

Alvin and International Collaborations

Alvin Tollestrup tribute

The 2014 Fermilab Users Meeting

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University and INFN, Pisa

Fermilab, June 12, 2014

The start of the Collaboration

In September 1979 Paolo Giromini and G.B. heard of the new Tevatron Collider project at the Lepton-Photon conference at Fermilab.

In december 1979 I met at CERN with Alvin and Bob Diebold to discuss how Italians could do research at the Tevatron. A collaboration between a number of US groups and a Tsukuba/KEK group headed by Kuni Kondo had already been established.

A collaboration among 3 Countries?

We talked of a USA-Japan-Italy Collaboration for designing and operate a large magnetic detector. Initially Italy would be represented by two Frascati-Pisa groups, but the plan was to involve a much wider INFN community.

Alvin asked a week time for answering. He wanted to discuss this plan back at home.

There was no CDF

In 1980 the 15th floor of the Hi Rise was made available to the newly born Collaboration. In a wide empty space there were a number of drawing boards with large white sheets of paper on display. There was no CDF. That was a frightening scenery to us standing in front of the boards.

During long discussions and confrontations of ideas, sketches became projects and CDF was born. No asymmetric collisions with two kissing proton rings, but a solenoid on a p-pbar collider

It happened by itself

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We started with a three-party scheme but the group was born in practice with time, beginning with working together in front of boards on the 15th floor.

Did Alvin have in mind to create a real international collaboration? What did he check in that week of consultations at home?

