

# Integrating Safety into MEDICIS project

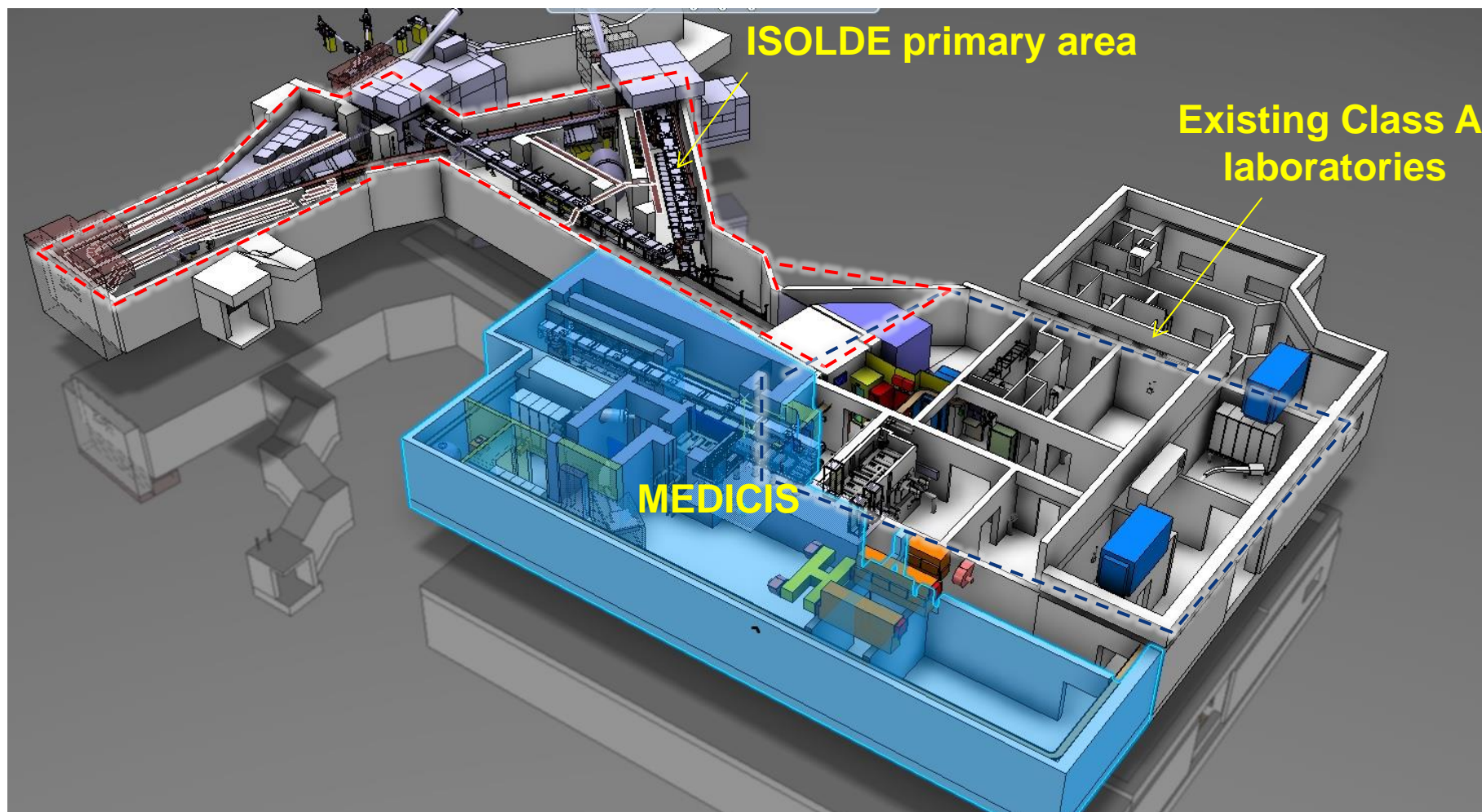
R.Augusto, AP.Bernardes, A.Broche, M.Di Castro, A.Dorsival, L.Kobzeva, S.Marzari, R.Necca, A.Polato, E.Sanchez, T.Stora, F.Valentini, J.Vollaire

# Outline

- Introduction
- Radioprotection
- Ventilation
- Fire
- Summary

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**MEDICIS laboratories will be classified as Class A laboratories**

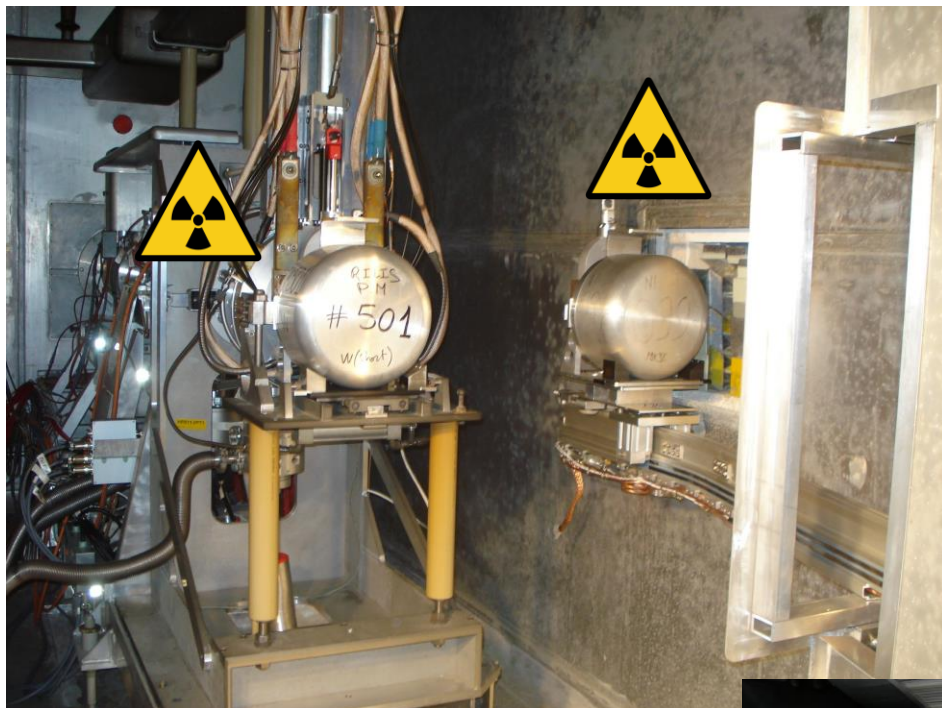
## Class A rules defined by the Ordonnance Suisse 814.501 and 814.554\*

Working sector	LA in Bq (Limite Autorisation)
Type C	$A < 100 \text{ LA}$
Type B	$100 \text{ LA} < A < 1000 \text{ LA}$
Type A	$\text{LA} > 1000 \text{ LA}$

Nucléide	Période	Type de désintégration/ de rayonnement	Grandeurs d'appréciation					LE Bq/kg ou $LE_{\text{sta}}$ Bq	Limite d'exemption	Limite d'autorisation	valeurs directrices		
			$e_{\text{inh}}$ Sv/Bq	$e_{\text{ing}}$ Sv/Bq	$h_{10}$ (mSv/h)/GBq à 1 m de distance	$h_{0,07}$ (mSv/h)/GBq à 10 cm de distance	$h_{c,0,07}$ (mSv/h)/(kBq/cm <sup>2</sup> )				CA Bq/m <sup>3</sup>	CS Bq/cm <sup>2</sup>	Nucléide de filiation instable
1	2	3	4	5	6	7	8	9	10	11	12	13	
Nb-98	51.5 m	$\beta^-, \gamma$	9.9 E-11	1.1 E-10	0.393	1000	1.8	9 E+04	5 E+07	8 E+04		3	
Mo-90	5.67 h	$\epsilon, \beta^+, \gamma$	5.6 E-10	6.2 E-10	0.147	1000	1.4	2 E+04	9 E+06	1 E+04		3-> Nb-90 [6]	
Mo-93	3.5 E3 a	$\epsilon$	1.4 E-09	2.6 E-09	0.016	4	<0.1	4 E+03	4 E+06	6 E+03		300	
Mo-93m	6.85 h	$\gamma$	3.0 E-10	2.8 E-10	0.330	800	0.8	4 E+04	2 E+07	3 E+04		10-> Mo-93	
Mo-99	66.0 h	$\beta^-, \gamma$	1.1 E-09	1.2 E-09	0.024	1000	1.6	8 E+03	5 E+06	8 E+03		3-> Tc-99m, Tc-99	
Mo-101	14.62 m	$\beta^-, \gamma$	4.5 E-11	4.2 E-11	0.196	1000	1.7	2 E+05	1 E+08	2 E+05		3-> Tc-101	
Tc-93	2.75 h	$\epsilon, \gamma$	6.5 E-11	4.9 E-11	0.222	20	0.1	2 E+05	8 E+07	1 E+05		100-> Mo-93	
Tc-93m	43.5 m	$\epsilon, \gamma$	3.1 E-11	2.4 E-11	0.098	300	0.4	4 E+05	2 E+08	3 E+05		10-> Tc-93, Mo-93	
Tc-94	293 m	$\epsilon, \beta^+, \gamma$	2.2 E-10	1.8 E-10	0.414	200	0.4	6 E+04	2 E+07	4 E+04		10	
Tc-94m	52 m	$\epsilon, \beta^+, \gamma$	8.0 E-11	1.1 E-10	0.285	700	1.3	9 E+04	6 E+07	1 E+05		3	
Tc-95	20.0 h	$\epsilon, \gamma$	1.8 E-10	1.6 E-10	0.135	20	0.1	6 E+04	3 E+07	5 E+04		100	

- *Ordonnance 814.501 sur la radioprotection:*
- <http://www.admin.ch/opc/fr/classified-compilation/19940157/index.html>
- *Ordonnance 814.554 sur l'utilisation des sources radioactives non scellées:*
- <http://www.admin.ch/opc/fr/classified-compilation/19970486/index.html>

