

Update from Technical Coordination: telescope material and gas crisis

D. De Gruttola
Centro Fermi

Summary

- Material requests
- New power supply
- Temperature and pressure monitoring
- New FEA cards
- Gas crisis
- DMEG Project

Material requests

Last station completely equipped
 ♦ REGC-01 (?) - Reggio Calabria

Site with all needed information for technical coordination

<https://sites.google.com/centrofermi.it/3etech/home>

Material request

* Required

your email address *

Your answer

Telescope ID *

example: ALTA-01

Your answer

Request (multiple choice is possible) *

VME crate

VME bridge

TDD 64 ch

TDC 128 ch

Trigger card

FEAs

Gas mixer

| Timestamp | Telescope ID | Trigger card, FEAs, notes | Please specify the number of needed FEAs | Notes - please ask here the material not included in the list or other special needs | your email address | Please specify the number and the polarity of needed HV boxes |
|--------------------|--------------|-------------------------------|--|---|---------------------------|---|
| 8/27/2018 11:08:23 | LODI-03 | Trigger card, HV boxes, notes | | adattatori amphenol-fea, pezzi mancanti del sistema del gas. Mancherebbe anche il sistema di alimentazione a bassa tensione che però non è disponibile. Sto guardando per un possibile sostituto e ho anche parlato con la scuola della possibilità di avere almeno degli alimentatori da banco semplici. | stefano.grazzi@ge.infn.it | 6 (3+3) |
| 8/27/2018 11:09:53 | GENO-01 | notes | | adattatori amphenol-fea | stefano.grazzi@ge.infn.it | |
| 8/27/2018 11:13:04 | SAVO-03 | Trigger card, notes | | Sostituzione scheda di trigger necessaria per sopperire alla mancanza della scheda gps spectracom che si è rotta. Si deve sostituire una camera già pronta al CERN (camera 30 o 31) in attesa della box | stefano.grazzi@ge.infn.it | |
| 8/28/2018 16:48:58 | BOLO-05 | FEAs, HV boxes | 6 | 6 Amphenol Cables+6 Amphenol/TDC adaptors+Remote controlled Power supply | garbini@bo.infn.it | 3 positive, 3 negative |
| 9/5/2018 16:11:58 | CAGL-04 | Trigger card, FEAs, notes | 6 FEAs, possibly 3L 3R | Amphenol CABLES (6). | corrado.cicalo@ca.infn.it | |

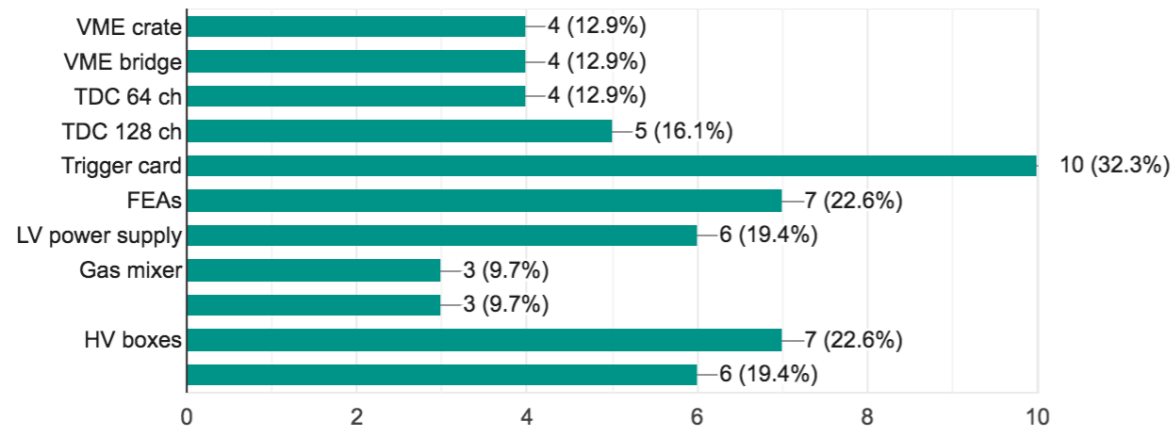
- Material requests are done via this form
- Easy tracking of requests
- Possibility to produce an **Excel sheet with a summary**

