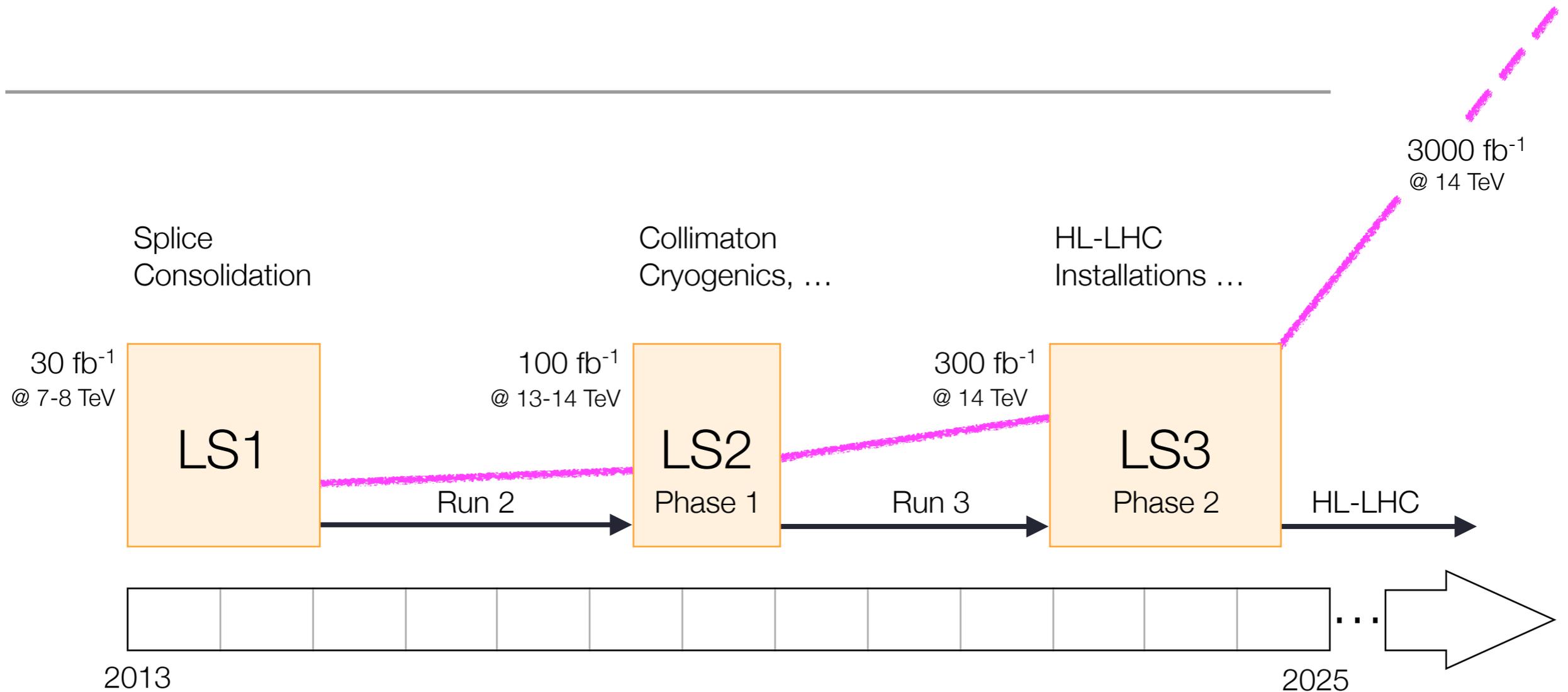
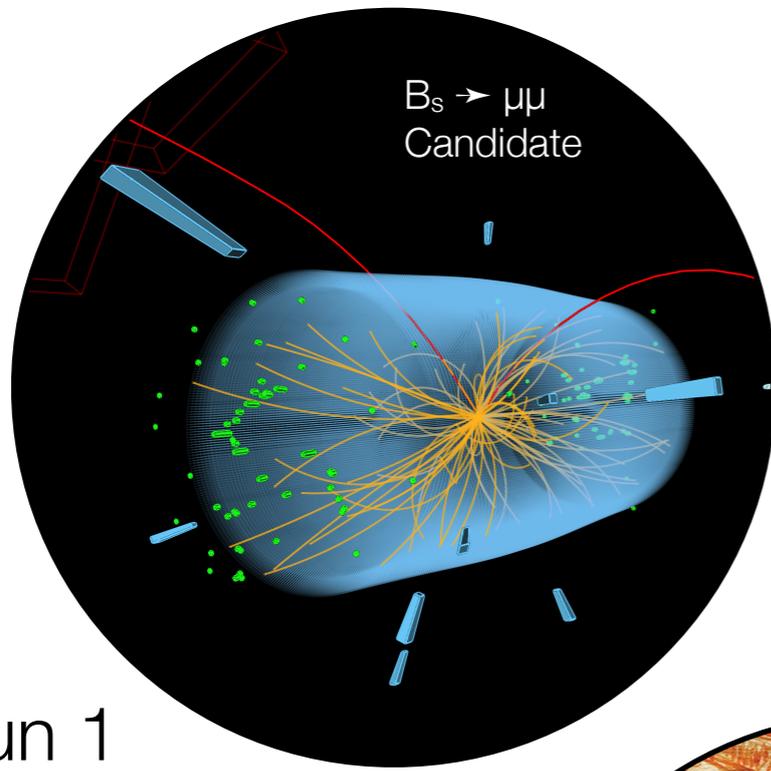


LHC-Experimente

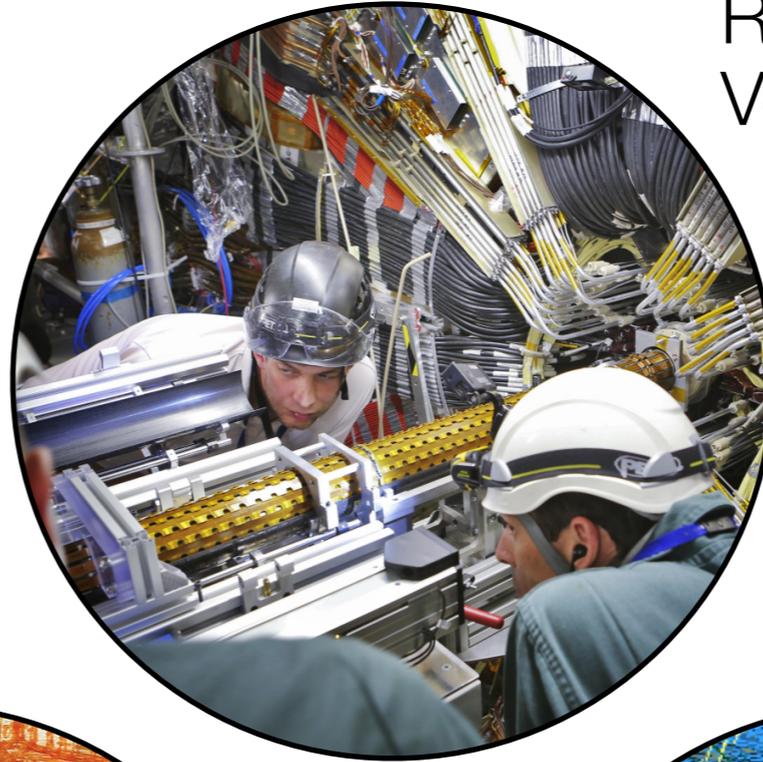
Highlights 2014,
Run 2 Vorbereitungen,
Arbeiten für Phase-I & Phase-II ...



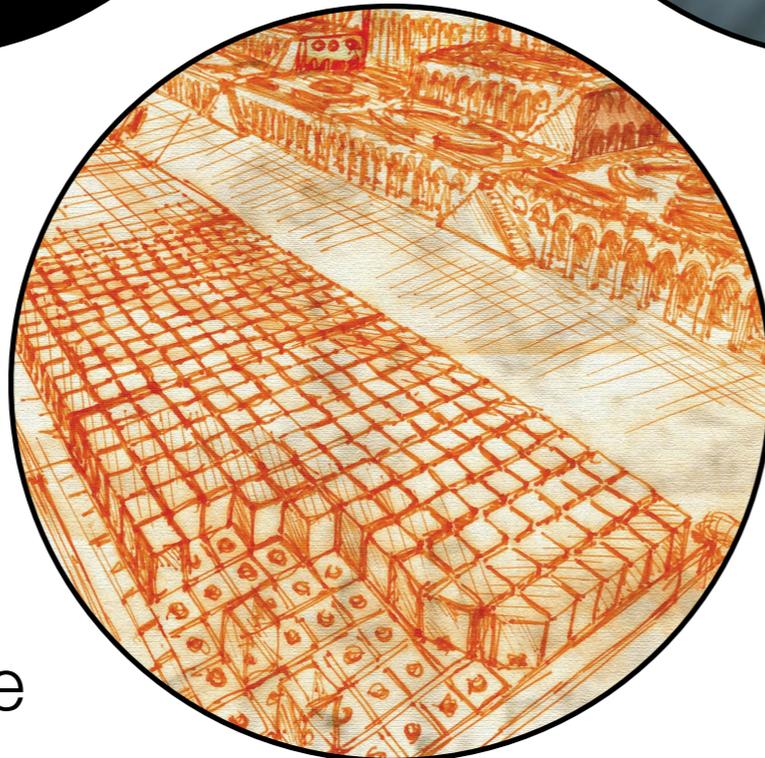
Laufende Aktivitäten



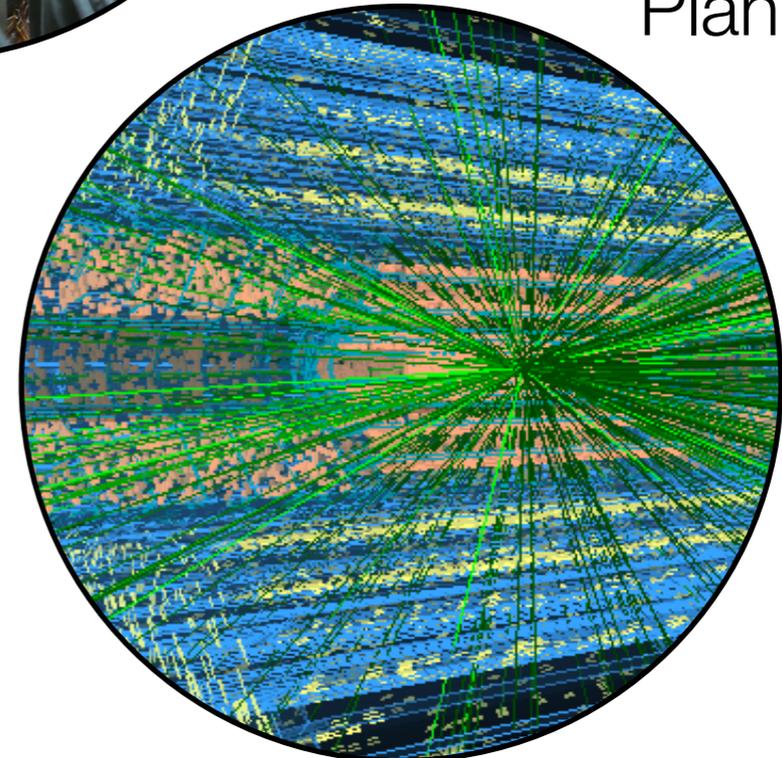
Run 1
Datenanalyse



Run 2
Vorbereitung



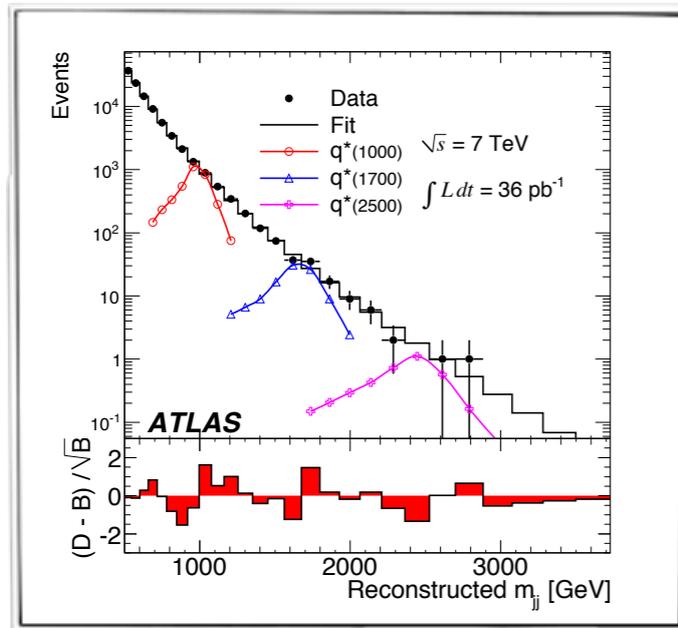
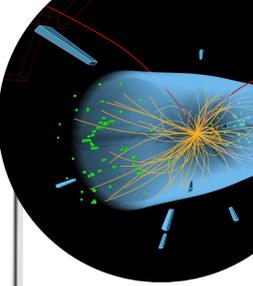
Phase-I
Upgrade



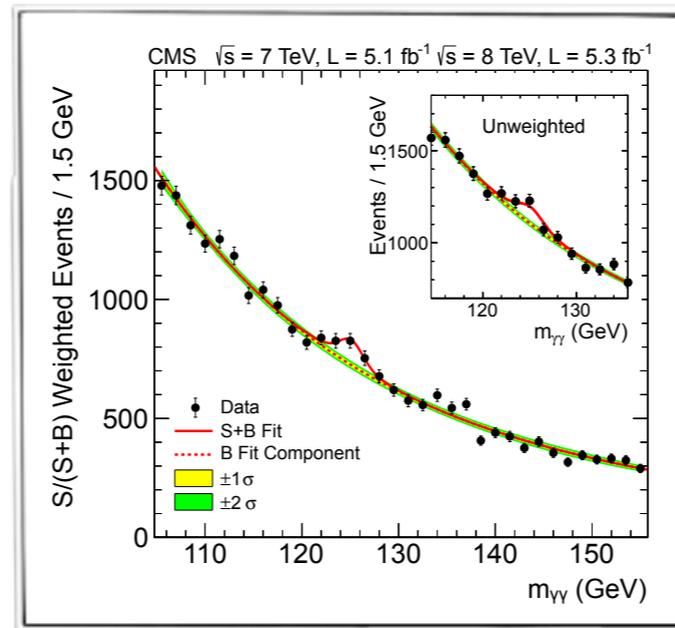
Phase-II
Planungen

ATLAS & CMS – Run 1 Historie

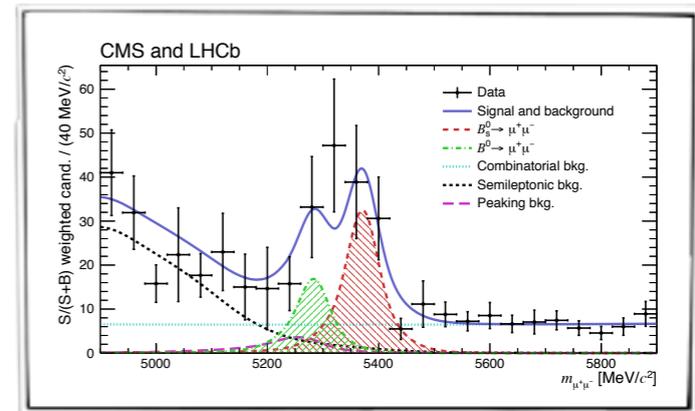
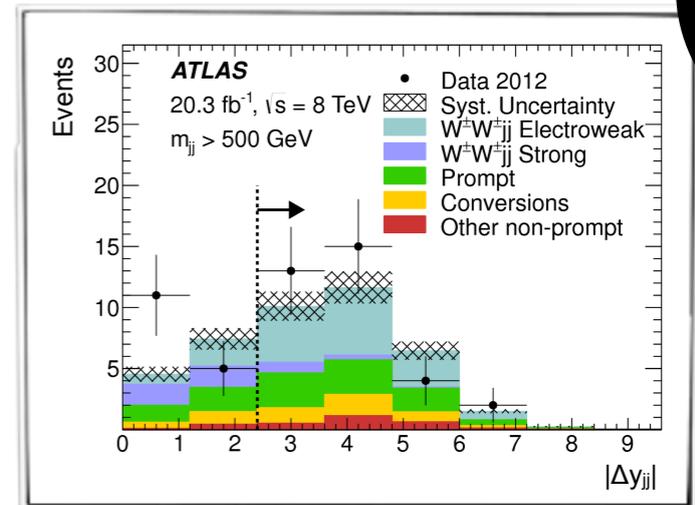
Erste Evidenz für WW-Streuung – Mai 2014



