

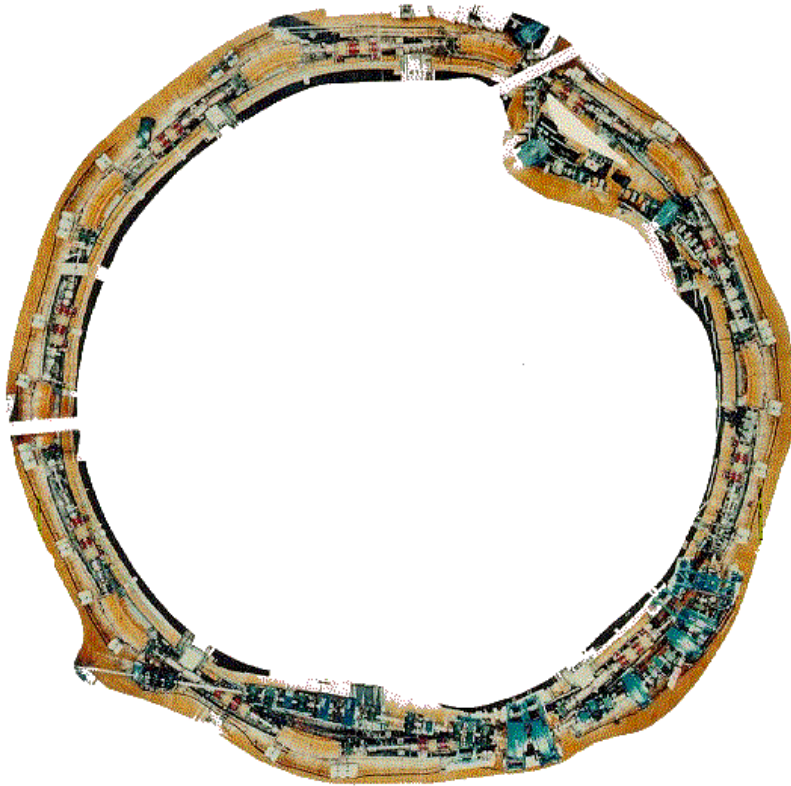
## Muon Beam at RAL

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Paul Flower, Ken Long

- **Introduction**
- **Target**
- **New beamline**
- **Expected performance**
- **Progress to date**

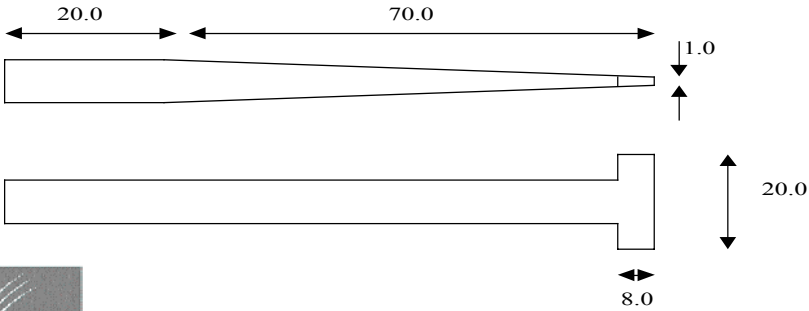
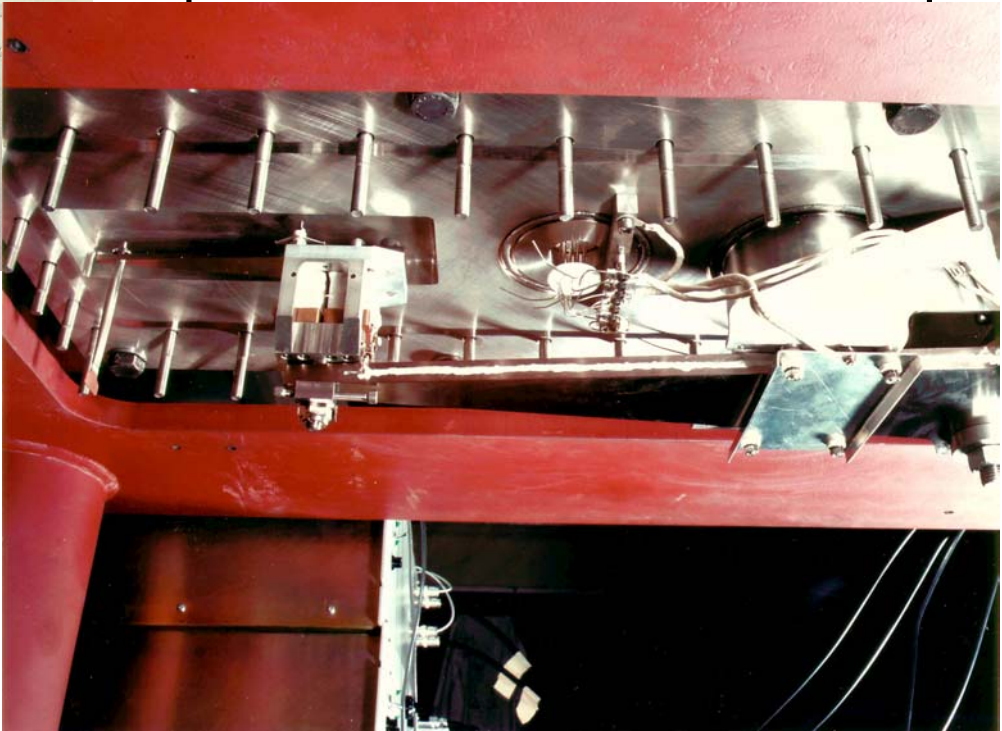
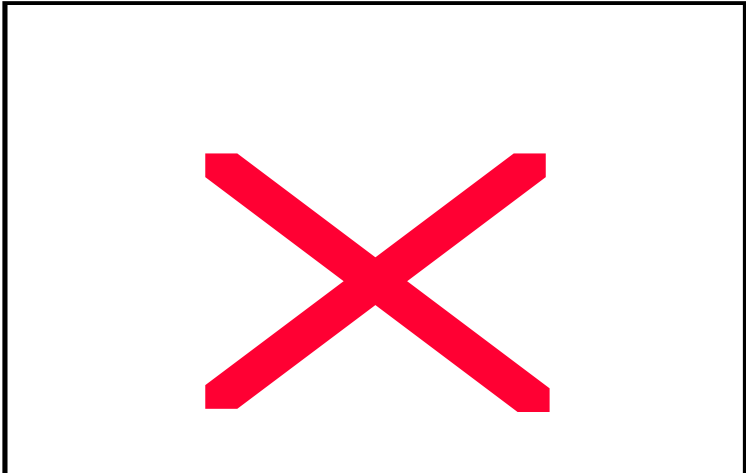
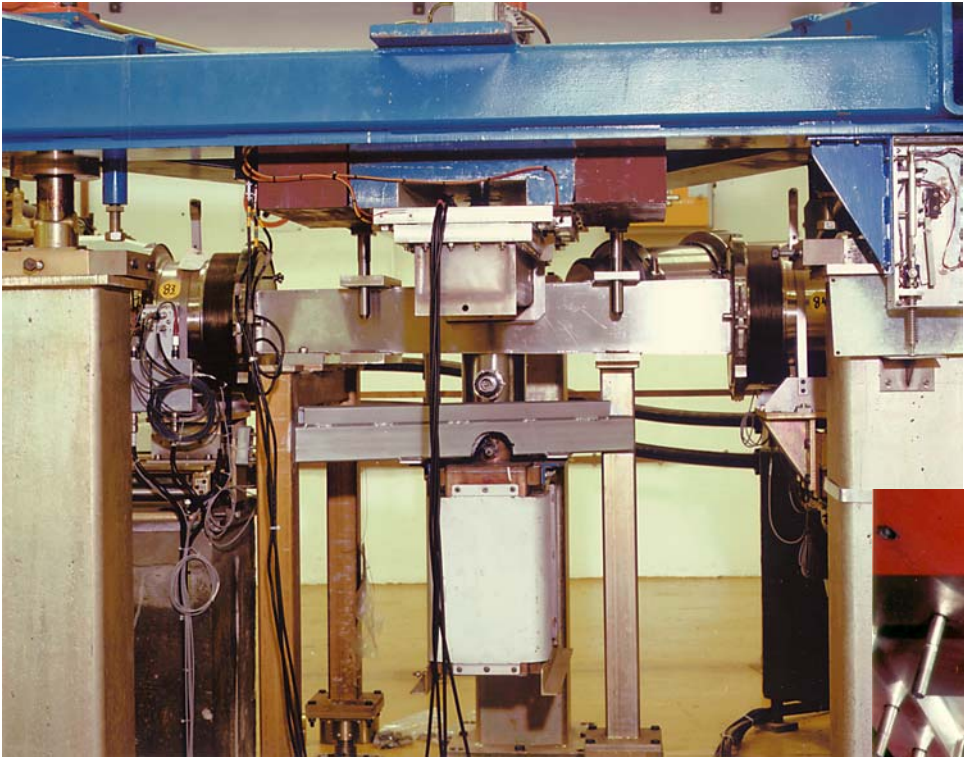
# Introduction

