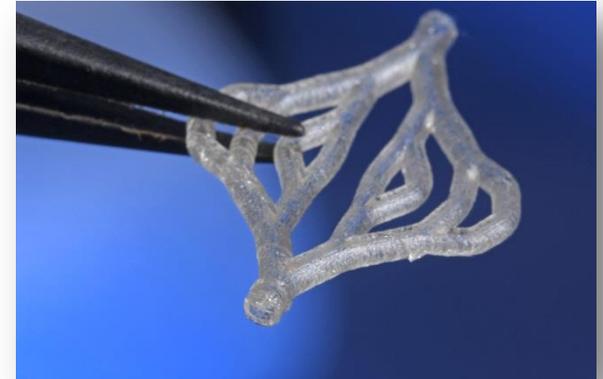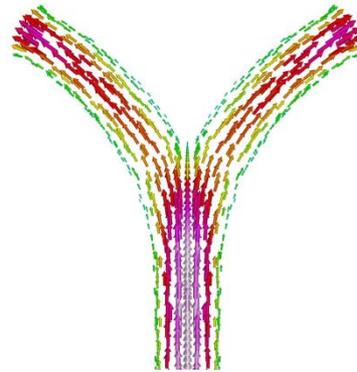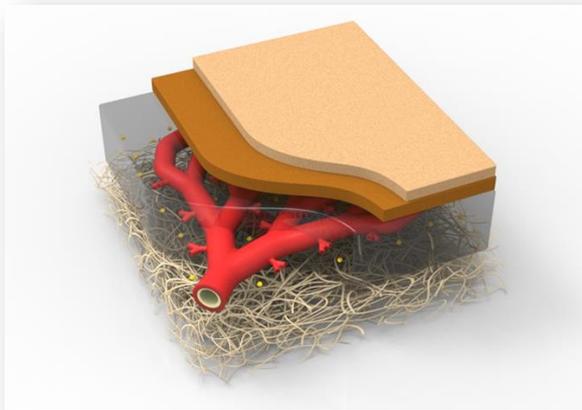# Biofabrication of Artificial Vascularized Tissue Technologies, Challenges and Perspectives

ArtiVasc 3D

Public Workshop

Aachen, Germany
October 28-29, 2015

Workshop Information Package

The ArtiVasc 3D (**Arti**ficial **vasc**ularised scaffolds for **3D**-tissue regeneration) programme would like to invite you to the final workshop at Fraunhofer Institute for Laser Technology ILT in Aachen, Germany on October 28-29, 2015.

ArtiVasc 3D is a European R&T programme launched in 2011. The artificial skin research project focuses on developing standardized processes for scaffold production and on cultivating vascularized skin rapidly and inexpensively. The ArtiVasc 3D workshop summarizes the 4 years of international multidisciplinary research among 16 partners consisting of research institutes, industry partners, universities and SMEs.

The workshop includes scientific talks covering research results on functionalisation technology, process and machine development and tissue generations. The workshop also includes a lab visit session, a showcase exhibition as well as poster sessions with networking opportunities.

Workshop venue: Fraunhofer ILT
in Aachen, Germany

Source: aachen-emotion.com, http://www.ilt.fraunhofer.de/en.html

Agenda – Day 1

DAY 1: Wednesday, 28th October 2015		
15:30	**Registration**	
16:00	**Opening of the workshop** By Dr.-Ing. Arnold Gillner, Fraunhofer-Gesellschaft, Institute for Laser Technology ILT	
16:30	**Keynote Speech** **Biofabrication – Technologies, Challenges and Perspectives** By Prof. Lorenzo Moroni, Maastricht University, MERLN Institute for Technology-Inspired Regenerative Medicine (45 min presentation, 15 min Q&A)	
17:30	**External Speech** *(TBC)*	
18:30	**Poster session, Exhibition showcase &** **Buffet dinner**	
20:30	**END OF DAY 1**	

Agenda – Day 2, Session 1

DAY 2: Thursday, 29th October 2015	
Session 1: Material design and simulation for biofabrication **Chaired by TBD** (2hours: 15' presentation, 5' Q&A each)	