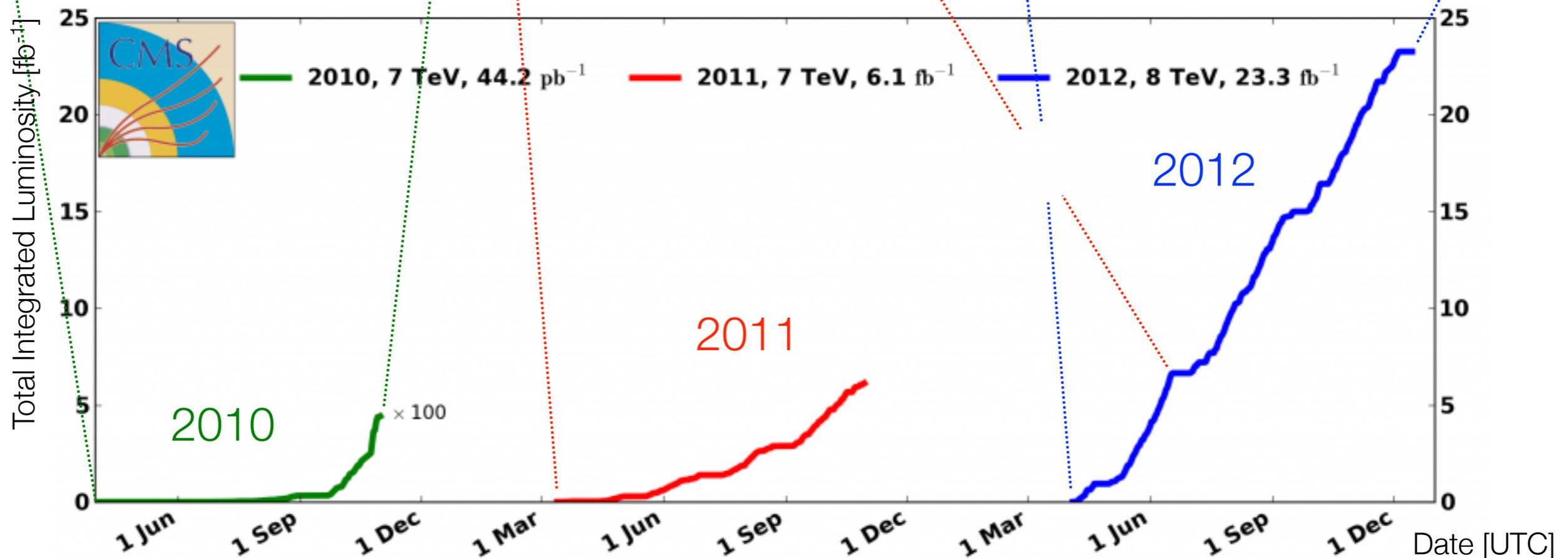
Resonanz-Suchen – Frühjahr 2011

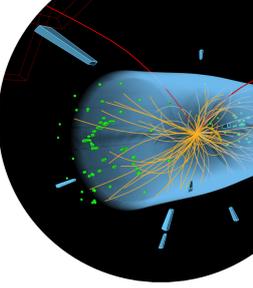


Higgs Entdeckung – Sommer 2012



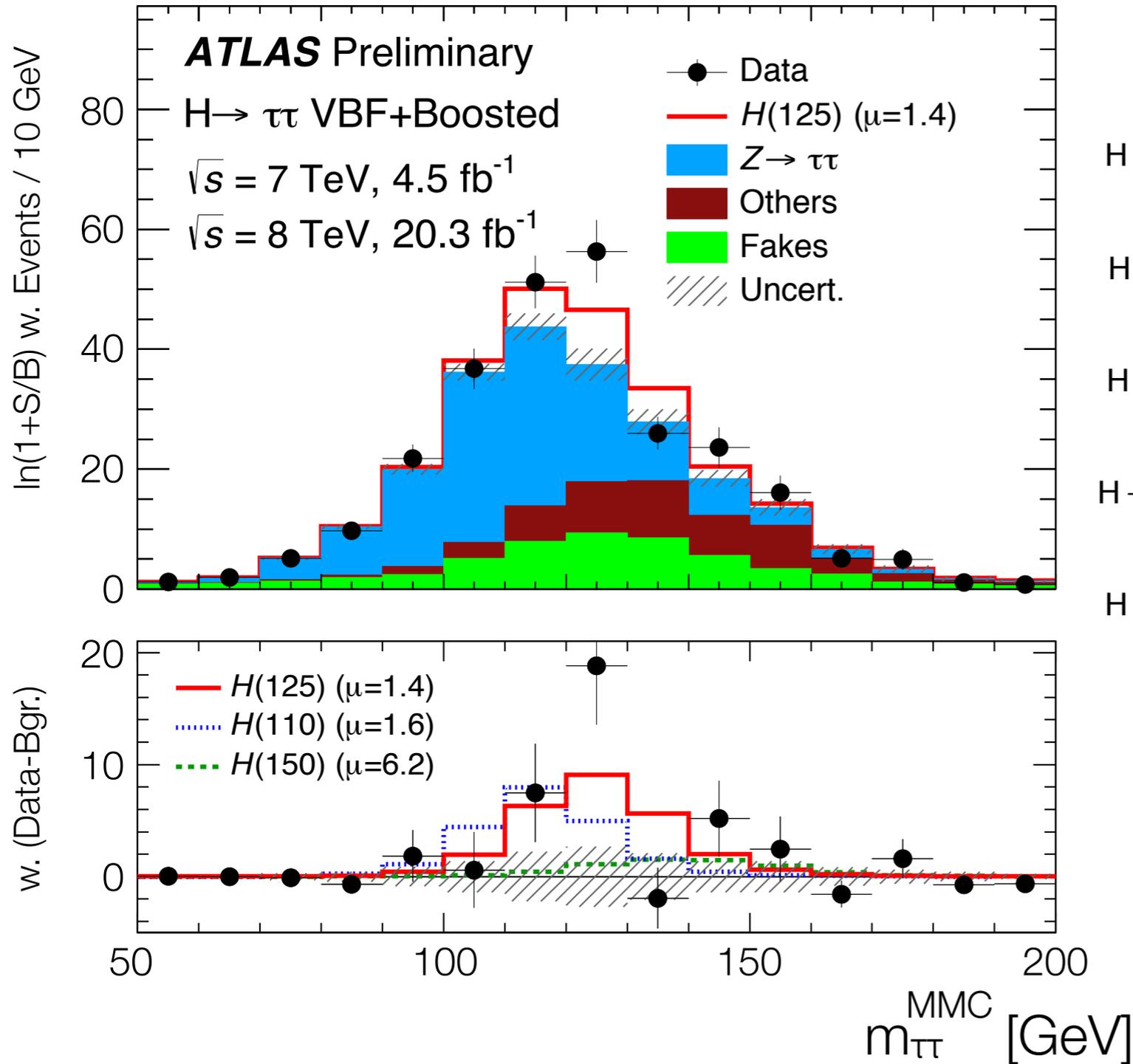
Bs → μμ
 Kombination – Nov. 2014





ATLAS & CMS – Higgs-Eigenschaften

ATLAS-CONF-2014-061



Combined
 $\mu = 1.00 \pm 0.13$

$H \rightarrow bb$ tagged
 $\mu = 0.93 \pm 0.49$

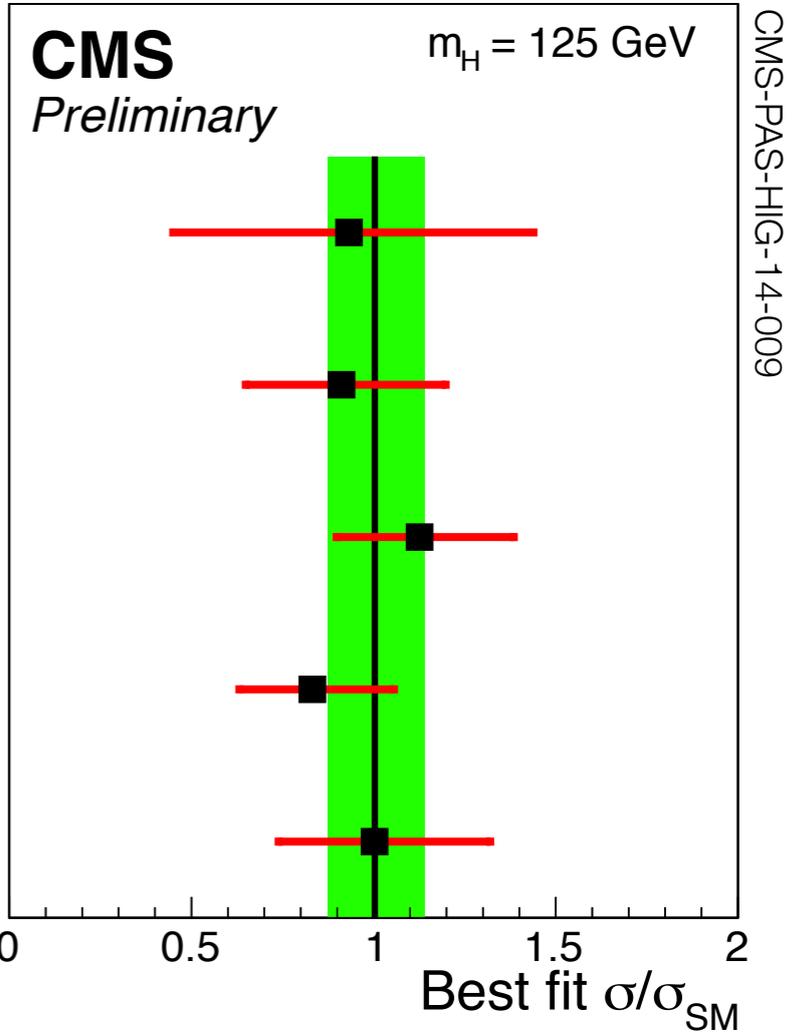
$H \rightarrow \tau\tau$ tagged
 $\mu = 0.91 \pm 0.27$

$H \rightarrow \gamma\gamma$ tagged
 $\mu = 1.13 \pm 0.24$

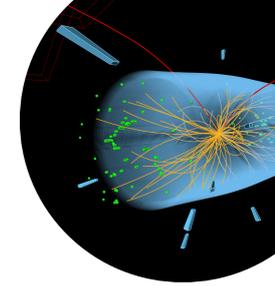
$H \rightarrow WW$ tagged
 $\mu = 0.83 \pm 0.21$

$H \rightarrow ZZ$ tagged
 $\mu = 1.00 \pm 0.29$

19.7 fb^{-1} (8 TeV) + 5.1 fb^{-1} (7 TeV)



Higgs-Produktion

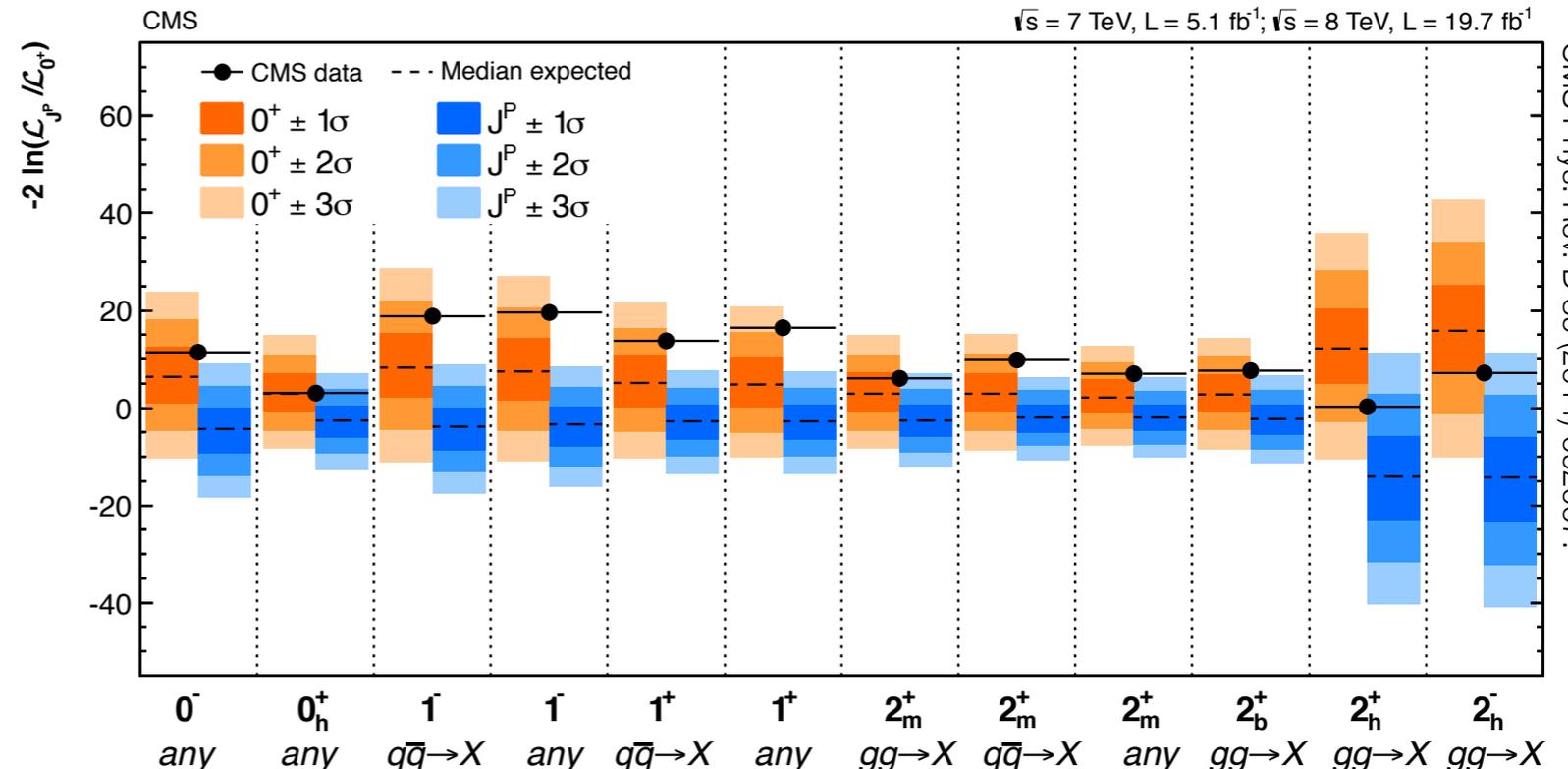
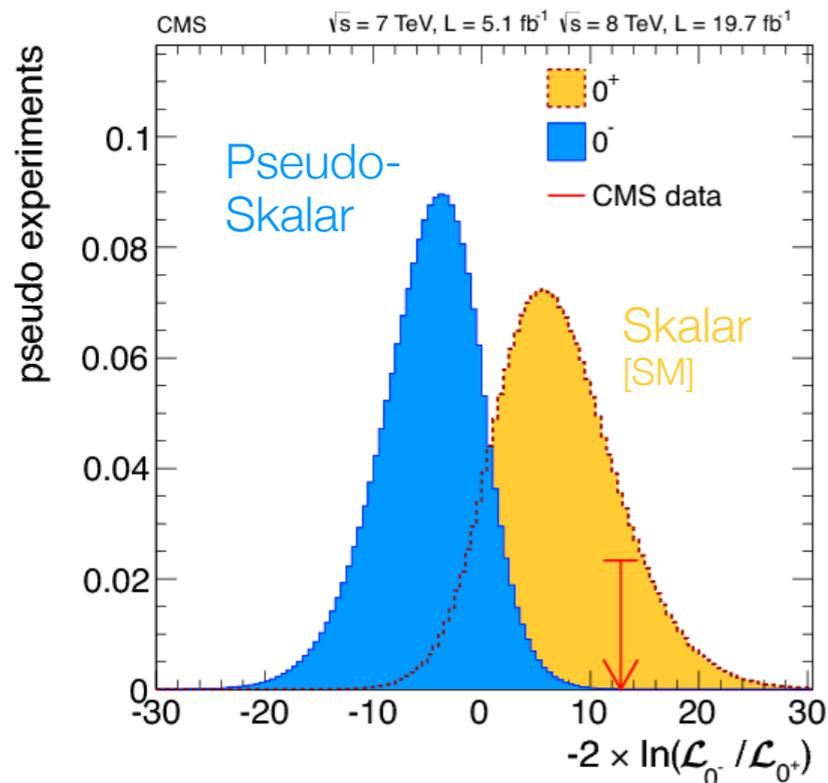
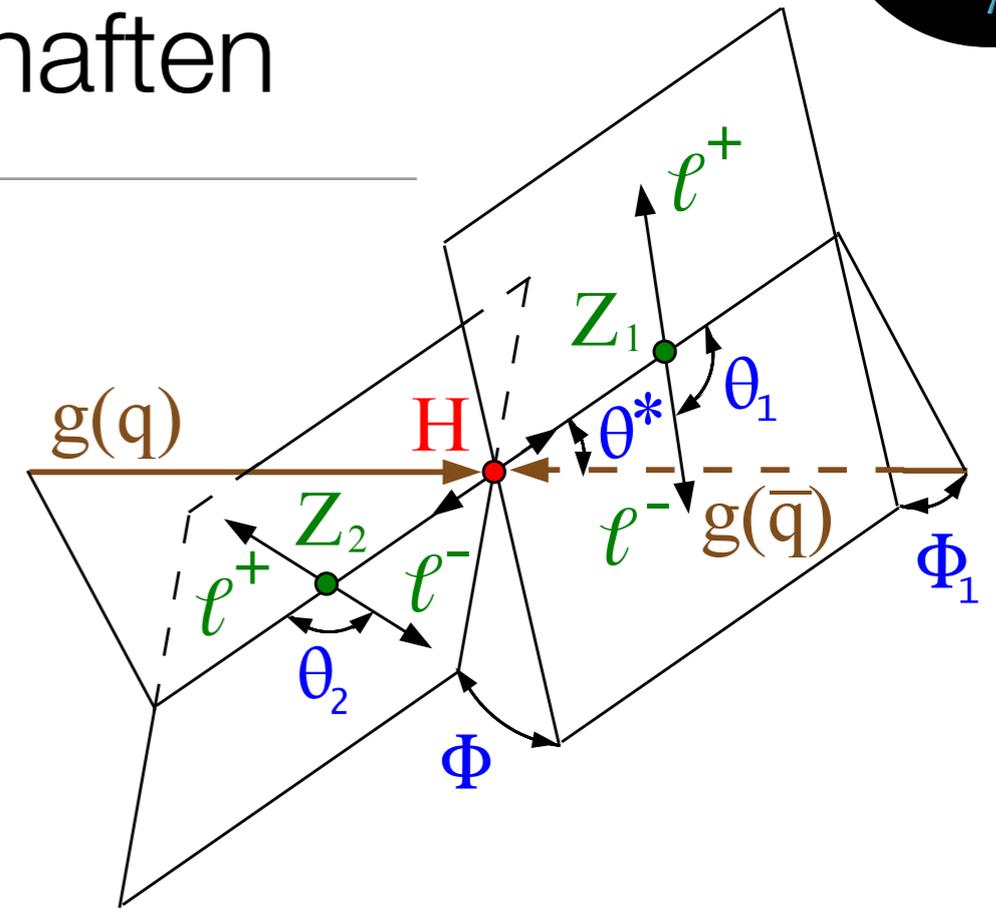


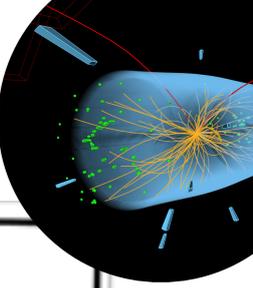
ATLAS & CMS – Higgs-Eigenschaften

Spin/Parität: $J^P = 0^+$?

Vermessung der Winkelverteilung von Higgs-Zerfällen e.g. $H \rightarrow ZZ \rightarrow 4$ Leptonen ...

Hypothesenvergleich anhand von MC-generierten Pseudodatenverteilungen ...

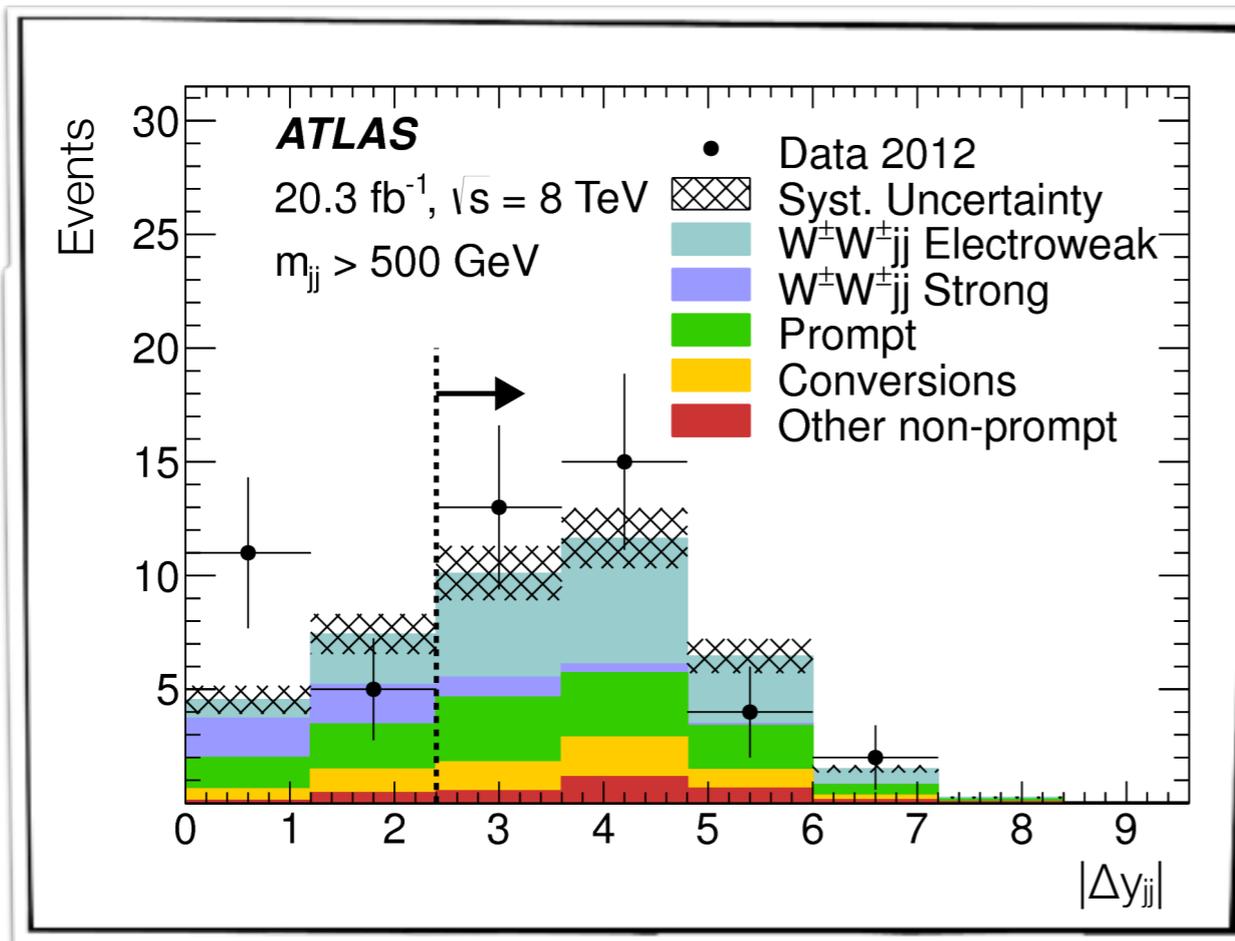
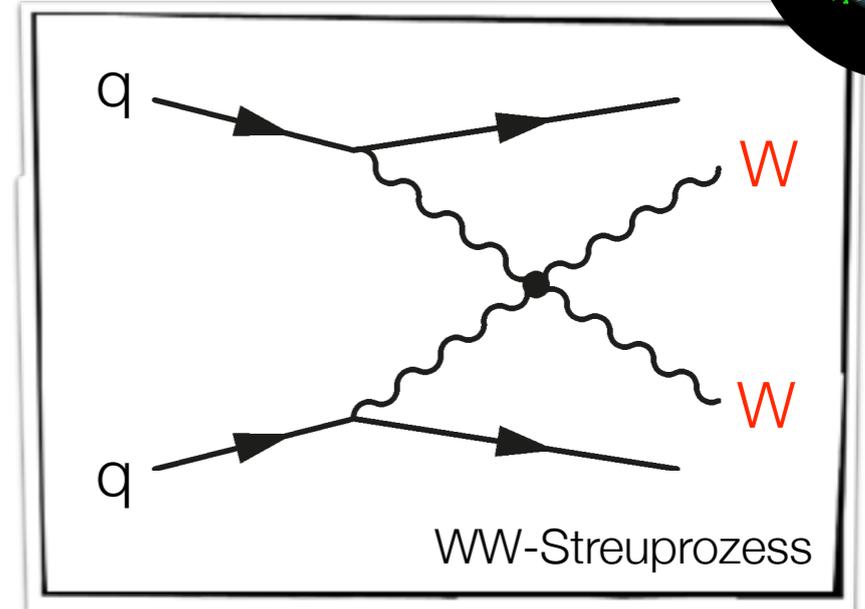




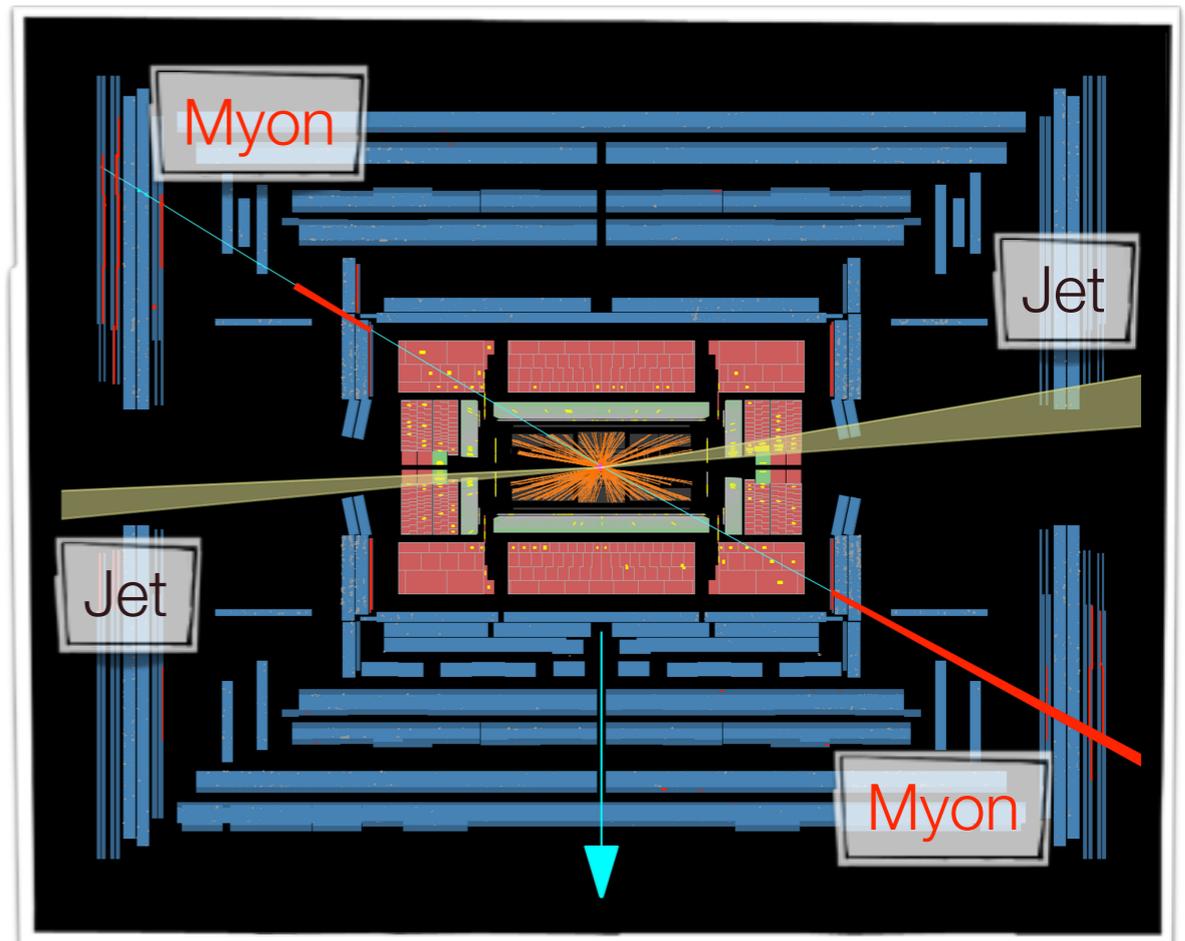
ATLAS & CMS – WW-Streuung

Erste Evidenz für WW-Streuprozess

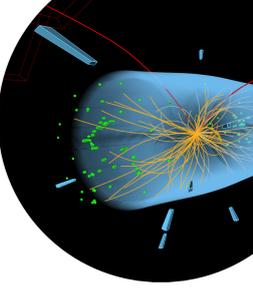
Wichtiger Konsistenztest des SM ...



