

EEE Upgrade

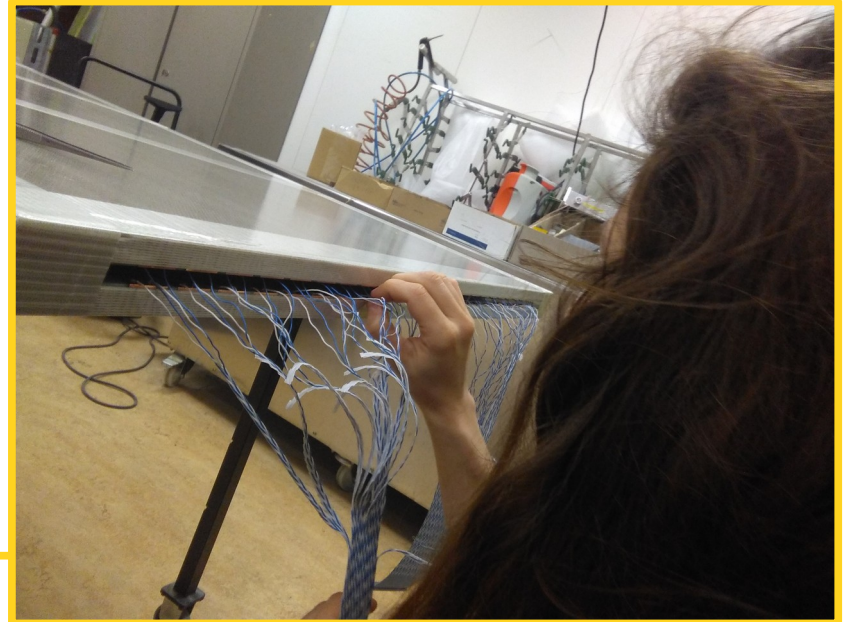
Status Update

# Tests during the constructions

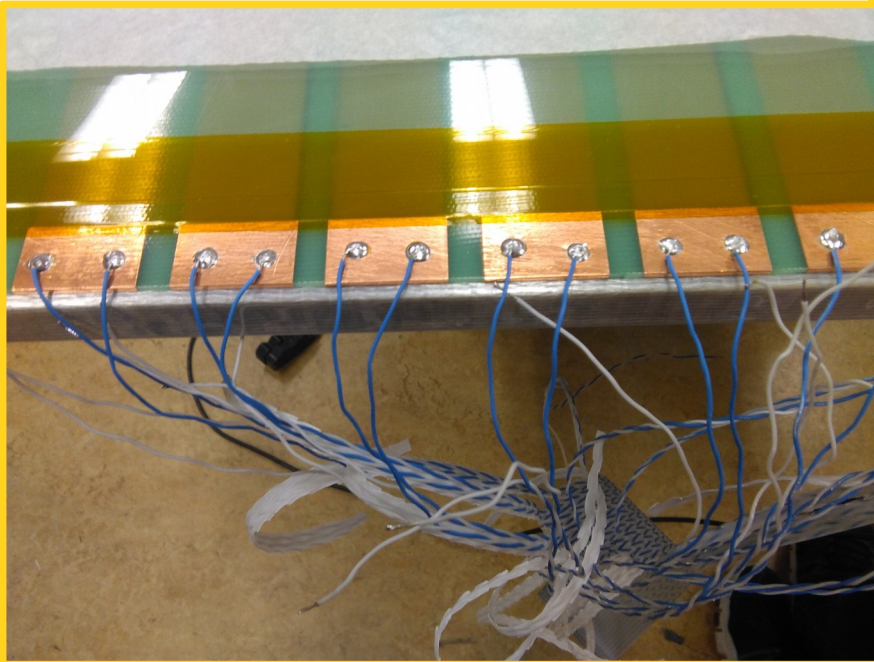
Flat cables are prepared in advance.

**Right orientation** is taught and checked during soldering.

**Unused** twisted pair are tied.



## Strips



Solderings are checked both for

1. **mechanical strength**
2. **right order**

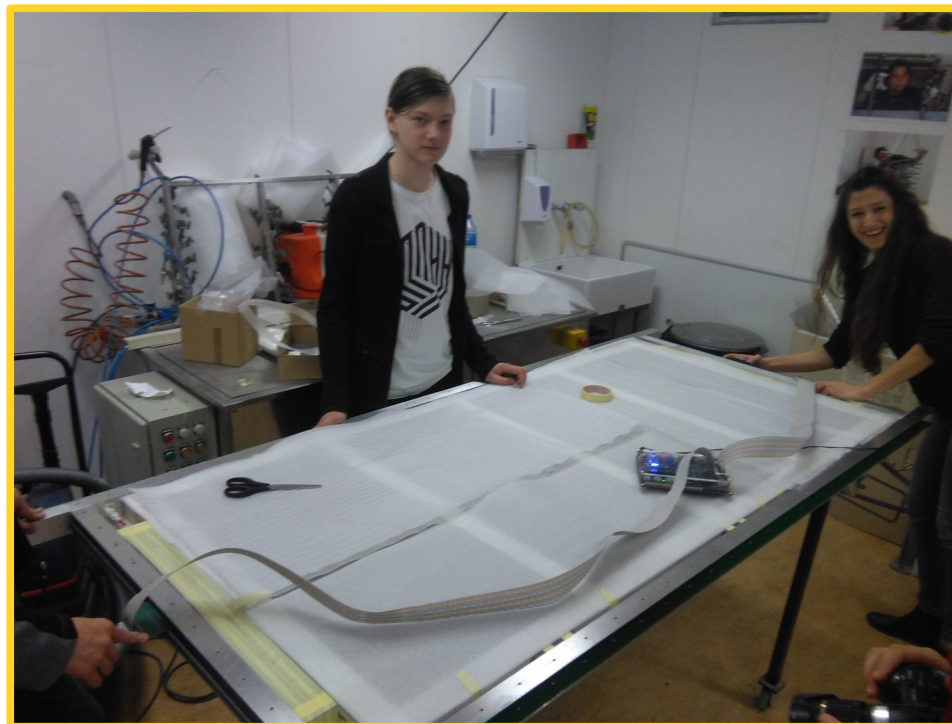
several times and by different people

# Tests during the constructions

Good electrical connections are tested by Bossini's Box on both sides.

The test is repeated:

1. with dummy connectors before closing the chamber
2. after laying the chamber within the chassis
3. after chassis closing