The Institutions in the 1981 CDF design report

US

Argonne,
Chicago,
Fermilab,
Harvard,
Illinois,
LBL,
Purdue,
Texas A&M,
Wisconsin

Japan

KEK
Tsukuba

Italy

Frascati,
Pisa

**CDF was born as a
USA-Japan-Italy endeavor**

13 Institutions

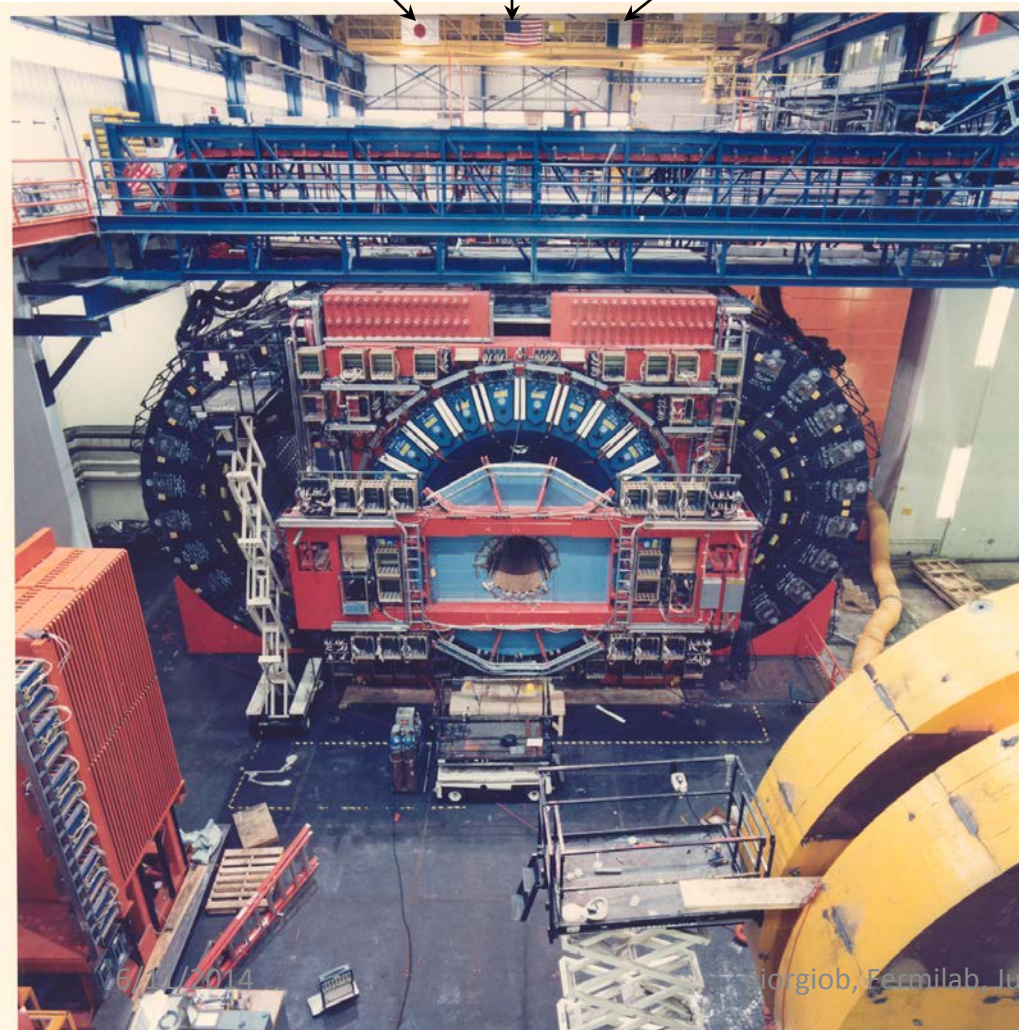
87 physicists

56 Americans, 15 Japanese , 16 Italians

The central CDF detector

Japan USA Italy

The three flags were displayed on top of the central detector in the assembly hall.



The growth of the Italian groups

1980, Frascati and Pisa

1990, Padova

1992, Bologna

1997, Trieste-Udine

1999, Rome

Discovery of the top quark (1995)

Start of Run 2 (2001)

53 CDF Institutions, about 650 physicists (111 Italians)

CDF at the discovery of the top quark

The CDF Collaboration

- Argonne, Bologna, Brandeis, UCLA, Chicago, Duke, Fermilab, Florida, Frascati, Geneva, Harvard, Hiroshima, Illinois, IPP (McGill-Toronto), Johns Hopkins, KEK, LBL, MIT, Michigan, Michigan State, New Mexico, Ohio State, Osaka City, Padova, Penn, Pisa, Pittsburgh, Purdue, Rochester, Rockefeller, Rutgers, Academia Sinica, Texas A&M, Texas Tech, Tsukuba, Tufts, Waseda, Wisconsin, Yale
- 475 people, 39 institutions, 6 countries



The Japanese and Italian authors in the top discovery papers were each about 13% of the Collaboration.

A Swiss group (Geneva) was the only other European group in CDF besides the Italians.

The jump forward in CDF2

After the top quark discovery many European groups from Germany, Russia, United Kingdom, Spain, France joined CDF for Run II.

Many non-European Institutions also joined from Canada, Japan, Korea, Norway, Taiwan.

The fully International Collaboration was in place.

In 2012 CDF comprised 30 US + 27 non-US Institutions
438 authors, ~ 50% non-US.

The happy end in 2012

CDF was a highly productive experiment.

New technologies were developed.

One major discovery was achieved.

Heavy flavor physics was opened at hadron colliders.

Many results will stay forever in the HEP books.

A model of international collaboration?

The Collaboration grown from Alvin`s initiative turned into a great success.

Physicists of different nations, races and genders got together in the US and produced good physics.

Questions;

Should we learn from this experience, can it be repeated?

Rather, can one do better?

Which political scheme is best?

Politics was second to success

The multi-national growth of CDF was prompted by its success. That swept away the original political design of a USA-Japan-Italy project.

The political design was motivating, but it faded away and was forgotten. Only success mattered.

Why was it successful?

The right accelerator and the right search were chosen.

With no high luminosity Tevatron and no top quark, such a success would have been impossible.

But there were the right leaders, primarily the right American leader at the start. They brought along smart collaborators and established a creative style of work.

What do we learn?

1- Let`s chose powerful physics instruments and attach fundamental physics questions.

2- It is good to adopt a fair politics, but focus on the leaders. At the end only people quality matters.

Alvin, this is my way of telling you how important you were for our Collaboration.

