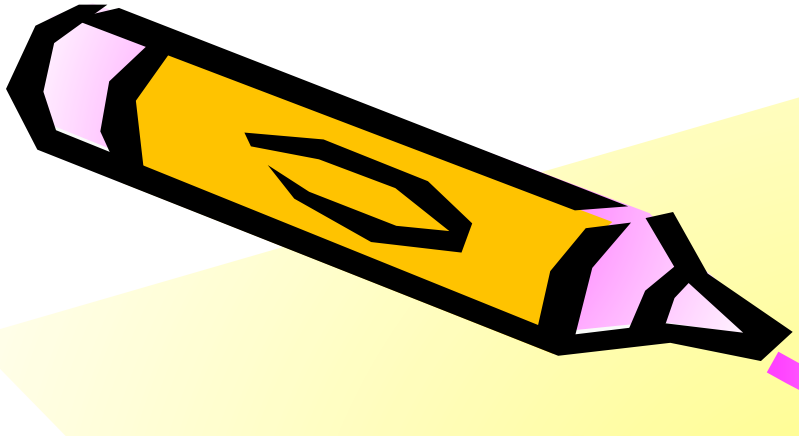


News from eRHIC

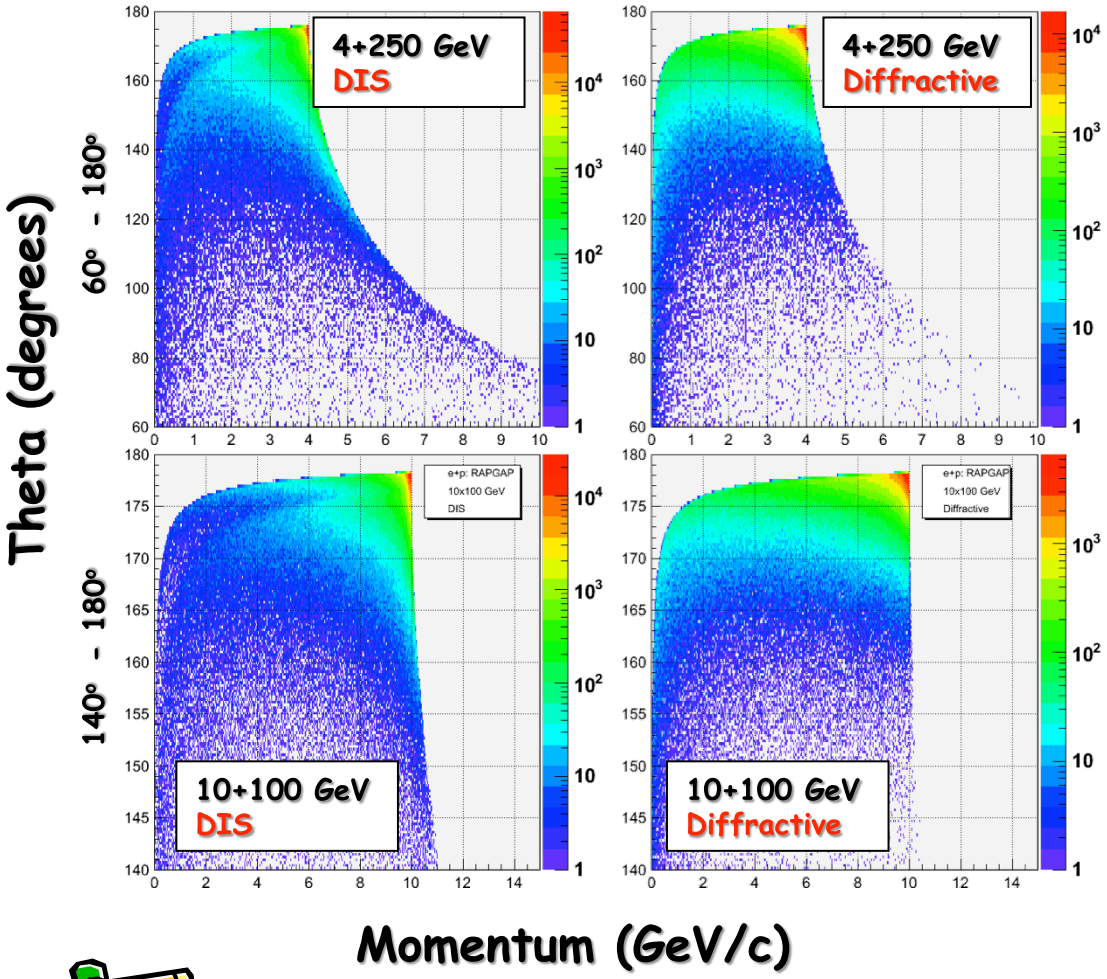
Matt Lamont,
Thomas Ullrich,
William Foreman,
Anders Kirleis,
Michael Savastio,
Elke Aschenauer
and the CAD-eRHIC Team

eRHIC group in Physics

- eRHIC taskforce formed
  - weekly meetings on EVO Thursday@2pm
  - concentrate on simulating "golden physics channels" and to develop tools/software to be used by collaboration
  - detector – IR design together with CAD
- In process of hiring 2 PostDocs
- Have 3 students over the summer
- Information available openly for everybody at
  - http://www.eic.bnl.gov/
  - https://wiki.bnl.gov/eic/index.php/Main_Page
- Summer Work
  - generate tools to simulate have rapgap & pythia → root-trees
    - work to provide dvcs, pepsi and Hermes-transversity generators
  - simulated dis & diffractive events for several energy settings
  - design a detector in Geant fitting in IP-2
    - (software based on STAR & ATLAS)
  - generate tools to MC → Geant → root-trees
  - and a lot of more

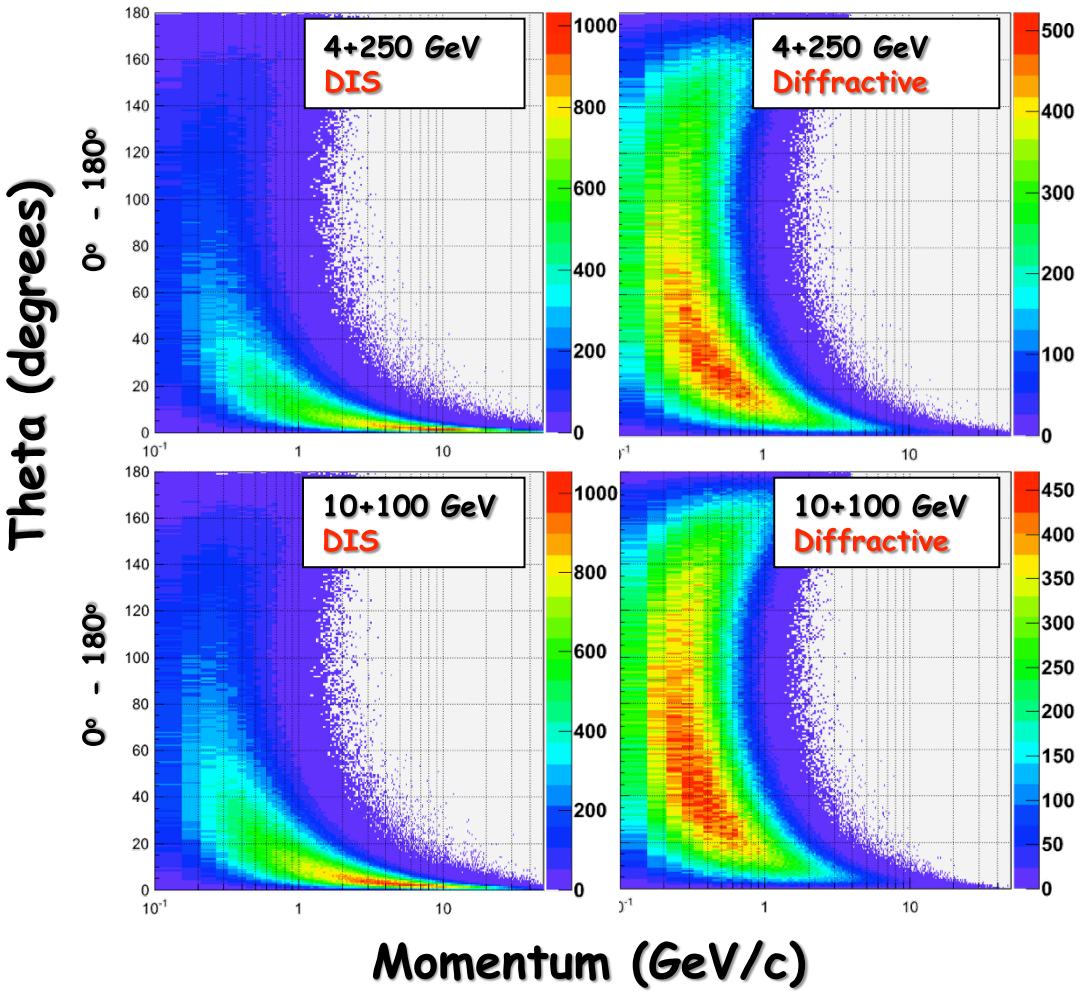
Momentum vs. Theta of Scat. Electron

All done by William Foreman



- What we do:
  - Edit codes so only information for certain particles are plotted, both in DIS and diffractive
- What we see:
  - Differences between DIS and diffractive events
  - Different angle & momentum distributions depending on electron + proton energies

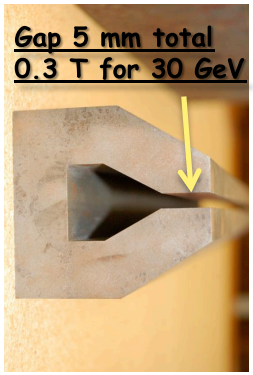
π^+ Momentum vs. Angle



- What we see:
  - Angles at which pions are projected for different energies in both DIS and diffractive events
  - In DIS events, pions tend to be sent at much smaller angles compared to diffractive events

We use this information to design the detector!