## ISIS



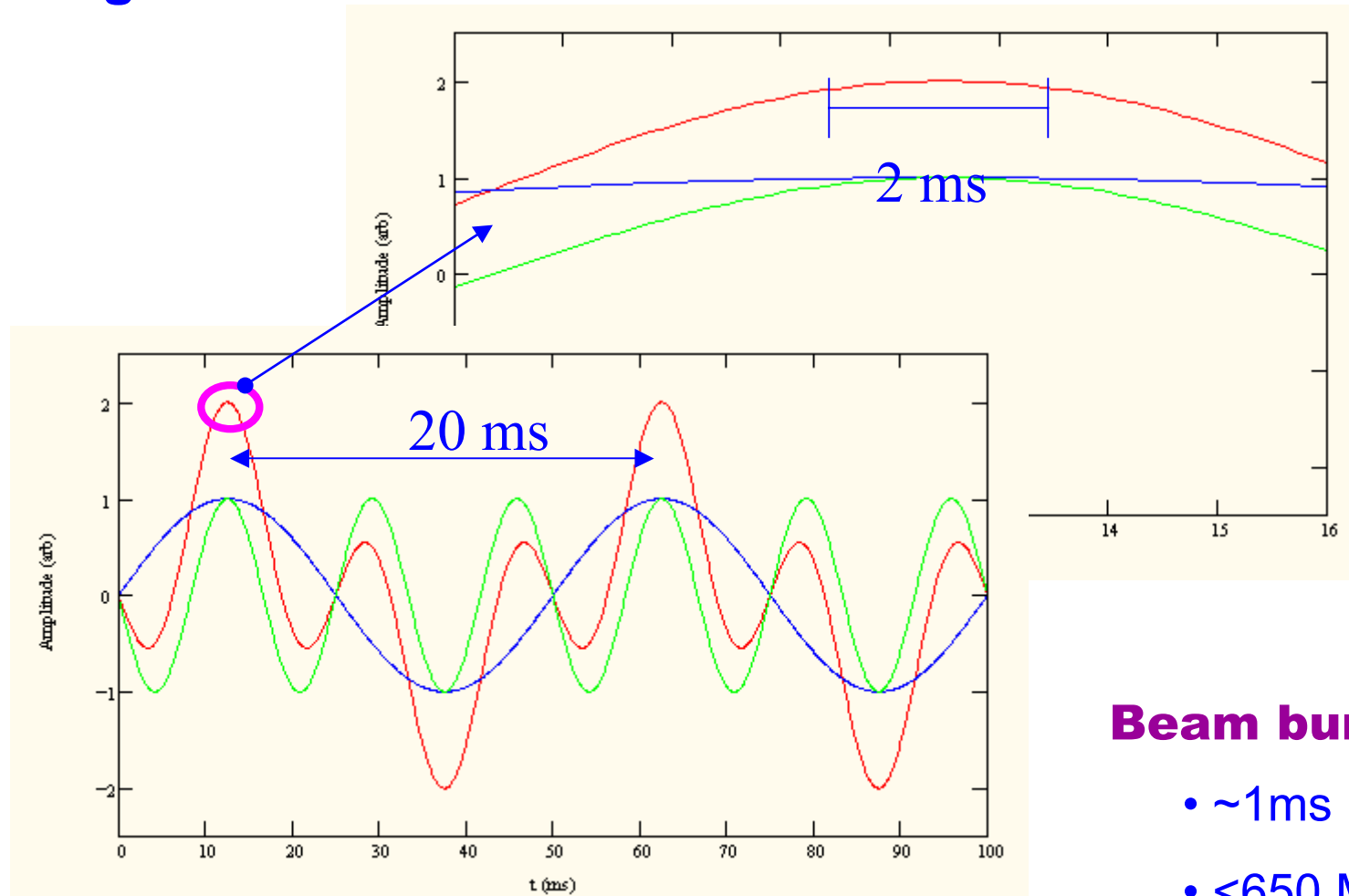
- 800 MeV synchrotron; 240kW
- 50 Hz,  $>100\ \mu\text{s}$  at close to maximum energy, 800 MeV  
    *fi ISIS is cw for cooling experiment!*
- 2 bunches, each 100ns long, separated by 230ns
- Each makes 200 turns during  $100\ \mu\text{s}$
- Target in ring could see 50MW for cooling experiment!