SPARES

57 Institutions in CDF today

CDF2 INSTITUTIONS (summer 2012)

30 US, 27 non-US

[Argonne National Laboratory](#)
[Baylor University](#)
[University of California Davis](#)
[Instituto de Fisica de Cantabria-University de Cantabria](#)
[Enrico Fermi Institute - University of Chicago](#)
[Joint Institute for Nuclear Research, Dubna](#)
[Fermi National Accelerator Laboratory](#)
[Laboratori Nazionali di Frascati](#)
[Glasgow University](#)
[University of Helsinki](#)
[Johns Hopkins University](#)
[Korea Center for High Energy Physics](#)
[University of Liverpool](#)
[CIEMAT - Madrid](#)
[IPP: McGill University and University of Toronto](#)
[University of Michigan](#)
[Northwestern University](#)
[Okayama University](#)
[University of Oxford](#)
[LPNHE and CNRS-IN2P3 - Paris](#)
[INFN - Sez. di Pisa](#)
[Purdue University](#)
[Rockefeller University](#)
[Rutgers University](#)
[Texas A&M University](#)
[University of Tsukuba](#)
[University of Virginia](#)
[Wayne State University](#)
[Yale University](#)

[IEAE - Universitat Autònoma de Barcelona](#)
[INFN - Università di Bologna](#)
[University of California Los Angeles](#)
[Carnegie Mellon University](#)
[Comenius Univ. and Institute of Experimental Physics](#)
[Duke University](#)
[University of Florida](#)
[University of Geneva](#)
[Harvard University](#)
[University of Illinois](#)
[Universitaet Karlsruhe](#)
[Lawrence Berkeley Laboratory](#)
[University College London](#)
[Massachusetts Institute of Technology](#)
[Michigan State University](#)
[University of New Mexico](#)
[The Ohio State University](#)
[Osaka City University](#)
[INFN - Sez. di Padova](#)
[University of Pennsylvania](#)
[University of Pittsburgh](#)
[University of Rochester](#)
[INFN - Sez. di Roma 1](#)
[Accademia Sinica](#)
[INFN, Trieste and University of Udine](#)
[Tufts University](#)
[Waseda University](#)
[University of Wisconsin](#)

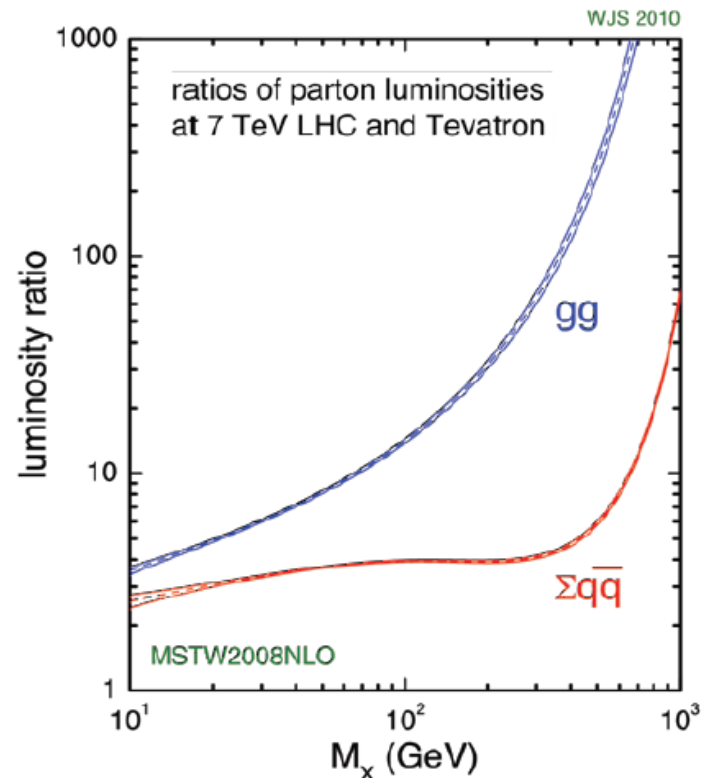
30 US + 27 non-US
Institutions
438 authors, ~ 50% non-US

