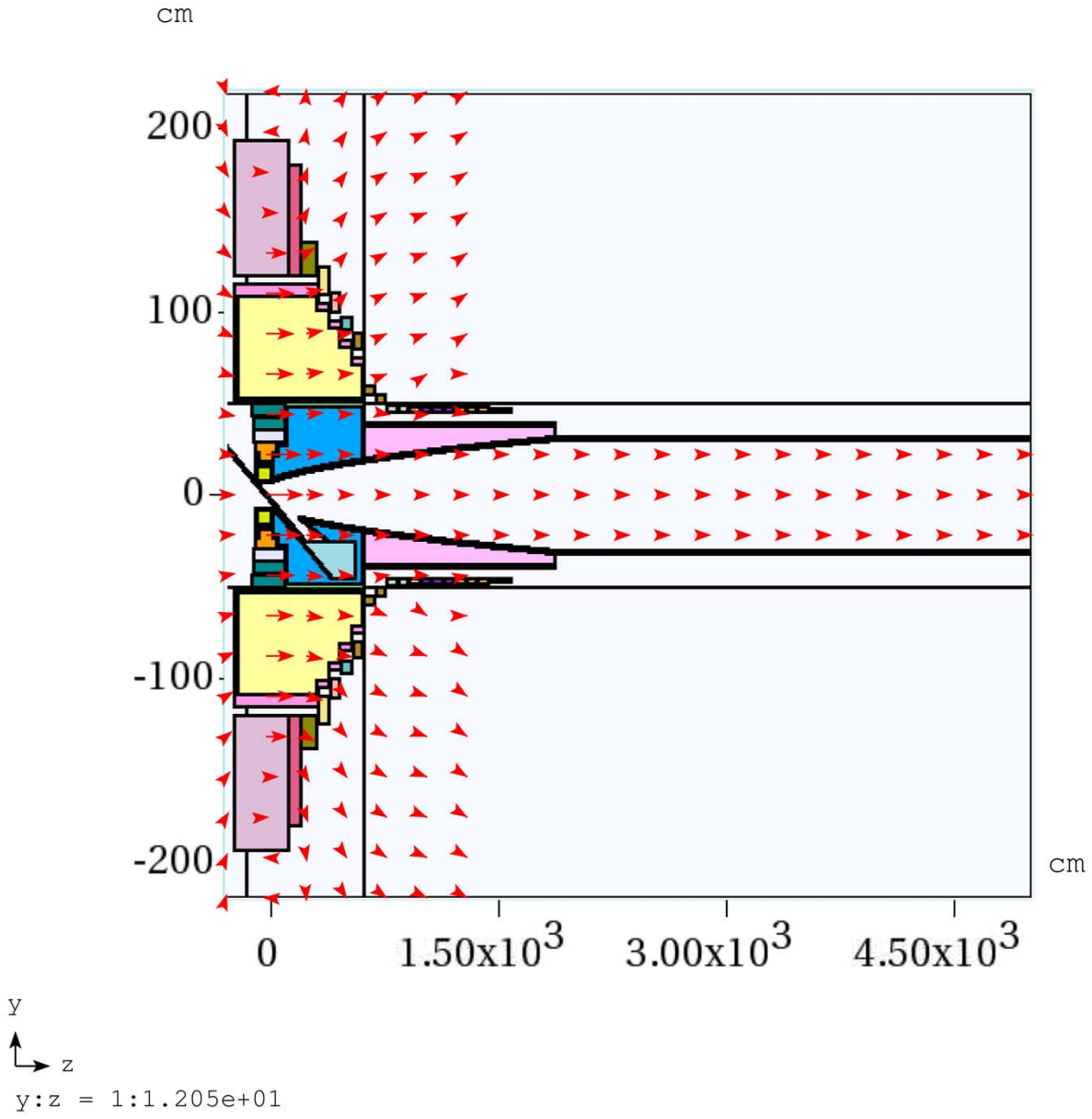
Meson Productios for Target System with Ga/Hg Jet and IDS120h Configuration