# Target



# Target

Target: 50 Hz + 150 Hz motion:

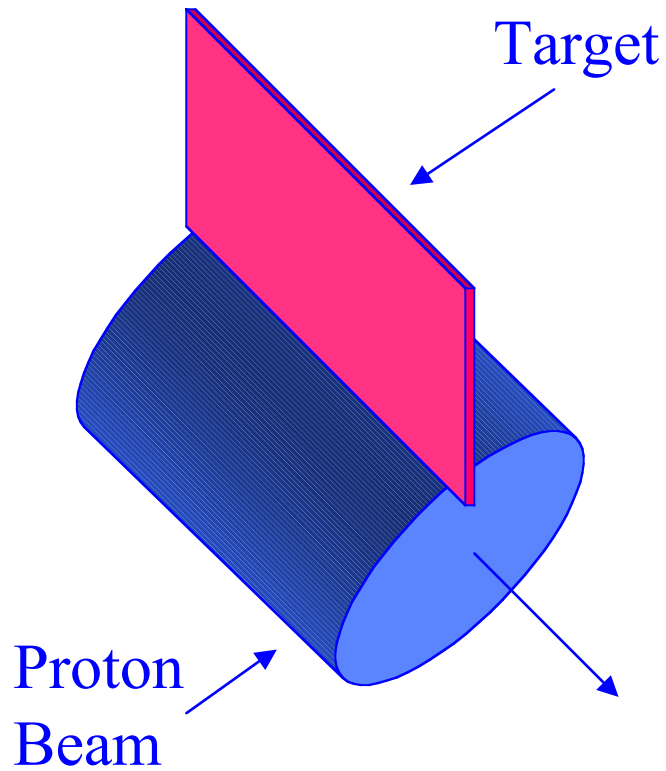


**Beam bump:**

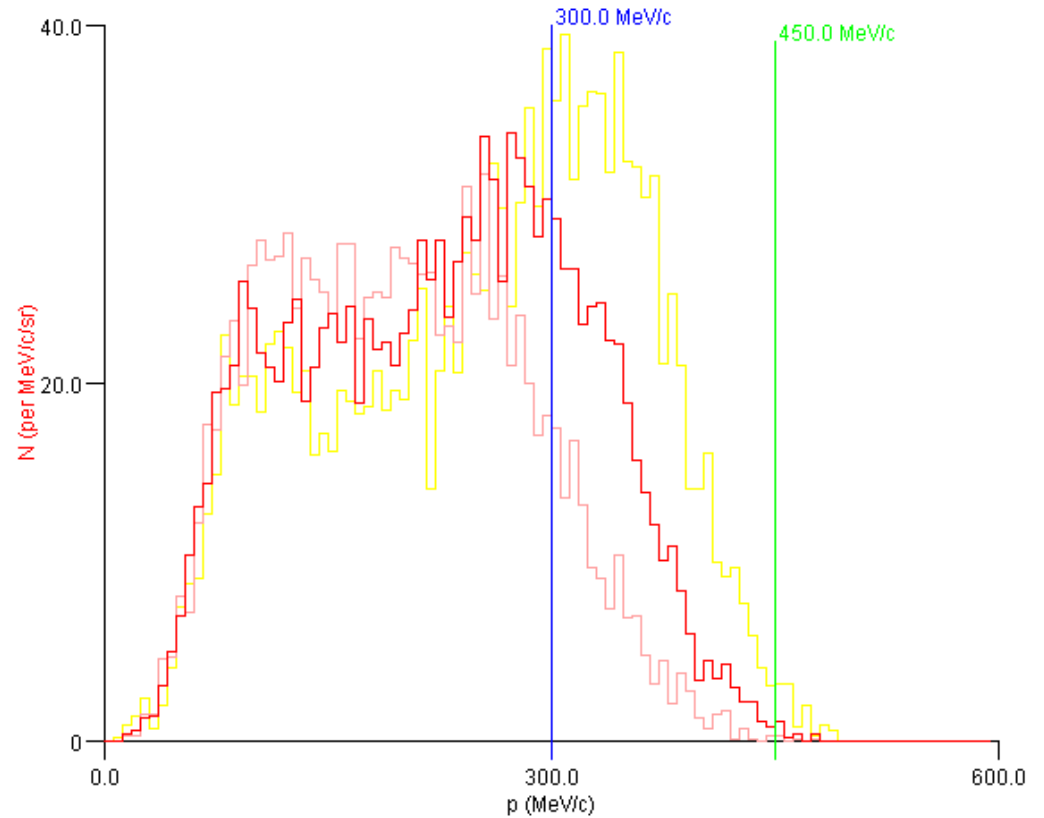
- ~1ms
- <650 MeV

# Target

LAHET - 626 MeV protons



25 to 35 degrees  
35 to 45 degrees  
45 to 55 degrees

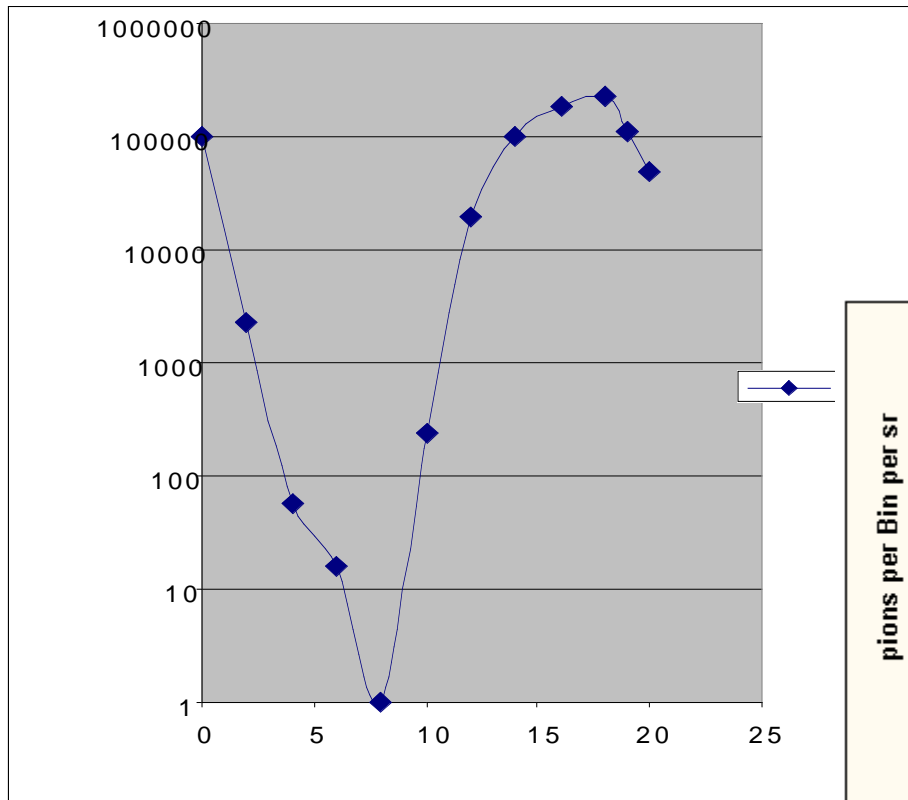