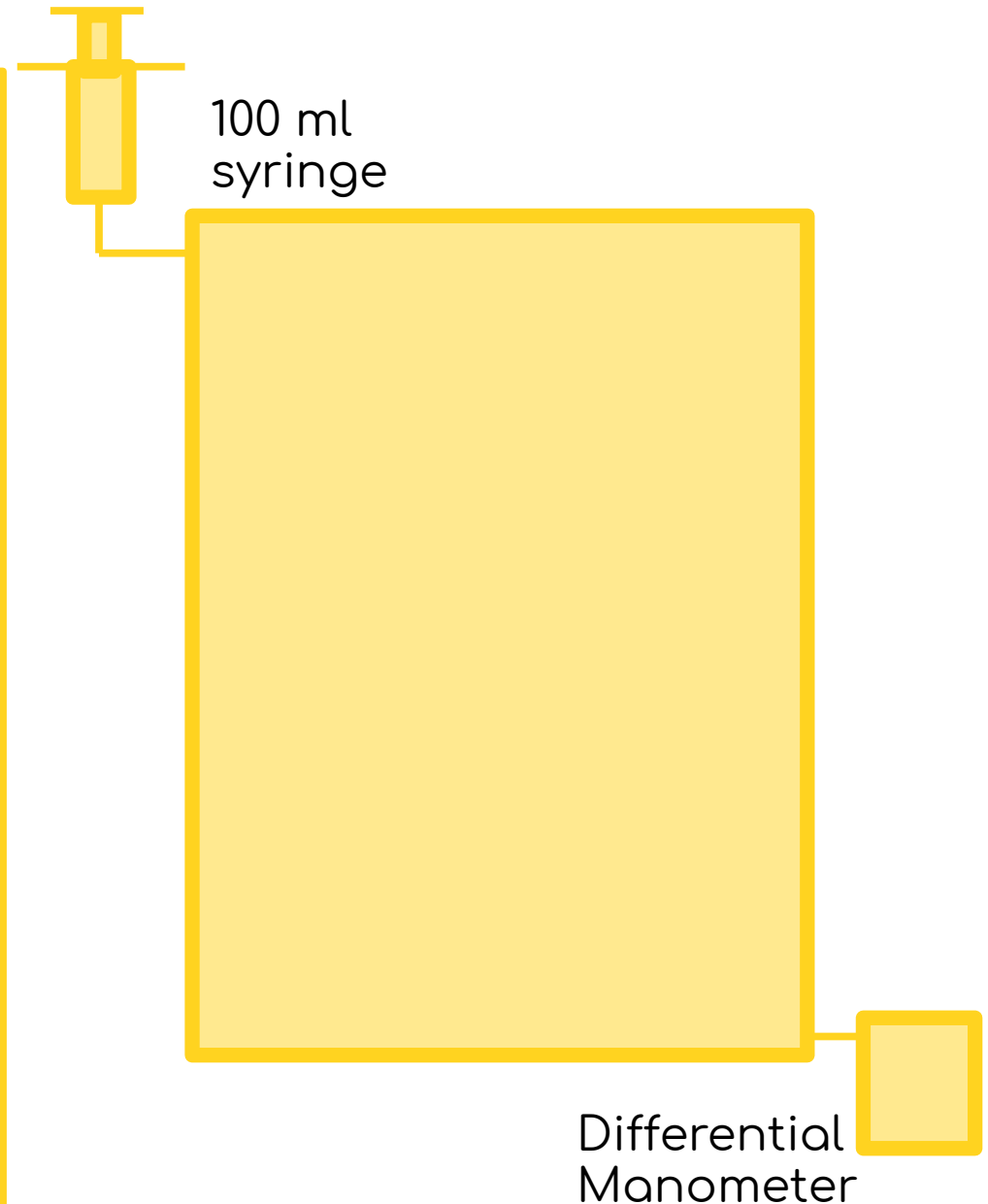


Strips

# Gas tightness tests

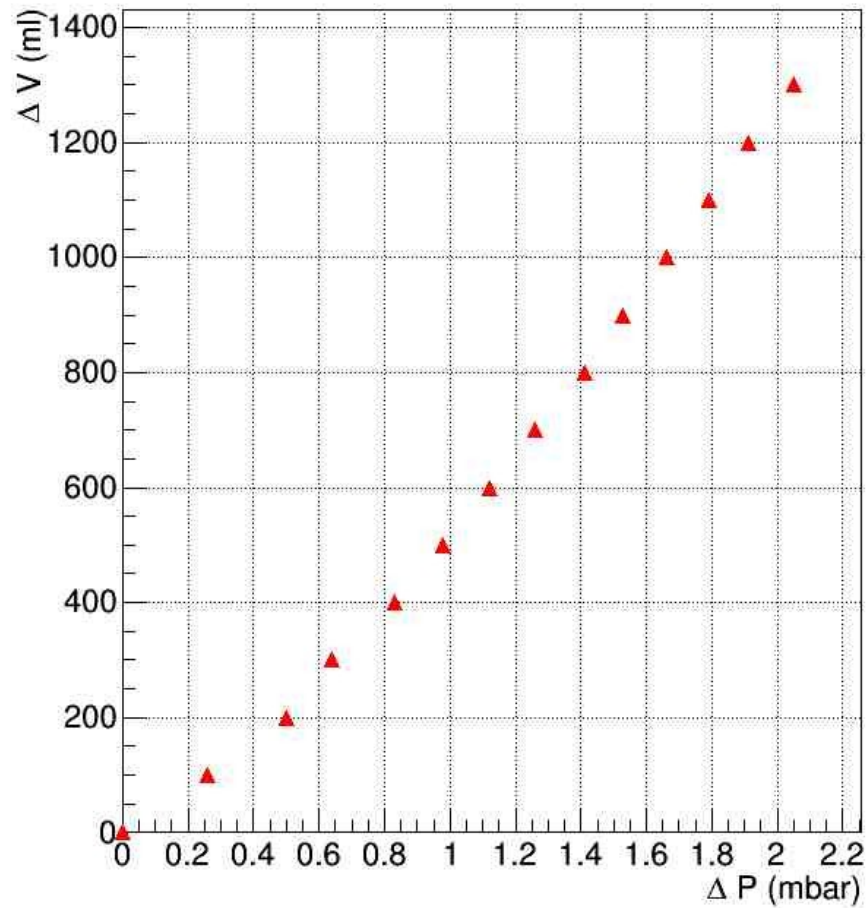
The gas tightness test is performed as follows:

1. 100 ml of air are injected during each step up to 2 mbar of overpressure
2. Volume vs Pressure curve is measured
3. the chamber is closed and the Pressure variation vs time is measured
4. corrections for volume variation due to Temperature are applied
5. the volume time derivative is the estimated leakage

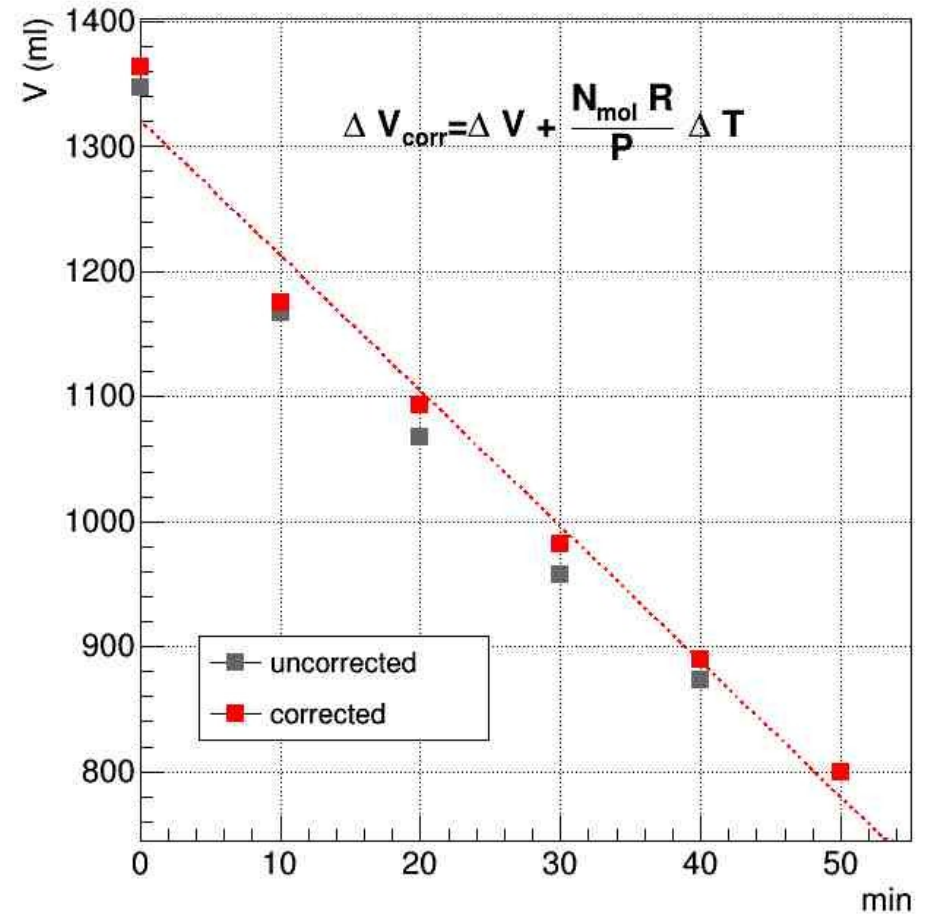


# Gas tightness tests

Calibration curve

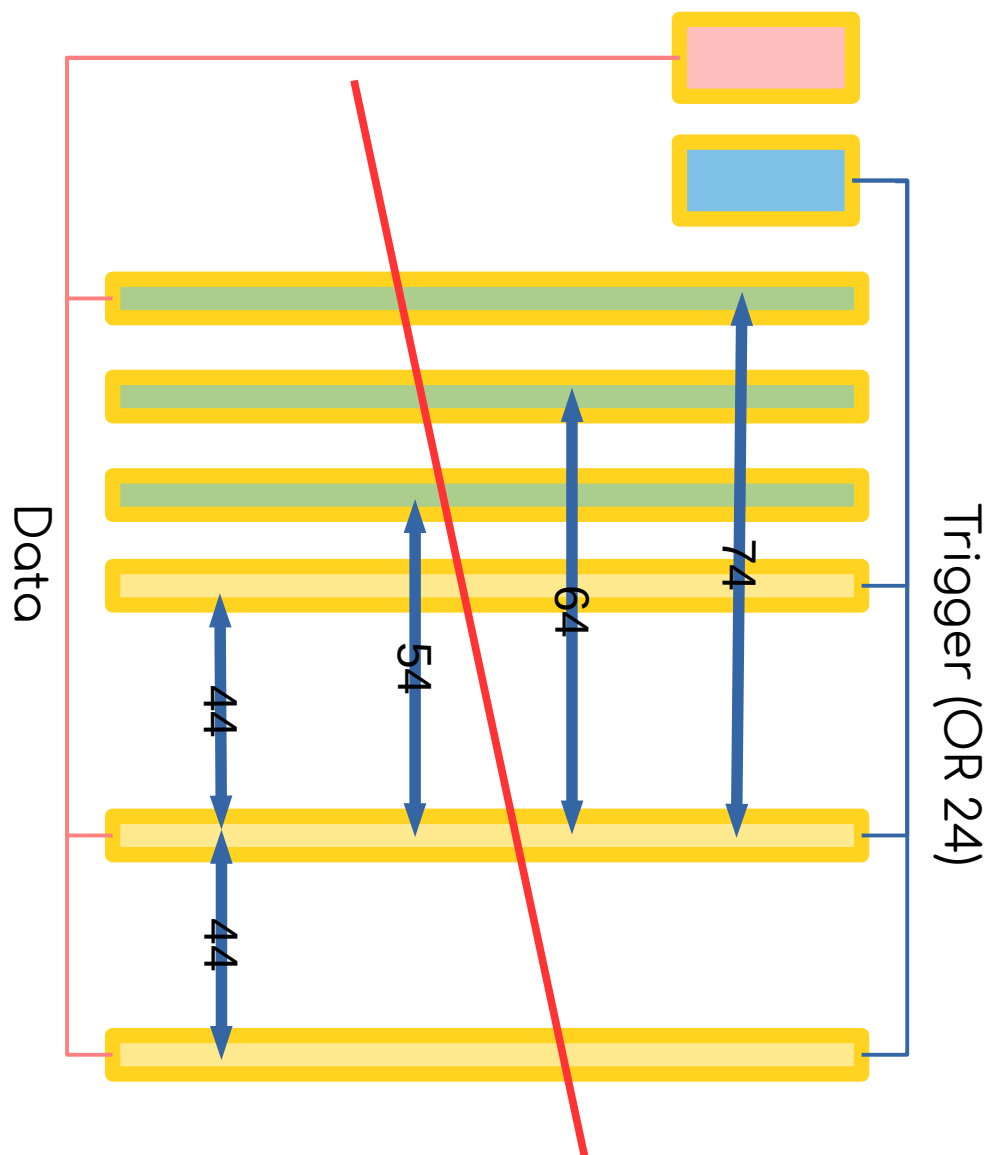


Temperature correction





# Efficiencies



Efficiency is measured for the 3 chambers laying on CERN-01 (green).

Chambers are fluxed 4 days before measurements.

The trigger is the CERN-01.

The data sent to DAQ come from CERN-01 bottom and middle chamber and one of the chambers under test.

By reconstructing tracks triggered by CERN-01, hits on tested chamber are searched.

