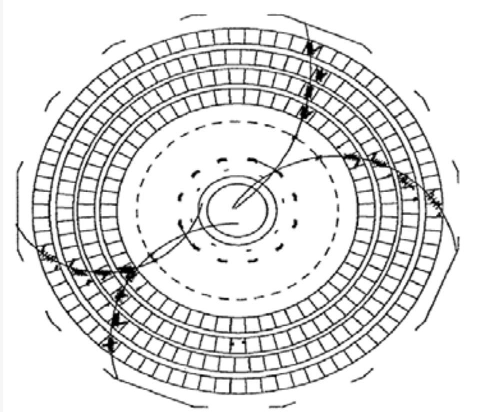
Decades of science

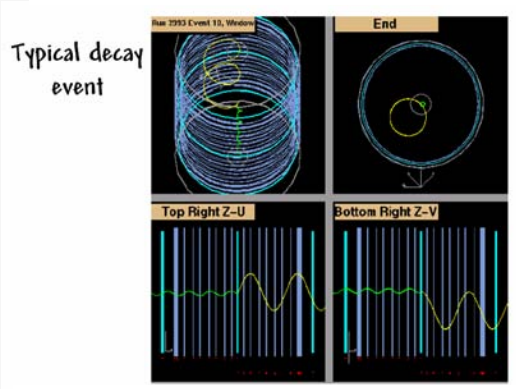
(A personal selection)

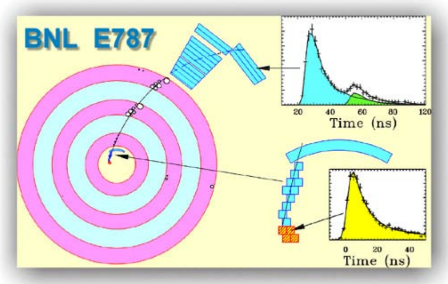
Jean-Michel POUTISSOU |

past science division head | TRIUMF

TUG AGM 14th December 2009

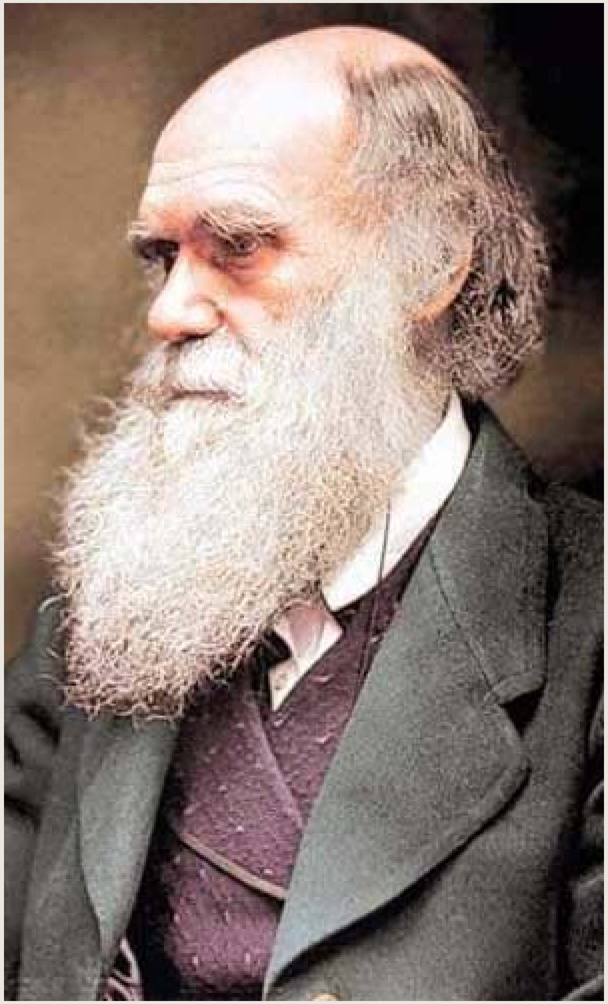




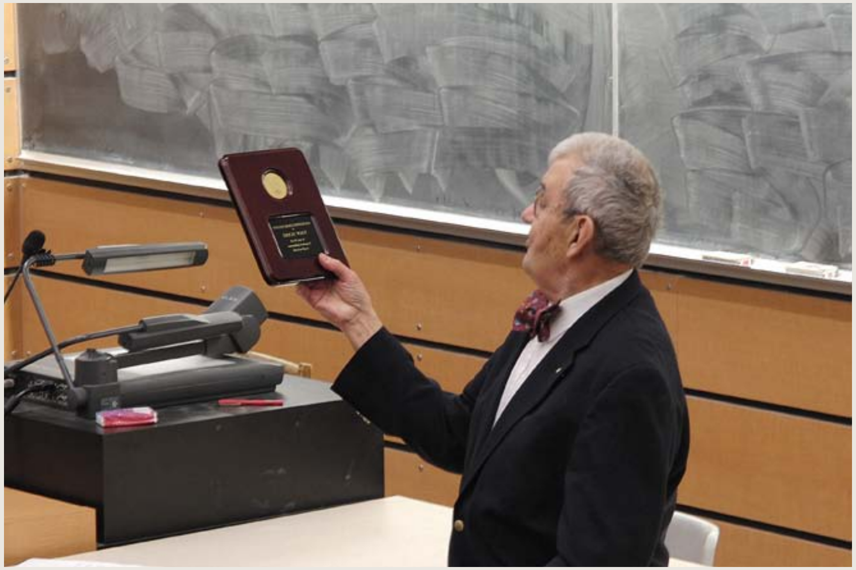


TRIUMF

200th anniversary of Darwin's birthday



Two passions: Hurdling and Teaching



1975 annual report

EXPERIMENT PROPOSALS

The following lists experiment proposals received up to the end of 1975 (missing numbers cover proposals that have been withdrawn, replaced by later versions, or combined with another proposal). Page numbers are given for those experiments which are included in this annual report.

[Spokesman underlined]

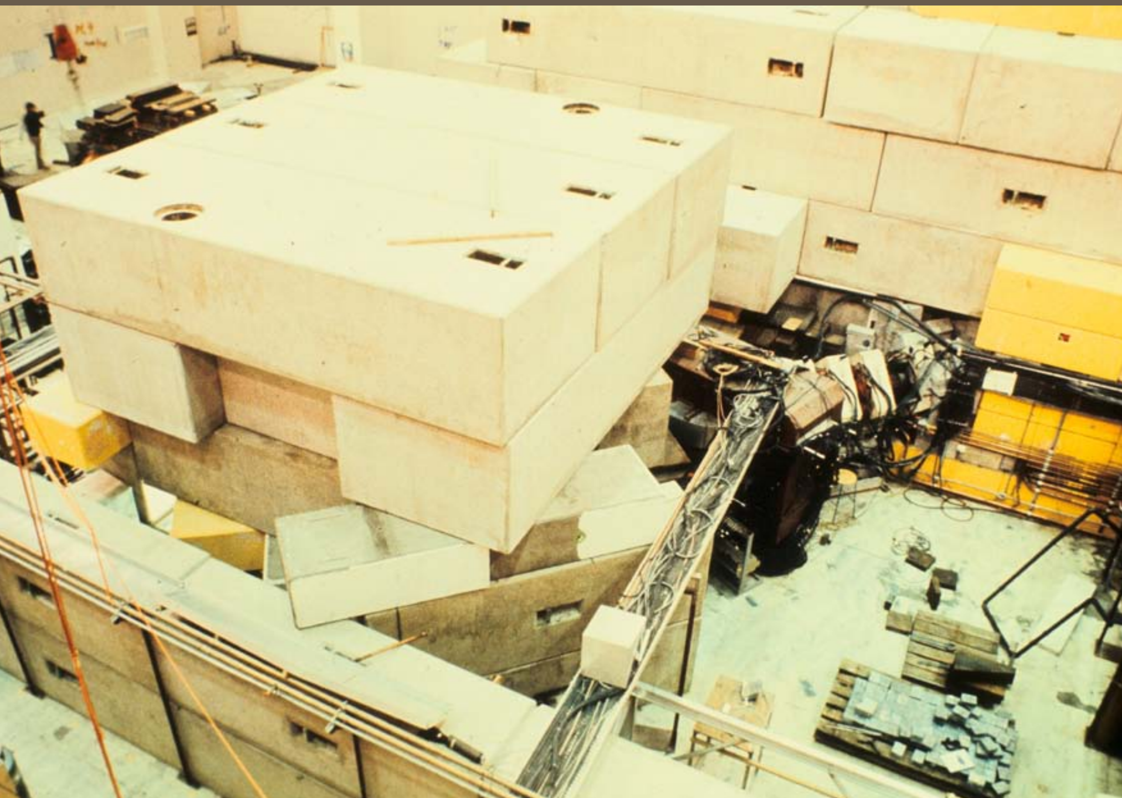
		Page
1.	Low-energy pi nuclear scattering, E.G. Auld, D.A. Axen, R.R. Johnson, G. Jones, (*Univ. of British Columbia*)	54
2.	Investigation of the D(p,2p)n reaction, J.M. Cameron, P. Kitching, W.J. McDonald, G.A. Moss, W.C. Olsen (*Univ. of Alberta*)	
3.	The study of fragments emitted in nuclear reactions, J.M. D'Auria, R. Green, R.G. Korteling, B.D. Pate (*Simon Fraser University*)	61
4.	A study of the reaction p + p → p + p + π^0 near threshold, D.F. Measday, J.E. Spuller (*Univ. of British Columbia*)	
6.	Studies of the proton- and pion-induced fission of light to medium mass nuclides, D. Dautet, F.M. Kiely, B.D. Pate (*Simon Fraser University*)	
9.	A study of the reaction of π^- + p → γ + n at pion kinetic energies from 20-200 MeV, M.D. Hasinoff, D.F. Measday, M. Salomon (*Univ. of British Columbia*), J-M Poutissou (*Univ. de Montréal*)	55
10.	Positive pion production in proton-proton and proton-nucleus reactions, D.A. Axen, R.R. Johnson, G. Jones, M. Salomon, J.B. Warren (*Univ. of British Columbia*) L.P. Robertson (*Univ. of Victoria*), P. Kitching, W.C. Olsen (*Univ. of Alberta*)	57
11.	A study of new, high neutron excess nuclides, G. Bischoff, J.M. D'Auria, H. Dautet, R.G. Korteling, B.D. Pate, W. Wiesehahn (*Simon Fraser University*), G.F. Coote (*INS, Dept. of Science & Industrial Research, New Zealand*)	63
12.	An experiment to measure the mass of new elements with Isospin T_Z=-2 and T_Z=-5/2 using (p,^{8}He) and (p,^{9}Li), J.M. Cameron, D.A. Hutcheon, G.C. Neilson (*Univ. of Alberta*), D.R. Gill (*TRIUMF*)	
13.	Measurement of the electromagnetic size of the nucleus with muonic x-rays, particularly the 2s-2p transition, G.A. Beer, G.R. Mason, R.M. Pearce, C.E. Picciotto, C.S. Wu (*Univ. of Victoria*), D.G. Fleming (*Univ. of British Columbia*), W.C. Sperry (*Central Washington State College*)	
14.	The interaction of protons with very light nuclei in the energy range 200-500 MeV, J.M. Cameron, R. McCamis, G.A. Moss, G. Roy, A.W. Stetz (*Univ. of Alberta*), D.S. Bhakar, L.A. Goulding, W.T.H. van Oers (*Univ. of Manitoba*), J.G. Rogers (*TRIUMF*)	66
15.	A Proposal to study quasi-free scattering in nuclei, J.M. Cameron, P. Kitching, W.J. McDonald, C.A. Miller, G.C. Neilson, W.C. Olsen, J.T. Sample, A.W. Stetz, G.M. Stinson (*Univ. of Alberta*), A.N. James (*Univ. of Liverpool*)	67
16.	Proton-deuteron quasielastic scattering, D.A. Hutcheon, P. Kitching, W.J. McDonald, C.A. Miller, G.A. Moss, W.C. Olsen, D.M. Sheppard, A.W. Stetz (*Univ. of Alberta*), A.N. James (*Univ. of Liverpool*), J.G. Rogers (*TRIUMF*)	68
18.	Influence of chemical environment on atomic muon capture rates, G.A. Beer, T.W. Dingle, D.E. Lobb, G.R. Mason, R.M. Pearce (*Univ. of Victoria*), D.G. Fleming (*Univ. of British Columbia*), W.C. Sperry (*Central Washington State College*)	