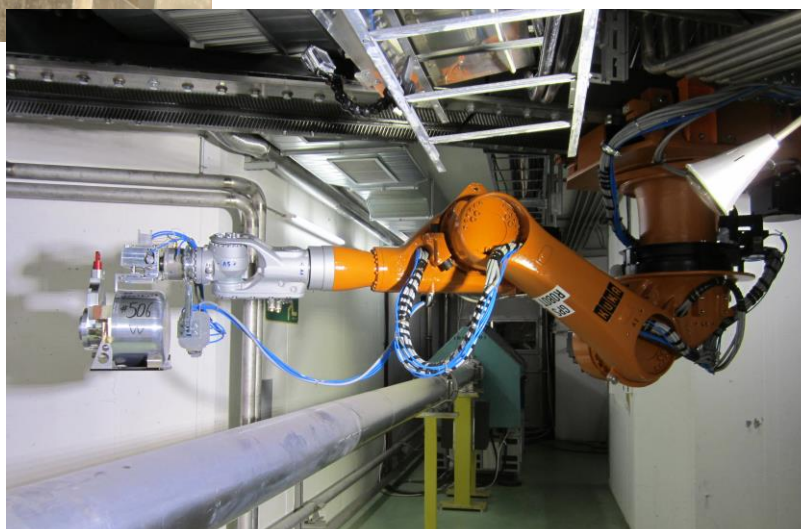
# Introduction



Irradiation Hazard



Contamination Hazard



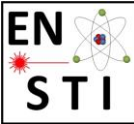
General safety (mechanical, electrical...hazard)

# Outline

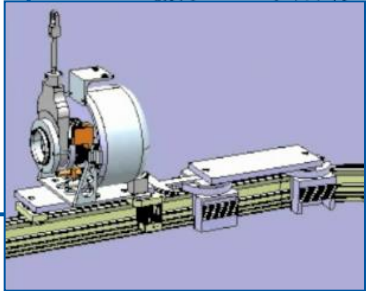
- Introduction
- **Radioprotection**
- Ventilation
- Fire
- Summary



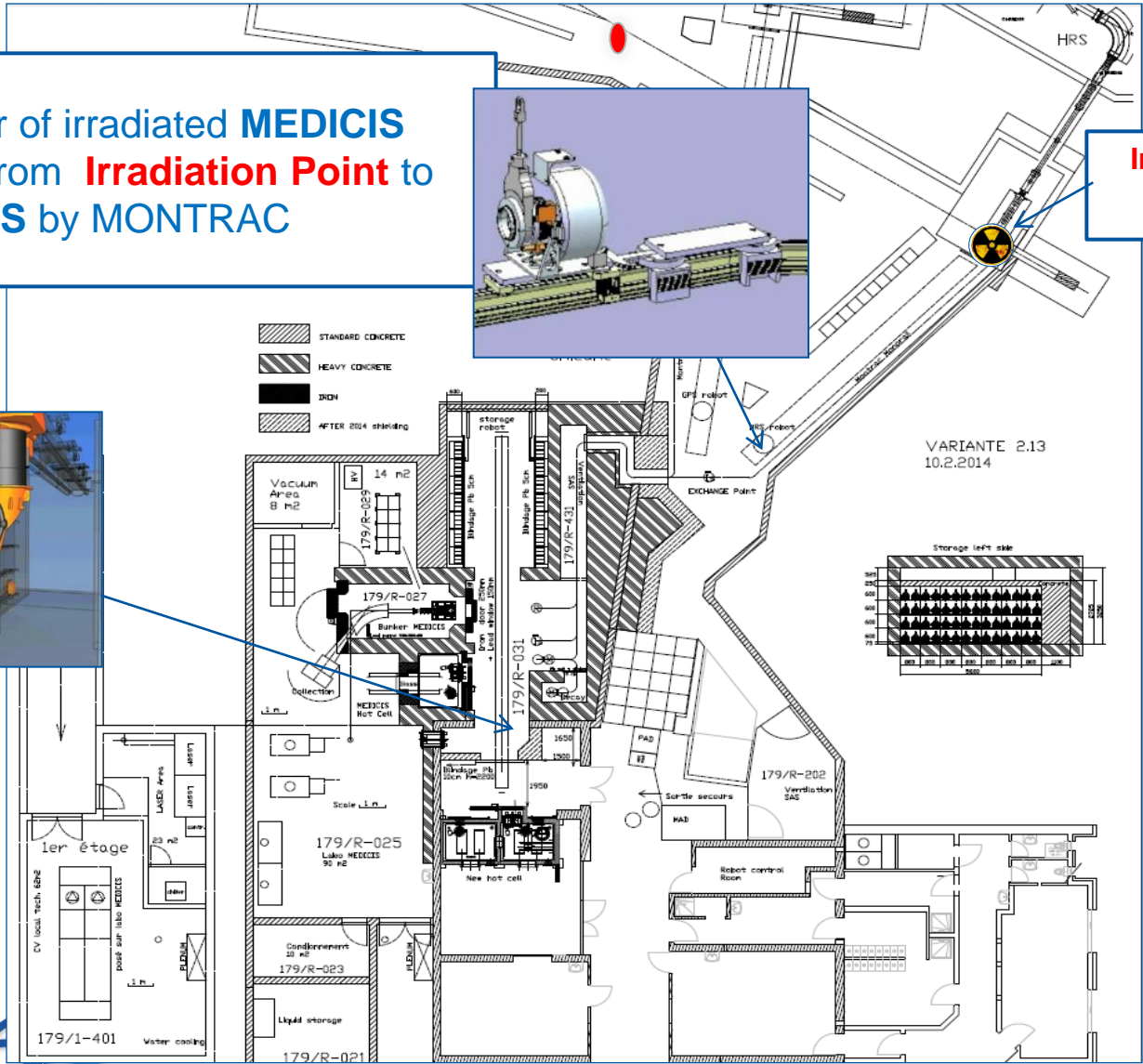
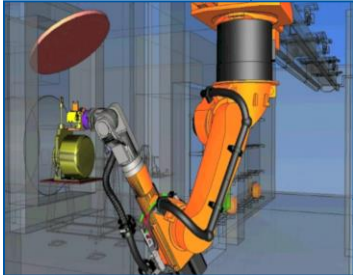
# Radioprotection



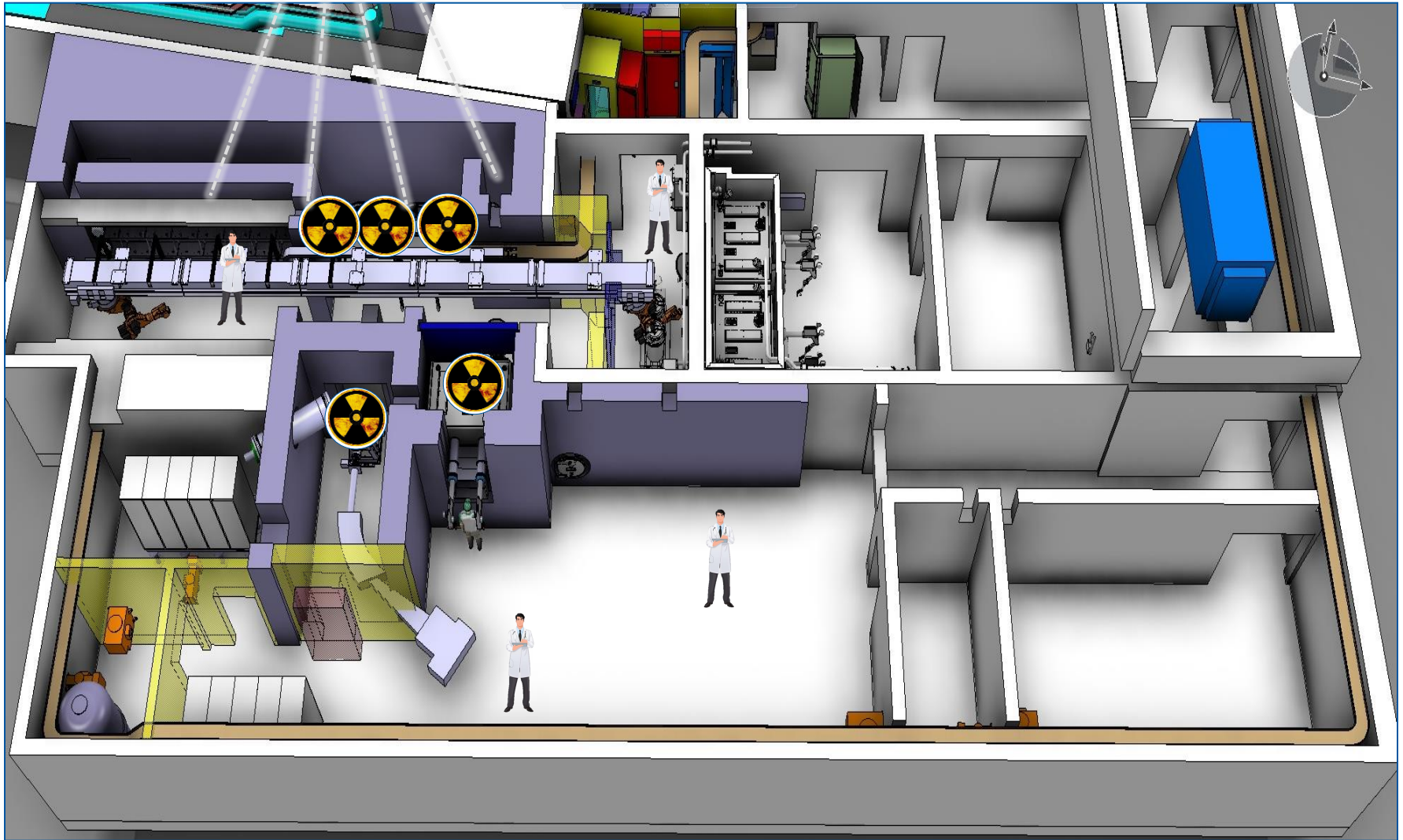
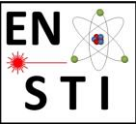
Transfer of irradiated **MEDICIS** target from **Irradiation Point** to **MEDICIS** by **MONTRAC**