$|\Delta y_{jj}|$ -Verteilung



ATLAS $\mu\mu jj$ -Kandidat
 [Run: 20749; Event: 33152138]
 [$m_{jj} = 2.8$ TeV; $|\Delta y_{jj}| = 6.3$]



LHCb Highlights – B_s -Mischung und Φ_s

CKM-Parameter
mit höchster Präzision ...

B_s -Mischung aus $B_s \rightarrow D_s \pi$:

$$\mathcal{P}_t \propto \Gamma_s e^{-\Gamma_s t} \left[\cosh\left(\frac{\Delta\Gamma_s t}{2}\right) + \xi \cos(\Delta m_s t) \right]$$

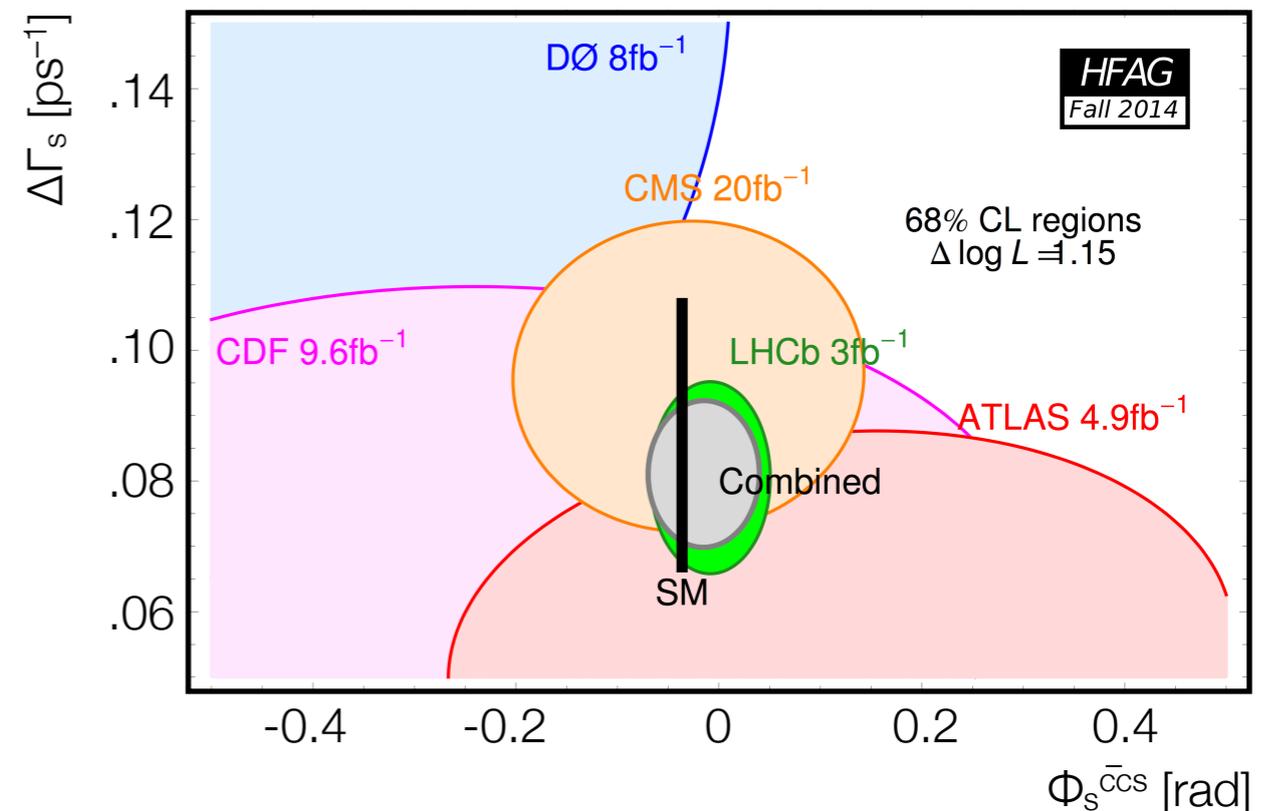
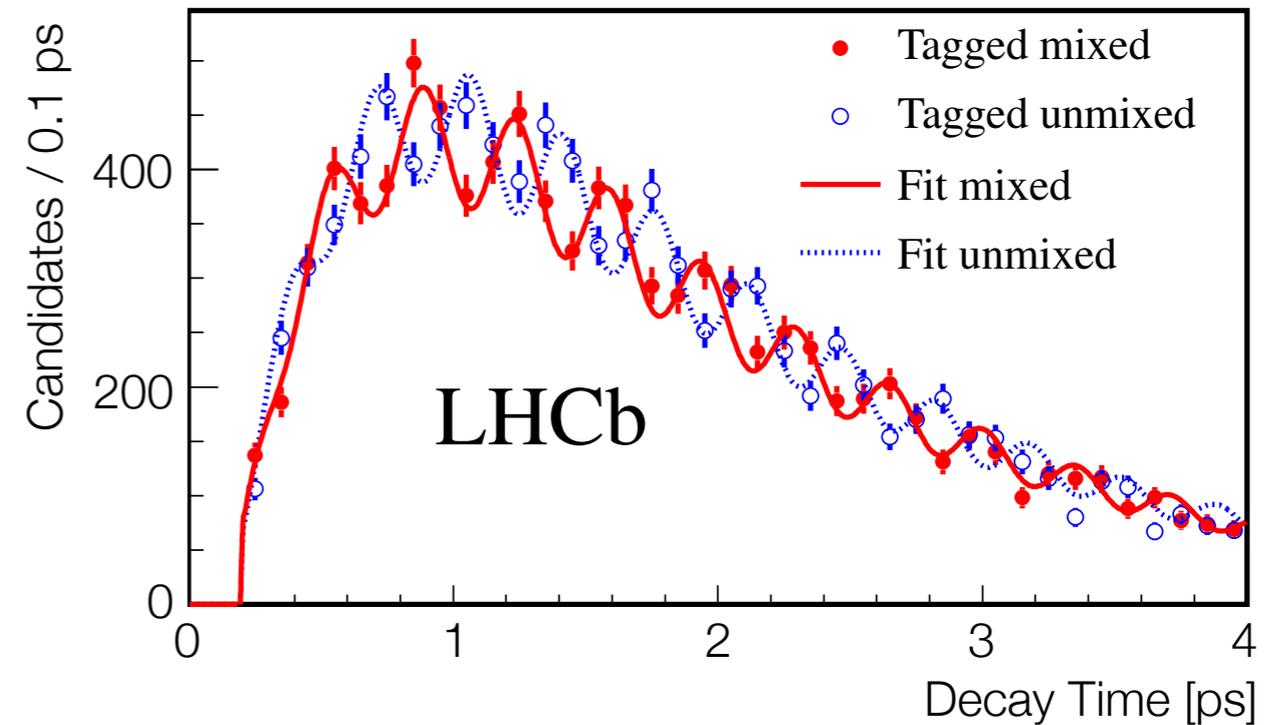
with

$$\Delta m_s \propto |V_{tb} V_{ts}|^2$$

$$\Delta\Gamma_s \propto |V_{cs} V_{cb}|^2 \cdot \cos \phi_s \quad [\text{fixed}]$$

Messung von $\Delta\Gamma_s$ und Φ_s
aus $B_s \rightarrow J/\psi KK$ und $B_s \rightarrow J/\psi \pi\pi$:
[Fit an Zerfallszeit- und Winkelverteilungen]

$$\phi_s = -2 \arg\left(-\frac{V_{ts} V_{tb}^*}{V_{cs} V_{cb}^*}\right) = -2\beta_s$$

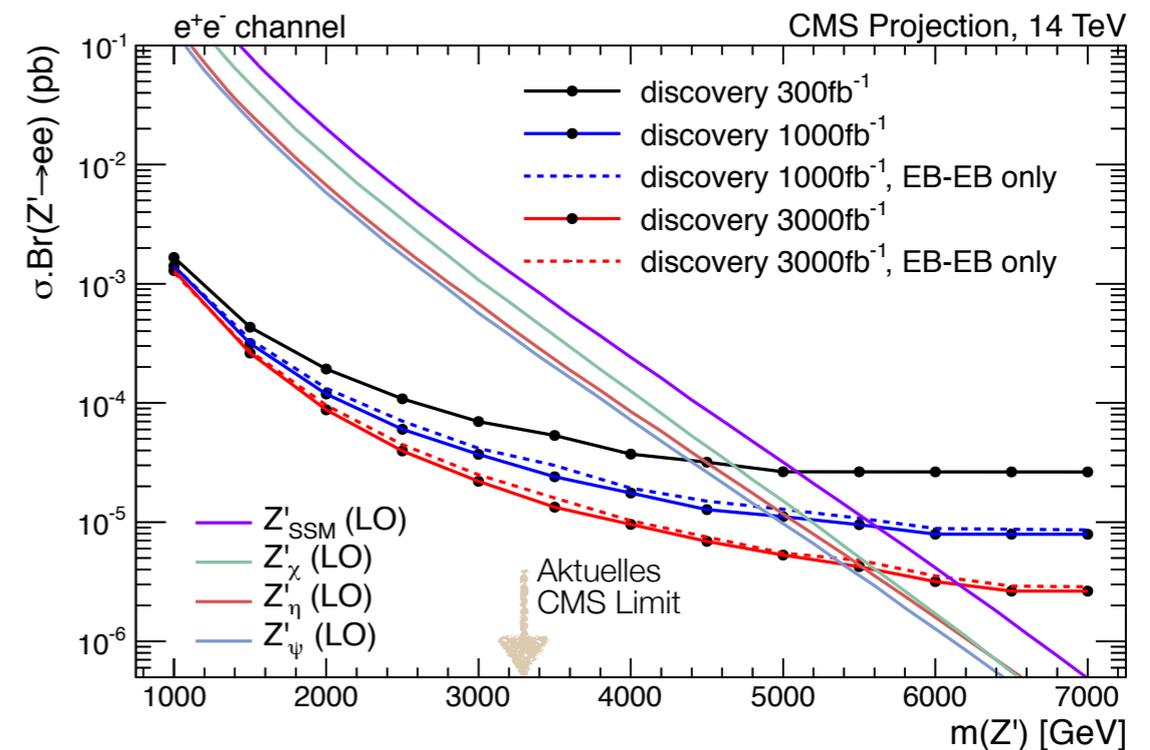
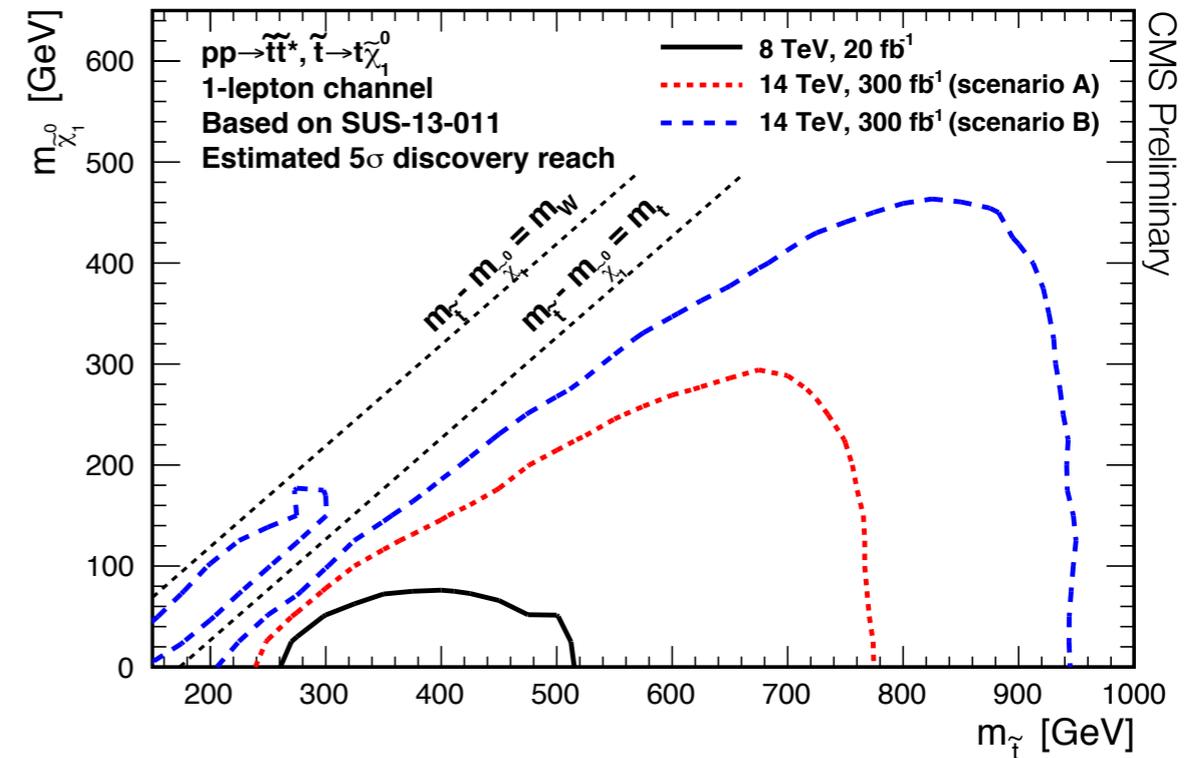
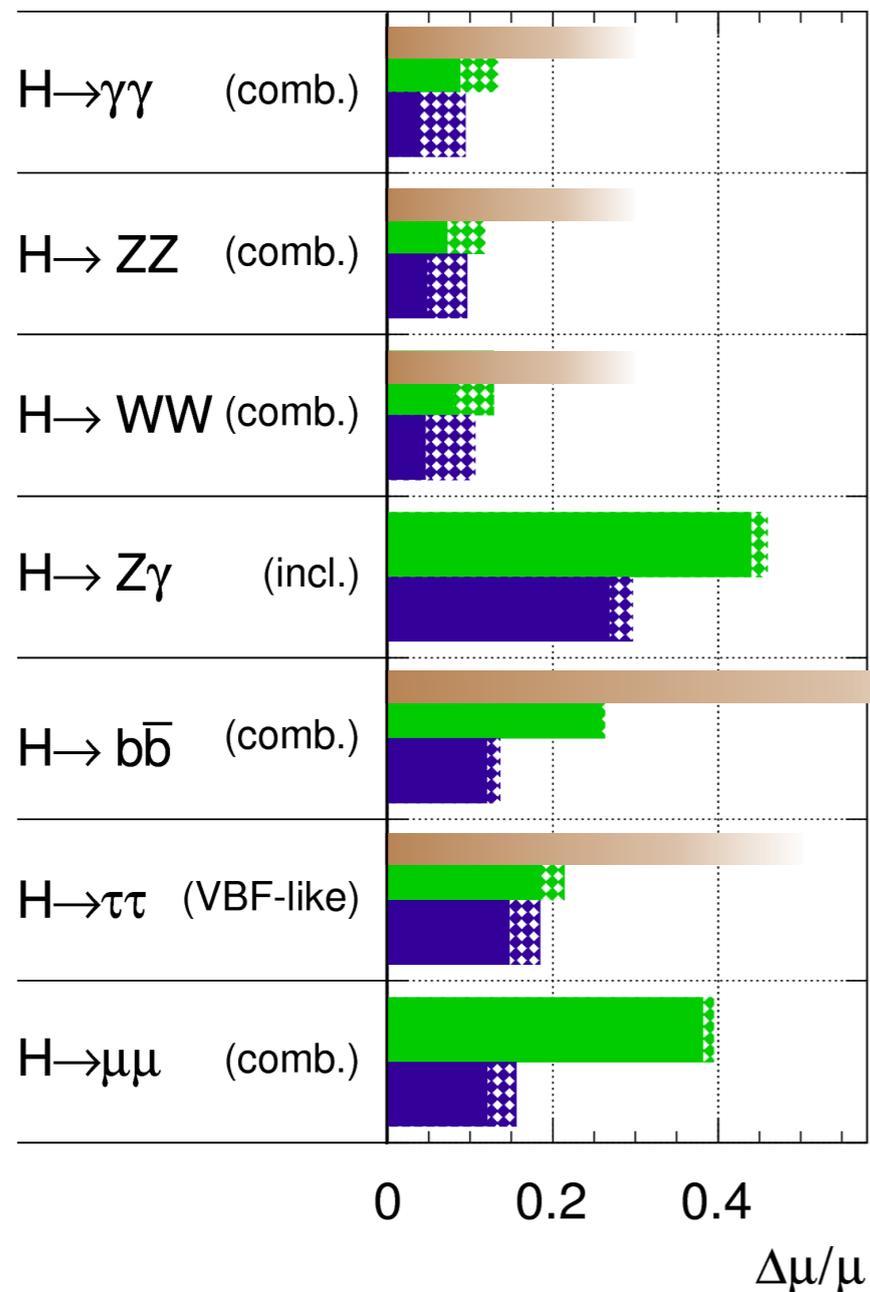




Aussichten @ 14 TeV – Run 2, 3, ...

ATLAS Simulation Preliminary

$\sqrt{s} = 14 \text{ TeV}$: $\int L dt = 300 \text{ fb}^{-1}$; $\int L dt = 3000 \text{ fb}^{-1}$



Run-2 Vorbereitung

ATLAS

Insertable B-Layer
[Extra Pixellage]

Myon-System
[Erweiterte Akzeptanz]

L1Calo Upgrade
[Extra Flexibilität; L1Topo]

Fast Tracker
[HLT-Spurtrigger]

...

CMS

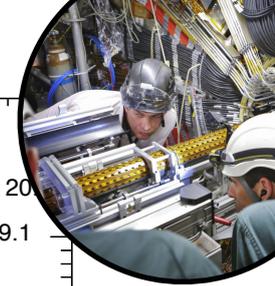
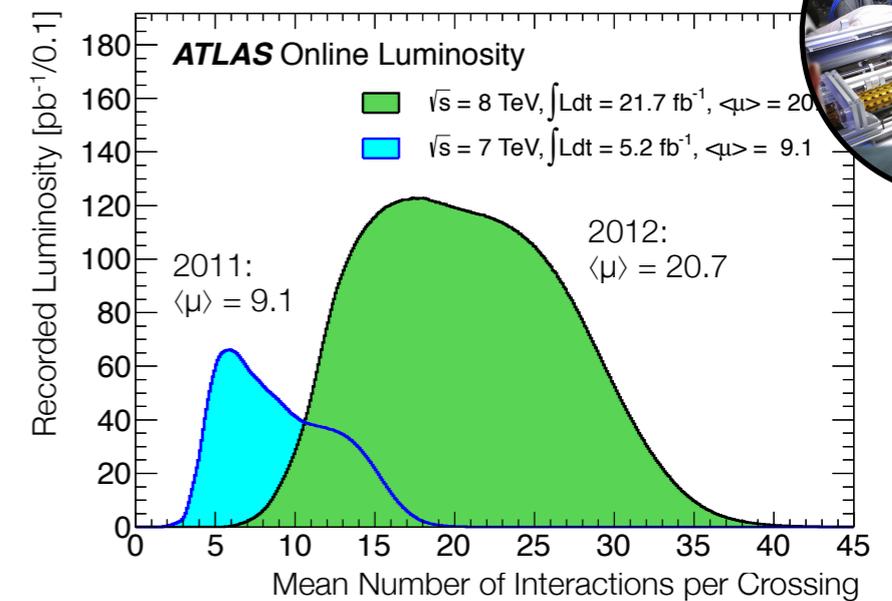
HCAL Upgrade
[neue Photodetektoren]

Myon-System
[Erweiterte Akzeptanz]

Trigger-System
[L1 Stage-1; HLT Algorithmen]

Beam Pipe
[$\varnothing = 45$ cm; dünner]

...



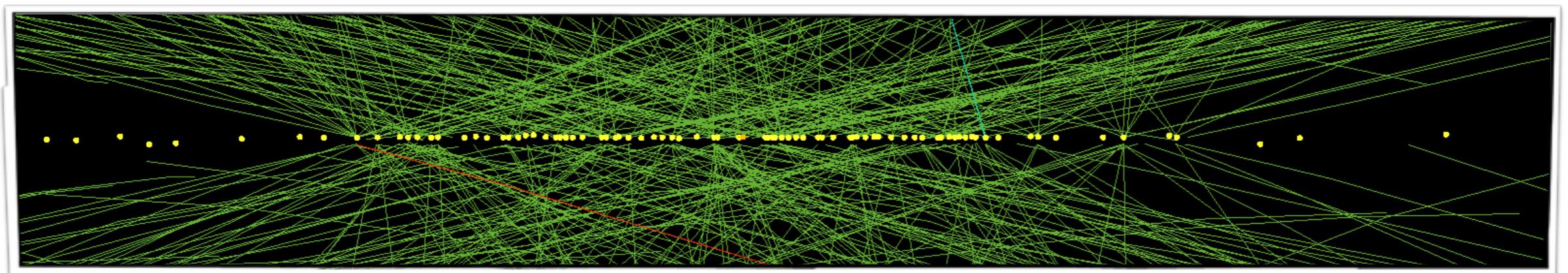
LHCb

Neue Schauerzähler
[Vorwärtsrichtung]

RICH-Detektor
[Wartung Photodetektoren]

Trigger-System
[Offline-Analyse @ 12.5 kHz]

...





ATLAS – Insertable B-Layer

Neue innerste
Pixellage

Neues
Strahlrohr



IBL-Projekt:

Zusätzliche 4. Pixellage ...