		Page
19.	Nuclear decays following muon capture, G.A. Beer, G.R. Mason, R.M. Pearce, C.E. Picciotto, C.S. Wu (*Univ. of Victoria*), G.A. Bartholomew, E.D. Earle, F.C. Khanna (*Chalk River Nuclear Laboratories*), D.G. Fleming (*Univ. of British Columbia*), W.C. Sperry (*Central Washington State College*)	
20.	Isotope effect in μ capture, G.A. Beer, G.R. Mason, R.M. Pearce, C.E. Picciotto, C.S. Wu (*Univ. of Victoria*), D.G. Fleming (*Univ. of British Columbia*), W.C. Sperry (*Central Washington State College*)	
21.	Optical activity induced by polarized elementary particles, L.D. Hayward, D.C. Walker (*Univ. of British Columbia*)	
22.	Fragmentation of light nuclei by low-energy pions, H.B. Knowles *et al.* (*Washington State University*). Now known as 'Negative pion capture and absorption on carbon, nitrogen and oxygen. [Passed to Biomedical Experiments Evaluation Committee]	
23a.	Search for the decay mode π^0 → 3γ, P. Depommier, J-P Martin, J-M Poutissou, R. Poutissou (*Univ. de Montréal*)	56
23b.	Investigation of the decay mode π^+ → e^+ + ν_e + γ, P. Depommier, J-P Martin, J-M Poutissou, R. Poutissou (*Univ. de Montréal*)	56
24.	Elastic scattering of polarized protons on ^{12}C, G.A. Moss, G. Roy, D.M. Sheppard, H. Sherif (*Univ. of Alberta*) [Combined with Exp. 14]	
26.	Measurement of the differential cross-section for free neutron-proton scattering and for the reaction of D(n,p)2n, L.P. Robertson (*Univ. of Victoria*), E.G. Auld, D.A. Axen, J. Va'vra (*Univ. of British Columbia*)	
27.	Measurement of the polarization in free neutron-proton scattering, E.G. Auld, D.A. Axen, J. Va'vra (*Univ. of British Columbia*), L.P. Robertson (*Univ. of Victoria*), G. Roy (*Univ. of Alberta*)	
28.	A programme of direct pickup reactions at intermediate energies, D.G. Fleming (*Univ. of British Columbia*)	
29.	A study of the reactions π + p → π + π + p at pion kinetic energies from 10 to 90 MeV, D.A. Axen, R.R. Johnson (*Univ. of British Columbia*), E.W. Blackmore (*TRIUMF*)	
30.	Scattering of pions from isotopes of hydrogen and helium, D.S. Bhakar, N. Davidson, W. Falk, W.T.H. van Oers (*Univ. of Manitoba*)	
31.	p-n elastic scattering with polarized protons and polarized neutrons, J.M. Daniels, P. Kirkby, R.S. Tlesic (*Univ. of Toronto*), J. McAndrew (*Memorial University*)	
33.	Basic radiobiological experiments with pions versus 260-280 kV x-rays, M.J. Ashwood-Smith (*Univ. of Victoria*) [Biomedical EEC]	
34.	Low-energy (π^+,π^-) differential and total cross-section measurements, R.R. Johnson (*Univ. of British Columbia*)	
35.	A study of positive muon depolarization phenomena in chemical systems, J.H. Brewer, D.G. Fleming, D.C. Walker (*Univ. of British Columbia*), K.M. Crowe (*Univ. of California*), R.M. Pearce (*Univ. of Victoria*)	58
36.	Neutron diffraction, J. Trotter (*Univ. of British Columbia*), M.J. Bennett (*Univ. of Alberta*), G. Bushnell (*Univ. of Victoria*), F.W.B. Einstein (*Simon Fraser Univ.*)	
37.	Search for μ^- + Cu → e^+ + Co, G.A. Beer, D.A. Bryman, L.P. Robertson (*Univ. of Victoria*), M. Blecher, K. Gotow (*Virginia Polytechnic Institute and State Univ.*)	
38.	Neutron scattering from fluids and amorphous solids, C.A. McDowell (*Univ. of British Columbia*), P.A. Egelstaff (*Univ. of Guelph*), I.M. Thorson (*Simon Fraser University*)	
39.	S-wave pion-nuclear interactions, D.A. Axen, G. Jones (*Univ. of British Columbia*)	
40.	A proposal for neutron experiments at TRIUMF, D.A. Axen, M.K. Craddock, J. Va'vra (*Univ. of British Columbia*), D.V. Bugg, J.A. Edgington (*Queen Mary College, London*), N.M. Stewart (*Bedford College, London*), A.S. Clough (*Univ. of Surrey*), I.M. Blair (*AERE, Harwell*)	64

The year was 1976

- 1976 is the year of the discovery of the C quark!
- The Glashow,Weinberg Salam model looks more and more promising
- U de Montreal has just received the second large NaI detector (MINA) to complement the TRIUMF one (TINA) and start a rare pion decay program.
- At the SIN(now PSI) PAC meeting in June, Steve Weinberg learned that the SIN rare decay experiment has 6 events that looks like μ->e γ events.
- Via slow mail (remember 1st E-mail was send in 1976!) the world gets in a frenzy and 50 theoretical papers are published within 3 months on what it could mean.
- We quickly convinced Jack Sample to change all our plans and mount a μ->eγ search using the set up for exp 23, building a cave with all the iron shielding piled up at the end of the meson hall for the TNF and all the concrete blocks we could find.
- We got “ charter sheet” , gate 1,2,3, reviews ,engineering and safety reviews, EEC approval , schedule shuffled in M9 within a month and got to work.
- We sent an abstract to the “PANIC” meeting to be held in Zurich in Aug 1977 without committing to a number for the branching ratio.

Muegamma 1997



1977

When I arrived in Zurich, I am cornered by our friends from SIN.

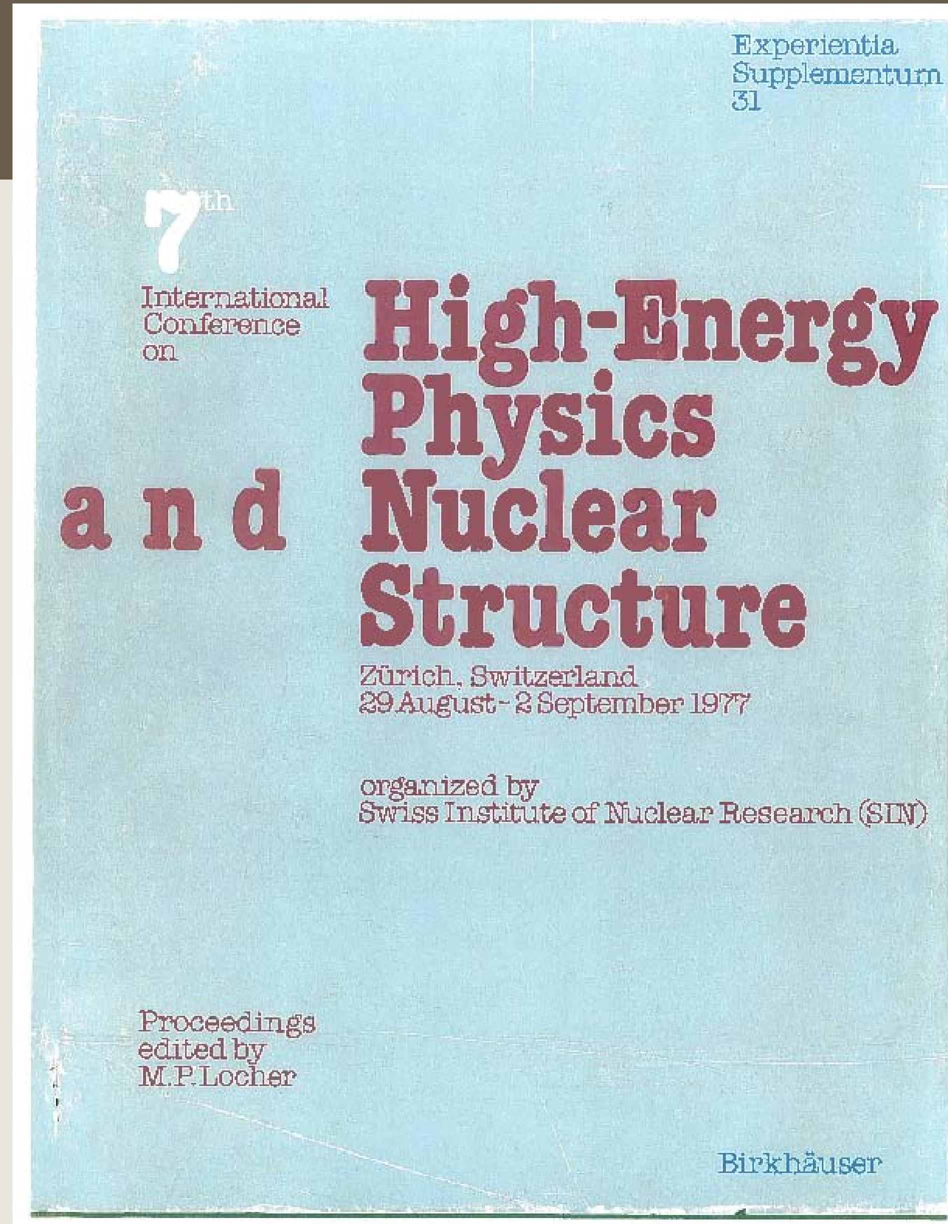
They want to know what our limit is (They know we have not confirmed their 6 “events “).

They confirm that they will present a upper limit.

Our final numbers are not revealed until the session on weak interaction .

Steve Weinberg gives the plenary talk.

Lincoln Wolfenstein chairs the parallel session on weak interaction

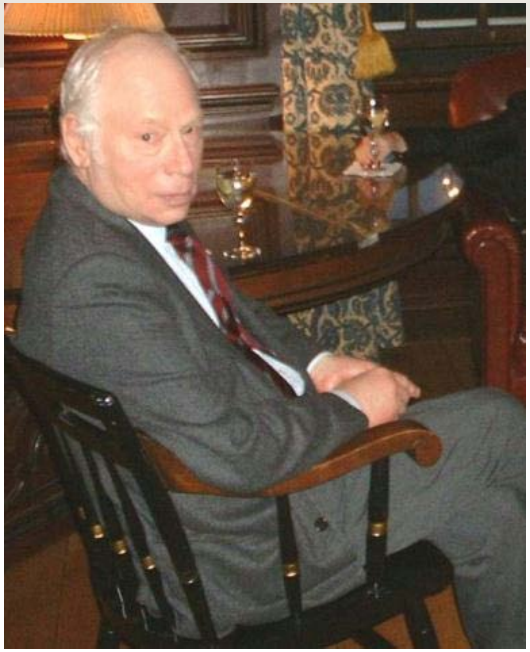


The Zurich meeting

Steven Weinberg
Harvard University, Cambridge, Massachusetts

Abstract

A review is presented of the general principles and recent developments in unified gauge theories of the weak, electromagnetic, and strong interactions.



Muon nonconservation is also possible in the standard model, if there is more than one scalar doublet. The coupling of Higgs bosons to any particle are generally proportional to the mass of that particle, so one-loop diagrams in which Higgs bosons are emitted and reabsorbed from lepton lines give very small contributions. The dominant effect comes from two-loop diagrams, in which a Higgs boson is emitted from a lepton and absorbed by a virtual W or Z. The branching ratio here depends on many unknown parameters, but under the most favorable circumstances it could take values[41] as large as $(\alpha/\pi)^3 \sim 10^{-8}$.

Very recently, a new upper limit[42] of 3.6×10^{-9} has been set on the $\mu \to e\gamma$ branching ratio. From the perspective of SU(2) × U(1) gauge theories, this is almost but not quite stringent enough to shed light on the question of whether muon conservation is really a fundamental symmetry principle. An improvement of one more order of magnitude in the sensitivity of this experiment (and experiments on $\mu\mathcal{N} \to e\mathcal{N}$) would be very illuminating.

42) P. Depommier *et al.*, (Montréal-UBC-Triumf collaboration) to be published. Also see the report of H. P. Povel (ETH-Zürich-SIN-Munich collaboration) at this conference. [See also the edit. postscript after L. Wolfenstein's report.

43) M. Kobayashi and K. Maskawa, Prog. Theor. Phys. 49, (1973) 652; A. Pais and J. Primack, Phys. Rev. D8, (1973) 3063; L. Maiani, Phys. Lett. 68B, (1976) 183; S. Pakvasa and H. Sugawara, Phys. Rev. D14, (1976) 305.

44) T. D. Lee, Phys. Rev. D8, (1973) 1226 and Phys. Rep. 9C, (1974) 143; S. Weinberg, Phys. Rev. Lett. 37, (1976) 657.

The Zurich meeting

WEAK INTERACTIONS – *Workshop P*

L. Wolfenstein

Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213, USA

Abstract

The study of the weak interactions involving pions, muons, and nuclei can clarify the laws of weak interactions. The present theoretical interest in muon-electron universality, nonconservation of muon number, and second-class currents is discussed.

This session is devoted to weak interaction processes involving pions, muons, and nuclei. The emphasis will be on the role of these processes in clarifying the form of the weak interaction Hamiltonian. The theory of weak interactions has had exciting developments in the last few years. A particular form of unified gauge theory of weak and electromagnetic interactions, which we will refer to as the standard model,[1] has had two striking successes: (1) neutral weak currents have been discovered in high-energy neutrino interactions with protons and neutrons and these currents appear to have a strength and form consistent with the predictions of the model. (2) Charmed particles, needed in the model to explain the absence of strangeness-changing neutral currents, have been discovered with the expected decay modes. Nevertheless, there are indications that this model may not be the total story.

If there is a conclusion to this talk, it is that the fundamental laws of weak interactions must be explored in many different ways: beta-decay, weak processes of pions and muons, atomic physics, colliding e^+e^- beams, and high-energy neutrino beams at the largest accelerators all have a role to play.

Editorial postscript:

As this contribution was prepared before the conference it does not contain the latest experimental results on muon number violating processes. With the permission of the authors we are quoting the following preliminary results which have been presented in the workshop P on weak interactions.

The ratio of $\mu \to e\gamma$ relative to the dominant decay mode is

$$R_{\mu e\gamma} < 3.6 \times 10^{-9}$$

reported by J.M. Poutissou from the TRIUMF group (abstract P4) and

$$R_{\mu e\gamma} < 1.6 \times 10^{-9} \text{ (90\% CFL)}$$

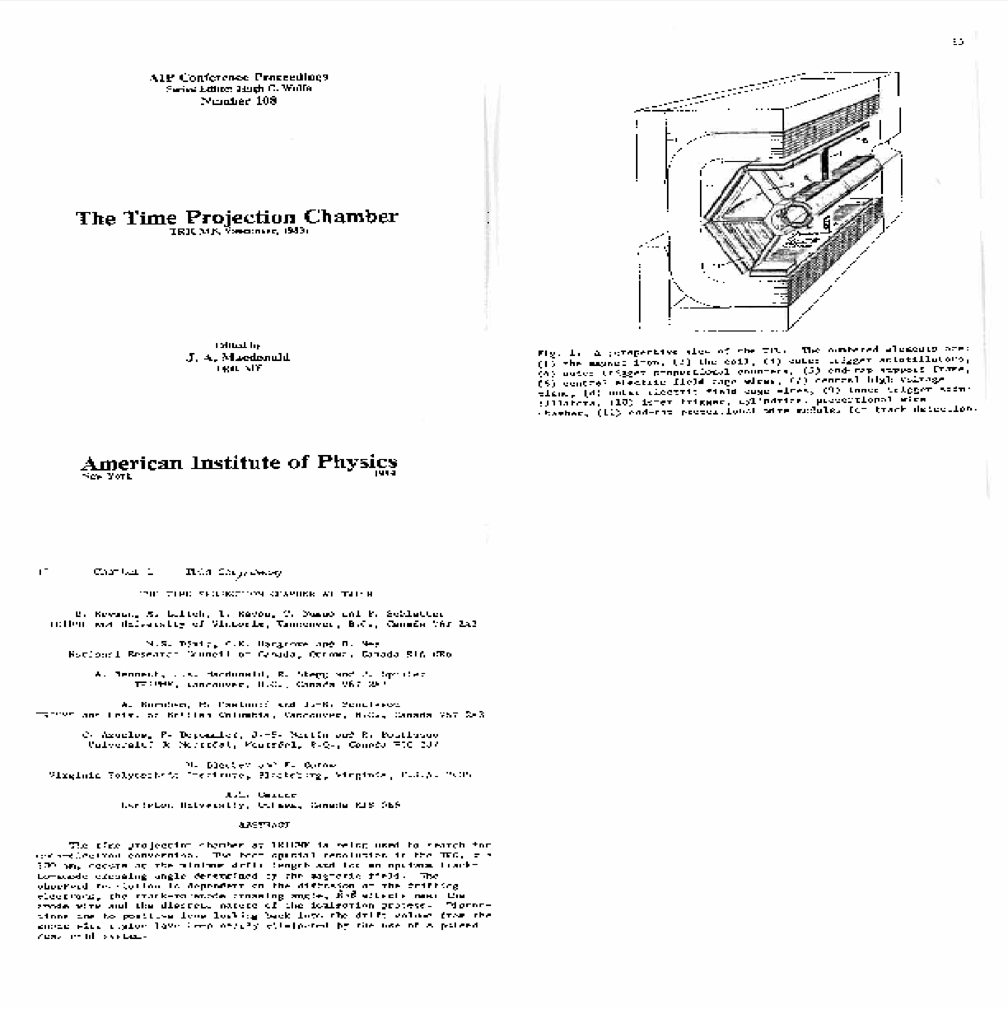
reported by H.P. Povel from the SIN group (abstract P18).

