Initial State Helicity Correlation in Wide Angle Compton Scattering E05-101

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Readiness Review
July 2, 2007

"Merely due to lack of available beam time, the PAC recommends that only the kinematic point in the backward hemisphere be measured." PAC28

Approved with A– rating for 14 days.

Introduction & Motivation

Compton Scattering off nucleons provides information on the substructure of nucleon in terms of quark and gluon d.o.f. → extremely complicated

Compton scattering in various kinematical regions

- low energy→ dominated by nucleon as a whole
- deeply virtual CS; low | t |, large Q^2→ handbag diagram involving skewed parton distributions
- 'wide angle' CS; low Q^2 , large |t| and s ensures dominance of short distance behavior

- What is the reaction mechanism?

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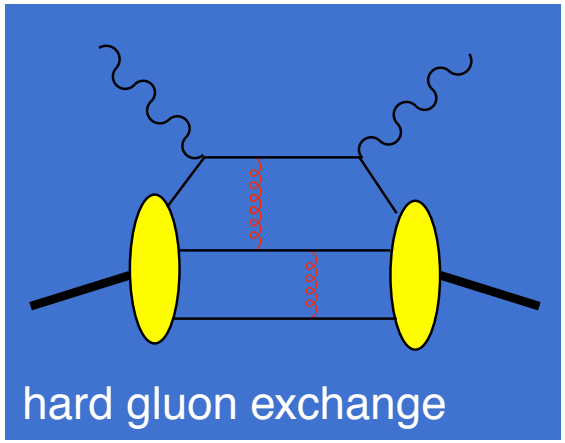
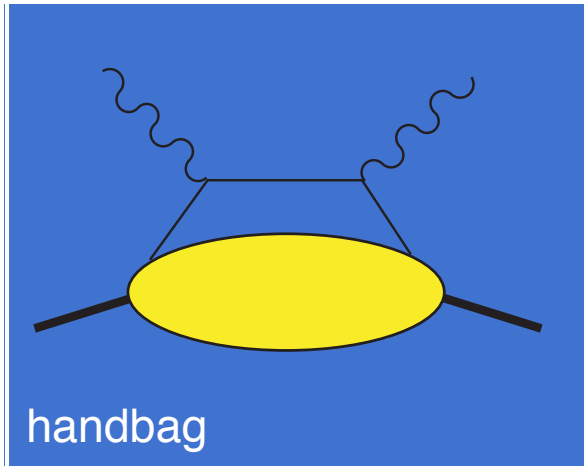


- 3 active quarks
- 2 hard gluons
- 3-body "form factor"