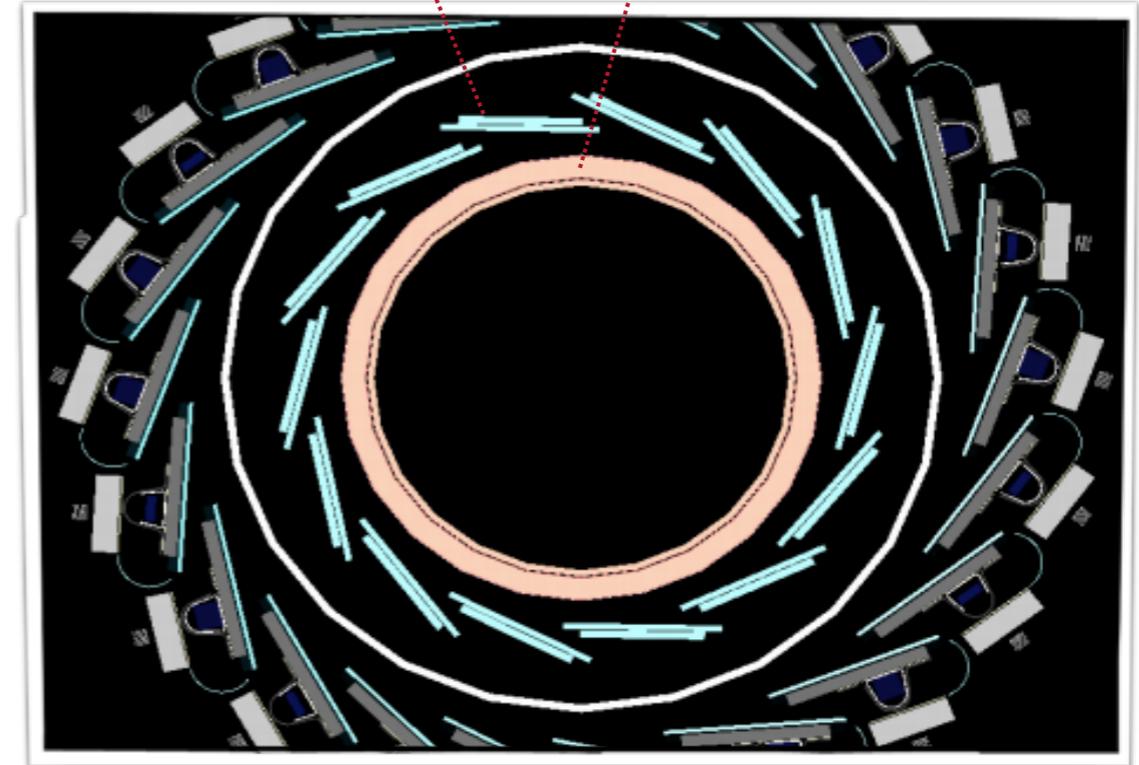
Vermessung von Spurpunkten
nahe am Wechselwirkungspunkt ...

[5.1 cm → 3.3 cm]

Kleinere Pixel ...

[50 × 250 μm]

Bessere Sensoren
und bessere Auslesechips ...



Status:

30/04: Montage



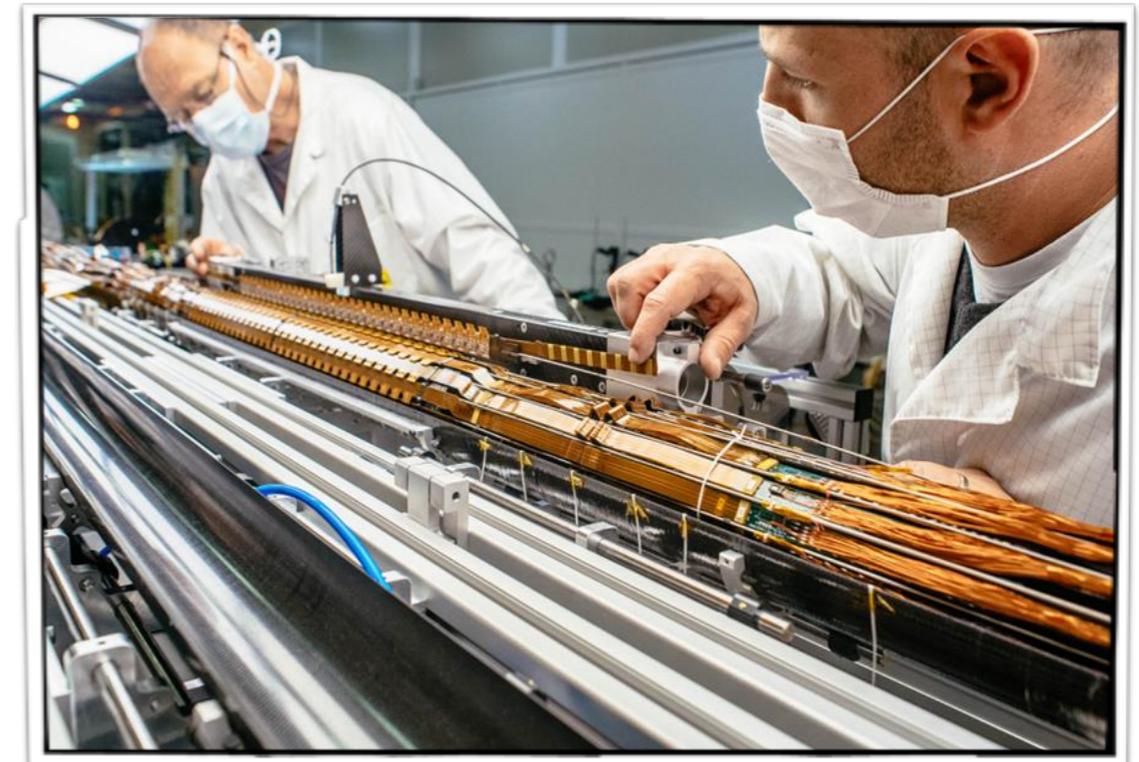
07/05: Installation



27/06: Verkabelung



10/09: DAQ-Integration





ATLAS – Insertable B-Layer

IBL-Projekt:

Zusätzliche 4. Pixellage ...

Vermessung von Spurpunkten
nahe am Wechselwirkungspunkt ...

[5.1 cm → 3.3 cm]

Kleinere Pixel ...

[50 × 250 μm]

Bessere Sensoren

und bessere Auslesechips ...

Status:

30/04: Montage



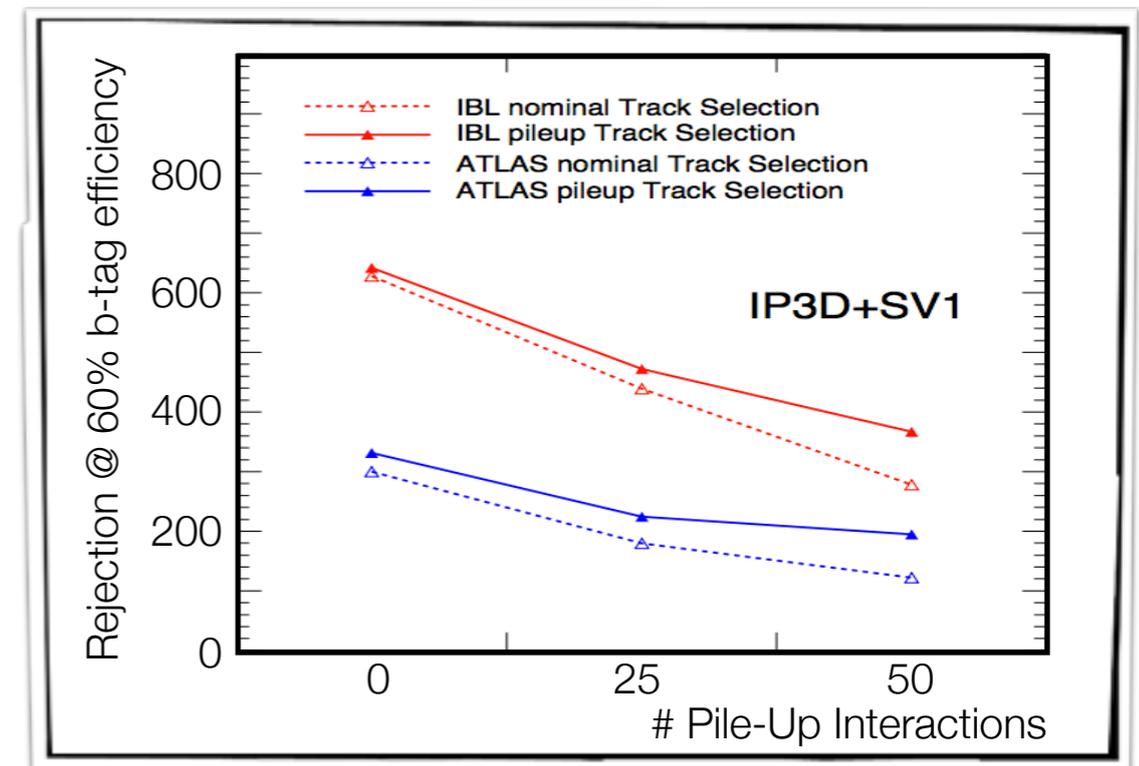
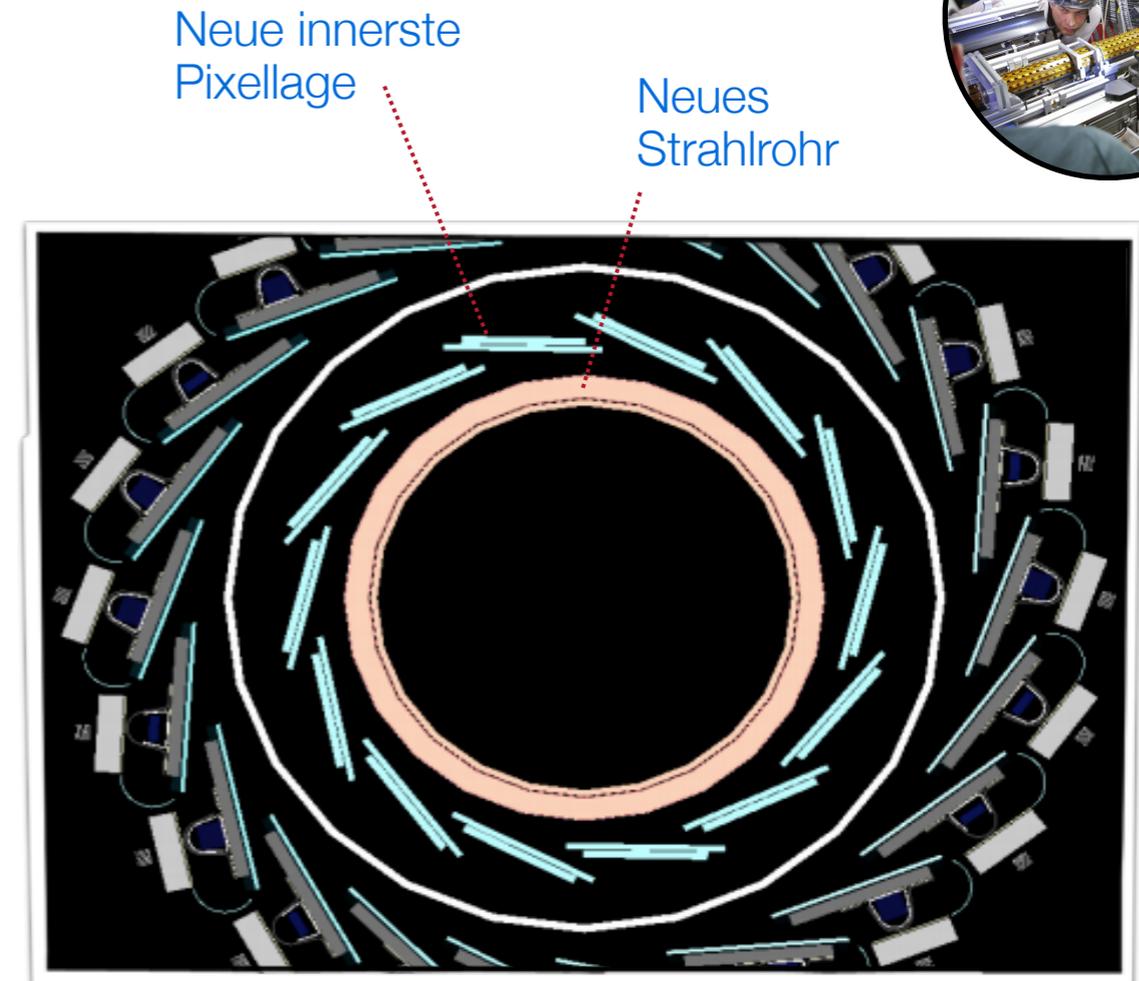
07/05: Installation



27/06: Verkabelung



10/09: DAQ-Integration





CMS – HCAL, DT-System & Pixel Reparatur

Reparatur BPIX

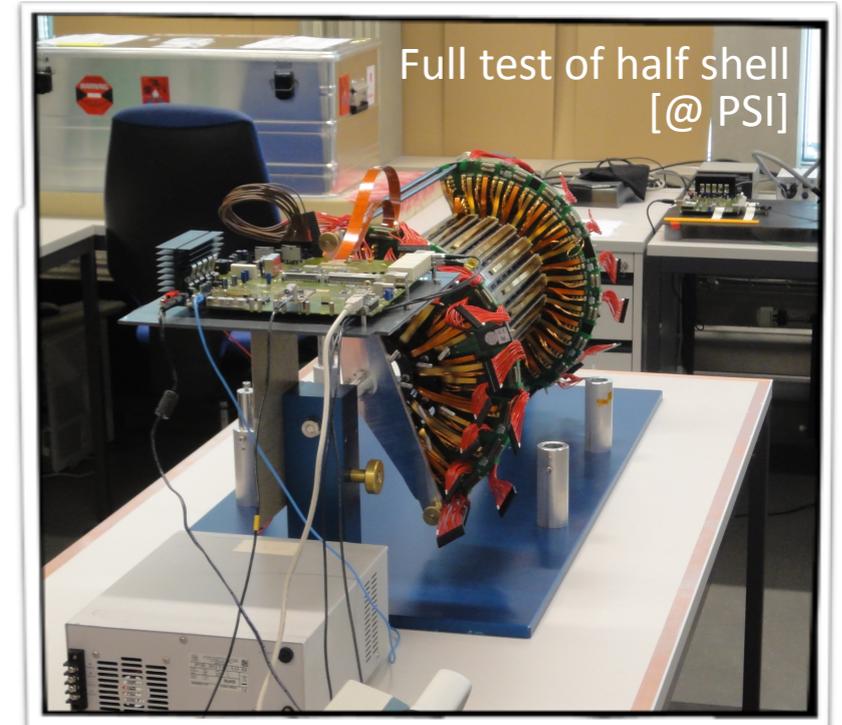
e.g. Kurzschlüsse zwischen Bond-Pads

HCAL Outer

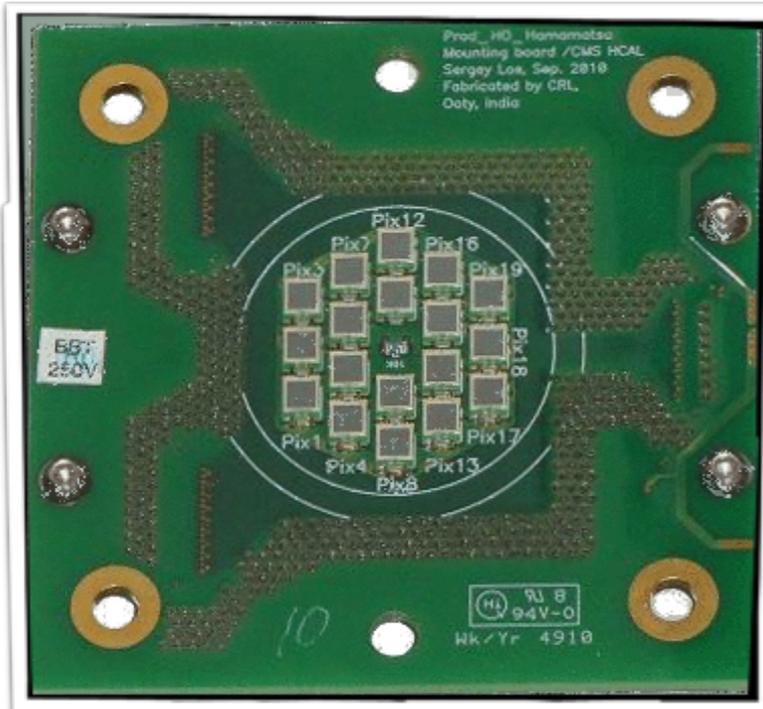
Neue SiPM Auslese; HPD-Ersatz

Myon-Drifttube-System

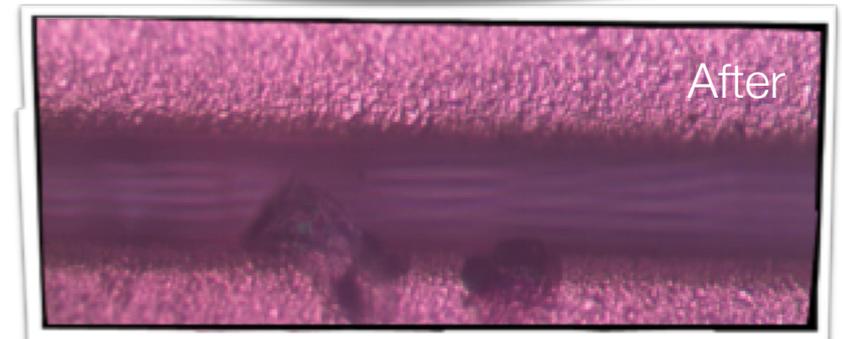
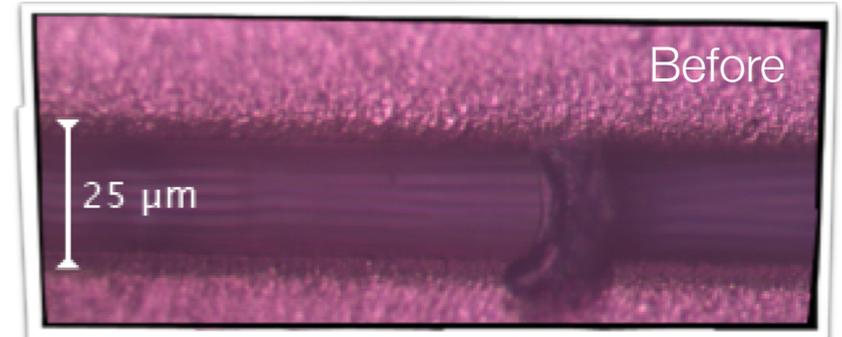
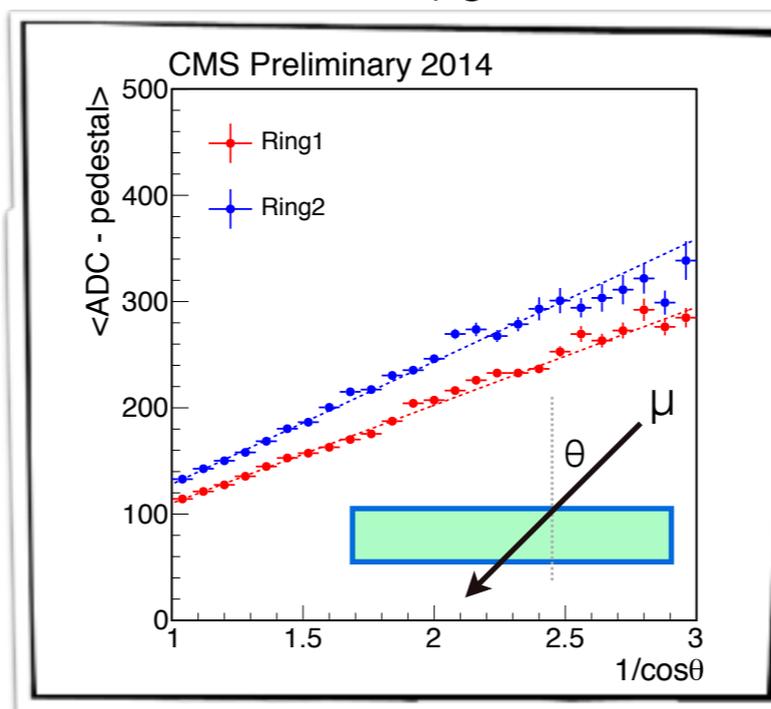
Verbesserung Trigger- & Datenauslese



SiPM Board



HCAL nach SiPM Upgrade



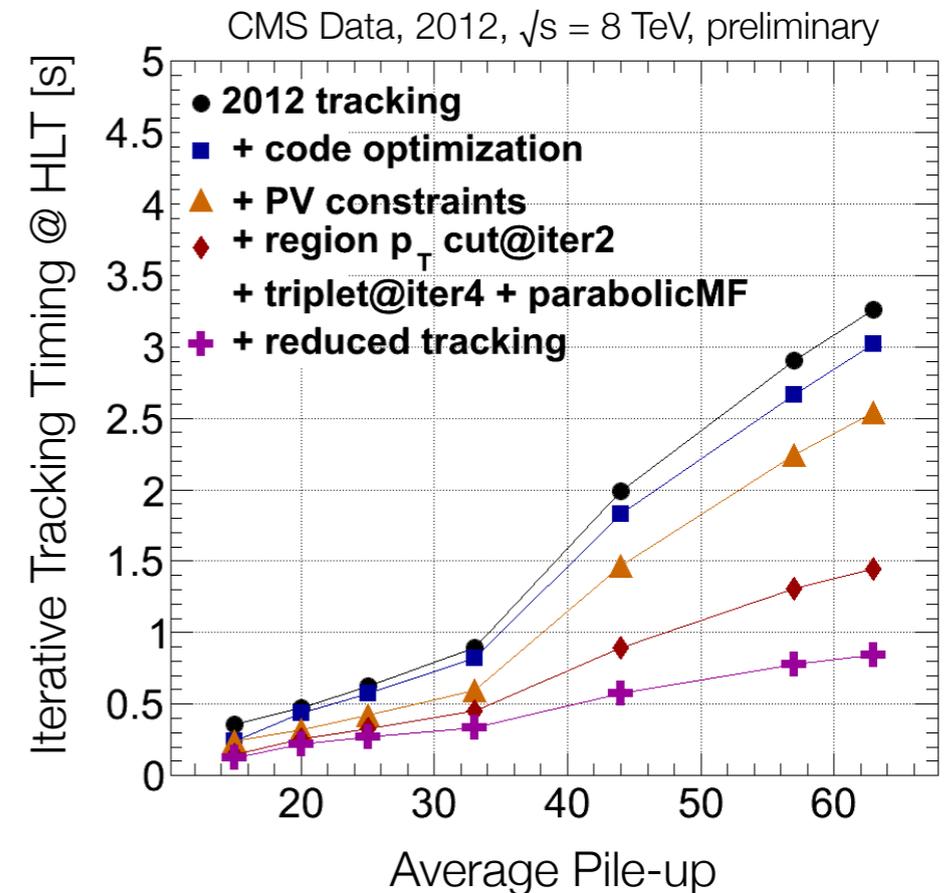
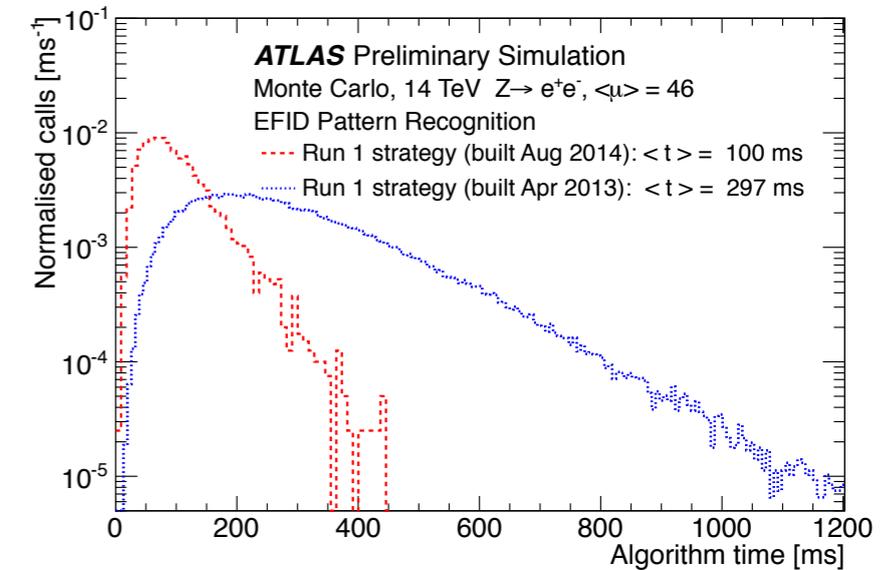
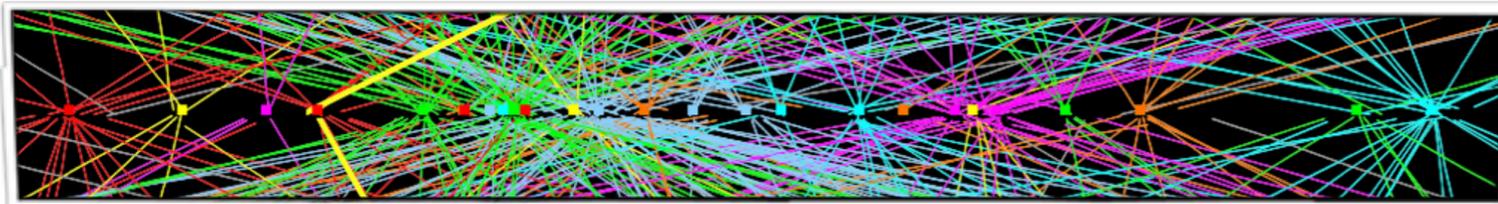