Material requests

- Tracking requests
- Percentage of requests can help with spotting:
 - weakness in terms of material
 - telescopes requiring more interventions/replacements

Request (multiple choice is possible)

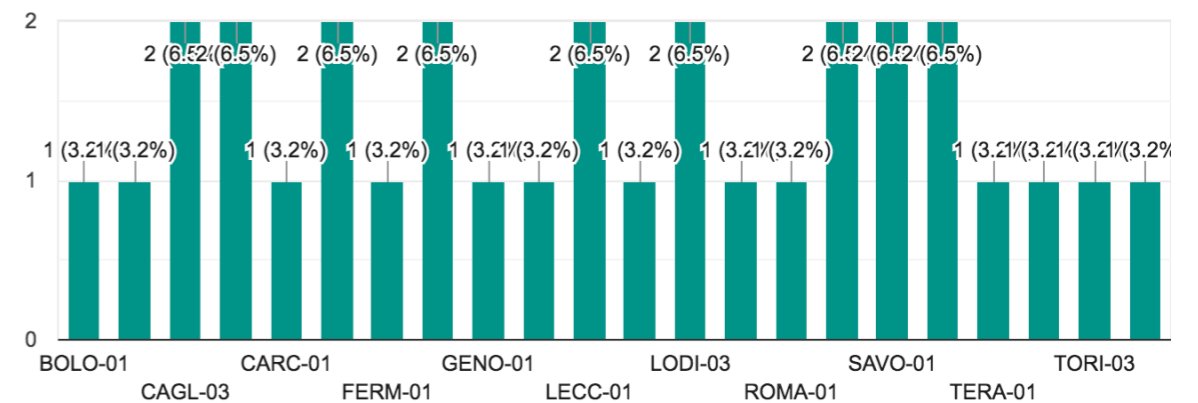
31 responses



Orders for new stations are listed together with replacement requests (it can be separated)

Telescope ID

31 responses



New power supply

14/01/2019

- ◆ Power supply (RS) with **3 independent channels** to supply **DC/DC** converters + 1 channel for **FEAs**
- ◆ **Remote control** with possibility to be connected via USB to the computer
- ◆ The cost is 649 € (2 already bought and delivered to Centro Fermi)
- ◆ **Reading voltage and currents in a separate homemade module** (N. Mazziotta, C. Pellegrino, F. Coccetti, D. De Gruttola)



FEATURES

- 4 Independent Isolated Output (V_{out} 0→30 V, 0→5 V, I_{out} 0→1 A, 3 x 0→3 A)
- 4 LED Display Sets : 3 Digits After Decimal Point (IPS-2303S/3303S/4303S)
- Minimum Resolution : IPS-2303S/3303S/4303S (1mV/1mA)
IPS-3303D (100mV/10mA)
- Digital Panel Control (Rotary Encoder Switch, Rubber Key With Indicator)
- User-Friendly Operation, Coarse/Fine Volume Control
- 4 Sets Save/Recall
- Key-Lock
- Output ON/OFF
- Tracking Series and Parallel Mode
- Smart Cooling Fan Achieving Low Noise
- Compact Design
- PC Software & USB Driver
- USB Standard Interface

[link to RS Datasheet](#)

- ◆ 2 PS tested in Lodi and at Centro Fermi: **OK**

Saving more than 50% wrt previous solution → possibility to supply **each single DC/DC polarity separately** by using 2 of them

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FEATURES

- 4 Independent Isolated Channels (0→5 V, I_{out} 0→1 A, 3 x 0→3 A)
- 4 LED Displays (Resolution: 100mV/10mA, 100mV/10mA, 100mV/10mA, 100mV/10mA)
- Minimum Load Regulation (IPS-2303S/3303S/4303S)
- Minimum Load Regulation (IPS-2303S/4303S (1mV/1mA))
- Precision Load Regulation (100mV/10mA)
- Precision Load Regulation (Encoder Switch, Rubber Key With Indicator)
- Precision Load Regulation (Coarse/Fine Volume Control)
- Precision Load Regulation (ON/OFF)
- Precision Load Regulation (Working Series and Parallel Mode)
- Precision Load Regulation (Smart Cooling Fan Achieving Low Noise)
- Compact Design
- PC Software & USB Driver
- USB Standard Interface