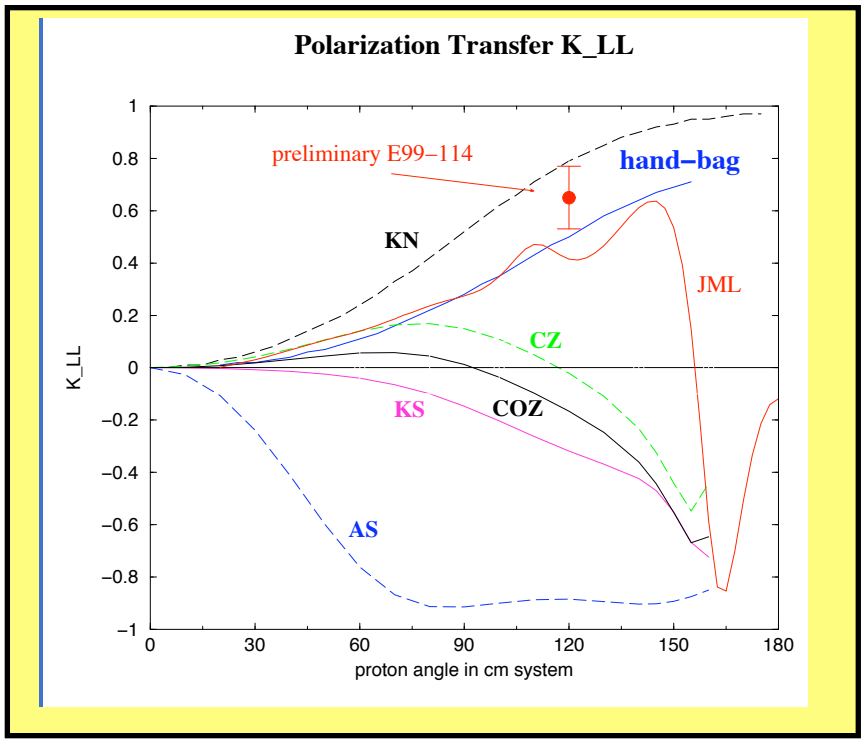


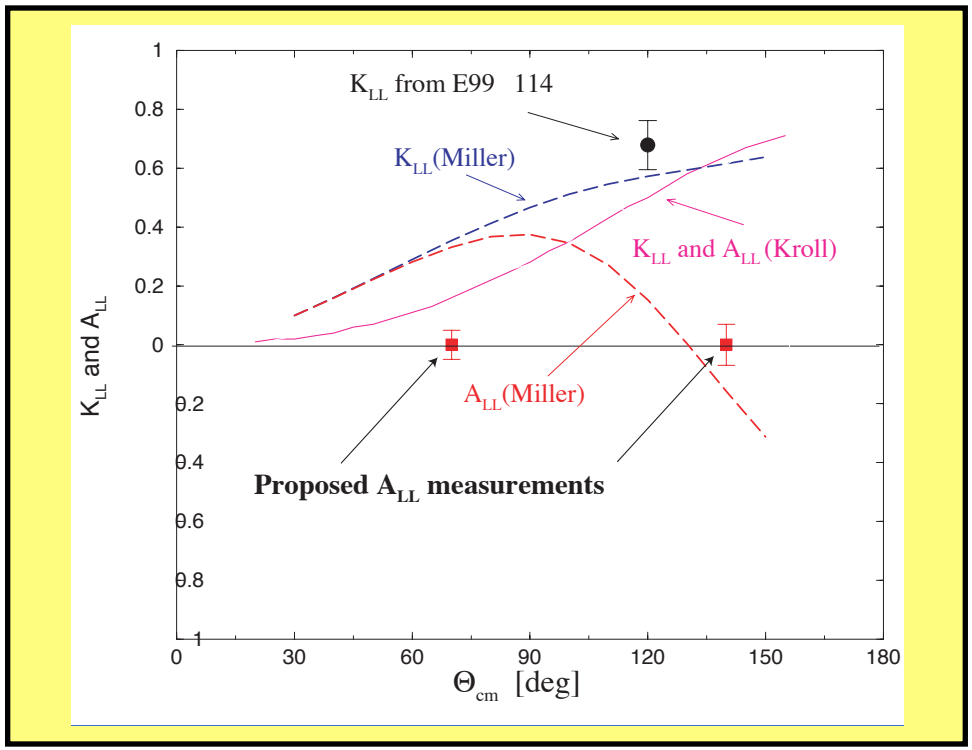
- 1 active quarks
- 0 hard gluons
- 1-body "form factor"

- ✦ Which, if either, dominates at few GeV?
- ✦ We will be able to distinquish among competing mechanisms