ATLAS & CMS – Upgrade Trigger-Systeme

- ATLAS**
- L1Calo – zusätzliche Flexibilität (e.g. nMCM)
 - L1Topo – Selektion topologischer Signaturen
 - L1Muon – neue TGC-Sektorlogik
 - CTP – zusätzliche Triggerinputs
 - FTK – Spuren für den HLT
 - HLT – Kombination von L2 & EF
schnellere Algorithmen

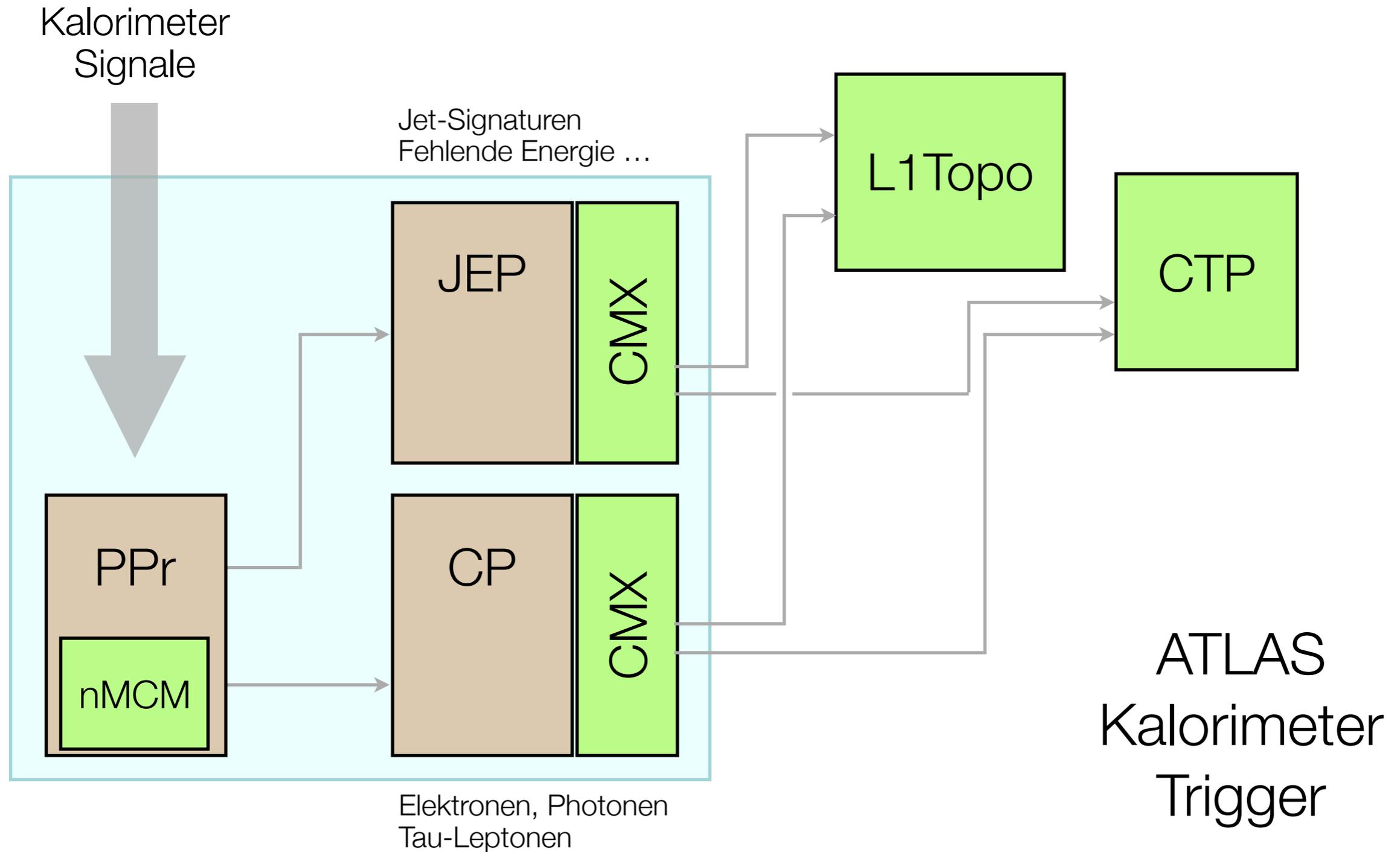
- CMS**
- L1Calo – extra Selektivität (MP7,CTP7)
 - L1Muon – extra Selektivität (MTF7)
– erweiterte Akzeptanz
 - HLT – Neues, iteratives Tracking
schnellere Algorithmen

Z → μμ Ereignisse; 25 rekonstruierte Vertices



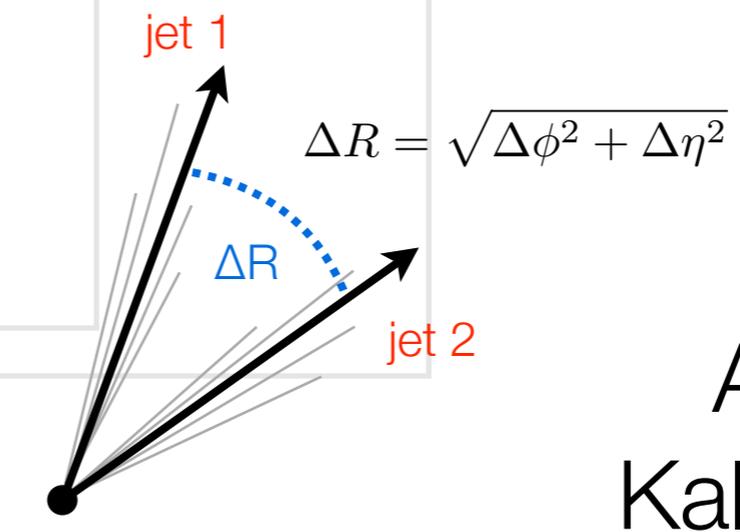
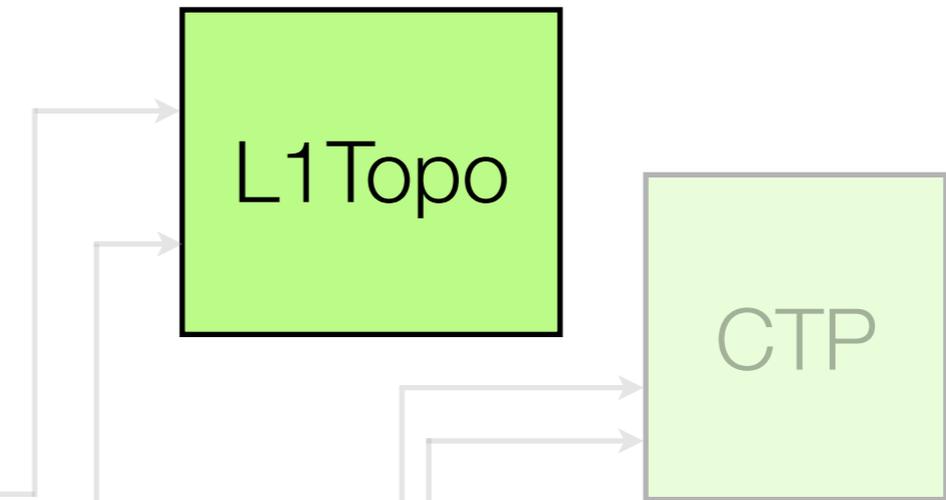
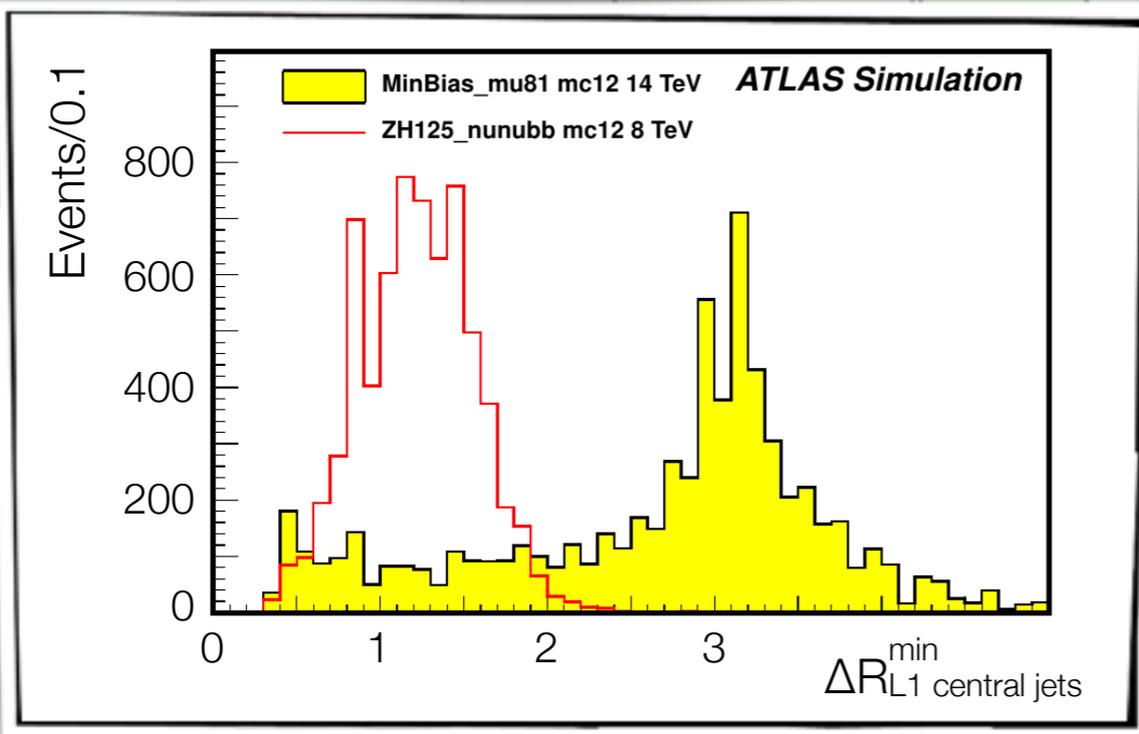
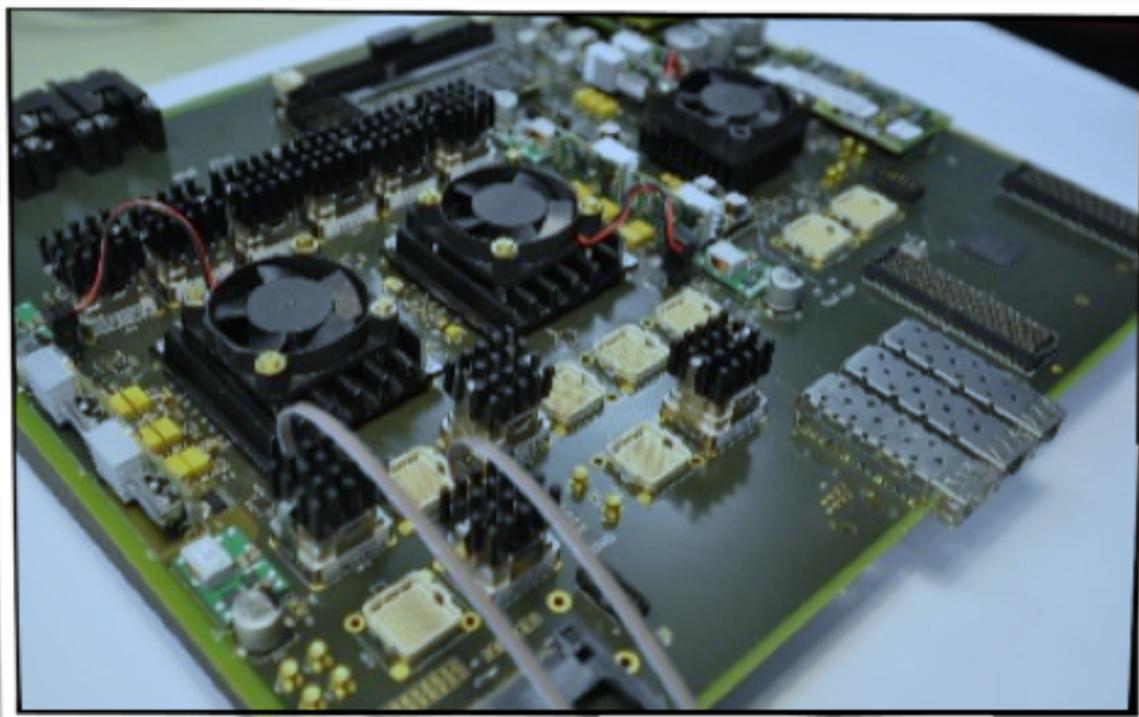


Upgrade Trigger-Systeme





Upgrade Trigger-Systeme



ATLAS
Kalorimeter
Trigger

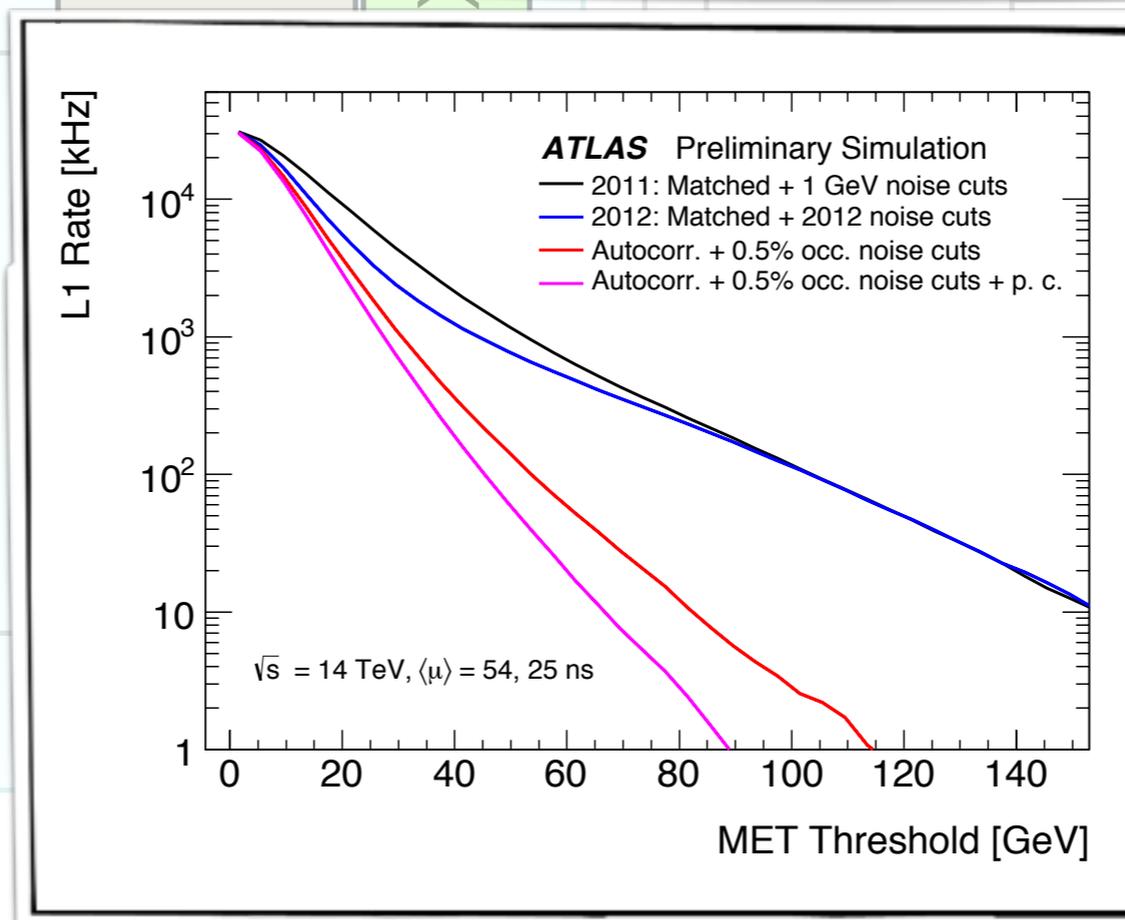
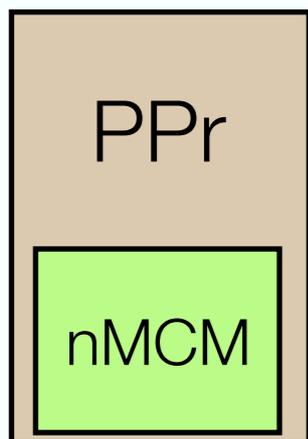
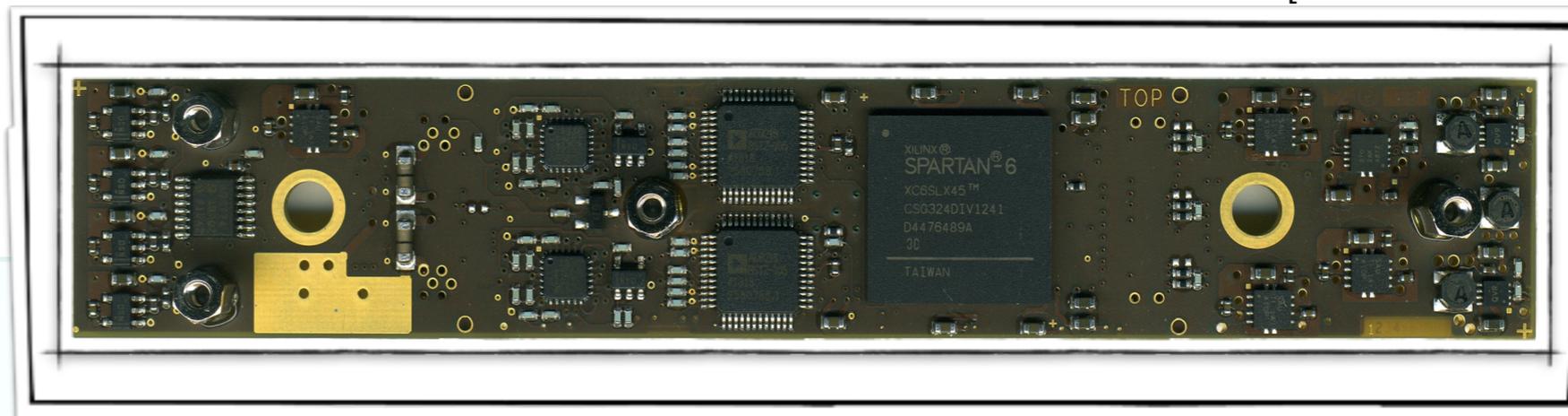
ZH → vvbb
Triggerselection



Upgrade Trigger-Systeme

[nMCM Module]

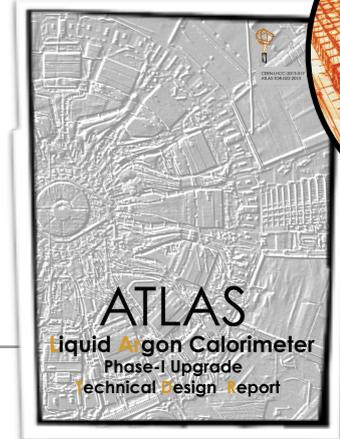
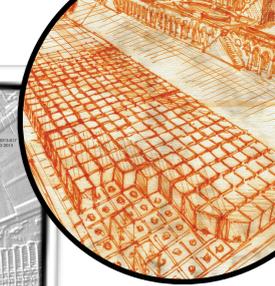
Kalorimeter
Signale



ATLAS
Kalorimeter
Trigger

Phase-I Upgrade

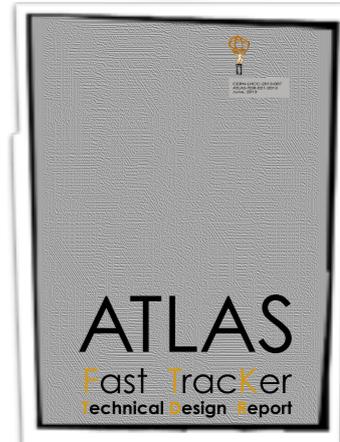
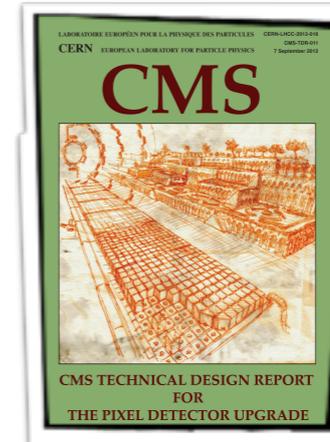
ATLAS



