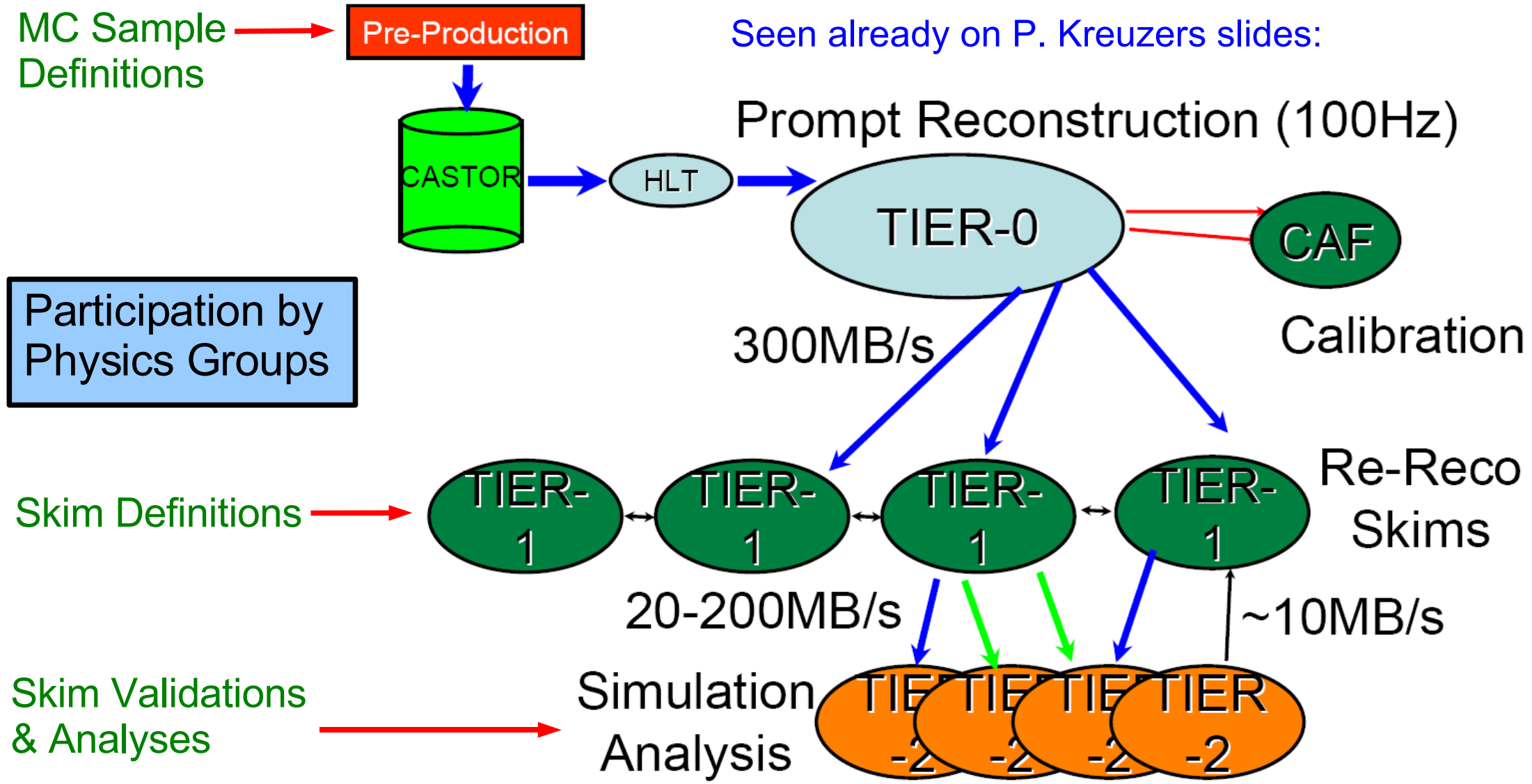
QCD	Alpgen n jets	2-5 excl & 6 incl jets	5M	Details	Details
QCD	Alpgen photon + n jets	2-3 excl & 4 incl jets, 6 pt photon bins	2.4M	Details	Details

- New EWK production with MC@NLO

EWK	Z(mumu) MC@NLO	--	1M	2nb	0.81	cfg	URGENT
EWK	W+(munu) MC@NLO	--	500K	12nb	0.44	cfg	URGENT
EWK	W-(munu) MC@NLO	--	500K	8.8nb	0.54	cfg	URGENT
EWK	Z(ee) MC@NLO	--	1M	2 nb	0.81	cfg	URGENT
EWK	W+(enu) MC@NLO	--	500K	12 nb	0.44	cfg	URGENT
EWK	W-(enu) MC@NLO	--	500K	8.8nb	0.54	cfg	URGENT