ERL-based eRHIC Design



2 x 200 m SRF linac
4 (5) GeV per pass
5 (4) passes

eRHIC detector

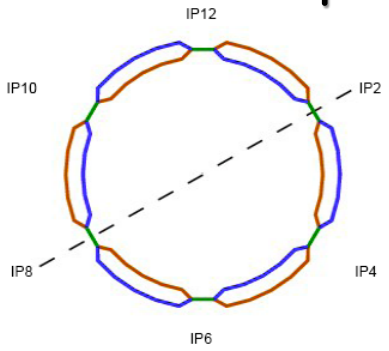
10-20 GeV e x 325 GeV p
130 GeV/u Au
possibility of 30 GeV @ low current operation

Coherent e-cooler

MeRHIC detector

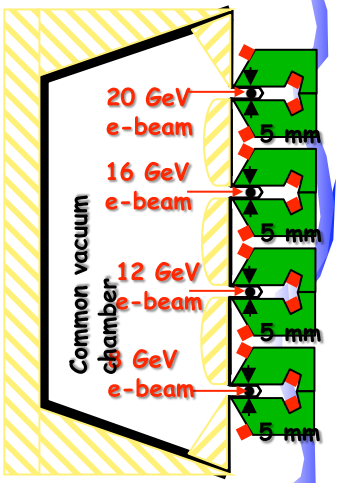
Polarized e-gun

Beam dump



PHENIX

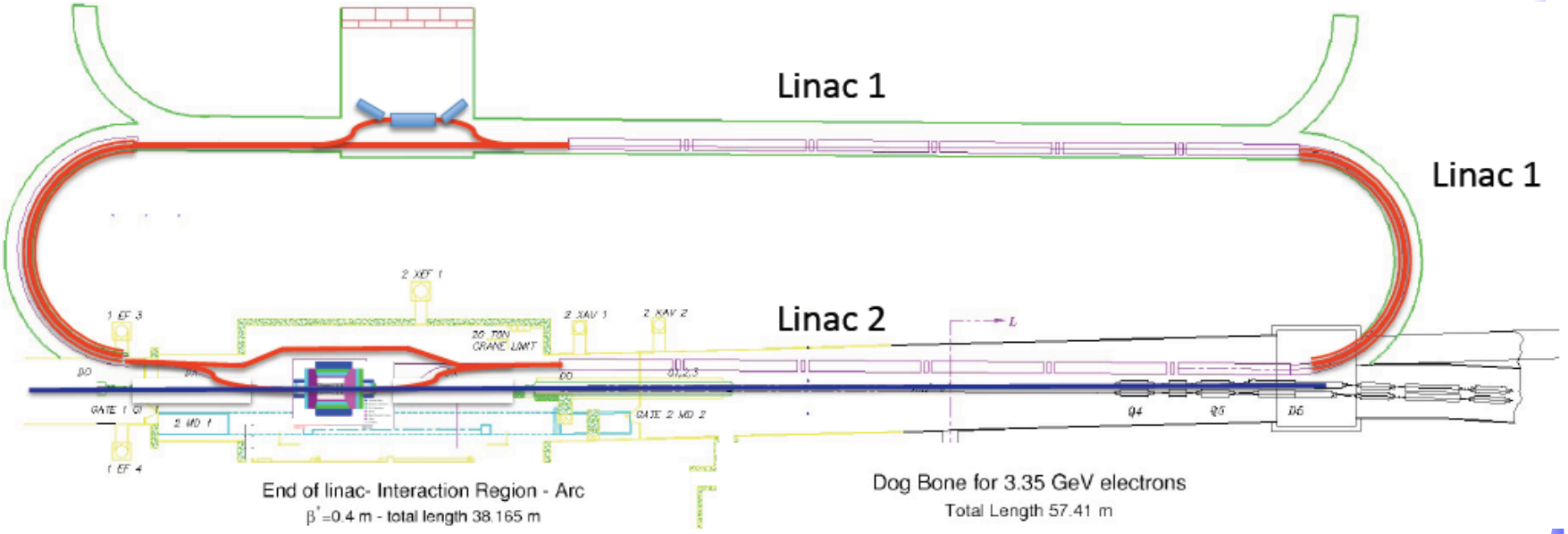
STAR



4 to 5 vertically separated recirculating passes

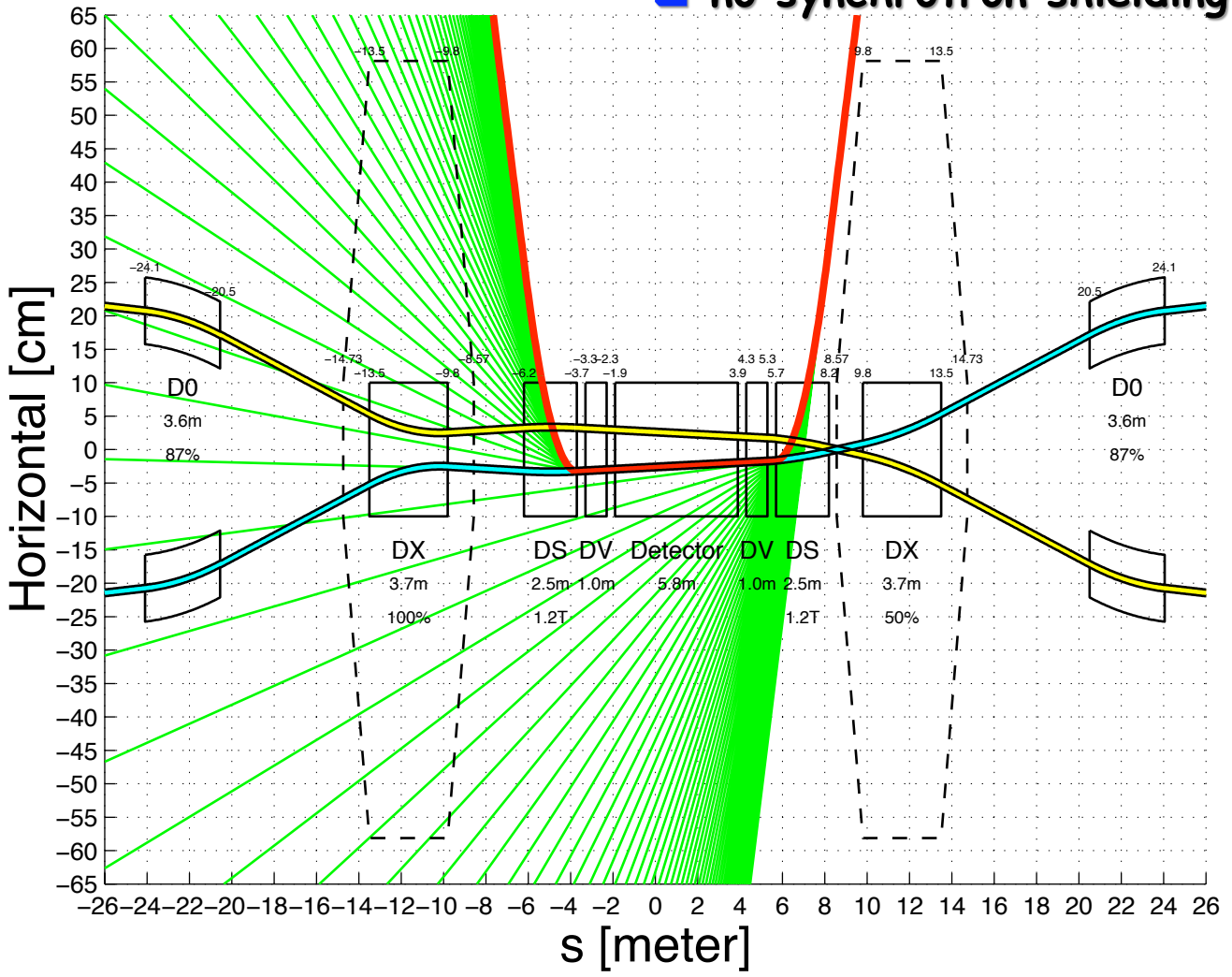
Medium Energy eRHIC Concept

- Geometrical constraints: If it is possible use the existing interaction region at RHIC 2 o'clock and wider tunnel to place the superconducting linac inside it. Minimize civil construction cost and re-use for eRHIC already built and installed linac.