B. Hahn from the Bern group working SIN reported the following preliminary limits on μe conversion on ^{32}S:

$$R_{\mu^- e^-} < 4 \times 10^{-10}$$

and $R_{\mu^- e^+} < 1 \times 10^{-9}$.

Rare decay program


AIP Conference Proceedings
Number 108

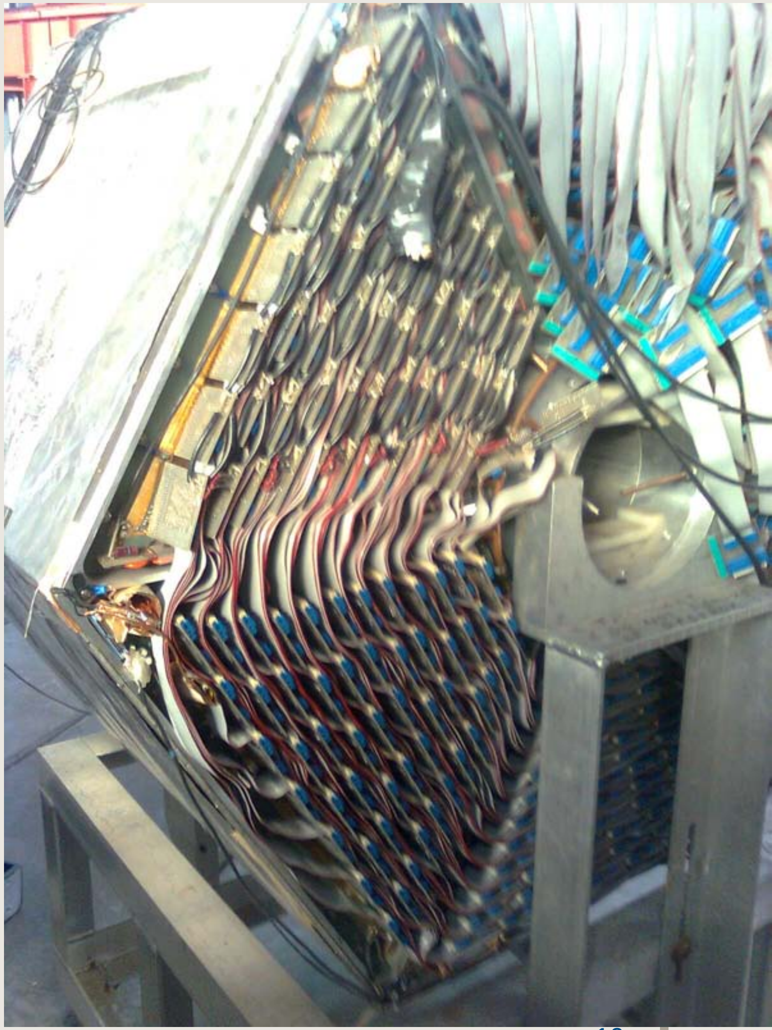
The Time Projection Chamber

Edited by
J. A. Macdonald

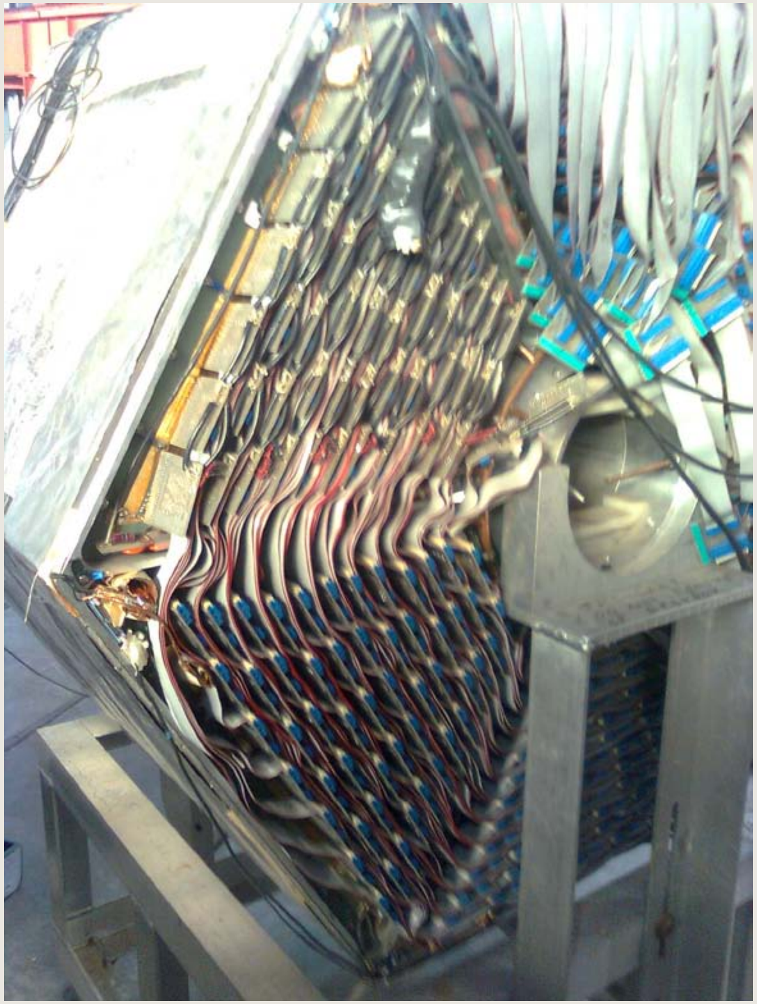
American Institute of Physics
New York

THE TIME PROJECTION CHAMBER AT TRIUMF

ABSTRACT

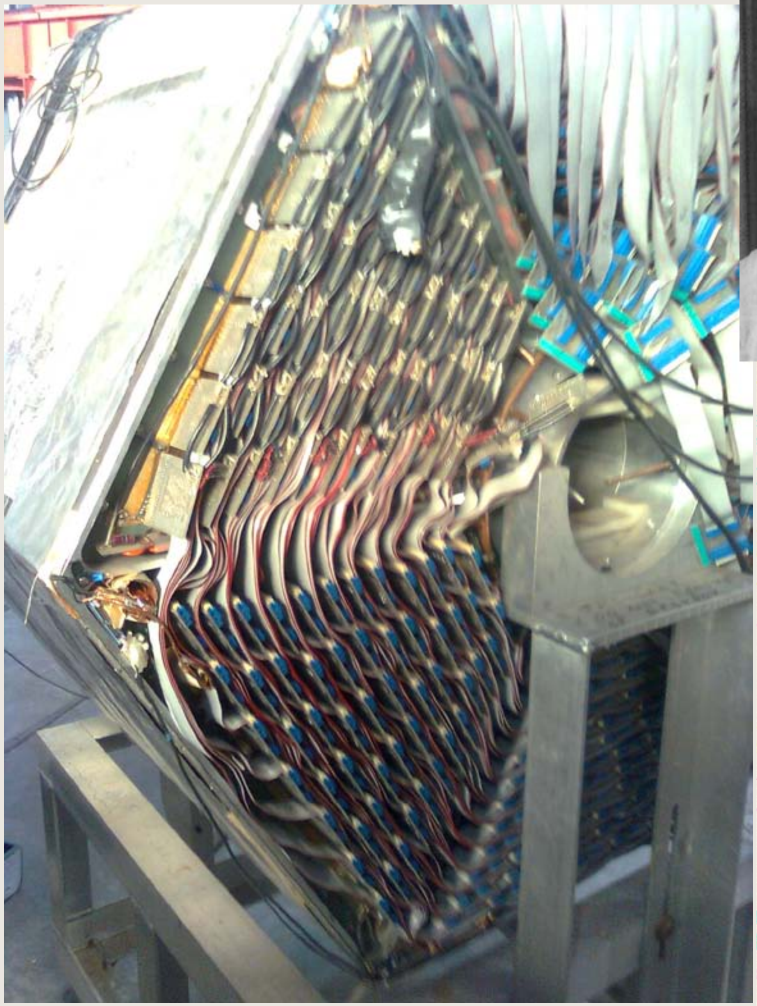


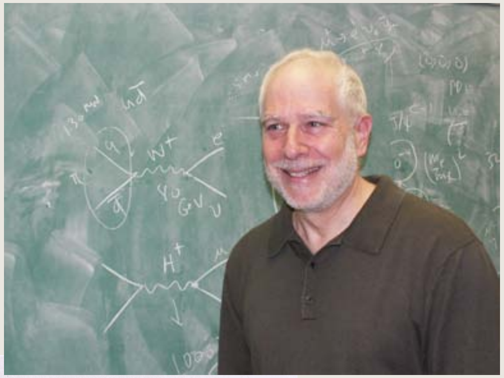
Detector group/Electronics/DAQ

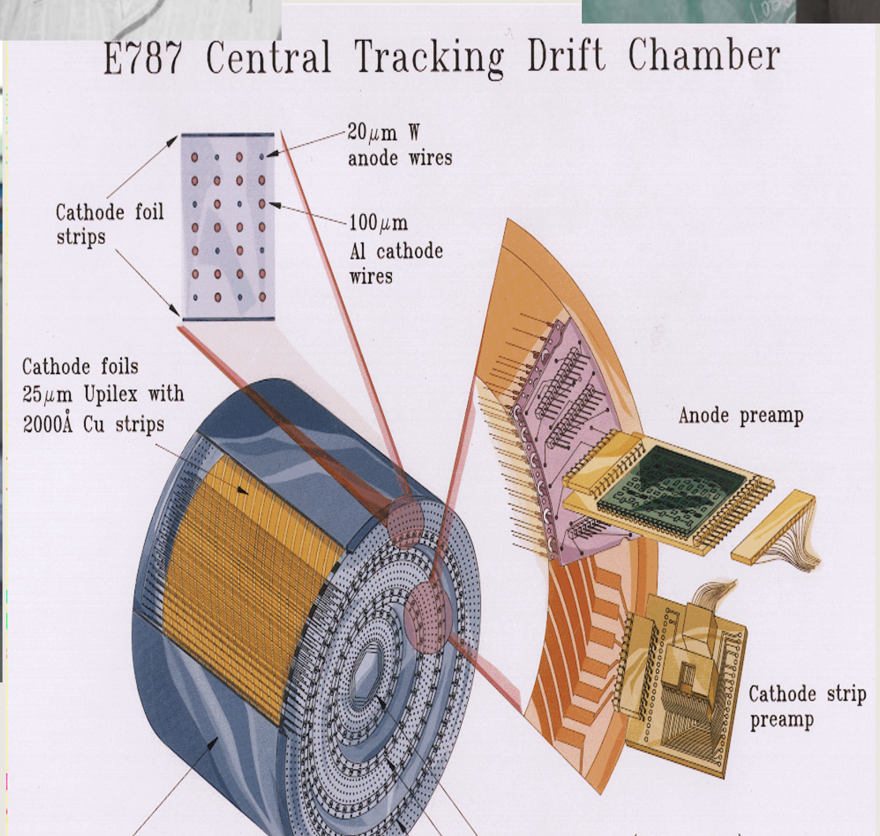


- First TPC use in an experiment.
- Hermes TRD's chambers
- RMC drift chamber
- E787 drift chamber
- Babar drift chamber
- T2K TPC's

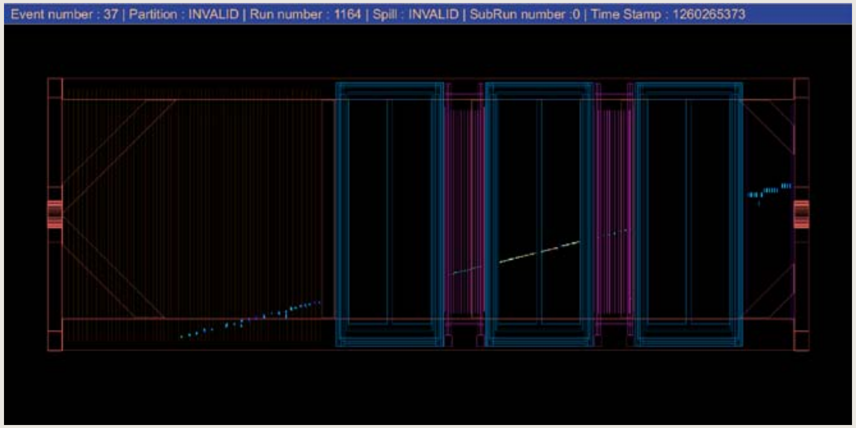
Rare decay tracking chambers-→ LADD

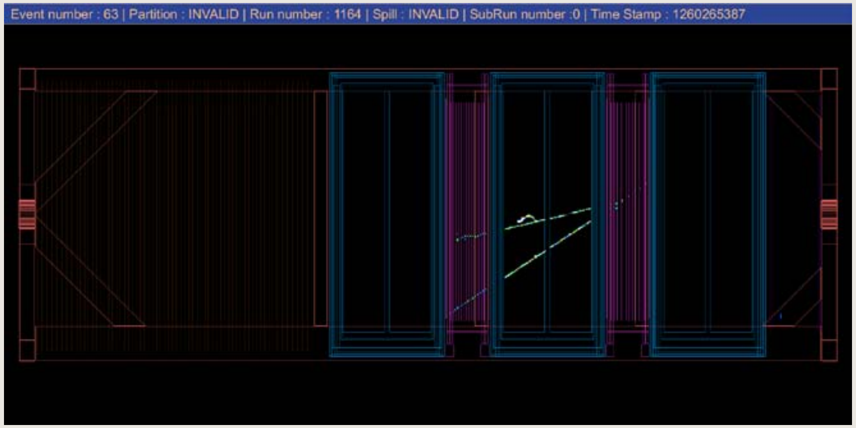






T2K cosmic ray event





Weak interactions at TRIUMF?