08:30	**Optimal design of vein systems** By Dr. Raimund Jaeger, Fraunhofer-Gesellschaft, Institute for Mechanics of Materials	Fraunhofer IWM
	Virtual blood – Study of adhesion dynamics of platelets using particle-based simulations and microfluidic experiments By Dipl.-Ing Jamel Khamassi and Dr. Claas Bierwisch, Albert-Ludwigs University of Freiburg, Institute of Physics	UNI FREIBURG
	Towards a sew-able polymeric blood vessel-like material By Dr. Wolfdietrich Meyer, Fraunhofer-Gesellschaft, Institute for Applied Polymer Research	Fraunhofer IAP
	Biodegradable scaffolds for soft tissue engineering By Dr. Matthias Schnabelrauch, Innovent e.V.	INNOVENT Technologieentwicklung Jena
	Photocrosslinkable polyurethane elastomers for stereolithography By Prof. Jukka Seppälä, Aalto University	Aalto University
	Biobased matrix materials for construction of biological tissues By Dr. Kirsten Borchers, University of Stuttgart, Institute for Interfacial Engineering	University of Stuttgart Institute for Interfacial Engineering
10:30	**Coffee break** (20 min)	

Agenda – Day 2, Sessions 2 & 3

	Session 2: Processing for biofabrication **Chaired by TBD** (1 hour and 20 min: 15' presentation, 5' Q&A each)
10:50	**Artificial vascular Bifurcations - Design and Modelling; Generation of the machine code for MPP-ink jetting integration** By Xiaoxiao Han et al., Loughborough University, Wolfson School of Mechanical and Manufacturing Engineering
	Artificial blood vessels scaffolds made by 3D printing By Dipl.-Phys. Sascha Engelhardt, Fraunhofer-Gesellschaft, Institute for Laser Technology ILT
	Prototype development for biological applications By Ivan Calderon, Unitechnologies S.A
	Electrospinning approach for generating the surrounding tissue of biocompatible scaffolds By Loredana Tammaro, University of Salerno, Industrial Engineering Department
12:10	**Poster session, Exhibition showcase &** **Lunch break** (1 hour and 50 min)
	Session 3: Development (biofabrication) of artificial skin **Chaired by Nadine Nottrodt** (1 hour: 15' presentation, 5' Q&A each)
14:00	**Soft tissue engineering using 3D cell culture systems** By Dr. Frank Jacobsen, Bergmannsheil Berufsgenossenschaftliches Universitaetsklinikum
	Generation of the hypodermis in a vascularized three layered skin substitute By Ass.-Prof. Maike Keck, Medical University of Vienna
	Development of a three layered skin model consisting of a fatty tissue layer with dermis and epidermis By Sandra Gehrke, Beiersdorf AG and Birgit Huber, Fraunhofer-Gesellschaft, Institute for Interfacial Engineering and Biotechnology IGB
15:00	**Closing remarks** By Dr.-Ing. Arnold Gillner Fraunhofer-Gesellschaft, Institute for Laser Technology ILT
15:15	**END OF WORKSHOP**

Hosted by Fraunhofer ILT in Aachen, Germany

Host:

Address: **Fraunhofer Institute for Laser Technology ILT**
Steinbachstr. 15
52074 Aachen
Germany

