



## Pilot #4

Presenter: JAUREGUI ABULARACH, Miguel -  
GUIDO LOPEZ, Leonardo Elias



### “Robotic Magnetic Navigation using Artificial Intelligence for mapping and ablation of cardiac Arrhythmias”

-Madrid Health Service (SERMAS)  Clinical coordinator

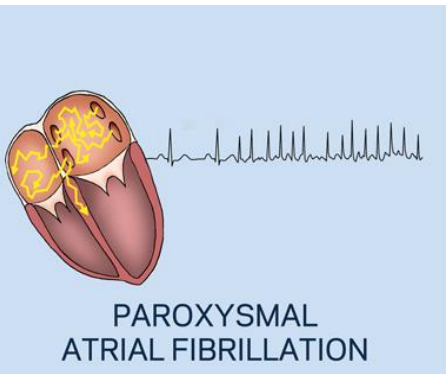
- 91  Artificial Intelligence

-Swiss Federal Institute of Technology in Zürich (ETHZ)  Robotics

## Atrial Fibrillation

Worldwide: Most common  
sustained arrhythmia

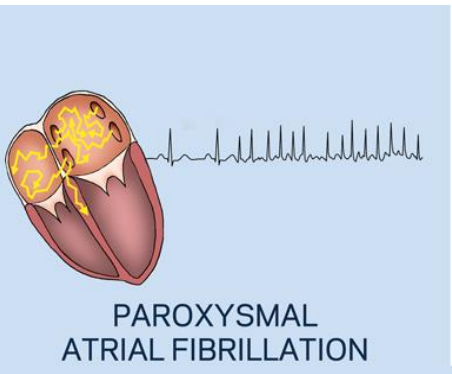
- Increasing age is a prominent  
AF risk factor



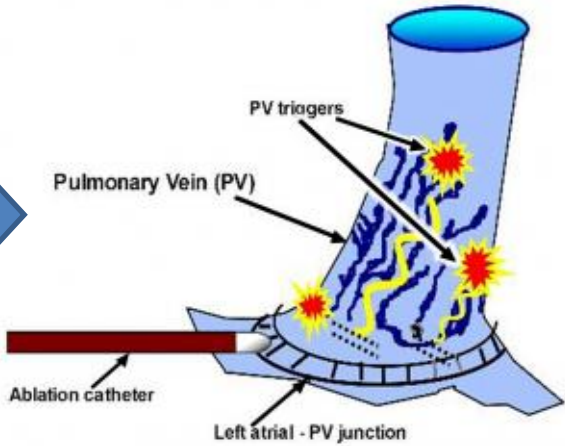
## Atrial Fibrillation

Worldwide: Most common sustained arrhythmia

- Increasing age is a prominent AF risk factor



## Triggers in Pulmonary Veins



 **ESC** European Heart Journal (2020) 42, 373–498  
European Society of Cardiology doi:10.1093/eurheartj/ehaa172

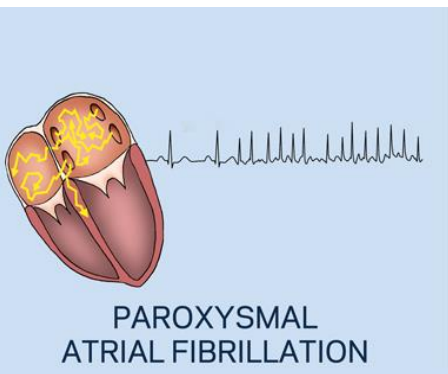
**ESC GUIDELINES**

2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS)

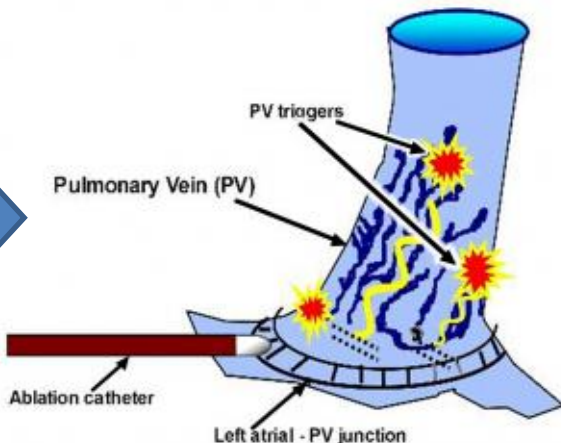
## Atrial Fibrillation

Worldwide: Most common sustained arrhythmia

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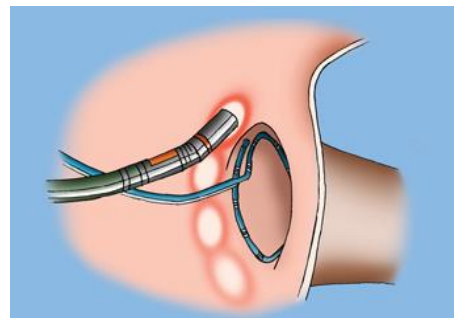
## Triggers in Pulmonary Veins