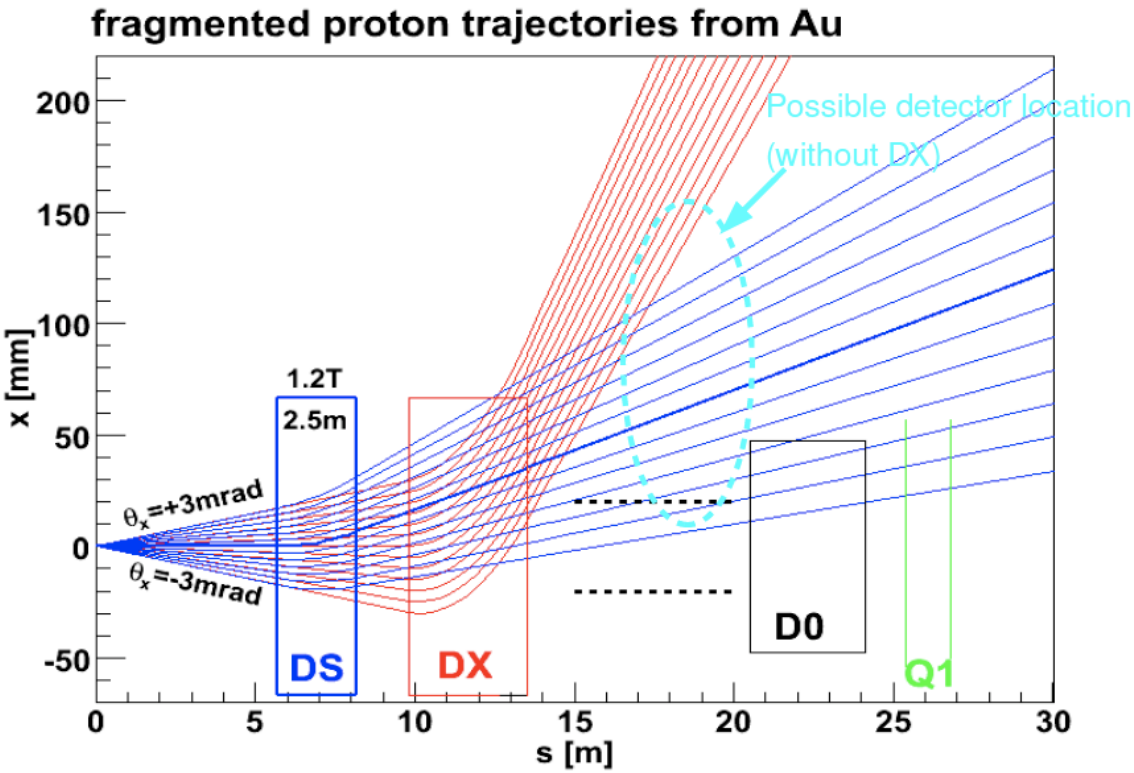
IR-Design for MeRHIC I

- no synchrotron shielding included



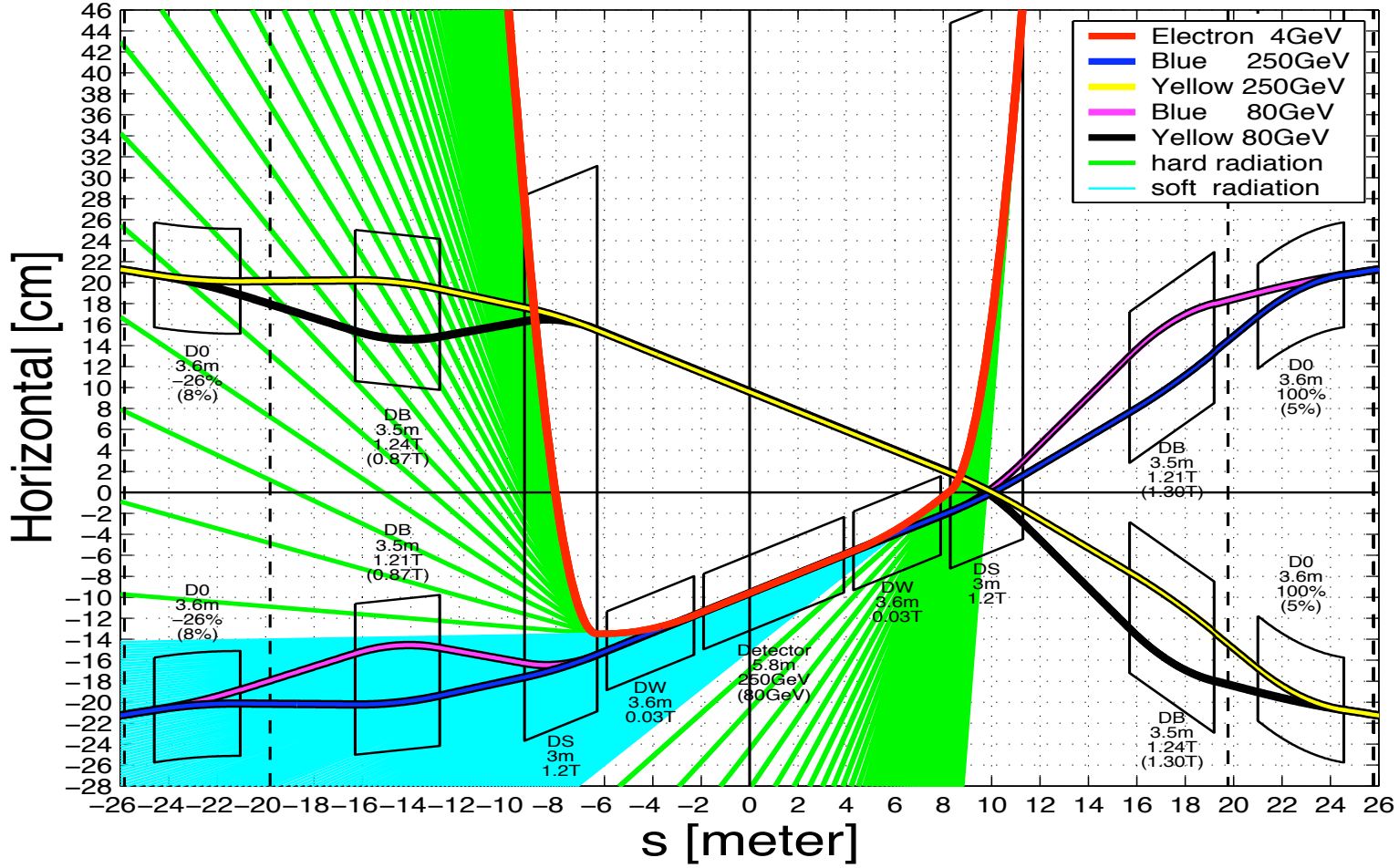
Detection from hadron beam fragments

- Tagging from Au fragments and p in ep
  - suppress incoherent scattering / ensure exclusivity
    - neutrons are detected in ZDC
    - protons use magnetic rigidity Au:p 2.5:1
  - DX magnets disturbs p tagging

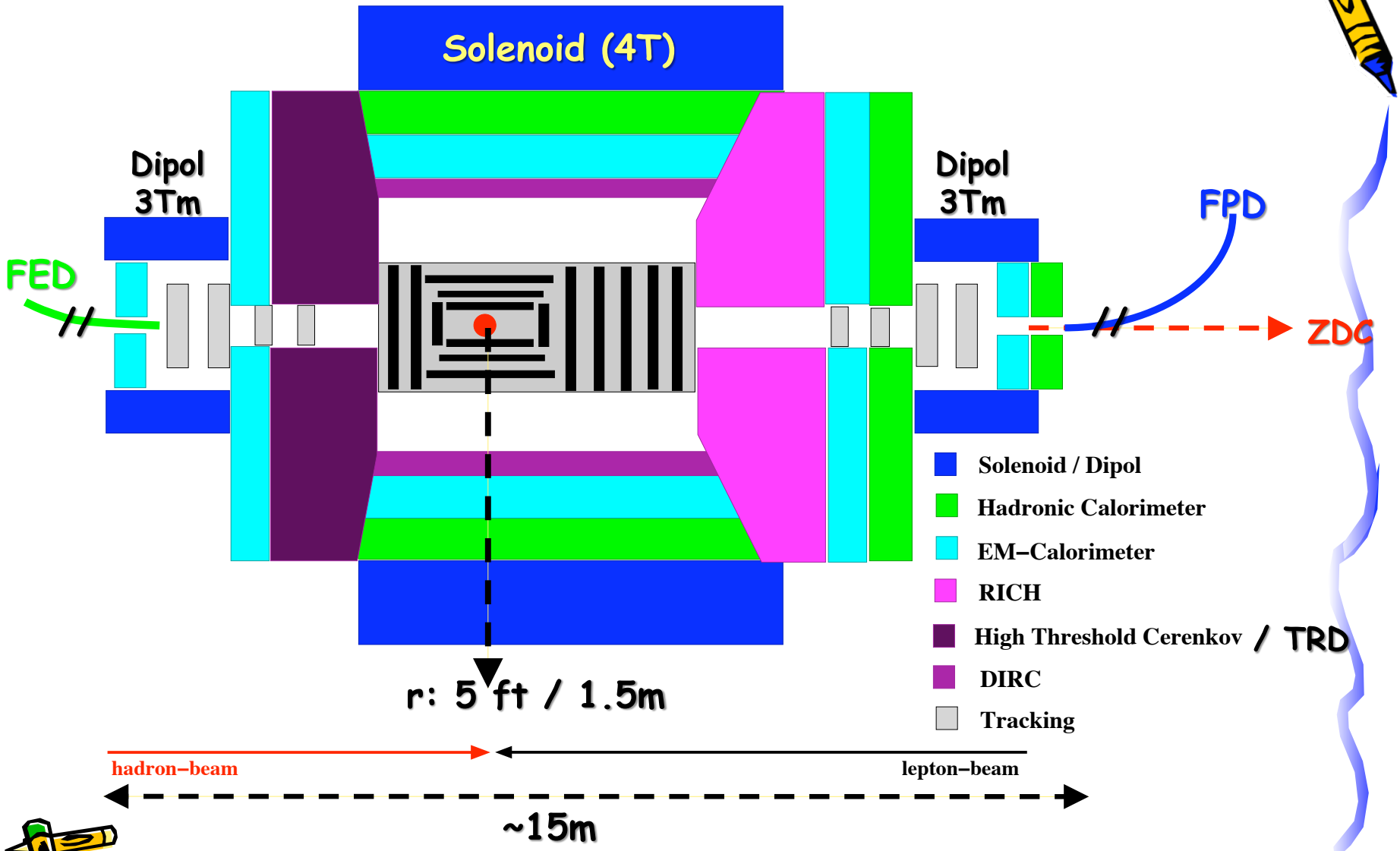


IR-Design for MeRHIC II

- no synchrotron shielding included
- allows p and heavy ion decay product tagging

