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Energéticas, Medioambientales
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6th EMUG

CIEMAT's Last Year Experience with MELCOR 2.1

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Unit of Nuclear Safety Research

Bratislava, April 15-16,2014



Background:

Test interpretation & Validation

- **In-containment source-term and thermal-hydraulics.**

LWR (Phebus-FP, FPT1/2 tests) → MELCOR 1.8.6 YV 3084

SFR (CP-ESFR, ABCOVE tests) → MELCOR 1.8.6 YV 3084

- **Fuel degradation in the presence of air.**

SFP (OECD-SFP project) → MELCOR 1.8.6 YV 3084 SFP

Sequence analysis

- **Input updating (1.8.4 → 2.1) & sequence analysis**

BWR3 (CSN agreement)	}	→	{	MELCOR 1.8.6 YV 3084
PWR (CSN agreement)				MELCOR 2.1.4803

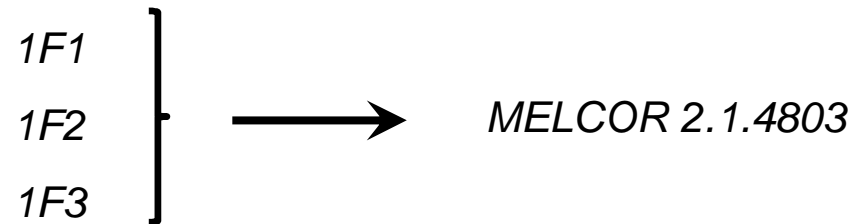




Current activities: OECD-BSAF project (CSN)

Plant modeling, Sequence analysis & Validation

- **+ Plant modeling**



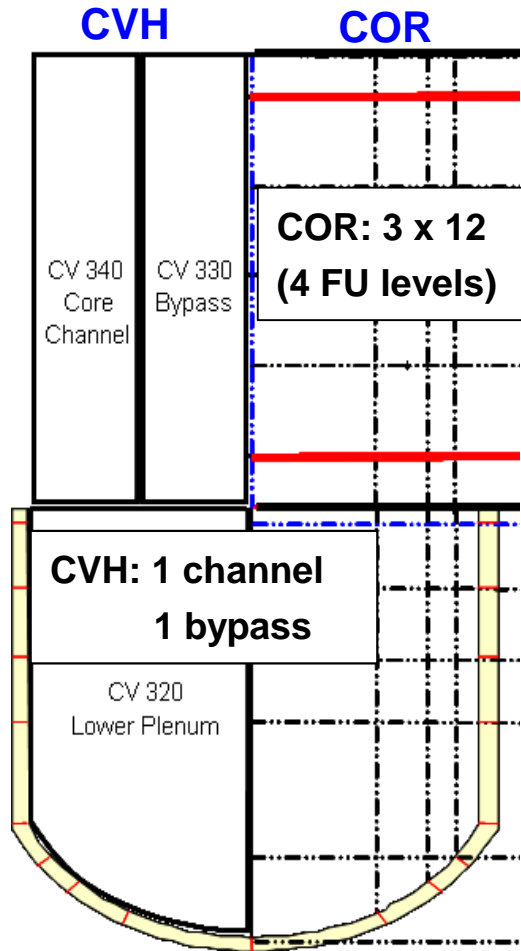
- **Starting point: Spanish BWR NPP**

- ✓ Detailed plant model
- ✓ MELCOR Best Modeling Practices (SOARCA, NUREG/CR-7008, 2010)