X. Ding, UCLA

Target Studies, April 3, 2012

Target/Collection System of IDS120h

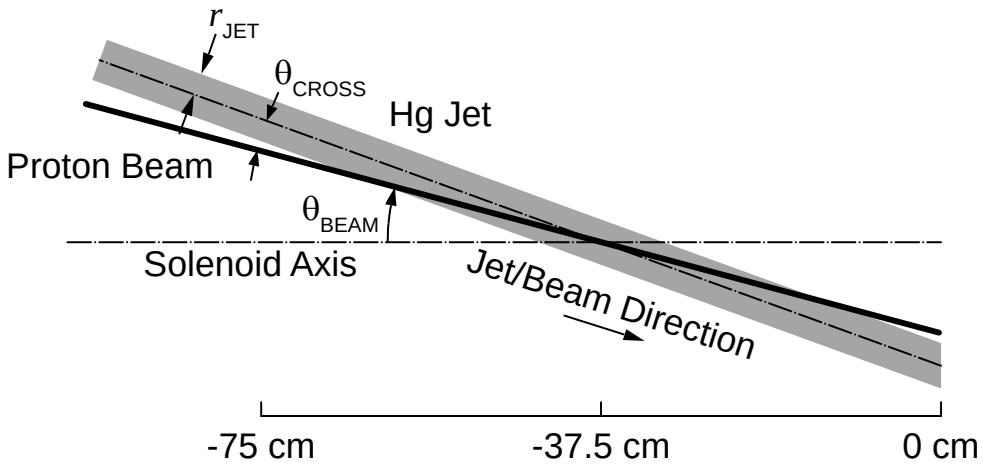


Count all the pions and muons that cross the transverse plane at z = 50 m.

For this analysis we select all pions and muons with 40 < KE < 180 MeV.

Hg/Ga Target Geometry

(New Setting Procedure)



The mercury jet target geometry. The proton beam and mercury jet cross at z = -37.5 cm.

1. Put beam exactly below the Hg/Ga jet at z=-37.5 cm (see above y-z plot), fix beam/jet intersection point at (0, 0, -37.5 cm) and project beam back to z =-200cm. (Difference: In previous simulation for study2, beam launching point is at z = -75 cm.)
2. Initial target parameters at proton KE of 8 GeV: target radius of 5 mm, beam angle of 67 mrad at z = -37.5 cm, beam/jet crossing angle of 33 mrad at z = -37.5 cm.
3. The SC coils, resistive Cu and Shielding are deleted in MARS code for speeding up simulation (Difference: not so in simulation for study2).

Optimization Method

- Take 3 runs in each cycle:

  1) Vary jet radius with initial beam angle and beam/jet crossing angle;

  2) Vary beam/jet crossing angle with new target radius while keeping jet fixed - always project beam back to z = -200 cm;

  3) Vary jet angle with new target radius and beam/jet crossing angle-always keep crossing angle constant-both jet and beam must be rotated about intersection point together and always project beam back to z = -200 cm.

- Repeat above cycle until convergence.

Optimized Target Parameters at 8 GeV at z = -37.5 cm

	Hg			Ga		
	Target radius, mm	Crossing angle, mrad	Beam angle, mrad	Target radius, mm	Crossing angle, mrad	Beam angle, mrad
Initial	(5mm, 33mrad, 67mrad)			(5mm, 33mrad, 67mrad)		
1st Cycle	4.6	23	120	6.7	21	112
2nd Cycle	4.15	23	117	5.5	17	94
3rd Cycle	4.15	21.6	120	4.9	13.2	92
4th Cycle	4.04	**20.6**	117	4.5	13	90
5th Cycle				4.4	12.8	86
6th Cycle				4.4	**13**	88

