



Bari CMS Muon Activities

CMS BA Group Meeting
Mar 19 2020

Piet Verwilligen – INFN Bari

-RPC Activities

-GEM Activities

CERN, Feb 03 2020



2020 Muon Context for INFN Bari

Second year of LS2; LS2 over half way

- However LS2 Activities interrupted now for unknow time (3 months?) due to Covid-19
- Serious risk for LS2 and long-term planning

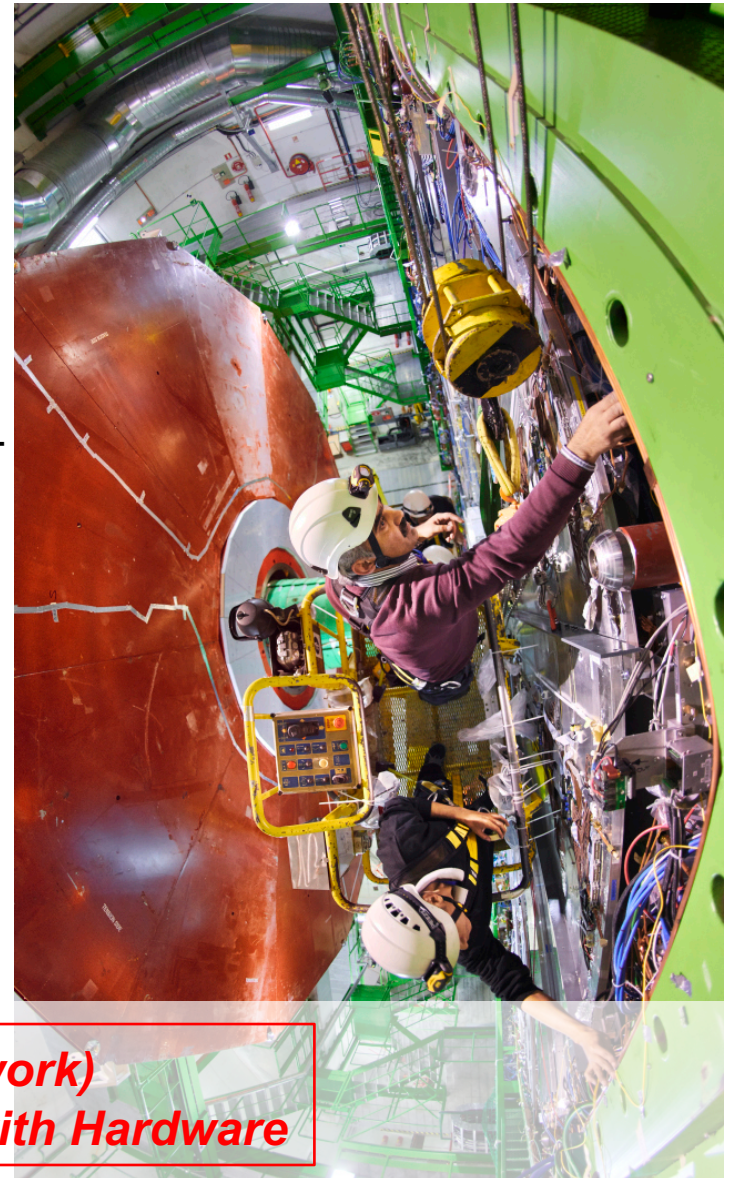
Big ongoing projects (LS2):

- Quality Control GE1/1: Cosmic Stand 904
- Installation & Cabling GE1/1
- Commissioning GE1/1 in MWGR
- Leak reparation RPC Barrel

Phase-2 upgrade of the Muon system

- Installation of Services for GE2/1
- GEM R&D: GEM Discharge studies
- Design & Construction ME0 Prototypes
- GIF++ studies improved (i)RPC