Alternative solution: self-powered CAEN HV boxes (waiting news from I. Gnesi)

~649 €

[link to RS Datasheet](#)

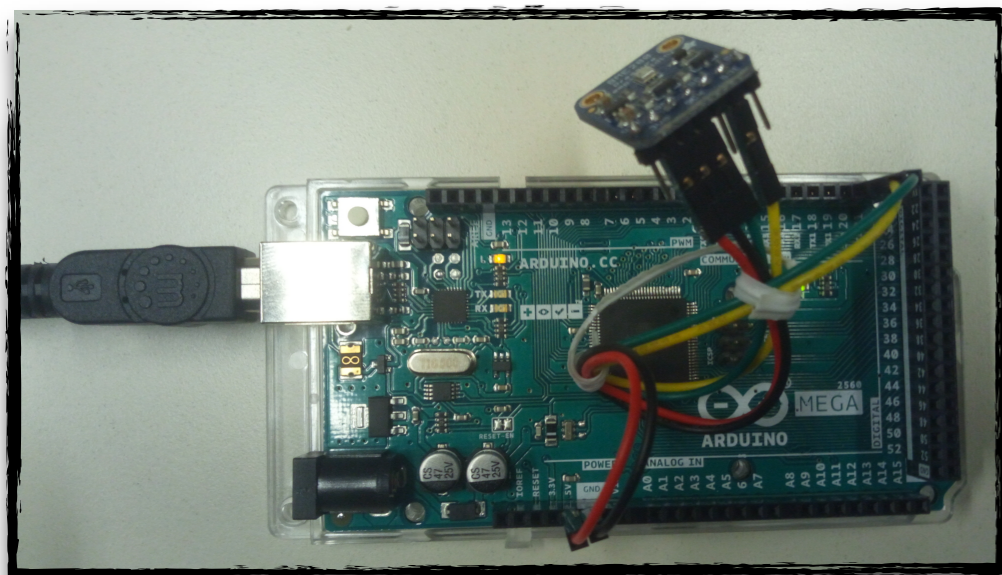
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Saving more than 50% wrt previous solution → possibility to supply **each single DC/DC polarity separately** by using 2 of them

T and p monitoring

14/01/2019

- ◆ New telescopes need sensors
- ◆ Some old telescopes have broken sensors and need new ones
- ◆ Oregon station can no longer be used (issue with software compatibility)
- ◆ Homemade solution using Raspberry (N. Mazziotta, C. Pellegrino, F. Coccetti, D. De Gruttola)
- ◆ System is almost ready (hope to use them on a couple of telescopes very soon)
- ◆ Two systems tested in Bari and Bologna **OK**



- ◆ Current situation:
- ◆ Arduino system with internal T, p and humidity Installer ready
- ◆ Data are saved in the required format for EEE DAQ
- ◆ Code working on Windows and Linux
- ◆ Code available on a repository (private at the moment)
- ◆ Ongoing work to add external T sensor
- ◆ User-friendly graphic interface

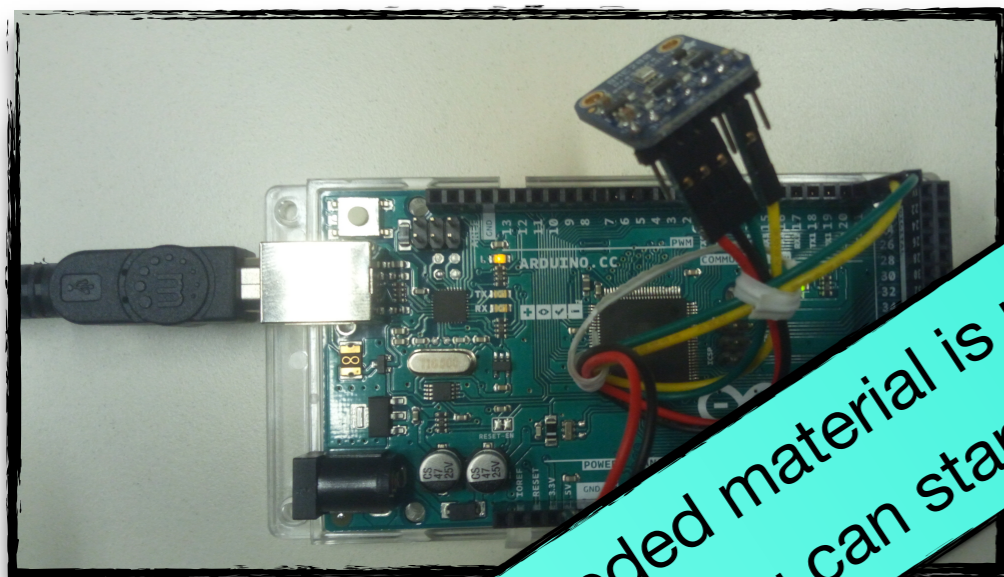
Reading of voltage and current can be easily added to this system (channel already prearranged)