553 PhD's
(~ 70 more on track)

Higgs search at LHC versus Tevatron

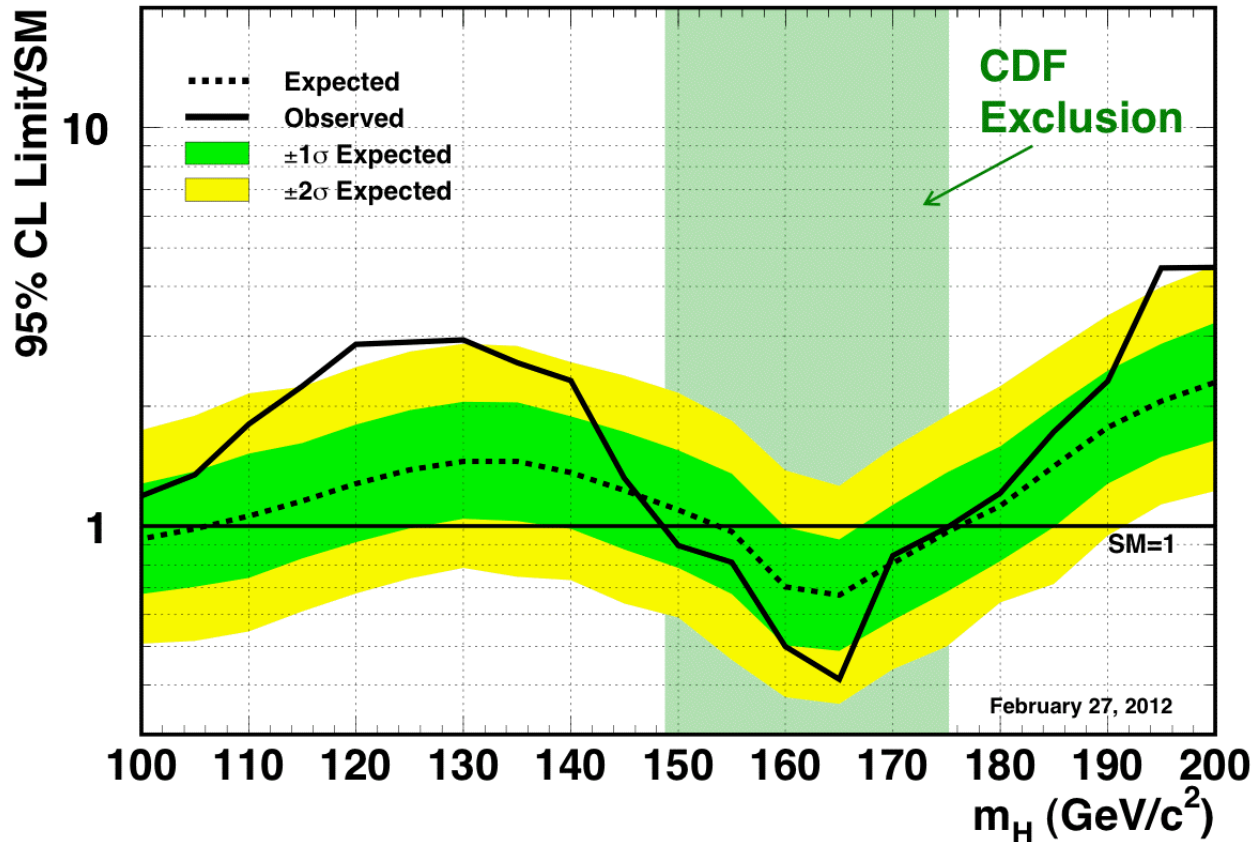
Depending on the production mechanism and the dominant backgrounds, there is a larger/smaller advantage for the LHC relative to the Tevatron

- $m_H < 130 \text{ GeV}/c^2$
 - ◆ $pp \rightarrow VH$ only 3x larger at LHC
 - ◆ Dominant backgrounds from $W/Z+bb$ and top production which increase more due to the rise in gg cross section
- $m_H > 140 \text{ GeV}/c^2$
 - ◆ $gg \rightarrow H$ ~15x larger at LHC
 - ◆ Dominant backgrounds from WW and ZZ production, from $qq\bar{q}$ production which increases by a smaller factor



New CDF combination

CDF Run II Preliminary, $L \leq 10 \text{ fb}^{-1}$



- Exclude SM Higgs at 95% C.L. : $147 < m_H < 175 \text{ GeV}/c^2$
- Expect to exclude: $100 < m_H < 106 \text{ GeV}/c^2$ & $154 < m_H < 176 \text{ GeV}/c^2$