# MRPCs construction & test update

# MRPC summary



## 13 new telescopes

last but not least  
the **Fermi Center** telescope

- **39 chambers**

+ **11 spare chambers**  
[ 7 delivered  
1 available  
3 under test]

**Total of 50 chambers**  
6 gaps/250 um technology



20170222001	LAMP-01
20170223002	LAMP-01
20170225003	LAMP-01
20170314004	GENO-01
20170316005	GENO-01
20170317006	GENO-01
20170405007	SIEN-02
20170406008	SIEN-02
20170407009	SIEN-02
20170425010	CARI-01
20170426011	CARI-01
20170427012	CARI-01
20170509013	TORI-05
20170510014	TORI-05
20170511015	TORI-05
20170523016	LODI-03
20170524017	LODI-03
20170524018	LODI-03
20170926021	CAGL-04
20170927022	CAGL-04
<b>20180221028</b>	<b>CAGL-04</b>

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**Total of 50 chambers**  
6 gaps/250 um technology



20171121025	BOLO-05
20171123026	BOLO-05
20171124027	BOLO-05

20190115037	BITE-01
20190117038	BITE-01
20190118039	BITE-01

20190130040	BRA-01
20190214041	BRA-01
20190215042	BRA-01

20190226043	CARC-01
20190227044	CARC-01
20190301045	CARC-01

20190312046	REGG-01
20190314047	REGG-01
<b>20170928023</b>	<b>REGG-01</b>

20180725034	CF
20180726035	CF
20180727036	CF

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the **Fermi Center** telescope

- **39 chambers**

+ **11 spare chambers**  
[ **7 delivered**  
**1 available**  
**3 under test**]

**Total of 50 chambers**  
**6 gaps/250 um technology**



20170719019	spare – ROMA-01
20170921020	spare – FRAS-01
20171026024	spare – COSE-01
20180222029	spare – REGG-01
20180227030	spare – SAVO-03
20180228031	spare – TRAP-01
20180320032	spare – CARI-01
20180322033	spare
20190315048	spare (to be retested)
20190410049	spare (under test)
20190411050	spare (under test)

# Issues found and solved – HV inversion

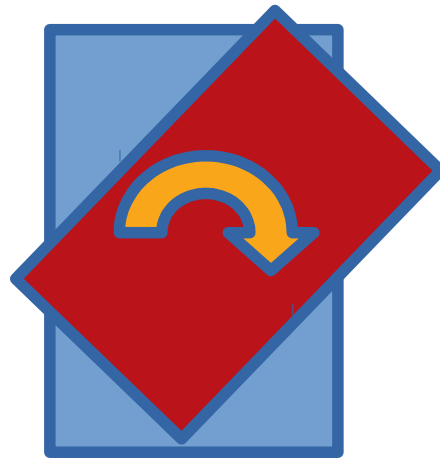
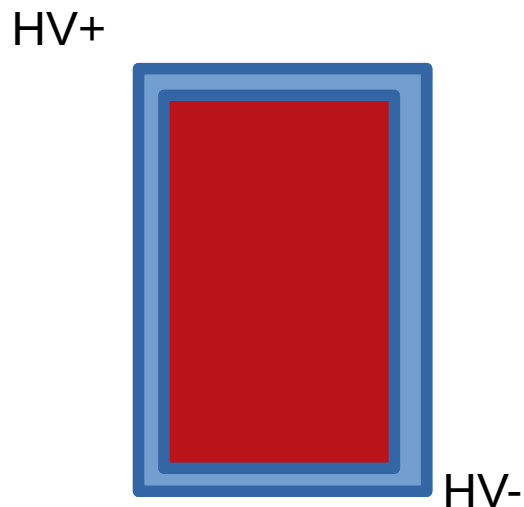
CH 36 was found with inverted HV

We found the problem was due to the new interface cards.

They are mounted 180 degrees w.r.t. previous ones.  
This correspond to and inversion of strips polarity

We asked to lay the chamber inside the chassis rotated  
by 180 degrees in order to solve the issue.

This worked



Ch **36-37-38-39**  
was found to be  
**correctly labeled** after the rotation

This is being a rule from now on

+

We found (and solved)  
**3 HV inversions** not related  
with new interfaces

# Issues found and solved

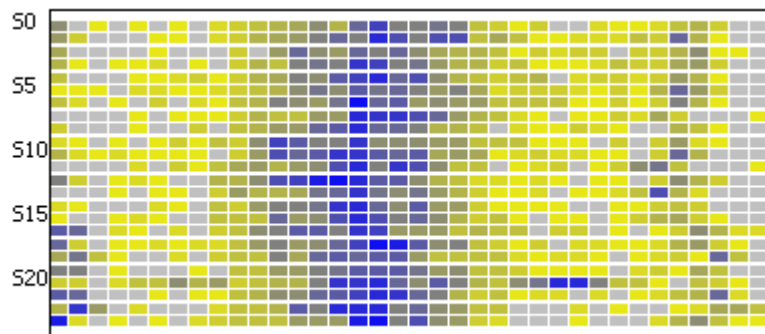
## – HV inversion – ch 48

CH 48 was tested in several configuration of

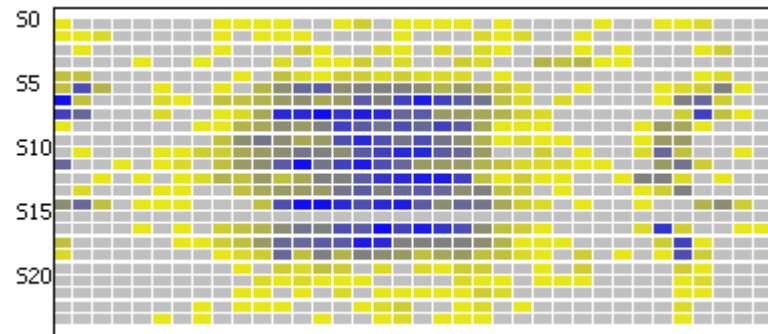
- HV polarity

- FEA connector mounting

Inverted HV

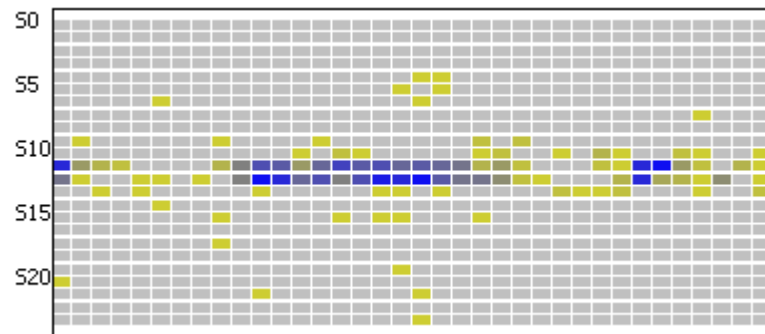


All V3

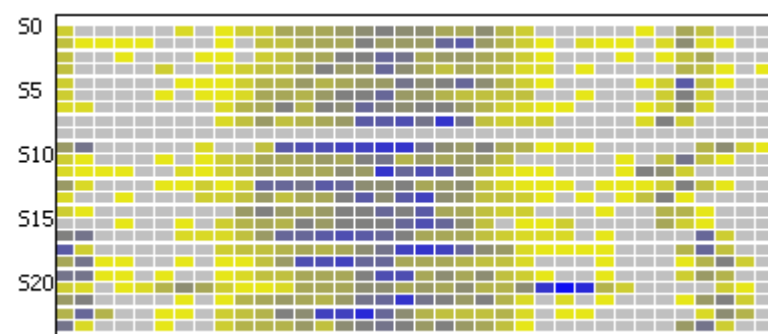


Eff~0.6

Mixed FEA config

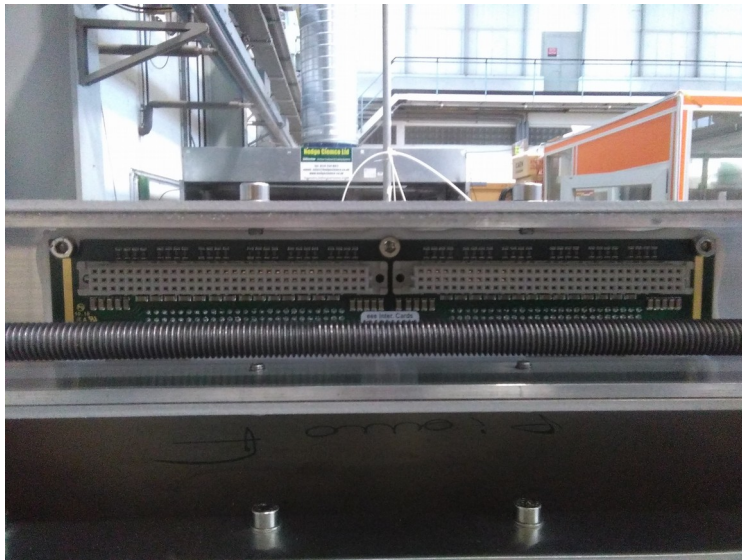


All V1



# Issues found and solved

- FEA mounting on new/old interconnections



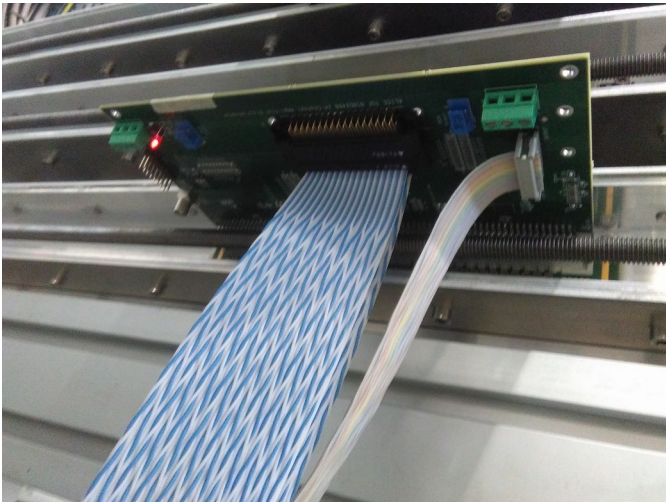
New interconnection cards are upside down mounted  
(look at the teeth)

The new cards will show  
the NUGENT connector on top



# Issues found and solved

- FEA mounting on new/old interconnections



On 300 um gap MRPCS  
the nugent connector  
shows on bottom

(plus also for  
250 um #chamber < 36)



The new FEA are just LEFT type  
When inserting the card type in DAQ

- V1 if #ch < 36 or 300 um gap

-V3 if #ch >= 36



# Issues found and solved

## – #42 issue

Ch42 was found with (non reproducible) strip connection

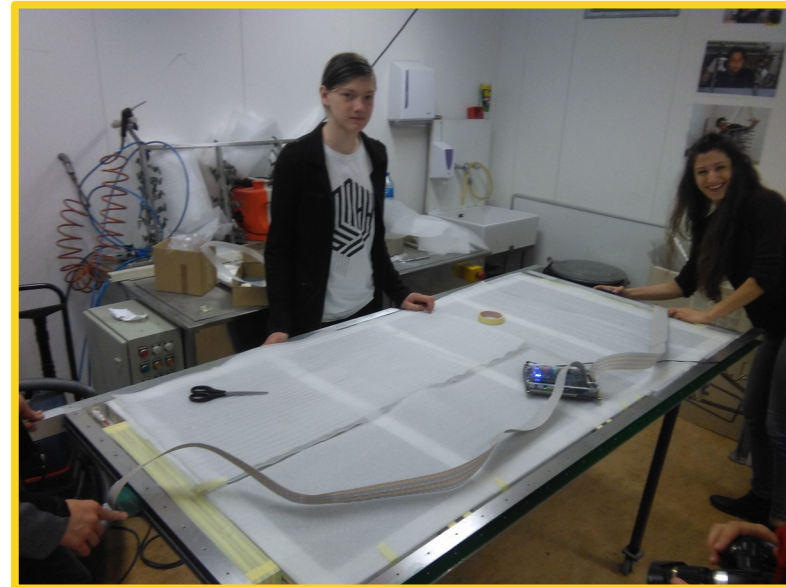
The Bossini Box test gave errors on ch #7 and #8

The connections were tested before and after interconnections with a tester

They were found working

When inserted in chassis and tested with Box, we got the error.