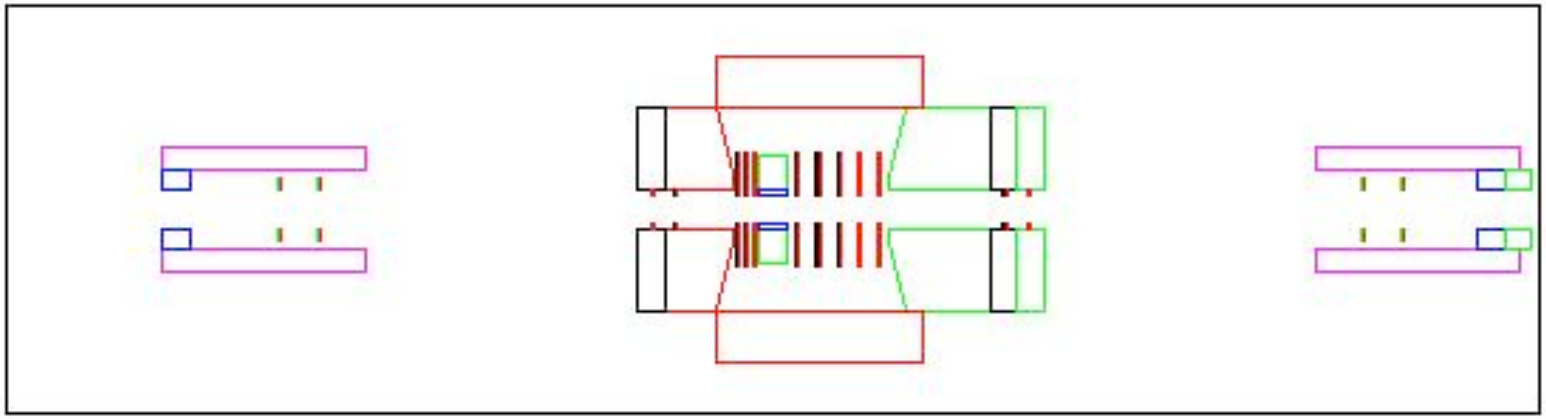


First ideas for a detector concept



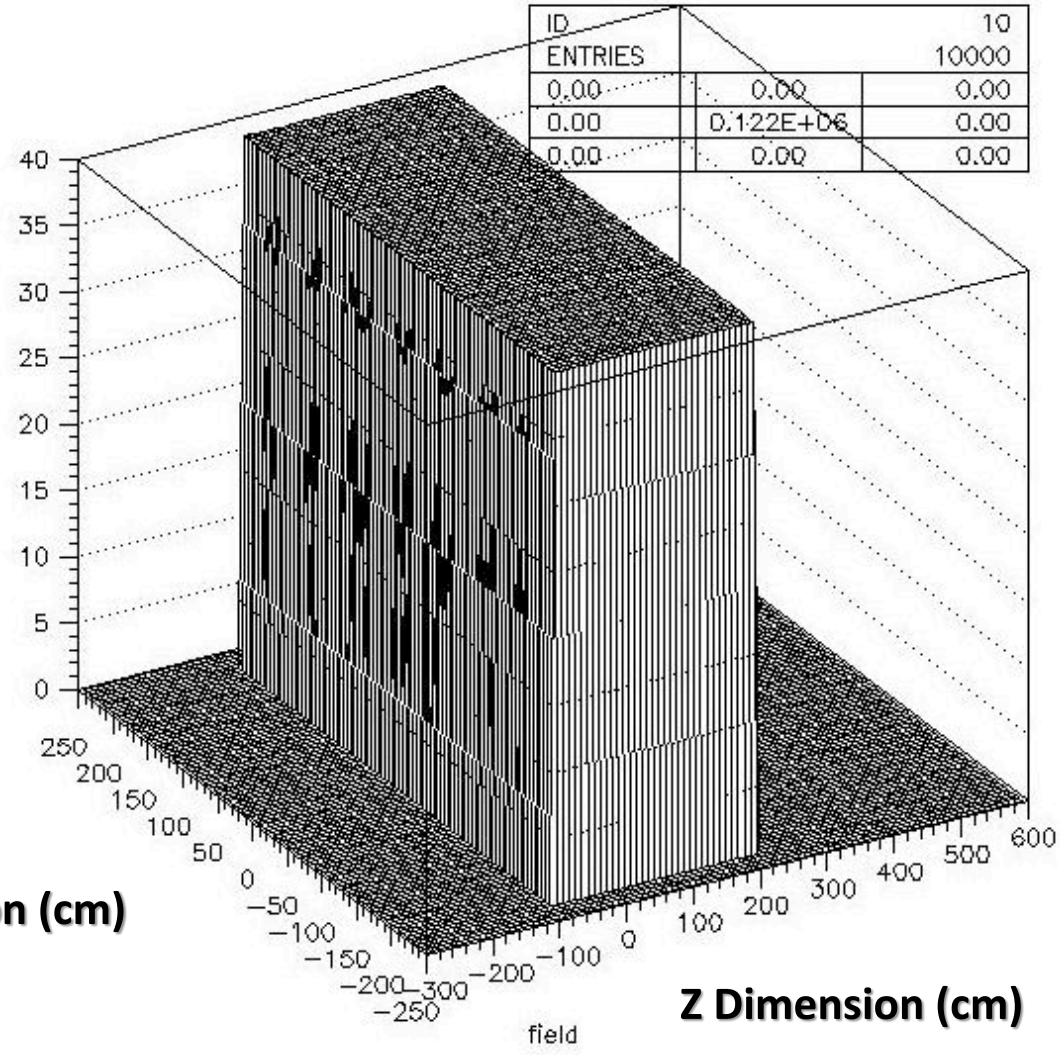
The (M)eRHIC Detetor

All the work was done by Anders Kirleis with a lot of help by Pavel Nevski



Still need to model EMCal in barrel and include the already modeled DIRC

Solenoid Magnetic Field in Z Dimension

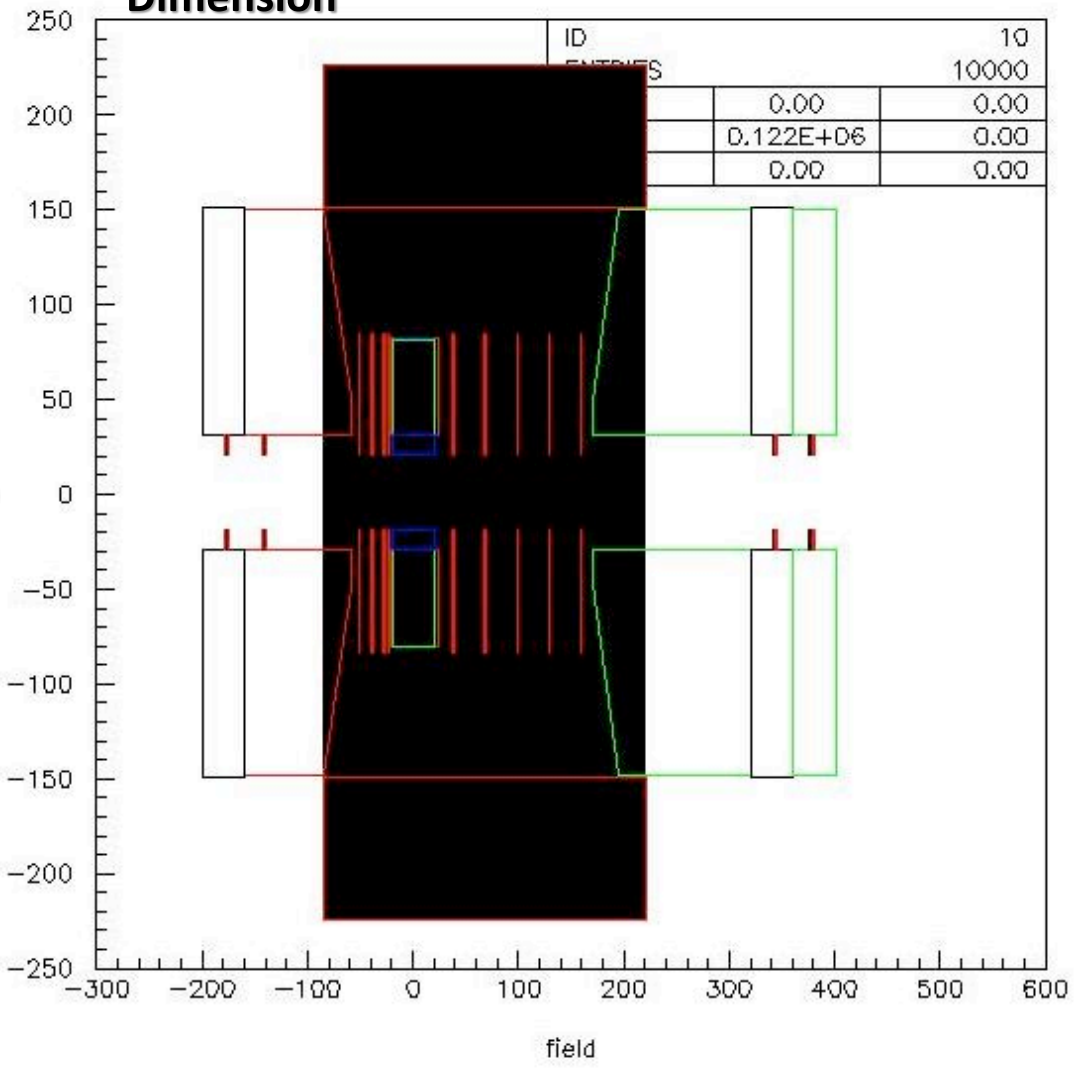


Magnetic Field (KG)

Radial Dimension (cm)

Z Dimension (cm)

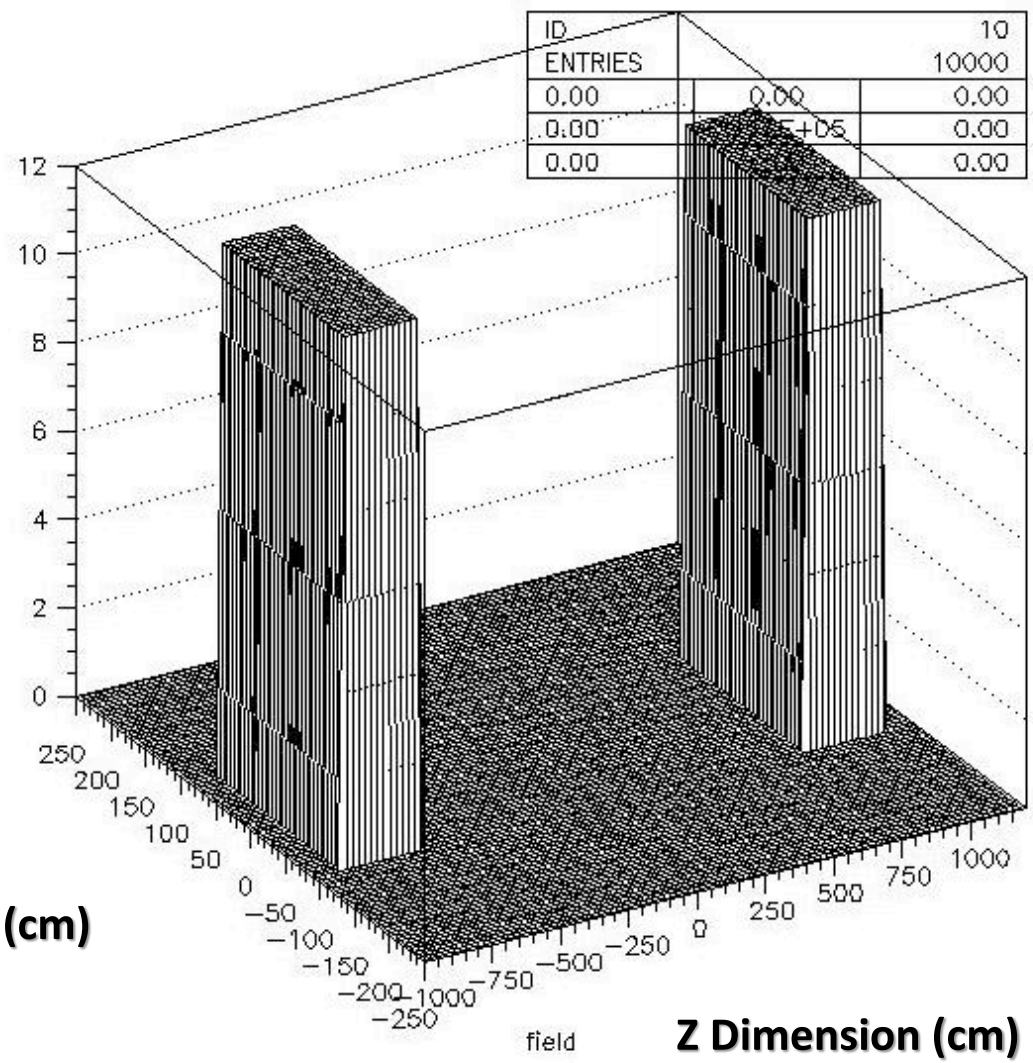
Solenoid Magnetic Field in Z Dimension



Radial Dimension (cm)

Z Dimension (cm)