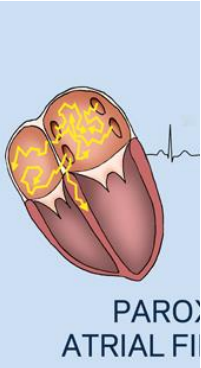
## Pulmonary vein isolation


Use in less than 1% of patients:

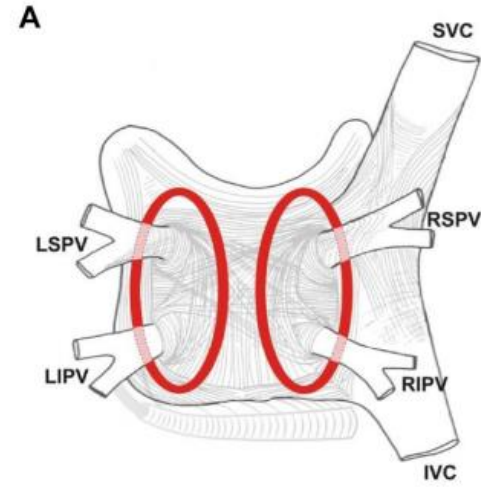
- long procedure time
- cost
- small number of specialized staff



**Atrial**  
Worlwid  
sustain  
. Increasing  
AI



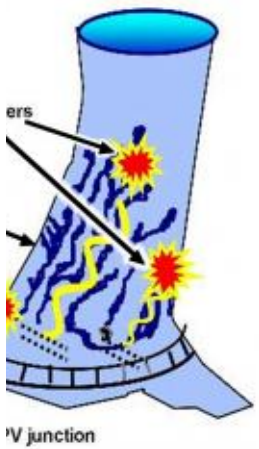
 **ESC**  
European Society  
of Cardiology  
2020 ESC Guidelin  
management of at  
collaboration with the European Association for  
Cardio-Thoracic Surgery (EACTS)



Source of the image:

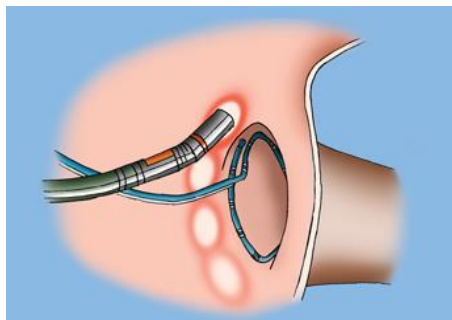
Summary of Expert Consensus Statement for CLINICIANS  
**2017 HRS/EHRA/ECAS/APHRS/SOLAECE  
Expert Consensus Statement on Catheter  
and Surgical Ablation of Atrial Fibrillation**

s in  
/ Veins



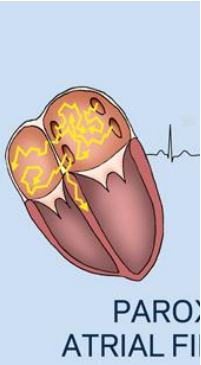
**Pulmonary vein  
isolation**


- Use in less than 1% of patients:
- long procedure time
  - cost
  - small number of specialized staff

