

SCTE ISBE CABLE-TEC  
**EXPO'16**

SEPTEMBER 26-29 PHILADELPHIA

**VR360 Ecosystem for  
Live Distribution**

**Thierry Fautier**

*Vice President, Video Strategy*

Harmonic



 **#CableTecExpo**

Essential Knowledge for Cable Professionals™

© 2016 Society of Cable Telecommunications Engineers, Inc. All rights reserved.

# Agenda

Introduction

Demand for VR Video

VR Video Approaches:

- Commercially deployed
- Tiling
- On Demand
- Polygon mapping

Approach Comparisons

Transmission Summary

Conclusion

# Introduction

---

Describe the different elements of the Video chain for VR Video distribution

---

Audio is by itself a dedicated topic, not addressed

---

Look at different alternatives available today

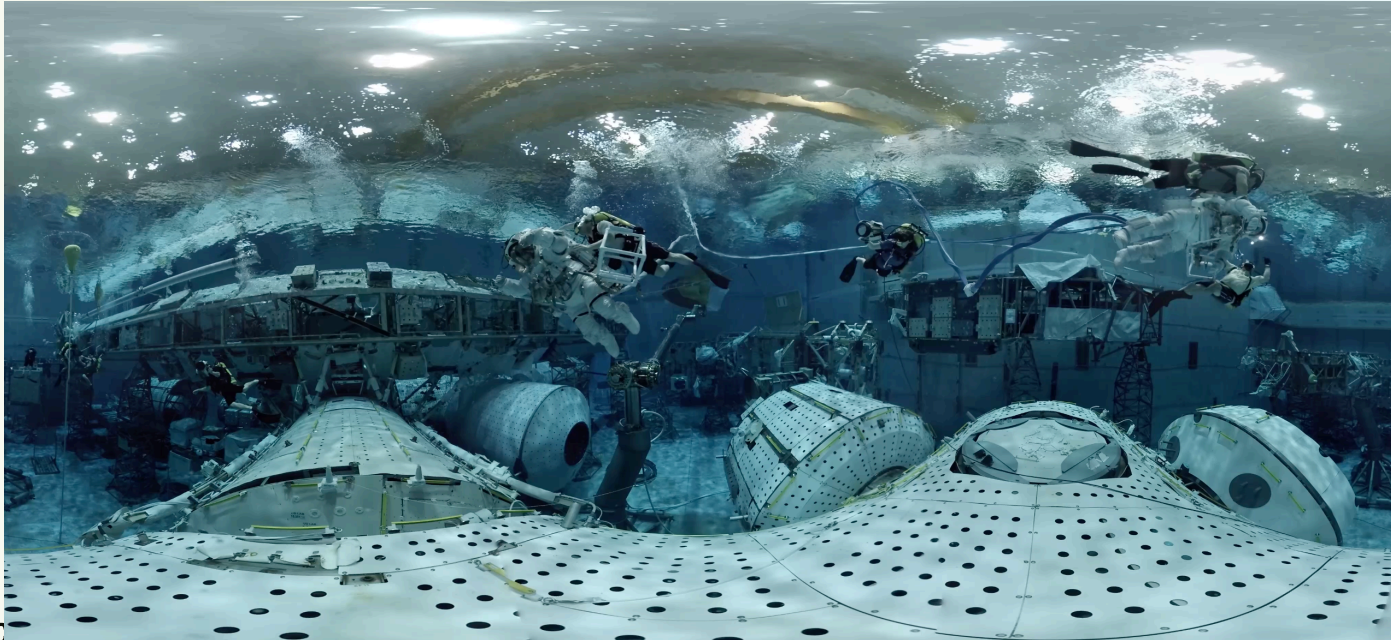
---

Paint the future of VR

---

# What is VR Video ?

VR Video is a panoramic representation of natural or computer generated video, presented on a head mounted or 2D device