The chamber is dismantled and ch#43 is named 42 and delivered to Bra.



# Issues found and solved

## Lampedusa leakage

LAMP-01/02/03 were found highly leaking

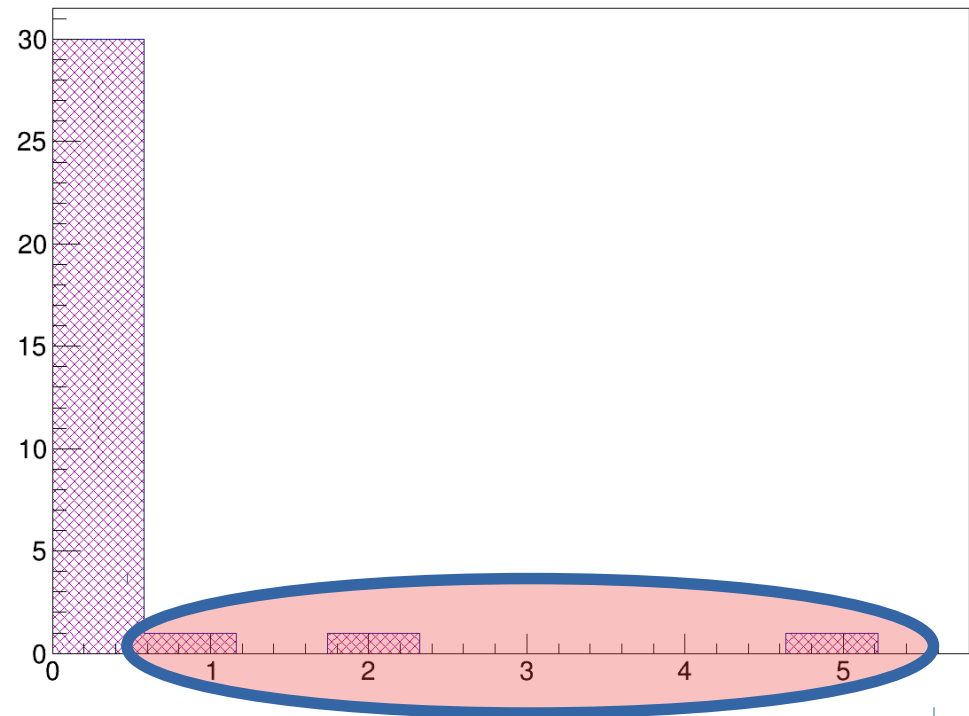
Maria Paola did again the measurements and found

01 ---> 0,36 l/h  
02 ---> 3,92 l/h  
03 ---> 0,49 l/h

Corrado's group investigated the issue and they opened the chamber with Roman

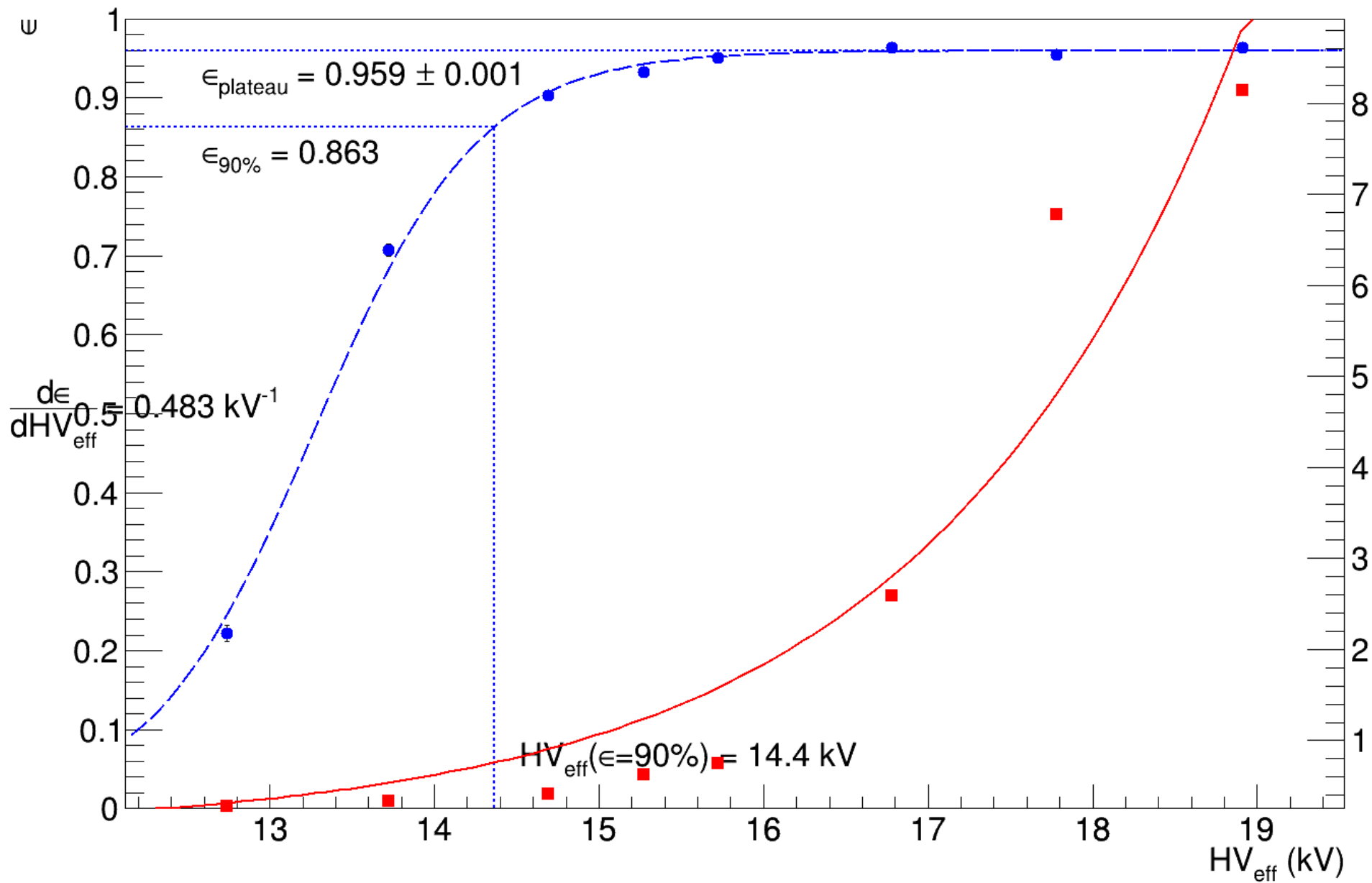
02 --> now is 0.47 l/h !

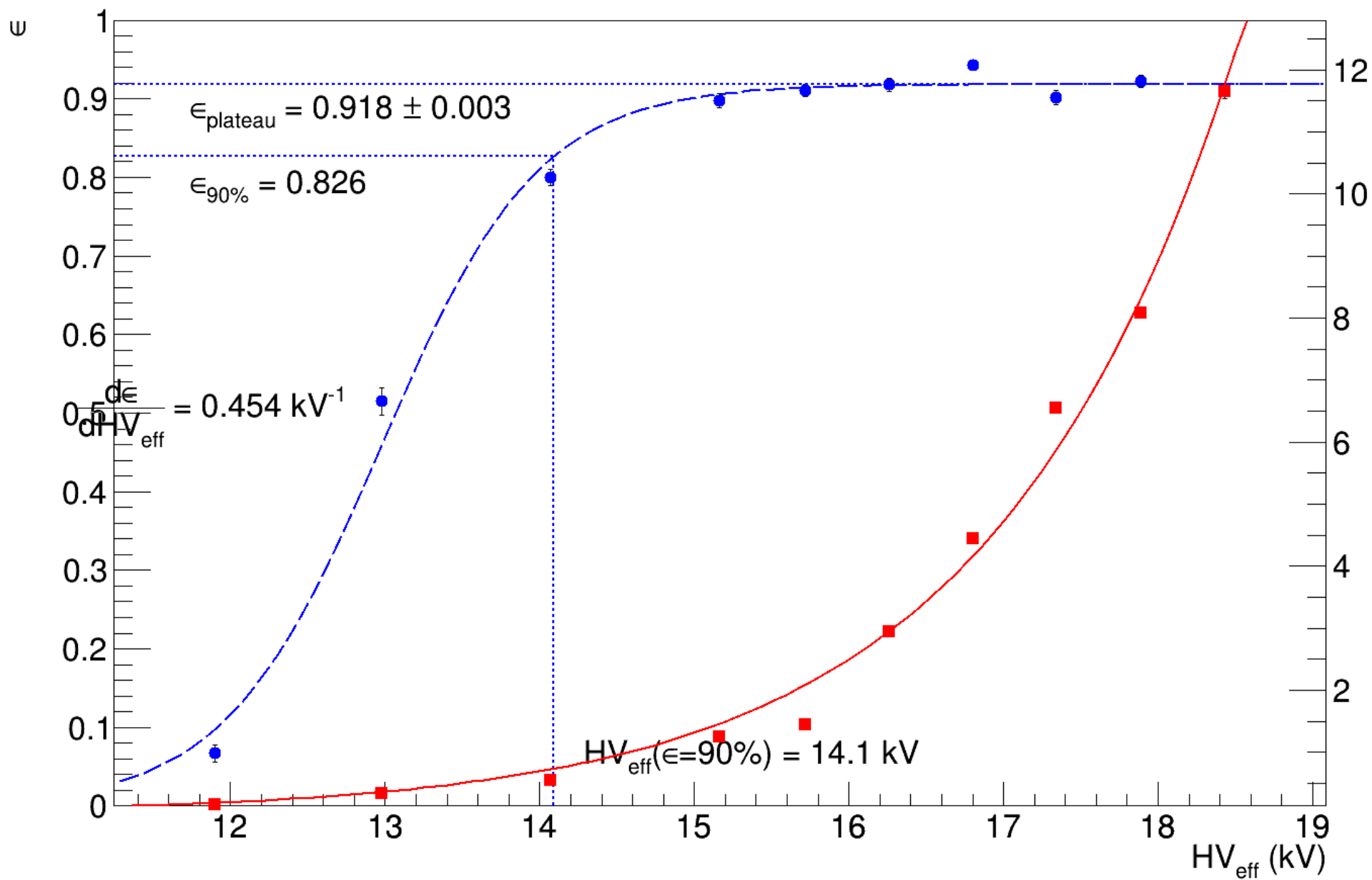
Gas tightness summary (l/h)