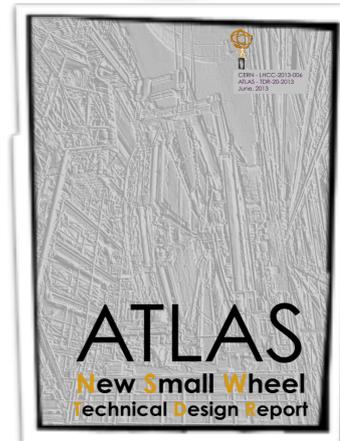
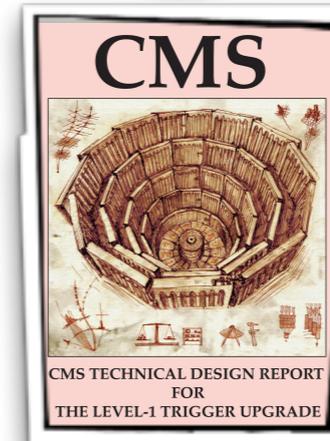
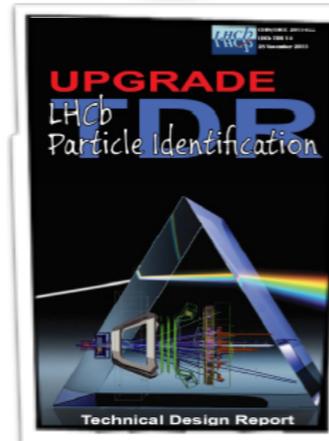
LHCb

CMS

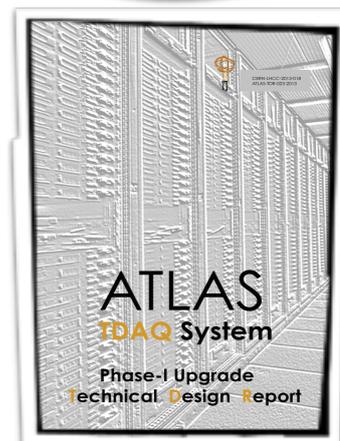
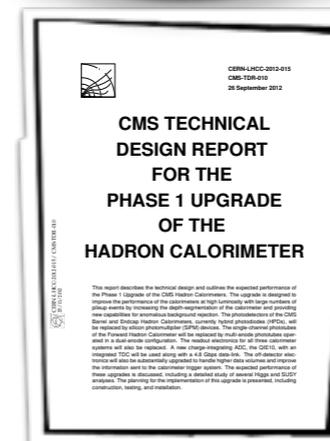
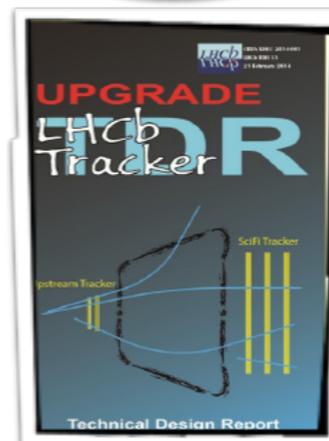
ATLAS: LAr-Kalorimeter [r/o]
Fast Tracker
New Small Wheel
Trigger & DAQ

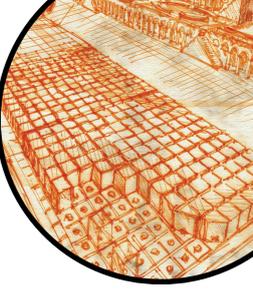


CMS: Pixel-Detektor
Level-1 Trigger
Hadron-Kalorimeter
Myon-System [GE1/1]



LHCb: LHCb Tracker
Particle ID
Trigger & DAQ



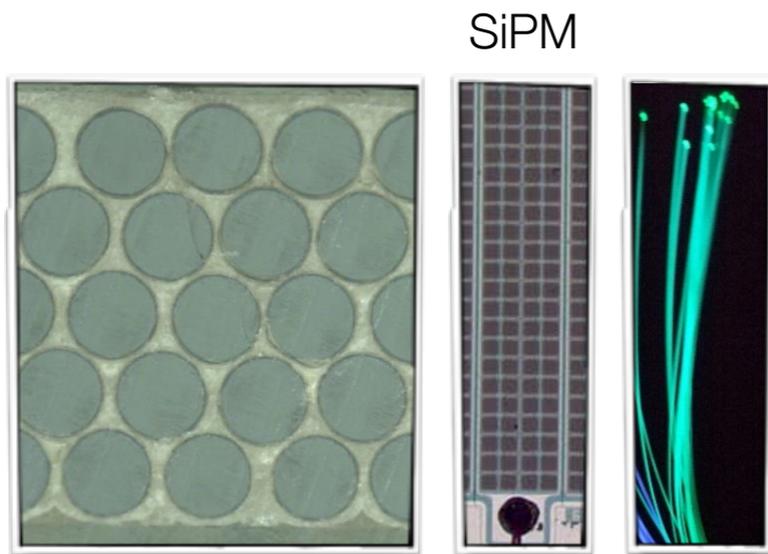


LHCb – Scintillating Fibre Tracker

Fasern:
2.5 m x 2.5 μm

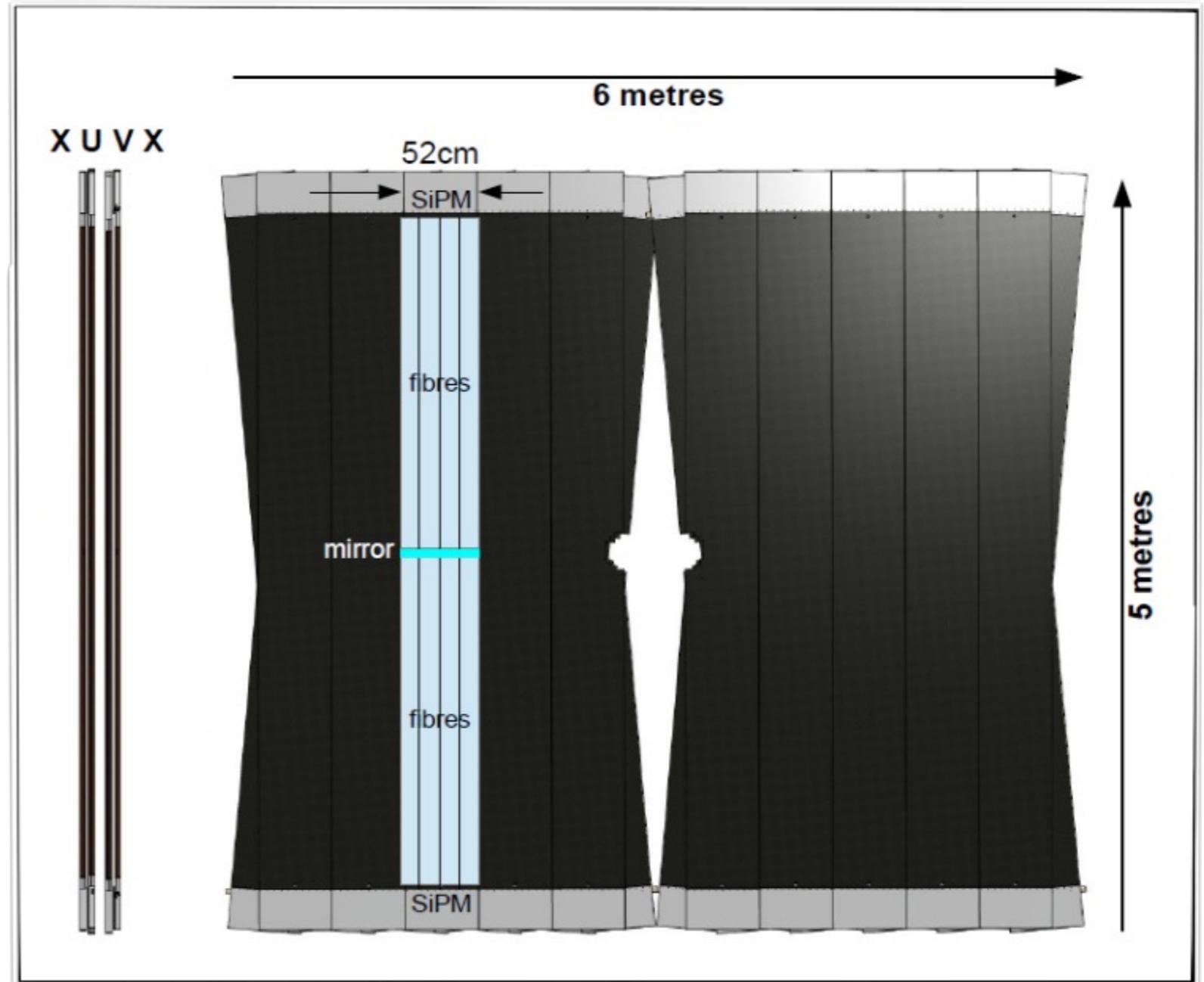
Faserebenen:
2.5 m x 13 cm

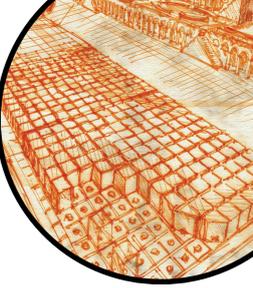
Lichtauslese
mit SiPMs



Faserebene

Fasern





CMS – Pixel-Detektor

Verbesserung

Neue Auslese

[Digitaler Auslesechip]

Zusätzliche Lagen

[BPIX: 3 → 4; FPIX: 2 → 3]

Kleinerer Radius

[innerste Lage]

Mechanik etc.

[Material, Kühlung, Powering]

Grund

Hochratenfähigkeit

[Max. Rate: 100 → 250 MHz/cm]

extra 3D-Spurpunkte

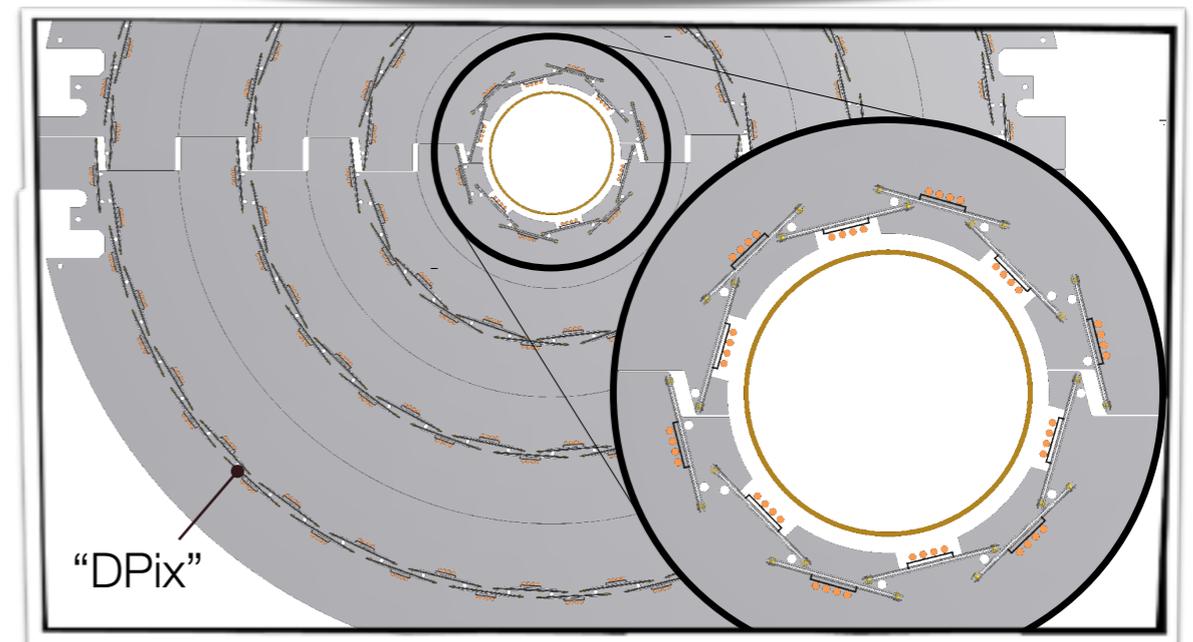
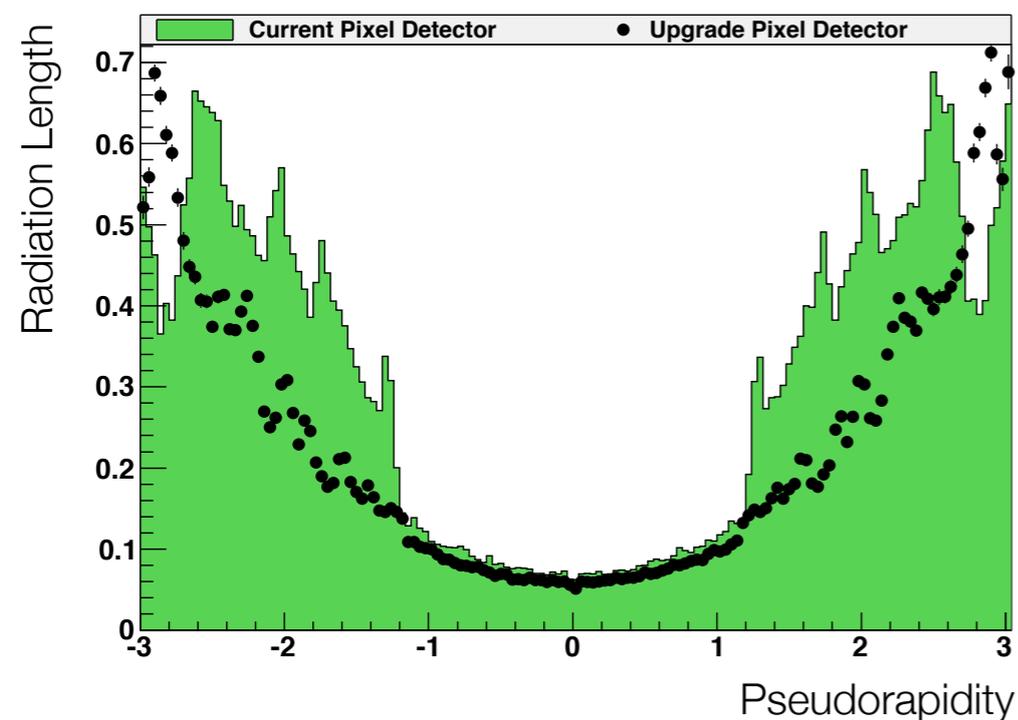
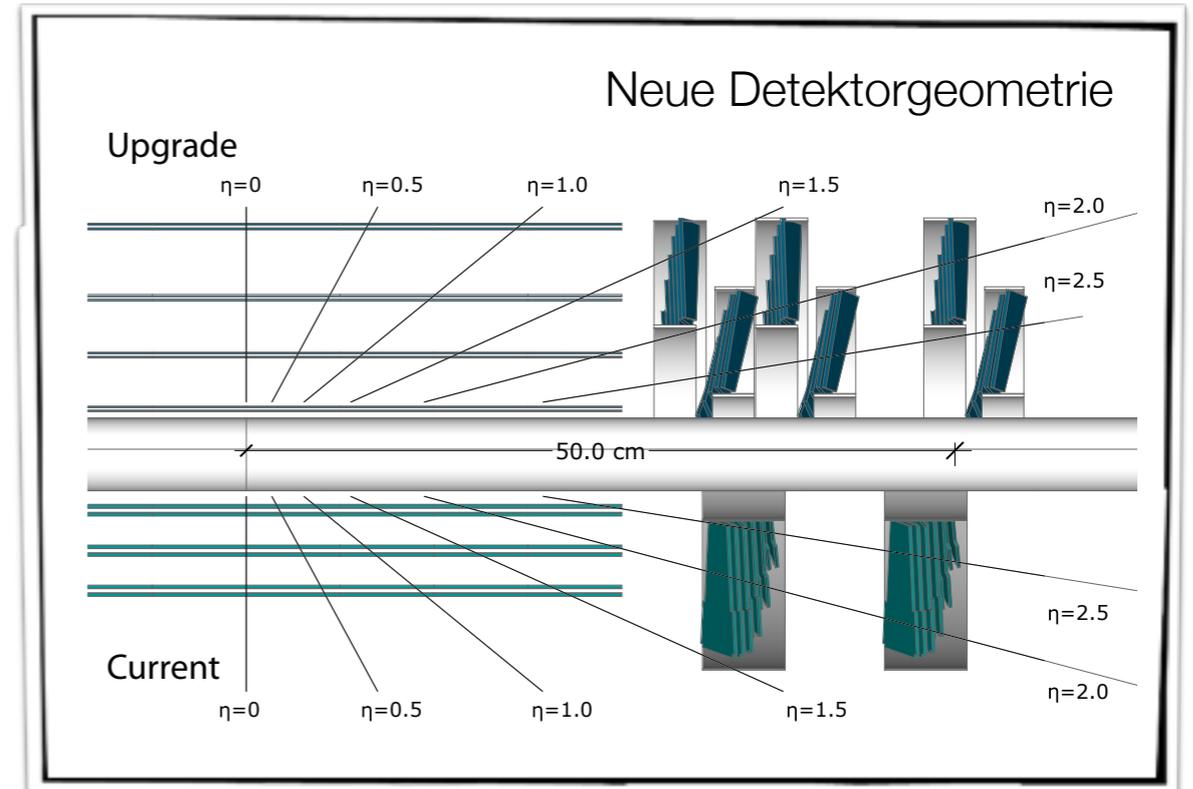
[d.h. mehr Redundanz]

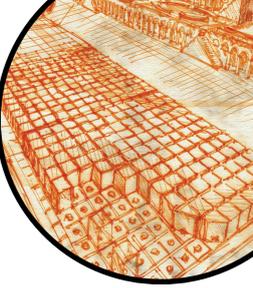
B-Tagging

[bessere IP-Auflösung]

Weniger totes Material

[weniger Vielfachstreuung ...]





CMS – Pixel-Detektor

Verbesserung

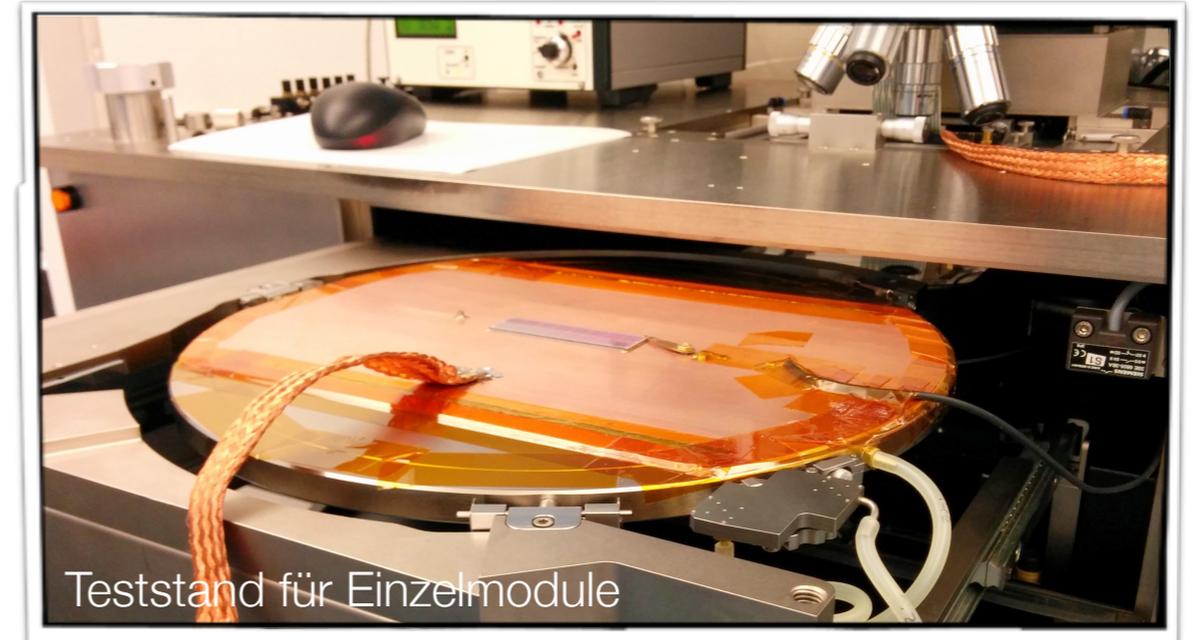
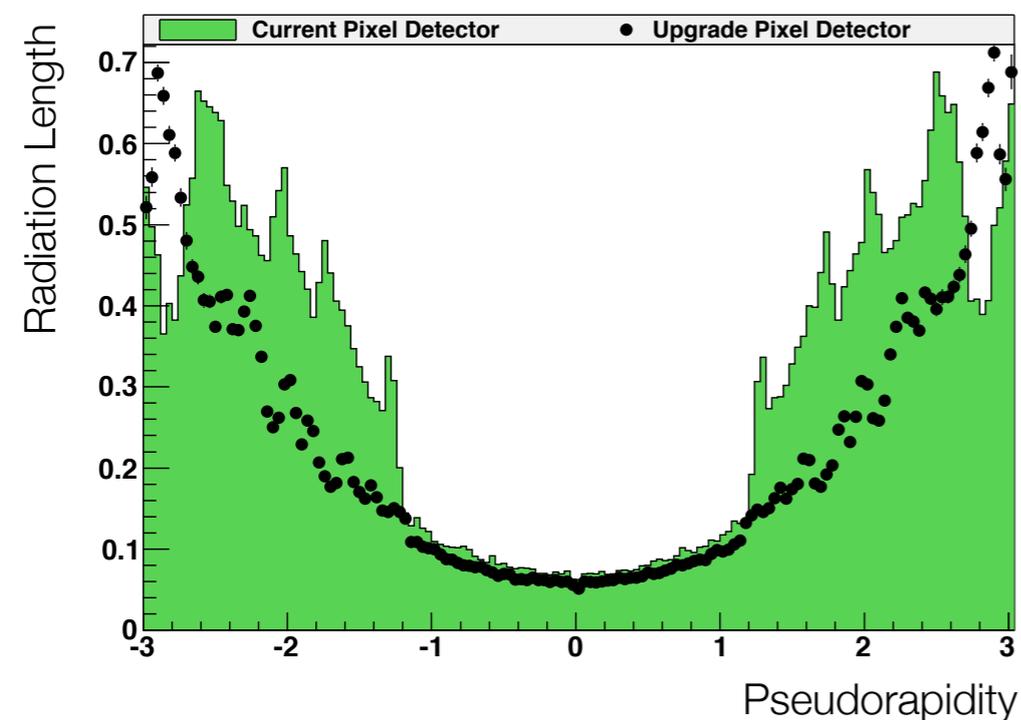
- Neue Auslese
[Digitaler Auslesechip]
- Zusätzliche Lagen
[BPIX: 3 → 4; FPIX: 2 → 6]
- Kleinerer Radius
[innerste Lage]
- Mechanik etc.
[Material, Kühlung, Powering]

Grund

- Hochratenfähigkeit
[Max. Rate: 100 → 250 MHz/cm]
- extra 3D-Spurpunkte
[d.h. mehr Redundanz]
- B-Tagging
[bessere IP-Auflösung]
- Weniger totes Material
[weniger Vielfachstreuung ...]