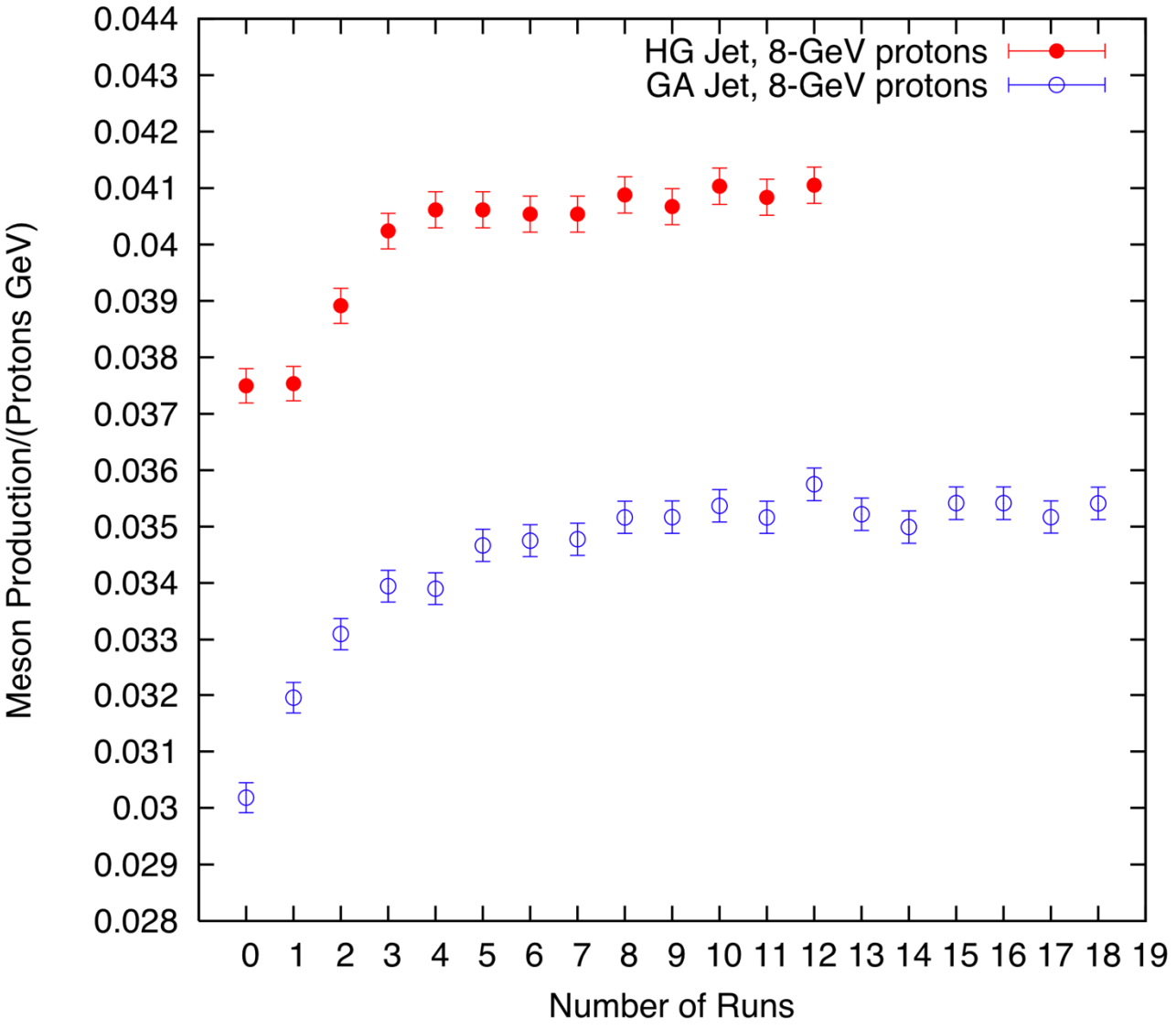
Nuclear interaction length: Hg/14.58 cm, Ga/23.92 cm.