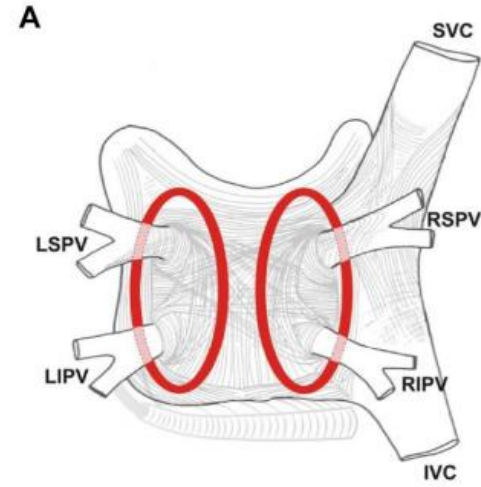


# Pilot #4 Introduction

Atrial  
Worlwid  
sustain  
. Increasing  
AI

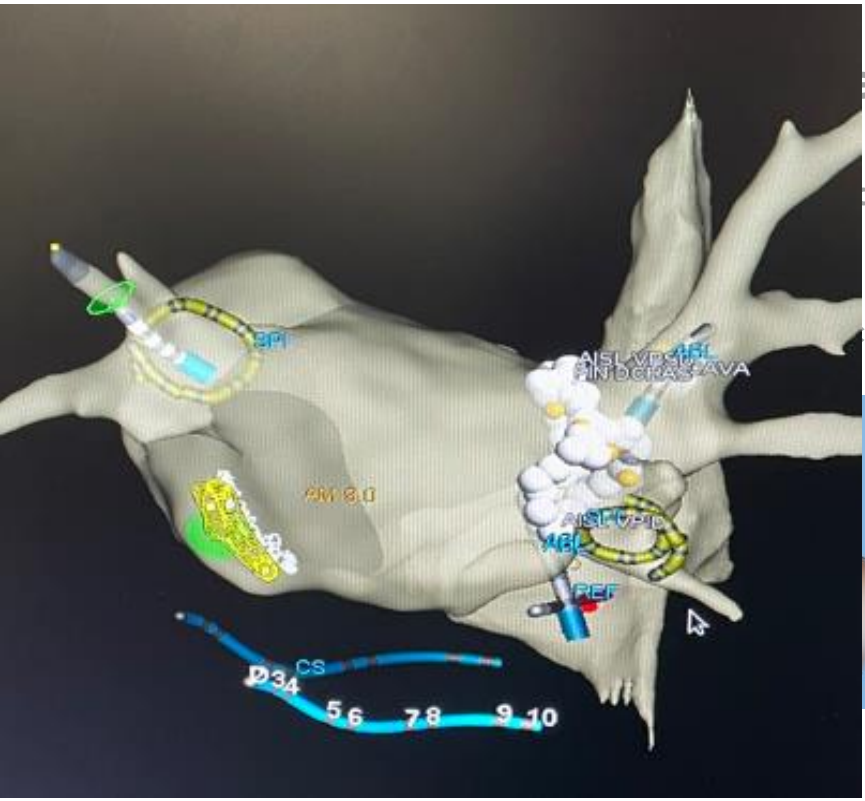


 **ESC**  
European Society  
of Cardiology  
  
2020 ESC Guidelines  
management of atrial  
fibrillation  
in collaboration with the European Association for  
Cardio-Thoracic Surgery (EACTS)



Source of the image:

Summary of Expert Consensus Statement for CLINICIANS  
  
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Expert Consensus Statement on Catheter  
and Surgical Ablation of Atrial Fibrillation



<https://a-fib.com/treatments-for-atrial-fibrillation/catheter-ablation-pulmonary-veins/>  
<https://www.ahajournals.org/doi/full/10.1161/CIRCEP.120.009573>

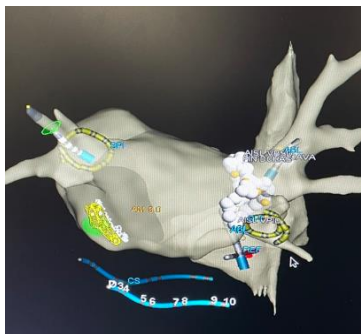


# Pilot #4 Artificial Intelligence

Ethical committee approval  
obtained (October 2022)  
Ref: 57/143583.9/22



## Cardiac Mapping Data



### DICTAMEN DEL COMITÉ DE ÉTICA DE LA INVESTIGACIÓN CON MEDICAMENTOS

D<sup>a</sup> EMMA FERNÁNDEZ DE UZQUIANO, Secretaria técnica del COMITÉ DE ÉTICA DE LA  
INVESTIGACIÓN CON MEDICAMENTOS del Hospital Universitario La Paz

### CERTIFICA

Que este Comité ha evaluado la propuesta de para que se realice el estudio titulado "HOSMARTAI  
PILOT 4: ROBOTIC MAGNETIC NAVIGATION (RMN)" NA, código INTERNO: 2022.441,  
código HULP: PI-5394