# Why is VR Relevant Now?

## Wave of New Launches This Year

PlayStation VR



Oculus



SAMSUNG  
Gear VR

Powered by Oculus

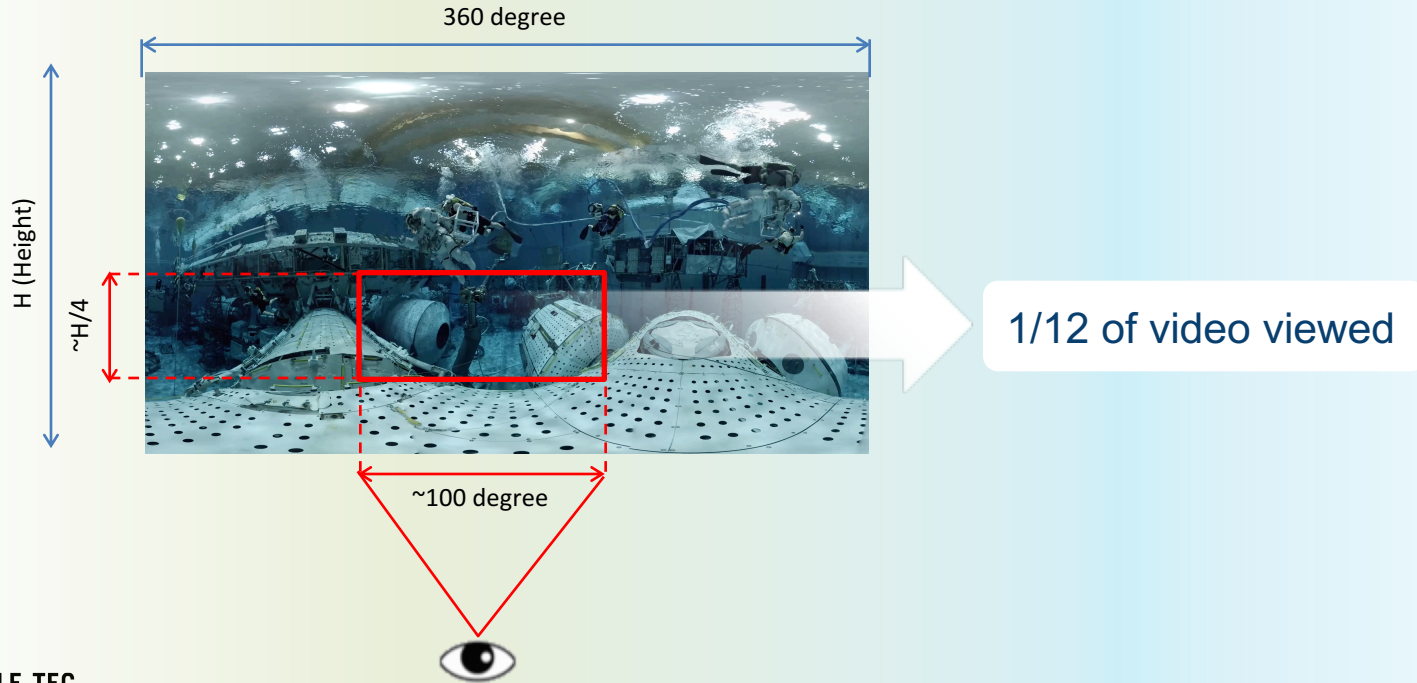


## Technology Available for Good