Editorial board report

- Conference talks-posters
- Publications:
  - General paper on FOOT
  - Submitted and in preparation

Ronja, Giovanni and roberto

Conferences in 2018

Name	Conference	Where	When	What	Sez
Morrocchi	Bormio 2018	Bormio (Ita)	1/18	Talk	Pi
Valle S.M.	Int. work Multi facets of Eos-Clust	LNS Catania(Ita)	5/18	Talk	Mi
Cerello	PTCOG57	Cincinnati, US	5/18	Poster	To
Biondi	14th Nordic Meet Nuclear Phys	Longyearbyen,Norway	5/18	Talk	Bo
Patera	biophysics-seminar	GSI, Darmstaadt	5/18	Seminar	Roma1
Silvestre G.	Pisa meeting	Elba	6/18	Poster	Pg
Ciarrocchi E.	Pisa meeting	Elba	6/18	Poster	Pi
Montesi	Rad 2018	Ohrid (Macedonia)	6/18	Talk	Na
Marafini M.	Nuclear React Mechanism NRM	Varenna (Ita)	6/18	Talk	Roma1
Traini G.	Nuclear Photonics 2018	Brasov (Romania)	6/18	Poster	Roma1
Yun	NSP2018	Trabzon (Turkey)	9/18		
Spighi	EUNPC 2018 Europ Nucl Phys Conf	Bologna	9/18	Talk	Bo
Cerello	CNR18	Berkeley, United States	9/18		To
	SIRR 2018	Rome, Italy	9/18		
	VERTEX 2018	Chennai, India	10/18		
Morone C.	Incontri di Fisica Nucleare	Catania	11/18	talk	Roma2
Franchini	Nuclear and Plasma Physics	London	11/18	Talk	Bo
	QNP2018	Tzukuba, Japan	11/18		
	NN2018 Nucleus–Nucleu Collision	Saitama, Japan	12/18		

- Talks (done + abstract accepted): **8**
- Poster: **4**
- Seminar: **1**

Before end of 2018,other 4-5 Talks

https://www.conference-service.com/conferences/nuclear-physics.html

FOOT paper

The FOOT experiment

FOOT Collaboration

Contents

We have the template, now we have to write!!! (we hope to submit in 2018)

Probable journal: JINST

FOOT Paper

Each sub-detector will be written by the responsible institute

Internal editors:

- Introduction-Motivation: Battistoni, Durante, Patera, + EB
- Start Counter: Patera, Sarti, Sciubba
- Beam Monitor: Battistoni, Tommasino
- Target:
- Vertex and Inner Tracker: Spiriti
- MSD: Ambrosi, Servoli
- Magnet:
- SCN: Morrocchi
- CAL: Cerello
- EMULSION chamber: Lauria, Montesi
- DAQ: Biondi
- Simulation
- Performance Spighi
- Make a homogeneous text: Battistoni, Patera, EB

Volunteers are welcome!!!

There is a mailing list

Someone still begin to write (Beam Monitor) !!!

Beam Monitor

Beam monitor.

The Beam Monitor (BM) is a drift chamber consisting of twelve layers of wires, with three drift cells per layer. Planes are oriented perpendicular to the BM axis (i.e. beam incidence direction). Two series of ortogonal planes are alternated in order to reconstruct the direction of incoming particles. The cell shape is rectangular (16 mm × 10 mm) with the long side orthogonal to the beam. In each view two consecutive layers are staggered by half a cell in order to solve left-right ambiguities in track reconstruction [?]. A technical drawing of the chamber is shown in Fig. 1. The BM was previously tested and operated in the framework of the FIRST experiment. The detector was employed at atmospheric pressure, at the working voltage of 1.8 kV in Ar/CO2, 80/20 gas mixture. The BM efficiency was measured to be close to unity for a 400 MeV/u carbon ion beam and the mean track spatial resolution was measured to be of the order of $\simeq 140\ \mu m$ [? ?]. The BM geometry has been implemented in the Garfield++ MC simulation tool [?]. This allows evaluating the impact of working conditions (e.g. high voltage settings, gas mixture) on detector performances. The electric field map inside a cell has been estimated (Fig. 1) and the space-time (ST) relations have been calculated (Fig. 2), thus reproducing the setup adopted in the carbon ion

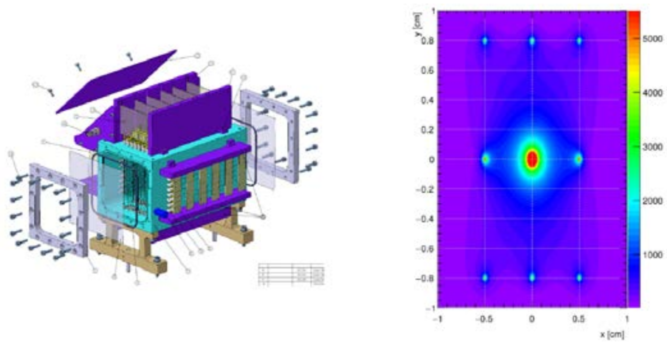

Figure 1 – Technical drawing of the BM drift chamber (left) and electric field map of a BM cell simulated with the Garfield++ code (right). At the center the anod wire is set to 1.8 kV and the 8 field wire surrounding the cell are set to 0 V.

experiment. As shown in the figure, ST relations appear in good agreement with the experimental data of the FIRST experiment.