Meson Productions at 8 GeV (400,000 events)

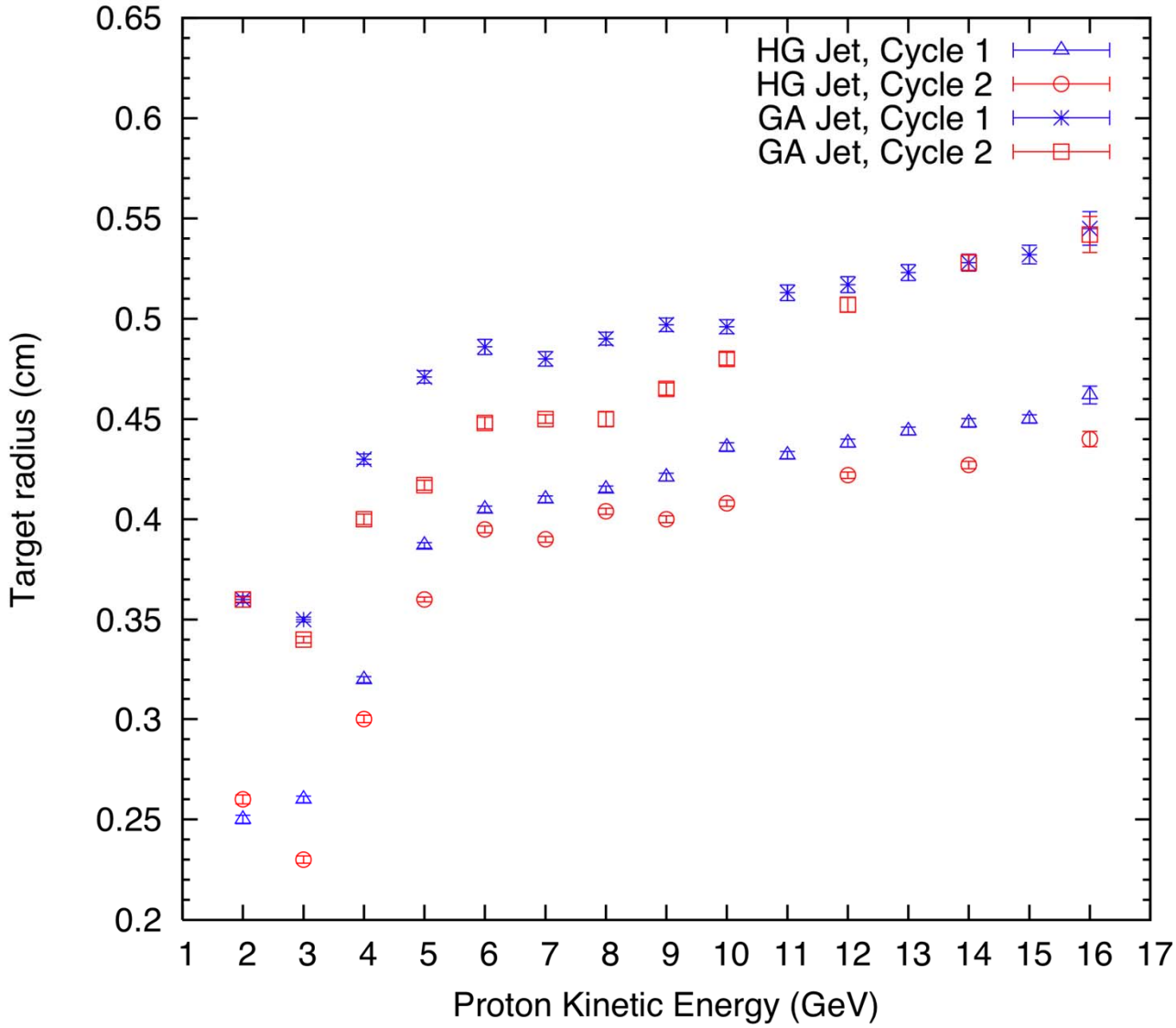
	Hg	Ga	[N(Ga)-N(Hg)]/N(Hg)
Before optimization (Target radius/beam angle/crossing angle)	108528 (5mm/67mrad/33mrad, Initial)	96586 (5mm/67mrad/33 mrad, Initial)	-11% (w/t opt)
After optimization (Target radius/beam angle/crossing angle)	131362 (4.04mm/117mrad/ 20.6mrad, end of 4th Cycle)	114401 (4.5mm/90mrad/ 13mrad, end of 4th Cycle)	**-12.9%** (opt)
[N(opt)-N(w/t opt)]/N(w/t opt)	+21%	+18.4%	

