



# WADAPT

## News

*Elizabeth Lucci*  
CEA-Saclay/DSM/IRFU/SPP

## Why this Meeting?

- ◆ Get together physicists/engineers interested in a common project of **wireless readout** (& wireless powering)
- ◆ Physicists working on **Wireless-readout** project in the context of ATLAS-experiment **vertex detector**. Similar vertex detectors are a must in present and future large HEP experiments
- ◆ Engineers, specialists of wireless techniques, constantly developing and making progress in those.



Learn from each other

- ◆ How to work work together in the frame of a Collaboration for the benefit of all?
- ◆ How to organize ourselves?
- ◆ Future plans?
- ◆ Milestones?

# WADAPT

chaired by Elizabeth Locci (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Friday, 12 June 2015 from 08:00 to 18:00 (Europe/Zurich)

CERN ( 4-S-020 )

Manage ▾















Videoconference Rooms

WADAPT

Join

4-S-020 ▾

## Friday, 12 June 2015

09:00 - 09:05	<b>Introduction 5'</b> Speaker: Elizabeth Locci (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR)) Material: <b>Slides</b> 	
09:05 - 09:45	<b>The 60 GHz transceiver chip 40'</b> Speaker: Hans Kristian Soltveit (Ruprecht-Karls-Universitaet Heidelberg (DE)) Material: <b>Slides</b> 	
09:45 - 10:25	<b>The 60 Ghz lab-measurements 40'</b> Speaker: Sebastian Dittmeier (Ruprecht-Karls-Universitaet Heidelberg (DE)) Material: <b>Slides</b> 	
10:25 - 10:40	Coffee break	
10:40 - 11:20	<b>Results from studies on 60 GHz strip and patch antennas 40'</b> Speaker: Richard Brenner (Uppsala University (SE)) Material: <b>Slides</b> 	
11:20 - 12:00	<b>Mmw readout 40'</b> Speaker: Cedric Dehos (CEA-Leti) Material: <b>Slides</b> 	
12:00 - 13:30	Lunch break	
13:30 - 13:50	<b>WADAPT Web site 20'</b> Speaker: Sebastien Ceuterickx (CERN)	
13:50 - 14:00	<b>AOB 10'</b> Speaker: Elizabeth Locci (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR)) Material: <b>Slides</b> 	
14:00 - 16:00	General Discussion - Plans - Organization 2h0'	

09:05 - 09:45

## The 60 GHz transceiver chip 40'

Speaker: Hans Kristian Soltveit (Ruprecht-Karls-Universitaet Heidelberg (DE))

# OUTLINE

- ⊙ Introduction to Millimeter Wave
- ⊙ Features of the 60 GHz band
- ⊙ Practical opportunities
- ⊙ Application in HEP
- ⊙ Proposed Readout Concept
- ⊙ Applied Technology
- ⊙ 60 GHz Transceiver Chip
- ⊙ Performance from Simulations
- ⊙ Silicon Integration Challenges
- ⊙ Summary and Outlook



# Summary and Outlook

- ✧ MM-wave technology presented as a possible solution for current bandwidth limitations of LHC and maybe other detector facilities.
- ✧ A 60 GHz transceiver has been proposed for the first prototype.
- ✧ Schematic and simulations of some blocks shown.
- ✧ SiGe BiCMOS technology chosen for the first prototype
- ✧ Challenges to integration of MM-wave system discussed

SnowMass 2013 Community Summer Study:  
The Instrumentation Frontier

“Wireless data transmission was identified as one of the innovations that could revolutionize the transmission of data readout of the detector”

There is a lot of interest for this development on different levels

3-student from University of Bergen (Norway) has shown interest for the project:  
2-3 months paid stay in HD for each of the student are possible.

**60 GHz ASIC prototype in HD under development**

Planned Submission: 30 Nov. 2015

09:45 - 10:25

## The 60 Ghz lab-measurements 40'

Speaker: Sebastian Dittmeier (Ruprecht-Karls-Universitaet Heidelberg (DE))

# Lab measurements done in Heidelberg

- Data transmission studies
- Material properties
- Antenna characterization
- Cross talk and link density studies

## Summary

Stable data transmission of 1.76 Gbps with test setup:  
 **$BER < 10^{-14}$**

By means of antennas, polarisation and graphite foam, a high link density can be achieved.  
Link pitch  $\leq 5$  cm @  $S/N \geq 20$

