



# FOOT CDR

*G. Battistoni, V. Patera  
with many others*

# Present status (May 24 @ 4:00 p.m.)

## Very first draft (V.0)

- it does not yet include some last minute updates (for instance, some results from Pisa)
- Prepared to be discussed at this meeting focusing on structure/organization, layout, general content.
- At present strictly reserved to collaboration (for example not yet show to referees)
- It is already impressive: >80 pages, 77 Figures, 16 Tables
- Many of us have contributed: Thanks a lot! The collaboration attitude has been quite positive

# Temporary Repository

(V0 @4 p.m. of May 24)

Dropbox link:

[https://www.dropbox.com/s/93zezux5lbbhcw2/FOOT\\_CDR\\_V0.pdf?dl=0](https://www.dropbox.com/s/93zezux5lbbhcw2/FOOT_CDR_V0.pdf?dl=0)

# Disclaimer

## V0 is still very preliminary:

- Is the layout/structure OK? Is the size adequate? (to be discussed now!)
- Some evaluations must be rechecked/redone...
- A good introduction is surely missing
- Figures are not yet correctly placed
- English is sometimes awful
- Spelling has not been checked
- It clearly appears that many different hands worked on this document
- References are out of order and there is not even a uniform style for them
- Author list to be checked
- ...

# Author list

## FOOT Conceptual Design Report

S. Argirò<sup>a,o</sup>, D. Barbosa<sup>b,v</sup>, G. Battistoni<sup>c</sup>, N. Belcari<sup>b,v</sup>, G. Bruni<sup>d</sup>, M. G. Bisogni<sup>b,v</sup>,  
S. Brambilla<sup>c</sup>, N. Camarlinghi<sup>b,v</sup>, P. Cerello<sup>a</sup>, E. Ciarrocchi<sup>b,v</sup>, A. Clozza<sup>e</sup>, G. De Lellis<sup>f,u</sup>,  
A. Di Crescenzo<sup>f,u</sup>, M. Durante<sup>g</sup>, R. Faccini<sup>h,q</sup>, V. Ferrero<sup>a</sup>, F. Ferroni<sup>h,q</sup>, C. Finck<sup>z</sup>,  
M. Fioralelli<sup>f</sup>, M. Franchise<sup>d,w</sup>, M. Garbini<sup>d,w</sup>, G. Girauda<sup>a</sup>, S. Hild<sup>g</sup>, A. Iacomino<sup>f</sup>,  
E. Iarocci<sup>h,q</sup>, A. Lauria<sup>f,u</sup>, C. La Tessa<sup>g,s</sup>, J. Lotti<sup>f</sup>, I. Mattei<sup>c</sup>, M. Marafini<sup>h,n</sup>,  
R. Mirabelli<sup>h,q</sup>, M. C. Montesi<sup>f,u</sup>, M. C. Morone<sup>i,t</sup>, M. Morrocchi<sup>b,v</sup>, S. Muraro<sup>b</sup>, L. Narici<sup>i,t</sup>,  
R. Paramatti<sup>h,q</sup>, A. Pastore<sup>m</sup>, N. Pastrone<sup>a</sup>, V. Patera<sup>h,q,n</sup>, C. Peroni<sup>a,o</sup>, L. Ramello<sup>a,o</sup>,  
V. Rosso<sup>b,v</sup>, M. Rovituso<sup>g</sup>, C. Sanelli<sup>e</sup>, M. Salvatore<sup>l</sup>, A. Sarti<sup>e,q,n</sup>, G. Sartorelli<sup>d,w</sup>,  
O. Sato<sup>r</sup>, A. Schiavi<sup>h,q</sup>, E. Scifoni<sup>g</sup>, C. Schuy<sup>aa</sup>, A. Sciubba<sup>h,q,n</sup>, M. Selvi<sup>d</sup>, L. Servoli<sup>l</sup>,  
M. Sitta<sup>a,p</sup>, R. Spighi<sup>d</sup>, P. Spinnato<sup>g</sup>, E. Spiriti<sup>e</sup>, G. Sportelli<sup>b,v</sup>, M. Testa<sup>e</sup>, V. Tioukov<sup>f</sup>,  
F. Tommasino<sup>g,s</sup>, G. Traini<sup>h,q</sup>, S. M. Valle<sup>c,y</sup>, M. Vanstalle<sup>z</sup>, M. Villa<sup>d,v</sup>, U. Weber<sup>aa</sup>,  
A. Zoccoli<sup>d,v</sup>

# Table of Contents - 1

Mi-Rm1-Tn

<b>1</b>	<b>Introduction, Motivations and Research Program</b>	<b>4</b>
1.1	Radiobiological background and Rationale . . . . .	4
1.2	Target fragmentation in proton beam irradiation . . . . .	6
1.3	Projectile fragmentation for oxygen beams . . . . .	6
1.4	Projectile fragmentation for Helium beams . . . . .	8
1.5	Radio Protection in Space . . . . .	9