Meson Productions vs. Run No. at 8 GeV

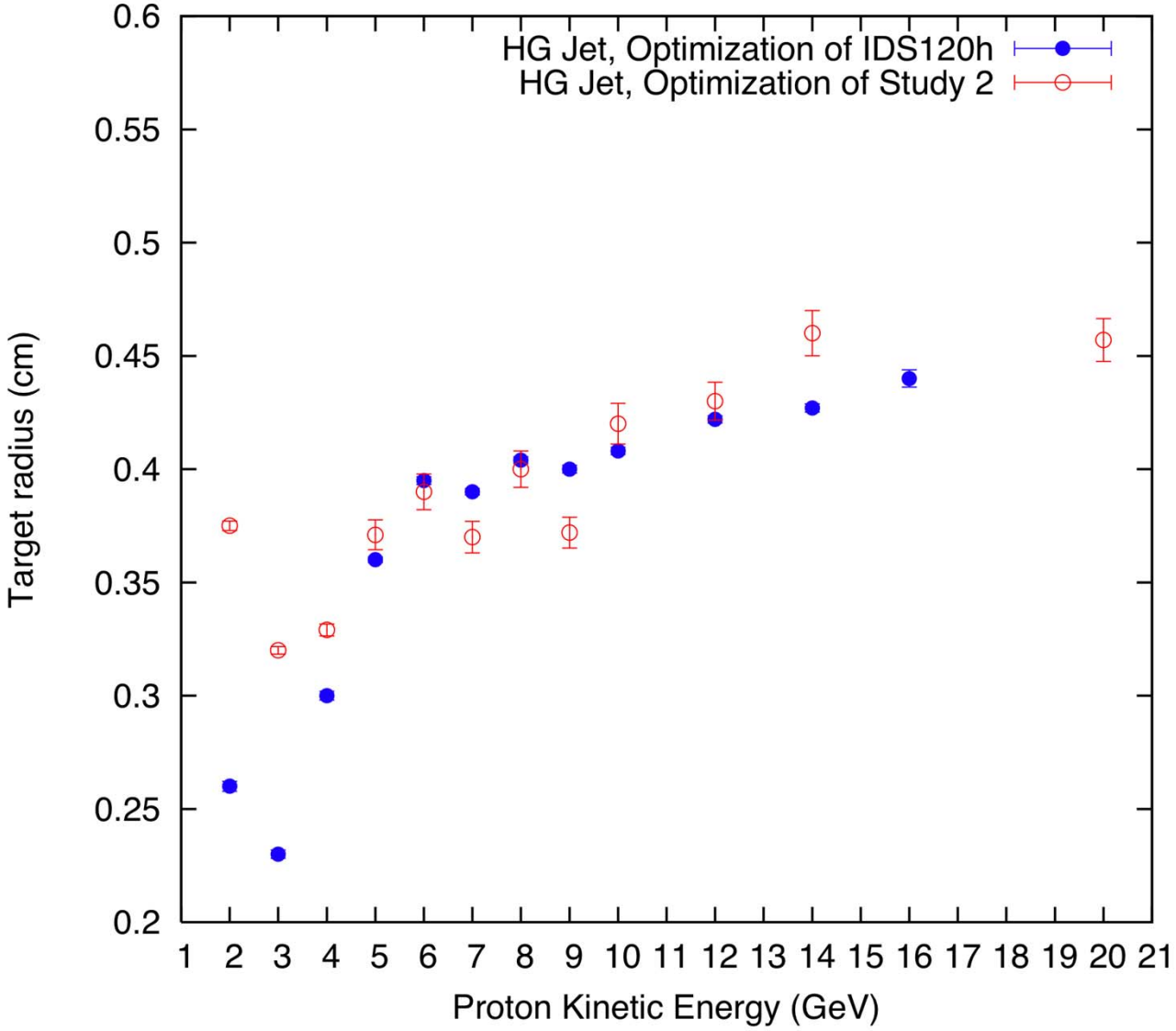
(Number of runs: 0-Initial, 1,4,7,10,13,16-optimized target radius, 2,5,8,11,14,17-optimized crossing angle, 3,6,9,12,15,18-optimized beam angle)