QoE

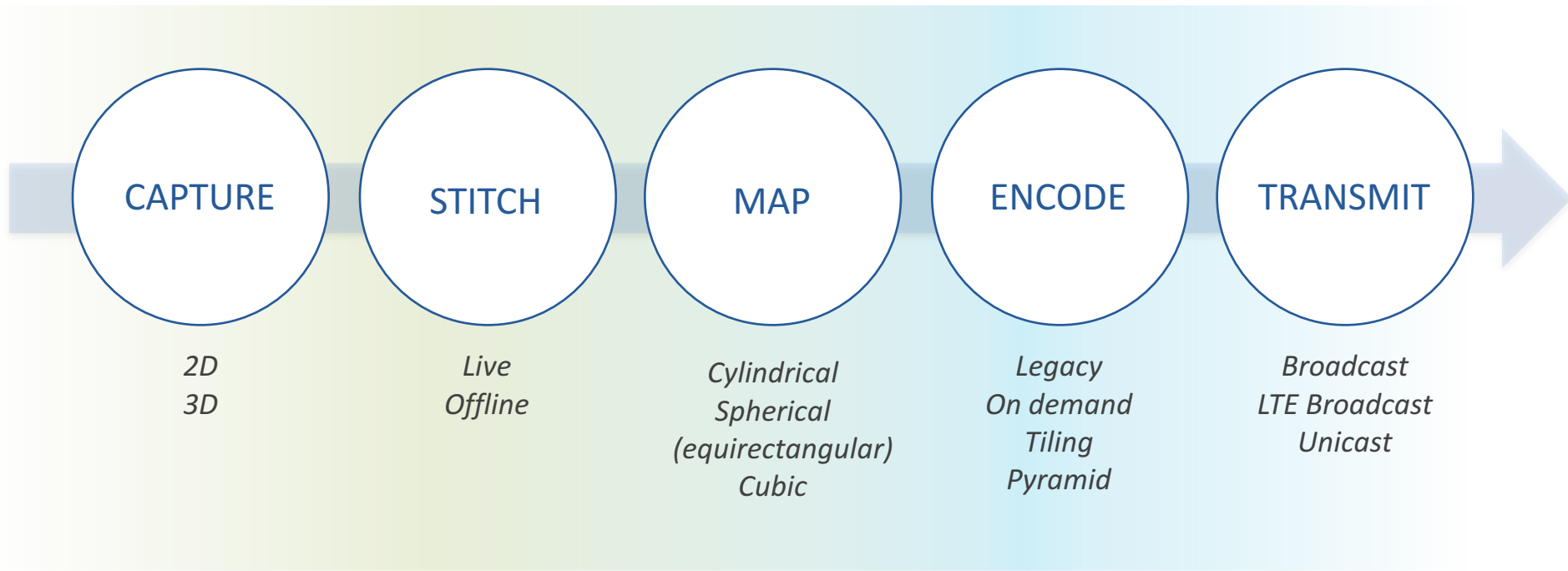
ULTRA  
HD

# Are We There Yet?

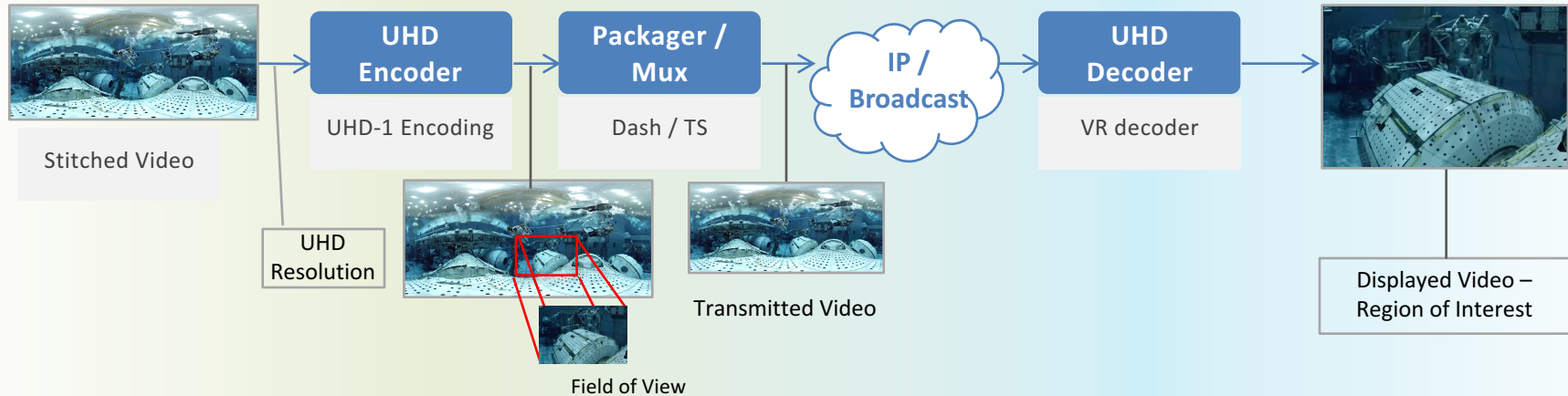
Even at UHD (3860x2160p60) resolution, video quality on HMD is judged “poor”