Protocolo	Versión 2.0, 29-09-2022
Hoja Información	V2.0 29/09/2022

y considera que, valorada la respuesta a las aclaraciones solicitadas:

- El estudio se plantea siguiendo los requisitos legalmente establecidos, se ajusta a las normas éticas esenciales y su realización es pertinente.
- Se cumplen los requisitos necesarios de idoneidad del protocolo en relación con los objetivos del estudio y están justificados los riesgos y molestias previsibles para el sujeto.
- Es adecuado el procedimiento para obtener el consentimiento informado y el modo de reclutamiento previsto.
- La capacidad del investigador y sus colaboradores, y las instalaciones y medios disponibles, tal y como ha sido informado, son apropiados para llevar a cabo el estudio.

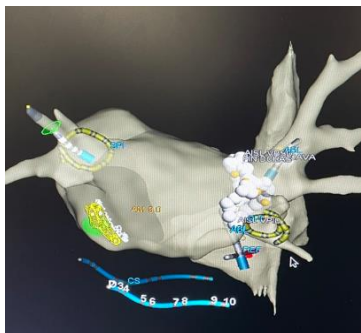
Que este Comité decidió emitir **DICTAMEN FAVORABLE** el día 6 de octubre 2022 (acta n<sup>o</sup> 18/2022) y acepta que dicho estudio sea realizado por JOSÉ LUIS MERINO LLORENS del Servicio de del Hospital como investigador principal.