Students of CDF-Pisa

(1985-2011)

Bachelor: 22

Master: 61

Ph.D.: 39

In addition: about 320 Italian summer students

Bachelor

Tesi Triennale	Anno	Ordin	Universita	Facolta'	Relatore		
Michele Basile	2008	Pisa	Ingegneria	Mauro	Dell'Orso		
Ottavia Bertolli	2011	Pisa	Fisica	Sandra	Leone		
Edoardo Bossini	2007	Siena	Fisica	Ciocci	Sartori	*	
Martina Bucciantonio	2003	Pisa	Fisica	Giorgio	Bellettini		
Sonia Budroni	2003	Pisa	Fisica	Giorgio	Chiarelli	*	
Michele Cascella	2004	Pisa	Fisica	Sandra	Leone	*	
Angelo Di Canto	2006	Pisa	Fisica	Giovanni	Punzi	Si	
Chiara DeBenedetti	2008	Pisa	Fisica	Bellettini	Scuri		
Januscia Duchini	2006	Siena	Fisica	Maria A.	Ciocci		
Paola Garosi	2005	Siena	Fisica	Maria A.	Ciocci	Si	
Paolo Giovacchini	2004	Pisa	Ingegneria		Dell'Orso		
GabrieleMari Grittani	2011	Pisa	Fisica	Simone	Donati		
Alessandro Iannarelli	2011	Pisa	Fisica	Giorgio	Chiarelli	*	
Federica Lionetto	2010	Pisa	Fisica	G. Chiarelli	S. Donati	*	
Simone Liuzzo	2008	Pisa	Fisica	Bellettini	Scuri		
Nicola Pozzobon	2004	Pisa	Fisica	Giorgio	Bellettini	Si	
Giulia Privitera	2006	Pisa	Fisica	Giorgio	Chiarelli	*	
Vito Schiraldi	2009	Pisa	Fisica	G. Punzi	M.J. Morello	Si	
Federico Sforza	2008	Siena	Fisica	Riccardo	Paoletti		
Marta Spinelli	2007	Siena	Fisica	Maria A.	Ciocci	*	
Leonardo Viti	2007	Siena	Fisica	Maria A.	Ciocci	*	
Stefania Vitillo	2010	Pisa	Fisica	Sandra	Leone	*	

Master (1)

Tesi Specialistica		Anno	Universita Facolta'		Relatore			
Antonio	Aldarese	1995-6	VO	Pisa	Fisica	Mauro	Dell'Orso	
Giorgio	Apollinari	1986	VO	Pisa	Fisica	Bellettini	G. Tonelli	No
Paolo	Bartalini	1993	VO	Pisa	Fisica	Paola	Giannetti	
Emanuela	Barzi	1996		Pisa	Fisica	G. Bellettini	A. Sansoni	
Alberto	Belloni	2001	VO	Pisa	Fisica	Giovanni	Punzi	Si
Stefano	Bettelli	1996	VO	Pisa	Fisica	Bellettini	Velev	No
Giulio	Berchiesi	1996	VO	Pisa	Fisica	Franco	Bedeschi	No
Massimo	Bitossi	2004		Pisa	Ingegneria	Mauro	Dell'Orso	
Andrea	Bocci	1997	VO	Pisa	Fisica	Giorgio	Bellettini	
Nunzio	Bonavita	1986		Pisa	Fisica	Bellettini	Cervelli	No
Martina	Bucciantonio	2010	NO	Pisa	Fisica	Mauro	Dell'Orso	*
Sonia	Budroni	2006		Pisa	Fisica	Giovanni	Punzi	
Pierfrancesco	Butti	2012	NO	Pisa	Fisica	Giorgio	Chiarelli	

Master (2)