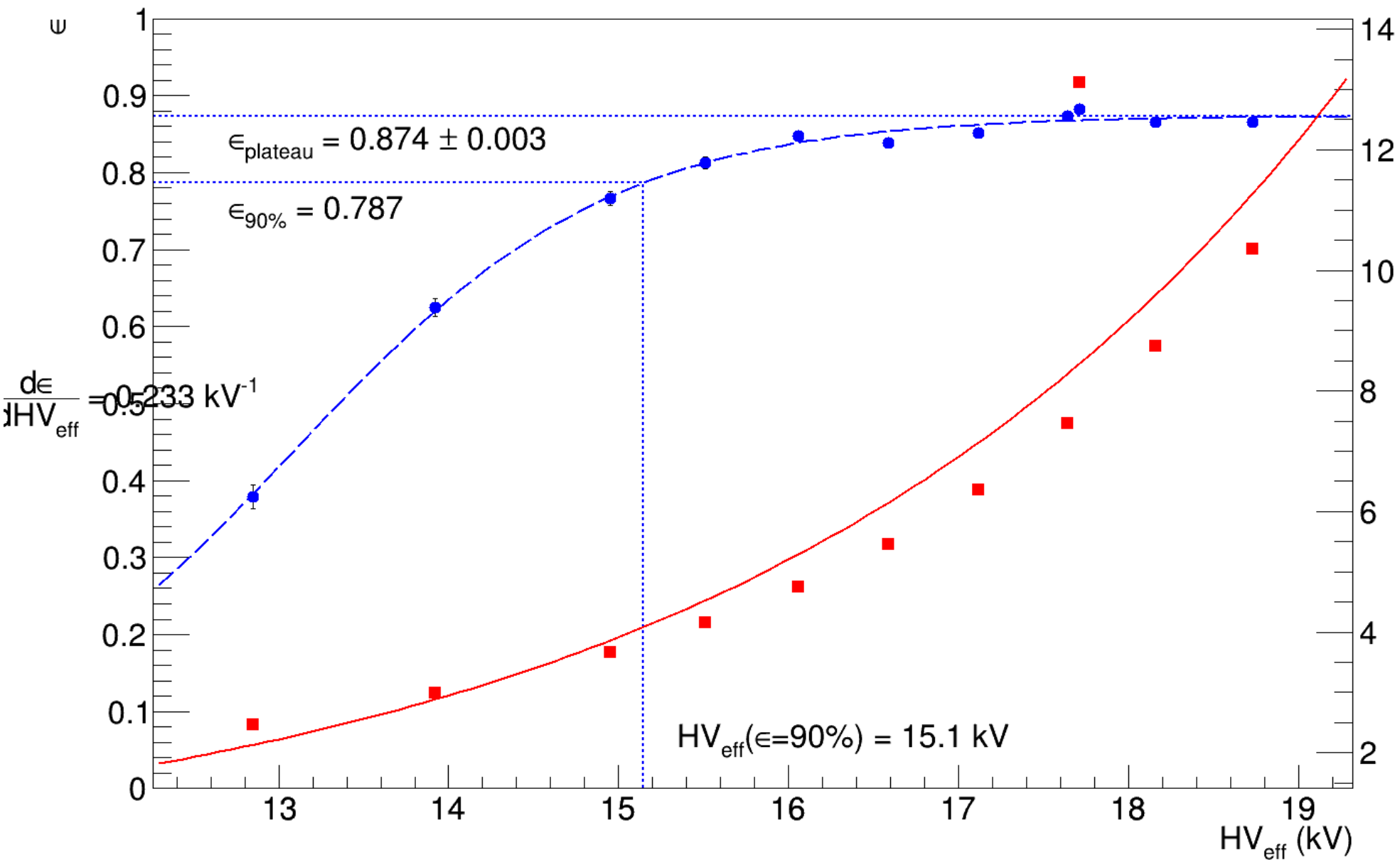


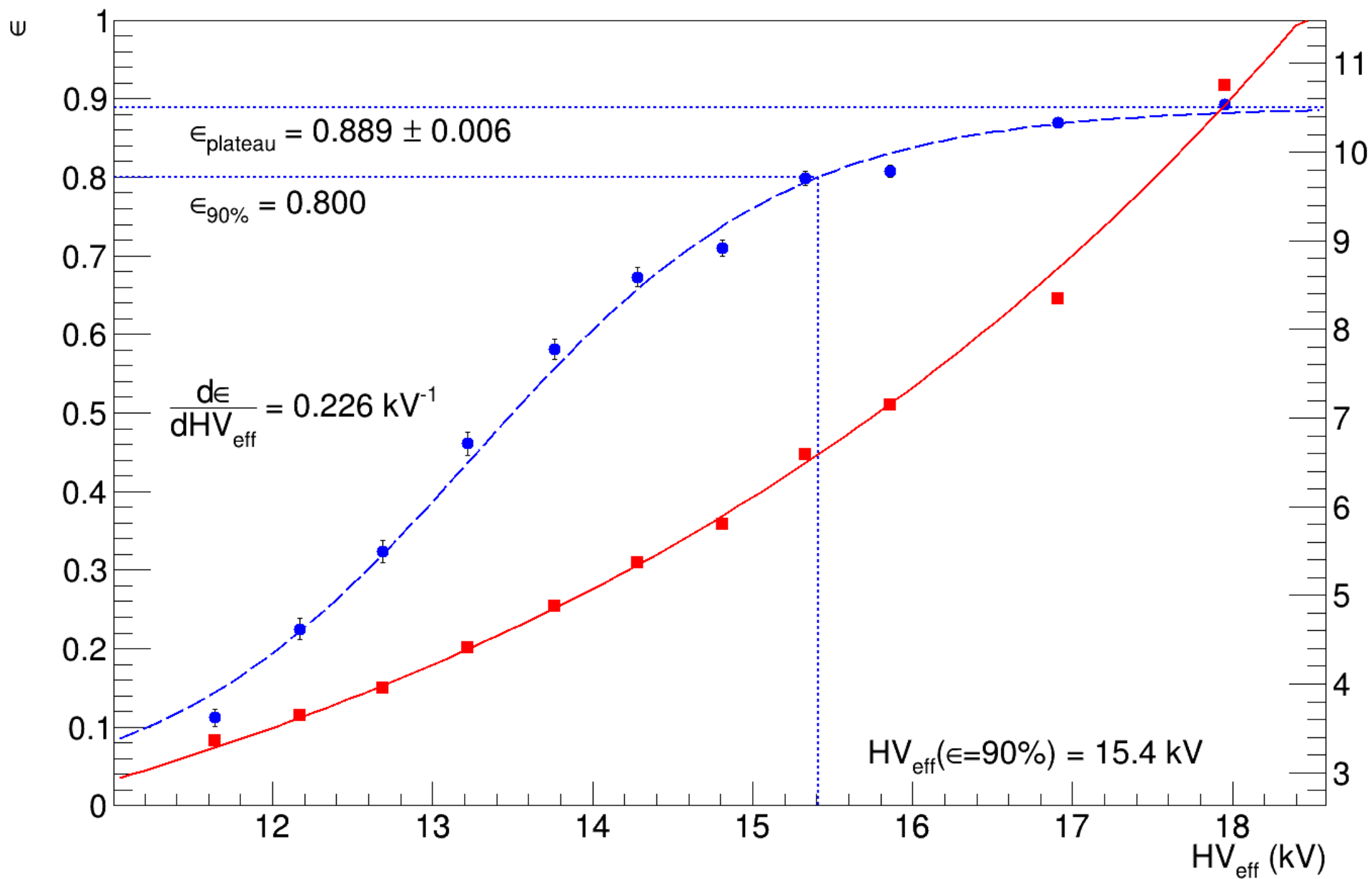
At the moment LAMP chambers are at UniCal Lab waiting for Lampedusa to be ready to receive them