**0.0001% of beam**  
**=  $10^7$  protons/bunch/turn**

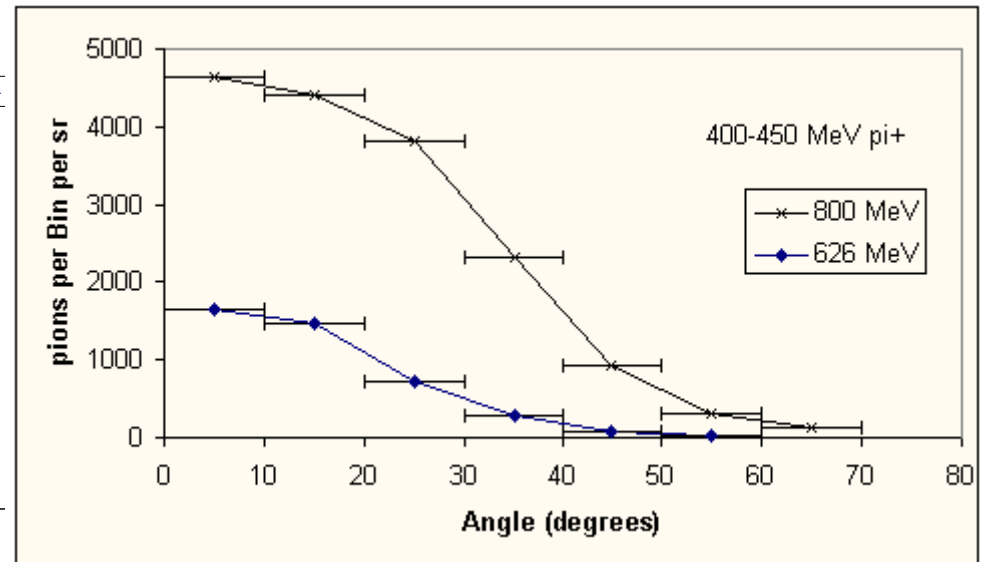


# Target Improvements

500 MeV/c - mainly protons

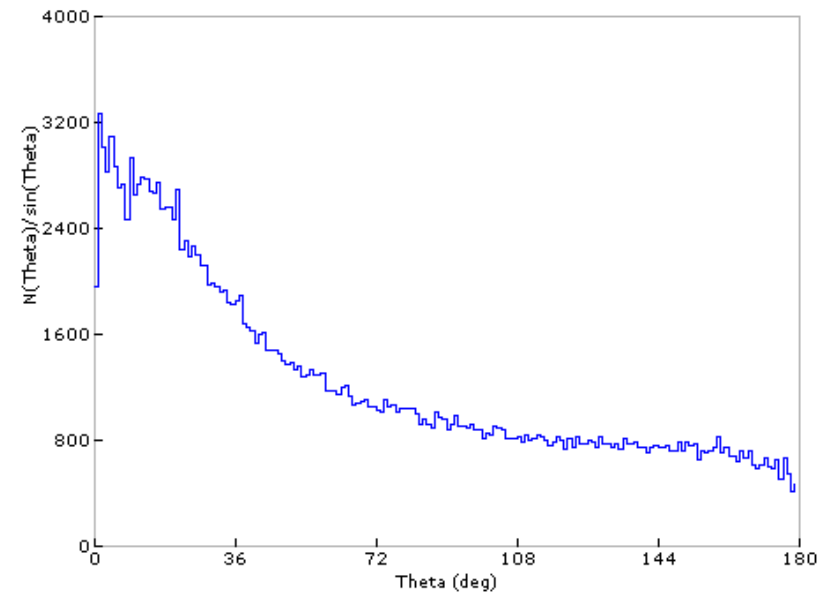
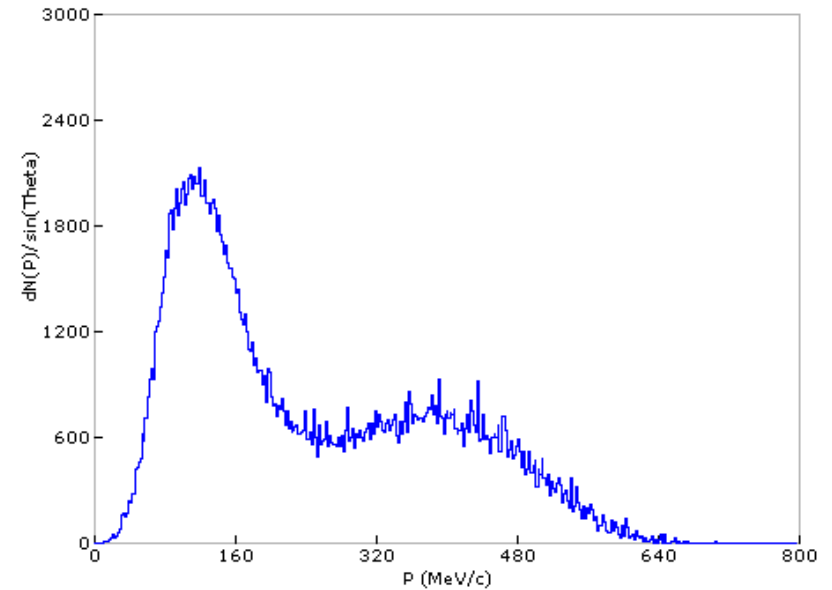
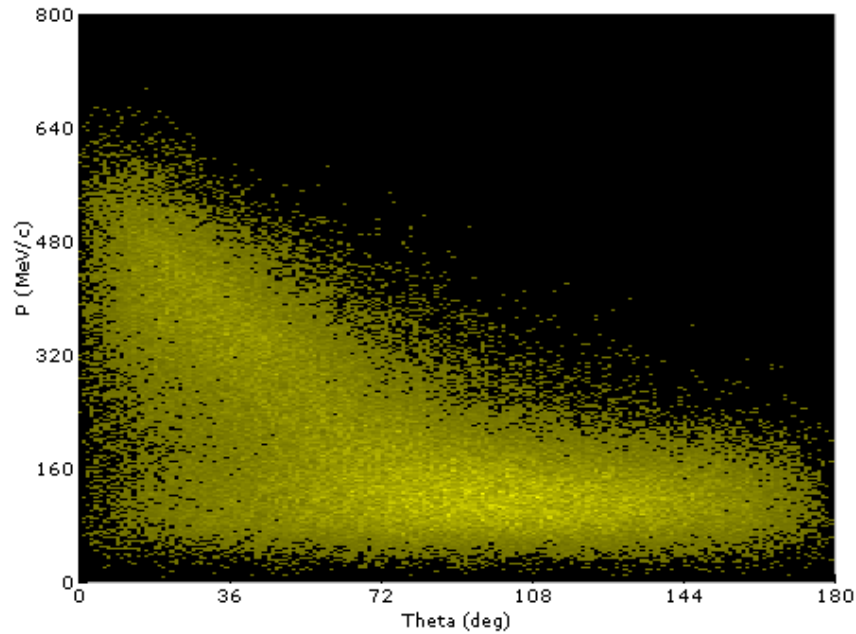