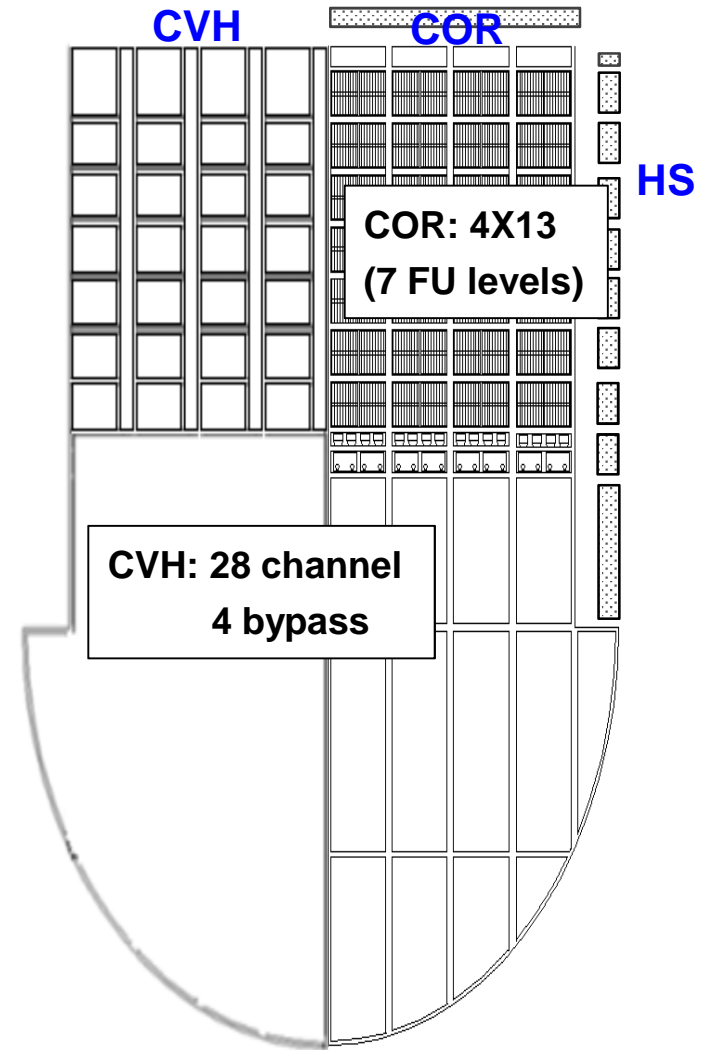


Current activities: OECD-BSAF project (CSN)



→

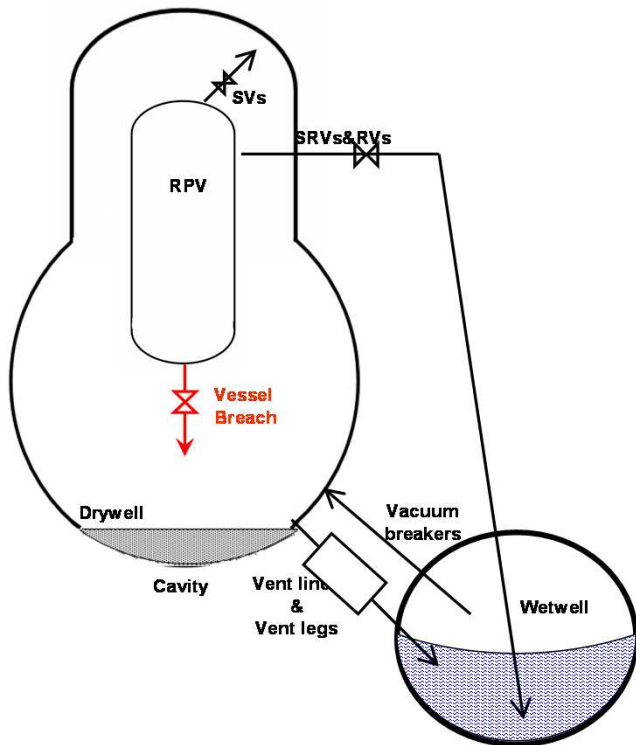
	CORE & LP	RPV
COR	53	-
CVs	33	5
FLs	40	6