Jessica	Cenni	2008	Pisa	Ingegneria Ae	Mauro	Dell'Orso	
Alessandro	Cerri	1997 VO	Pisa	Fisica	Mauro	Dell'Orso	
Silvio	Cherubini	1991	Pisa	Fisica	Michelangelo	Mangano	No
Giorgio	Chiarelli	1985 VO	Pisa	Fisica	Giorgio	Bellettini	No
Riccardo	Condorelli	2000 VO	Catania	Ingegneria	Luciano	Ristori	No
Simone	Dell'Agnello	1989 VO	Pisa	Fisica	Giorgio	Bellettini	No
Maria	D'Errico	2007	Pisa	Fisica	Giorgio	Bellettini	
Simone	Donati	1993 VO	Pisa	Fisica	Luciano	Ristori	No
Angelo	Di Canto	2008	Pisa	Fisica	Giovanni	Punzi	*
Januscia	Duchini	2010	Siena	Fisica	Maria A.	Ciocci	*
Giampiero	Ferri	2002	Pisa	Ingegneria El	Giannetti	Iannaccone	No
Paola	Garosi	2008 NO	Pisa	Fisica	Giovanni	Punzi	*
Guido	Gagliardi	1993 VO	Pisa	Fisica	Giovanni	Punzi	
Paolo	Gatti	1996 VO	Pisa	Fisica	Salvatore R.	Amendolia	No
Fabrizio	Giordano	2001 VO	Pisa	Fisica	Giovanni	Punzi	
Paolo	Giovacchini	2004	Pisa	Ingegneria	Mauro	Dell'Orso	
Giovanni	Giusti	1996	Pisa	Fisica	Franco	Bedeschi	No
Marco	Incagli	1988 VO	Pisa	Fisica	G. Bellettini	M. Franklin	No
Nicola	Labanca	1994 VO	Pisa	Fisica	Giovanni	Punzi	No
Giuseppe	Latino	1996 VO	Pisa	Fisica	Stefano	Lami	
Marzio	Lanzoni	1996 VO	Pisa	Fisica	Bellettini	Velev	No
Sabato	Leo	2009 NO	Pisa	Fisica	Giorgio	Bellettini	*
Sandra	Leone	1990 VO	Pisa	Fisica	Hans	Grassmann	No
Emilio	Meschi	1991 VO	Pisa	Fisica	Mauro	Dell'Orso	No
Michael	Morello	2003 VO	Pisa	Fisica	Giovanni	Punzi	*
Carmine	Pagliarone	1993 VO	Pisa	Fisica	Franco	Cervelli	
Riccardo	Paoletti	1987 VO	Pisa	Fisica	Luciano	Ristori	No
Ilenia	Pedron	2006 VO	Ferrara	Fisica	Tripiccione	Sartori	No
Amedeo	Perazzo	1994 VO	Pisa	Fisica	Salvatore R.	Amendolia	No

Master (3)

Silvio	Pinizzotto	1996 VO	Pisa	Fisica	Stefano	Belforte	No
Nicola	Pozzobon	2005	Pisa	Fisica	Giorgio	Bellettini	*
Giovanni	Punzi	1985 VO	Pisa	Fisica	Franco	Bedeschi	No
Nicola	Rafanelli	2008	Pisa	Fisica	Mauro	Dell'Orso	
Luca	Rogondino	2004	Pisa	Ingegneria	Mauro	Dell'Orso	
Francesco	Rubbo	2010 NO	Torino	Fisica	Diego	Tonelli	
Fabrizio	Ruffini	2009	Pisa	Fisica	Punzi	Morello	*
Paolo	Sestini	1985 VO	Pisa	Fisica	Franco	Cervelli	No
Federico	Sforza	2008	Pisa	Fisica	Giorgio	Chiarelli	*
Giovanni	Signorelli	1999 VO	Pisa	Fisica	Giovanni	Punzi	
Franco	Spinella	1994 VO	Pisa	Fisica	Stefano	Belforte	No
Domenico	Susca	2003 VO	Pisa	Fisica	Mauro	Dell'Orso	
Giuseppe Fr	Tartarelli	1990 VO	Pisa	Fisica	Bellettini	Bedeschi	No
Diego	Tonelli	2000 VO	Pisa	Fisica	Giorgio	Bellettini	*
Marco	Trovato	2008	Pisa	Fisica	Giorgio	Bellettini	*
Nicola	Turini	1988 VO	Pisa	Fisica	Luciano	Ristori	No
G.	Varotto	VO	Pisa	Ingegneria	Mauro	Dell'Orso	
Caterina	Vernieri	2011 NO	Pisa	Fisica	Giorgio	Bellettini	
G.	Zucchelli	1993 VO	Pisa	Fisica	Franco	Bedeschi	No