- R.Feynman visited TRIUMF in the winter of 1974.
- I showed him the beginning of BI1A, I was building with John Vincent.
- He asked me what I was going to do with it and I answered studying the weak interaction.
- He shuddered and said : At that low an energy? I don’t remember if I answered “ *you surely must be joking Dr. Feynman* “ but…. I should have .

- Anyway we did start a program in muon and pion decay parameters measurement, life time, and rare decays etc.

Search for Right handed currents

PHYSICAL REVIEW D VOLUME 34, NUMBER 7 1 OCTOI

Search for right-handed currents in muon decay

A. Jodidio,* B. Balke, J. Carr,† G. Gidal, K. A. Shinsky,‡ H. M. Steiner,
D. P. Stoker,§ M. Strovink, and R. D. Tripp
Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720

B. Gobbi
Department of Physics, Northwestern University, Evanston, Illinois 60201

C. J. Oram
TRIUMF, Vancouver, British Columbia V6T 2A3, Canada
(Received 27 May 1986)

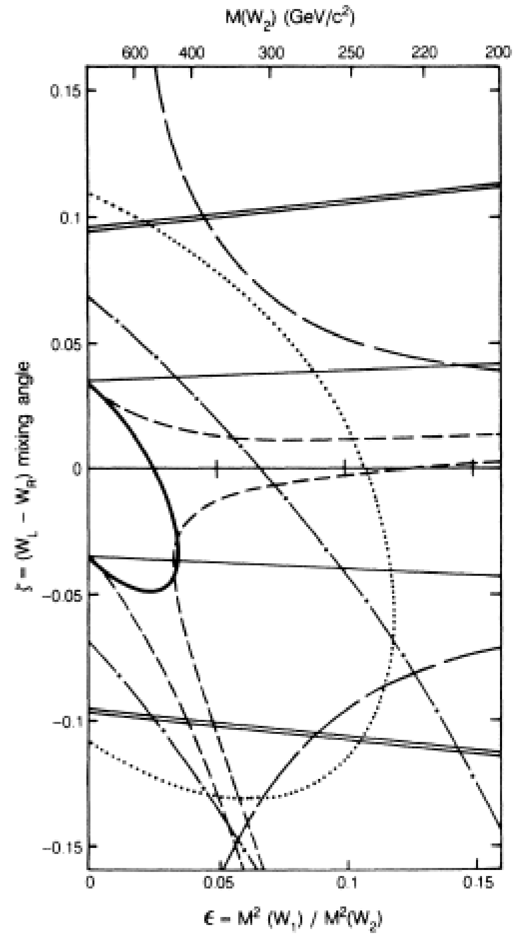


FIG. 1. Experimental 90% confidence limits on the mass squared ratio ϵ and mixing angle ζ for the gauge bosons W_1 anc W_2. The allowed regions are those which include $\epsilon=\zeta=0$. Th bold ellipse is the combined result from the analysis presented ir this paper and from our μSR analysis (Refs. 11 and 12). Th sources of the other limits are described in the text.

Muon decay parameters

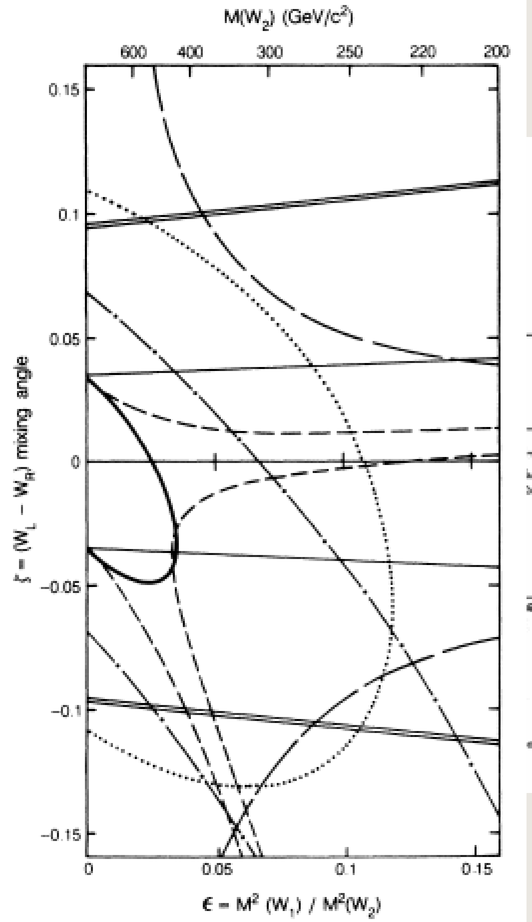
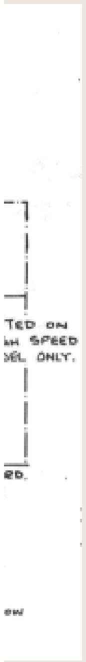
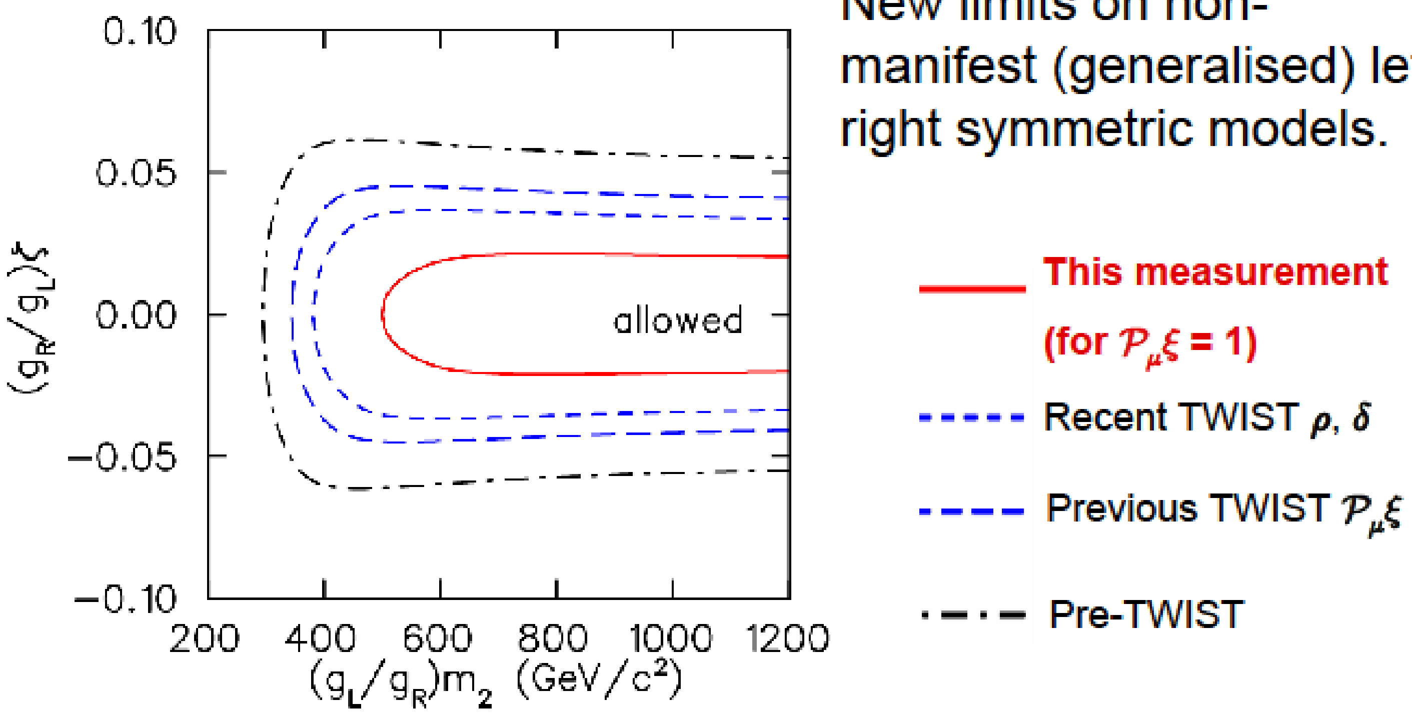


FIG. 1. Experimental 90% confidence limits on the mass squared ratio ϵ and mixing angle ζ for the gauge bosons W_1 and W_2. The allowed regions are those which include $\epsilon = \zeta = 0$. The bold ellipse is the combined result from the analysis presented in this paper and from our μSR analysis (Refs. 11 and 12). The sources of the other limits are described in the text.



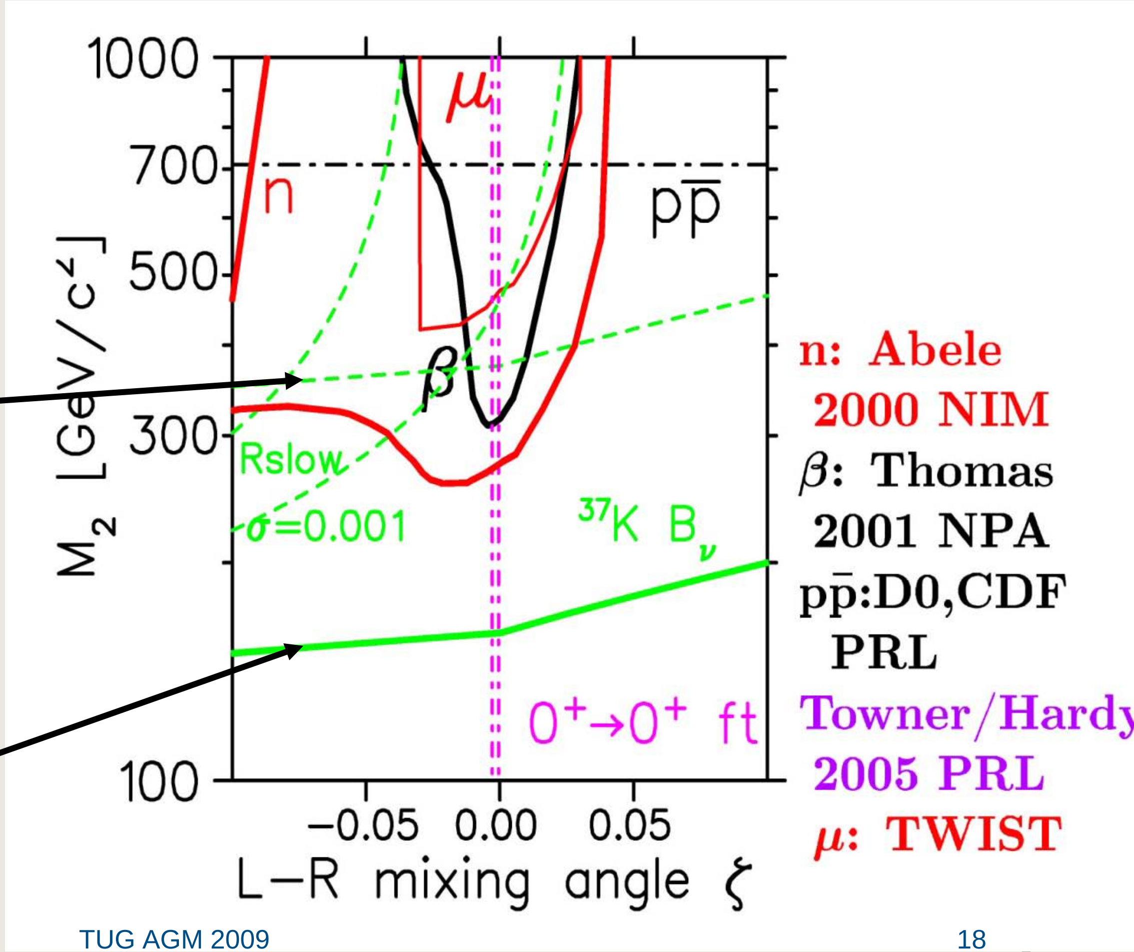
Twenty years later

TWIST impact on Left-Right model



New limits on non-manifest (generalised) left-right symmetric models.

In manifest left-right models, parity is partially restored with a Heavy mass Right handed W with = coupling strenght



TRINAT goals of 0.1% in B_ν and R_{slow}

Present TRINAT 3% B_ν 37K result.

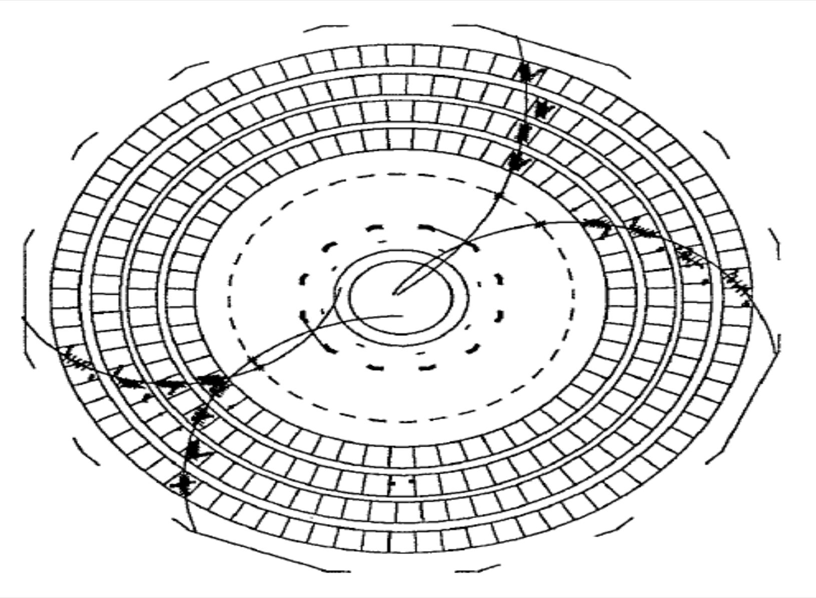
RMC collaboration

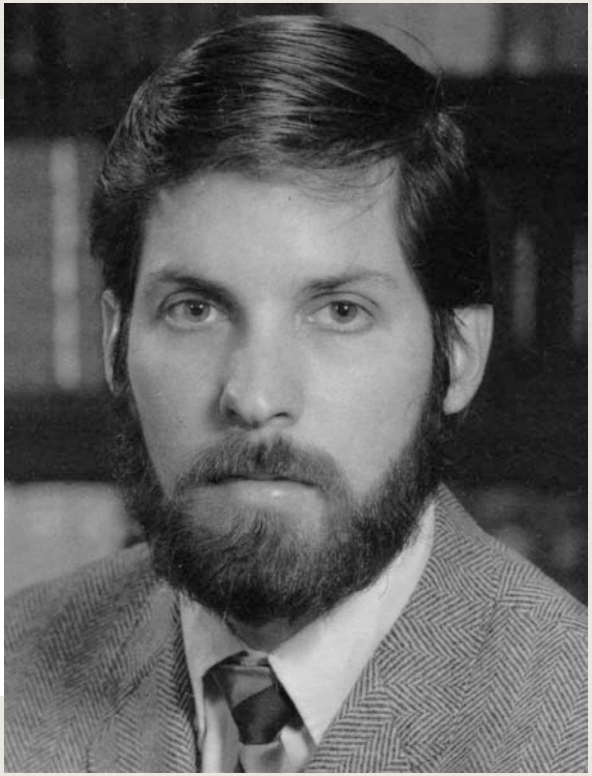
Radiative muon capture on hydrogen

W. Bertl[3], S. Ahmad[1], D.S. Armstrong[4], G. Azuelos[2,5], M. Blecher[4], C.Q. Chen[1], P. Depommier[5], P. Gumplinger[1], T.P. Gorringe[7], M.D. Hasinoff[1], R. Henderson[2,6], G. Jonkmans[5], A.J. Larabee[1], J.A. Macdonald[2], S.C. McDonald[6], J.-M. Poutissou[2], R. Poutissou[2], B.C. Robertson[8], D.G. Sample[1], W. Schott[1], G.N. Taylor[6], T. von Egidy[2], D.H. Wright[1], N.S. Zhang[2]