Dipole Magnetic Field in Y Dimension

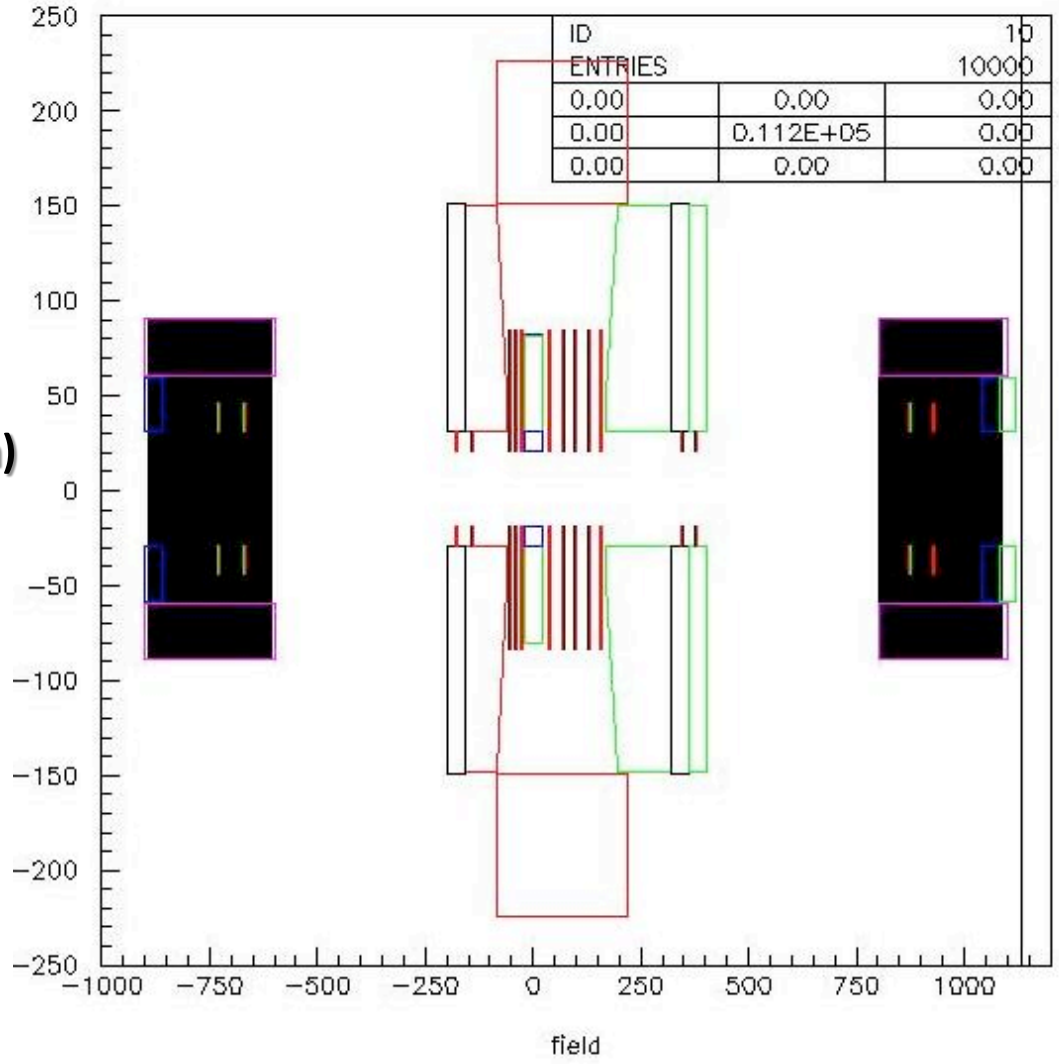


Magnetic Field (KG)

Radial Dimension (cm)

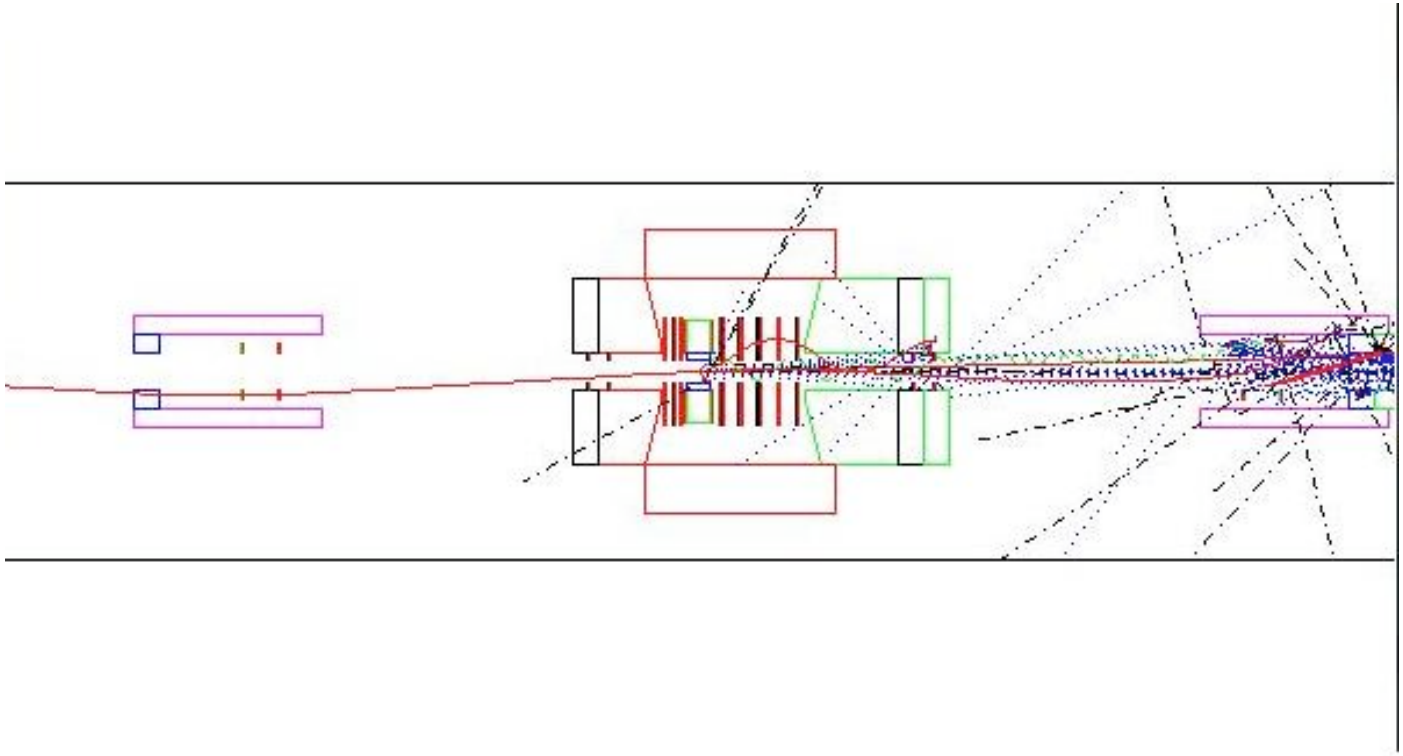
Z Dimension (cm)

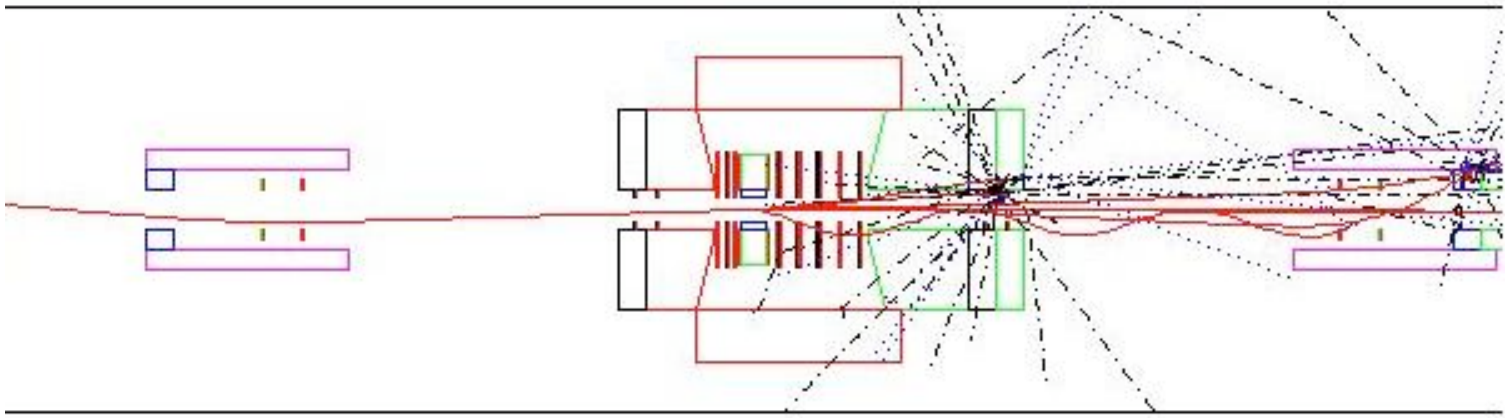
Dipole Magnetic Field in Y Dimension

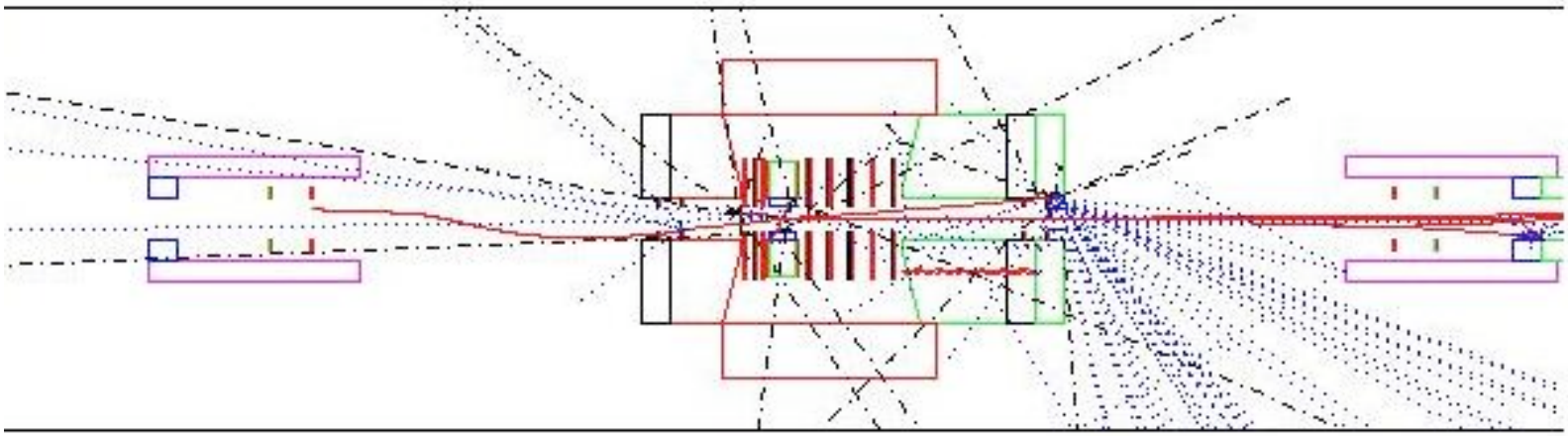


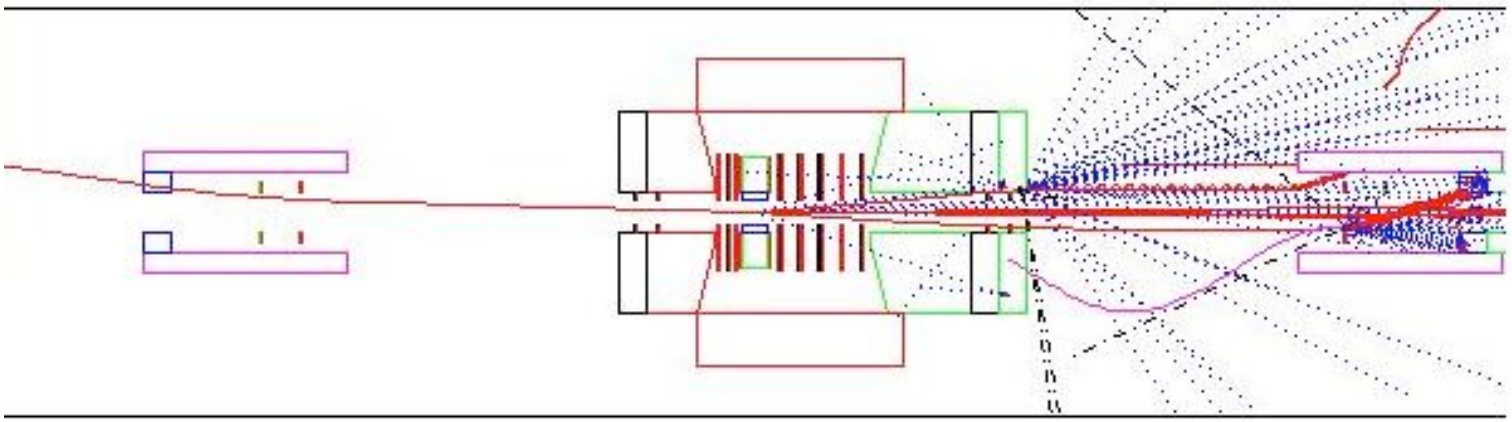
Radial Dimension (cm)