**Irradiation Point**



# Radioprotection

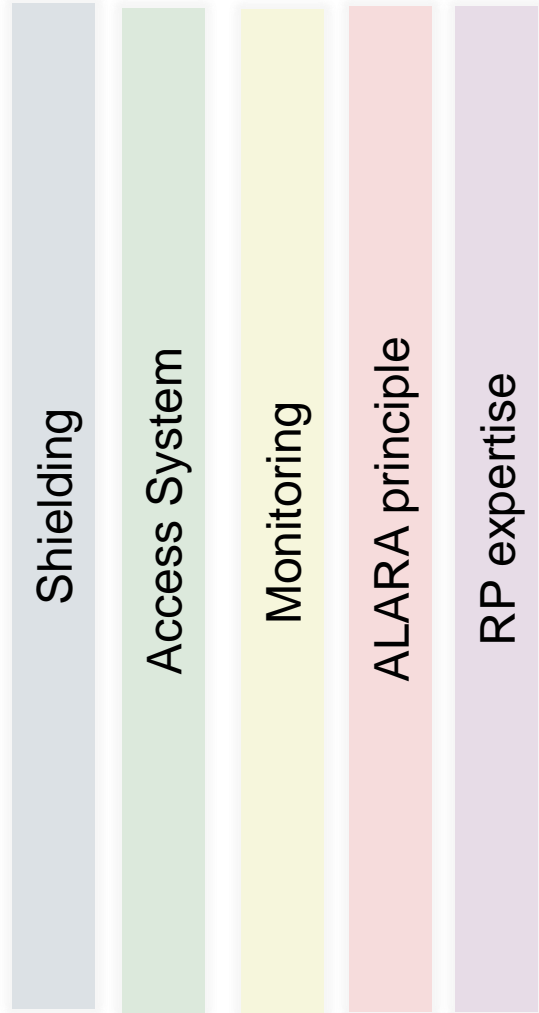
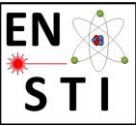


15/10/2014

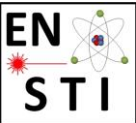
CERN-MEDICIS Day

10

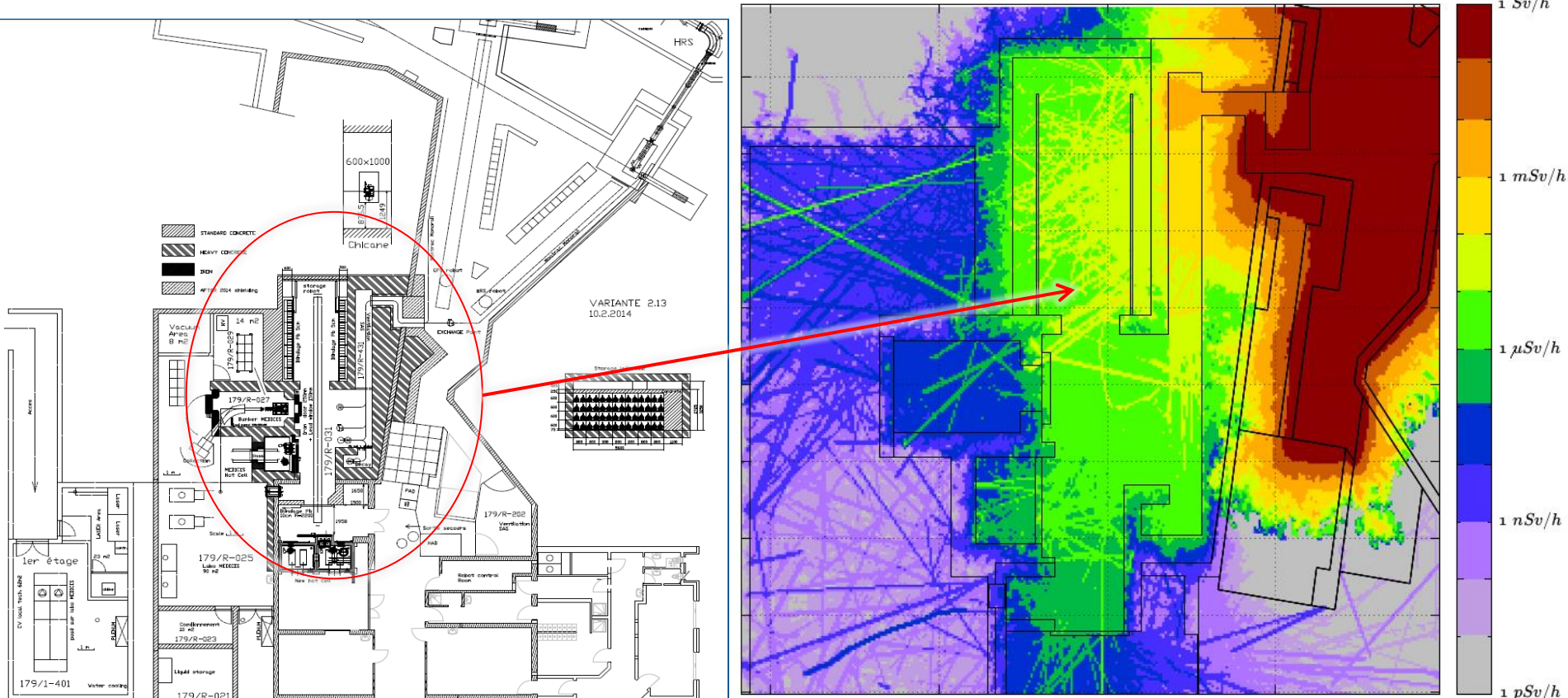
# Radioprotection



# Radioprotection



## Shielding to protect workers against prompt dose rate due to stray radiations



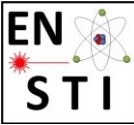
Acknowledgement to R. Dos Santos Augusto and J. Vollaire

Ambient dose equivalent rate during HIE-ISOLDE (HRS) operation, with an ISOLDE (UCx) and a MEDICIS (Ta) target

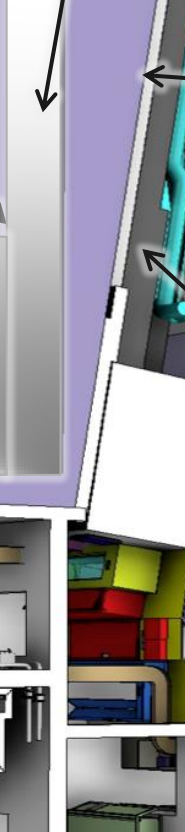
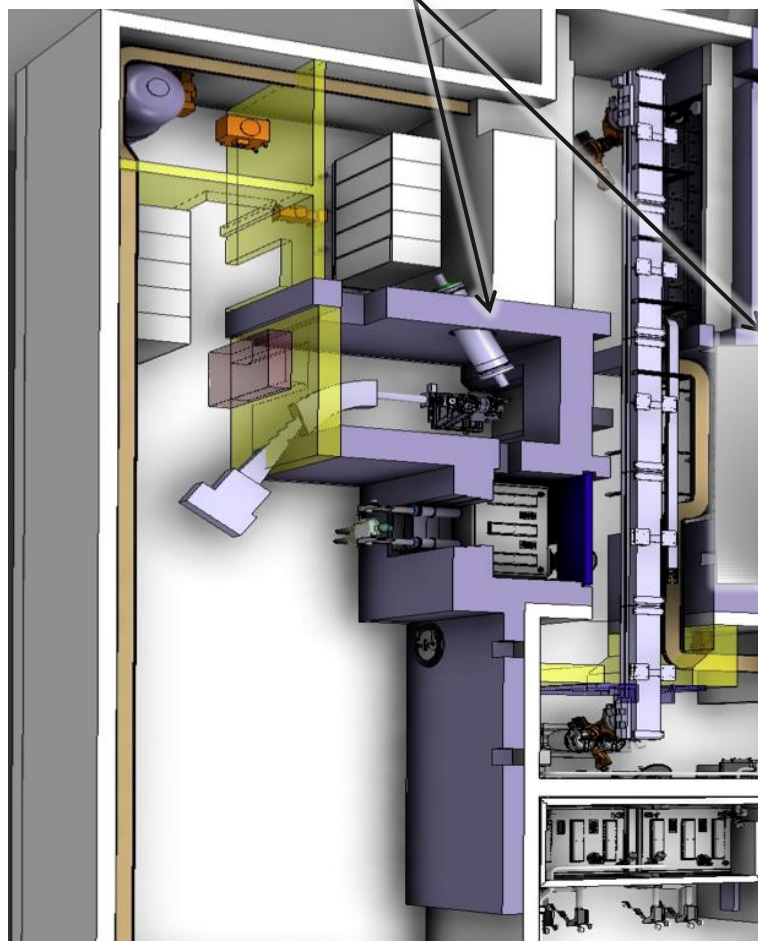
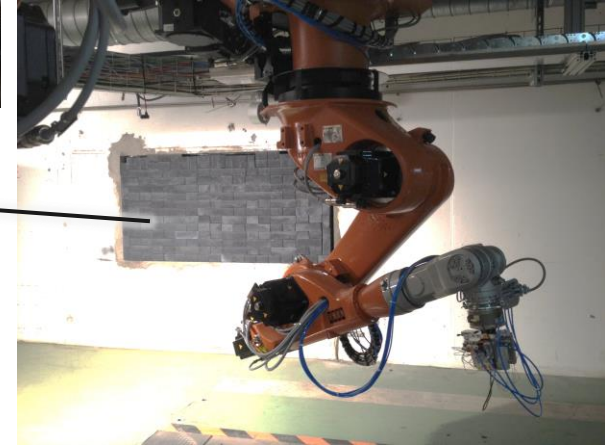


# Radioprotection

Magnetite 3.9 g/cm<sup>3</sup> (concrete 2.35 g/cm<sup>3</sup>)



Magnetite bricks shielding the chicane during installation work



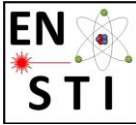
Additional shielding on primary area side