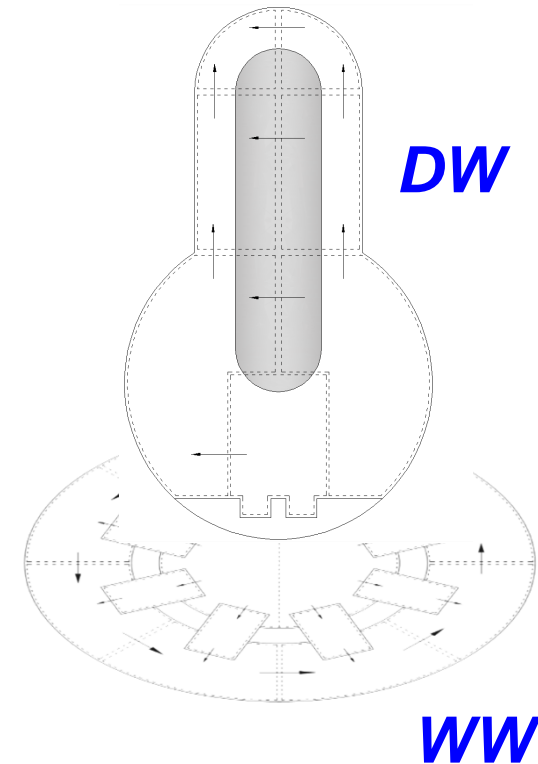


Current activities: OECD-BSAF project (CSN)