# VR Video Processing Chain



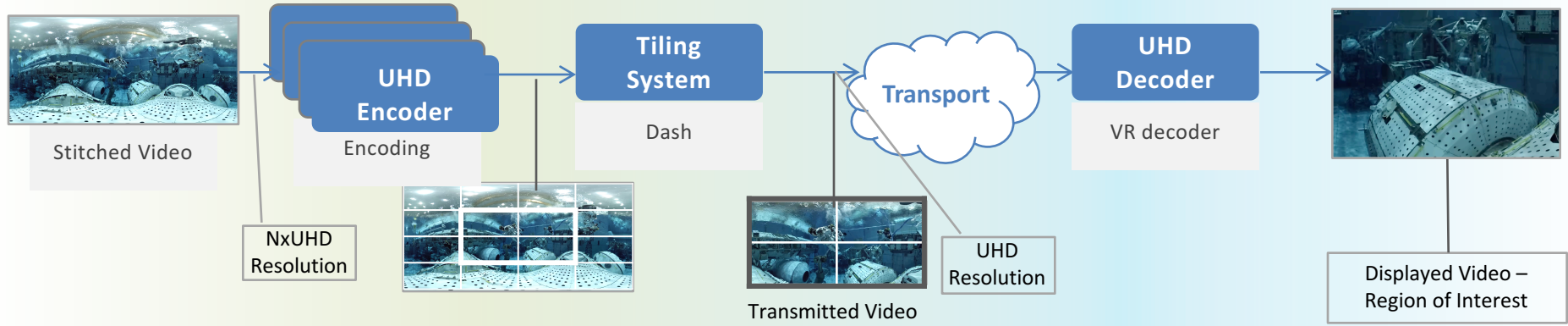
# Commercially Deployed System



Status	Function	Resolution	Assessment
Deployed today	Capture	3840x2160x60 fps	+ No network delay
Limited video quality	Transmission (broadcast or unicast)	3840x2160x60 fps	+ Ease of implementation
More quality requires more resolution	Player Display	1280x540x60 fps	- Poor video quality

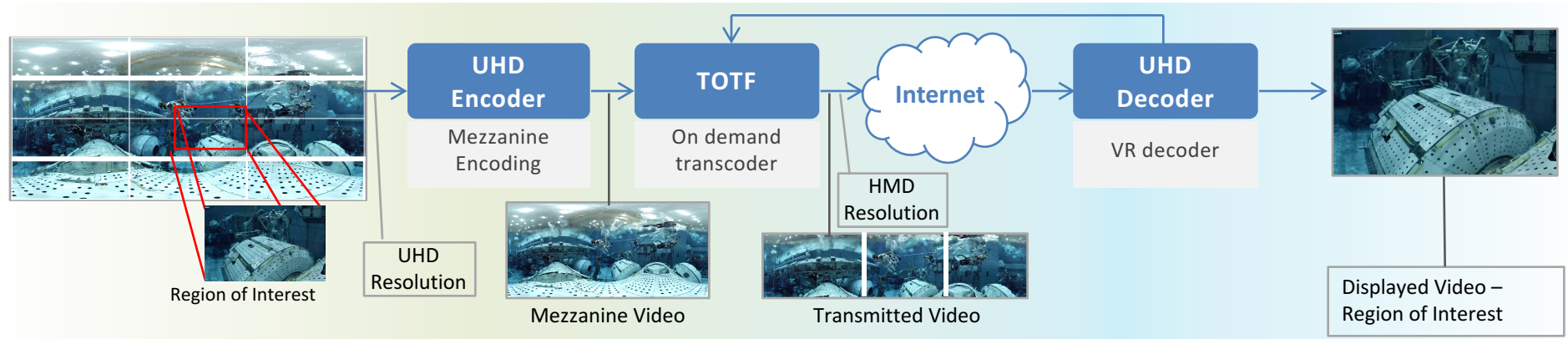


# Tiled Approach Principle



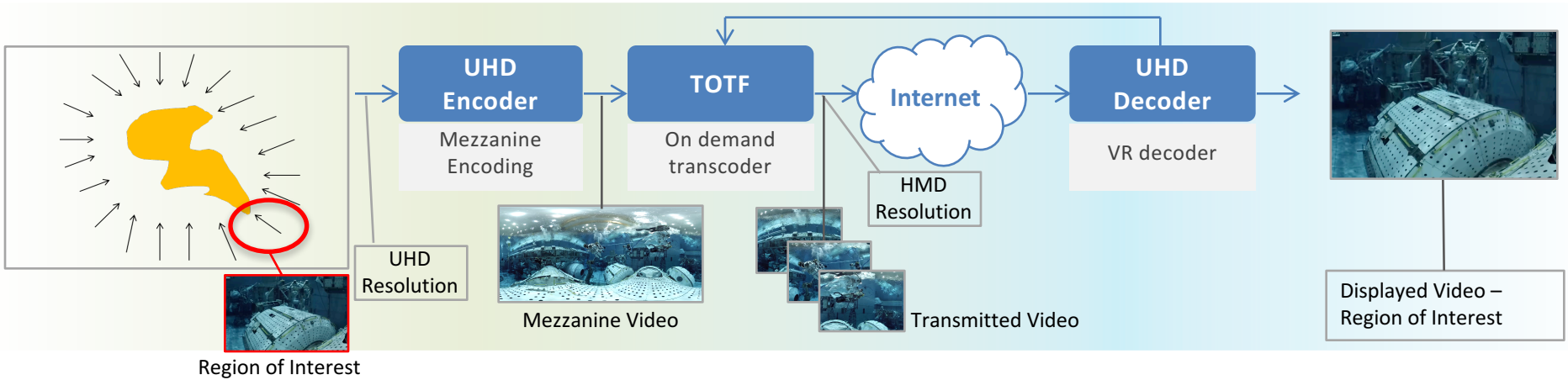
Status	Function	Resolution	Assessment
Research stage	Capture	16000x8000x30 fps	+ UHD native display  - Network delay during tile refresh
Use of existing HEVC tiling scheme	Transmission (unicast)	5000x1500x30 fps	
	Player Display	2160 x 1200x30 fps	