**Acknowledgment:** Radiobiological motivations from E. Scifoni (CSN5/MoVE-IT)

**Notice: we have not yet considered an initial summary/abstract**

# Table of Contents - 2

2	The design criteria of FOOT apparatus	13
3	The Electronic Detector Setup <b>Mi-Na-Bo-Rm1-Rm2-Pi-LNF-To-Tn</b>	15
3.1	Upstream Region . . . . .	16
3.2	Pixel tracker and Magnetic Region . . . . .	17
3.2.1	Target and Vertex Tracker . . . . .	17
3.2.2	Intermediate Magnetic Region . . . . .	19
3.2.3	Inner Pixel Tracker . . . . .	21
3.3	Downstream Tracking: the Drift Chamber . . . . .	24
3.4	$\Delta E$ and TOF Detector . . . . .	26
3.4.1	The $\Delta E$ /TOF prototype . . . . .	27
3.4.2	Data acquisition . . . . .	28
3.5	Calorimeter . . . . .	28
3.6	Preliminary test . . . . .	29
3.7	Layout and planning . . . . .	30
4	The FOOT Emulsion Spectrometer	32
4.0.1	ES Section 1: vertex and tracking detector . . . . .	34
4.0.2	ES Section 2: ionization detector for charge identification . . . . .	34
4.0.3	ES Section 3: energy measurements . . . . .	35
4.0.4	Emulsion read-out . . . . .	37

This could be better organized

Editorial issue: hitting the limit on subsectioning level

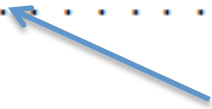
From the content point of view:  
- not always equilibrated among the different parts

For some detectors ideas are not really definite, but we do not make any comment...

*A reference to new alternative RD for ITR can be mentioned*

# Table of Contents - 3

<b>5</b>	<b>DAQ and Trigger</b>	<b>Bo</b>	<b>39</b>
5.1	Data acquisition limiting conditions and principles . . . . .		39
5.2	Trigger system . . . . .		39
5.3	Data acquisition infrastructure, data rates and volumes . . . . .		39
5.4	Online monitoring . . . . .		40
<b>6</b>	<b>Software</b>	<b>Mi-Na-Bo-Rm1</b>	<b>42</b>
6.1	Simulation . . . . .		42
6.2	Emulsion Spectrometer simulation . . . . .		44
6.3	Reconstruction . . . . .		45



But we don't say a word about computing needs...



# Table of Contents - 4

	<b>Mi-Na-Bo-Rm1-Rm2-Pi-LNF-To-Tn</b>	
<b>7</b>	<b>Expected Performances</b>	<b>47</b>
7.1	Study of the Beam Monitor performance . . . . .	47
7.1.1	Expected fragmentation in Start Counter . . . . .	47
7.1.2	Expected fragmentation in Beam Monitor material . . . . .	47
7.1.3	BM Expected performances . . . . .	48
7.2	Global Tracking and Momentum Measurement . . . . .	50
7.2.1	Momentum Performance . . . . .	50
7.3	Calorimetric measurement . . . . .	54
7.3.1	Calorimeter Length study . . . . .	54
7.3.2	Calorimeter fragments study . . . . .	55
7.4	Z and A identification . . . . .	58
7.5	Inverse Kinematics . . . . .	70

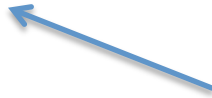
**Very dense and rich**

**Warning! After this meeting  
we have to recalculate things  
using less “punitive” resolutions**

# Table of Contents - 5

**Mi-Rm1**

8	Logistics and Timescale	74
9	Bibliography	76
10	Appendix A: proton cross section <b>Mi</b>	81



**Maybe we can drop this**

# What else could be missing?

- We do not present yet in a single place a construction schedule
- Do we need to include a draft-0 Gant chart? (**Probably this is something useful.** *BTW: in the next future INFN is going to ask this, together with other kind of project management documentation, at least to all big projects, by means of a uniform set of software tools. It will be probably appreciated also for smaller scale experiments*)
- Do we need to include an organization diagram? (*see above comment*)
- Are we requested to include in CDR the cost estimate?

# Deadlines

CSN3 Meeting is June 21-23

A public version of CDR would be needed  
~1 week before (June 16) → Not a lot of  
time available...

# Work organization in view of next Versions

## Co-editing

- At first we used anonymous Overleaf, but we overcame the file number limit
- Overleaf with access control has a larger limit
- Dropbox can do it (as for V0, where the folder was shared only by GB and VP for practical purposes)
- The key point in multiple-author editing is to avoid overwriting. We have split the tex files, but it works up to a certain point. Furthermore: latex does not allow nested include files.
- Are there more official tools recommended by INFN for this purpose?

# Organization proposal *(to be discussed now)*

## **Everybody:**

reads/check the document and, in case, sends comments to the Reviewing team

## **Reviewing team:**

a first pool of people (of the order of 5 guys) who critically go through the document; collect and filter comments/observations also coming from anybody else in the collaboration; send digested corrections to editing team; if needed looks for relevant people in case clarifications are needed in specific parts.

## **Editing team:**

a second pool of people (again of the order of 5 guys) who receives material from reviewer team, interacts with all relevant people in the collaboration to retrieve material, if needed, edits the text, takes care of graphical formatting, etc.

**This meeting will terminate only after all necessary people is identified...**