Outlet power cycle could be added too

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All needed material is now available at Centro Fermi
Assembling can start (and possibly committed to schools)

- ◆ Current
- ◆ ... with internal T, p and humidity Installer ready
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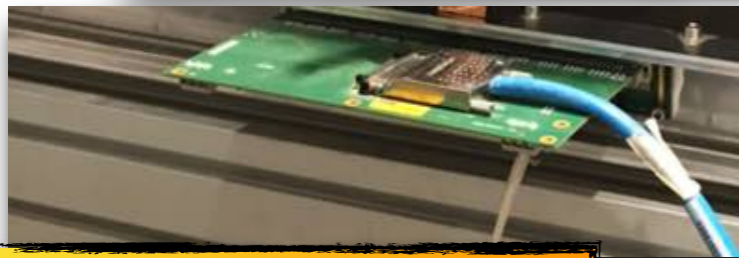
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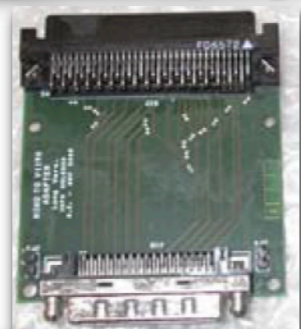
New FEA cards

14/01/2019

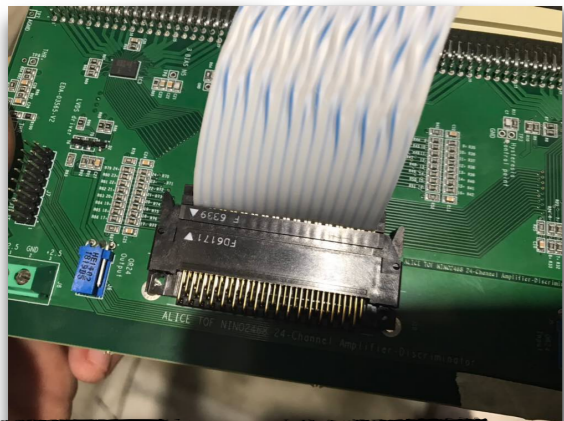
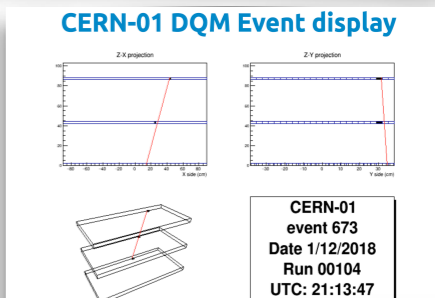
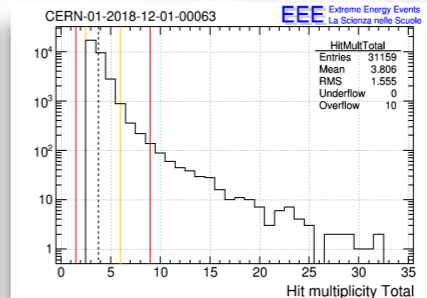
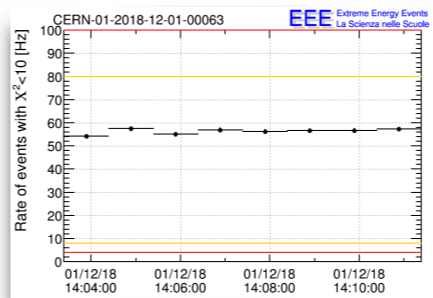
- ◆ Same technology as old cards (NINO ASIC)
- ◆ **Optimization** of PCB and new connector
- ◆ Shielded Amphenol cables needed with old FEAs
- ◆ New FEAs use **flat cables** (twisted pairs)
- ◆ Easier to handle
- ◆ No need of Amphenol-TDC adaptors used with old cards
- ◆ **160 cards** produced by an Italian Company (INGEL) and delivered at mid-November at Centro Fermi
- ◆ 160 cables and a card to test them can be done by a technician in Salerno University in the coming weeks