Physics Goals

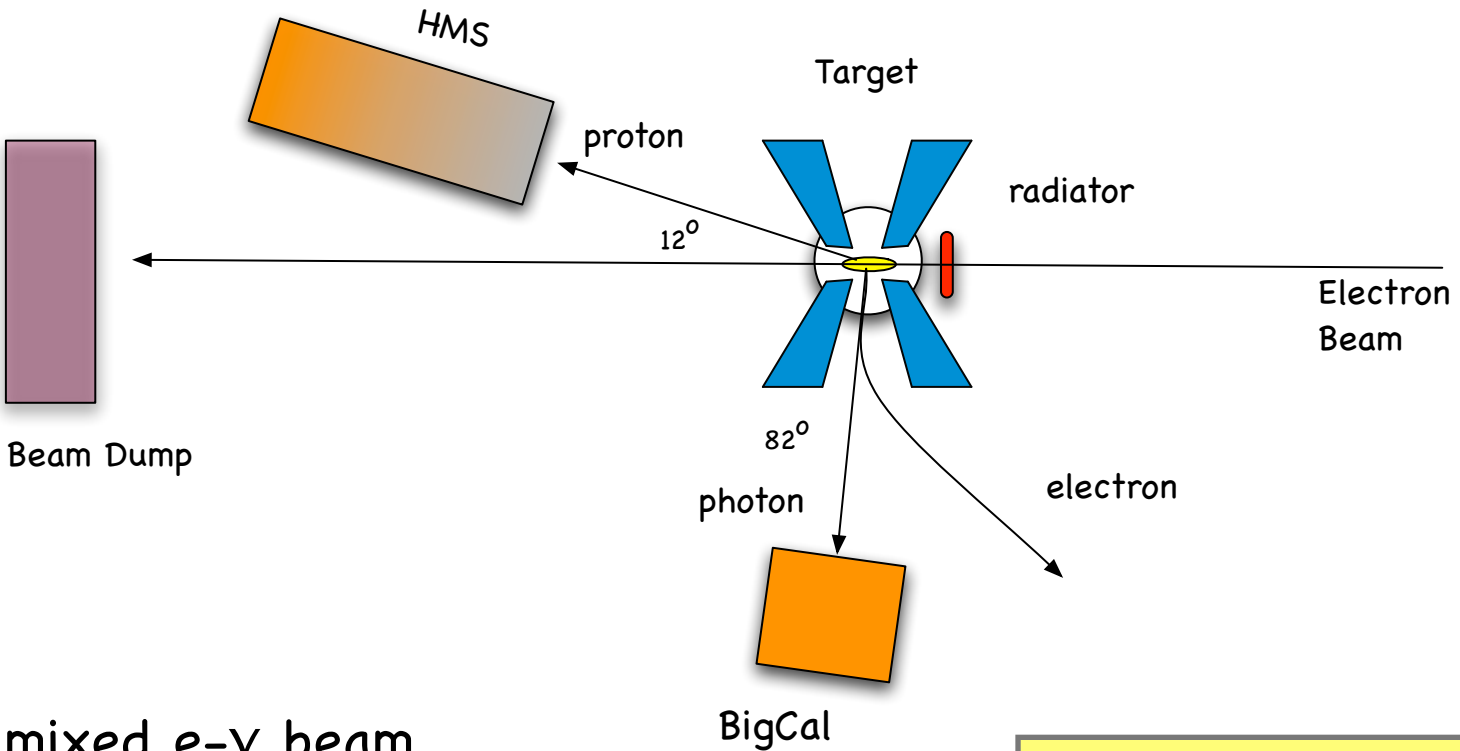
- Measure A_{LL} (never been measured) at two scattering angles: $\theta^{\gamma}_{CMS} = 70^{\circ}$ corresponding to $-t = 2.4$ (GeV/c)^2 and $\theta^{\gamma}_{CMS} = 140^{\circ}$ corresponding to $-t = 6.4$ (GeV/c)^2
- Provide an experimental test of the RCS reaction mechanism: does the photon interact with a constituent or a current quark?
- Provide an additional test for hadron helicity conservation and pQCD