# Stats and Criteria



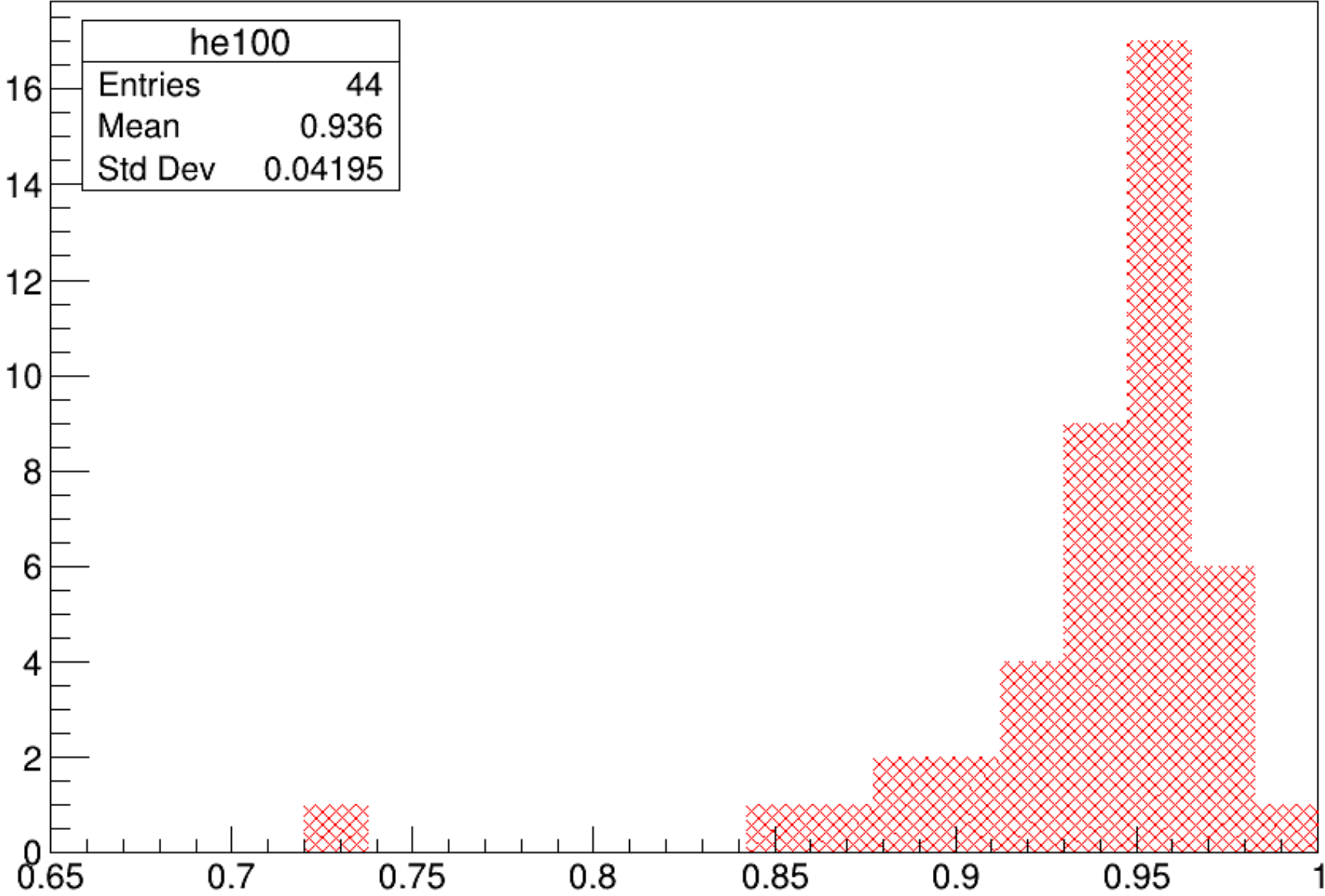




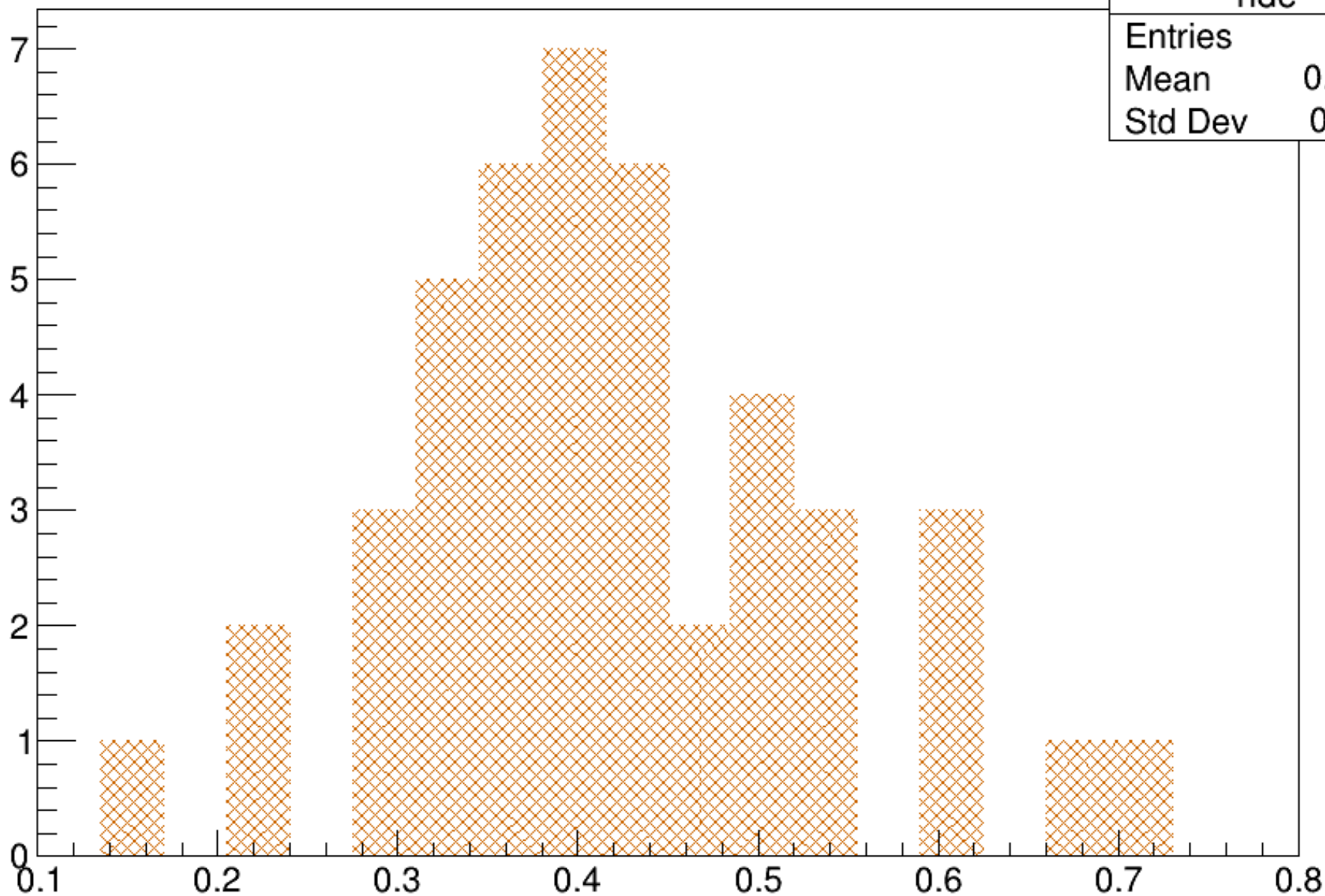




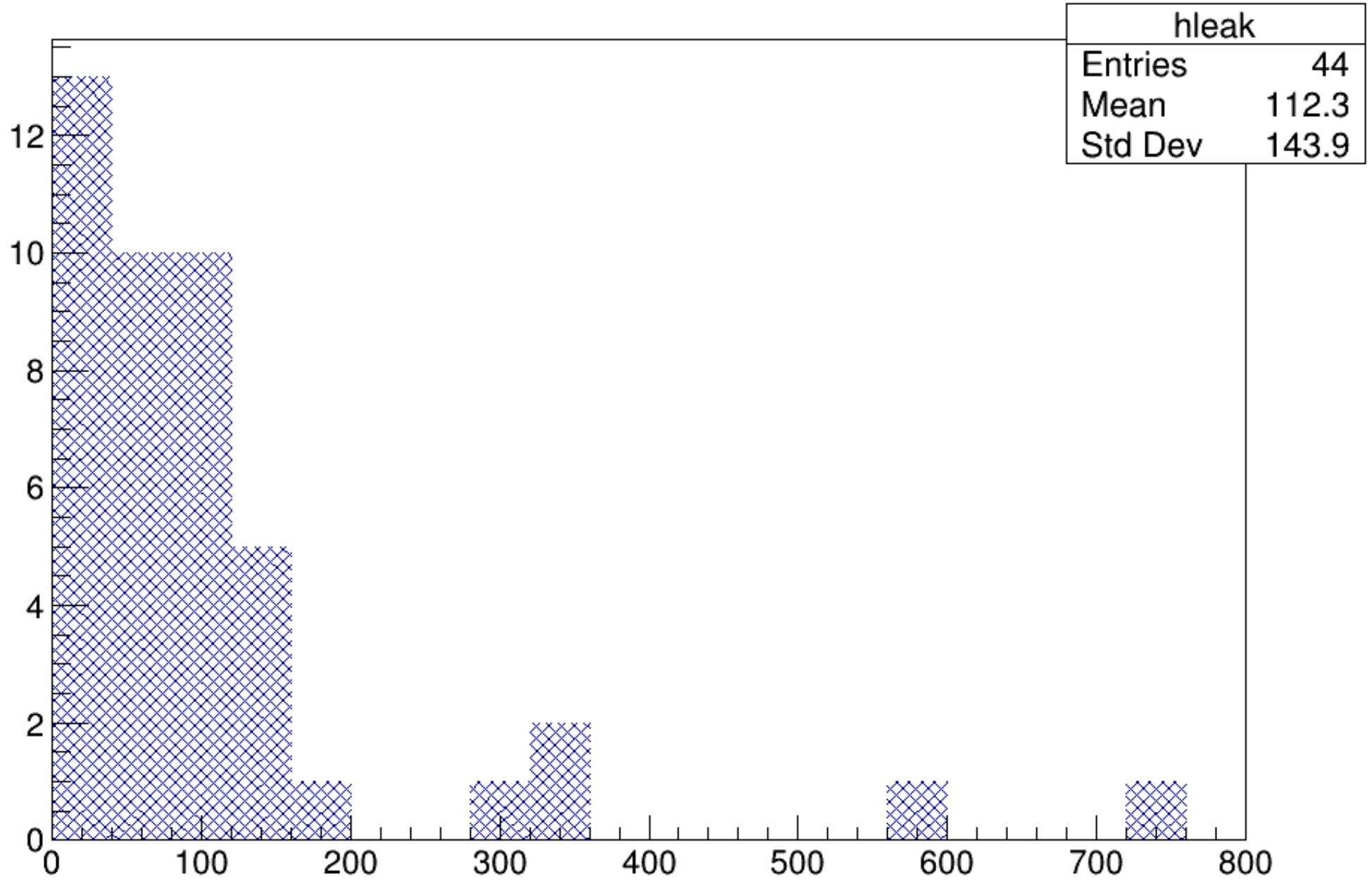
# Efficiency distribution



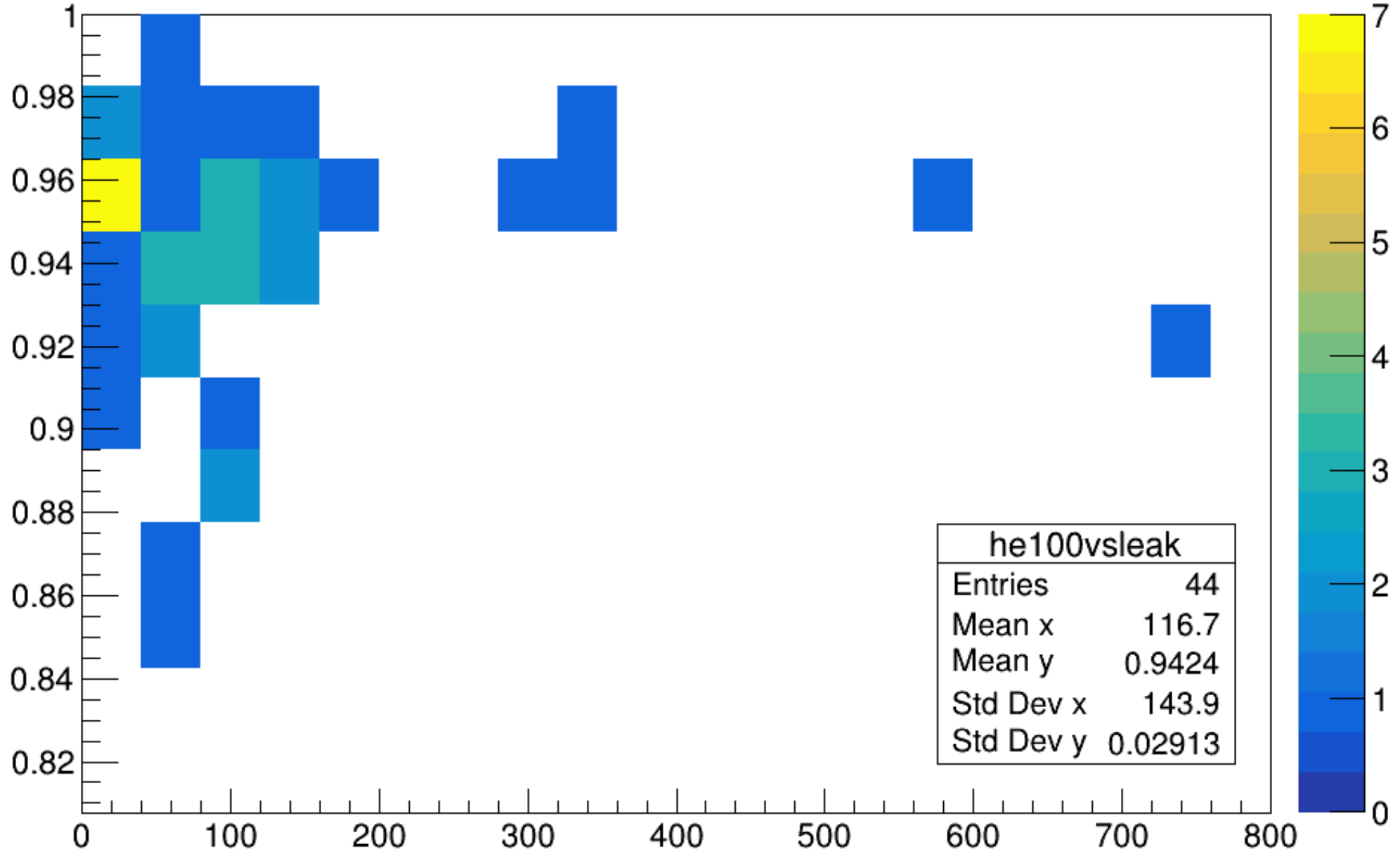
# Efficiency ramp ( $\text{kV}^{-1}$ )



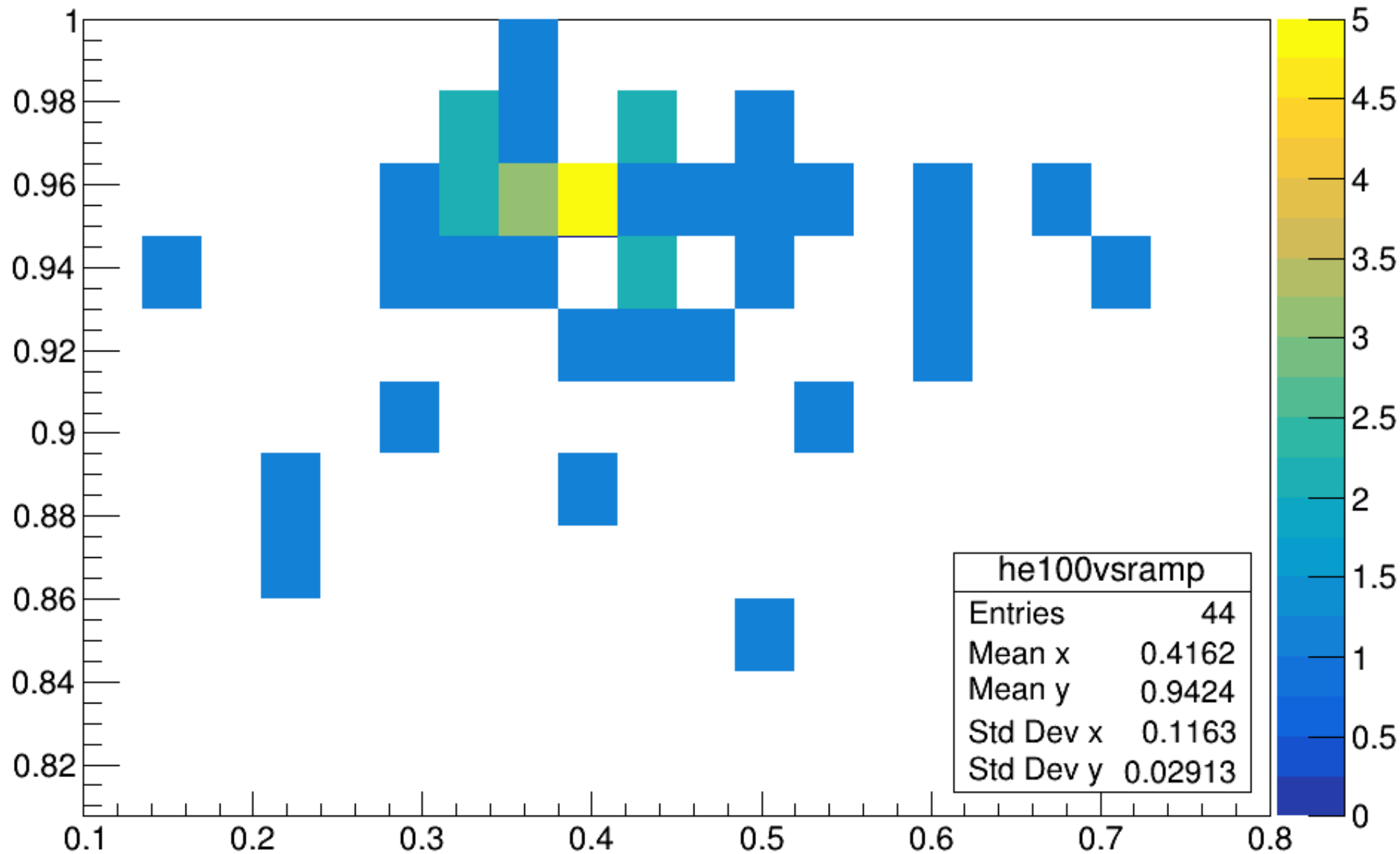