Ph. D. (1)

Tesi Dottorato		Anno	Universita'		Relatore		
Alberto	Annovi	2005	Pisa	Fisica	Mauro	Dell'Orso	
Patrizia	Barria	2012	Siena	Fisica	MariaAgnese	Ciocchi	
Valeria	Bolognesi	1992	Bologna	Fisica	Franco	Bedeschi	No
Alessandro	Cerri	2001	SNS	Fisica	Luciano	Ristori	
Ciro	Bigongiari	1999	Pisa	Fisica	Aldo	Menzione	
Pierluigi	Catastini	2006	Siena	Fisica	Maria A.	Ciocchi	*
Viviana	Cavaliere	2010	Siena	Fisica	Maria A.	Ciocchi	*
Marina	Cobal	1994	Pisa	Fisica	Giorgio	Bellettini	
Ernesto	Cocca	1998	Pisa	Fisica	Franco	Bedeschi	
Francesco	Crescioli	2010	Pisa	Fisica	ApplicatMauro	Dell'Orso	Si
Simone	Dell'Agnello	1994	Pisa	Fisica	Giorgio	Bellettini	
Simone	Donati	1997	Pisa	Fisica	Giovanni	Punzi	No
Claudio	Ferretti	2000	Pisa	Fisica	Salvatore R.	Amendolia	
Michele	Giunta	2007	Siena	Fisica	Giorgio	Bellettini	*
Marco	Incagli	1992	Pisa	Fisica	Angelo	Scribano	
Paola	Garosi	2012	Siena	Fisica	Giovanni	Punzi	
Giuseppe	Latino	2001	Cassino	Ingegneria	Giovanni	Piacentino	
Sandra	Leone	1994	Pisa	Fisica	Giorgio	Bellettini	No
Donatella	Lucchesi	1995	Catania	Fisica	Franco	Bedeschi	
Emilio	Meschi	1995	SNS	Fisica	Luciano	Ristori	
Michael	Morello	2007	SNS	Fisica	Giovanni	Punzi	*
Antoni	Munar-Ara	2002	Valencia	Fisica	Franco	Bedeschi	
Carmine	Pagliarone	1997	Torino	Fisica	Giorgio	Bellettini	
Francesco	Palmonari	2000	Cassino	Ingegneria In	Fabrizio	Raffaelli	
Riccardo	Paoletti	1992	Pisa	Fisica	Giorgio	Bellettini	
Giovanni	Punzi	1991	SNS	Fisica	Mauro	Dell'Orso	
Paola	Squillacioti	2006	Siena	Fisica	Maria A.	Ciocchi	*

Ph. D. (2)

Giuseppe Fr	Tartarelli	1996	Milano	Fisica	L. Moroni	Bedeschi	Si
Diego	Tonelli	2006	SNS	Fisica	Giovanni	Punzi	*
Stefano	Torre	2005	Siena	Fisica	Roberto	Carosi	
Nicola	Turini	1994	Bologna	Fisica	Franco	Bedeschi	
Guido	Volpi	2008	Siena	Fisica	Maria A.	Ciocchi	*

Angelo	Di Canto	III	Pisa
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Sabato	Leo	II	Pisa
Federico	Sforza	III	Pisa
Marco	Trovato	III	SNS

Manfredi	Ronzani		Pisa
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CDF milestones

1980-1981: Detector Design Report (57 American, 15 Japanese, 15 Italian authors)

1985: Collisions detected by central calorimeters (24 events)

1988-1989: $\sim 4 \text{ pb}^{-1}$ on tape at $\sqrt{s} = 1,8 \text{ TeV}$

1992-1996: “Run I” $\sim 110 \text{ pb}^{-1}$ on tape at $\sqrt{s} = 1,8 \text{ TeV}$

2001-2011: “Run II” at $\sqrt{s} = 1,98 \text{ TeV}$, $\sim 10 \text{ fb}^{-1}$ on tape