Shielding

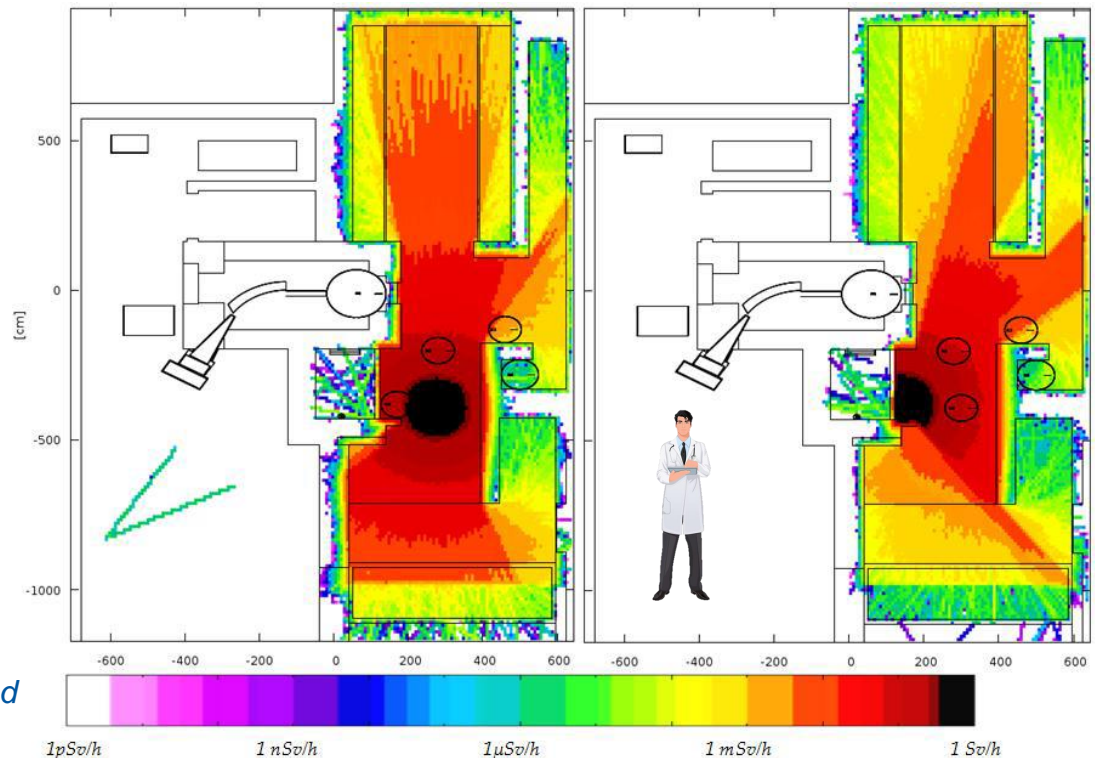
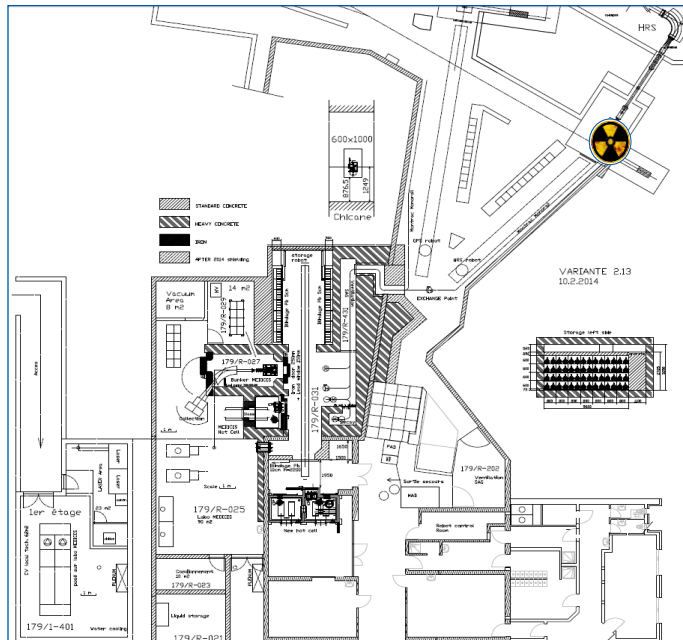


# Radioprotection



Shielding to protect workers against target in unshielded positions

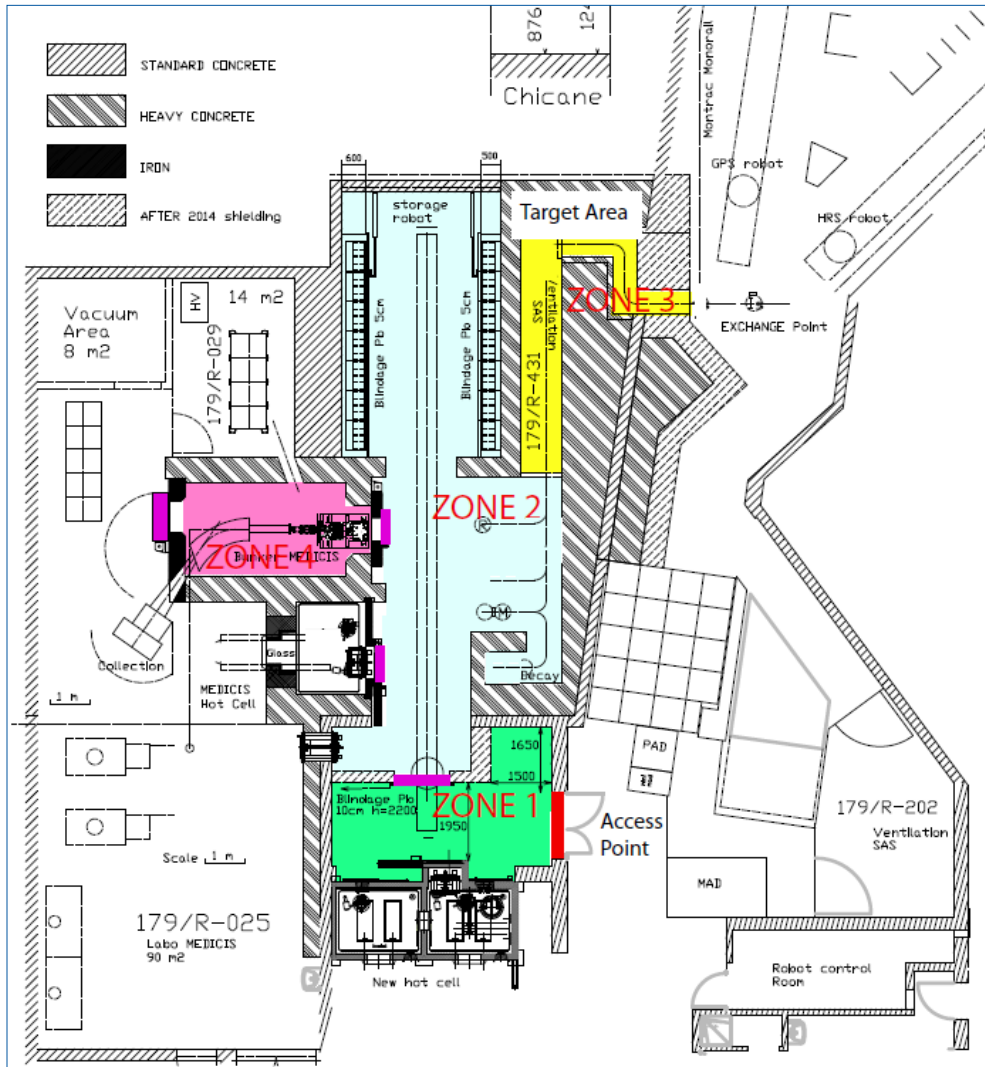
- Dose Rate of the order of Sv/h (1 mn ~ 20 mSv)
- “Back-cell” access is not ok (prohibited area > 100 mSv/h)



Acknowledgement to R. Dos Santos Augusto and J. Voltaire



# Radioprotection



## Access Sectorisation

**Zone1** - “back-side” of the hot cell used for the ISOLDE target dismantling.

**Zone2** - target storage area, the “back-side” of the MEDICIS hot cell and Offline Separator, Exchange and Decay point

**Zone3** – Transit tunnel, new sector of ISOLDE primary area

**Zone4** - MEDICIS bunker houses mass separator

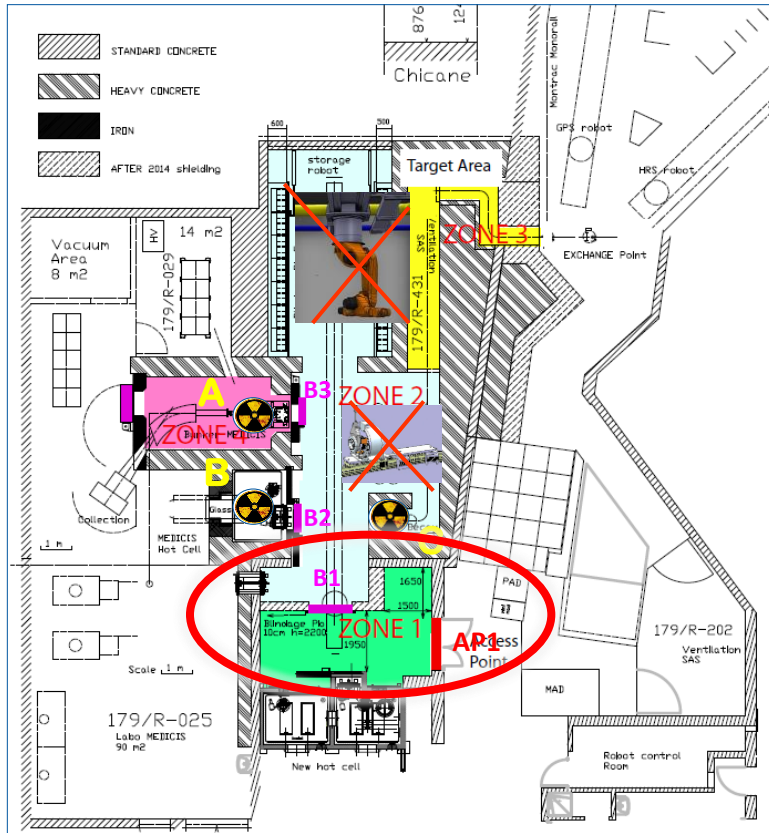
*Acknowledgement MEDICIS access working group: M.Di Castro, E.Sanchez, F.Valentini, L.Kobzeva, J.Vollaire*

# Radioprotection

ACCESS  
System



## ACCESS - ZONE 1 (As exemple)



**LIMITED STAY  
SÉJOUR LIMITÉ**  
Dosimeters obligatory  
Dosimètres obligatoires

Access to Zone1 via **AP1**

### Conditions for ACCESS

- All target on safe positions: **A, B, C**
- Doors **B1, B2, B3** – **Closed**
- Robot – **No motion and No target** (No mechanical and no radiation hazard)
- Montrac - **No motion and No target** (No radiation hazard)
- **NO RP Veto for Zone1**