[1] University of British Columbia, Vancouver, B.C., Canada V6T 2A6, [2] TRIUMF, Vancouver, B.C., Canada V6T 2A3, [3] PSI/SIN, CH-5232, Villigen, Switzerland, [4] Virginia Polytechnic Inst. and State U., Blacksburg, VA, USA 24061, [5] Université de Montréal, Montréal, P.Q. Canada H3C 3J7, [6] University of Melbourne, Parkville, Victoria, Australia, 3052, [7] University of Kentucky, Lexington, KY, USA 40506, [8] Queen's University, Kingston, Ontario, Canada K7L 3N6

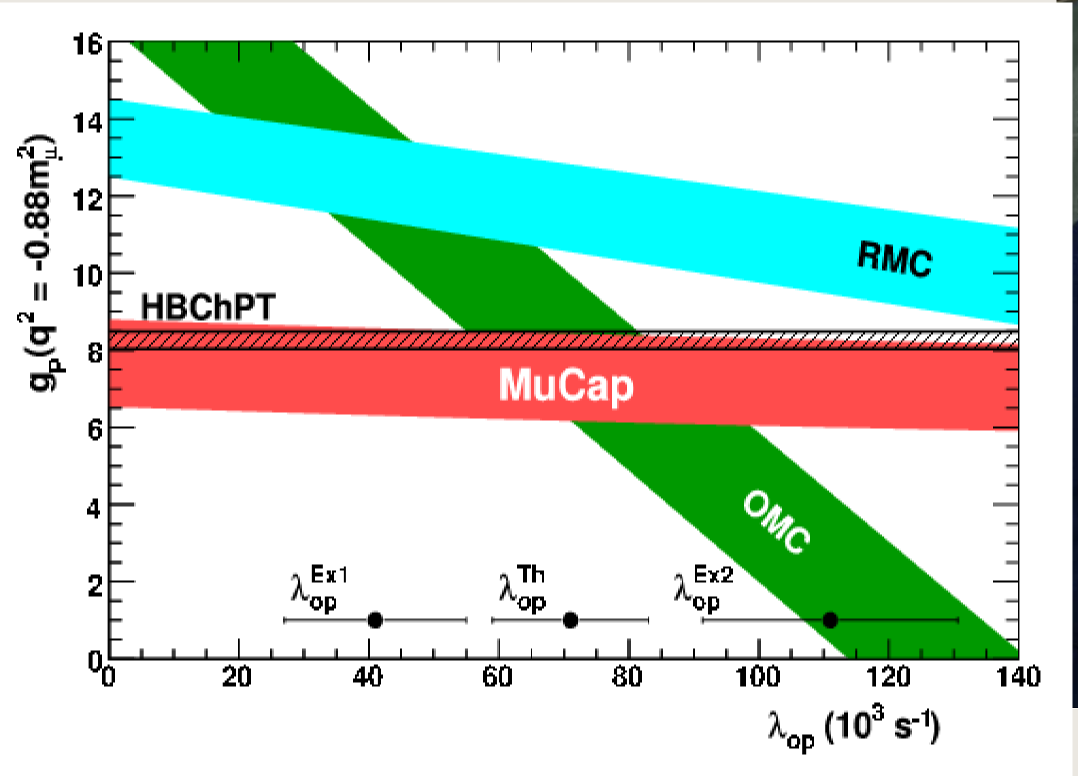
28 October 1991



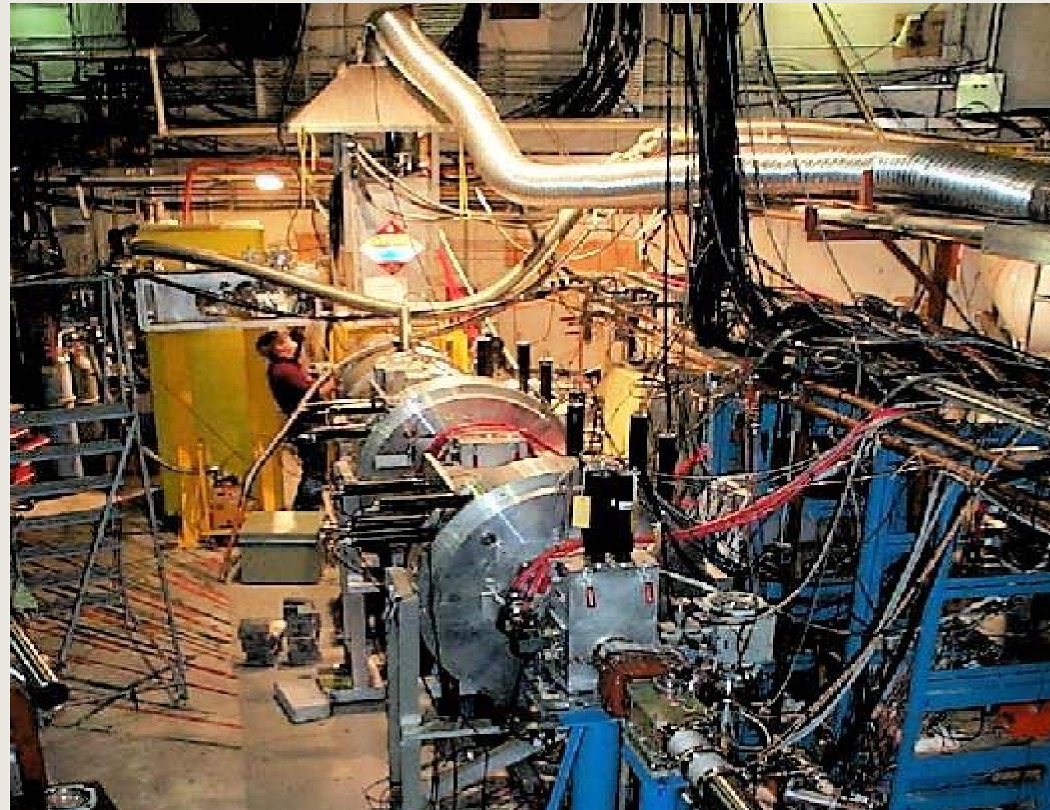


From RMC to J-PARC

- Recent results



Parity experiment



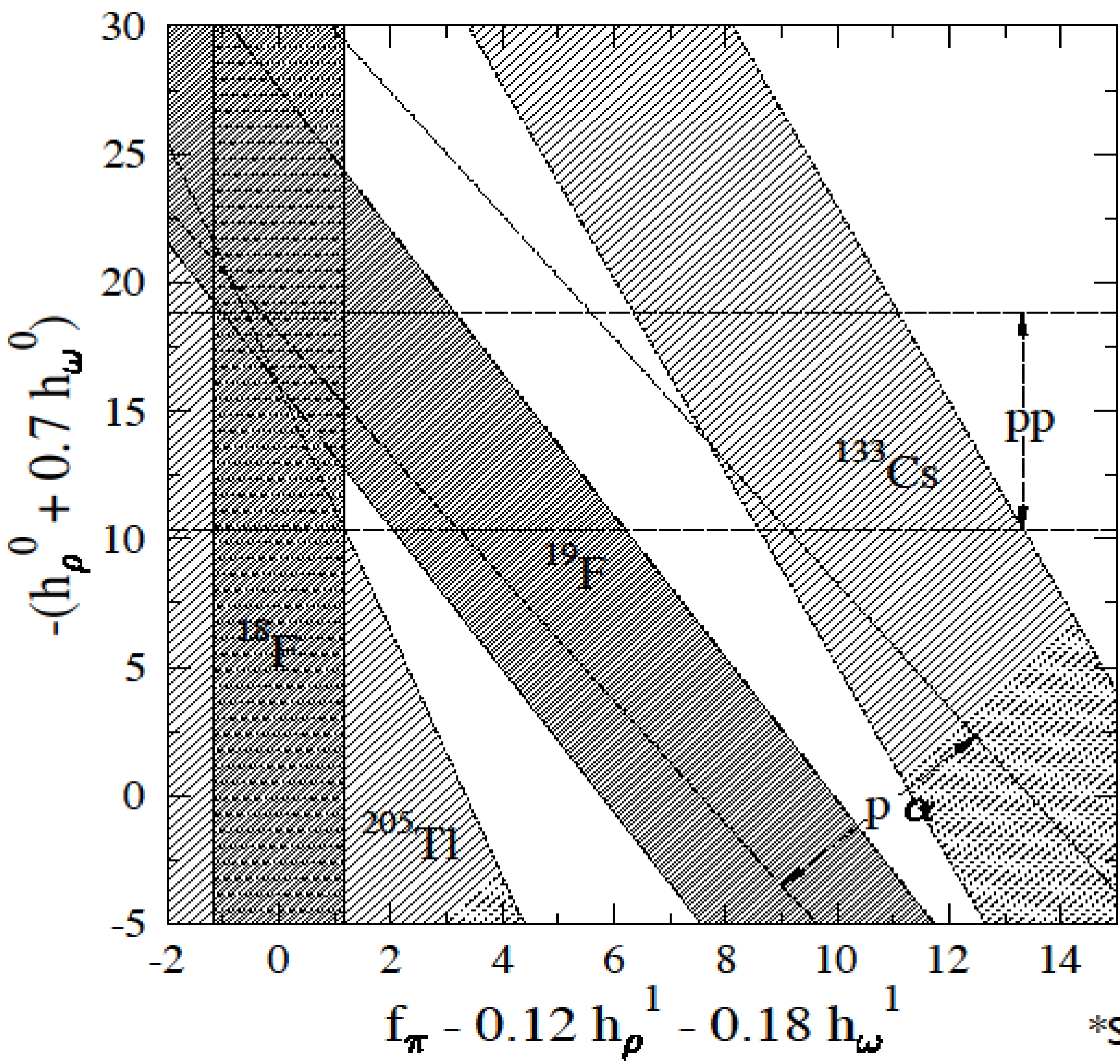
VOLUME 87, NUMBER 27 PHYSICAL REVIEW LETTERS 31 DECEMBER 2001

Parity Violation in Proton-Proton Scattering at 221 MeV

A. R. Berdoz,[1] J. Birchall,[1] J. B. Bland,[1] J. D. Bowman,[2] J. R. Campbell,[1] G. H. Coombes,[3] C. A. Davis,[1,3] A. A. Green,[1]
P. W. Green,[4] A. A. Hamian,[1] R. Helmer,[3] S. Kadantsev,[3] Y. Kuznetsov,[5,*] L. Lee,[1] C. D. P. Levy,[3] R. E. Mischke,[2]
S. A. Page,[1] W. D. Ramsay,[1] S. D. Reitzner,[1] T. Ries,[3] G. Roy,[1] A. M. Sekulovich,[1] J. Soukup,[4] G. M. Stinson,[4]
T. J. Stocki,[4] V. Sum,[1] N. A. Titov,[5] W. T. H. van Oers,[1] R. J. Woo,[1] S. Zadorozny,[5] and A. N. Zelenski[5]

TRIUMF

Weak Nucleon-nucleon couplings



Cs anapole moment further confuses an already uncertain plot

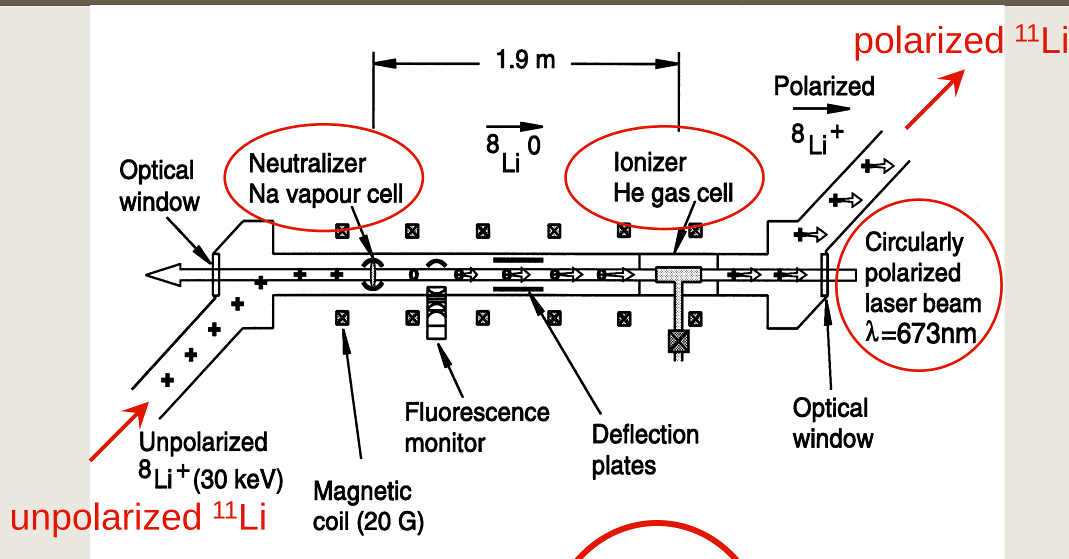
Need independent evidence of the ^{18}F conclusion that $\Delta I = 1$ PNC is weak*

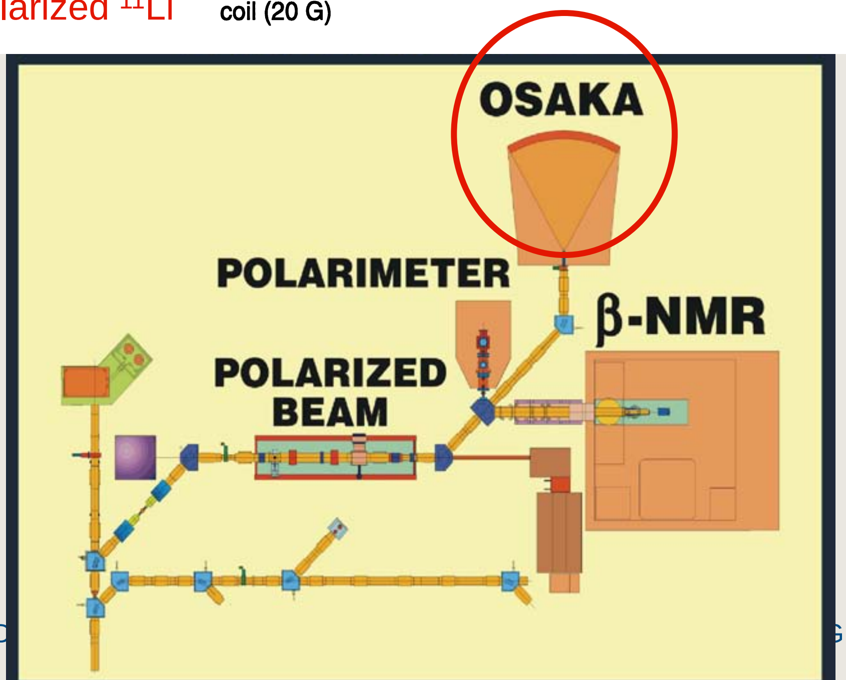
Need a set of np experiments to suplement these data

*See talk by Valery Nesvizhevsky

Polarized Beam at TRIUMF ISAC

Phil Levy et al.

