DE LA RECHERCHE À L'INDUSTRIE

CEA - Saclay

CRITICAL DESIGN REVIEW #1 FOR MEDIUM BETA CAVITY CRYOMODULES

3-4 APRIL 2017

-

SAFETY AND RAMI INPUTS

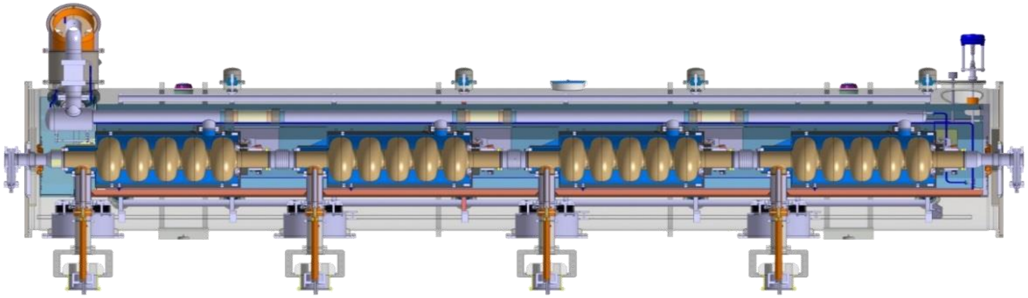
-

FRANCK PEAUGER

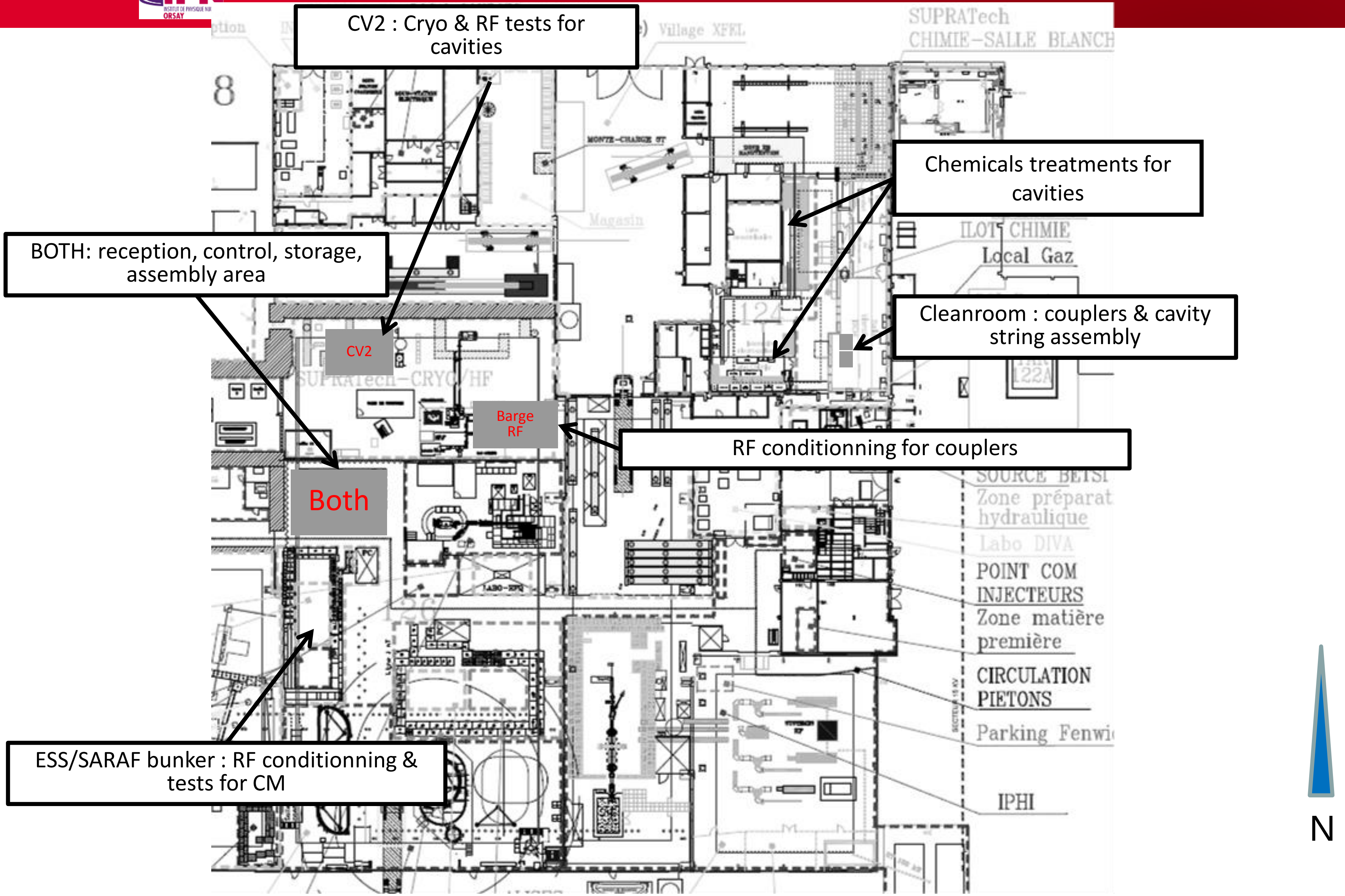
OLIVIER KUSTER (INSTALLATION AND SAFETY MANAGER)