Contact at FhG-ILT: Dr.-Ing. Arnold Gillner - Coordinator
arnold.gillner(at)ilt.fraunhofer.de
Dr. rer. nat. Nadine Nottrodt – Project Manager
nadine.nottrodt(at)ilt.fraunhofer.de
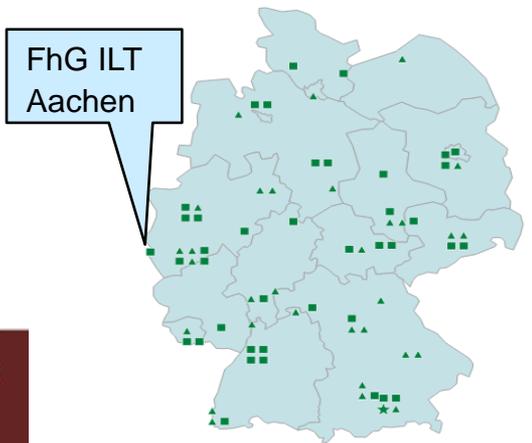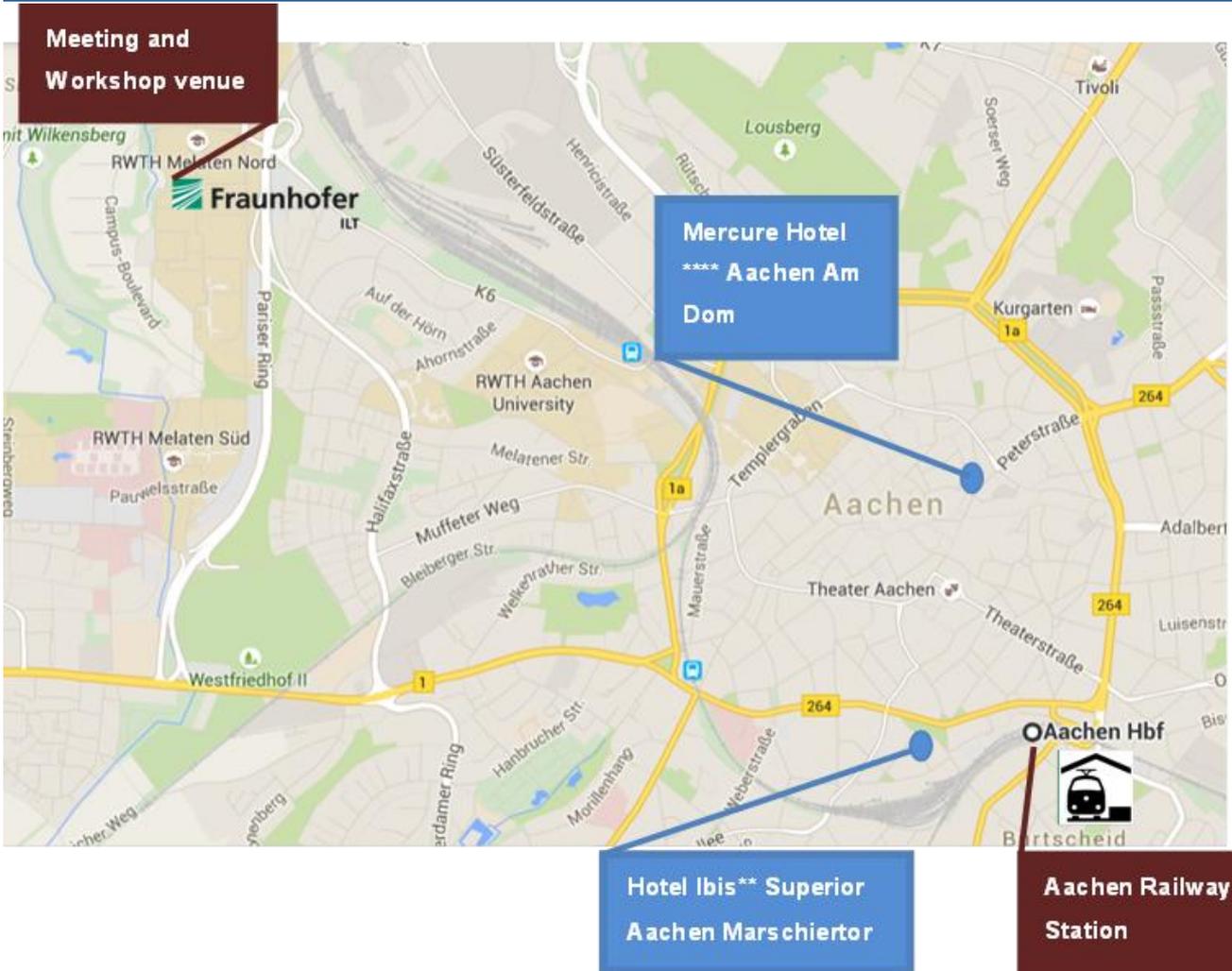
For any questions please contact:
ArtiVasc Project Office: Angela Wittmann, Tanja Oster
artivasc_3d(at)eurtd.com
+49 89 840 08 08 16

Location of the workshop venue

Access and travel information to Aachen

General Information

In Germany, the voltage is in line with the EU standard of 230 V. You might need a plug adapter for Germany to charge your electronic device.

Type C and Type F plugs are common on appliances (see images to the right).

Type C
- commonly used in Europe, South America & Asia (for a full list, click here)
- 2 pins
- not grounded
- 2.5 A

Type F
- used almost everywhere in Europe & Russia, except for the UK & Ireland (for a full list, click here)
- 2 pins
- grounded
- 16 A

© World standards/Plugs and sockets

Travelling by train to Aachen

The closest railway station is Aachen ("Aachen Hauptbahnhof" or "Aachen Hbf"). Besides walking to the hotel (see maps on previous page), there are two additional options to travel from Aachen Railway Station to your accommodation:

Option 1 – By Taxi at around 7-10 € per trip

You may take a taxi directly at the stand in front of the main station.