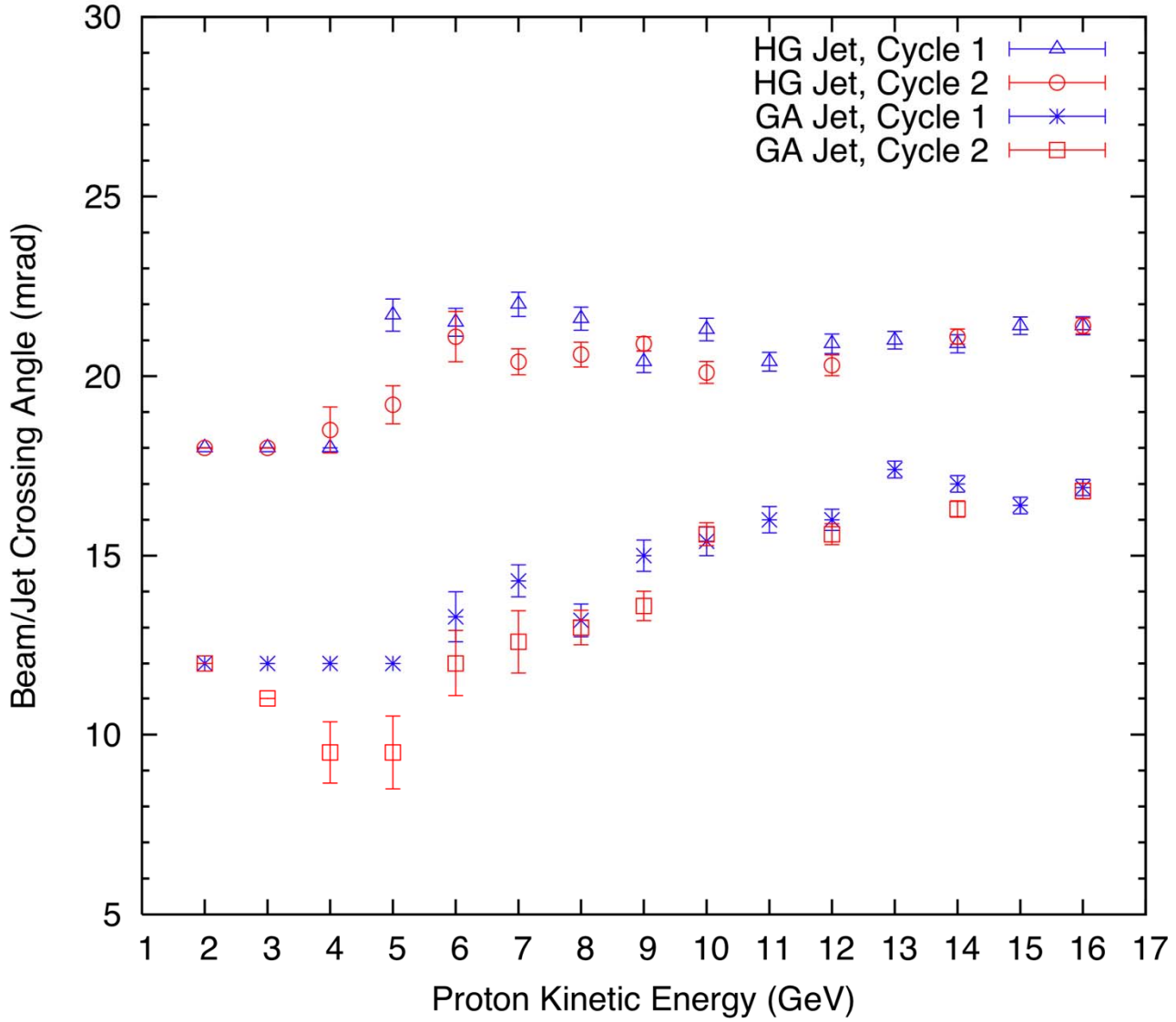
Target Radius vs. KE (Hg/Ga Jet)