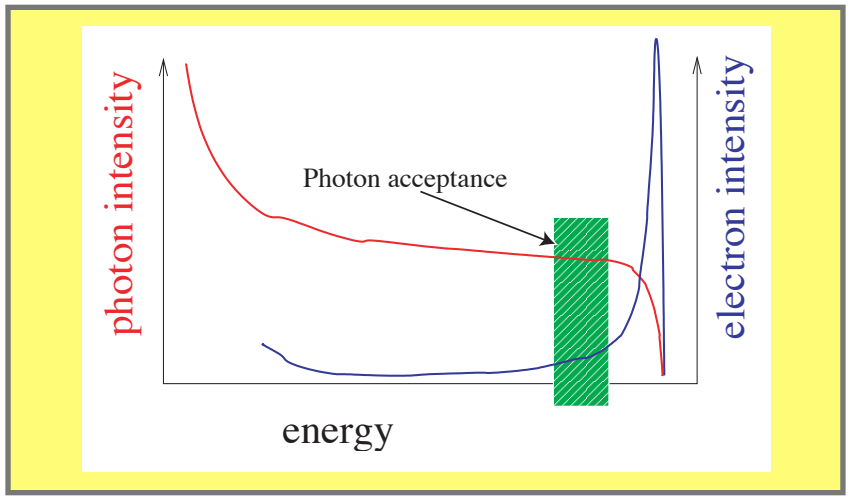


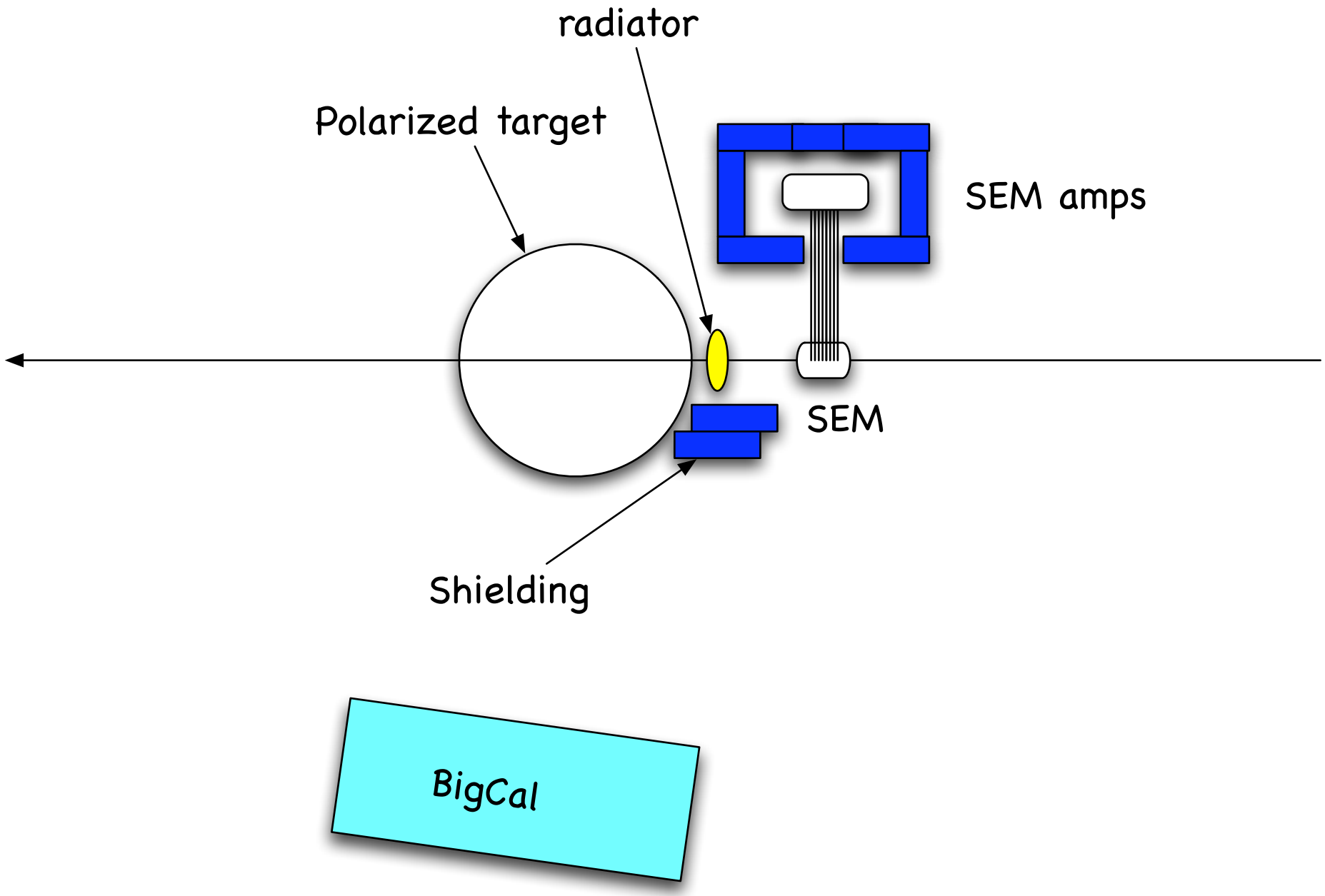
Experimental Layout

4.8 GeV electrons $E_\gamma = 4.3\ GeV,\ s = 9\ GeV^2$ $\theta^{CMS} = 70°,$ 140°



- ☑ mixed e-γ beam
  - ☑ e-p/RCS discrimination needed
  - ☑ control of backgrounds
- ☑ good angular resolution
- ☑ Polarized Target
- ☑ HMS Trigger only




radiator
Polarized target
SEM amps
SEM
Shielding
BigCal

kin P#	t (GeV/c)2	θ_γ^{lab} degree	θ_γ^{cm} degree	θ_p^{lab} degree	E_γ^{lab} GeV	p_p GeV/c	L	θ_V^e degree	θ_V^p degree
P1	-2.4	25	70	39	3.00	2.02	7	1/7	4.1
P2	-6.4	82	140	12	0.87	4.25	2.8	15.4	0.6

