



# CMS GEM SERVICES: COOLING

P. Tropea – CMS Gem Workshop III, 18-20 April 2012



# GEM Cooling

## What?

Chamber on-board cooling design & performances are described in Antonio and Andrey presentations.

34 W per chamber, distributed on 30 VFAT (1W each) and 1 HV divider (4 W).

Typical need of about 1.7 l/min for each chamber in order to extract the power and keep very low  $\Delta T$  on water along the circuit, as indicated by CFD studies.

## How much?

36 double chambers for each station of GE1/1 (on CMS nose)

18 double chambers for each station of GE2/1 (on YE1)

Power to be cooled on each station:

GE1/1: 2.45 kW +z, 2.45kW -z

GE2/1: 1.22 kW +z, 1.22 kW -z

Total power: 7.35 kW

## How?

Existing cooling system on CMS Endcaps, with demineralized water: can we re-use it?

# The CMS Endcap cooling circuit

## Existing systems on YEs

Demineralized water cooling system dedicated to copper circuits

Specification:

Total flow: 1200 l/min

Total power: 170 kW as per spec EDMS 440027

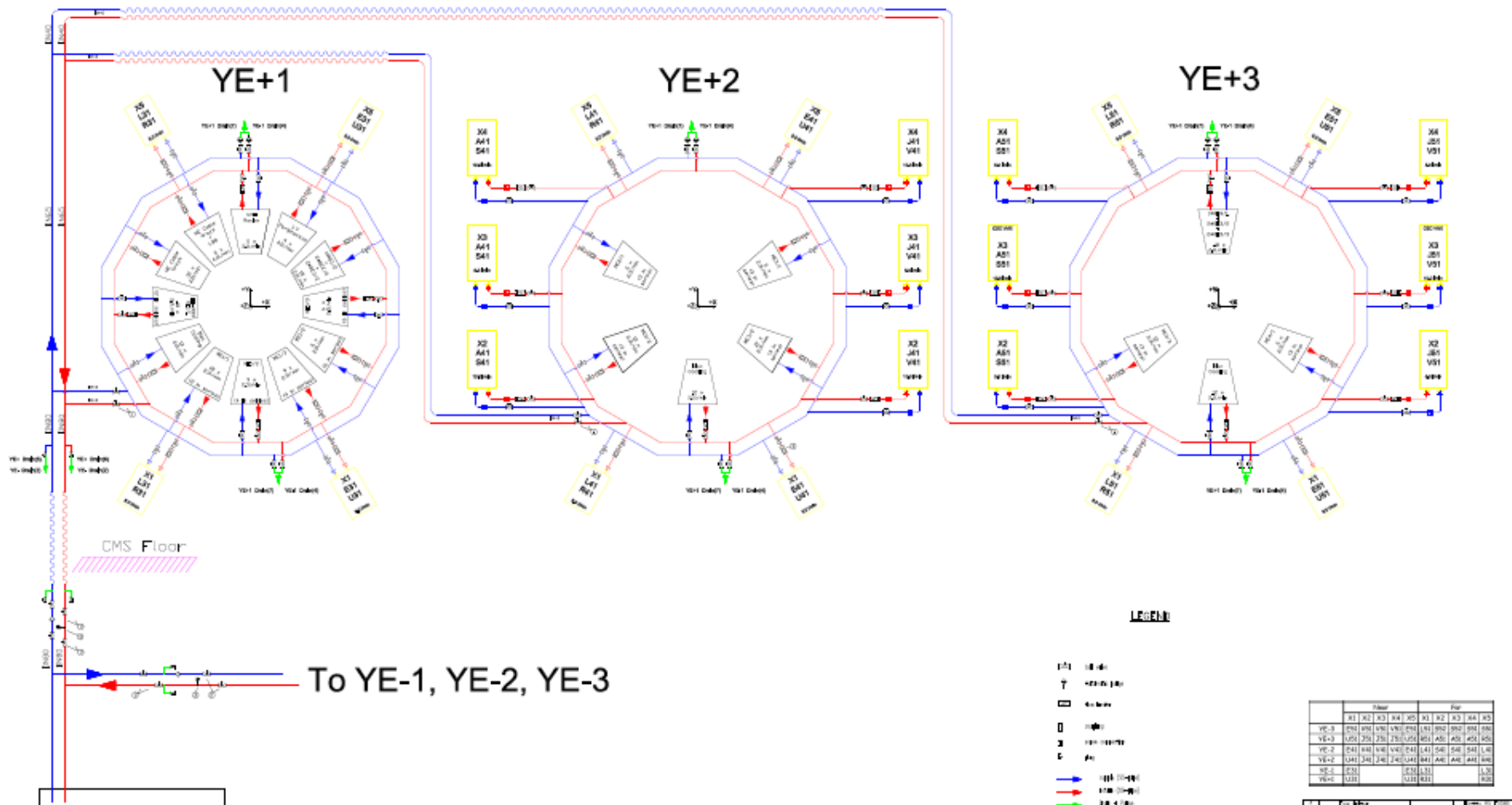
Pureness of water: demineralized water, 0.5 mm strainers