***Think of which tasks we can close now (telework)
and how to restart in few months from now with Hardware***



Short overview of Muon 2019 Activities

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RPC Leak Repair campaign

- CERN priority to reduce GWP exhaust to envmt
- Heavy involvement Bari

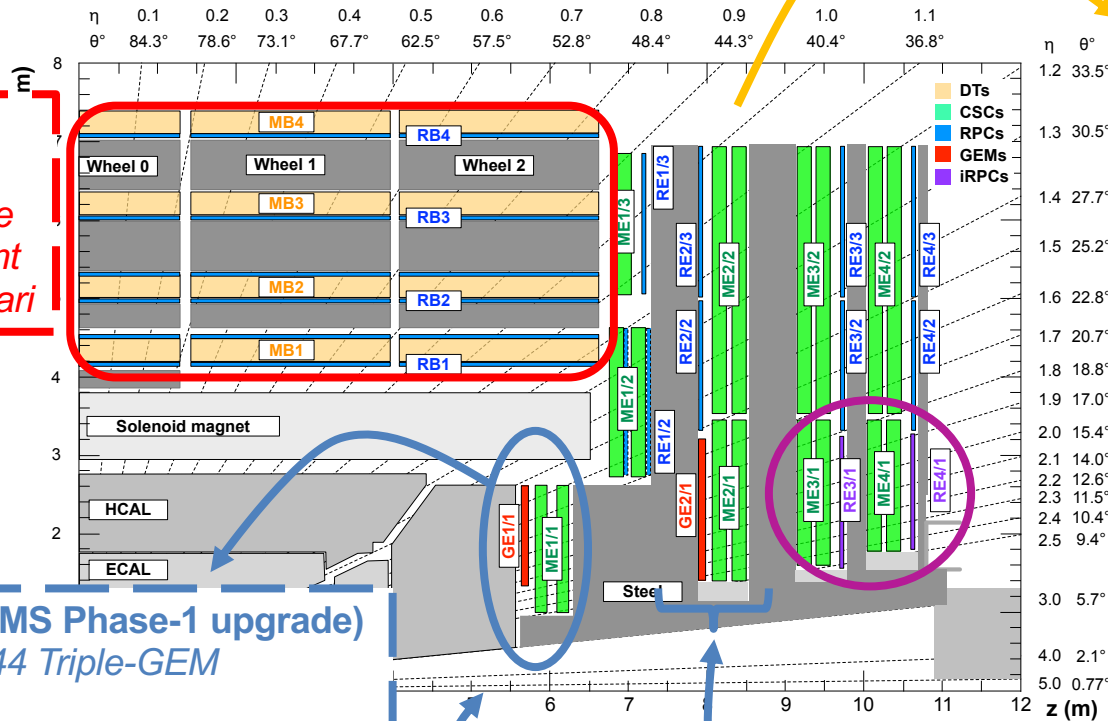
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GEM GE1/1 Project (CMS Phase-1 upgrade)

- Construct & Qualify 144 Triple-GEM detectors

- Installation during LS-2

Priority of CMS during LS-2 all eyes are on us!



RPC Ecogas Studies

- Poss. replacement R134 → HFO
- Studies under bkg radiation in GIF++

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Improved RPC

- Prototype Tests
- Services installation

2

GEM Phase-2 upgrades: GE2/1 & ME0

- Prototype Design & Construction
- Discharge tests @ Neutron Facility
- Simulation of various HW design
- Simulation of HGCal & Neutron Bkg

GEM Activities 2019 - Now

- **GE1/1 Production finished** (160 chambers constructed)

- **Jeremie Merlin --- Production Coordinator**
- Bari produced 18 chambers in 2018; **first site to finish production**
 - *A.Ranieri, S.Nuzzo, R.Venditti, A.Sharma, E. Soldani & P.Verwilligen*
- Bari involved in super-chamber assembly @ CERN in 2019
 - *M. Franco, N. Lacalamita, S. Martiradonna, P. Dipinto, D. Dell'Olio E.Soldani, S.Nuzzo*
- **Francesco Licciulli --- Electronics Coordinator**
- Bari designed the FE and contributed to the production and tests
 - *F.Licciulli, G.De Robertis & students (C. Aruta, F.Ivone, F. Simone)*