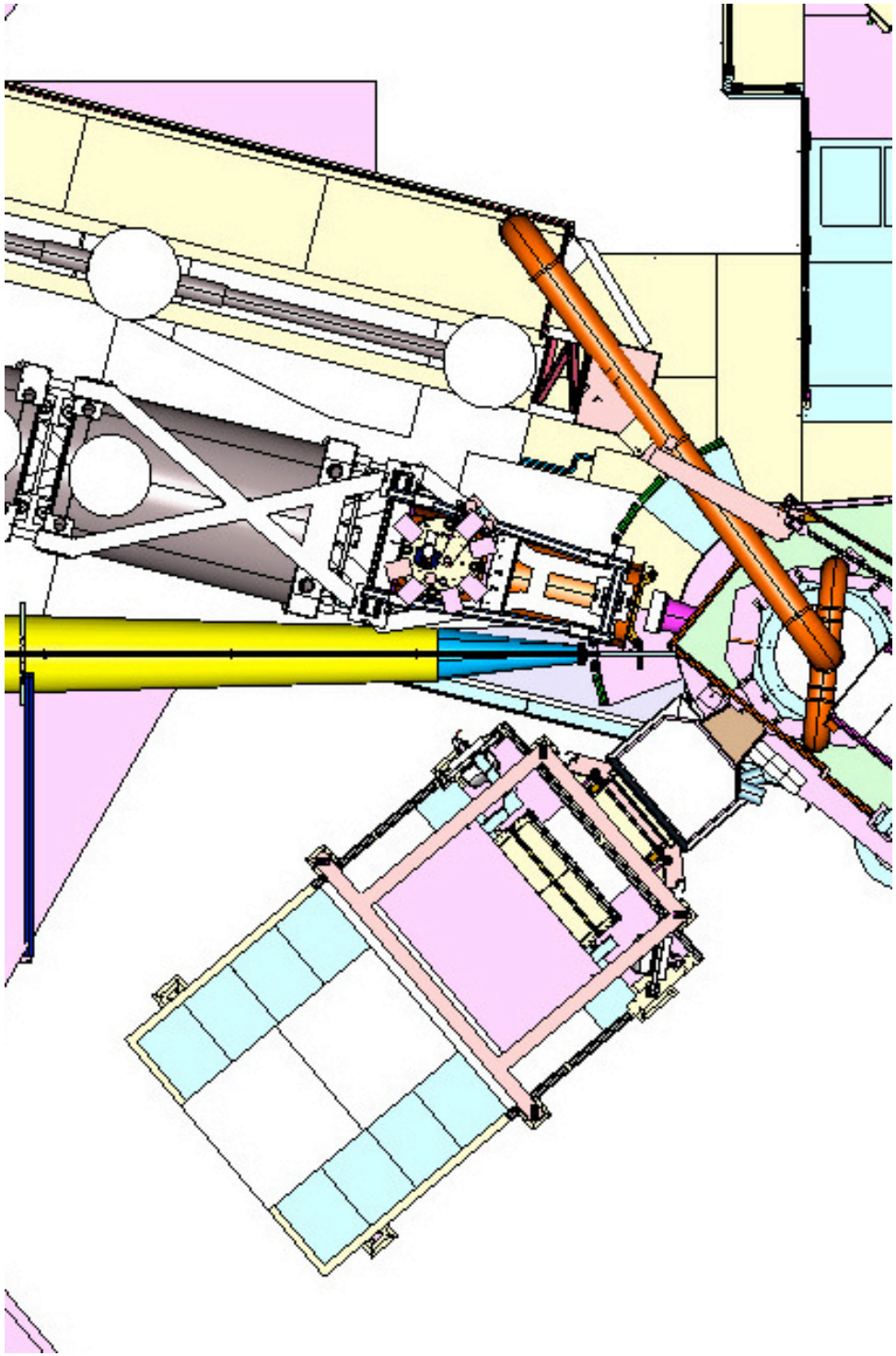
kin P#	Procedure	Beam nA	time hours
P1	RCS data	90	176
P2	RCS data	90	240
	Packing Fraction	90	8
	Moller	200	10
	Target Anneals		30
	Stick Changes		18
	e-p elastics		30
	Allocated	14 days	336
	Requested		506