# On Demand Transcoding Approach



Status	Function	Resolution	Assessment
Trial stage	Capture	3840x2160x60 fps	+ Decreased bit rate
Use of existing HEVC tiling scheme	Transmission (unicast)	1280x540x60 fps	- Scalability
	Player Display	1280x540x60 fps	- Network delay

# Polygon Mapping Approach



Status	Function	Resolution	Assessment
Use of existing HEVC tiling scheme	Capture	Nx3840x2160x60 fps	+ Decreased bit rate
	Transmission (unicast)	3840x2160x60 fps	- Scalability
	Player Display	1280x540x60 fps	- Network delay

# Comparison Table

	Deployed		Tiling		On-demand Transcoding		Polygon Mapping	
	H res	V res	H res	V res	H res	V res	H res	V res
Source resolution	3840	2160	15360	2160	3840	2160	3840	2160
ROI resolution	1280	540	2560	1440	1280	540	1280	540
Transmitted resolution	3840	2160	2560	1440	1280	540	3840	2160
Display (GearVR)	2560	1440	2560	1440	2560	1440	2560	1440
Zoom factor	5.3		1.0		5.3		5.3	
Transmitted bitrate	10-15 Mbps		6-10 Mbps		<2 Mbps		2.5-4 Mbps	
Target delay	Base		Base + 40 ms		Base + 40 ms		Base + 40 ms	

# Summary

	Deployed	Tiling	On-demand Transcoding	Polygon Mapping
Quality	●	●	●	●
Latency	●	●	●	●
Scalability	●	●	●	●
Bitrate	●	●	●	●

Latency is Achille's heel

# Scalable Coding (SHVC) to Solve Latency

Status
Can help to overcome the network latency issue
Can be applied to Tiling and On Demand approaches
Base layer is the Legacy approach
Advance layer is additional layer reconstructed from base

Assessment
+ Less network delay dependent
- Complexity
- Increased bitrate

# Transmission Formats

	Deployed			Tiling	On-demand Transcoding	Polygon Mapping
Transmission	Broadcast		Unicast	Unicast	Unicast	Unicast
Transport	TS	TS > IP (via Home GW)	DASH ISO BMFF	DASH ISO BMFF	DASH ISO BMFF	DASH ISO BMFF
Device	STB/TV	Any IP device	Any IP device	Any IP device	Any IP device	Any IP device

# Still to be Addressed...

Encoding based on ROI

Zooming on player side  
using either scalability  
of tiling techniques

5G network  
considerations  
(leverage of low  
latency)

Use of SHVC



# Conclusion

## VR Video is in Its Infancy

- Different competing techniques with different merits
- Need to test at scale before defining next generation scheme
- Need standards (MPEG, DVB, ...) based solution

## Harmonic is Committed to VR Video

- Has several Tier-1 trials done or underway
- Participation in MPEG & DVB work on VR standardization
- Developing VR specific video processing chain

SCTE ISBE CABLE-TEC  
**EXPO'16**

SEPTEMBER 26-29 PHILADELPHIA

**Thierry Fautier**

[Thierry.Fautier@harmonicinc.com](mailto:Thierry.Fautier@harmonicinc.com)

**Visit our booth : 1948**

**harmonic** 



 **#CableTecExpo**

Essential Knowledge for Cable Professionals™

© 2016 Society of Cable Telecommunications Engineers, Inc. All rights reserved.