August, 1981

DESIGN REPORT

For the Fermilab Collider Detector Facility (CDF)

Argonne National Laboratory - D. Ayres, R. Diebold, E. May,
B. Musgrave, L. Nodulman, J. Sauer, R. Wagner, A.B. Wicklund

University of Chicago - H. Frisch, C. Grosso-Pilcher,
M. Shochet

Fermi National Accelerator Laboratory - M. Atac, F. Bedeschi,
A. Brenner, T. Collins, T. Droege, J. Elias, J. Freeman,
I. Gaines, J. Grimson, D. Gross, D. Hanssen, H. Jensen,
R. Kadel, H. Kautzky, R. Kephart, M. Ono, R. Thatcher,
D. Theriot, A. Tollestrup, R. Yamada, J. Yoh

Laboratori Nazionali dell' INFN - Frascati - S. Bertolucci,
M. Cordelli, P. Giromini, P. Sermoneta

Harvard University - G. Brandenburg, R. Schwitters

University of Illinois - G. Ascoli, B. Eisenstein, L. Holloway,
U. Kruse

KEK - S. Inaba, M. Mishina, K. Ogawa, F. Takasaki, Y. Watase

Lawrence Berkeley Laboratory - W. Carithers, W. Chinowsky,
R. Kelly, K. Shinsky

University of Pisa - G. Bellettini, R. Bertani, L. Bosisio,
C. Bradaschia, R. Delfabbro, E. Focardi, M.A. Giorgi,
A. Menzione, L. Ristori, A. Scribano, G. Tonelli

Purdue University - V. Barnes, R.S. Christian, C. Davis,
A.F. Garfinkel, A. Laasanen

Texas A & M - P. McIntyre, T. Meyer, R. Webb

Tsukuba University - Y. Asano, S. Kim, K. Kondo, S. Miyashita,
H. Miyata, S. Mori, I. Nakano, Y. Takaiwa, K. Takikawa, Y. Yasu

University of Wisconsin - D. Cline, R. Loveless, R. Morse,
L. Pondrom, D. Reeder, J. Rhoades, M. Sheaff

Italian authors in the CDF Design Report

ITALIANs IN CDF IN RUN2

(April 2003)

53 CDF Institutions (6 Italians), about 650 physicists (111 Italians)
6 Italian, 111 fisici

Gruppo di Bologna:	10 fisici
Gruppo di Frascati:	7
Gruppo di Padova:	22
Gruppo di Pisa:	37
Gruppo di Roma:	21
Gruppo di Trieste/Udine:	14

10 years of lower limits to M_{top}

Hunting for the top quark started full steam after the discovery of the b quark in 1977.

Petra/Pep	1984	$m_{\text{top}} > 22 \text{ GeV}$ (95% c.l.)
Tristan	1988	$> 26 \text{ GeV}$
SLC	1989	$> 41 \text{ GeV}$
LEP	1989	$> 45 \text{ GeV}$
UA1	1990	$> 50 \text{ GeV}$
UA2	1990	$> 69 \text{ GeV}$
CDF	1990	$> 77 \text{ GeV}$
UA2, CDF	1991	$> 71 \text{ GeV}$
CDF	1992	$> 91 \text{ GeV}$

CDF at the discovery of the top quark

The CDF Collaboration

- Argonne, Bologna, Brandeis, UCLA, Chicago, Duke, Fermilab, Florida, Frascati, Geneva, Harvard, Hiroshima, Illinois, IPP (McGill-Toronto), Johns Hopkins, KEK, LBL, MIT, Michigan, Michigan State, New Mexico, Ohio State, Osaka City, Padova, Penn, Pisa, Pittsburgh, Purdue, Rochester, Rockefeller, Rutgers, Academia Sinica, Texas A&M, Texas Tech, Tsukuba, Tufts, Waseda, Wisconsin, Yale
- 475 people, 39 institutions, 6 countries



60 Italian authors in the top discovery papers

BOLOGNA	8
FRASCATI	5
PADOVA	11
PISA	36

60 Italian authors, ~13% of the CDF Collaboration.
A Swiss group (Geneva) was the only other European group in CDF.