Transition from SANE to WACS

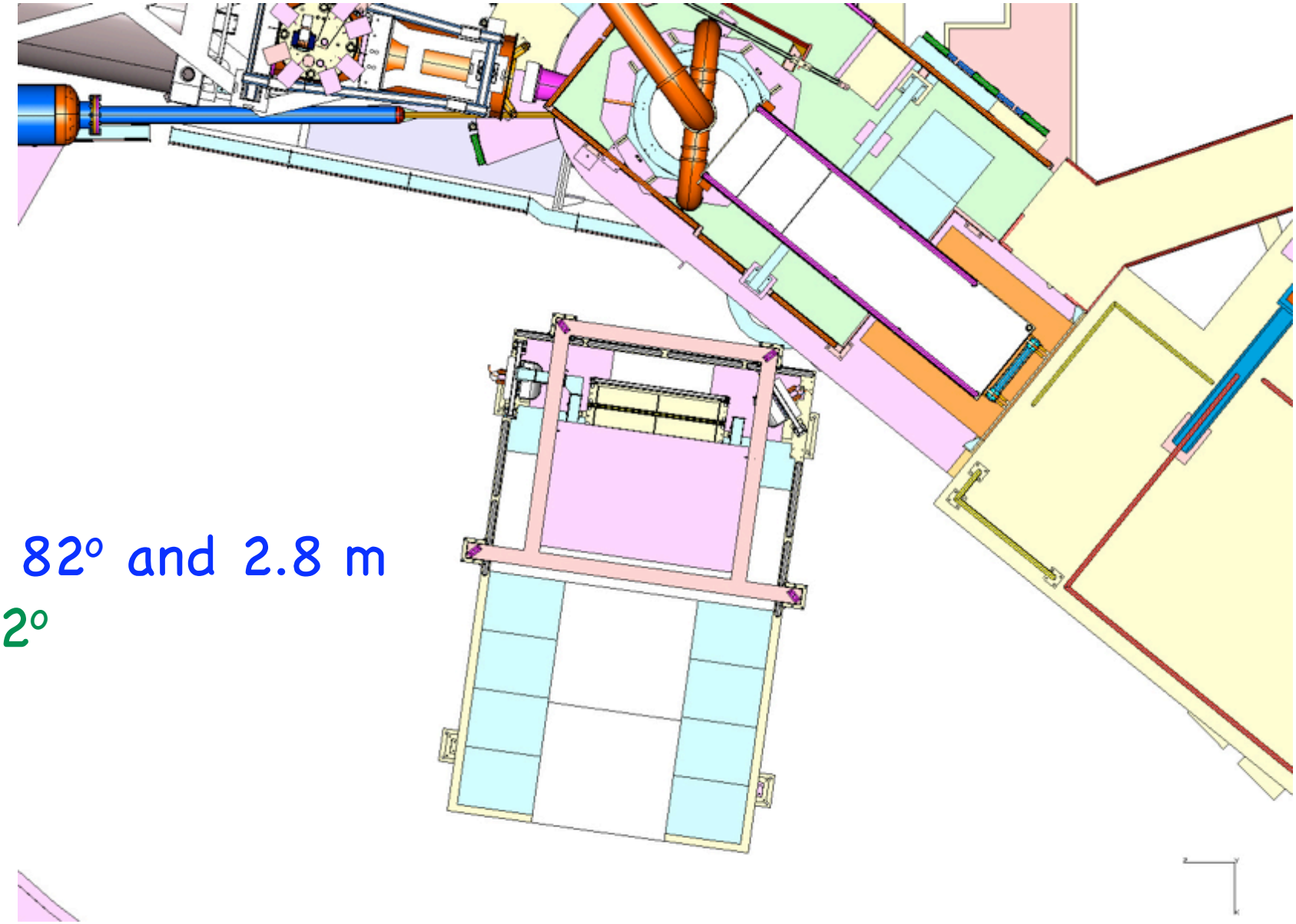
- Remove Cherenkov
- Remove Tracker
- Position BigCal
- Rotate HMS
- Modify trigger (HMS)
- Reconfigure chicane for longitudinal running
- Replace He bag with standard beam pipe
- Checkout radiator