Goto higher energy & lower angle



# Target Improvements

## Pion production from 800 MeV protons on Ti



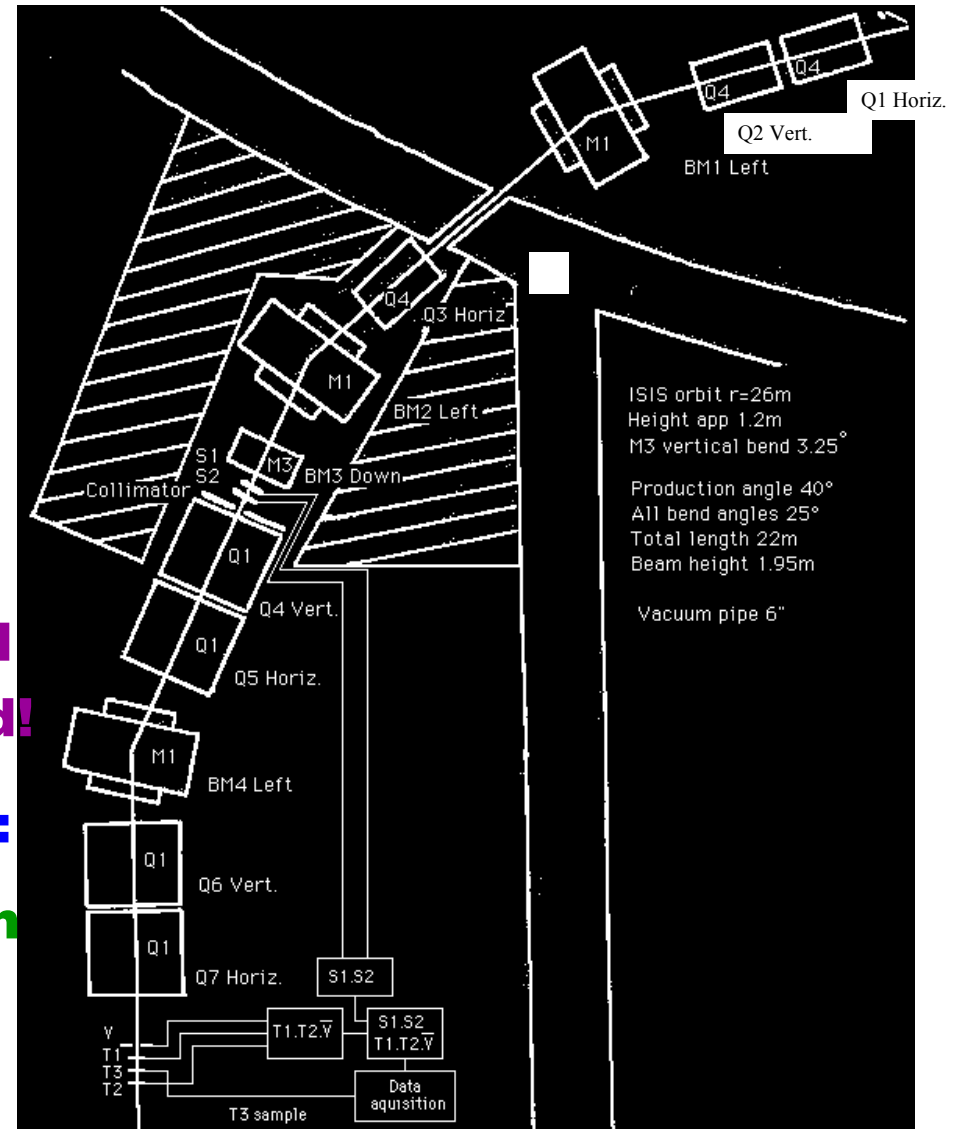
# Existing beamline

- Capture at 40°
- 25m long
- Uses NIMROD beamline magnets: 7 GeV synchrotron
- Transmission poor at low momentum
- Closed in 1978: magnets and power supplies ~40 years old!