SCT detector modules attenuate transmission of 60 GHz waves by  $\geq 55$  dB

Performance of detector modules will not be degraded by 60 GHz waves

10:40 - 11:20

## Results from studies on 60 GHz strip and patch antennas 40'

Speaker: Richard Brenner (Uppsala University (SE))



### Motivation



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- Data link with large bandwidth
- Minimal extra material
- Freedom of routing (and breaking boundaries) allowing for topological trigger



### Work in progress



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- Antennas suitable for usage in tracking detectors
  - Design, simulation of various types
  - Fabrication and characterization
  - Preliminary radiation studies
- Interconnection of antennas to transceivers
  - Interconnecting antenna to transceiver with wire bonding
  - Design of demonstrator



11:20 - 12:00

## Mmw readout 40'

Speaker: Cedric Dehos (CEA-Leti)

### ■ CERN specifications

- Radial wireless transmission of detector data
- Remote power supply as a must

### ■ Technical issues

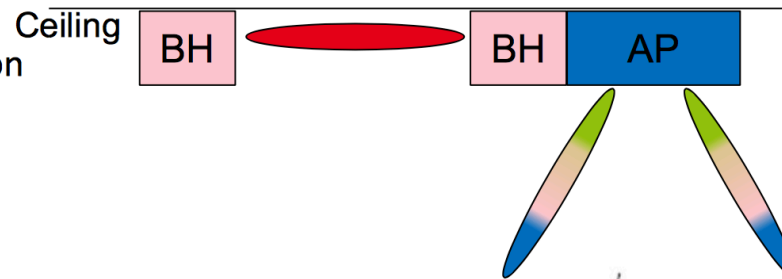
- Important aggregated data rate from detectors (Tbytes/s)
- Important number of detector modules (20000 for ATLAS)
- Crosstalks
- Signal confinement
- Liability in harsh environment (radiations)
- Low power consumption (for remote power supply)
- Efficiency of remote power transmission
- Etc.

-> Wifi not suitable: Limited data rate, low QoS, important power consumption

-> Optical links not suitable: Difficult implementation

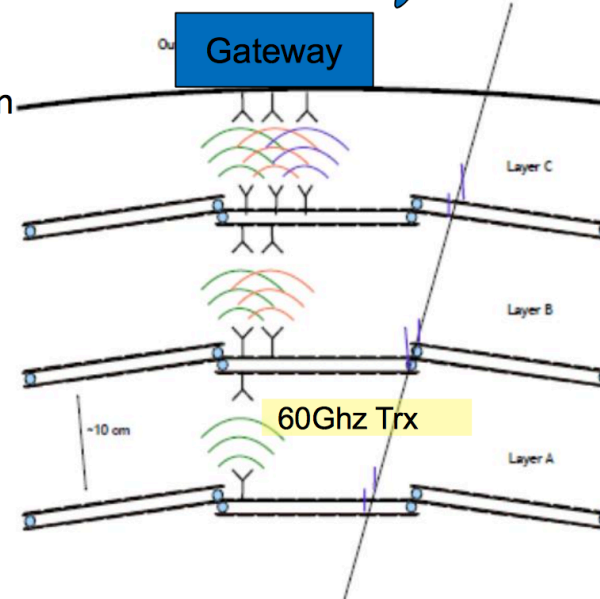
## 1. Layer to layer transmission of data @60GHz

- Proposed by Heidelberg Univ.
- Low power short range transmission
- Time domain transceiver



## 2. Gateway

- Aggregation of data
- Medium range high data rate transmission
- Frequency domain transceiver



## 3. Wireless access point

- Multi user access scheme
- Very high data rate
- Frequency domain transceiver

## 4. Data Backhauling

## Possible CEA Leti contributions – short term

- Architecture and system studies
- Preliminary experimentation

## Possible CEA Leti contributions – medium term

- RF/mmwave design
- Antenna/package design
- Prototyping

13:30 - 13:50

[WADAPT Web site](#) 20'

Speaker: Sebastien Ceuterickx (CERN)

# General Discussion

## DRAFT

- ◆ Completion ? Publication? Seminars? Conferences?

## ORGANISATION

- ◆ Responsibilities? Meetings? Milestones? Steps?

## CONTACTS – Possible Collaborations/PhD Thesis

- ◆ TELECOM Paris
- ◆ ESA – Environment (radiations, EMC/EMI aspects)
- ◆ AWE - Simulation

## News from ASAHEL

- ◆ Draft on Archive <https://archive.org/details/ASAHEL>
- ◆ Presentation at the Detector Workshop June 17-18<sup>th</sup>