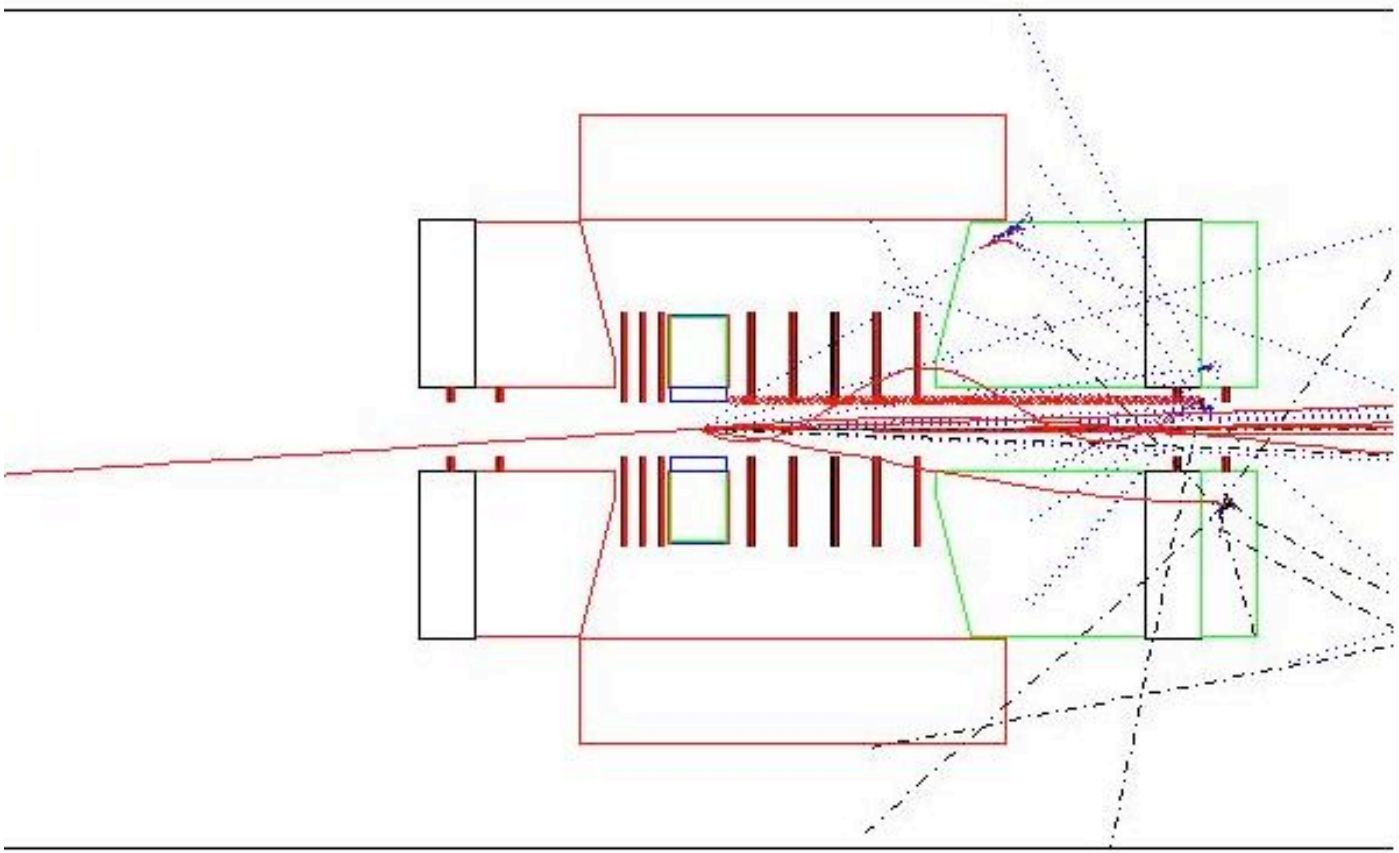
Z Dimension (cm)