For  $10^7$  protons at 626 MeV:

€ ~0.05 muons/bunch/turn

€ background 50 times  
at 300 MeV/c





# New beamline

- Capture at 20/30°
- 15-20m long
- Main change: 5T, 10m, 20cm SC solenoid
- Muon transmission 2.0-2.5%
- Pion transmission ~0.1%

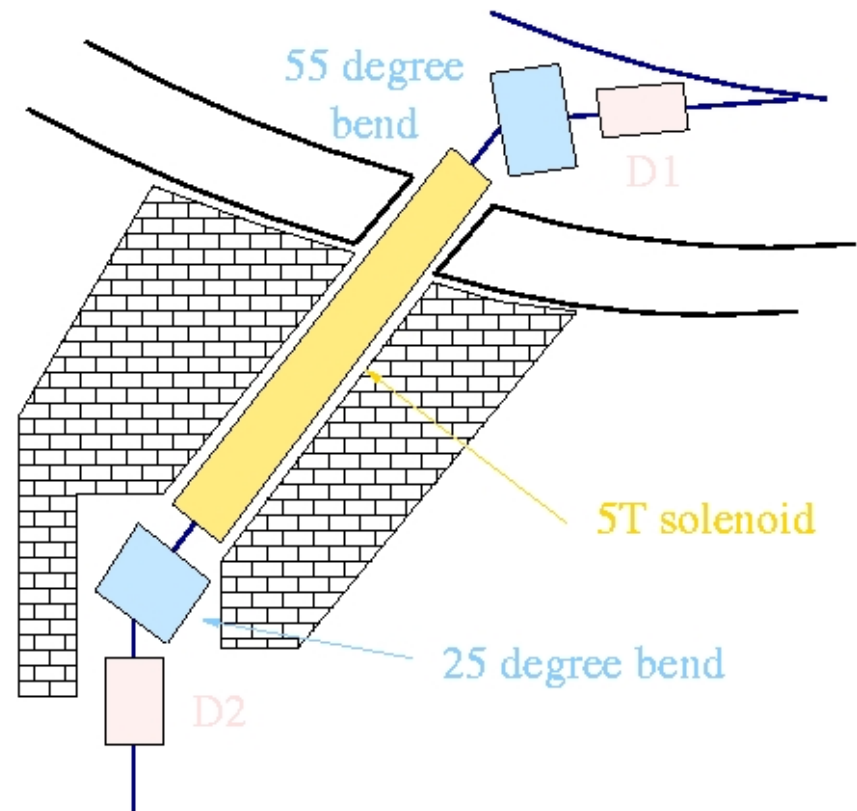
## Simulations

For  $10^7$  protons at 800 MeV:

€ ~50/60 muons/bunch/turn

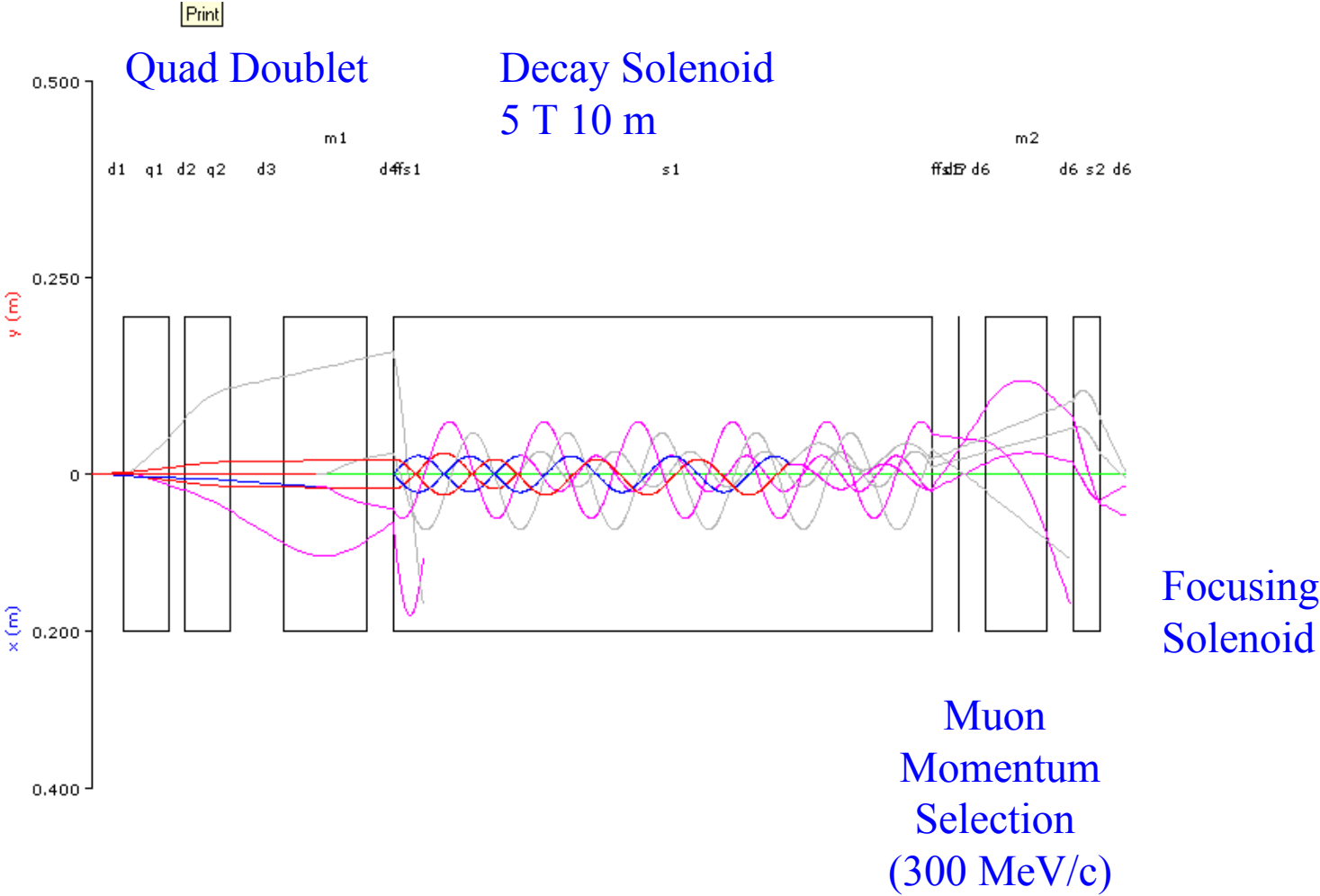
€ background ~2.5 pions

at 300 MeV/c



fi 1./1.2 ¥  $10^6$  muon/s

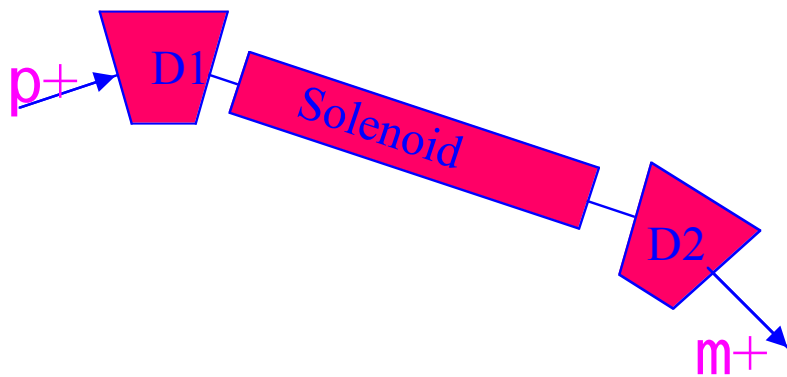
# New beamline



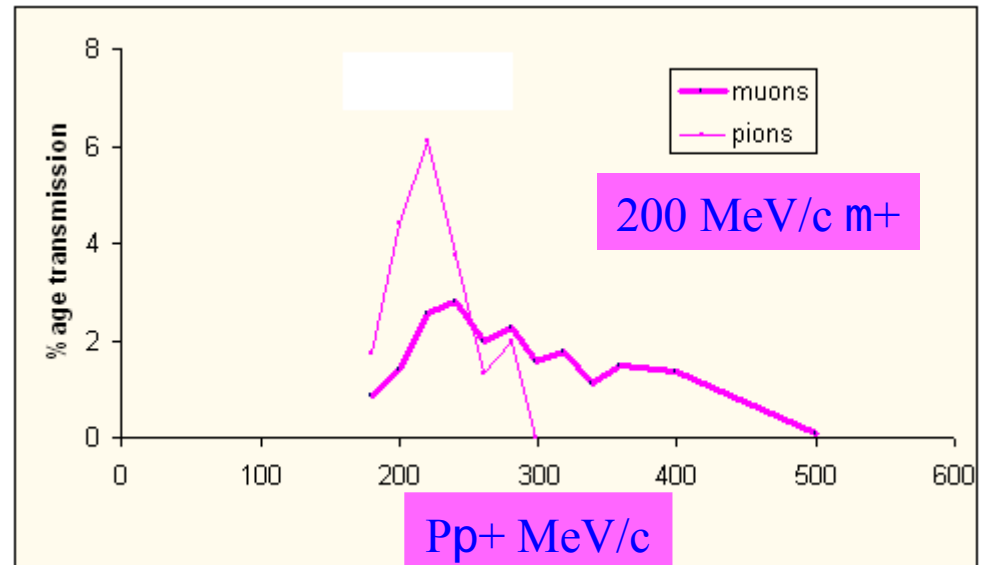
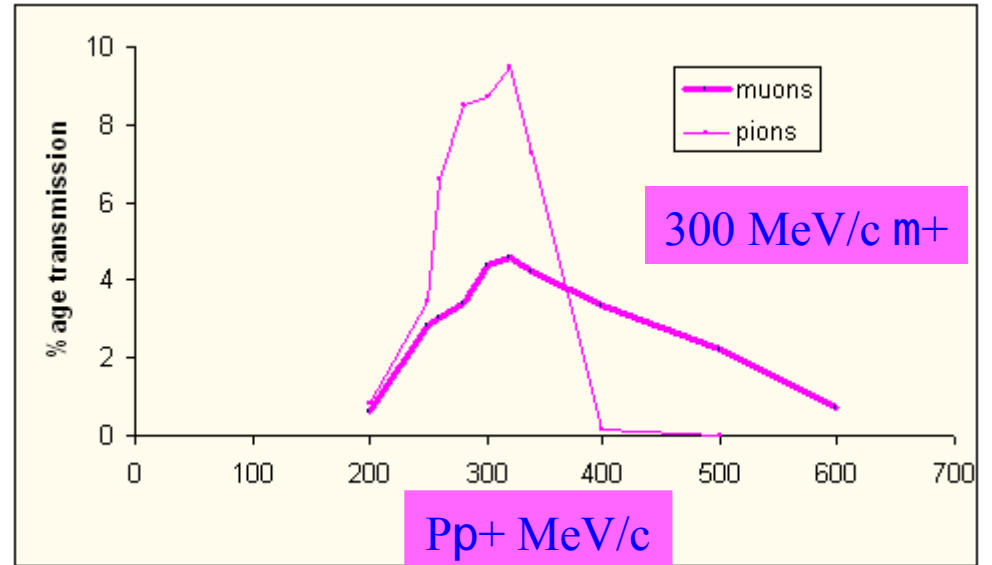
4 pi+ beams  
 4 pi+ decays (100.000 %)  
 mu+ 2 in acceptance (50.000 %)  
 pi+ 0 in acceptance (0 %)



# Background



**Background rejection  
using the solenoid**

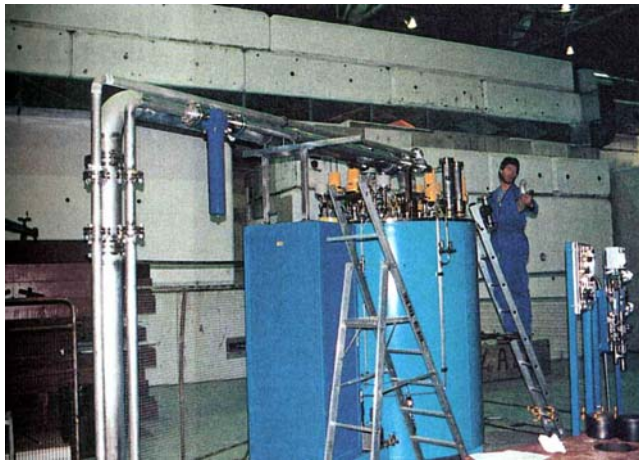
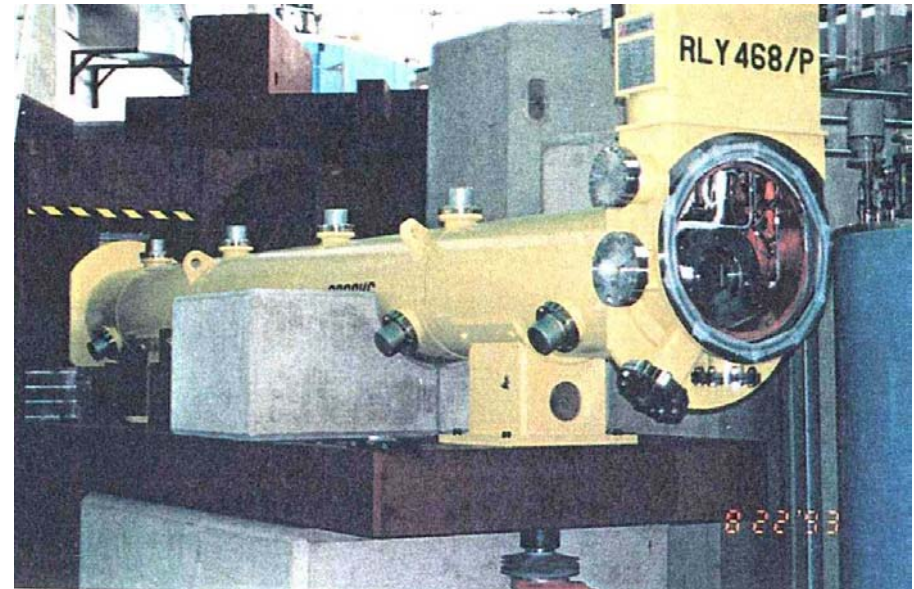