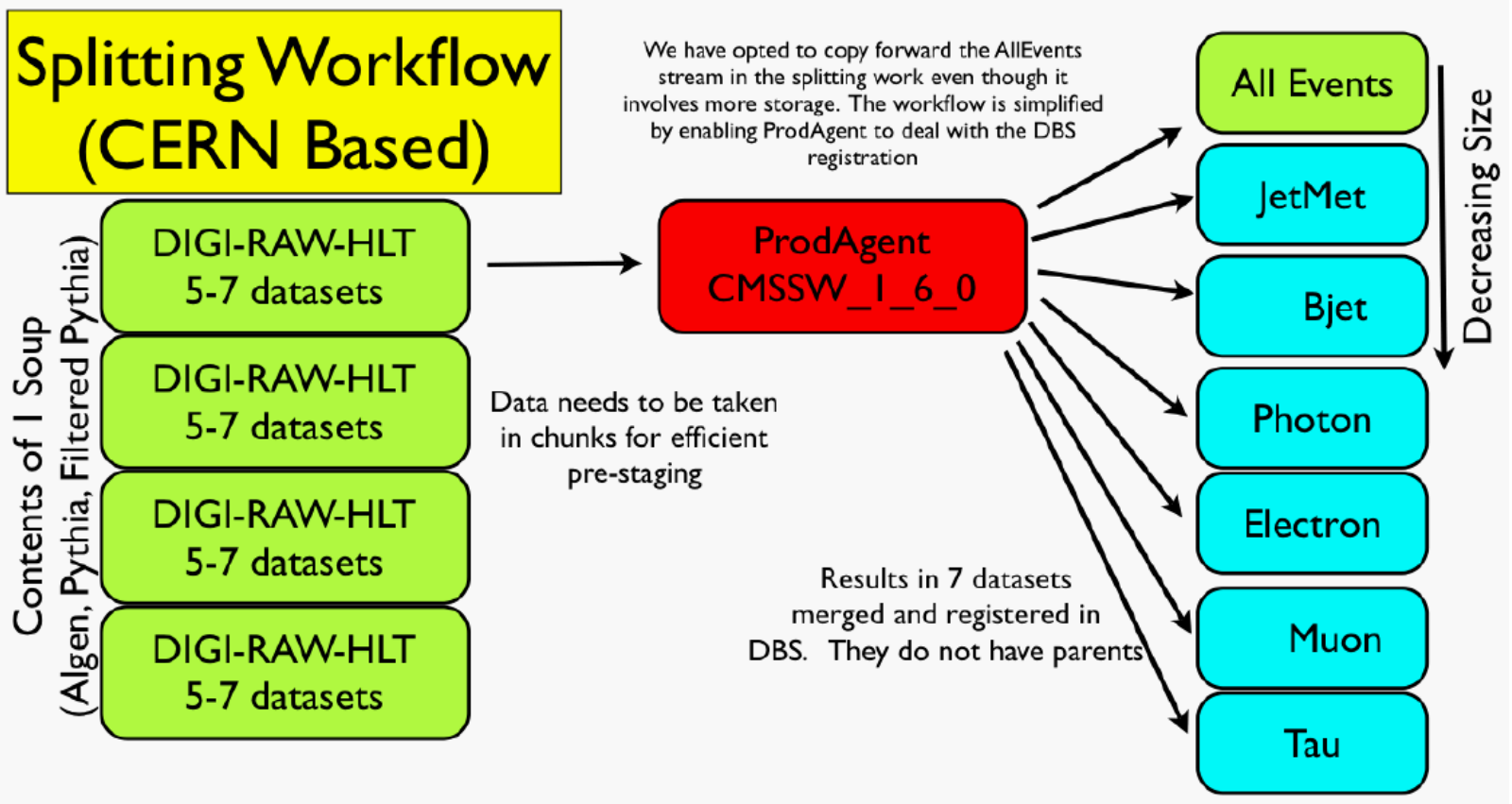
Moving to comparisons with available more precise theory!

CSA07 Workflow



CSA07 PD Preparation

PD = Primary Dataset: Should resemble Version -1 of data streams from real CMS data
Special CSA07: - No prescales → No prescaled triggers in PD definitions allowed
→ Artificial AllEvents required
This is to avoid too much event double-counting.



CSA07 PD Mapping to T1s

Proposal from Neil Geddes, CMS week, 19.09.2007
Nevertheless presumably not up-to-date ...
Could not get hold of an official new one :-(

		Tier 1 Streams						
Primary Dataset	**CSA size (TB)**	**ASGC**	**IN2P3**	**CNAF**	**FZK**	**PIC**	**RAL**	**FNAL**
Tau	**3.4**		**1**					1
Photon	14.6						**1**	1
Muon	10	1			**1**			1
Electron	14.5					**1**		1
Bjet	27.5	1		**1**				1
JetMET	31.2		1					**1**
AllEvents	83.4			**0.2**	**0.2**		**0.2**	**0.4**
Total	231	38	35	54	36	14.5	40	153

Red = Custodial copies (for CSA07)
Black = Duplicate copies
0.2 => 20% of the dataset etc.