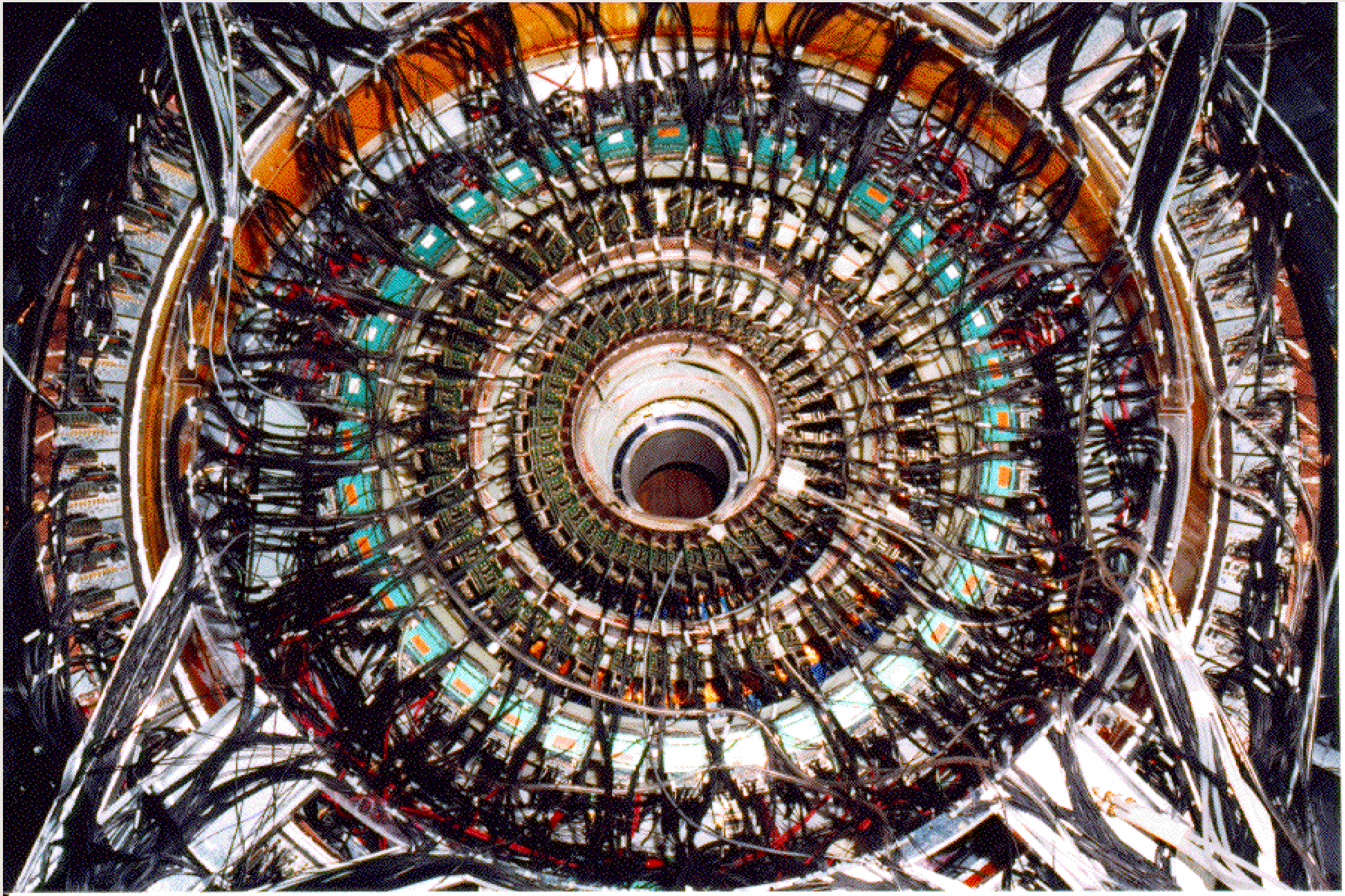




collinear optical pumping
for fast atomic beam (alkaline)

Major involvements in
G0,Qweak, Moller exp.
at J-LAB,
Polarized proton Ion
source for RHIC by
A.Zelensky.
In the future
UCN at TRIUMF

PION physics



Pion Nucleon

- Experiments to test the predictions of ChPT and determine the LECs of ChPT
- E560: Analyzing Powers for πp elastic 57 to 267 MeV
- E624: Differential Cross sections for (π,ππ)
- E778: πp elastic in region of Coulomb Nuclear Interference
- E862: Analyzing Powers for (π,ππ)
- G.Hoehler: “These measurements will lead to a more accuate value of the Σ term, and will be helpful in the search for violations of charge independence near threshold”

Dibaryon Investigations

- There was considerable excitement with reports of a π^{-}pp resonance (the d') which we addressed with three experiments
- **E725**: ^{4}He(π^{+}, π^{-})pppp using Regina cryogenic target
- **E719**: ^{4}He(π^{+}, π^{-}pp)pp using a Helium gas target to determine invariant mass spectra.
- **E785**: ^{3}He(π^{-}, π^{+}n)nn using Regina cryogenic target
- No significant dibaryon signal was observed

Pion Nuclear Experiments

- CHAOS provides good kinematical information for multiparticle final states with relatively large solid angle.
- **E721**: pion deuteron breakup investigating Delta N FSI
- **E722**: Pion Absorption mechanisms
- **E723**: Pion Nuclear Reactions
- **E653, E781**: Pion induced pion production – FSI dependence upon nucleus for isospin 0 vs 2 which many interpret in context of medium modification of interaction.

Where are all these data used today:

- Just one example close to my interest is in the new generation of neutrino interaction Monte Carlo codes. (Genie, Neut)

- In the T2K experiment we have to understand in detail the response difference of SK water cerenkov detector (High pion momentum threshold) from the ND280 detector (low pion threshold, better Neutrino energy reconstruction)

The students of Chaos

Moe Kermani

Director, President and CEO

Moe Kermani brings to Bycast extensive experience with entrepreneurial technology driven companies. Before joining Bycast, Moe was the Chief Scientist and Director of Research and Development for Sonigistix Corporation, **a world *leader in the field of high performance audio systems.*** *Previously, Moe was involved in physics research at the TRIUMF Particle Physics* Research Laboratory. Moe holds a M.Sc. and Ph.D. in physics from the University of British Columbia, and he has been awarded several US patents for his work at Sonigistix.

40 under 40 award in 2001

S.MacFarland	UBC	MSc	1993	2LT
M.Kermani	UBC	MSc,PhD	1993,1997	E624
G.Hofman	UBC	MSc,PhD	1991,1997	MWDC,E560
A.Ambardar	UBC	MSc	1996	pi0 detection
B.Jamieson	UBC	MSc	1999	E778
S.Buttazzoni	U.Trieste	MSc	1991	CFT
P.Camerini	U.Trieste	PhD	1992	E657
F.Bonutti	U.Trieste	MSc,PhD	1992,1996	E781
E.Fragiacomo	U.Trieste	MSc,PhD	1994,1999	E778
A.Fumagelli	U.Trieste	MSc	1998	technical
R.Baissalov	U.Regina	MSc	1996	E721
P.Hong	U.Regina	MSc	1996	E725
P.Bhargava	U.Regina	MSc	1998	pion abs.
K.Babcock	U.Regina	MSc	2001	E624,E862
H.Xu	U.Regina	MSc	2002	E721
J.Patterson	U.Colorado	PhD	2001	E560
J.Clark	U.Melbourne	PhD	2001	E719
J.Graeter	U.Tuebingen	PhD	1999	E725,E785
J.Paetzold	U.Tuebingen	MSc	1998	E725
H.Denz	U.Tuebingen	PhD	2003	E778

Chargex facility for (n,p) and (p,n) reactions

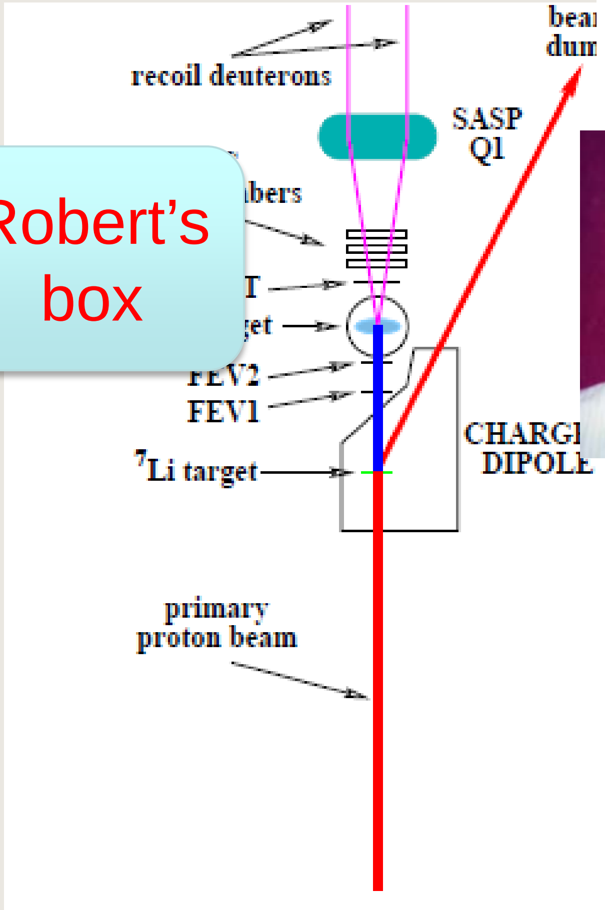


Fig. 28. Schematic drawing of CHARGEX neutron-be
facility, LH_2 target, and front end detectors for $np \rightarrow$
measurement.

Robert's box

PHYSICAL REVIEW C VOLUME 40, NUMBER 2 AUGUST 1989

-Teller strength deduced from charge exchange reactions on ^{54}Fe at 300 MeV

. Vetterli,[a] O. Häusser,[a),(b] R. Abegg,[b] W. P. Alford,[c] A. Celler,[a] D. Frekers,[b),(d]
er,[c] R. Henderson,[b),(e] K. H. Hicks,[b] K. P. Jackson,[b] R. G. Jeppesen,[a] C. A. Miller,[b]
K. Raywood,[e] and S. Yen[b]
[a]Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6
[b]TRIUMF, Vancouver, British Columbia, Canada V6T 2A3
[c]University of Western Ontario, London, Ontario, Canada N6A 3K7
[d]University of Toronto, Toronto, Ontario, Canada M5S 1A7
[e]University of Melbourne, Melbourne, Australia

(Received 12 April 1989)

Angular distributions of the ^{54}Fe$(p,n)^{54}$Co and ^{54}Fe$(n,p)^{54}$Mn cross sections have been measured to test the Gamow-Teller sum rule $[S_- - S_+ = 3(N-Z)]$ in a case where the Gamow-Teller strength is large for both channels. The results for S_- and S_+ are compared to several models which have moderate success in describing the data. Large scale shell-model and quasiparticle random-phase-approximation calculations correctly predict the distribution of Gamow-Teller strength but overestimate the total strength. A model that approximates the nuclear surface to be a semi-infinite slab describes the cross sections well in the quasielastic scattering region if 2p-2h correlations are included.

Parker Alford and Peter Jackson

Chargex facility

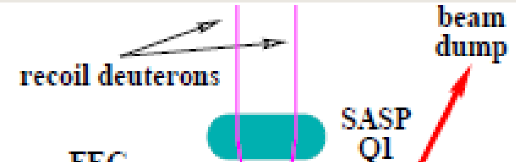


Fig. 28. Schematic drawing of CHARGEX neutron-bea
facility, LH_2 target, and front end detectors for $np \rightarrow d\pi^-$
measurement.