old FEA with Amphenol cable



Amphenol-TDC adaptor



New FEA with flat cable

- All quantities checked with DQM
- The cards **work properly** (15 bad cards will be reworked by company)
- Good quality of data in terms of telescope performance and coincidences
- **Long period test** performed on random samples (more than 1 month)
- CERN-01 taking data with new FEAs

All **160** FEAs have been **tested** at CERN in December
They will be used on new telescopes
All cards labelled and corresponding infos stored



| FEA | Rate and Mult. | Reco | Date | File | Problem or note |
|-----|----------------|------|------------|----------|---------------------|
| 1 | ok | ok | 01/12/2018 | 00063-79 | - |
| 2 | ok | ok | 01/12/2018 | 00063-79 | - |
| 3 | ok | ok | 01/12/2018 | 00063-79 | - |
| 4 | ok | ok | 01/12/2018 | 00063-79 | - |
| 5 | ok | ok | 01/12/2018 | 00063-79 | - |
| 6 | ok | ok | 01/12/2018 | 00063-79 | - |
| 7 | ok | ok | 01/12/2018 | 00080-82 | - |
| 8 | ok | ok | 01/12/2018 | 00080-82 | - |
| 9 | ok | ok | 01/12/2018 | 00080-82 | - |
| 10 | ok | ok | 01/12/2018 | 00080-82 | - |
| 11 | ok | ok | 01/12/2018 | 00080-82 | - |
| 12 | ok | ok | 01/12/2018 | 00080-82 | - |
| 13 | ok | ok | 01/12/2018 | 00083-85 | - |
| 14 | ok | ok | 01/12/2018 | 00083-85 | - |
| 15 | ok | ok | 01/12/2018 | 00083-85 | - |
| 16 | ok | ok | 01/12/2018 | 00083-85 | - |
| 17 | KO | | 01/12/2018 | | Power fail (short?) |

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at Centro Fermi
in the coming weeks

CERN-01 taking data with new FEAs since Nov 2018

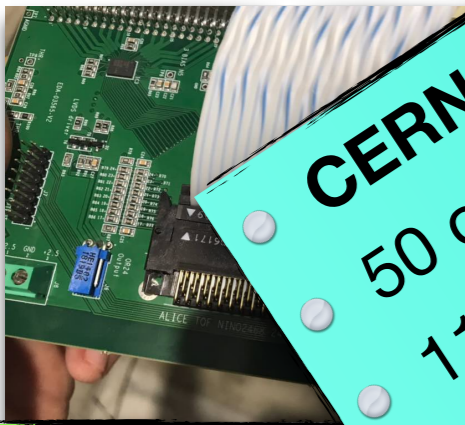
50 cables produced

110 cables will be produced soon

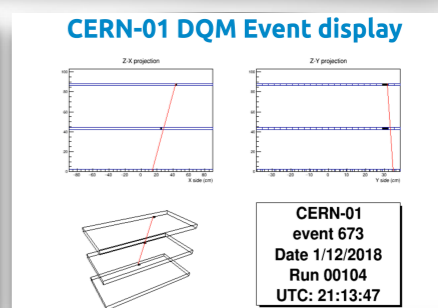
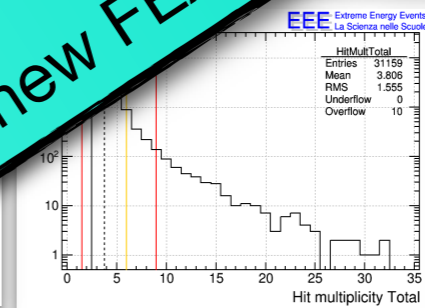
New telescope in Reggio Calabria will use new FEAs



old FEA with Amphenol cable



New FEA with flat cable



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Gas crisis

- ◆ New contract with *SIAD* to buy Freon and SF₆
- ◆ Scheduled start of new contract **end of May**
- ◆ Contract is frozen at the moment because the **cost increased by a factor 5!**