# Pilot #4 Artificial Intelligence

Servicio Madrileño de Salud  
 **SERMAS**  
SaludMadrid

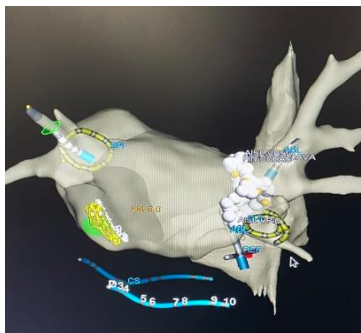
## Cardiac Mapping Data



# Pilot #4 Artificial Intelligence

Servicio Madrileño de Salud  
 **SERMAS**  
SaludMadrid

Cardiac  
Mapping Data



 **ninety  
one**

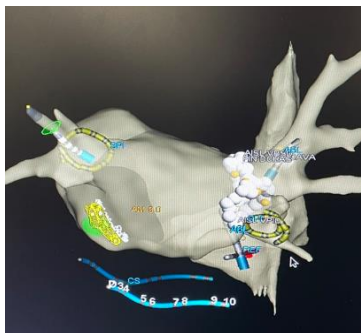
Artificial  
Intelligence



# Pilot #4 Artificial Intelligence

Servicio Madrileño de Salud  
 **SERMAS**  
SaludMadrid

Cardiac  
Mapping Data

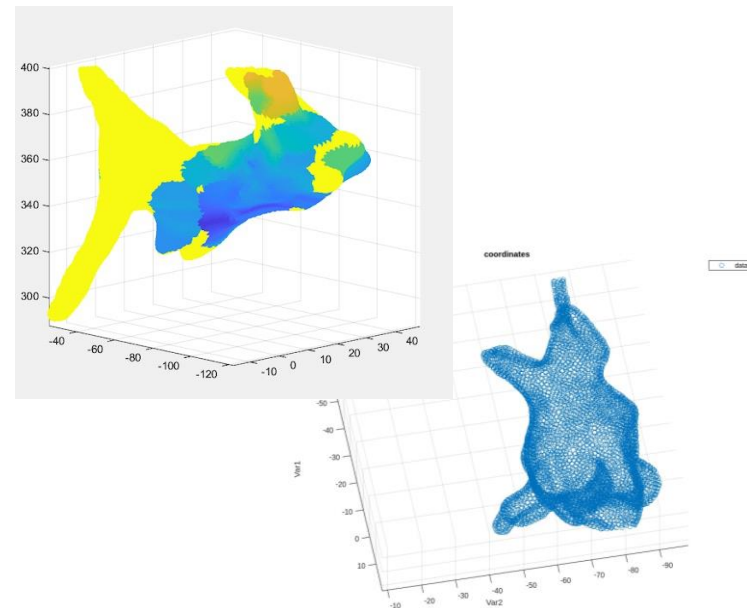


 **ninety  
one**

Artificial  
Intelligence



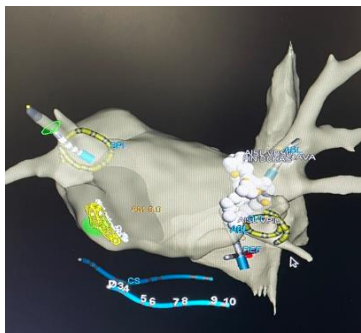
AI interface



# Pilot #4 Artificial Intelligence

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 **SERMAS**  
SaludMadrid

Cardiac  
Mapping Data

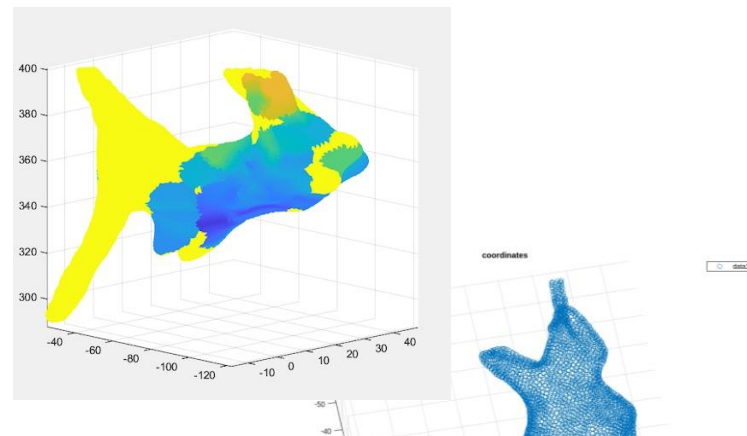


 **ninety one**

Artificial  
Intelligence



AI interface



**Primary outcomes**

User interface  
Ablation targets

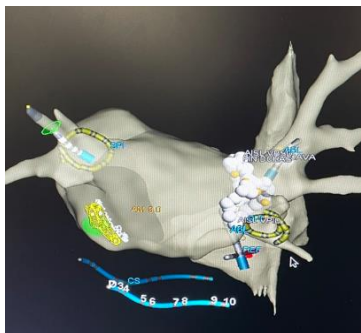
The user should be able to define equally-spaced ablation targets around the pulmonary veins (AF ablation)

In evaluation.  
(91 is improving the mapping software with real data)

# Pilot #4 Artificial Intelligence

Servicio Madrileño de Salud  
 **SERMAS**  
SaludMadrid

## Cardiac Mapping Data

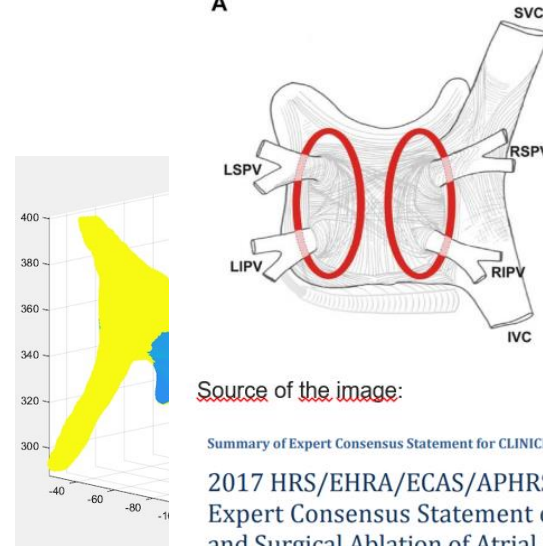




## Artificial Intelligence



## AI interface



### Primary outcomes

User interface  
Ablation targets

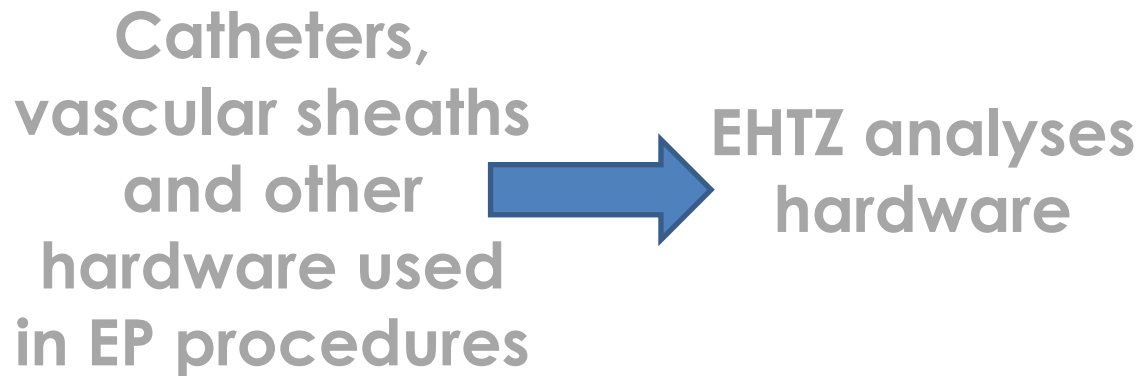
The user should be able to define equally-spaced ablation targets around the pulmonary veins (AF ablation)