Transition can be done in ≈ 4-5 days

SANE at 40°



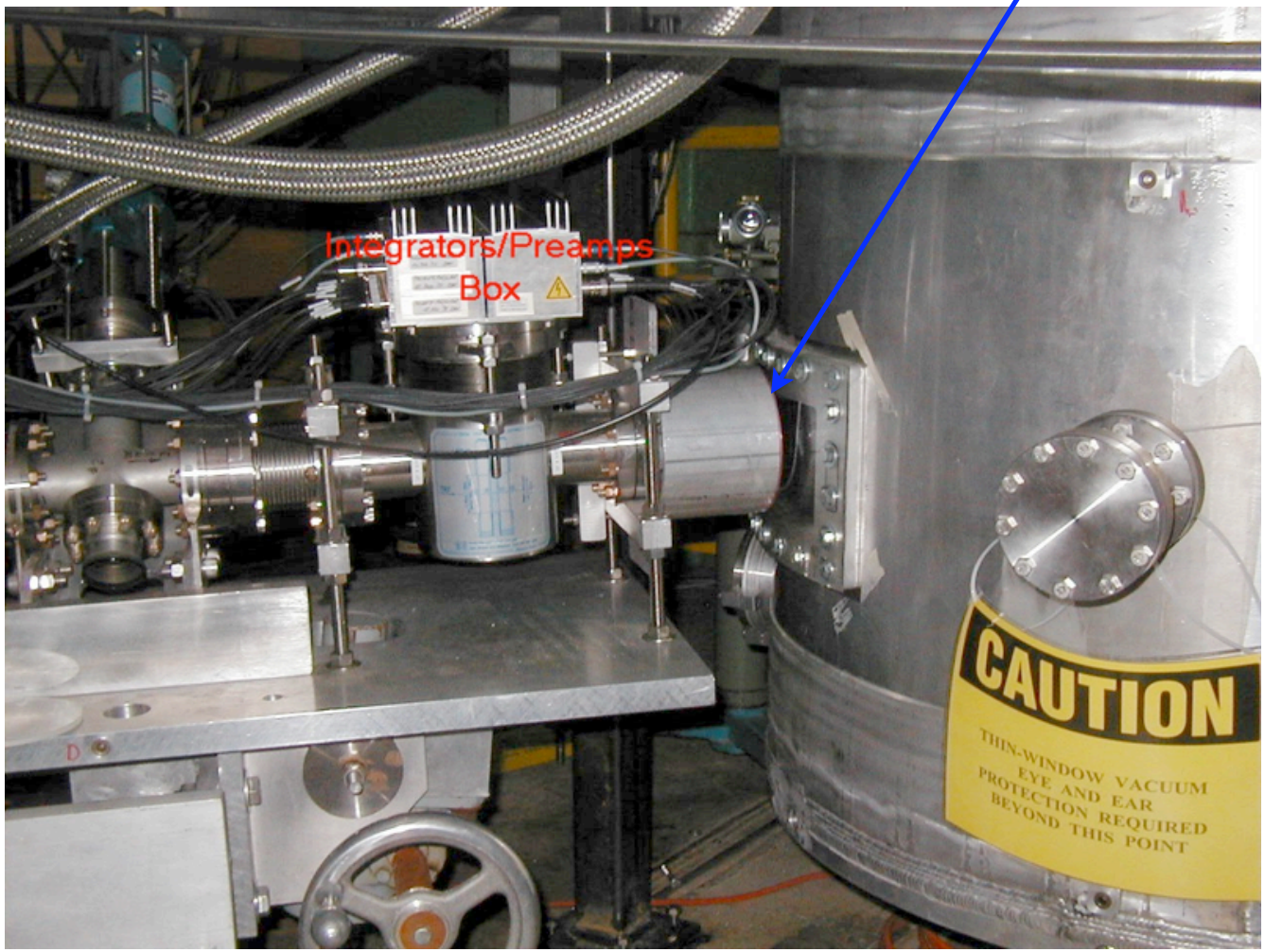
WACS



BigCal at 82° and 2.8 m

HMS at 12°

Radiator here



Collaboration

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