- **Super Chamber (SC) validation ongoing (904 Cosmic Stand):**

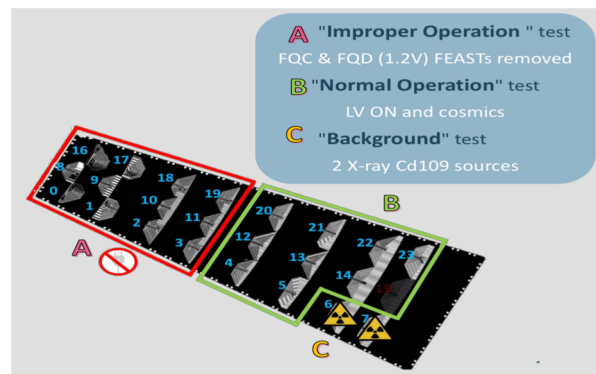
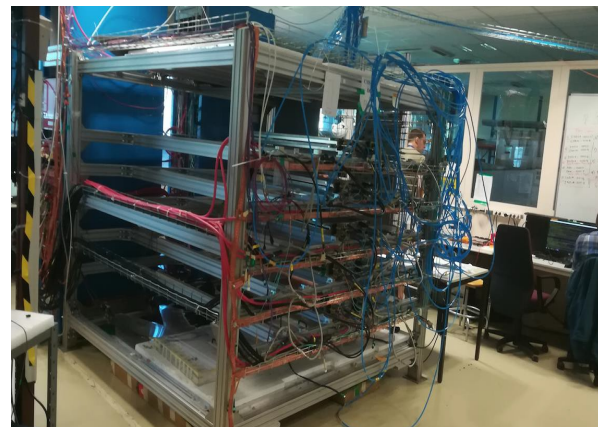
- Analysis of Chamber data x matching: *E.Soldani* → **1 PhD thesis**
- Bari physicists in leading role:
 - M. Maggi (Run coordinator 20xx-2019)*
 - F. Simone (2019) + A.Pellecchia & C.Aruta (2020)*

- **GEM R&D**

- "Sustained Operation" to understand channel loss Slice-Test
 - *C.Aruta, F.Simone & F.Ivone* → **1 Master Thesis (2019)**
 - *Important impact of G.De Robertis & F. Licciulli*
- Study of impact of discharges on GEM with setups in Bari & CERN
- Discharges at high Rate & Rate-Capability test in Bari
 - *J.Merlin, A.Stamerra & A.Colaleo* → **expect Master Thesis 2020**

- **Phase-2 R&D**

- *Phase-2 Electronics: Packaged VFAT (INFN responsibility)*
 - *Construction & Test of GE2/1 Prototypes*
 - *Design ME0 Readout Board & Design ME0 GEB*
 - *Simulation of ME0 Background & Design of ME0 Shielding*
 - *GEM Simulation coordination*
- F.L. & G.D.R.
R.V., A.R & P.V.
P.V.
P.V.
P.V.*



RPC Activities 2019 - Now

- **Subsystem manager** *G.Pugliese*
- **RPC Barrel Leak Repair**
 - Leak of ~900l out of 8800l in 2018 (63 chambers)
 - **CMS Strategy to reduce GHG emission --> repair!**
 - *G. Pugliese & M. Franco*
- **Study of RPC Performance in Run-2**
 - *Clustersize studies* *M.Abbrescia & W. Elmatanawee*
- **iRPC tests (Phase-2)**
 - Readout iRPC to be decided soon (Petiroc vs Cardarelli)
 - Prototype iRPCs tested in GIF++
 - *A.Gelmi & A. Reham*
- **RE3-4/1 Services**
 - *N. Lacalamita*
- **RPC & iRPC Longevity studies @ GIF++**
 - Ageing tests: $1\text{C}/\text{cm}^2$ + iRPC rate capability ($2\text{-}3\text{kHz}/\text{cm}^2$)
 - Study use of more ecofriendly gas (HFO1234ze)
 - Production of HF in EcoGas & StandardGas
 - *A. Gelmi & G. Pugliese* → 1 PhD thesis

Common Muon Activities

System & Resource Manager
ML tools for DQM
Common Muon Background

A. Colaleo
R.Venditti & F.Simone
P.Verwilligen



Muon Activities 2020

GEM Activities suspended: (INFN-Ba)

- Cosmic Test of Negative-Endcap GE-1/1 chambers @ 904
- Cabling & Installation of GE-1/1 @ P5
- Commissioning of GE1/1 in MWGR @ P5
- Packaged VFAT3 in production
 - Testing as soon as we can return to INFN-Ba labs
 - Ass Tech (Moh Rafik) will sign contract in next months
- Production of GE2/1 in Autumn 2020 @ INFN-Ba
- R&D on discharge mitigation strategies to work at higher Rate
- GEM Discharge studies @ INFN-Ba lab

GEM Activities that continue:

- Analysis of Cosmic Data GE1/1
- Preparation of GE2/1 construction: Tools design & Production
- Update of ME0 Background hit models
- Design & Study of ME0 Background shield
- Design of ME0 Readout: GEB design

RPC Activities suspended:

- RPC Barrel Leak Repair
- iRPC prototype tests @ CERN
- Ecogas tests & iRPC tests @ GIF++
- RPC Commissioning in MWGR
- Setup iRPC lab @ Bari with Prototype (*D.Ramos – Dott Industr*)

RPC Activities that can continue:

- Data analysis GIF++, Proceeding RPC conference
- Prototype tests data analysis

We should take advantage of closing some tasks & start preparing now on how to restart in few months

Fundamental hardware activities are now halted both @ CERN & @ INFN-Ba, many activities have started and can continue from remote





GEM Request

For the GE2/1 and ME0 production site
For R&D on Triple-GEM detectors
CMS Bari Meeting 3

Piet Verwilligen
INFN sez. Bari



BARI, February 12 2020

A bit of History

- INFN budget for Phase-2: few MEUR left for «Pre-Prototypes» and «Infrastructure»
- **Bari GEM Lab has functioned very well during production of GE1/1**
but thanks to a lot of qualified manpower, **infrastructure is not at the same level**
furthermore we cannot do GEM R&D in parallel with production (canibalized R&D lab for QC)
We are even short on cheap 20MHz Oscilloscopes (3kEUR) !!!
- Budget redefinition in CSN-1 → Ask a small «**potenziamento**» of the Bari GEM Lab
- Presented a list of requests for investment of ~45kEUR containing:
 - **Necessary spares** (APV – 1.1kEUR)
 - **Necessary new table in clean room** (8kEUR)
 - **Necessary new HV module for CAEN Mainframe** (8kEUR)
 - **Necessary a cheap oscilloscope (3kEUR)**
 - **Less urgent but highly desirable: Hospital setup + Shared with GEM R&D**
(monitor/repair faulty chambers in parallel with ongoing construction) (23kEUR)
- However due to problems with hiring manpower according to CTS referees would like larger backup to hire people with better contracts than foreseen (45kEUR / person) and therefore a strong budget cut was applied
- **Discussion with S. Ventura (RA Muon), GM. Bilei (RN) and S.My (Coord GR1)**
lead to suggestion to finance necessary aquisitions by GR1 & CMS BA
 - Cleanroom table will be partly financed by CSN-1 (5kEUR)
remaining (3kEUR) could come from sezione (need to check with the Director)
 - APV spares can be bought from CMS Bari Team Account (1.1kEUR)
 - HV module + tooling (8kEUR) can be financed by CMS Ba + Gr1

GEM Lab Hardware overview

	Clean room	QC4	QC5	R&D / Hospital
Pre-Amp	0	1	1	0
Amp	0	1	1	0
CFD	0	1	1	0
Scaler	0	1	1	0
Oscilloscope	0	1	1	0
High-Voltage	1	1	1	0

CAEN A1515TG

- Evolved from the LNF-GEM module where different HV channels powering the same GEM are coupled
→ Safer Operation mode Adopted by CMS-GEM
- 14 independently controllable High Voltage channels
- Individual Floating Channel (insulated up to 5 kV)
- Designed specifically for GEM detectors
- Output channels grouped into 2 Complex channels = 2 GEMs
- Radial 52 pin connectors
- 0 ÷ 1kV and 0 ÷ 1.3kV output ranges
- Dual range current:
 - High Power: 0 ÷ 1/3 mA, (1/3 nA I_{mon} resolution)
 - High resolution: 0 ÷ 100/300 μ A, (100/300 pA I_{mon} resolution)
- Programmable TRIP parameter (Complex channel setting)
- Current generator operation in Overcurrent conditions