- ◆ 18 companies contacted
- ◆ Some of them abroad for a more general inquiry
- ◆ A few replies at the moment
- ◆ Not encouraging feedback neither for R134a nor for 1234ze

| |
|--|
| R134a: |
| • 1 bombola 25 / 60 Kg R134a: 18,00 €/kg |
| Transporte: 47,89€ |
| • 150 bombole 25 / 60 Kg R134a: 17,00 €/kg |
| Potes pagados. |
| Precio bombola vuota 27L: 50,00 € |
| Precio bombola vuota 61L: 72,12 € |
| 1234ze: |
| • 1 bombola 25 / 60 Kg R1234ze: 23,00 €/kg |
| Transporte: 47,89€ |
| • 150 bombole 25 / 60 Kg R134a: 22,00 €/kg |
| Potes pagados. |
| Precio bombola vuota 27L: 70,00 € |
| Precio bombola vuota 61L: 95,00 € |

Buongiorno,

ringraziandoVi per la Vostra gentile richiesta, la presente per comunicare nostri prezzi:

- Bombola da 40 kg contenente 1234 yf 3800€ (cadauna)
- Bombola da 40 kg contenente 1234 ze 2200€ (cadauna)
- Bombola da 40 kg contenente R134a 1200€ (cadauna)

L'occasione è gradita per porgerVi

Distinti Saluti.

- ◆ As a consequence, the contract for SF₆ and gas mixers has been frozen too
- ◆ At the moment **freon** bottles are **over in 5 telescopes**
- ◆ A fast solution needs to be found - a couple of ideas are on the table:



Solution 1

New gas mixtures according to the studies performed and currently ongoing



Solution 2

Recirculation system to drastically reduce consumption

Gas crisis

Solution 1

Promising solutions found - **tetrafluoropropene** instead of **tetrafluoroethan**

But tetrafluoropropene still expensive at the moment

The performance of these chambers with **new gas mixtures of tetrafluoropropene and carbon dioxide or sulfur hexafluoride** have been studied with **cosmic muons** detected by one of the telescopes installed at CERN, under different conditions as a function of the applied HV.

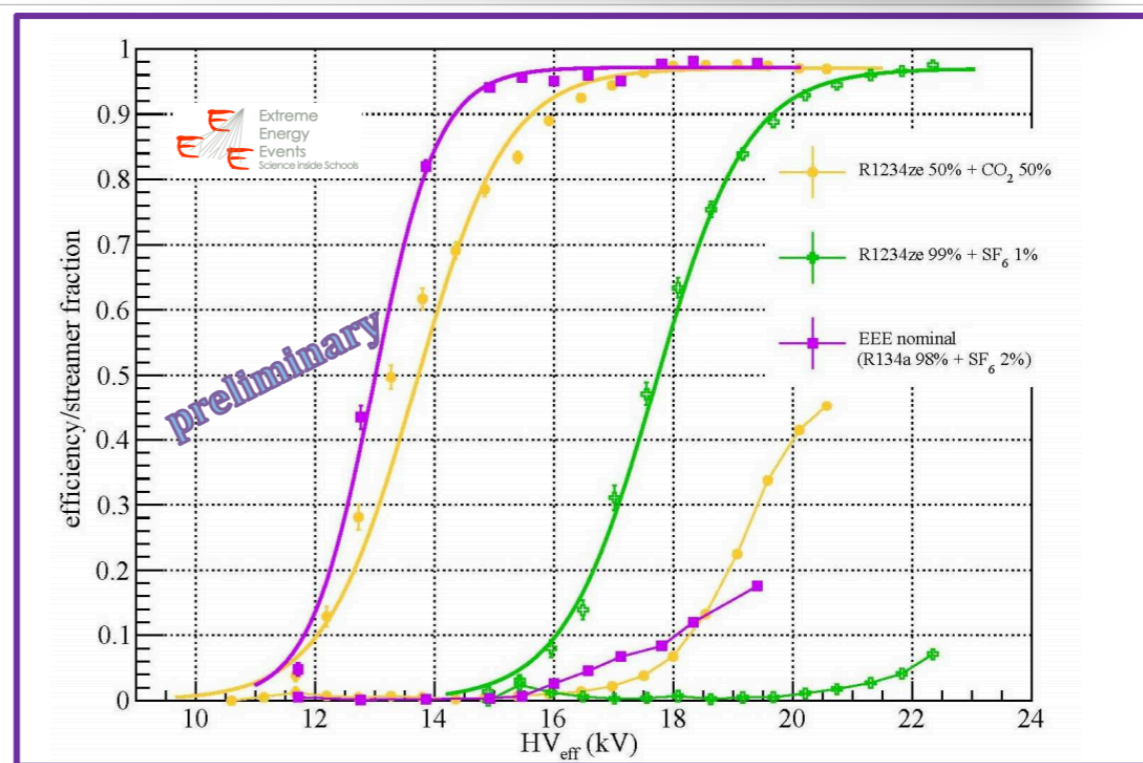
Most promising configurations:

R1234ze(50%) + CO₂ (50%)

R1234ze(99%) + SF₆(1%)

Future Plans:

CF₃I ; R1234ze(99,5%) + SF₆(0,5%); R1234ze + He



Solution 2

Contact with CERN experts (R. Guida and B. Mandelli) established

Possibility to assemble a **portable and cheaper system**, that could be useful for other Collaborations too

[R. Guida and B. Mandelli 2017 JINST 12 T10002](#)

- ◆ **Solution 2** is the only one feasible at the moment (till the cost of tetrafluoropropene remains the same)
- ◆ Major efforts should go there
- ◆ This solution will be useful regardless of the future gas mixture

DMEG Project

Cooperation Italy-Korea

PGR00
824




Ministero degli Affari Esteri
e della Cooperazione Internazionale

Domanda di contributo (L. 401/90)

| | |
|----------------|----------|
| Identificativo | PGR00824 |
| Anno | 2019 |
| Paese | Corea |

Elementi generali

| | |
|--------------------------|---|
| Macrosettore | Basic Sciences |
| Titolo (in italiano) | Sviluppo di Multigap Resistive Plate Chamber con Gas Ecologici |
| Titolo (in altra lingua) | Development of the Multigap Resistive Plate Chamber using Ecological Gases (DMEG) |



Ministero degli Affari Esteri
e della Cooperazione Internazionale

DIREZIONE GENERALE PER LA PROMOZIONE DEL SISTEMA PAESE
Ufficio IX

Roma, 28 marzo 2019

Prot. nr. **MAE0057327**

Dott. Daniele De Gruttola
Museo Storico della Fisica e Centro
Studi e Ricerche Enrico Fermi
Piazza del Viminale 1
00184 Roma

Oggetto: Anno finanziario 2019. Assegnazione di contributo per il progetto: "Sviluppo di Multigap Resistive Plate Chamber con Gas Ecologici" - Corea

Gentile Dott. De Gruttola,

in relazione alla richiesta di contributo per l'anno 2019 per la realizzazione dell'iniziativa citata in oggetto,

- 3-years Project approved by **MAECI**
- Studies to operate MRPC with eco gases
- 100k€** per year
- Work already started at CERN with Korean colleagues
- 1 or 2 contracts to work on the project:** tender should be ready in a month
- Part of the funding (~10k€ per year) can be used to buy consumable material (gas and material for new MRPC geometry)

Conclusions

- Material requests → site to easily submit and track requests, track material..
- New power supply → remote control, chip solution
- Temperature and pressure monitoring → homemade system to be assembled
- New FEA cards → 160 cards available (cables done in Salerno and 2 telescopes equipped)
- Gas crisis → working on two possible (**matchable**) solutions
- DMEG Project → 2 possible contracts for the next 3 years