# Leak distribution (ml/h)



# Efficiency vs leak (ml/h)

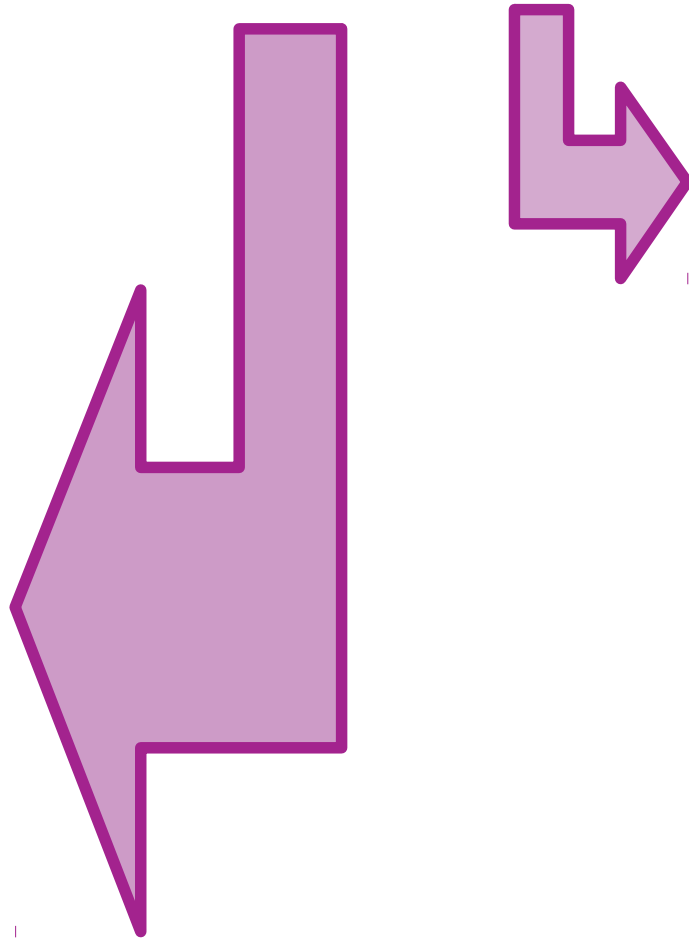
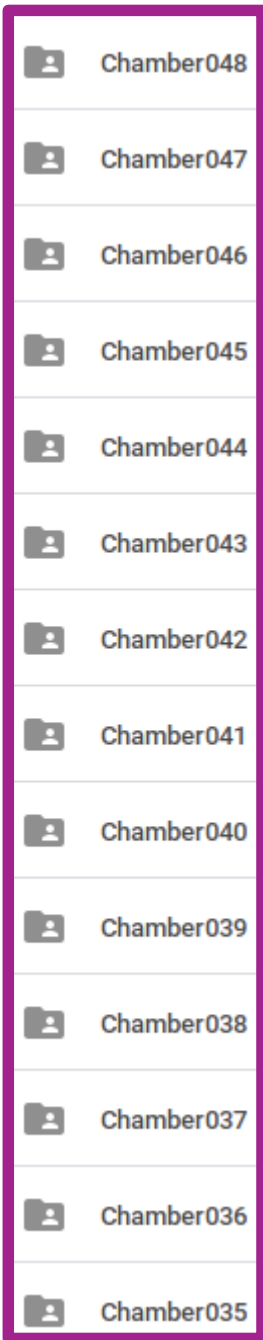


# Efficiency vs Ramp ( $\text{kV}^{-1}$ )

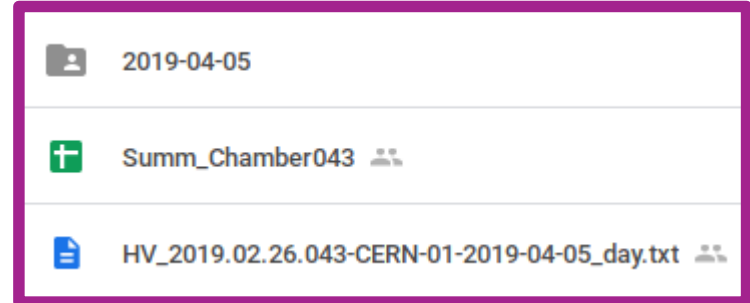


**New DB**

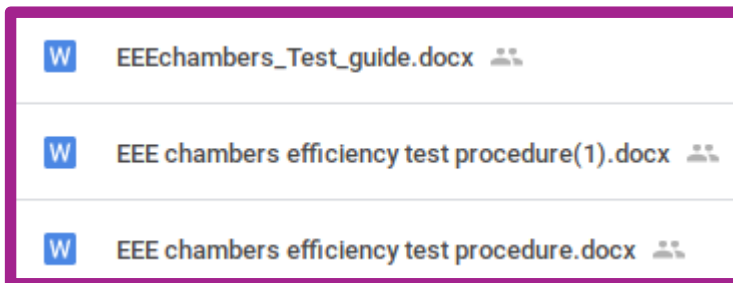
Data are saved on a Shared Gdrive folder