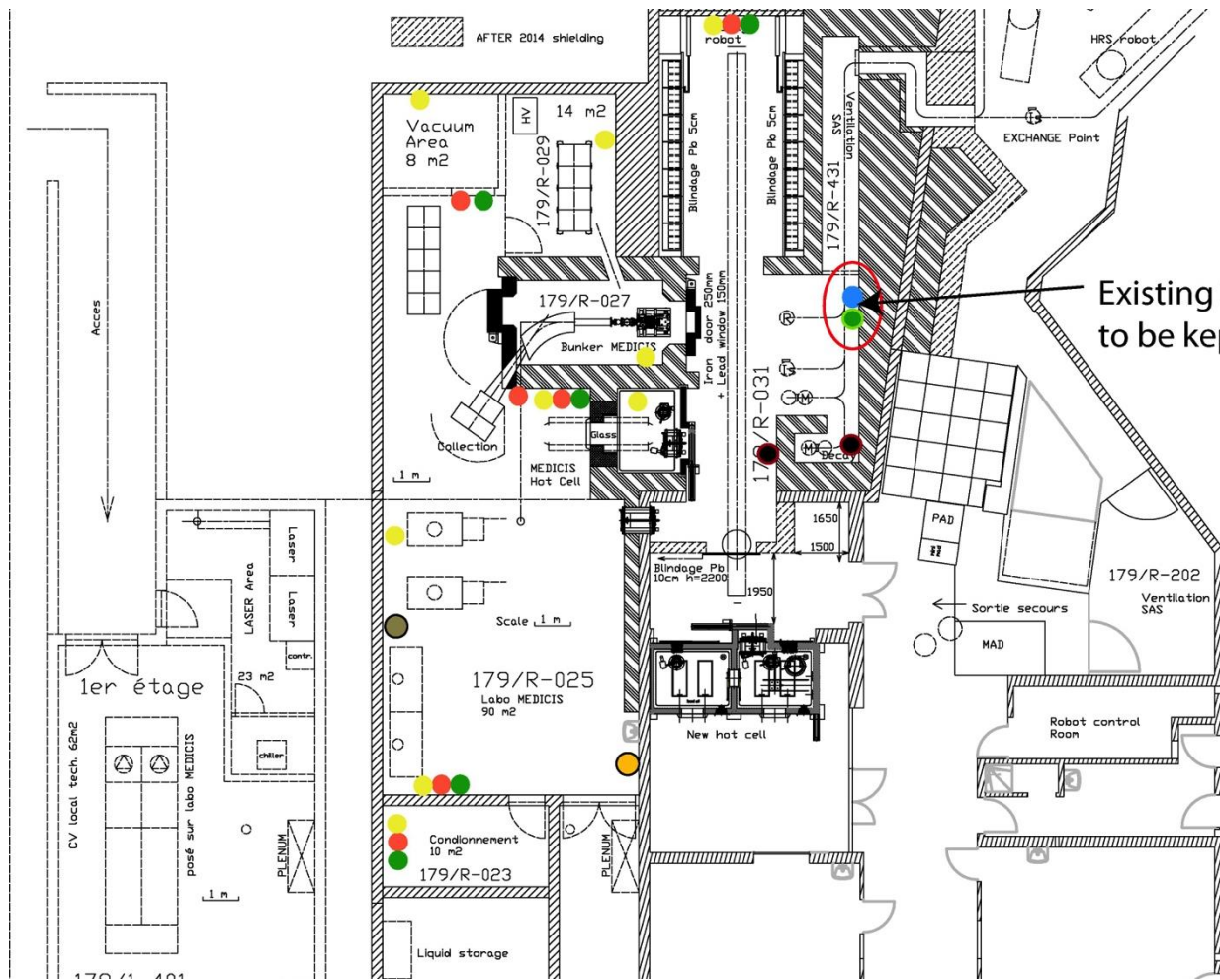


Acknowledgement MEDICIS access working group: M.Di Castro, E.Sanchez, F.Valentini, L.Kobzeva, J.Vollaire





# Radioprotection



- Ionisation chamber IAM (2)
- Alarm unit (GRAMS) (6)
- Central unit (GRAMS) (7)
- Gamma probe (GRAMS) (10)
- Hand Foot Monitor (1)
- Aerosol monitor (1)
- Ionisation Chamber AMF (1 existing to be kept)
- Alarm units (RAMSES) (1 existing to be kept)

**+ Air monitoring**

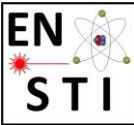
Monitoring



*Acknowledgement A.Dorsival and J.Vollaire*



# Radioprotection



## ALARA : As Low As Reasonably Achievable (EDMS 1244380)

**Group 1** is comprised of the two dose equivalent criteria (collective and individual) for which the optimization process can be measured. It is proposed that these 'hard' limits are used to determine the ALARA Level.

Individual dose equi.	Level I	100 $\mu$ Sv	Level II	1 mSv	Level III
Collective dose equi.		500 $\mu$ Sv		5 mSv	

Access with Radioprotection expert support only



ALARA principle  
RP expertise



Acknowledgement A.Dorsival and C.Saury



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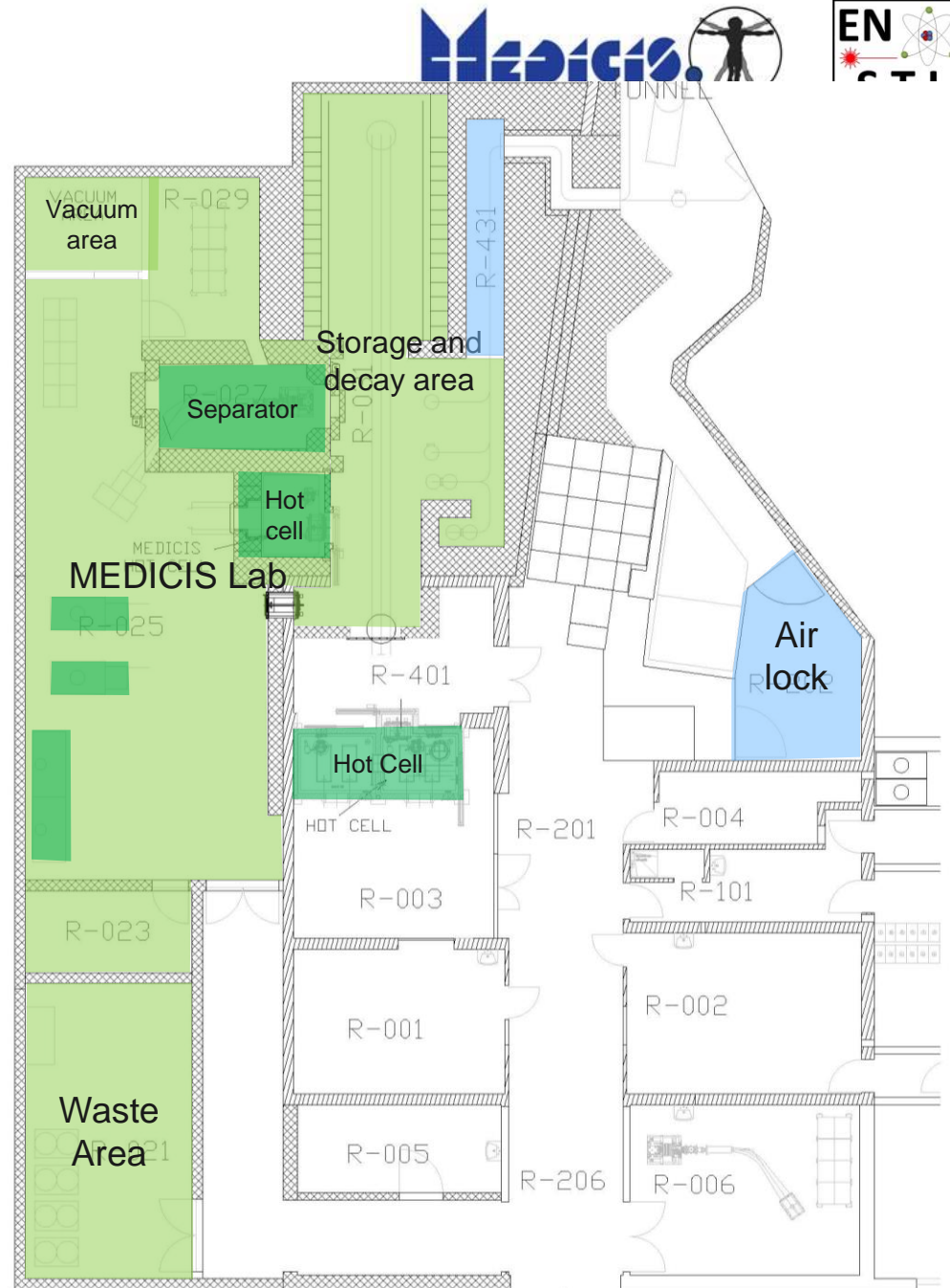
# Ventilation