Some margin exist on the total available flow and power, to be verified by tests!

This circuit feeds, on all YEs:

- RPC chambers
- CSC chambers
- HE-RBX
- LV cable trays
- Disk cooling
- HE cable trays

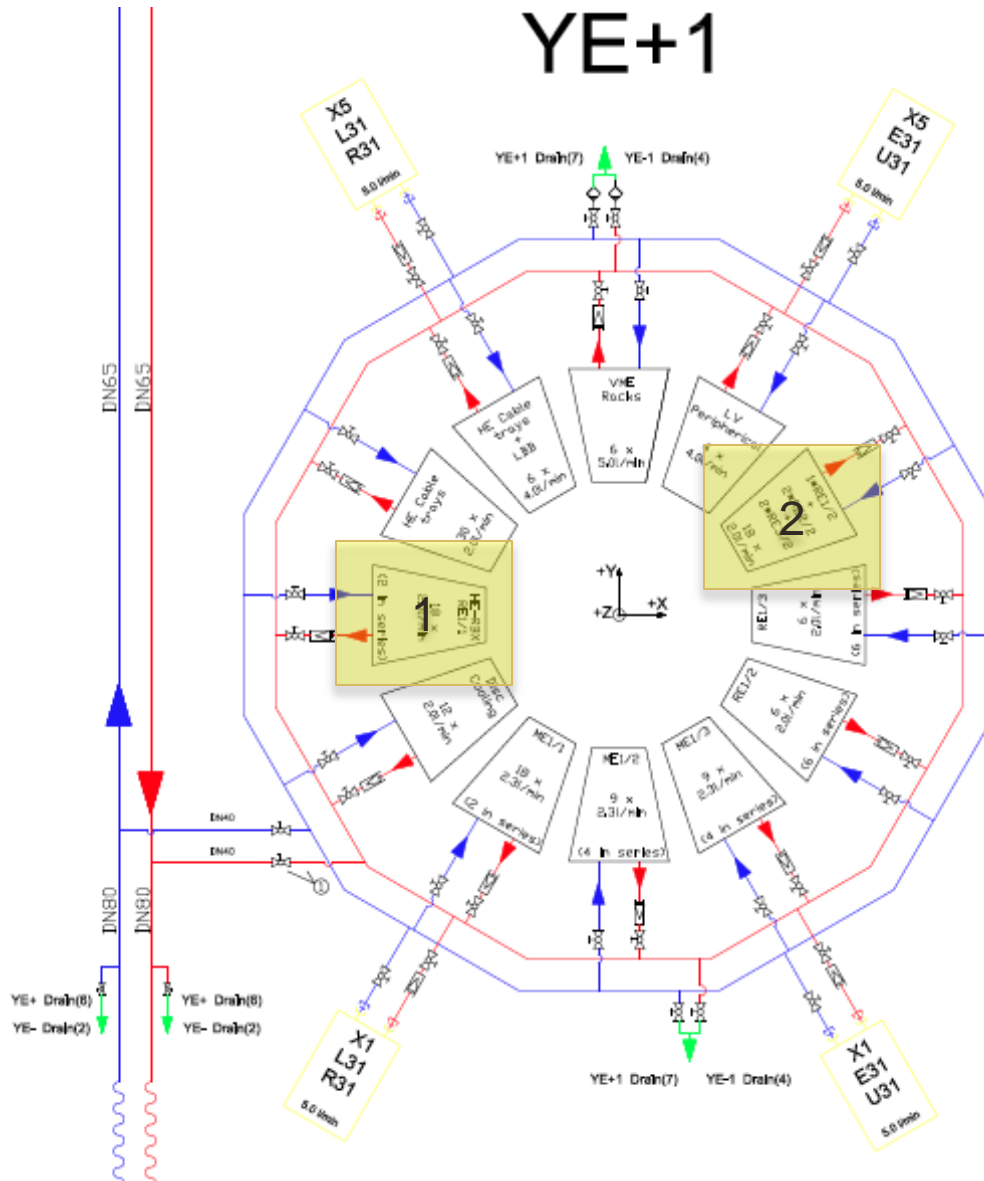
# Schematics of the existing cooling system