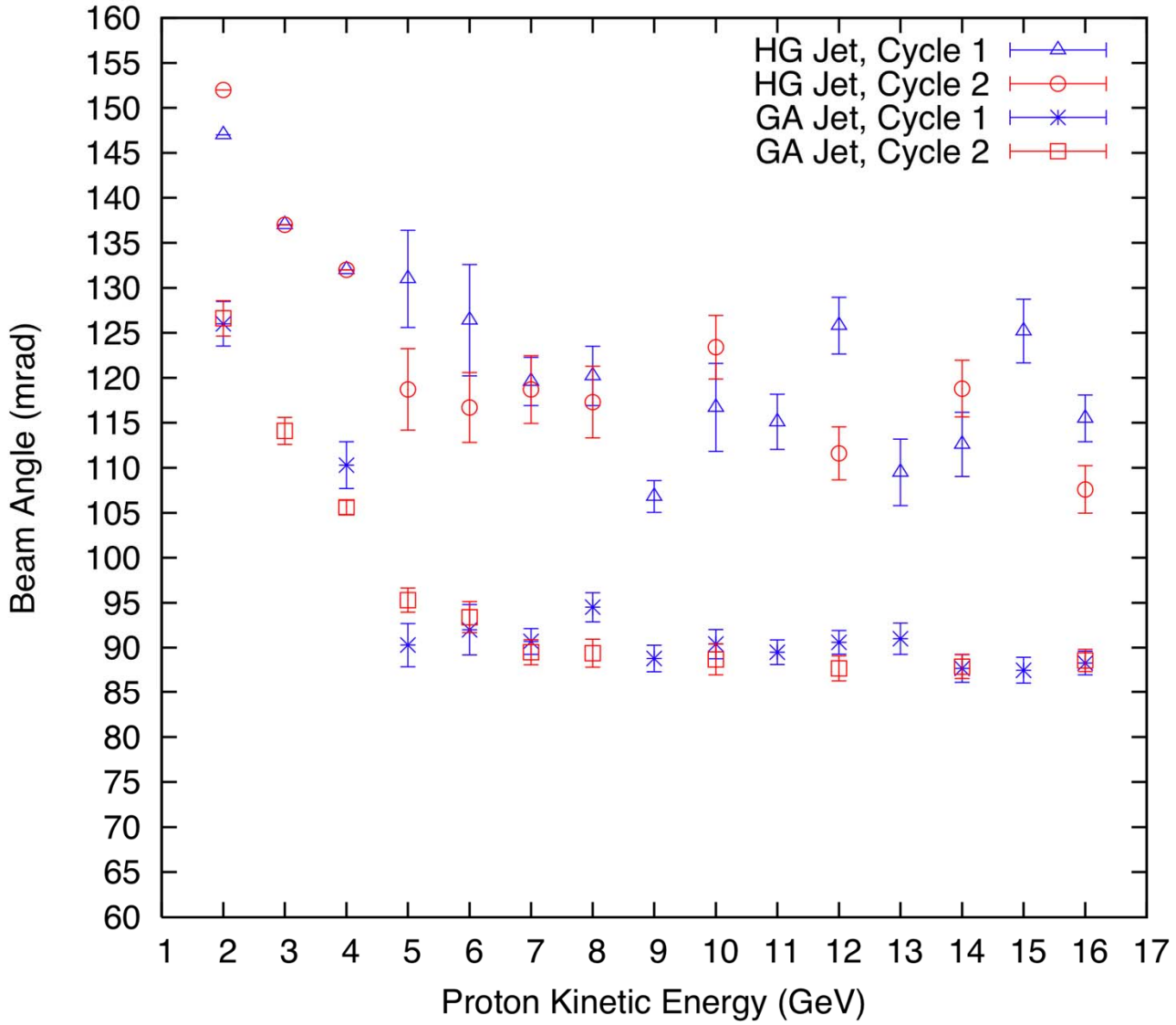
Target Radius vs. KE (IDS120h/Study2, Hg Jet)



