Packing Fraction Run Plan

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Packing Fraction Run Plan - Motivation

- Each load of NH_3 can take ~45hrs of 85nA beam before it loses its ability to reach high polarization → need multiple loads for SANE
- Each load has a unique packing fraction PF (NH_3 : LHe volume ratio)
- There is a procedure for measuring the PF (used in RSS, other polarized target experiments)
  - Involves counting rates on NH_3 and C disks of known thickness
  - Compares experimental rates to simulated Monte Carlo (MC) rates
  - MC calibrated to experimental C rates
  - Can also use He and empty target rates to further check against MC

Packing Fraction Run Plan – Kinematics

$Q^2 = 4EE'\sin^2(\theta/2)$

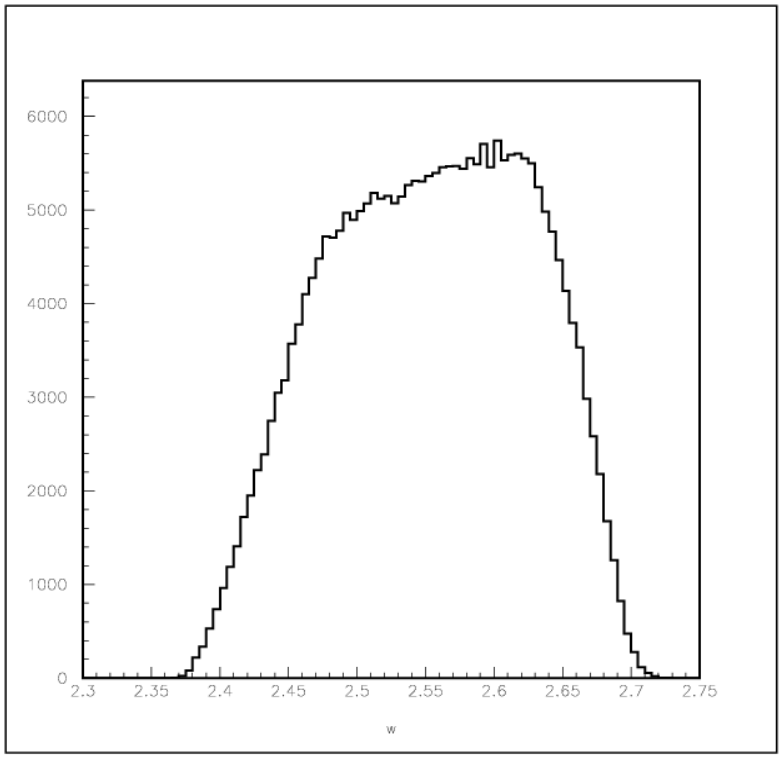
$W^2 = m^2 - Q^2 + 2(E-E')m$

where

E = beam energy E' = HMS momentum

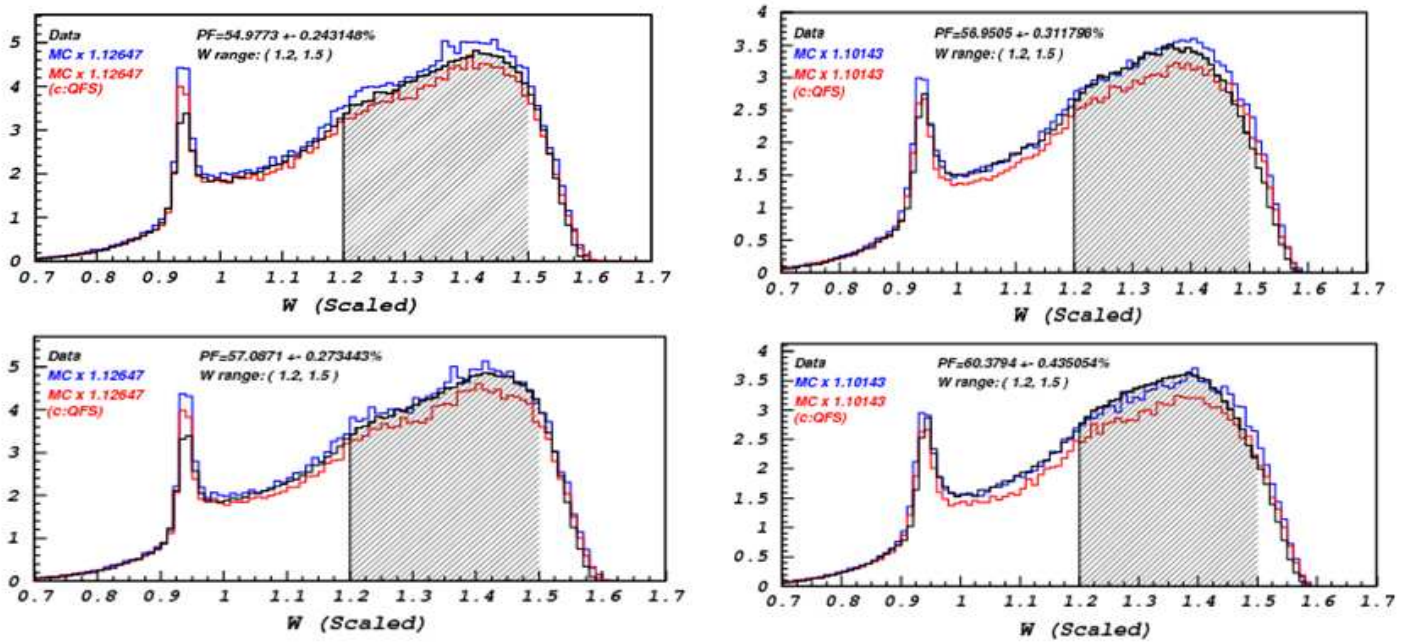
θ = HMS angle m = proton mass

- Need to use DIS kinematics which give:
  - Good e- rates
    - lower $Q^2 \rightarrow$ higher $W^2 \rightarrow$ lower E' and/or θ
  - Featureless x-sections
    - Negligible e+ rates
      - E' ≥ 2.0 GeV



Packing Fraction Run Plan

- 4 inserts: 2 cups, 1 C cell each
- 4 different configurations:
  - 4.7 GeV, 180° and 80° fields
  - 5.9 GeV, 180° and 80° fields
- C, C+He runs need to be done for each insert in each config.
- 2 NH3 runs need to be done for each target load (4 per insert)
- Each target load has a different PF



Packing fractions from various NH3 loads used during RSS. Note the range of values from 55 - 60%

	Calibration			Data				Moller		C runs		Commissi
	B OFF	B ||	B anti ||	4.7 ||	4.7 80°	5.9 80°	5.7 ||	B anti	B 80°	B anti	B 80°	