Single-CV approach



Multiple-CV approach



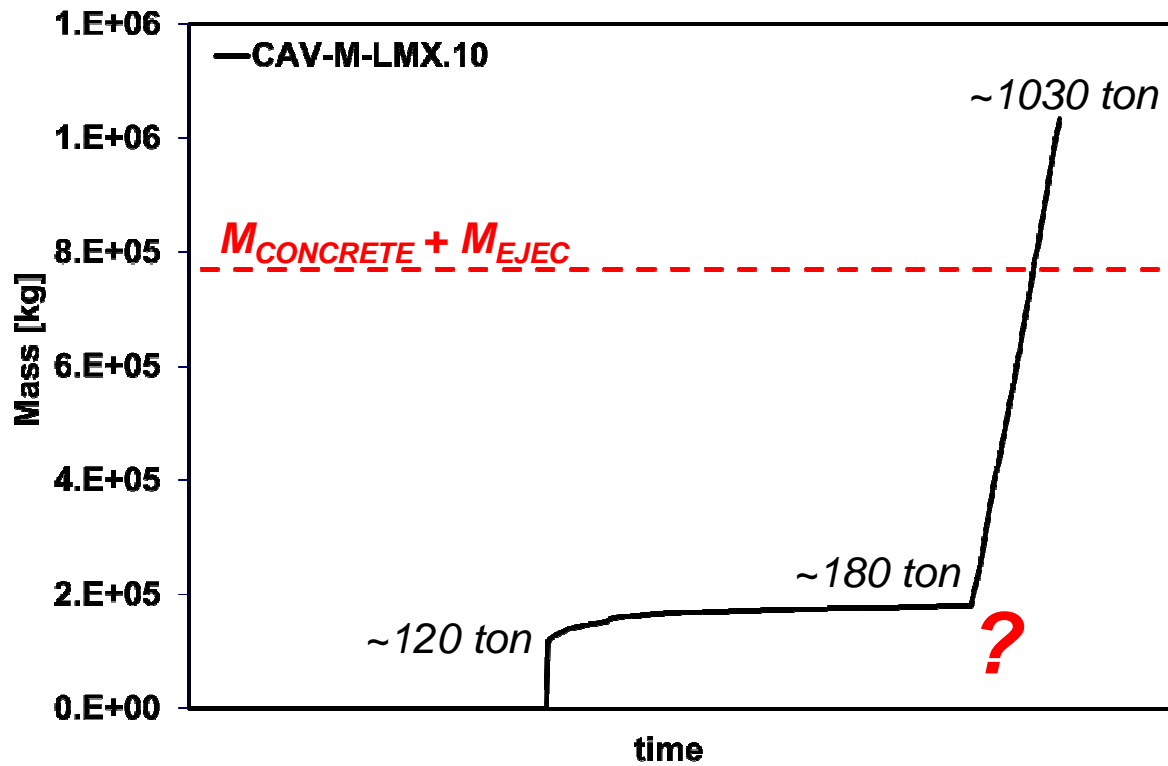
	DW	WW
CVs	7	16
FLs	10	24





Modeling Cavity: CAV Overfilled

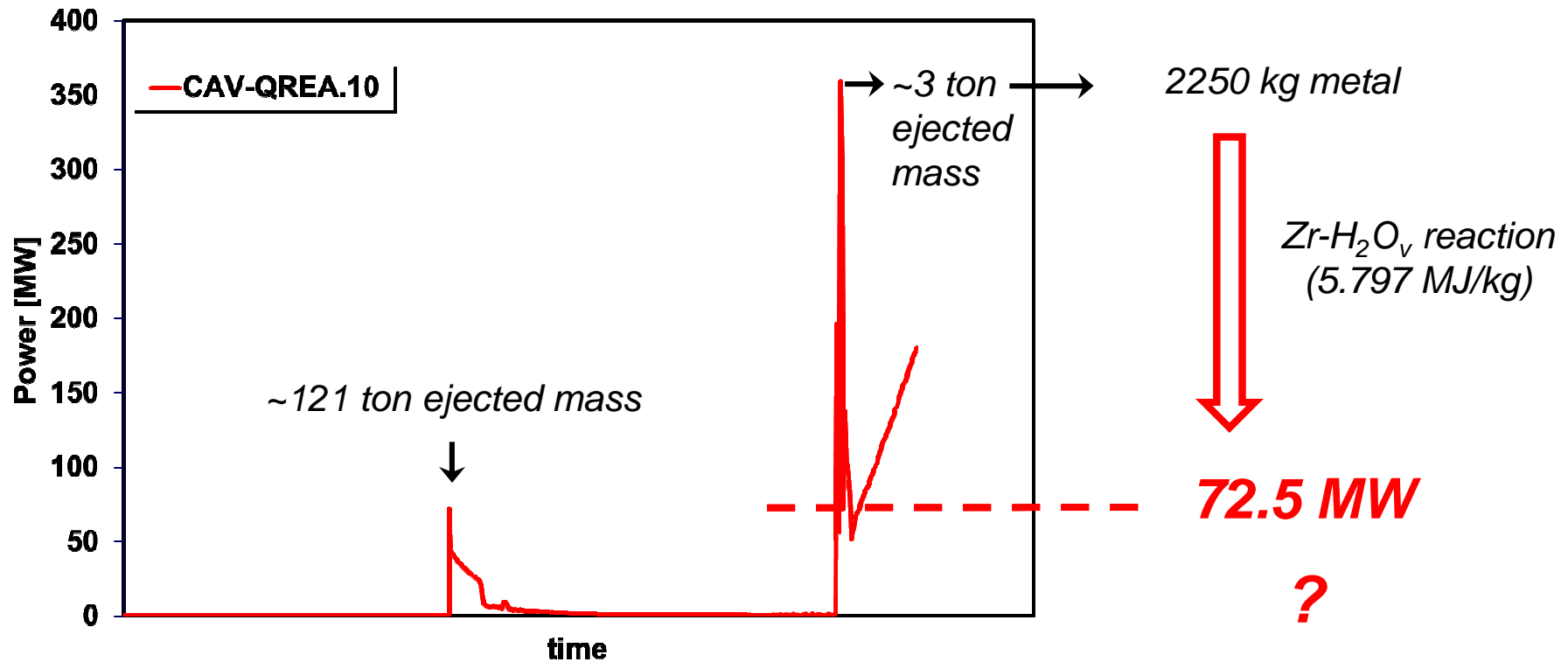
Mass in cavity mixing layer





Modeling Cavity: ☒ CAV Overfilled

Heating rate by chemical reactions

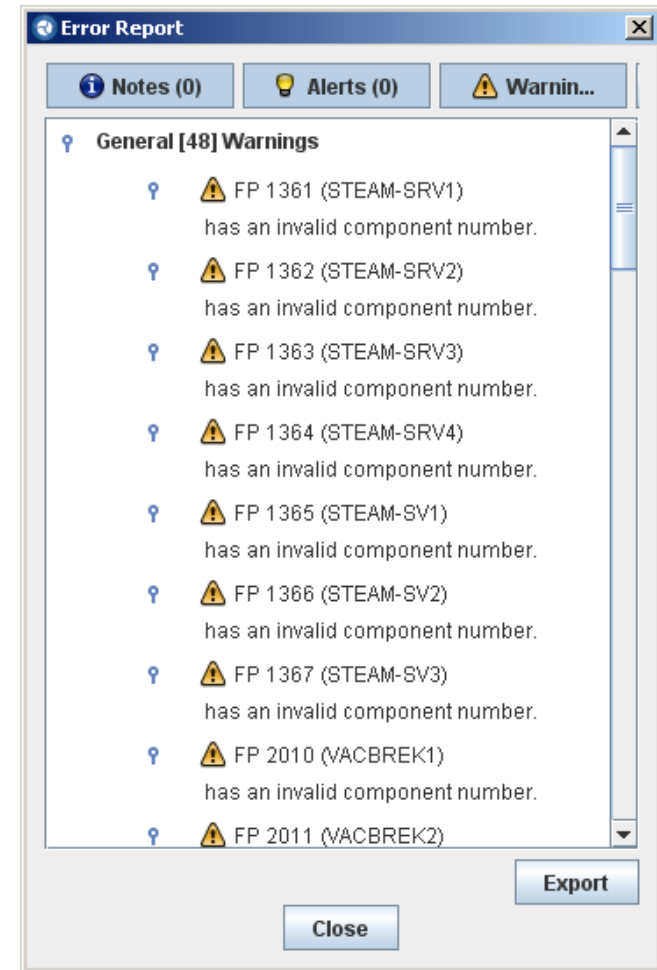




User's tools: SNAP

✔ SNAP: checking tool for input debugging & input development

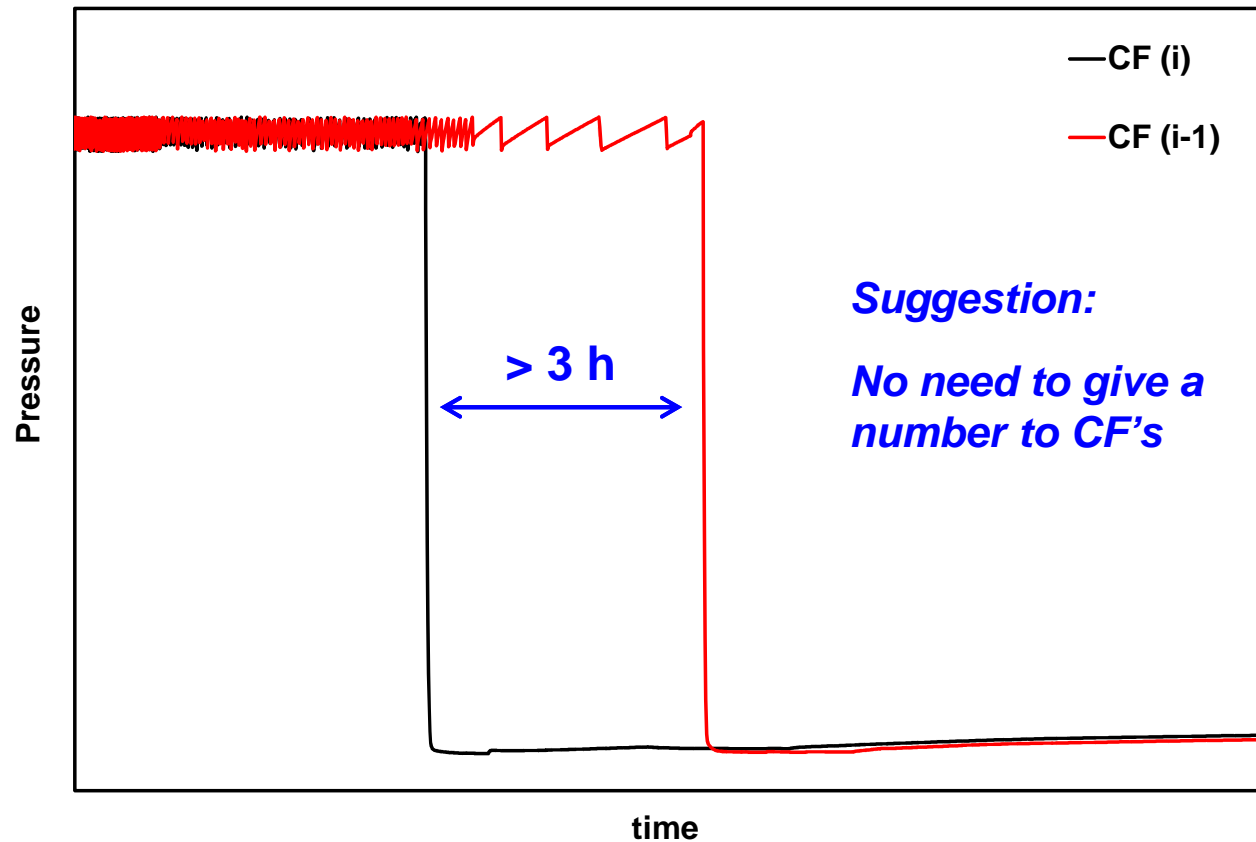
- **Importing an input:**
 - Alerts, Warnings & Errors besides MELGEN
 - Number of Flow Paths
 -
- **Activating a new package (ex. RN)**
 - Useful template
- **Paying attention to CF**