As a part of the FOOT electronic apparatus, the BM detector will be placed between the SC and the target and will be used to measure the direction and impinging point of the ion beam on the target, a crucial information needed to address the pile-up ambiguity in the slow VTX detector (readout time = 187 μs). In fact the BM read-out time, of the order of 1 μs or less, is fast enough to ensure that tracks belonging to different events cannot be mixed at the typical acquisition frequencies. Howeever, in the case of pile-up ,event discrimination is still possible according to the following procedure. The vertices reconstructed in the pixel vertex detector (VTX) are randomly distributed with a shape dictated by the transverse size of the beam. According to our baseline experience CNAO or HIT facilities, the beam spot provided at the experimental facilities can be well described by a gaussian with FWHM in the order of a few mm. A similar beam setup can be easily obtained at GSI. The positions of the vertices reconstructed by the VTX for each event can be compared with the position of the BM track extrapolated to the target, and only the closest vertex to the BM extrapolation is selected as matched vertex. To this purpose, a precision of few hundred μm in the impact point provided by the BM is needed in order to discriminate the correct vertex in pile-up events. Obviously, this procedure requires a very accurate alignment between BM and VTX. In addition to that, the BM will be also used in the emulsion chamber setup.

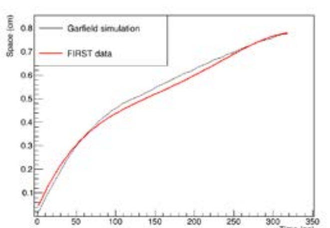

Figure 2 – Space-time relations for a mixture of Ar/CO2 at 80/20% from the FIRST experimental data (red line) and from Garfield simulations.

3. Performances

3.1. Electronic Setup Performances

Extensive work based on Monte Carlo simulations has been performed in order to evaluate BM performances. Specifically, the possiblity to exploit the BM to reject events related to undesired upstream fragmentation (e.g. fragmentation in the SC detector or in the BM itself) has been investigated in detail and is dicussed below. Results refer to an incident carbon ion accelerated at 200 MeV/u.

Study of the out of target fragmentation. The purpose of the BM in the FOOT experiment is to measure the direction of the incident beam and to reject the events in which the primary ion has fragmented before the target. The primary ion passes through different amounts of material which can lead to fragmentation processes before the target, mostly in the SC and in the BM material itself.

Expected fragmentation in Start Counter According to our MC simulations, the estimated percentage of fragmentation events in the SC is $\sim 0.13\%$. As shown in Fig. 3, protons are the most abundant fragments. Particles of increasing charge are then produced with an increasing smaller angular deflection. Secondary particles produced in the SC can increase the number of hits in the BM and have an initial angular deflection that can be exploited to identify and reject

Material	Density (g/cm^3)	Fragmentation percentage
1° Mylar ($C_{10}H_8O_4$)	1.4	28%
Gas (Ar-CO_2 80% – 20%)	$1.68\,10^{-3}$	41%
Field wires (Al)	2.70	2%
Sense wires (W)	19.3	< 1%
2° Mylar ($C_{10}H_8O_4$)	1.4	29%

Table 1 – Approximate percentage contributions of fragmented primary particle in the BM reported for the different BM material components.

such events. Problems arises for events in which only one of the produced fragments crosses the BM, since the particle track is in principle identical to the track of a primary ^{12}C ion, leading to a misidentification that cannot be solved. For instance, this happens when there is the production of Boron and Carbon isotope nuclei. These fragments also have a small angular deflection (see Fig. 3) and are responsible for the generation of an unrejectable background.

Expected fragmentation in Beam Monitor In addition to the fragmentation in the SC, inelastic nuclear interactions of the projectile can occur in the BM material, namely when hitting the mylar windows, the wires or the gas molecules. As a first-order approximation, we can neglect the surrounding air. The MC estimate of fragmentation events in the BM is $\sim 0.1\%$, similar to that of the SC. Details on the fragmentation percentage due to each BM component is reported in tab. 1.

If the projectile undergoes nuclear interactions on the first mylar window or before the last plane of cells in the BM, it is possible to reject the event since the produced particles can be detected. On the other hand, when fragmentation of the projectile takes place in the second mylar window the event cannot be rejected, since the primary particle leaves a signal in the BM identical to an event without nuclear interactions before the target. Therefore, it is expected at least a $\sim$30% of the events fragmenting in the BM material (*i.e.* $0.3\% \times 0.1\% = 0.03\%$) will contribute to the potentially unrejectable background. This is mainly due to primary fragmentation in the second mylar window. However, the vertex detector placed beyond the target could be useful in identifying these very few critical events.

BM and SC rejection performances. Altough the estimated level of background due to fragmentation events in SC and BM is low, a possible strategy has been envisaged to reject this background. Taking into account MC information, a tracking algorithm has been developed based on the GENFIT software. By analyzing the parameters of the fitted tracks, different criteria have been defined in order to reject the events in which the primary ion undergoes fragmentation before the target (i.e. background) and accept the events without fragmentation (i.e. signal).

Paper submitted – in preparation

Pisa Group:

"Development and characterization of a ΔE-TOF detector prototype for the FOOT experiment"

NIMA-D-18-00219

Half of april they received the comments from referees, 2 months to answer

Signed by the whole collaboration

Roma1 - Milano Group:

"Double differential cross section of ^{12}C on H, C and O"

In preparation

Data acquired at CNAO on july 2017

Development and characterization of a ΔE-TOF detector prototype for the FOOT experiment

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Papers from Conferences/posters

From Leonello

Papers and Conferences

→ Poster at FDFP2018 : Full Collaboration paper. Proceedings to be written.
Performance of standard microstrip + VA140 chip on ion beams.

→ LGAD paper: Technical paper concerning LGAD performances on ion beams.
Most likely submitted before end of summer)

→ Paper with more Trento Test beam results on standard microstrip.
Full collaboration paper. Data to be analyzed in the next months. Target: autumn submission.

→ Submission for oral talk at Vienna Conference in Instrumentation (2019)