Klebestation für Pixel-Module



Teststand für Einzelmodule



ATLAS – New Small Wheels

Run 3 [up to $L = 5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$]:

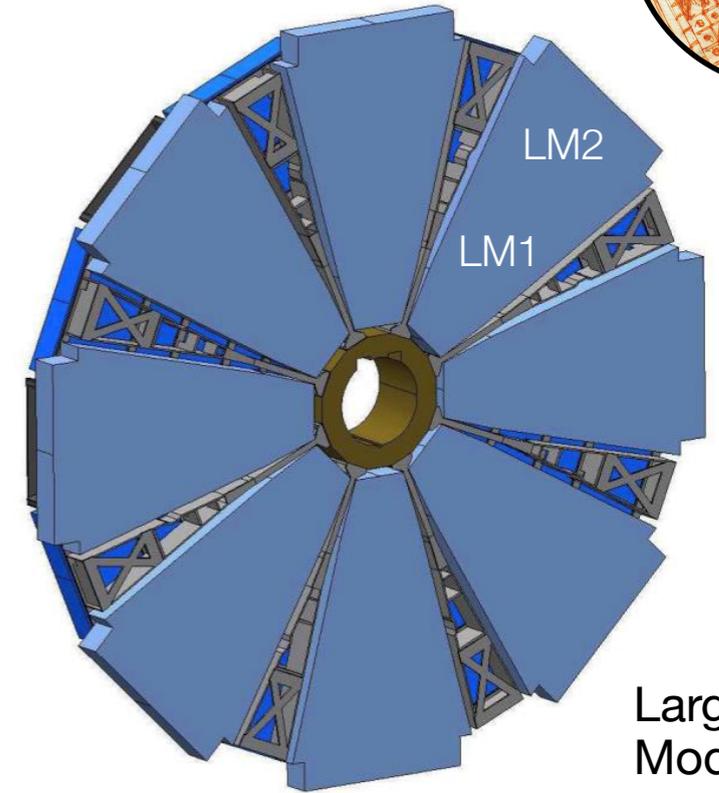
Hohe Trefferquoten im Vorwärtsbereich

Hohe Triggerraten durch 'Fakes'

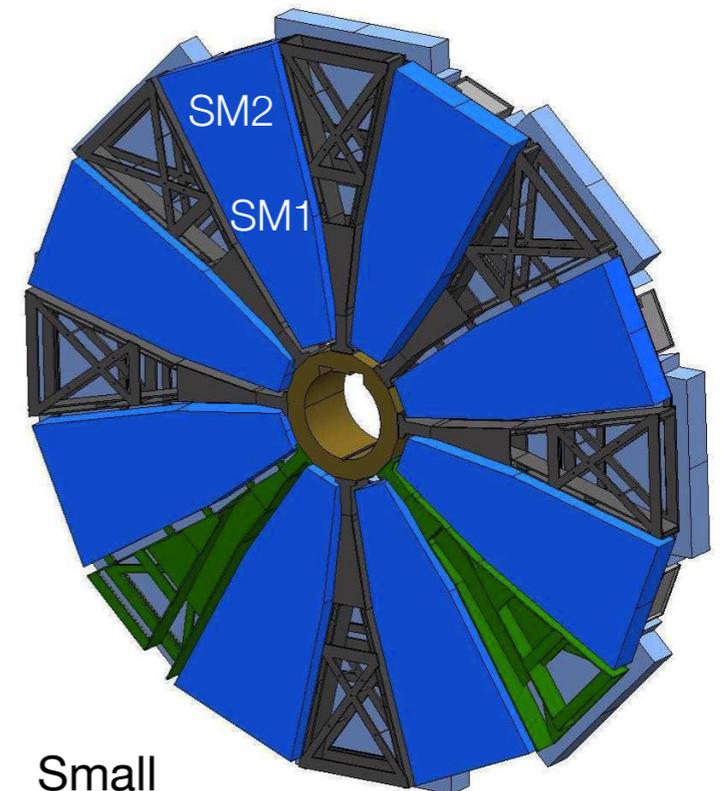
→ Neue 'Small Wheels'

Ratenfeste Myon-Detektoren [Mircromegas]

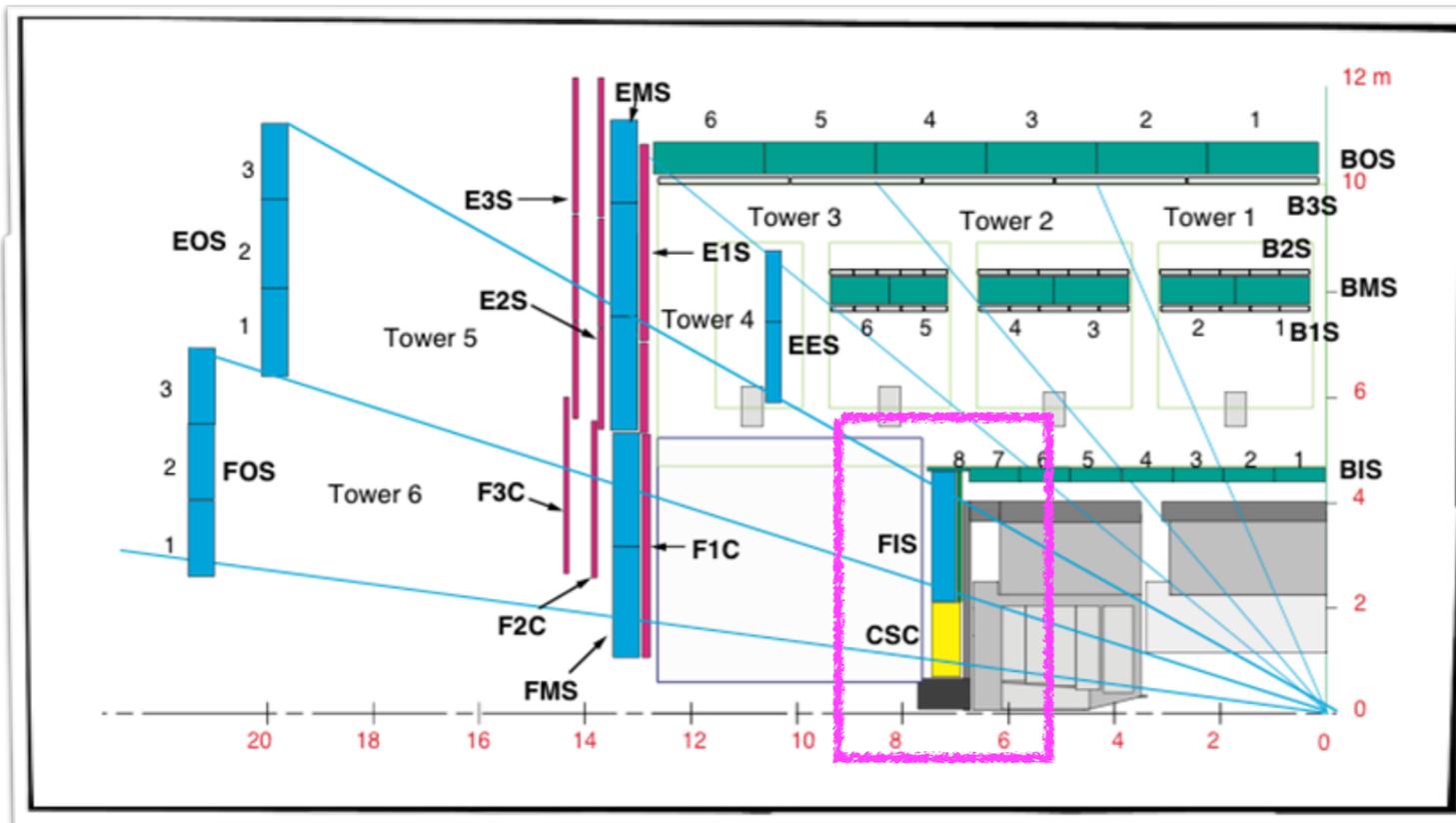
Extra Triggerkammern [sTGC]



Large Modules



Small Modules





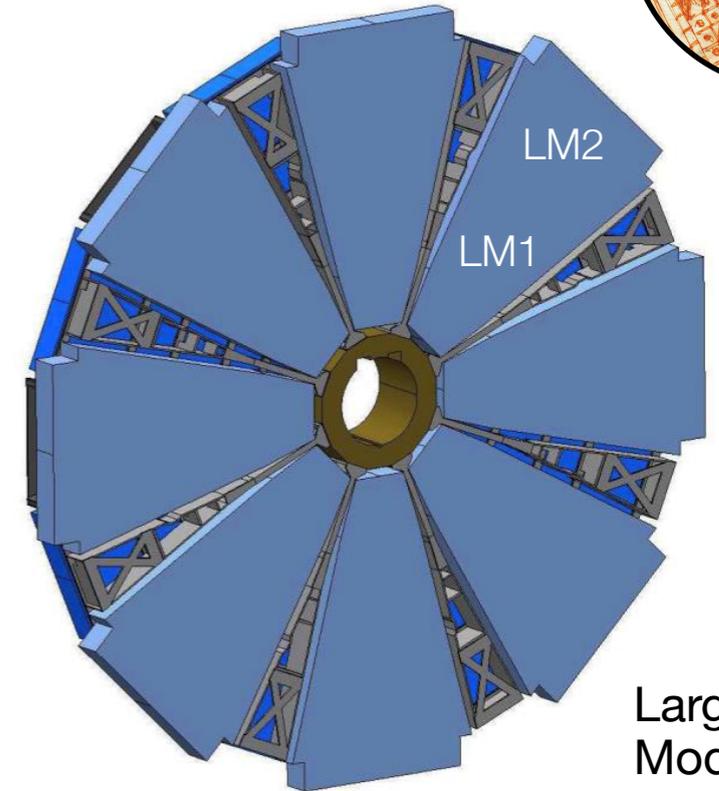
ATLAS – New Small Wheels

Run 3 [up to $L = 5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$]:

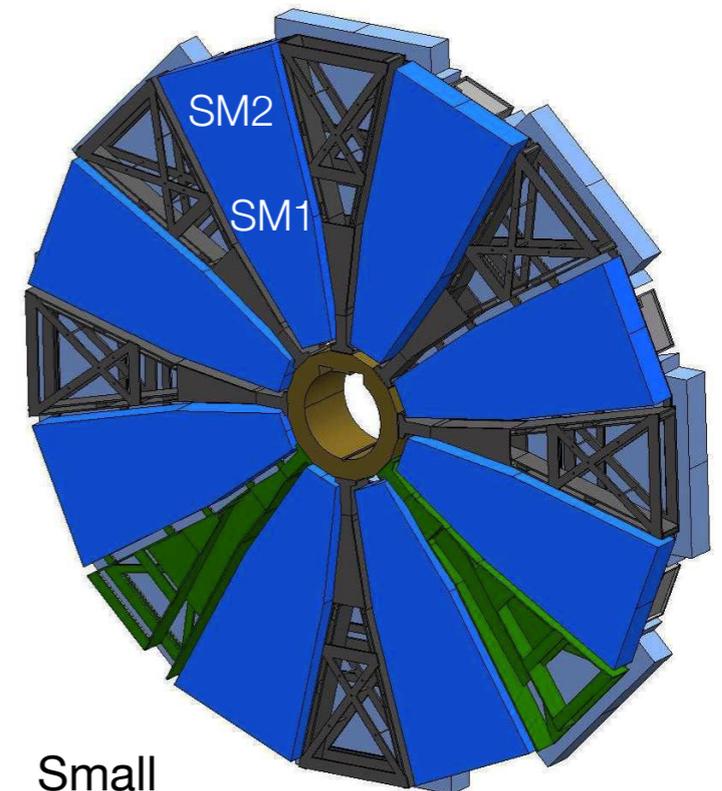
Hohe Trefferquoten im Vorwärtsbereich

Hohe Triggerraten durch 'Fakes'

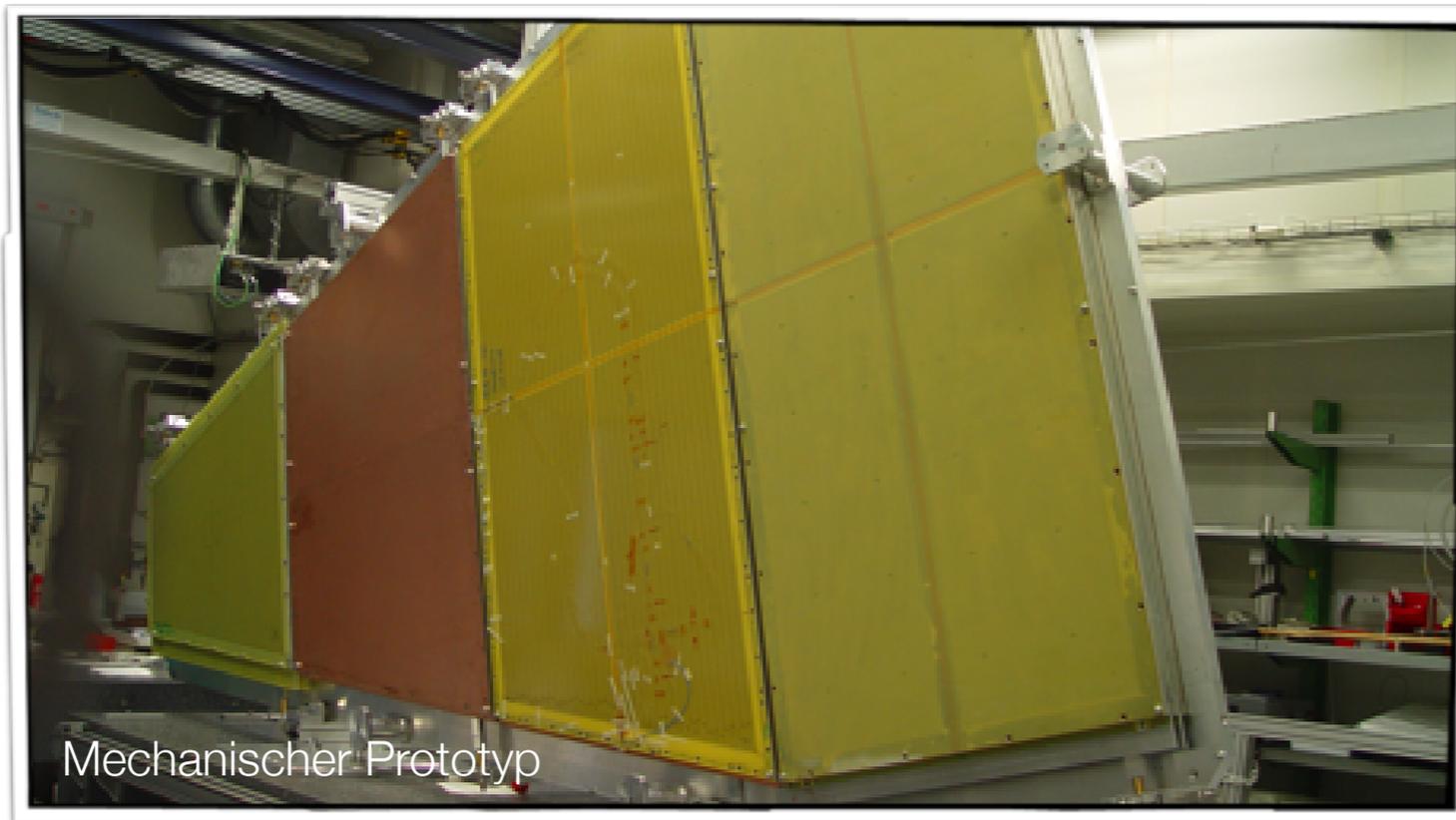
- Neue 'Small Wheels'
- Ratenfeste Myon-Detektoren [Mircromegas]
- Extra Triggerkammern [sTGC]



Large Modules

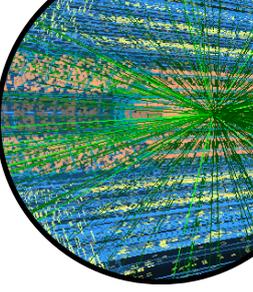


Small Modules

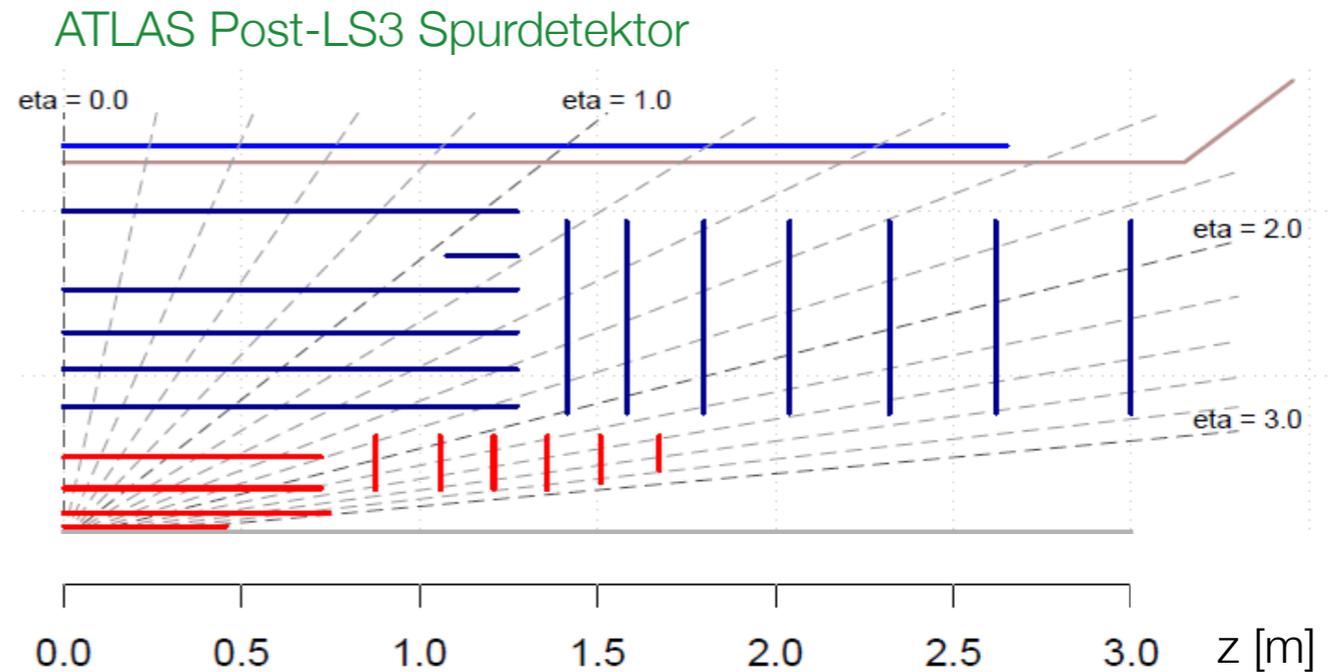


Mechanischer Prototyp

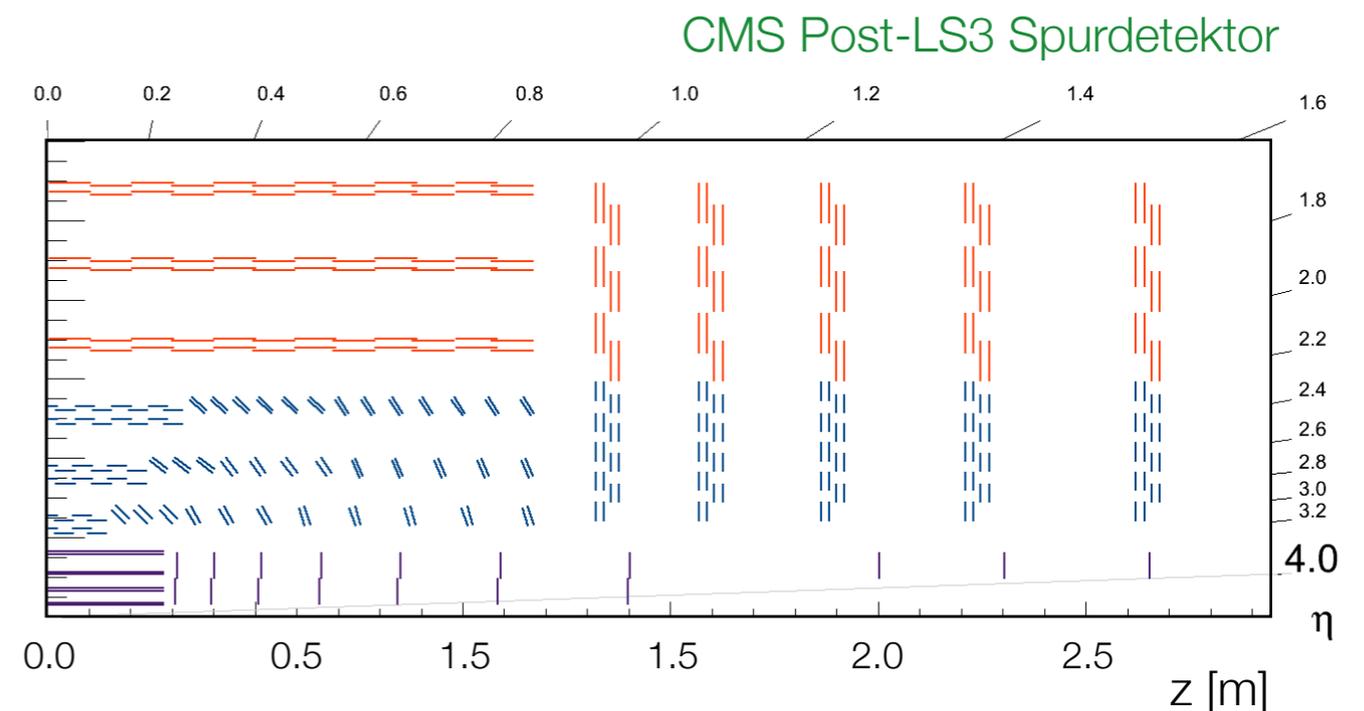
Phase-II Upgrade

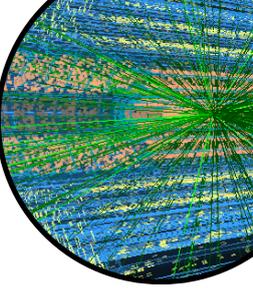


ATLAS: Pixel-Detektor
Silizium-Streifen-Detektor
Trigger & DAQ
Myon-System (Elektronik)
LAr- und Tile (Elektronik)
...