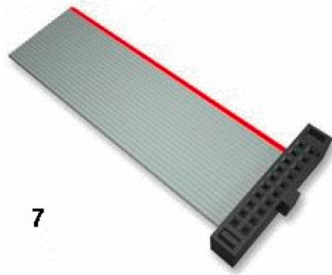
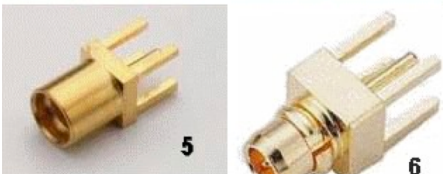
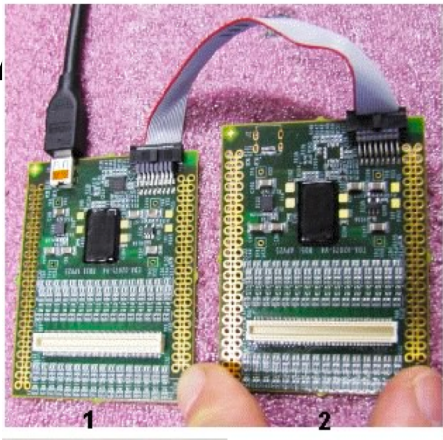


		Excl. IVA	Incl IVA
A1515TG	HV module	6.2 kEUR	7.57 kEUR
A995	Insertion tool A996	240 EUR	0.29 kEUR
A996	52 pin connector	320 EUR	0.39 kEUR
Total		6.85 kEUR	8.25 kEUR

APV boards for SRS

- **Required for Gain Uniformity (QC5)**

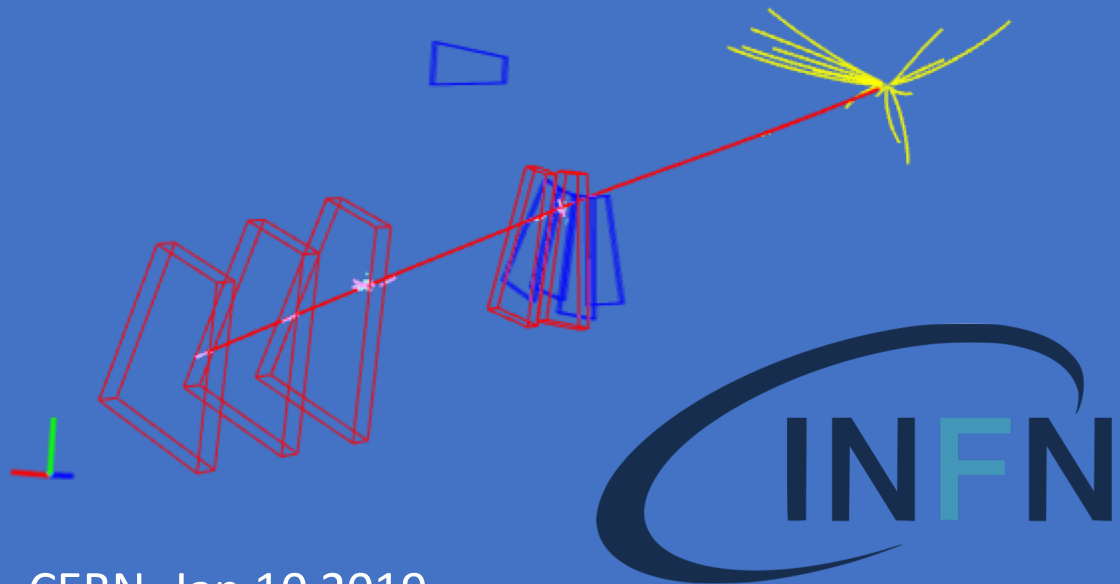
- No spares available in BARI
- In use since 2015; to be used until 2025
- Out of production; spares should be bought now!
- Cost: ~ 400CHF each (pair)



	SCEM code	COST	Figure
MASTER	07.89.00.005.9	160 CHF	1
SLAVE	07.89.00.010.2	140 CHF	2
GND Conn (M)	07.89.00.200.8	6.9 CHF	5
GND Conn (F)	07.89.00.205.3	7.4 CHF	6
Flat-cable	07.89.00.211.5	42.5 CHF	7
USB cable	07.89.00.216.0	41.5 CHF	8