PHYSICAL REVIEW C VOLUME 40, NUMBER 2 AUGUST 1989

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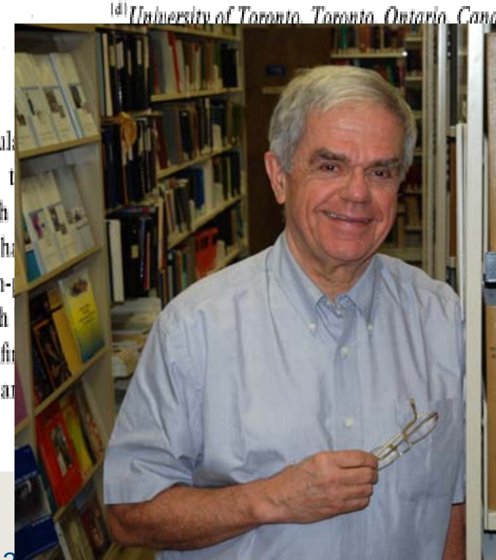
[d]University of Toronto, Toronto, Ontario, Canada M5S 1A7
tralia

ss sections have been measured
case where the Gamow-Teller
re compared to several models
shell-model and quasiparticle
distribution of Gamow-Teller
ates the nuclear surface to be a
scattering region if 2p-2h corre-
lations a



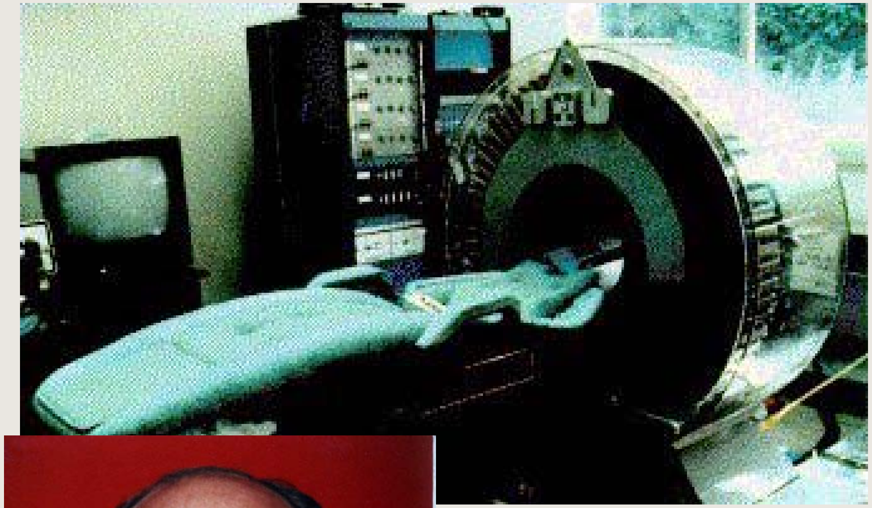
Chargex impact

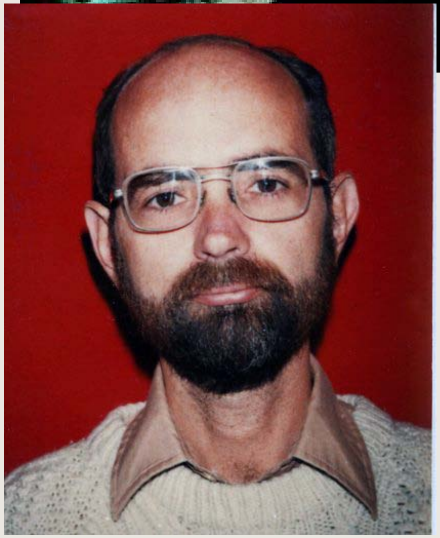
- From Karl Heinz Langanke:
- "(n,p) data from TRIUMF are the best source of information on electron capture rates for Supernovae modeling in the f/p shell region "

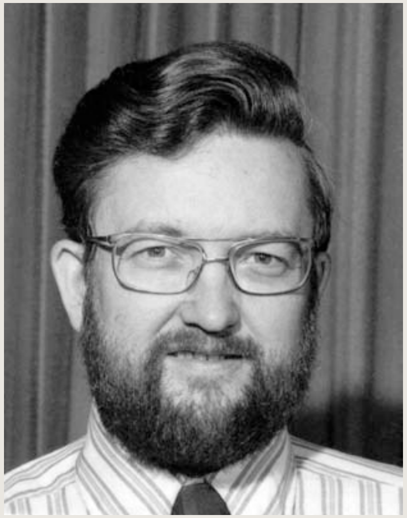
- (n,p) at zero degree and intermediate energies is dominated by the $\sigma.\tau$ operator.
- Get Gamow-Teller strength distribution
- Electron capture rates ^{48}Ti, ^{51}V, ^{55}Mn, ^{54,56}Fe, ^{58,60,62,64}Ni, ^{59}Co, ^{70,72}Ge, ^{76}Se, ^{90}Zr, ^{208}Pb

TRIUMF

Nuclear medicine in the 80's







TRIUMF	4004 WESBROOK MALL, UBC CAMPUS, VANCOUVER, B.C. V6T 2A3			
DESIGN NOTE	NAME J.J. Burgerjon*	DATE June 1983	FILE NO TRI-DN-83-27	PAGE 1 of 19

SUBJECT Transportation of radio-isotopes via a long "air-chute"**

* Z. Gelbart, V. Lau, J. Lenz, B.D. Pate, T.J. Ruth, H.P. Sprenger, N. van Oers.

**Also known as a "Pneumatic transfer system"
"Rabbit system"

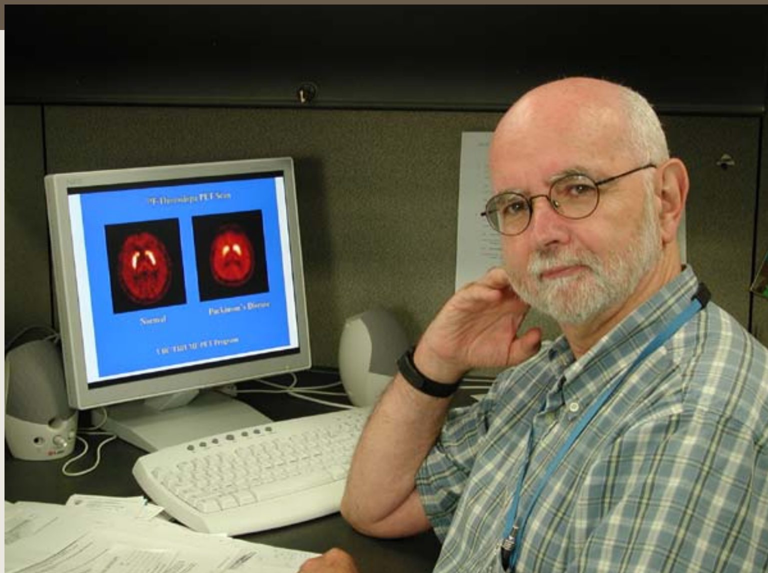
This note presents the text and illustrations for a poster paper to be presented at the CAP Meeting in Victoria on June 27, 1983. The display will also include colour photographs of the CP-42 cyclotron and the PET (not included in this design note) and some actual "rabbits" and pieces of rabbit tubing.

References:

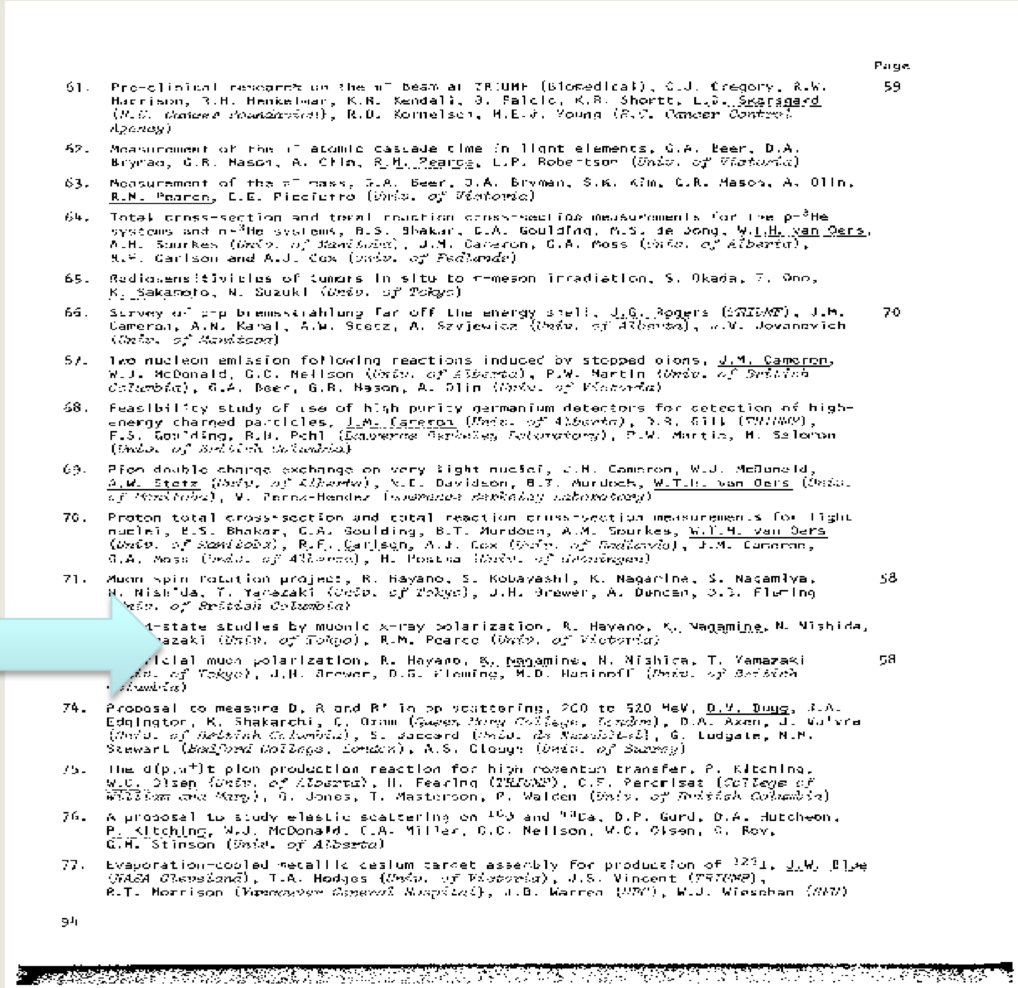
J.J. Burgerjon, J. Lenz, B.T. Trevitt: "Long distance rabbit tests". TRI-DN-79-8, June 1979.

J.A. Correia, W.B. Bucelewicz, H.W. Strauss, N.M. Alpert, G.L. Brownell, and J.M. Taveras, "Transportation of short-lived positron emitter from a medical cyclotron to a remote imaging suite", Med. Phys. 10(2), Mar/Apr 1983.

Nuclear medicine



μSR,MuSR,CMMS



Page

61. Pre-clinical research on the π^- beam at TRIUMF (Biomedical), C.J. Gregory, R.W. Harrison, B.H. Henkelman, K.R. Kendall, B. Palcic, K.R. Shortt, L.D. Skarsgard (B.C. Cancer Foundation), R.O. Kornelsen, H.E.J. Young (B.C. Cancer Control Agency) 59

62. Measurement of the π^- atomic cascade time in light elements, G.A. Beer, D.A. Bryman, G.R. Mason, A. Chin, R.M. Pearce, L.P. Robertson (Univ. of Victoria)

63. Measurement of the π^- mass, G.A. Beer, D.A. Bryman, S.K. Kim, G.R. Mason, A. Olin, R.M. Pearce, E.E. Picciotto (Univ. of Victoria)

64. Total cross-section and total reaction cross-section measurements for the p-^{3}He systems and n-^{3}He systems, B.S. Bhakar, G.A. Goulding, M.S. de Jong, W.T.H. van Oers, A.M. Sourkes (Univ. of Manitoba), J.M. Cameron, G.A. Moss (Univ. of Alberta), R.F. Carlson and A.J. Cox (Univ. of Redlands)

65. Radiosensitivities of tumors in situ to π-meson irradiation, S. Okada, T. Ono, K. Sakamoto, N. Suzuki (Univ. of Tokyo)

66. Survey of pp bremsstrahlung far off the energy shell, J.G. Rogers (TRIUMF), J.M. Cameron, A.N. Kamal, A.W. Stetz, A. Szyjewicz (Univ. of Alberta), M.V. Jovanovich (Univ. of Manitoba) 70

67. Two nucleon emission following reactions induced by stopped pions, J.M. Cameron, W.J. McDonald, G.C. Neilson (Univ. of Alberta), P.W. Martin (Univ. of British Columbia), G.A. Beer, G.R. Mason, A. Olin (Univ. of Victoria)

68. Feasibility study of use of high purity germanium detectors for detection of high-energy charged particles, J.M. Cameron (Univ. of Alberta), D.R. Gill (TRIUMF), F.S. Goulding, R.H. Pehl (Lawrence Berkeley Laboratory), P.W. Martin, M. Salomon (Univ. of British Columbia)

69. Pion double charge exchange on very light nuclei, J.M. Cameron, W.J. McDonald, A.W. Stetz (Univ. of Alberta), N.E. Davidson, B.T. Murdoch, W.T.H. van Oers (Univ. of Manitoba), V. Perez-Mendez (Lawrence Berkeley Laboratory)

70. Proton total cross-section and total reaction cross-section measurements for light nuclei, B.S. Bhakar, G.A. Goulding, B.T. Murdoch, A.M. Sourkes, W.T.H. van Oers (Univ. of Manitoba), R.F. Carlson, A.J. Cox (Univ. of Redlands), J.M. Cameron, G.A. Moss (Univ. of Alberta), H. Postma (Univ. of Groningen)

71. Muon spin rotation project, R. Hayano, S. Kobayashi, K. Nagamine, S. Nagamiya, N. Nishida, T. Yamazaki (Univ. of Tokyo), J.H. Brewer, A. Duncan, D.G. Fleming (Univ. of British Columbia) 58

[illegible]-state studies by muonic x-ray polarization, R. Hayano, K. Nagamine, N. Nishida, [illegible]azaki (Univ. of Tokyo), R.M. Pearce (Univ. of Victoria)

[illegible]icial muon polarization, R. Hayano, K. Nagamine, N. Nishida, T. Yamazaki [illegible] of Tokyo), J.H. Brewer, D.G. Fleming, M.D. Hasinoff (Univ. of British [illegible]olumbia) 58

74. Proposal to measure D, R and R' in pp scattering, 200 to 520 MeV, D.V. Bugg, J.A. Edgington, K. Shakarchi, C. Oram (Queen Mary College, London), D.A. Axen, J. Va'vra (Univ. of British Columbia), S. Jaccard (Univ. de Neuchâtel), G. Ludgate, N.M. Stewart (Bedford College, London), A.S. Clough (Univ. of Surrey)

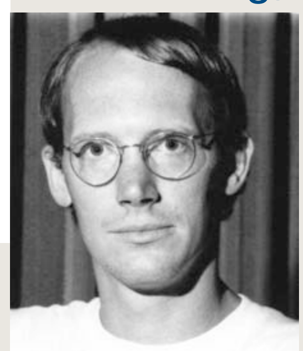
75. The d(p,π^+)t pion production reaction for high momentum transfer, P. Kitching, W.C. Olsen (Univ. of Alberta), H. Fearing (TRIUMF), C.F. Perdrisat (College of William and Mary), G. Jones, T. Masterson, P. Walden (Univ. of British Columbia)

76. A proposal to study elastic scattering on ^{16}O and ^{40}Ca, D.P. Gurd, D.A. Hutcheon, P. Kitching, W.J. McDonald, C.A. Miller, G.C. Neilson, W.C. Olsen, G. Roy, G.M. Stinson (Univ. of Alberta)

77. Evaporation-cooled metallic cesium target assembly for production of ^{123}I, J.W. Blue (NASA Cleveland), T.A. Hodges (Univ. of Victoria), J.S. Vincent (TRIUMF), R.T. Morrison (Vancouver General Hospital), J.B. Warren (UBC), W.J. Wiesehahn (UBC)

94

- Initiation of the MuSR program:
- Hayano First PhD student to graduate at TRIUMF, Nishina Prize winner 2008
- T.Yamazaki ,Bunka Karosha prize 2009, Nishina prize 1975
- S.Nagamiya, J-PARC director
- N.Nishida, chair of meson users in Japan.
- Brewer, Brockhouse medal 2008
- Fleming, Seaborg prize 2004



The year was 1987

SHORT HISTORY of SUPERCONDUCTORS:

1911	Hg	4.2K	K. Onnes
~1933	NbC	~10K	?
~1948	NbN	16K	?
~1958	Nb_3Sn	18K	?
~1972	Nb_3Ge	23K	?
~1982	$BaPb_{1-x}Bi_xO_3$	13K	Bednorz & Müller
1986: May	$La_{2-x}Ba_xCuO_{4-y}$	33K	" " "
1986: Dec.	$La_{2-x}Sr_xCuO_{4-y}$	38K	Bell Labs group
1987: Feb.	⊛ $Y_{2-x}Ba_xCuO_{4-y}$	94K	Houston group
1987: March	$Sc_{2-x}?_xCuO_{4-y}$	RUMOURS	Berkeley group + others

+ Hardy (UBC) produces $La_{1.85}Sr_{0.15}CuO_4$ and

⊛ ~~$Y_{1.2}Ba_{0.8}CuO_4$~~ successfully

"THE RIGHT STUFF" ⊛ $YBa_2Cu_3O_8$ (!) for open house!