➢ To reach the "Mercure Hotel Aachen Am Dom", the rate is around 9.40 €.
➢ To reach the "Ibis Aachen Marschiertor Superior", the rate is around 6.20 €.
➢ To reach the "Ibis Styles Aachen City", the rate is around 7.80 €.

Access and travel information to Aachen

Option 2 - By public transportation at 1.50 € per trip

For individual travel arrangements and timetables, please check the website of the local public transport AVV.

https://avv.de/de/startseite

(a) To "Mercure Hotel Aachen Am Dom" – 10 minutes'

trip + 4 minutes' walk:

➢ You will need a short trip ticket ("Kurzstrecke") at 1.50 €. There is a direct bus connection every five minutes:

  o Walk to the bus stop at the main station and take bus line "1", "14", "21", "44" or "46". All lines stop at "Aachen Bushof" where you should get off.
  o Walk 4 minutes to reach the hotel to your right (see map below).
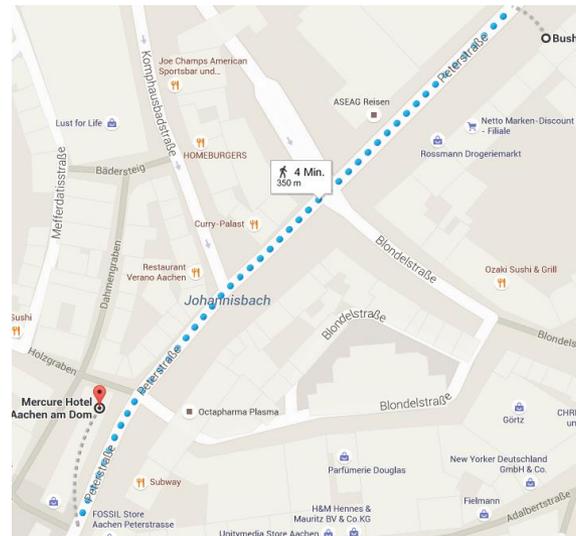
© Googlemaps

Access and travel information to Aachen

(b) To "Ibis Aachen Marschiertor Superior" – 3 minutes' trip + 4 minutes' walk:

➢ You will need a short trip ticket ("Kurzstrecke") at 1.50 €. There is a direct bus connection every two to five minutes:
  o Walk to the bus stop at the main station and take bus line "3B", "13B" or "SB63". All lines stop at "Aachen Misereor" where you should get off.
 o Walk 4 minutes to reach the hotel to your right (see map).

© Googlemaps

(c) To "Ibis Styles Aachen City" – 7 minutes' trip +4 minutes' walk:

➢ You will need a short trip ticket ("Kurzstrecke") at 1.50 €. There is a direct bus connection every ten minutes:
  o Walk to the bus stop at the main station and take bus line "3A" or "13A". All lines stop at "Hansemannstraße" where you should get off.
  o Walk 4 minutes to reach the hotel to your right.
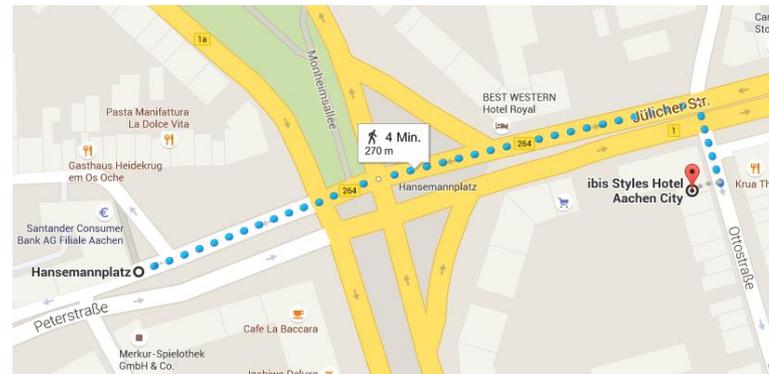
© Googlemaps

Access and travel information to Aachen

Travelling by Plane to Aachen

For travelling from the closest airports to Aachen, you have three options:

41 km	Airport Maastricht-Aachen (MAA)	40 minutes' drive by shuttle bus or car
85 km	Airport Cologne/Bonn(CGN)	90 minutes' trip by train or car
90 km	Airport Düsseldorf International (DUS)	90 minutes' trip by train or car
143 km	Brussels Airport (BRU)	90 – 120 minutes' trip by train

Option 1 - By public transportation

For individual travel arrangements and timetables, please check the websites of Deutsche Bahn, of Belgian Rail and of the Aachen public transport AVV (de).