 - Reorders the input by component number





User's tools:

- **Reminder of the relevance of the CF's order**
 - MELCOR evaluates CF's in the order they are input





User's tools: diagnostic messages

Lack of knowledge

- **High frequency message (> 10000 times)**

<Diagnostic Message> Time= 5.1903E+01 Dt= 1.0000E+00 Cycle= 130 (CVH)
 CVHMOM: ERROR IN SOLUTION OF FLOW EQUATIONS
 SPARSE MATRIX SOLVER RETURNED WITH ERROR NUMBER 2

Trying to find solutions:

1. Revision of FL definition: unknown parameters → default values
2. Modified CVH_SC card:

!	nstr	nnnn	value	na
	1	4415	2000	3
			(500)	



'maximum number of iteration permitted for the iterative solver'

- Similar results
- 181 mssg occurrences
- $1.3 \times t_{exec}$

Any other way?





User's tools: diagnostic messages

- **Low frequency message (~100 times at core degradation)**

<Diagnostic Message> Time= 2.8091E+05 Dt= 1.0224E+00 Cycle= 213051 (COR)

VIEW FACTOR ERROR IN CORVF

SUM OF VIEW FACTORS EXCEEDS UNITY FOR SURFACE CLAD IN CORE CELL 309

<Diagnostic Message> Time= 2.8120E+05 Dt= 6.3953E-01 Cycle= 213935 (CVH)

Error in equilibrium thermo routine CVTWGE

Called from CVTNQE for Volume CHAN352

What to do with transient mssgs?





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Thank you!



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