Run plan calendar days	1	2	2	6	12	21	10					12
Run plan PAC hours	12	24	24	72	144	252	120	7	14	7	13	144
Proposal hours	12	24	24	70	130	200	100	7	14	7	13	144
Proposal Data + systematics				76	141	216	108	4	8	4	8	
Efficiency: (proposal+syst.) / run plan				1.05	0.98	0.86	0.90					
Tentative 11/07				5	9	21	18					
Tentative PAC hours				60	108	252	216					
Efficiency: (proposal+syst.) / tentative				1.26	1.30	0.86	0.50					

Eo = 4.7 GeV, E' = 2.0 GeV, θ = 18°

PARALLEL FIELD (72 hrs - 1 insert)

target	W range (GeV)	e- rate [Hz]	time [hr] * for 1% stats	# loads	# runs	total time [hr]	total rate [Hz] **
NH3	2.20 - 2.32	8.8	0.4	2	2	1.5	140.0
C		7.9	0.4	1	3	1.2	123.0
C+He		10.3	0.3	1	3	1.0	161.0
						3.7	

80° FIELD (144hrs - 2 inserts)

target	W range (GeV)	e- rate [Hz]	time [hr] * for 1% stats	# loads	# runs	total time [hr]	total rate [Hz] **
NH3	2.18 - 2.30	5.0	0.7	4	2	5.2	74.3
C		4.4	0.7	2	3	4.5	64.8
C+He		5.5	0.6	2	3	3.6	85.0
						13.3	

Eo = 5.9 GeV, E' = 2.3 GeV, θ = 16°

PARALLEL FIELD (120 hrs - 2 inserts)

target	W range (GeV)	e- rate [Hz]	time [hr] * for 1% stats	# loads	# runs	total time [hr]	total rate [Hz] **
NH3	2.52 - 2.64	9.1	0.4	4	2	2.9	143.6
C		7.8	0.4	2	3	2.5	126.9
C+He		10.5	0.3	2	3	1.9	165.9
						7.3	

80° FIELD (252 hrs - 3 inserts)

target	W range (GeV)	e- rate [Hz]	time [hr] * for 1% stats	# loads	# runs	total time [hr]	total rate [Hz] **
NH3	2.49 - 2.61	5.2	0.6	6	2	7.6	78.5
C		4.6	0.7	3	3	6.4	70.5
C+He		6.1	0.5	3	3	4.8	92.3
						18.8	

* 1% stats per 15MeV bin in W (rates use 100nA in monte-carlo, time is adjusted to account for SANE's 85nA)

** Total integrated rate, no HMS cuts. Used as a check to ensure we are within HMS DAQ constraint of 1-2 kHz.