Schematics based on design (V. Delachenal): to be updated with as-built and measurements of performances (1 flow meter on each end)

THE ENDCAP COOLING CIRCUIT

# YE1 cooling manifold



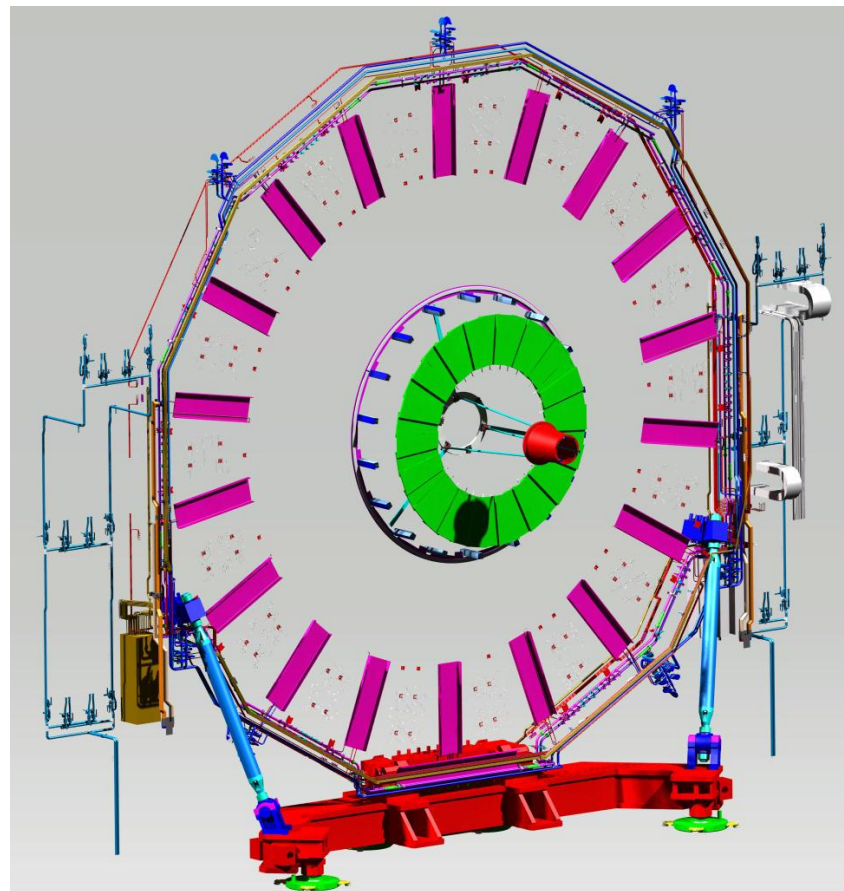
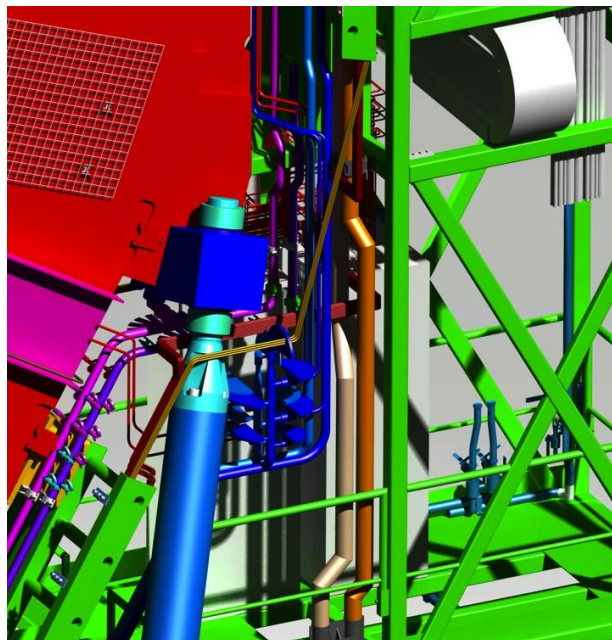
- 1) GE 1/1: 36 double chambers to be connected to the 18 cooling loops now in use for HE-RBX only – 2 chambers in series on each loop
- 1) GE 2/1: 18 double chambers to be connected to the 18 cooling loops now in use for RE 2/2 and RE 2/3 chambers (on each loop: 1 GE 2/1, 2 RE 2/2, 2 RE 2/3 in series)