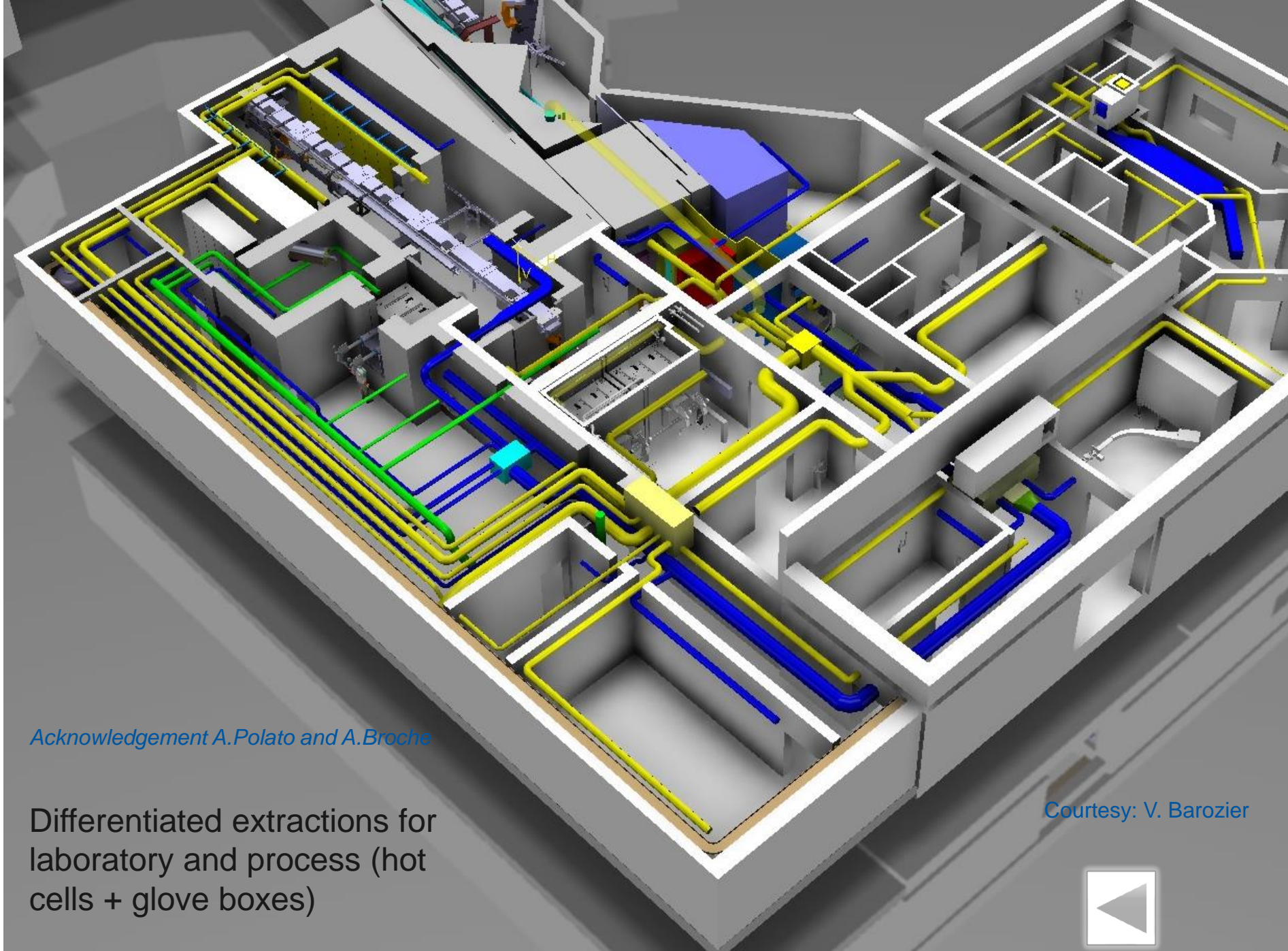
New ventilation and confinement system for the whole building

WHY?

- 240 m<sup>2</sup> extension (from 265 m<sup>2</sup> to 505 m<sup>2</sup>);
- New airlock chambers for the separation from the tunnel
- Differentiated extractions for the laboratory and process (hot cells + gloves boxes)

Acknowledgement A.Polato and A.Broche





*Acknowledgement A. Polato and A. Broche*

Differentiated extractions for  
laboratory and process (hot  
cells + glove boxes)

Courtesy: V. Barozier



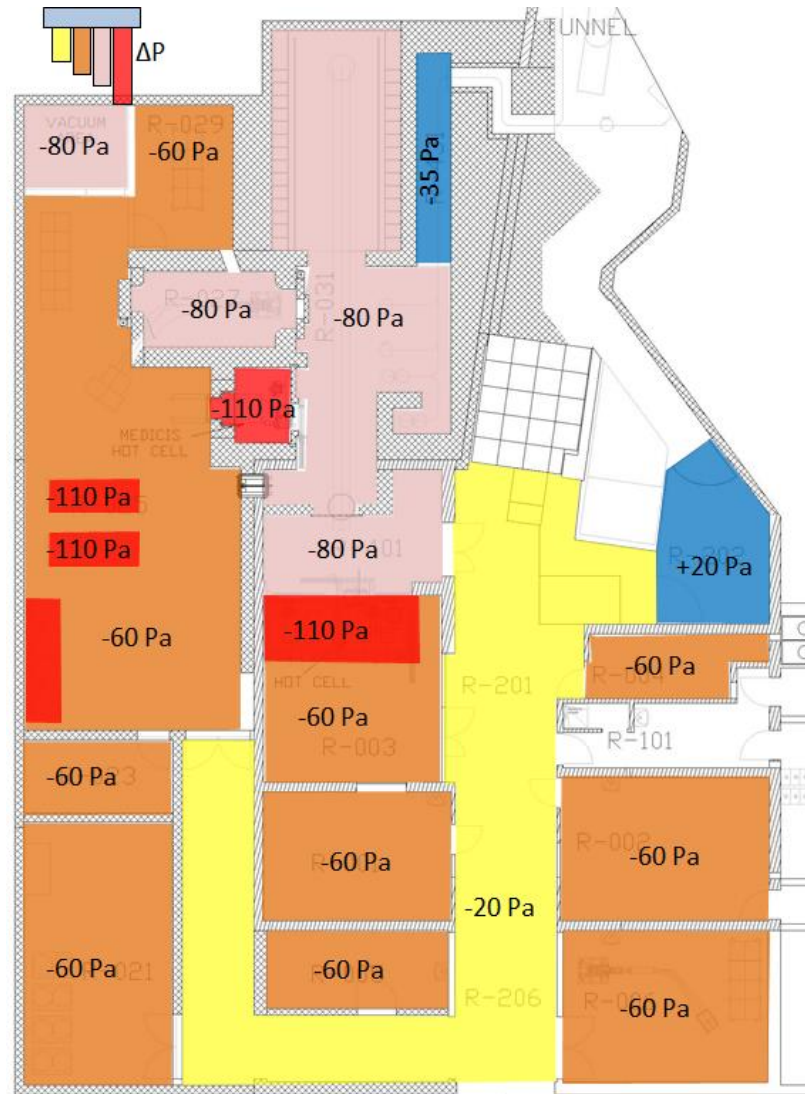
# Ventilation

## New ventilation and confinement system for the whole building

### WHY?

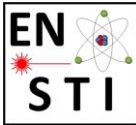
- Updated definition of the pressure hierarchy
- Redundancy of materiel

Acknowledgement A.Polato and A.Broche



ZON E	Activity	$\Delta p$ vs. Outdoors
Yellow	transport of radioactive material, no handling	-20 Pa
Orange	handling of radioactive material with collective protections	-60 Pa
Red	storage of contaminated material, presence of contamination expected	-80 Pa
Red	glove boxes or hot cells, confinement highly contaminated material	-110 Pa
Blue	Target Airlock Chamber R431	-35 Pa
Blue	Airlock chamber R202	+20 Pa

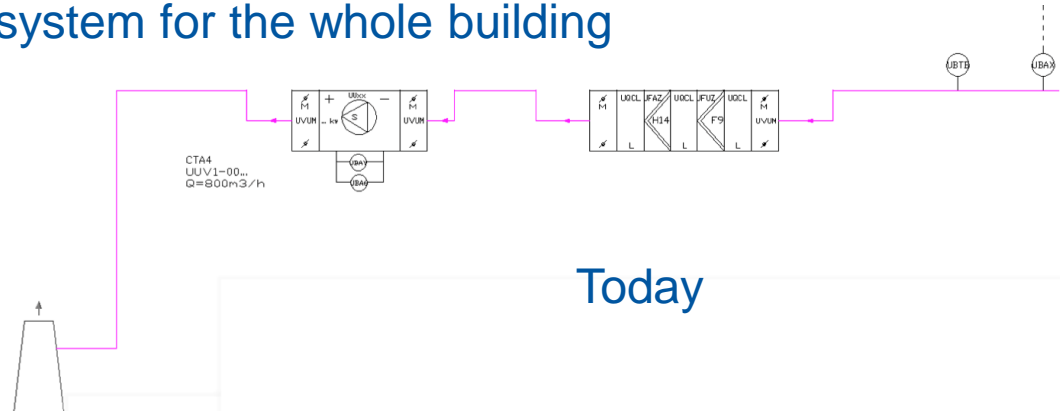
# Ventilation



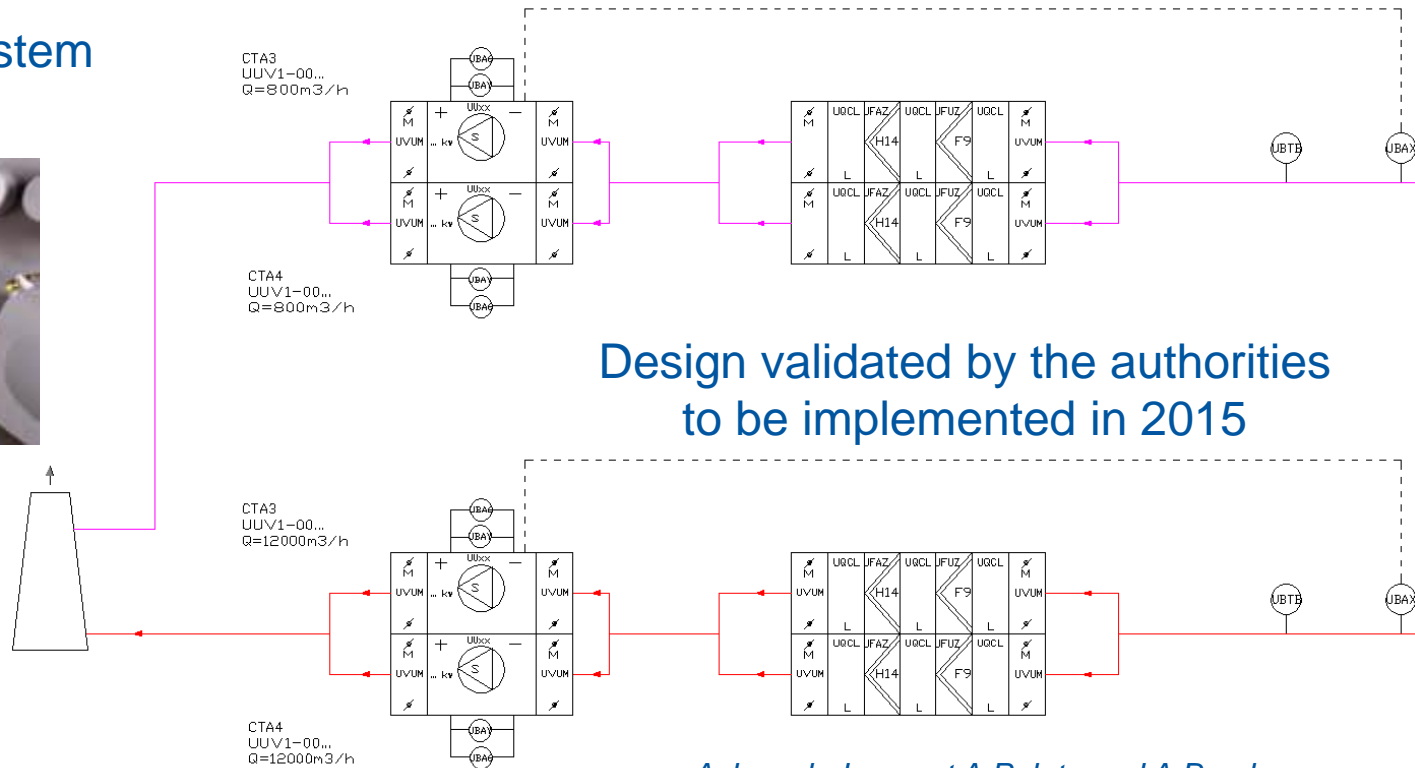
## New ventilation and confinement system for the whole building