www.cea.fr

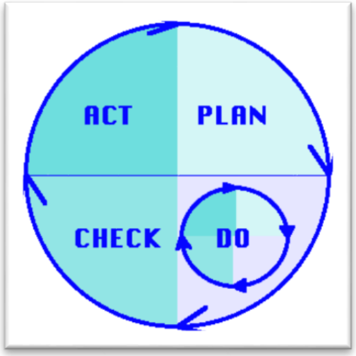
SAFETY FOR THE ESS CRYOMODULE



ESS TESTS AREAS



SAFETY RISKS ANALYSIS



- « Prototype phase »
  - Safety studies of existing experimental stations
  - ESS safety study for the CEA Saclay Safety Local Commission (CLS) authorization (April-May 2017)
  - Radiation protection study
  - Equipment under pressure study (PED)
  - Prevention plans, fire permits, etc. for work sites to fit out ESS areas
- « Industrial phase »
  - Safety & environmental requirements for ESSI specifications
  - ESSI safety study for the CEA Saclay Safety Local Commission (CLS) authorization
  - Prevention plan with the chosen industrial partner for the assembly production

MAIN HAZARDS FOR ESS TESTS IN SACLAY

Ionizing radiations

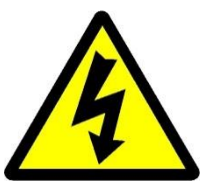
Risk of anoxia

Non ionizing radiations (RF)

Cryogenic hazard

Handlings

Chemical hazards



Electrical hazard

Fire

Noise

Interferences

Ergonomics

SAFETY MANAGEMENT & EXPLOITATION

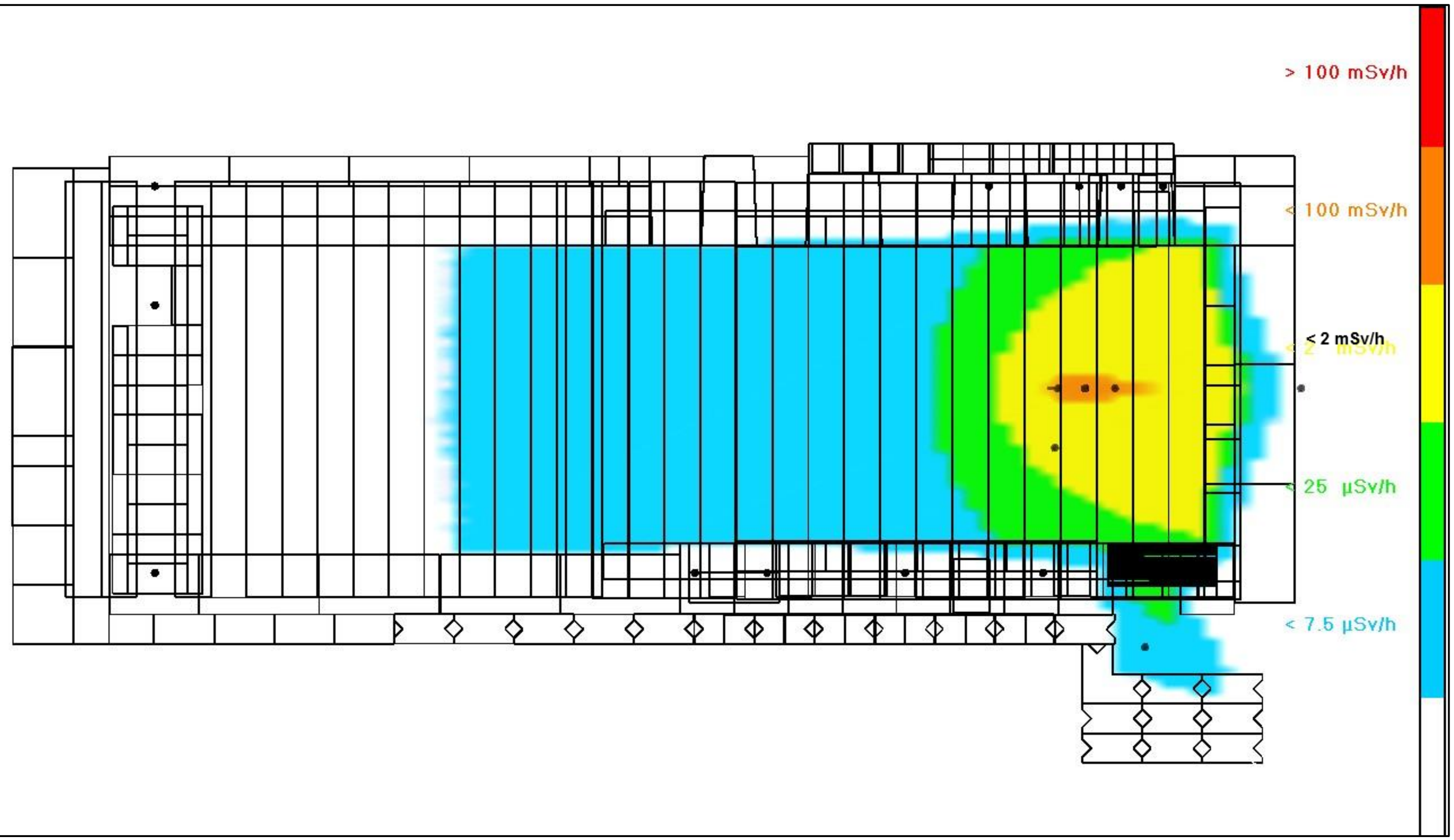
- Works, logistics, environment, health and safety team
- 2 Team leaders on each experimental station
- General safety rules, procedures, safety instructions
- Twice-monthly meetings to manage exploitation and prevent interferences
- Quaterly meetings for land use of Synergium infrastructure
- Prior authorization sheet to begin a test
- Safety inspections & safety drills
- Periodical and regulatory controls of equipments
- Safety training plan, medical supervision, personal protective equipments