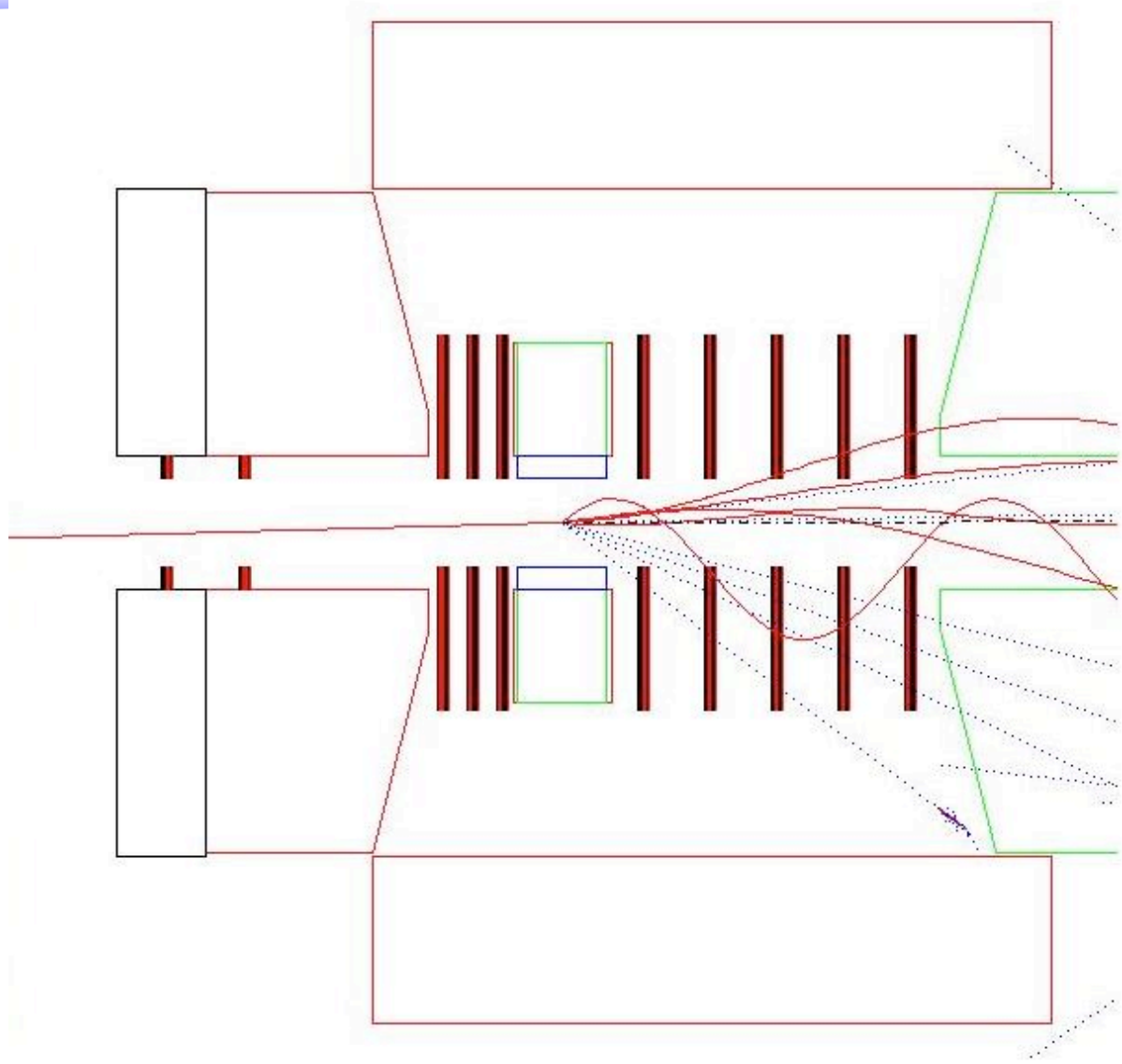


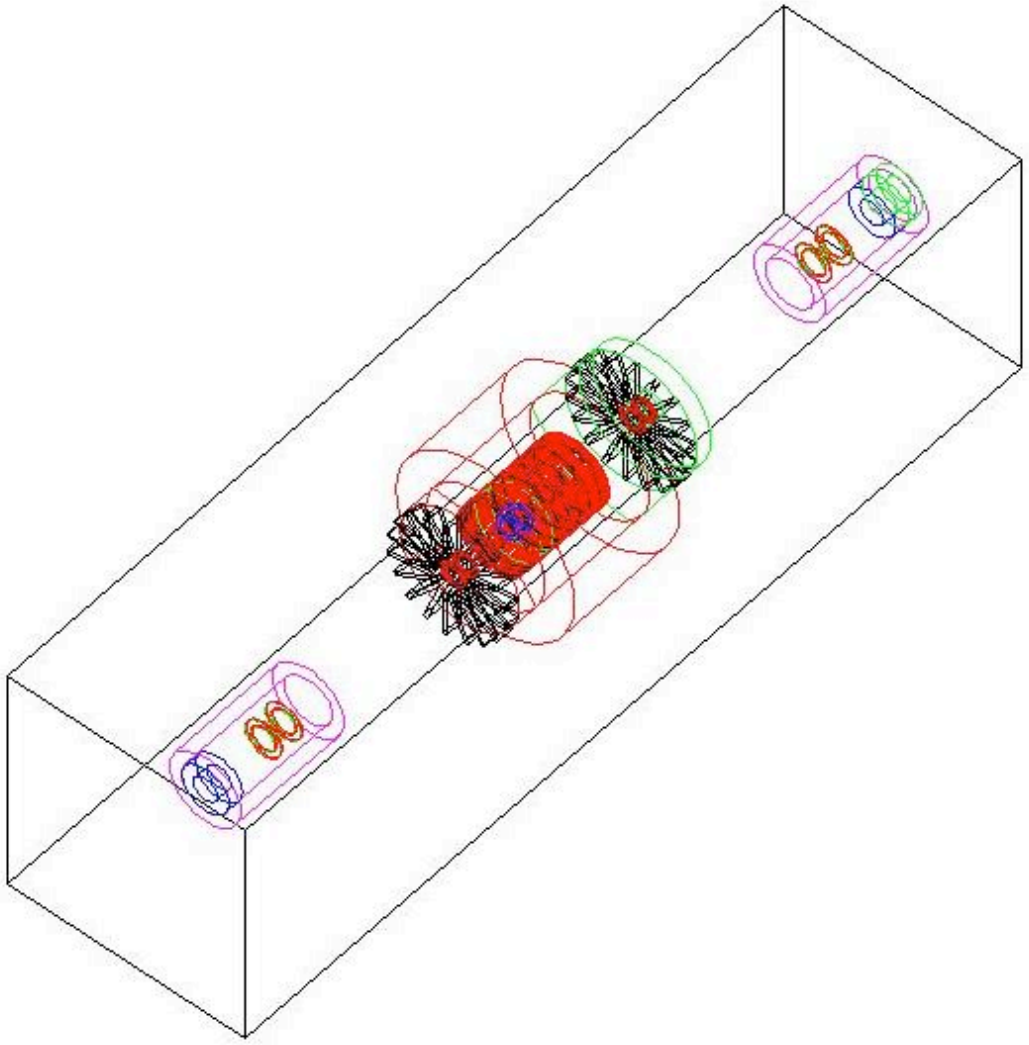


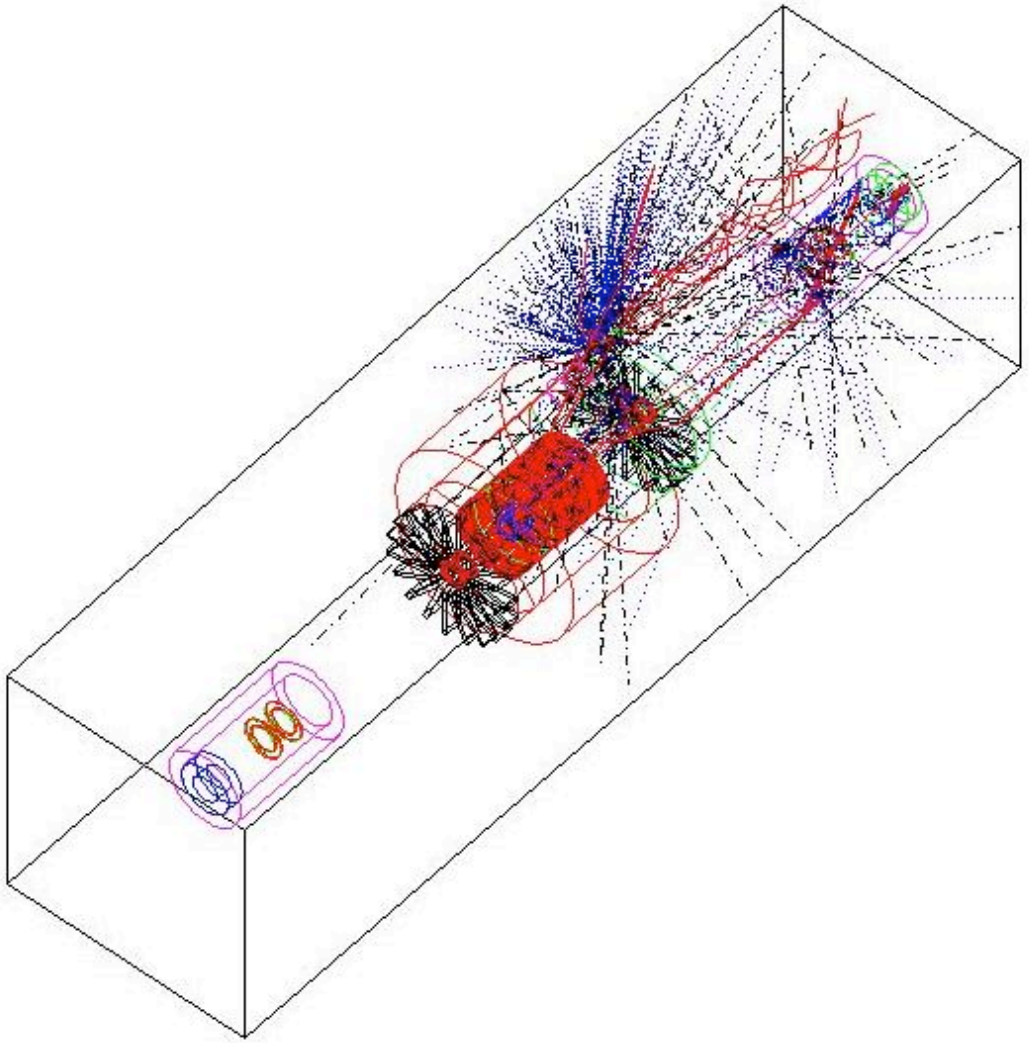


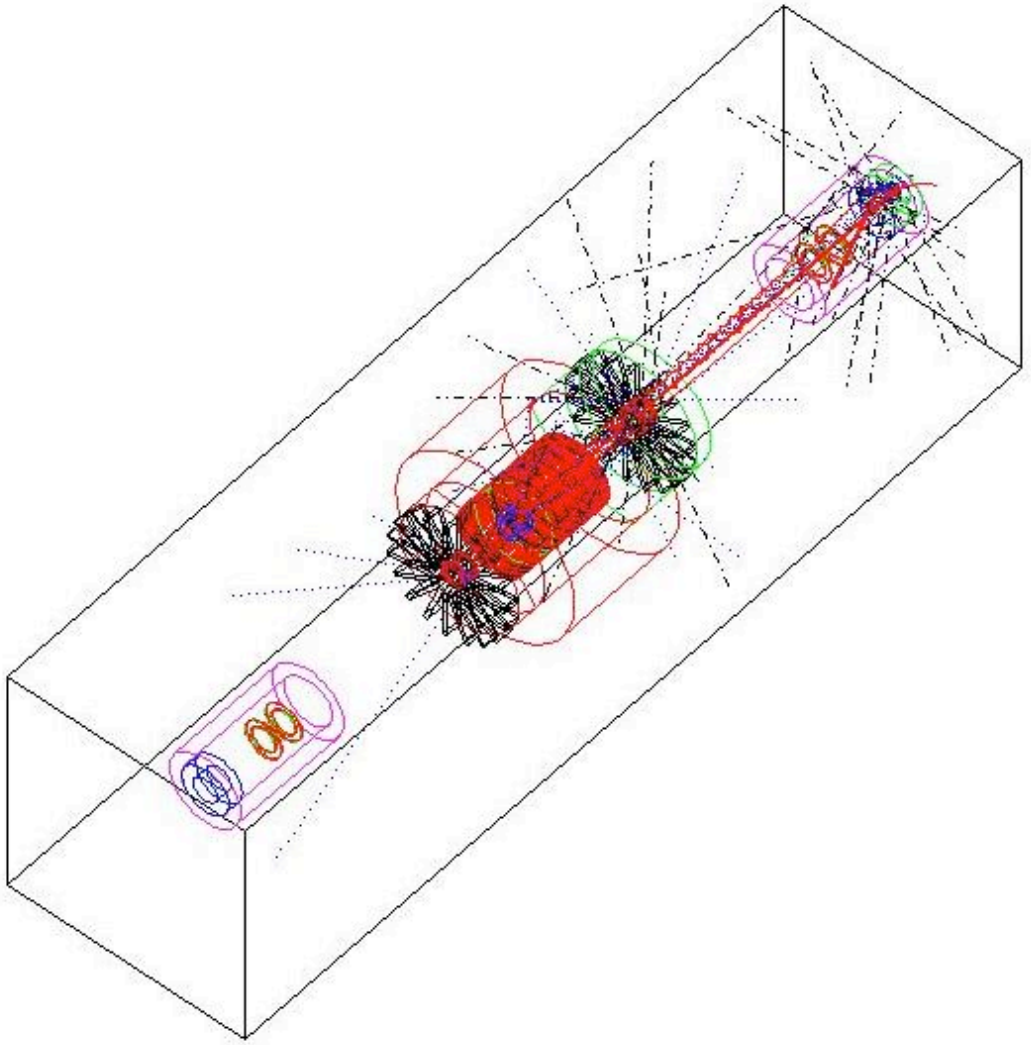