### WHY?

- Redundancy of materiel
- Bag in bag out system



Today



Design validated by the authorities  
to be implemented in 2015



Acknowledgement A.Polato and A.Broche

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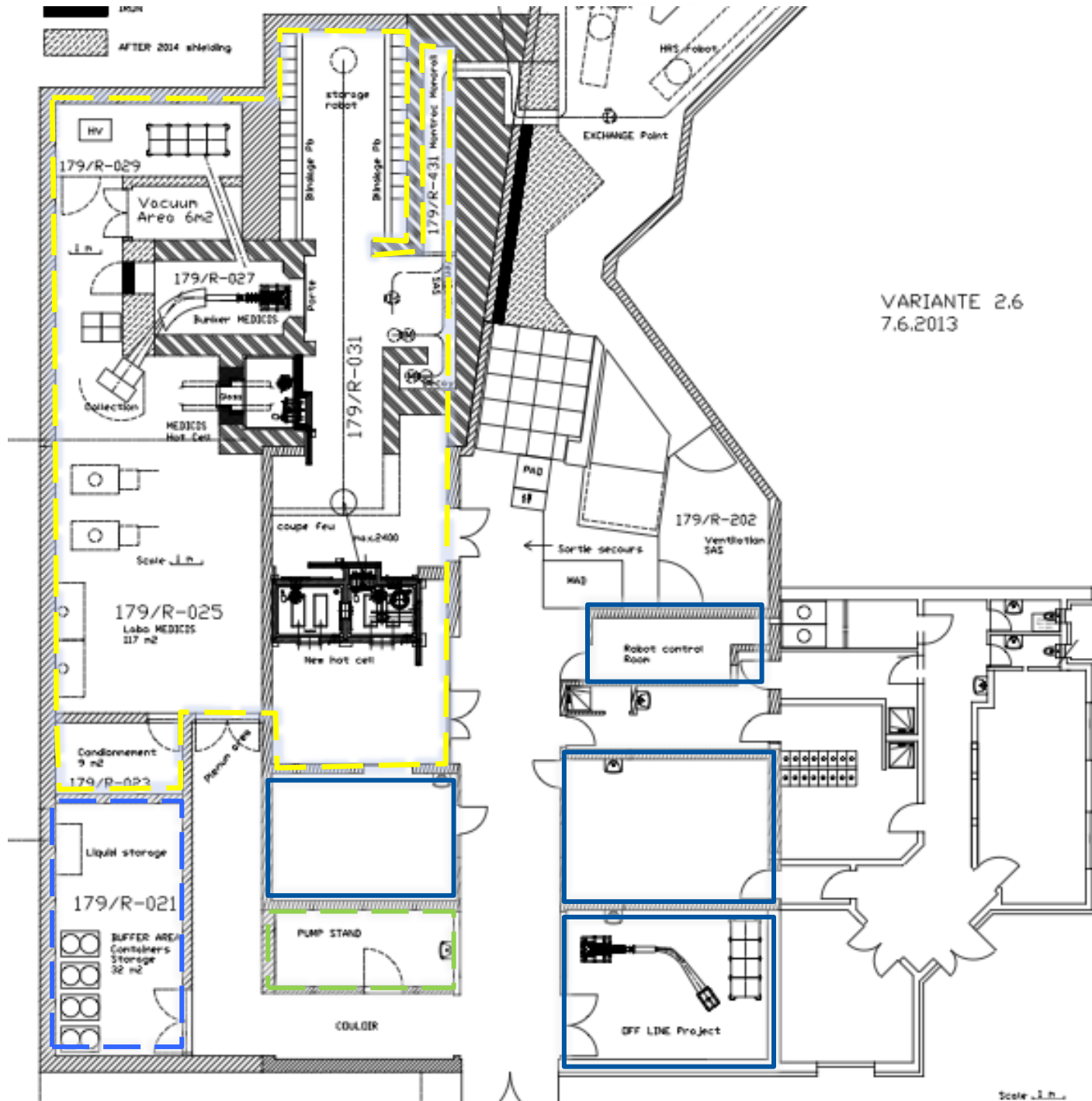


# Fire

New fire sectors

Existing fire sectors

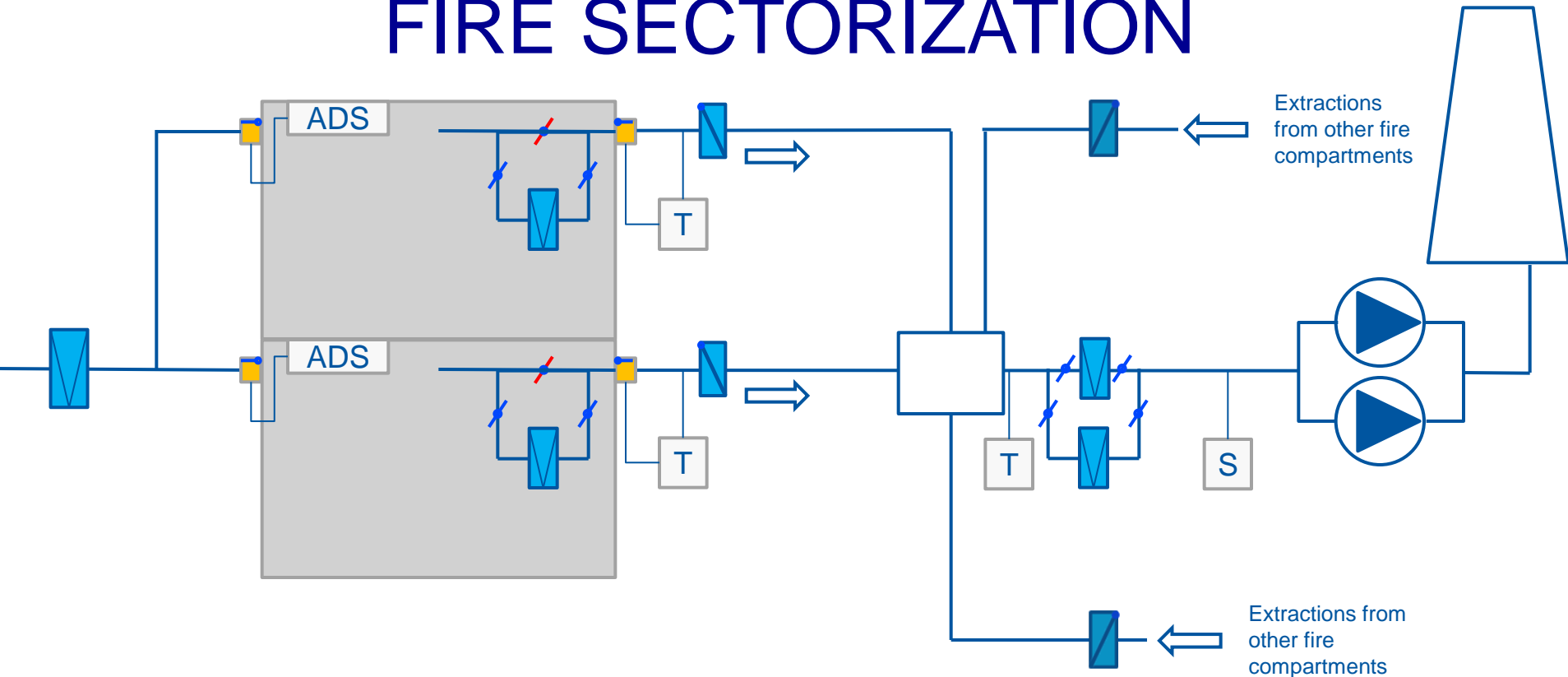
Fire detection will be extended to MEDICIS building