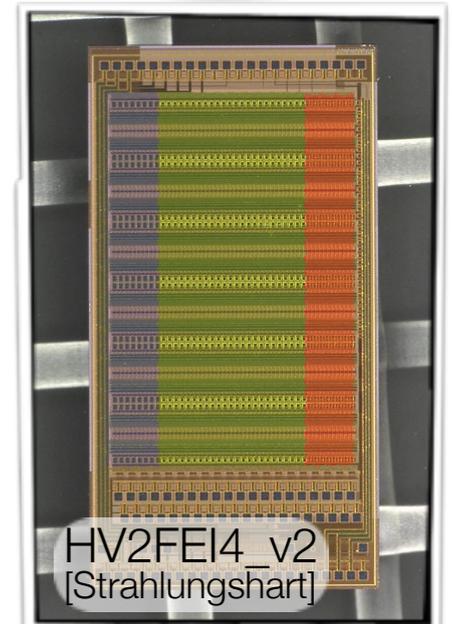
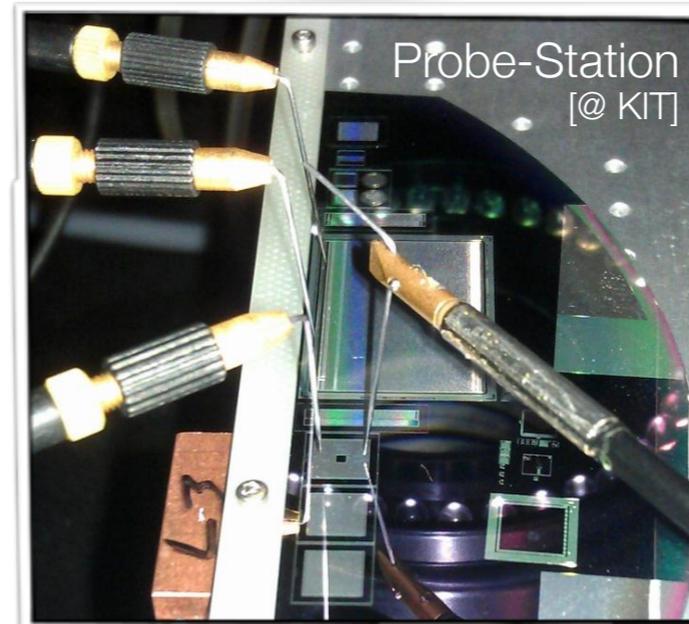
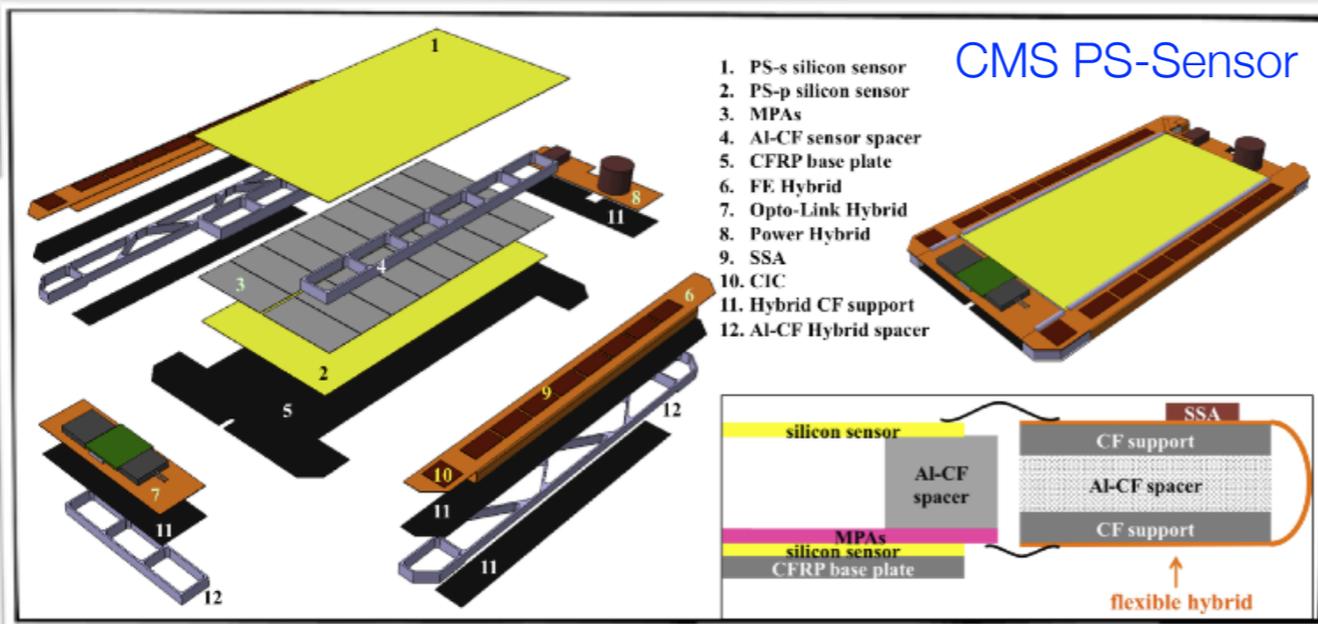
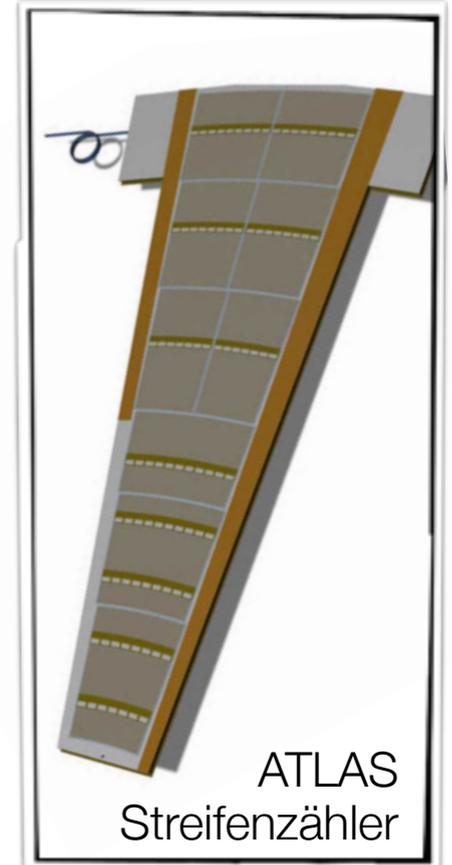
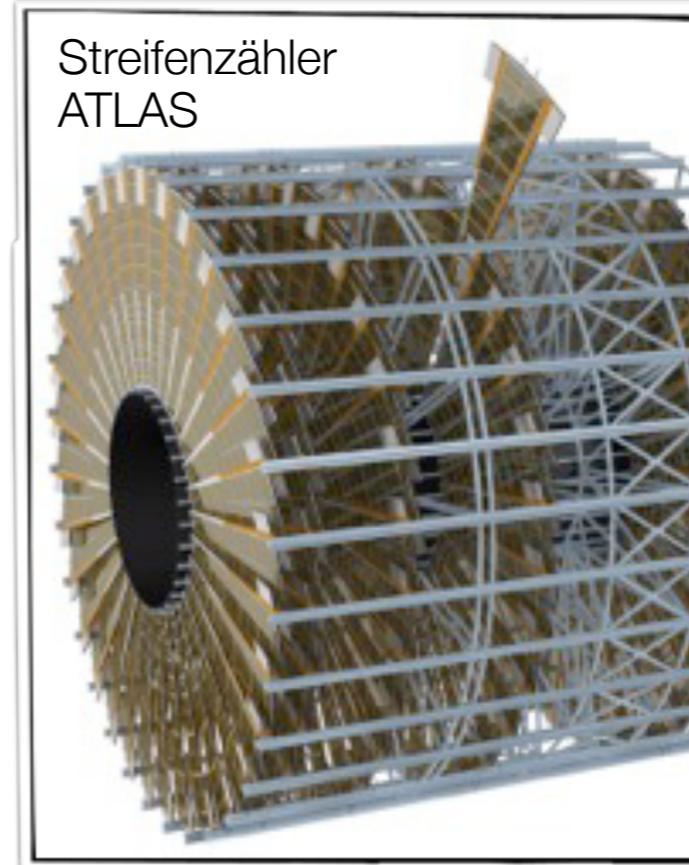
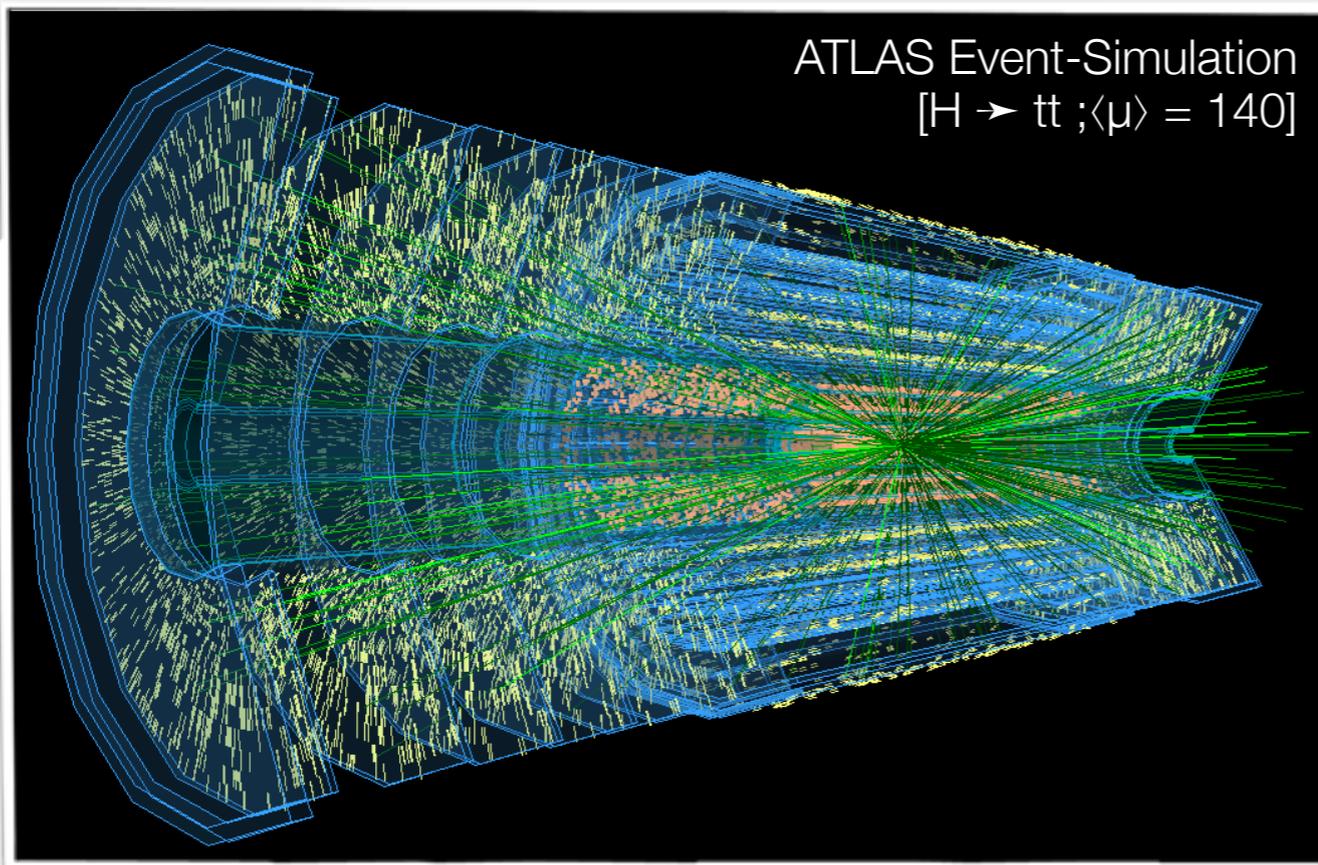


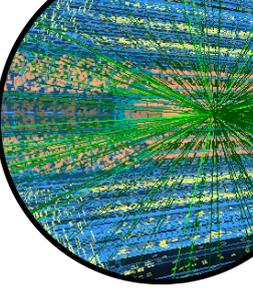
CMS: Spurdetektor-Upgrade
Kalorimeter-Upgrade
Myon-Upgrade
CMS Spurtrigger
Vorwärtsdetektoren
...



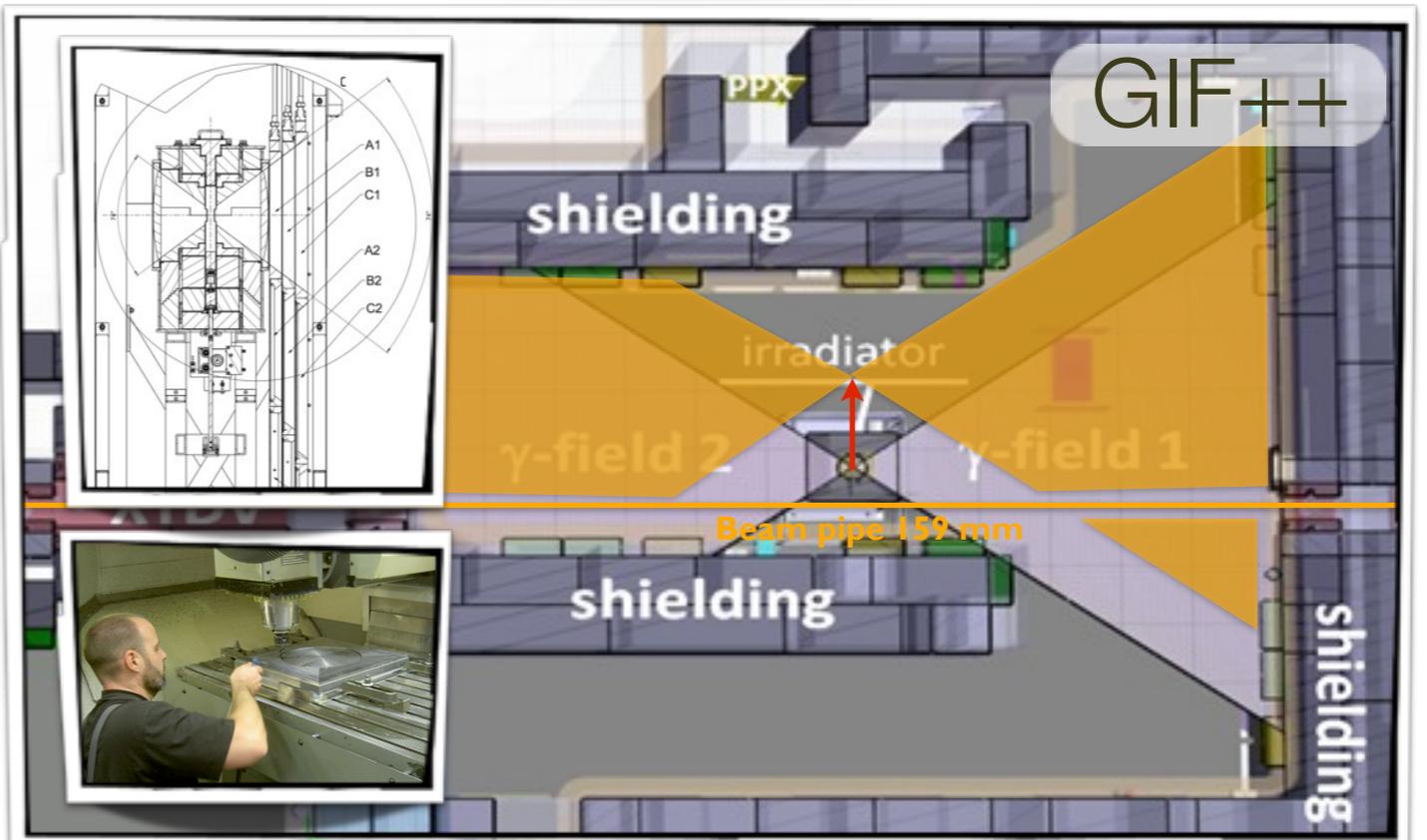
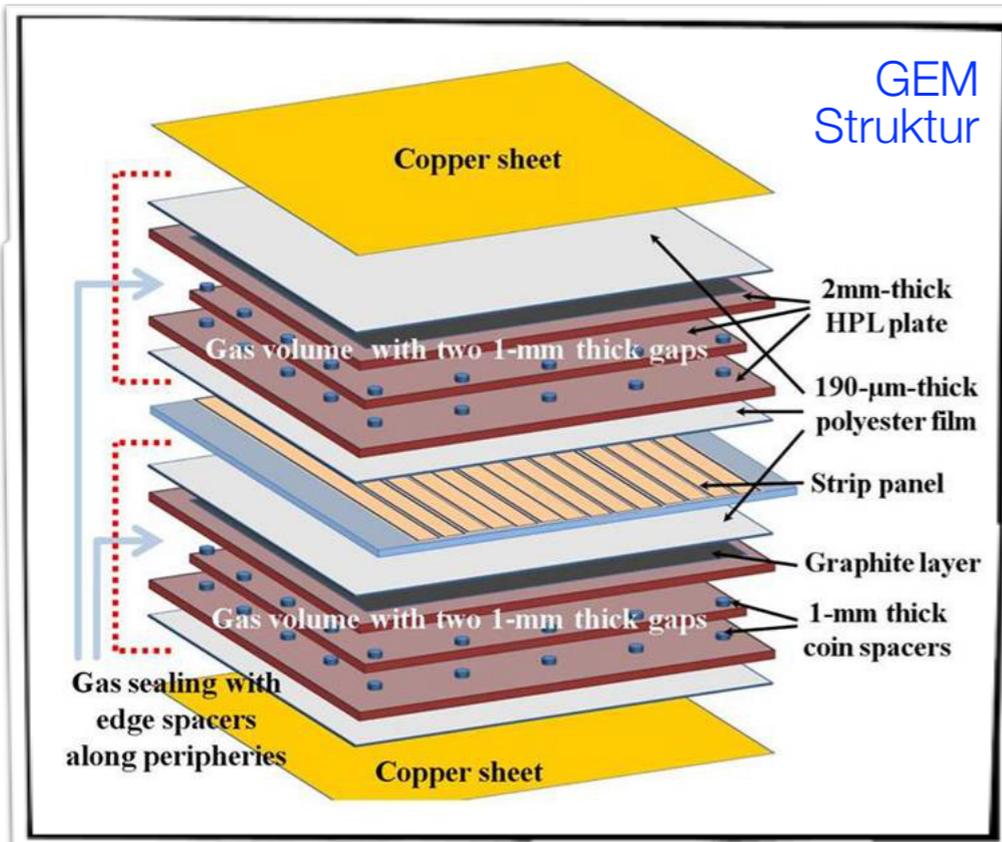
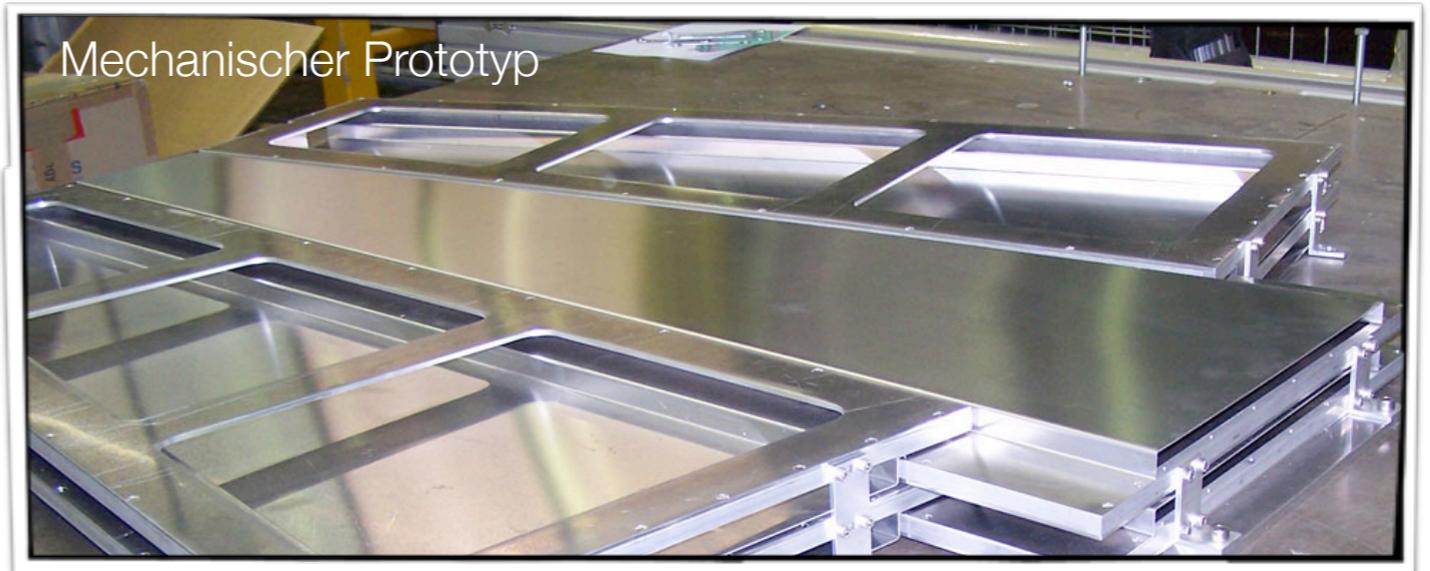
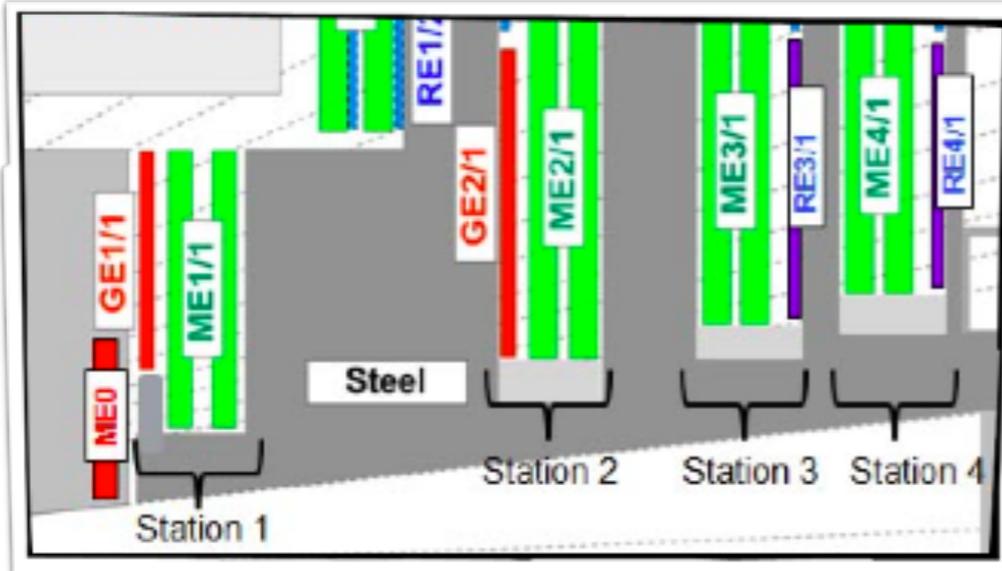


Beispiel 1: Phase-II Upgrade – Spurdetektoren





Beispiel 2: Phase-II Upgrade – CMS GEM Myon-Kammern



Comments (16-Feb-2013 08:25:13)

*** END OF RUN 1 ***

No beam for a while. Access required
time estimate: ~2 years

Ready for Run 2