Websites:
- http://www.bahn.de/i/view/USA/en/index.shtml
- http://www.belgianrail.be/en/Default.aspx
- https://avv.de/de/startseite

a) Transfer from and to Airport Maastricht-Aachen (MAA)

➢ There is a direct shuttle bus provider from the airport to Aachen Central Station and back, see AirportXpress.

➢ The shuttle transfer from Maastricht Airport to the Maastricht bus terminal takes about 20 minutes.

➢ The shuttle bus stops across from the passenger terminal.

Websites:
- http://www.maa.nl/en/
- http://www.gilbacher.de/airportx.html

b) Transfer from and to Airport Cologne/Bonn (CGN)

➢ Depending on the connections, the train ride with Deutsche Bahn from Cologne/Bonn Airport to Aachen takes about one to one and half hours with a changeover at Cologne Central Station.

Websites:
- http://www.koeln-bonn-airport.de/en.html
- http://www.bahn.de/i/view/USA/en/index.shtml

c) Transfer from and to Airport Düsseldorf International (DUS)

➢ Train rides from Dusseldorf Airport to Aachen take about one and a half to two hours with Deutsche Bahn; trains run about every hour.

➢ The SkyTrain connects the railway station and the terminals (5 min).

Websites:
- http://www.dus.com/en
- http://www.bahn.de/i/view/USA/en/index.shtml
- http://www.dus.com/dus_en/b_skytrain/

Access and travel information to Aachen

d) Transfer from and to Airport Brussels (BRU)

➢ The most convenient way to get to Aachen (Aix-la-Chapelle) from Brussels Airport is by train.

➢ You have to change trains either in Brussels North or Midi, depending on your train connection.

➢ The train ride takes about two hours.

➢ For connections, please see the Belgian Rail website.

Websites:
- http://www.brusselsairport.be/en//
- http://www.belgianrail.be/en/Default.aspx

Option 2 – By Taxi

Airport transfer services are being provided by Aixclusive Shuttle, in air conditioned minivans, if needed, at the following rates (VAT included). You may pay cash on the spot or via invoicing after your trip. Please book your transfer individually, no group arrangements have been made.

Website:
http://www.aixclusive-shuttle.de/index.html

Destinations (from => to)	1-2 persons	3-4 persons	5-6 persons	7-8 persons
Aachen => Airport Cologne/Bonn (CGN)	75 €	90 €	105 €	120 €
Airport Cologne/Bonn (CGN) => Aachen	80 €	90 €	105 €	120 €
Aachen => International Airport Düsseldorf (DUS)	75 €	90 €	105 €	120 €
International Airport Düsseldorf (DUS) => Aachen	80 €	90 €	105 €	120 €
Aachen => Maastricht-Aachen Airport (MAA) or Maastricht-Aachen Airport (MAA) => Aachen	50 €	70 €	100 €	120 €
Aachen => Brussels Airport (BRU) or Brussels Airport (BRU)=> Aachen	130 €	160 €	210 €	240 €

Access and travel information to Aachen

Option 3 – Car rental
It is possible to rent a car at Düsseldorf Airport
It is possible to rent a car at Cologne/Bonn Airport
It is possible to rent a car at Maastricht-Aachen Airport

Websites:
- http://www.koeln-bonn-airport.de/en/parking-arrival/rental-cars.html
- http://www.koeln-bonn-airport.de/en/parking-arrival/rental-cars.html
- http://www.maa.nl/en-us/passengers/attheairport/rentalcars