# Super-conducting Solenoid

**Initial study performed  
by Elwyn Baynham et al  
based on Riken solenoid.**

**Looks feasible.**

**Cost being determined.**



Cold box



Compressor

# PSI Solenoids?

## (1) PMC from Sindrum2

**1.5T, 40cm bore, 9m long**

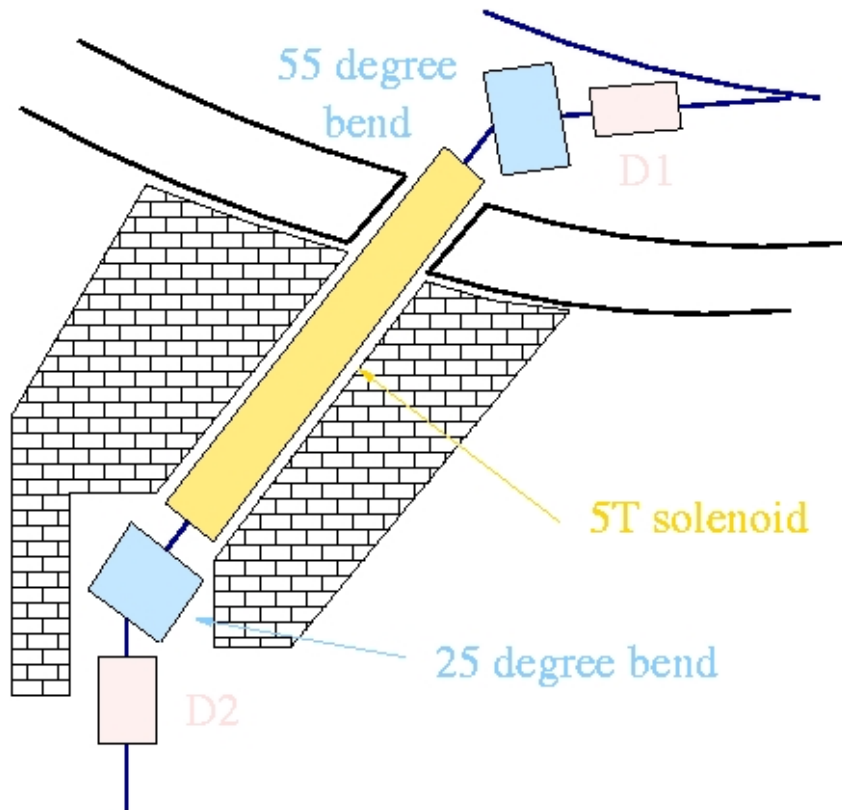
**Two possibilities(?):**

## (2) muE4

**5T, 10cm bore, 5m long**

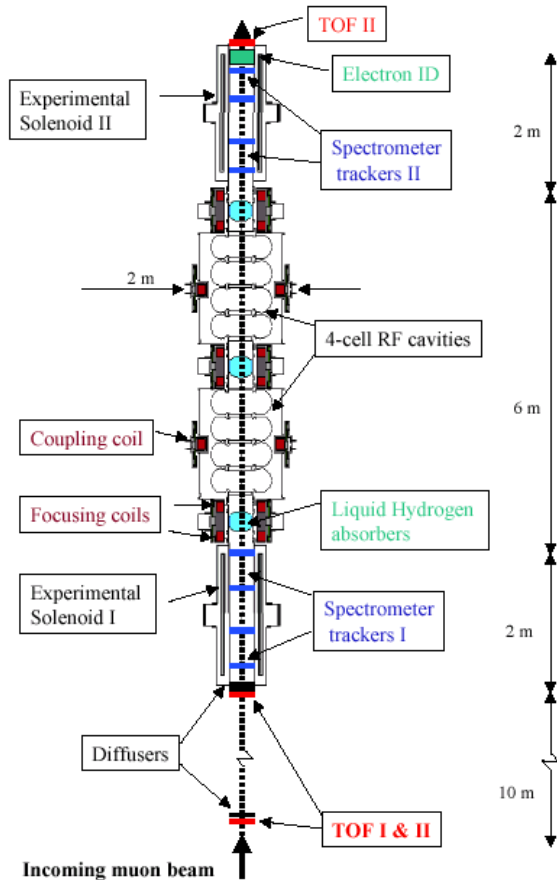
	pion MeV/c	muon MeV/c	Length m	Field T	Bore Radius	Transmission	
						muons	pions
*	300	200	10	5	0.1	1.6%	0.0%
muE4			5	5	0.05	0.8	0.0
PMC			9	1.5	0.2	0.34	0.1
*	450	310	10	5	0.1	2.5	0.1
muE4			5	5	0.05	1.4	0.2
PMC			9	1.5	0.2	0.6	0.0

# Other Practicalities/Showstoppers



- Interference with ISIS - OK
- Heat load on magnet - OK
- Hole in ISIS wall - OK
- Radiation safety (close area?) - OK
- Crane coverage - OK?
- SC infrastructure - OK

# Other Practicalities/Showstoppers



- Mains power - OK
- Cooling water - OK
- Space - OK
- Radiation safety (close area?) - OK
- LH2 safety - ?
- Funding - ?

# Conclusions

- **A muon beam with the required performance can be provided at RAL**
- **Cost can be significantly reduced if components can be borrowed from elsewhere**
- **Nothing has yet stopped the show, but further and more detailed investigations are required**
- **Project is supported by the directors of CLRC, PPD, ISIS and PPARC and main UK peer review body.**
- **Interest expressed by other muon users at RAL**
- **Funding being investigated**