In evaluation.  
(91 is improving the mapping software with real data)

# Simultaneously working with ETHZ→Robotics:

Catheters,  
vascular sheaths  
and other  
hardware used  
in EP procedures

# Simultaneously working with ETHZ → Robotics:





# Simultaneously working with ETHZ → Robotics:



Robotic Navigation **ETH** zürich

## In-vitro evaluation setup



Robotic Navigation **ETH** zürich

## In-vitro evaluation setup



## Primary outcomes

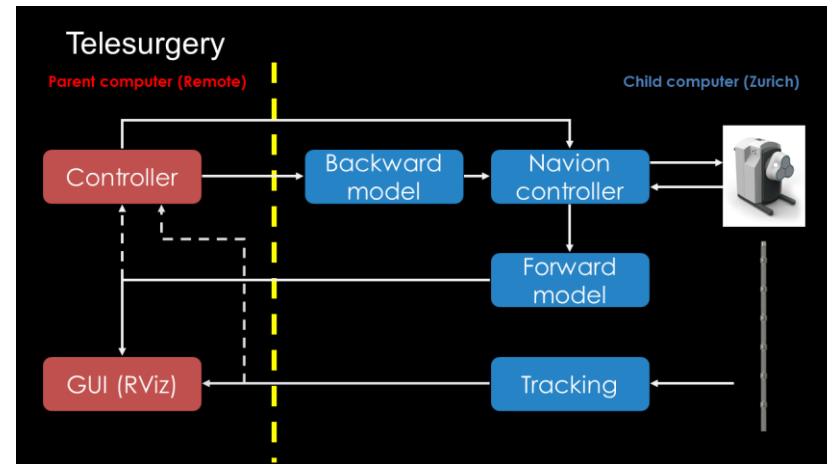
The user should be able to **plan a trajectory connecting all ablation targets and autonomously follow it**

## In evaluation

# Pilot #4 Robotic and Remote Navigation

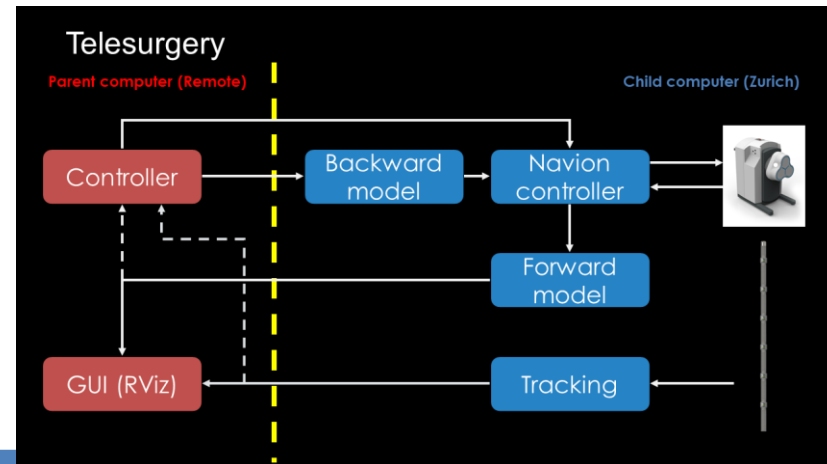
## Standard Manual Navigation vs Remote Navigation

Madrid vs Zurich



# Pilot #4 Robotic and Remote Navigation

## Standard Manual Navigation **ETH** zürich Remote Navigation vs Madrid Zurich



**Primary outcomes**  
Remote navigation

The user should be able to use a control interface to manipulate the external field and thereby **steer the robot in a remote manner**.

In evaluation  
(Remote navigation **test successful**, March 2022)

Thank you very much on behalf of SERMAS, 91  
and ETHZ!