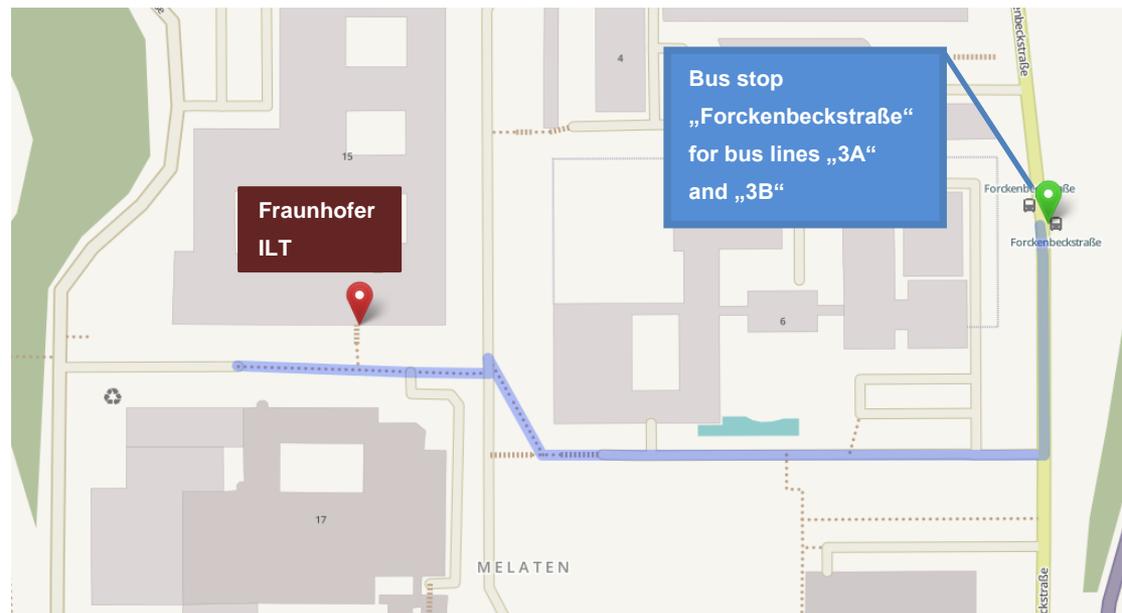# *Workshop venue: Fraunhofer ILT in Aachen, Germany*

There are three options for getting to the Fraunhofer ILT at Steinbachstraße 15 in Aachen. A map of the hospital

premises is given below, for an interactive map click here: http://www.standortkarte.fraunhofer.de/main.jsp?lang=de&topic=institutes&topicvalue=&focus=germany&focusvalue=

Option 1 - By public transportation

From Aachen Railway Station (Hauptbahnhof) – 19 minutes' trip + 5 minutes' walking distance

➢ You will need a single trip ticket ("Einzel-Fahrt") at 2.65 €.

➢ There is a direct bus connection every ten to twelve minutes:

- o Take the bus lines "3A" or "3B" (direction of "Uniklinik über Ponttor/Schanz") until you reach "Forckenbeckstraße" bus stop.
- o Get off, turn right and walk about 60 meters on "Forckenbeckstraße".
- o Turn left onto "Sommerfeldstraße" (you will pass RWTH Aachen University buildings) until reaching venue at "Steinbachstraße 15"

© OpenStreetMap

Workshop venue: Fraunhofer ILT in Aachen, Germany

Option 2 - By car (see map below)

➢ Take the A44/A4 highway to the Aachen crossing,
➢ then, if coming on A44, take the A4 in the direction of Antwerp.
➢ If coming on A4, pass under the Aachen Kreuz and take the fork to the right in the direction of Antwerp.
➢ Then, take the "Aachen-Laurensberg" exit, turn right at the first traffic light, pass one traffic light and turn right at the fork onto the next exit toward "RWTH/Klinikum".
➢ Directly after passing under the train crossing, take the exit "RWTH-Melaten/ Fraunhofer Institutes".
➢ Take the first exit in the roundabout and go straight ahead.
➢ Turn left at the second street onto the "Steinbachstraße".
➢ Please follow the signs (turn left after the Fraunhofer ILT and another left.)
➢ Visitor parking places can be found on the right hand side.

Option 3 - By taxi

A taxi ride to the Fraunhofer ILT takes about 15 minutes and will cost you around 14-15 €.