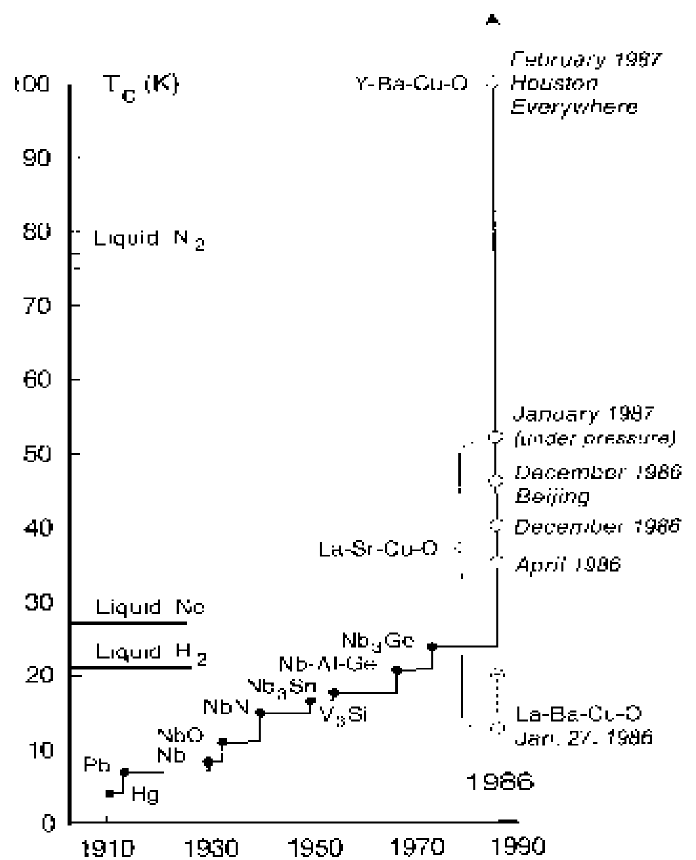
Chaklader (UBC metallurgy) starts production

Negotiations with CTF systems + TIR Ltd (?)

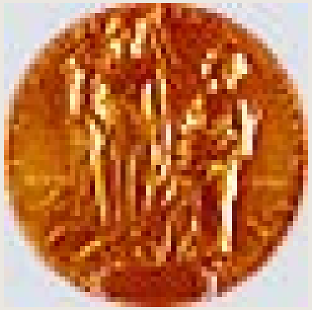
⊛ "EMERGENCY" TRIUMF expt. on "RIGHT STUFF"

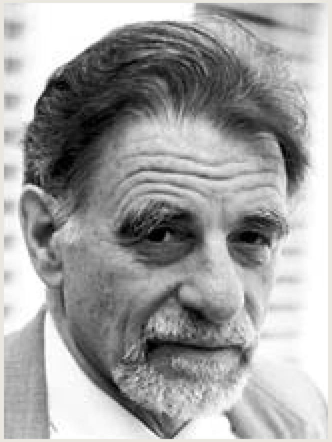
- Pre 1987: MuSR,μSR techniques developed but program in search of a focus.
- After 1987: HTSC dominates the μsr program for a long time and still does to some extent
- Best YBCO samples coming from Walter Hardy's lab at UBC
- Best technique to get coherence length and pairing symmetry
- Nobel prize to Alex Muller and Georg Bednorz1987

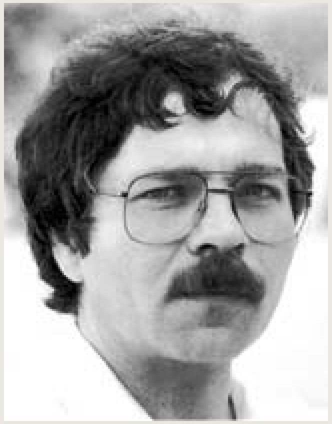
1987



T_c (K)
100
90
80
70
60
50
40
30
20
10
0
Liquid N_2
Liquid Ne
Liquid H_2
Y-Ba-Cu-O
February 1987
Houston
Everywhere
January 1987
(under pressure)
December 1986
Beijing
December 1986
La-Sr-Cu-O
April 1986
Nb_3Ge
Nb-Al-Ge
Nb_3Sn
V_3Si
NbN
NbO
Nb
Pb
Hg
La-Ba-Cu-O
Jan. 27, 1986
1986
1910
1930
1950
1970
1990



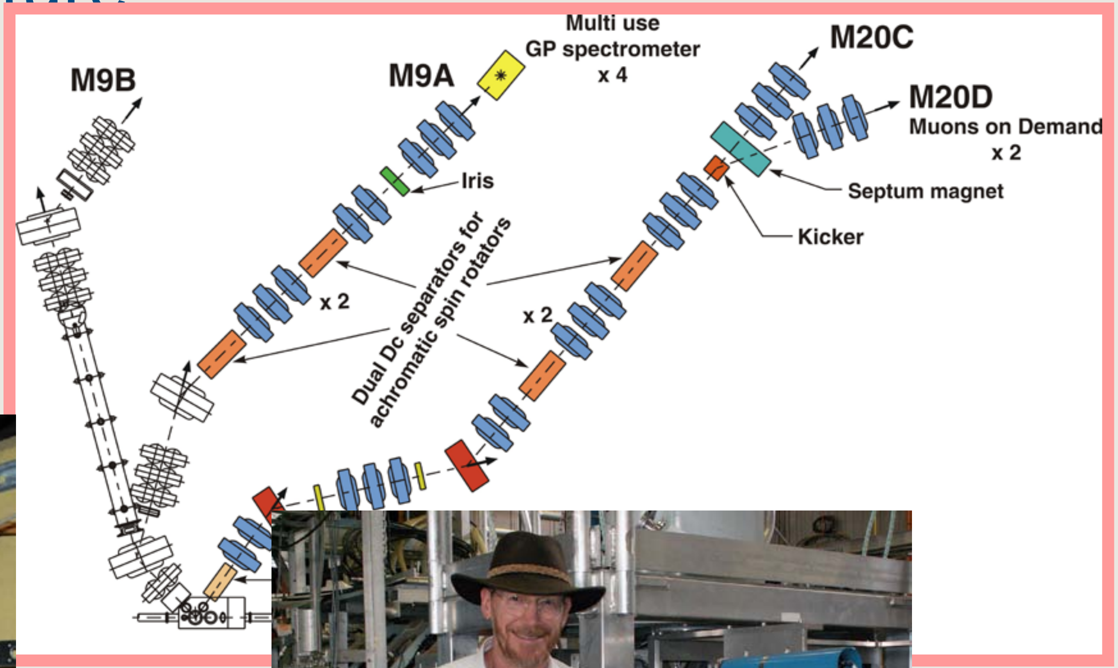


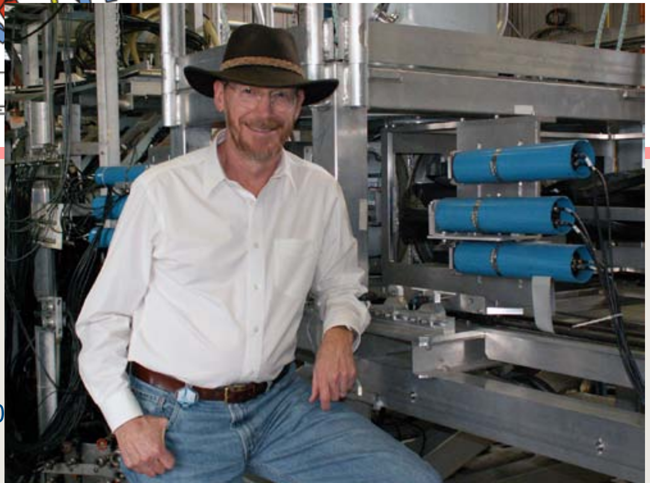


TRIUMF

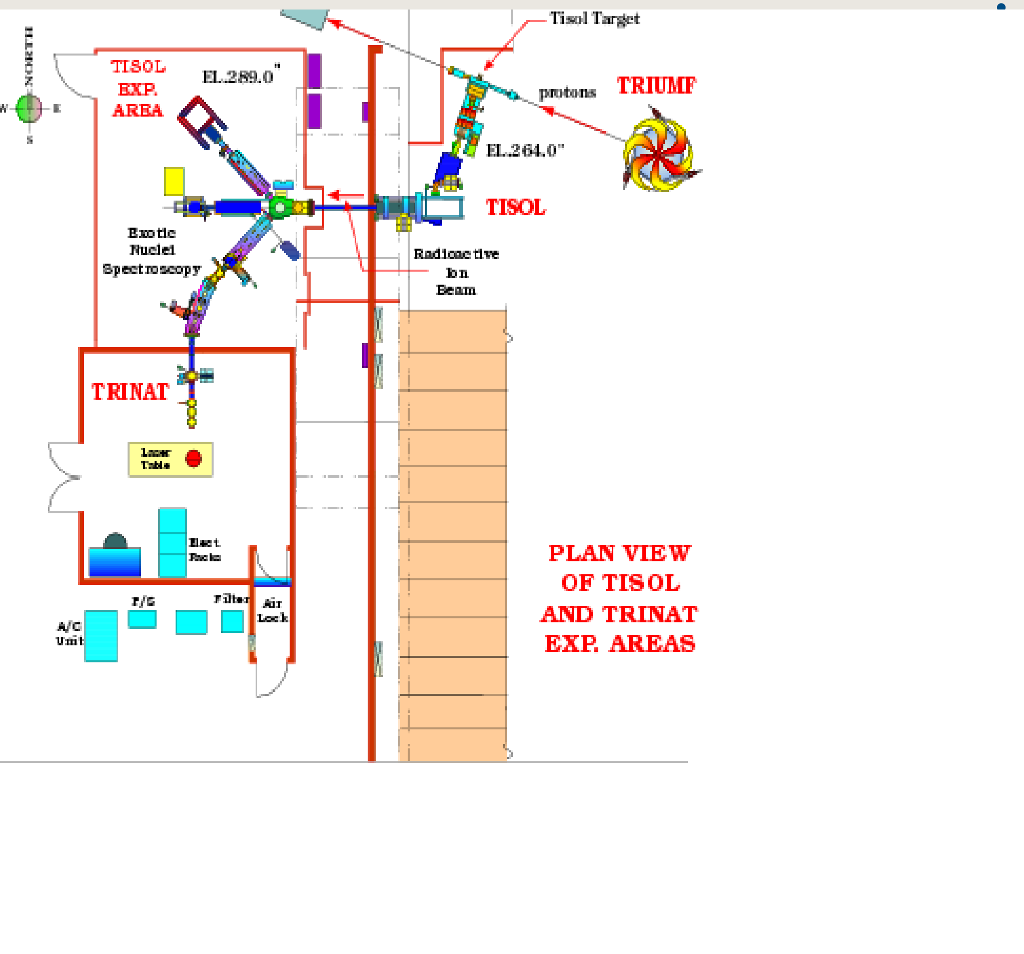
New MuSR facilities

- Syd and Gerald are building the new MuSR facilities for the future





RED GIANT at TISOL



- R. E. Azuma, L. Buchmann, F. C. Barker, C. A. Barnes, J. M. D'Auria, M. Dombsky, U. Giesen, K. P. Jackson, J. D. King, R. G. Korteling, P. McNeely, J. Powell, G. Roy, J. Vincent, T. R. Wang, S. S. M. Wong, and P. R. Wrean

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Department of Theoretical Physics, Research School of Physical Sciences Engineering, Australian National University, Canberra, Australian Capital Territory 0200, Australia
W. K. Kellogg Laboratory, California Institute of Technology, Pasadena, California 91125
Department of Chemistry, Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6
Department of Physics, University of Alberta, Edmonton, Alberta, Canada T6G 2J1

Red Giants

- ^{16}N beta delayed alpha emission
- ^{16}N beam(Dombsky/d'Auria)
- 4T solenoid not funded by NSERC
- Negotiated a set of 4T SC coils to be made by INR by the Lobashev group.

New method found to get rid of electrons

1993 Red giant publication in famous astrophysics newpaper:

The Toronto Star

Passing the baton

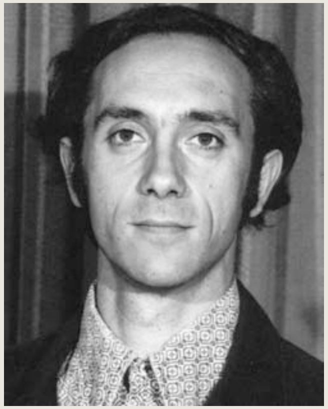
- A generation of pioneers built and developed TRIUMF
- We had a lot of fun because we were given a lot of opportunities and freedom to explore what we fancied most

- New generation of talented researchers has joined the family and

and I wish they have the same opportunities.

Merci!

Thank You!



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