Backup



CERN, Jan 10 2019

Overview of Request to CSN-1

Object	#	Unit Cost	Total Cost	Cost details
Cleanroom Table	1	8kEUR	8kEUR	Previous offer
Oscilloscope 200MHz (*)	2	3kEUR	6kEUR	RS Components
Amplifier ORTEC 474	1	5kEUR	3kEUR	Previous offer
PlcoAmm meter Napoli (**)	1	5kEUR	5kEUR	Estimate
CAEN CFD	1	4.5kEUR	4.5kEUR	Catalogue price
CAEN Scaler	1	5kEUR	5kEUR	Catalogue price
MultiChannel Analyzer (MCA)	1	4kEUR	4kEUR	Previous offer
APIC module	1	1.8kEUR	1.8kEUR	Pre-prod run (email)
CAEN A1515TG HV	1	7.6kEUR	7.6kEUR	Catalogue price
CAEN A1515TG accessories	1	400 EUR	650 EUR	Catalogue price
APV Master-Slave for QC5	3	365 EUR	1.1kEUR	CERN Store
Total			40.6kEUR	

(*) Auto-censored, we will fund through Metabolismo-CSN1. We need to give back one oscilloscope for TRK production, furthermore hospital stand needs its own oscilloscope.

(**) Depends on CAEN commercialization. Likely 5kEUR are needed in 2021 not 2020.



Preventivo nr. 304/2018

Data: 15/10/2018

Oggetto: **KS-table#**

Spettabile
Istituto Nazionale Fisica Nucleare
Sezione di Bari

Dr. Luigi Fiore
 (BA)
 Dr. luigi.fiore@ba.infn.it
 ITALIA

Codice	Descrizione	Importo netto	IVA 22%	Importo totale
NPN	5704-3672-31 OPTICAL BREADBOARD SYSTEM CONSISTING OF: KSI MODEL # 5704-3672-31 KINETIC SYSTEMS 5700 SERIES HONEYCOMB TABLE TOP 914 MM WIDE X 1829 MM LONG X 102 MM THICK WITH M6 TAPPED HOLES ON 25 MM CENTERS 5 MM THICK NON-MAGNETIC STAINLESS STEEL TOP SURFACE 5 MM THICK PAINTED NON-MAGNETIC STEEL BOTTOM SURFACE SPILLPRUF SPILL MANAGEMENT 176 KILOGRAMS TABLE WEIGHT (QTY 1) ----- - KSI MODEL NUMBER 9000-24 SYSTE 9000 SERIES NON ISOLATED LEG STANDS FOR 914 MM WIDE BY 1829 MM LONG TABLE TOPS (QTY.1)	€ 6.160,00	€ 1.355,20	€ 7.515,20
DHL	shipping,insurance - Handling	€ 335,00	€ 73,70	€ 408,70
			Imponibile	€ 6.495,00
			IVA 22% su € 6.495,00	€ 1.428,90
			Totale dovuto	€ 7.923,90

Offerta N. 200FC.00312

Pagina 1

Spettabile
INFN - BARI
VIA ORABONA 4
70126 BARI (BA)
Italy

Luogo di Destinazione
INFN - BARI
VIA ORABONA 4
70126 BARI (BA)
Italy

Viareggio, 13/03/2020

Come da Voi richiesto, Vi sottoponiamo la nostra migliore offerta per la fornitura di:

Codice Prodotto *	Descrizione	Cons. **	Cons. ***	Q.tà	Prezzo unitario	Sconto %	Totale	Cod. IVA
WA1515TGXAAA	A1515TG - 14 Channel Floating 1kV, 1mA Board for Triple GEM detectors		90G	1	6.200,00		6.200,00	IVA22SP
WA995XAAAAAA	A995 - Insertion/extraction tool Radiall 282549024 for A996	STOCK s.v.	90G	1	240,00		240,00	IVA22SP
WA996XAAAAAA	A996 - 52 pin cable connector for A173XB-A183XB-A1932A-A1535 ACCORDO QUADRO - LOTTO 1 - CIG 791324043A	STOCK s.v.	90G	1	320,00		320,00	IVA22SP

Descrizione IVA IVA22SP IVA 22% Split Payment		Imponibile 6.760,00	Importo IVA 1.487,20	Totale Imponibile	Totale IVA
				6.760,00	1.487,20
		Totale Fattura 8.247,20 EUR			
Condizioni Pagamento bonifico 30gg d.f.f.m.		Banca d'Appoggio CASSA RISPARMIO VOLTERRA C/C - 098 ABI/CAB: 06370 24800 C/C:000010000042 IBAN: IT05F0637024800000010000042 SWIFT: CRVOIT3V			
Prezzi Porto Franco	Validità dell'offerta 60G	Garanzia 1A			
Note *****					