Note:
AllEvents
ideally stat. mix
of CSA07 soup

Not possible due to problems with SW framework:
→ 3 soups:
- Alpgen
- Pythia
- Pythia filtered

CSA07 QCD Skims

QCD CSA07 Skimming Table:

QCD Skims	Description	Primary Datasets	HLT Paths etc.	Est. Size	Input/Output Format	T2 Hosts
HPT_JET_SKIM High PT Jets Event Filter	Inclusive Jets, Dijets;	PDJetMET	HLT1jet:HLT OR PT > 140 GeV, uncalibrated MC7 or FJ6	1.4 TB	Input: AODSIM Output: AODSIM	T2DESY, T2FNALLPC, T2Manno
VHPT_JET_SKIM Very High PT Jets Event Filter	Inclusive Jets, Dijets;	PDJetMET	PT > 500 GeV, uncalibrated MC7 or FJ6	286 GB	Input: AODSIM Output: AODSIM	T2DESY, T2FNALLPC, T2Manno
UHPT_JET_SKIM Ultra High PT Jets Event Filter	Inclusive Jets, Dijets;	PDJetMET	PT > 1 TeV, uncalibrated MC7 or FJ6	72 GB	Input: AODSIM Output: AODSIM	T2DESY, T2FNALLPC, T2Manno
UE_DIMUON_SKIM $\mu\mu$	UE analysis: $Z/\gamma \rightarrow \mu\mu$	PDMuon	HLT double non-isolated μ	320 GB	Input: HLT+RECO Output: diMuonEventContent= MBUE specific subset of AOD + L1extraParticles	T2Florida, T2MIT, T2Pisa
UE_SOFTJETS_SKIM j+X	UE analysis: QCD events with calo jets above 20 GeV	AllEvents	!HLT1MuonNonIso:HLT AND !HLT1ElectronRelaxed:HLT AND !HLT1PhotonRelaxed AND Cut on 20 GeV pt MC7 jet uncalibrated	4.5 TB	Input: HLT+RECO Output: softJetsEventContent= MBUE specific subset of AOD + L1extraParticles	100% @ T2MIT 60% @ T2Florida 40% @ T2Pisa
Useful	**Skims**		**of other**	**Groups**		**T2 for QCD**
1JET_SKIM	Jet analyses		JetMET	11 TB	Output: AODSIM	Agreed with JetMET: 100 % @ T2FNALLPC 50 % @ T2DESY 50 % @ T2Manno
PHOTON_JET_SKIM	Photon + jets analyses		JetMET	4 – 7 TB	Output: AODSIM	Agreed with JetMET: 100% @ T2Wisconsin + further JetMET destinations
DIPHOTON_SKIM	Diphoton analyses		Higgs	2.2 TB	See Higgs	See Higgs

Analysis Plans:

- Run common validation with JetMET
- Run ongoing analyses (UE, high pt jets,...)

CSA07 Open Points

- Final dataset distribution over Tier-2s:
  - Skim destinations almost finished
  - Sridhara Dasu is collecting all info on skim destinations PLUS all additional datasets required by the Physics Groups to prepare a distribution table
- Re-reconstruction:
  - First CSA07 processing of „data“ with 10 pb-1 mis-alignment and -calibration
  - Re-processing will be done for 100 pb-1 scenario
  - Two options under discussion:
  - 1. Re-reconstruct data as they are organized in PrimaryDatasets (Event mix!)
  - 2. Re-reconstruct data going back to original MC datasets (Ordered)

CSA07 Open Problems

- Correct event weighting:
  - Access to x section weights, process ID and hard p_t needed in AODSIM
  - Not available in CMSSW_1_6_0, should be fixed in 1_6_1 (last night)
  - BUT: Gets lost during merging! Under investigation ...
- Software installation:
  - Tier wide creation of pool accounts also for SW admins
  - Huge problems with CMS SW installation via grid
  - Partially due to lack of representation of CMS when discussed in corr. Forums
  - P. Elmer: Other sites dumped sw admin pool accounts to fix. DESY?
- Are all mandatory T1 -> T2 links commissioned?
- Skim dataset names to look for in DBS2:
  - Know only hint from Benedikt Hegner: Should contain skim name ...
  - Which one? I have seen already three different ones for one QCD skim ...

Outlook

- CSA07 is an interesting test scenario for our start-up preparations
- Let's try to make it a success
- In any case, physics analyses have gained a lot more data to analyse!
- Last questions before I hand over to the detailed physics talks?