Accommodation

Option 1 – Mercure Hotel Aachen Am Dom****	Option 2 – Ibis Aachen Marschiertor** Superior	Option 3 – Ibis Styles Aachen City***
© Mercure hotels	*© Ibis hotels*	*© Ibis hotels*
➢ Located in the heart of Aachen, close to the historic city centre and the cathedral	➢ Located in the heart of Aachen, close to the historic city centre and the cathedral	➢ Located in the heart of Aachen, close to the historic city centre and the gothic town hall
➢ Modern rooms	➢ The 104 soundproofed, contemporary rooms feature large "Sweet Beds" by ibis, soundproofing, flat-screen TV and a functional desk.	➢ Modern rooms
➢ Business centre available free of charge		➢ Quiet courtyard available
➢ Fitness centre included free of charge		
➢ Approx. 11 minutes' walk from Aachen Railway Station "Aachen Hbf" (see directions below).	➢ Approx. 5 minutes' walk from Aachen Railway Station "Aachen Hbf" (see directions below).	➢ At 17 minutes' walk from Aachen Railway Station "Aachen Hbf" (see directions below)
➢ Free WiFi in your room	➢ Free WiFi	➢ Free WiFi
➢ Parking available directly at the hotel – at own expense	➢ Parking available directly at the hotel – at own expense	➢ Parking available directly at the hotel – at own expense
➢ Rooms available at around 115 € for single use, including breakfast	➢ Rooms available at around 70 € for single use, excluding breakfast	➢ Rooms available at around 85 € for single use, including breakfast

*Please book your room **individually** before **2nd** **of** October 2015.*

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Accommodation

**Option 1 – Mercure Hotel Aachen Am Dom****

{Peterstraße 1, 52062 Aachen}
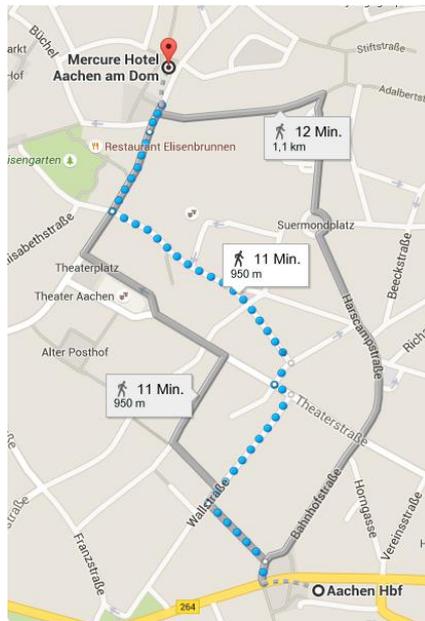
T +49 (0)241 1801-0
E h5326@accor.com
Online booking
http://www.mercure.com/de/hotel
-5326-mercure-hotel-aachen-am-
dom/index.shtml

Option 2 – Ibis Aachen Marschiertor Superior**

{Friedlandstraße 8, 52064 Aachen}

T +49(0)241 47880
E h0967@accor.com
Online booking
http://www.ibis.com/de/hotel-1703-ibis-styles-
hotel-aachen-cityindex.shtml

Option 3 – Ibis Styles Aachen City*

{Juelicher Strasse 10-12, 52070 Aachen}
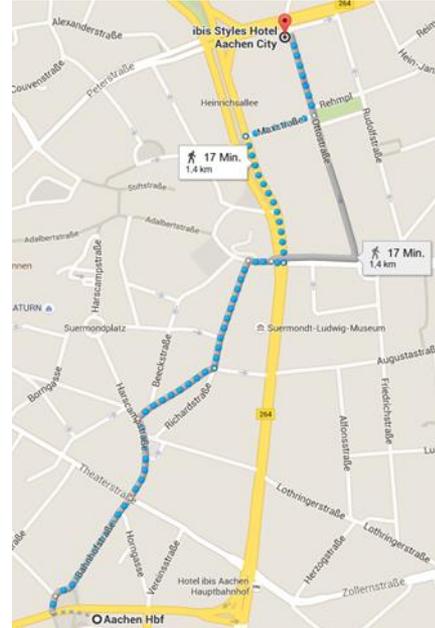
T +49 (0)241 5106-0
E h1703@accor.com
Online booking
http://www.ibis.com/de/hotel-
1703-ibis-styles-hotel-aachen-
cityindex.shtml

Social Event in Aachen on October 28

Fraunhofer ILT is pleased to invite the ArtiVasc 3D workshop participants to the social event:

➢ *Buffet dinner will take place at the Fraunhofer ILT premises.*

➢ *Then a guided walking tour through Aachen town center will take place including the visit of the Cathedral. The recommended hotels are in walking distance of the main sights in Aachen.*

Source: aachen-emotion.com; tambiente.de

Registration

Please download and fill out the registration form http://www.artivasc.eu/ and send it to

artivasc_3d(at)eurtd.com

by October 2, 2015.

We are looking forward to welcoming you in Aachen.

Aachen

Cathedral of Aachen
Source: www.aachen.de

Cathedral Treasury

Elisa Fountain