Flow rate is regulated to 2 l/min on each circuit

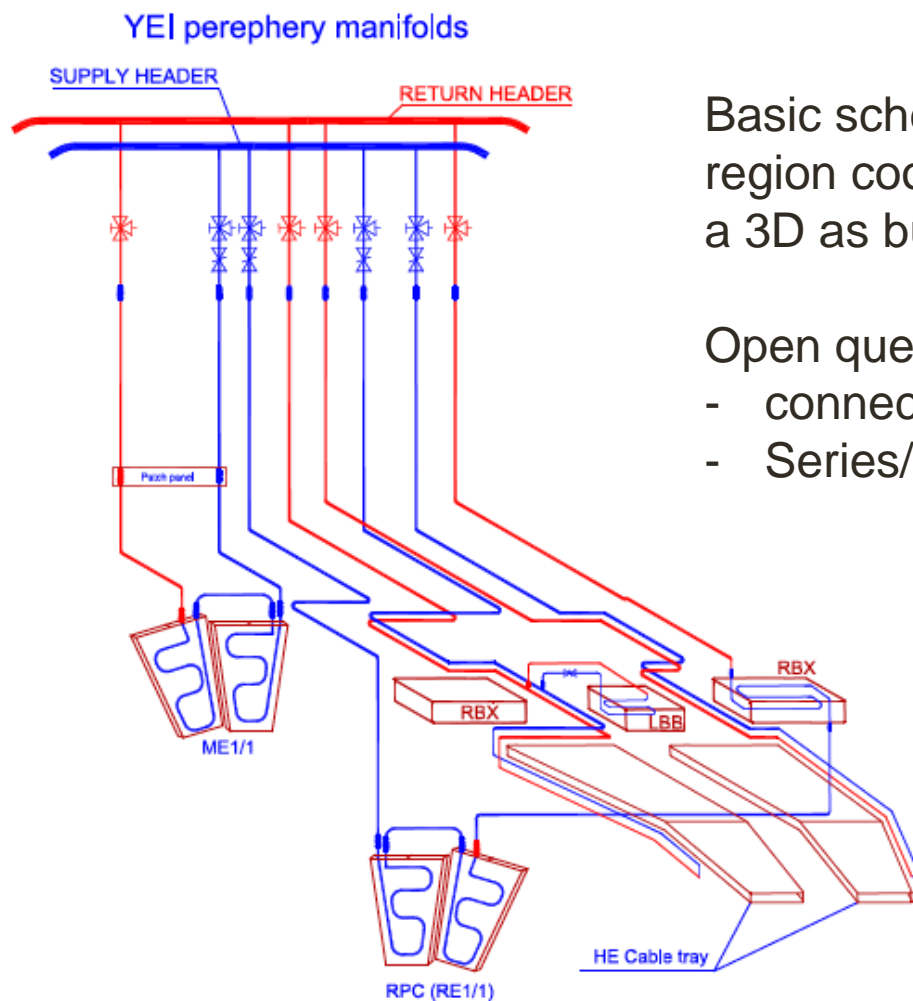
## YE1 cooling manifold and available ports

YE1 manifold:  
3D “as built” model by Boki  
Based on measurements on the  
peripheral connections & PSL cad  
drawings

Missing data on the part after the  
manifold: model to be completed  
after LS1 measurements



# GE 1/1 manifold



Basic schematics existing for the nose region cooling: to be transformed into a 3D as built model

Open questions:

- connectors?
- Series/parallel of chambers?

# Outlook

- 1) Finalize the flow needs for the different chambers: optimization of cooling contacts, tests. Series/parallel feeding of chambers to be defined
- 2) Finalize the on-board design, based on fluid velocity ( $<1.5$  m/s) & water quality (no pipes smaller than 6 mm ID, no Al or brass components can be foreseen)
- 3) Specify the max flow rate needed for the full YE cooling circuit and compare with max flow available on pump (keeping in mind an additional 5% flow on the Endcap circuit already added with respect to design by RE4 station)
- 4) Study the integration and connectivity system for the new chambers (profit of LS for on-site measurements and development of 3D as built model)