VARIANTE 2.6  
7.6.2013



## FIRE SECTORIZATION



**ADS** Automatic Detection System

**T** Temp transmitter

 Check damper

*Acknowledgement A.Polato and A.Broche*

 Fan

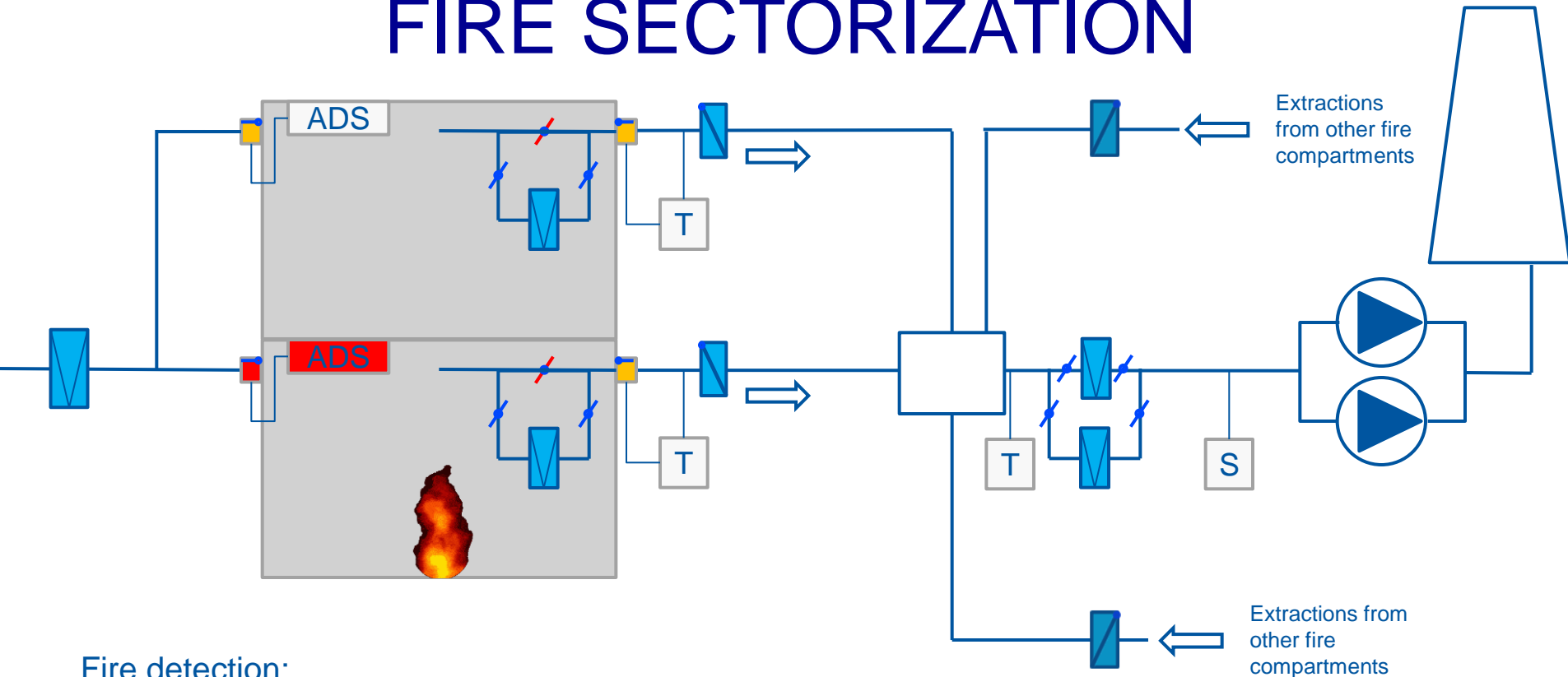
 Fire damper



**S** Smoke detector

 Filter

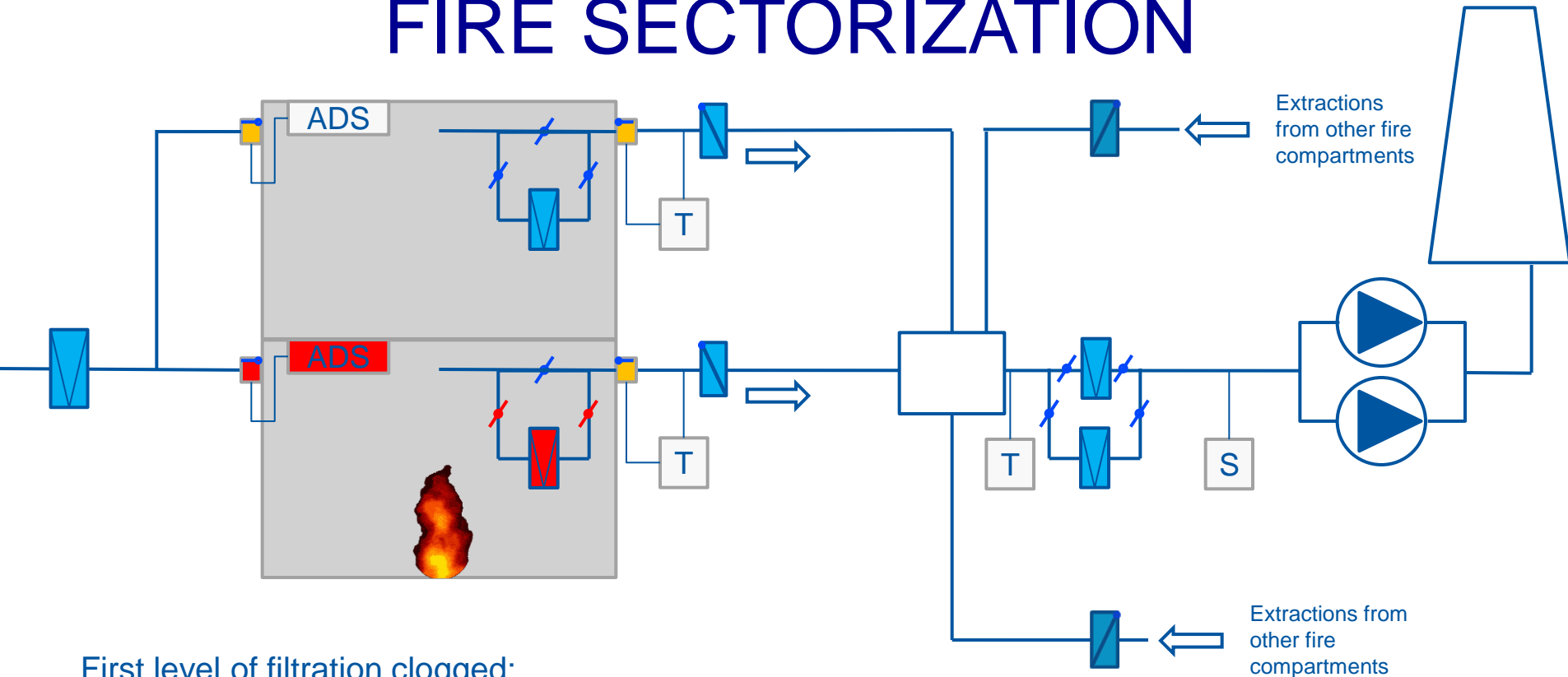
## FIRE SECTORIZATION



### Fire detection:

- Allow workers to go out of the Fire Sector (temporization of supply damper);
- Close the supply fire damper (no O<sub>2</sub> supply);
- Continue extraction to keep the confinement in place;

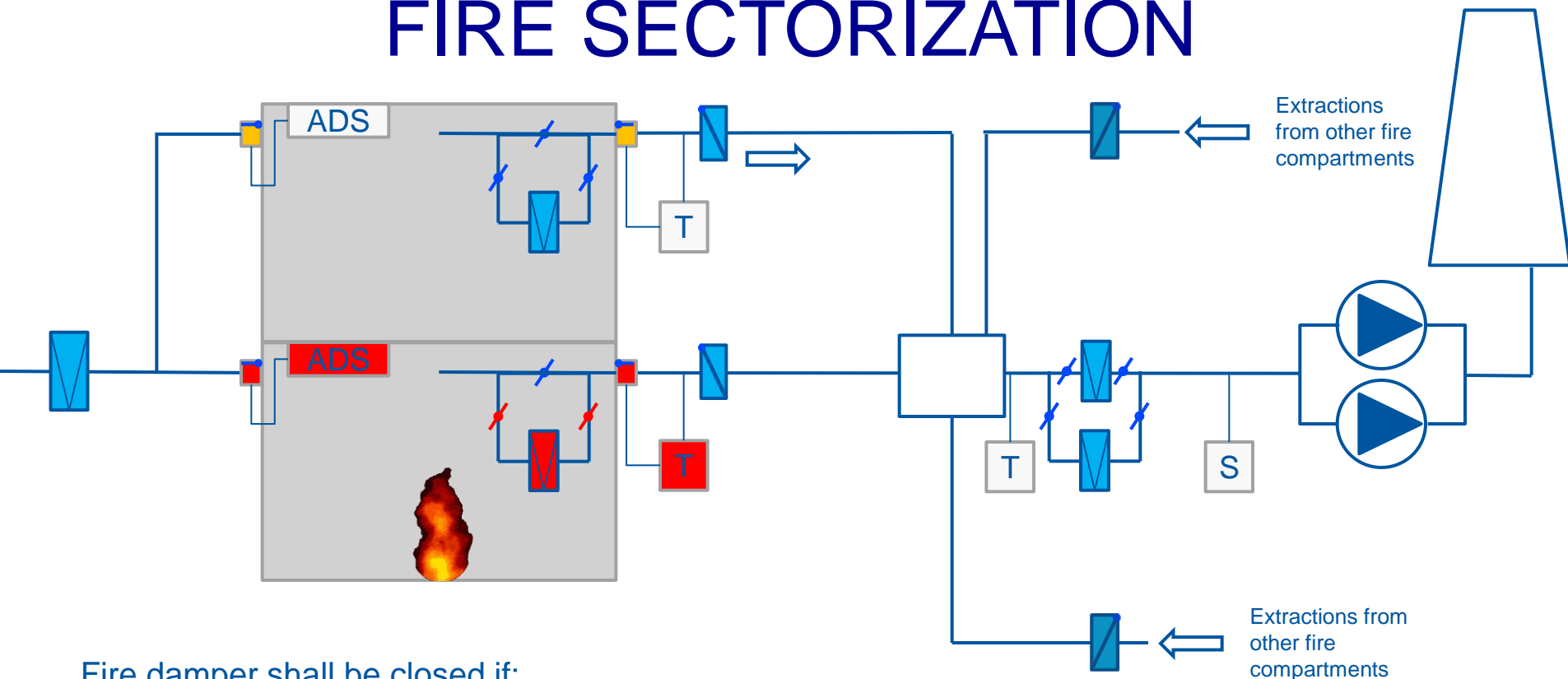
## FIRE SECTORIZATION



First level of filtration clogged:

- Bypass the first level of filtration

## FIRE SECTORIZATION



Fire damper shall be closed if:

- high temperature is detected after the extraction fire damper

Ventilation in the fire sector stopped and FIRE SECTOR ISOLATED

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# Summary

- Several safety studies have been already achieved and implemented for MEDICIS project thanks to:
  - R.Dos Santos Augusto and J.Vollaire for the **Shielding**
  - A.Dorsival for the **Monitoring**
- **Access** have been defined thanks to the access working group (GS-ASE, DGS-RP, EN-STI)
- **Ventilation and Fire protection** has been studied, validated by the authorities and contract has been attributed thanks to A.Polato and A.Broche EN/CV
- Many other groups are involved DGS/SEE, EN/EL, TE/ABT...

**Thank you to all contributors and for your attention!**