Each chamber contains:



A set of guides also available



- Root files
- Bin files
- Spreadsheet
  - with data taking info
  - Leak measurement
- TXT files with recon values



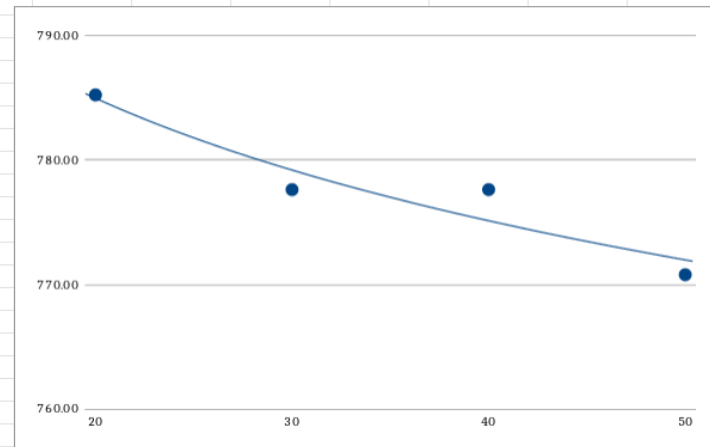
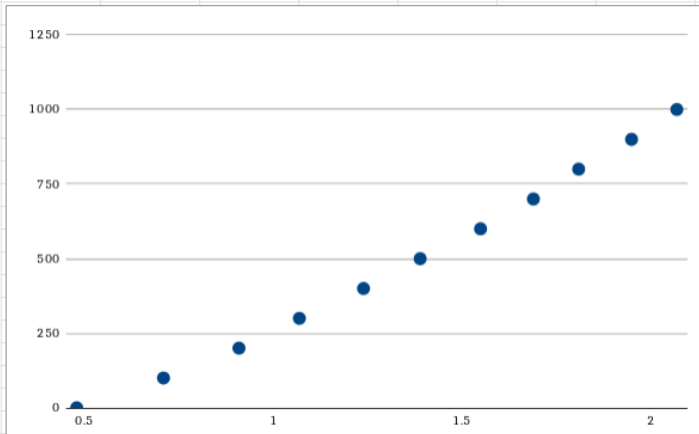
## A typical data file after reconstruction

## Data are corrected by T and P

-----file-----	HV (kV)	Eff	dEff	Syst_err	DarkCurrent	DarkRate	hv_mis	n. events	Pressure	Temp. Indoor	HV_eff
CERN-01-2019-02-07-00001	11.0	0.102	0.024	0.006	0.48	1126	11.00	20000	965	26.9	11.79
CERN-01-2019-02-07-00002	11.5	0.29	0.034	0.008	0.55	2093	11.50	20000	965	27.0	12.33
CERN-01-2019-02-07-00003	12.0	0.525	0.033	0.006	0.68	4283	12.00	20000	965	27.0	12.87
CERN-01-2019-02-07-00004	12.5	0.677	0.024	0.003	0.75	8522	12.50	20000	965	27.1	13.41
CERN-01-2019-02-07-00005	13.0	0.797	0.017	0.002	0.93	16108	13.00	20000	965	27.1	13.94
CERN-01-2019-02-07-00006	13.5	0.857	0.013	0.0	1.17	27484	13.50	20000	965	27.3	14.49
CERN-01-2019-02-07-00007	14.0	0.883	0.011	0.002	1.53	43043	14.00	20000	965	27.5	15.03
CERN-01-2019-02-07-00008	14.5	0.915	0.009	0.001	2.05	72635	14.50	20000	965	27.1	15.55
CERN-01-2019-02-07-00009	15.0	0.938	0.007	0.001	3.13	124422	15.00	20000	965	27.1	16.09
CERN-01-2019-02-07-00010	15.5	0.95	0.006	0.001	4.54	180089	15.50	20000	965	27.2	16.63
CERN-01-2019-02-07-00011	16.0	0.938	0.007	0.0	6.53	238599	16.00	20000	965	27.2	17.16
CERN-01-2019-02-08-00003	16.5	0.958	0.006	0.001	5.25	109575	16.50	20000	968	26.4	17.60
CERN-01-2019-02-08-00001	17.0	0.963	0.005	0.001	5.14	142041	17.00	20000	968	25.7	18.09
CERN-01-2019-02-08-00002	17.5	0.968	0.005	0.001	6.22	181781	17.50	20000	968	26.3	18.66

## A typical leak measurement

Gas Tightnes			Test									
Calibration Curve			P(mbar)	V(ml)	Vcorr	T(°C)	RH(%)	Time (min)	Time	Leak(l/h)		
0.48	0	28	2.07	1000.29	1000.29	28	25	0	0			
0.71	100		1.84	816.57	808.26	28.1	25	10	10	1.102		
0.91	200		1.81	793.57	785.26	28.1	25	10	20	0.138		
1.07	300		1.8	785.95	777.64	28.1	25	10	30	0.046		
1.24	400		1.8	785.95	777.64	28.1	26	10	40	0.000		
1.39	500		1.78	770.79	770.79	28	26	10	50	0.091		
1.55	600											
1.69	700									0.044962497		
1.81	800											
1.95	900											
2.07	1000											



# Transport

We got a **damage on 2/3 chambers** of the last 250 um production, Most likely because of the transport.

**CARI-01**                      substitution with a spare. Now working  
**SIEN-02**                      working at 18 kV (plateau was at 15 kV)

For all the detectors the sites refer the transport arrived on a little Van. The company put in charge by CERN is most likely outsourcing the local dispatch, it's a normal logistics approach.

We should try to fix the problem.

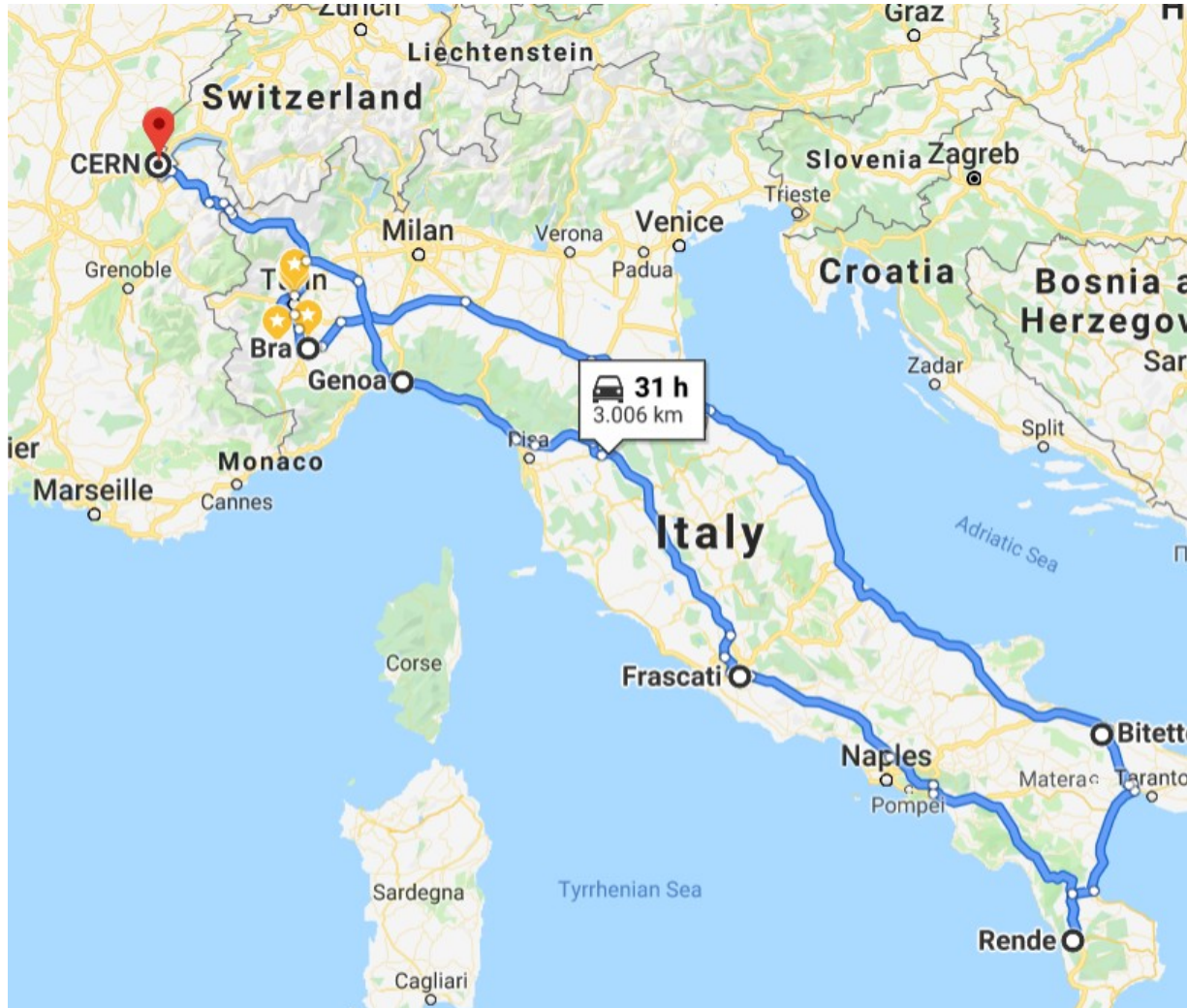
Two possible solutions:

- **self transport** (done with the last 6 telescopes – 19 chambers)
- **agreement with a special transport company** - SI-EXPRESS

# Transport of last

- 3 stations + 1 spare MRPC
- 3 stations

Bra-Bitetto-Lampedusa+spare  
Carcare-CentroFermi-ReggioC.



Van H4 Mobility Center CERN

### Go:

- 10 camere EEE su foam
- carrello quadruplo SM1 ATLAS

### Back:

- carrello quadruplo con 4 SM1
- pezzi per il carrello universale per le MM in GIF



Outside measurements: L 645 x W 220 x H 340

Loading area: L 411 x W 212 x H 198

ca. 200 moving boxes

Max. permissible load 815 kg

Price from

**CHF 149.00**

Cost (CF)~900 euro/travel

(with a company we can save 20-25%)

# Thanks!

Maria Paola

Paola

Marina

Chiara

Silvia

Stefano

Lorenzo

Antonio

Ivan