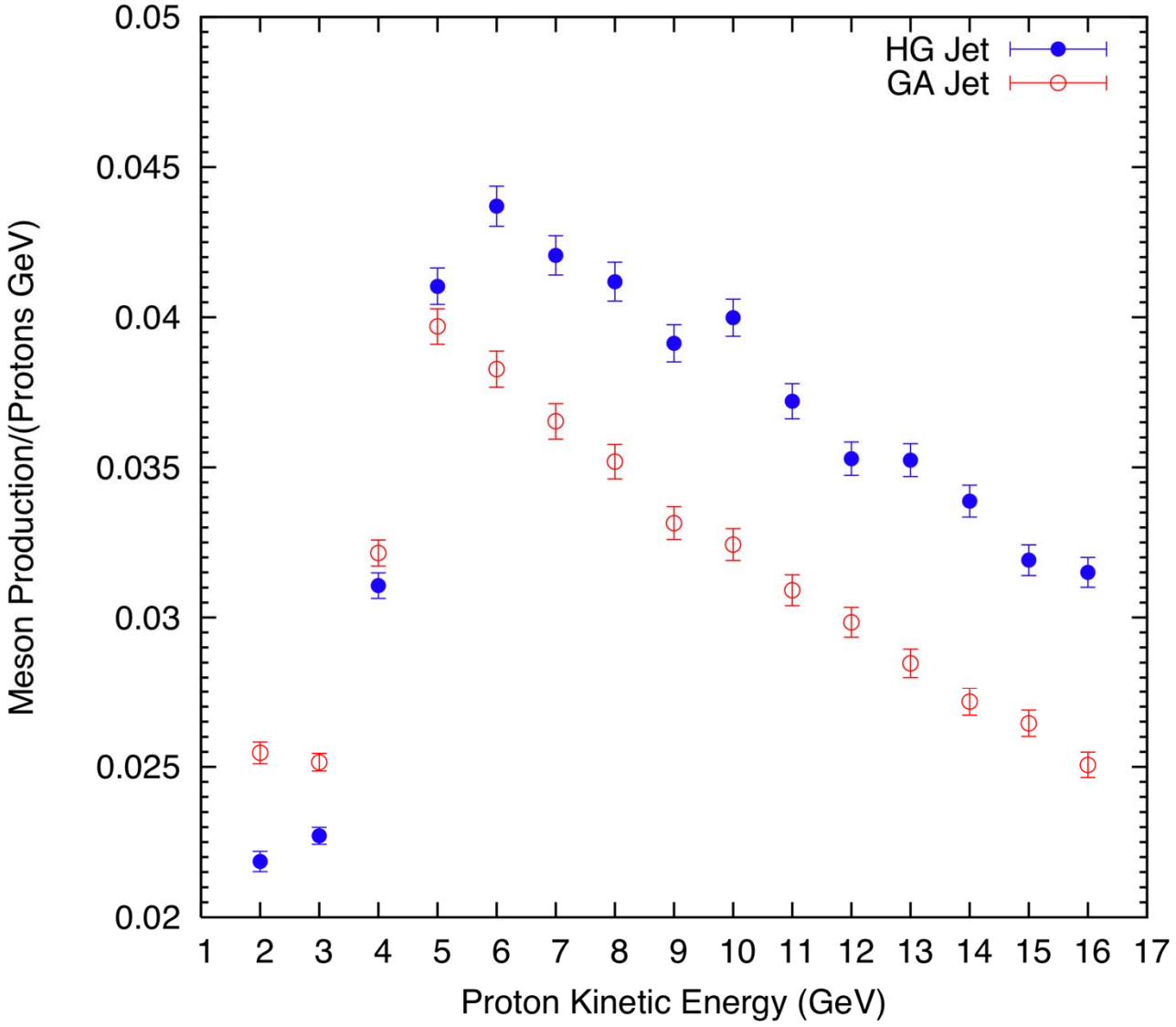
Beam/Jet Crossing Angle vs. KE (Hg/Ga Jet)



Beam Angle vs. KE (Hg/Ga Jet)



Meson Production vs. KE (Hg/Ga Jet)



Meson Production vs. KE (IDS120h/Study2/Nikolai's paper, Hg Jet)