Update on RICH status

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The MAPMT status
The RICH-1 gas radiator status
The gas-chromatography results
The Hbrid PDs stability during the run
RICH surveying
The (n-1) “double peak” studies
MAPMTs status

In 2018 the RICH will operate with N2 as radiator and MAPMTs only as detectors.

The MAPMT system needs minor fixing of HV and CMAD problems. Intervention foreseen in March.

New LV power supply bought: will be prepared as spare.

24 new fibers bought: they are in bundles of 6.
In 2021 the RICH should operate with C\textsubscript{4}F\textsubscript{10} as radiator and all detectors

We need \(\sim 1500\) kg of C\textsubscript{4}F\textsubscript{10}

About 700 kg of “clean” C4F10 are presently in the COMPASS tank.

\(\rightarrow 800\) kg of clean C\textsubscript{4}F\textsubscript{10} have to be provided.

We have \(\sim 400\) kg which cannot be cleaned with standard procedure

LHCb agreed to exchange them with equivalent amount of their (cleaner) gas

A market investigation allowed to find one producer:

F2 Chemicals confirmed the availability of C\textsubscript{4}F\textsubscript{10} for both small and large quantities.

They quoted a price of 110 £/kg for large quantities.

We are ordering 20 kg to F2 Chemicals at a price of 125 £/kg (half of the cost is covered by LHCb RICH colleagues)
The CERN VSC (Vacuum Surface and Coating) Group has performed a Gas-chromatography analysis of several C4F10 gas sample. A report will be provided soon. Some preliminary results have been anticipated by Benoit Teissandier and are presented here.

The main three peaks before the major C4F10 peak are:

- $\text{C}_3\text{F}_8$
- $\text{CF}_8\text{S}$
- $\text{C}_2\text{F}_6\text{S}_2$ ?
Identification: \( C_3F_8 \)

In this case the identification via comparison with the corresponding NIST database mass spectra is convincing.
Identification: $\text{CF}_8\text{S}$

In this case however the identification is less obvious. For instance: $m(\text{S}) = 32$ but also $m(\text{O}_2) = 32$. A molecule as $\text{CF}_8\text{S}$ is likely to absorb in the far UV: it could be responsible for our problems.
Identification: $C_2F_6S_2$

Another molecule containing sulfur is strongly suspected: $C_2F_8S_2$

In this case the identification is more ambiguous.
In the tail of the main peak of $C_4F_{10}$ other suspected contaminants appear.

The question marks indicate ambiguous interpretations.
More Sulfur compounds, C-H, NO,...

We decided not to proceed with the cleaning of this gas
- 12 Detectors 6144 Chs each.
- The average of the 6144 $\sigma$s is called $<\sigma_{\text{Det}}>$.

- MWPC $\sim$ 500 e$^-$
- Hybrid $\sim$ 700 e$^-$
**MWPCs with CsI and Hybrids**

In 2017 we collected data in nominal conditions

Micromegas performed nicely, despite few shorted pads (25 for a total of ~20k)

- 16 pads were shorted at the beginning of the run
- 9 new shorts appeared during the data taking
- Filters installed on Aug 30 on PD1 and PD5 lines
- 1 new short appeared on PD1 on October 8

### Data Collection Table

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<th>Date</th>
<th>PD1</th>
<th>PD2</th>
<th>PD5</th>
<th>PD6</th>
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</table>

### Filter Information

- **Swagelok 316 stainless steel particulate filter 7 μm pore size**

### Development of Short

*Filter in gas input of PD1 & PD5 inserted on 30-Aug*
Rate of sparks in THGEMs

Spark rate during the data taking

Spark = I > 23 nA
Gain stability

P T corrections were essential to guarantee a constant gain

- Typically two runs/day, in the morning and in the evening during coolest and hottest periods.
- 155 processed runs with no problems chosen for this analysis.
- Average gain for each high voltage sector was calculated.
- Voltage correction:

\[ V = V_0 (1 + C) \]

where \( C = 0.5 \times \left( \frac{P}{P_0} \times \frac{T_0}{T} - 1 \right) \)
Detector Gain variation over time

- **PD6**
  - Effective Gain vs Run No
  - Points colored by PD Id:
    - PD650
    - PD651
    - PD652
    - PD653

- **PD5**
  - Effective Gain vs Run No
  - Points colored by PD Id:
    - PD550
    - PD551
    - PD552
    - PD553

- **PD2**
  - Effective Gain vs Run No
  - Points colored by PD Id:
    - PD250
    - PD251
    - PD252
    - PD253

- **PD1**
  - Effective Gain vs Run No
  - Points colored by PD Id:
    - PD150
    - PD151
    - PD152
    - PD153
Gain Stability with PT correction
Gain Stability with PT correction

PD6S0
\[ \sigma / \text{Mean} = 3.7\% \]

PD1S3
\[ \sigma / \text{Mean} = 6.3\% \]

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<tr>
<th>JURA</th>
<th>Average Effective Gain</th>
<th>SALEVE</th>
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<table>
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<tr>
<th>JURA</th>
<th>Sigma of the Effective Gain distribution</th>
<th>SALEVE</th>
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<tr>
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RICH surveying

Measurements performed by Pascal Sainvitu on January 23 -26. PDs targets, vessel and large frame targets + APV boards have been measured. Measurements to be completed this week and, for the part which needs Straws and DCs in beam position, as soon as they will be moved.
2017 - 2010 MAPMT comparison

(n-1) 2017 \(L_\pi / L_{\text{second}} > 2\)

Salève top

1119
\(\sigma = 92\)
(ppm)

Salève bottom

1117
\(\sigma = 112\)
(ppm)

Run 281012

(n-1) 2010

Salève top

1300
\(\sigma = 83\)
(ppm)

Salève bottom

1299
\(\sigma = 98\)
(ppm)

2017 shows 10% larger \(\sigma\) values than 2010
hints for remaining 2017 alignment problems

(n-1) 2017

Jura top
1124
σ = 102
(ppm)

Jura bottom
1114
σ = 109
(ppm)

(n-1) 2010

Jura top
1292
σ = 86
(ppm)

Jura bottom
1297
σ = 103
(ppm)
2017 tracks with $z_{\text{hit}} > z_{\text{RICH}}$

This provides further hints for remaining alignment problems.
Ten days ago we evaporated a new CsI sample and compared its QE with that of an old sample, exposed to air for long time.

The QE deterioration is more important for large wavelengths: aged CsI moves the spectrum of detected photons toward smaller wavelengths with respect to fresh CsI.

The refractive index would thus result to be higher.

This effect cannot be responsible for the discrepancy between \((n-1)\) of hybrid and MWPC.