IONIZING RADIATION PROTECTION FOR CM TESTS (1/2)

Radiation calculations and simulations

15 MeV (uprating)
Beam toward the North
Usual concrete (uprating)

Cartography in hourly dose rate (H*(10)) for an electrons flow at 0,1 nA (adapted for a 4% pulsed cycle)



points calcul	ded Sv/h **0,1 nA**
contact	**2.35E-01**
50cm	**1.80E-02**
100cm	**5.82E-03**
200cm	**1.70E-03**
coté_100cm	**5.80E-05**
entrée	**1.27E-05**
entrée ext	**1.85E-06**
derriere mur	**1.61E-07**
trou1_coté_est	**8.85E-07**
trou2_coté_est	**2.00E-07**
trou3_coté_est	**5.86E-08**
trou4_coté_est	4.20E-08
trou5_coté_est	6.60E-09
trou1_coté_ouest	**2.08E-07**
trou2_coté_ouest	**2.04E-07**
trou3_coté_ouest	**2.70E-07**
trou4_coté_ouest	**1.67E-07**
trou5_coté_ouest	6.40E-10
trou_coté_sud	7.83E-09

>> Exposure level outside bunker compatible with public people

IONIZING RADIATION PROTECTION FOR CM TESTS (2/2)

- Radiation protections : concrete bunker with roof

- Homogeneity control of the bunker with an Xray generator

- Plugging of leaks with Lead (bricks, leaves, balls)

- Safety chain
- RF shutdown beyond public level outside
- Controls of the chain by radiation protection team

- Monitoring of radiations levels :
  > Gamma rays measurer (hourly dose rates)
  > Neutrons measurer (hourly dose rates)
  > Cartographies around the bunker by radiation protection team
  > Dosemeter films around the bunker

- Radiation prevention plan (DIMR), procedures, signs, restricted access area

- Authorized staff, safety trainings

Ionizing chamber
150 nSv/h-0,15 Sv/h
OK for Pulsed cycle

RAMI

- RAMI = Reliability, Availability, Maintainability and Inspectability
- Objective:
  - reduce the risk level of a main function breakdown
  - decrease the time to repair
- WHAT can go wrong, WHERE and WHEN
- Strategy:
  - spare components
  - back-up systems
  - Maintenance
  - component standardization
  - systems design optimization

WHAT CAN GO WRONG

- Very preliminary analysis

	WHAT	PROBLEM	WHERE
1	Cavity	failure	
2	Stepper motor	failure	Tuning system
3	Piezo actuator	break	Tuning system
4	Cryogenic circuit	Flange leak	Gasket connections
5	Elastomer gasket	degradation	Vacuum vessel
6	Internal RF cable	degradation	From cavity pick-up port to vacuum vessel port
7	Helium valves	failure	Top of the vacuum vessel extremities
8	Vacuum gate valves	failure	vacuum vessel extremities
9	Ceramic	break	Power coupler or pick-ups

Thank you

•Commissariat à l'énergie atomique et aux énergies alternatives
•Centre de Saclay | 91191 Gif-sur-Yvette Cedex
•T. +33 (0)1 69 08 76 11 | F. +33 (0)1 69 08 30 24
•Etablissement public à caractère industriel et commercial | RCS Paris B 775 685 019