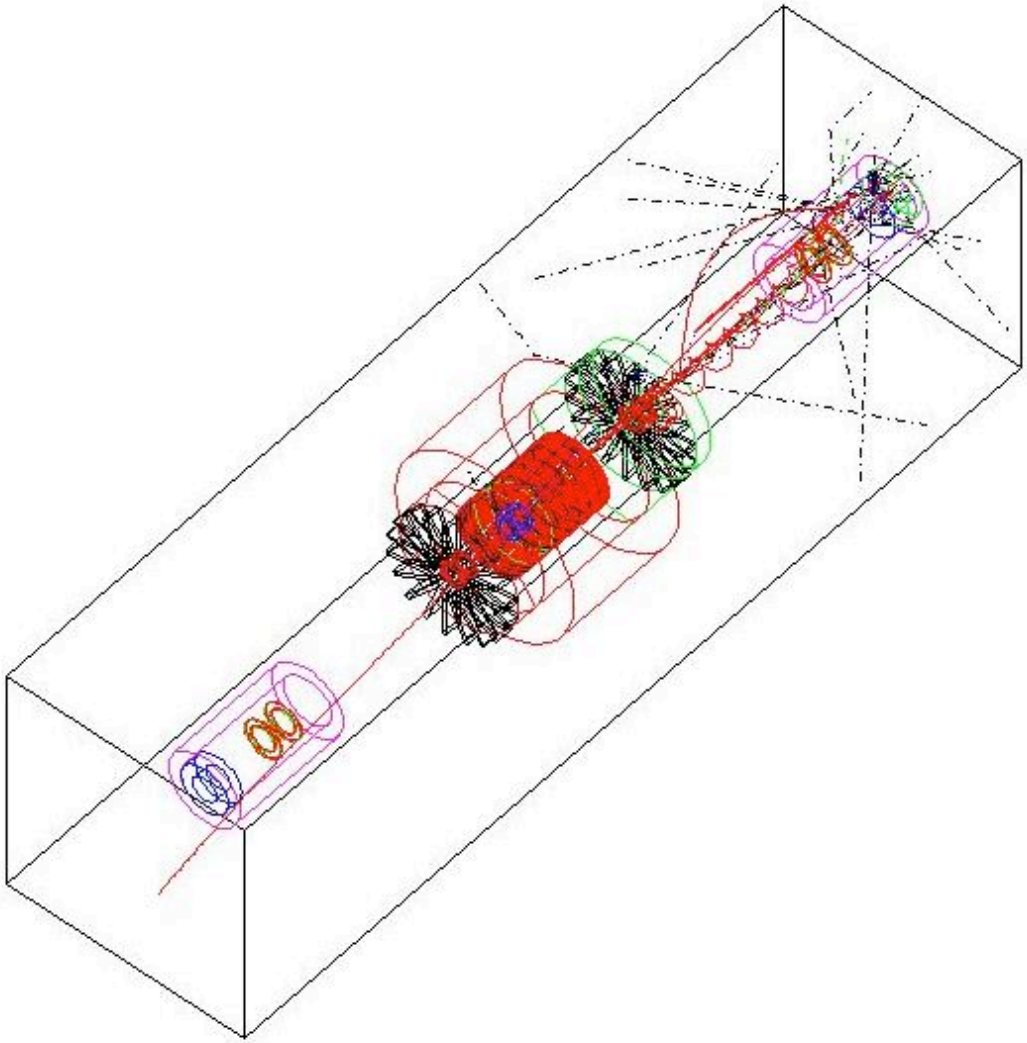


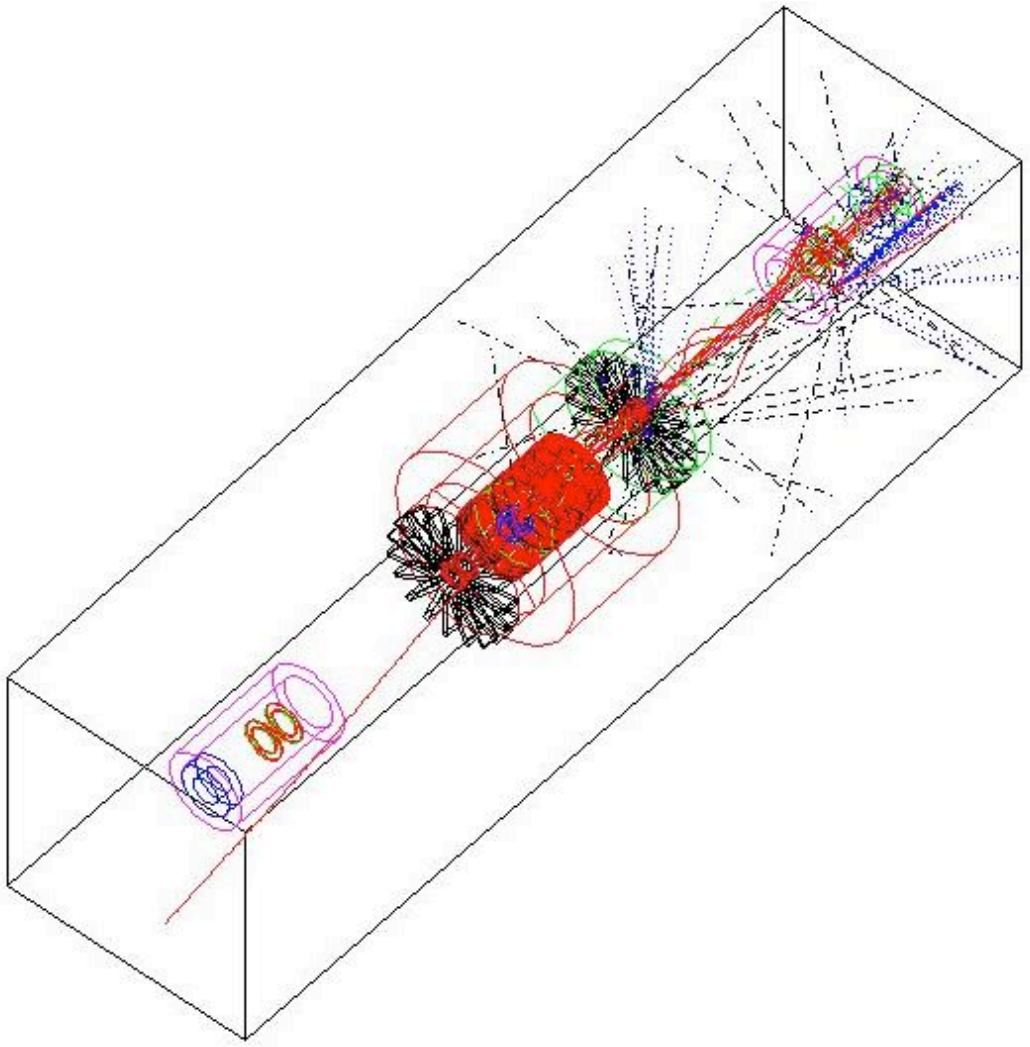


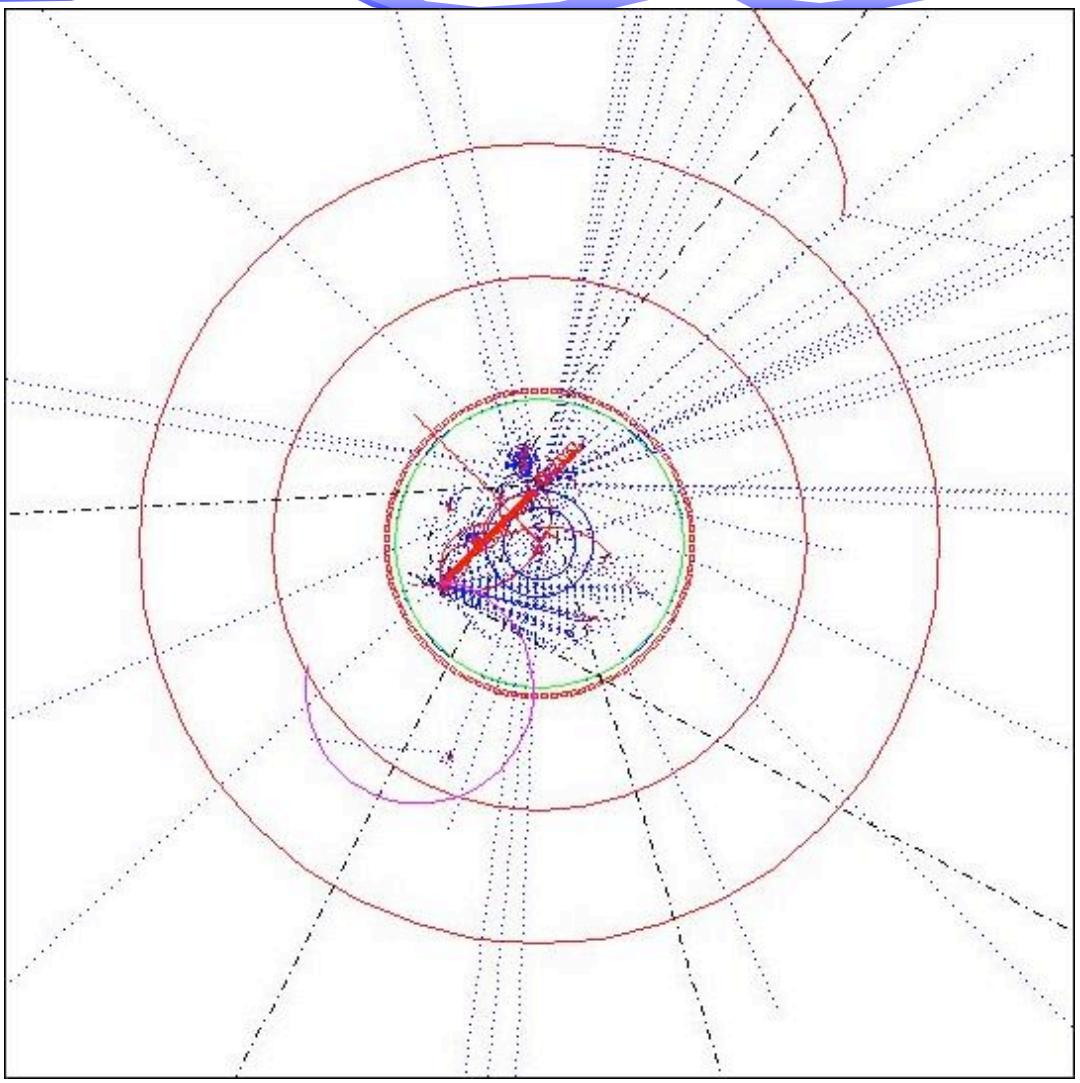


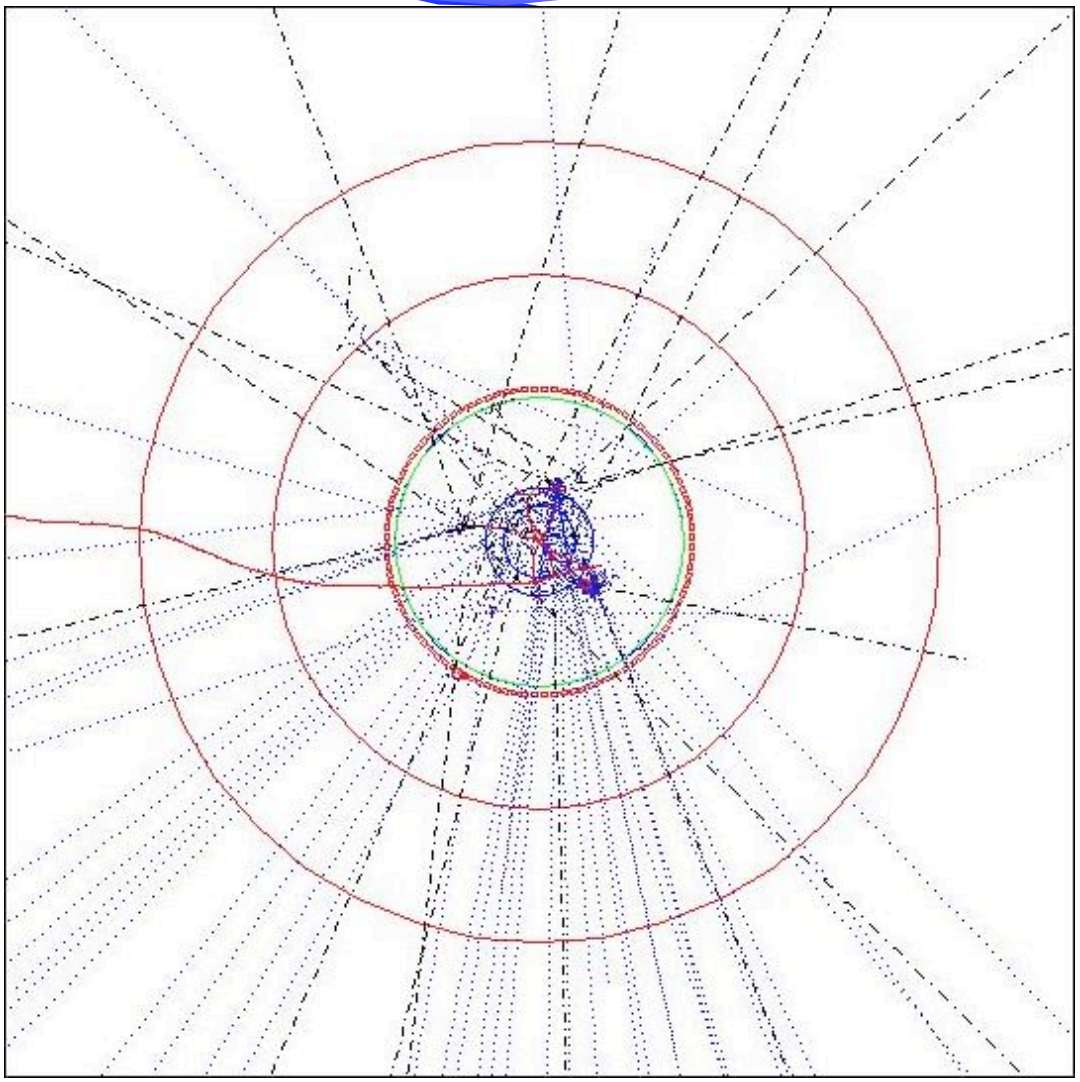


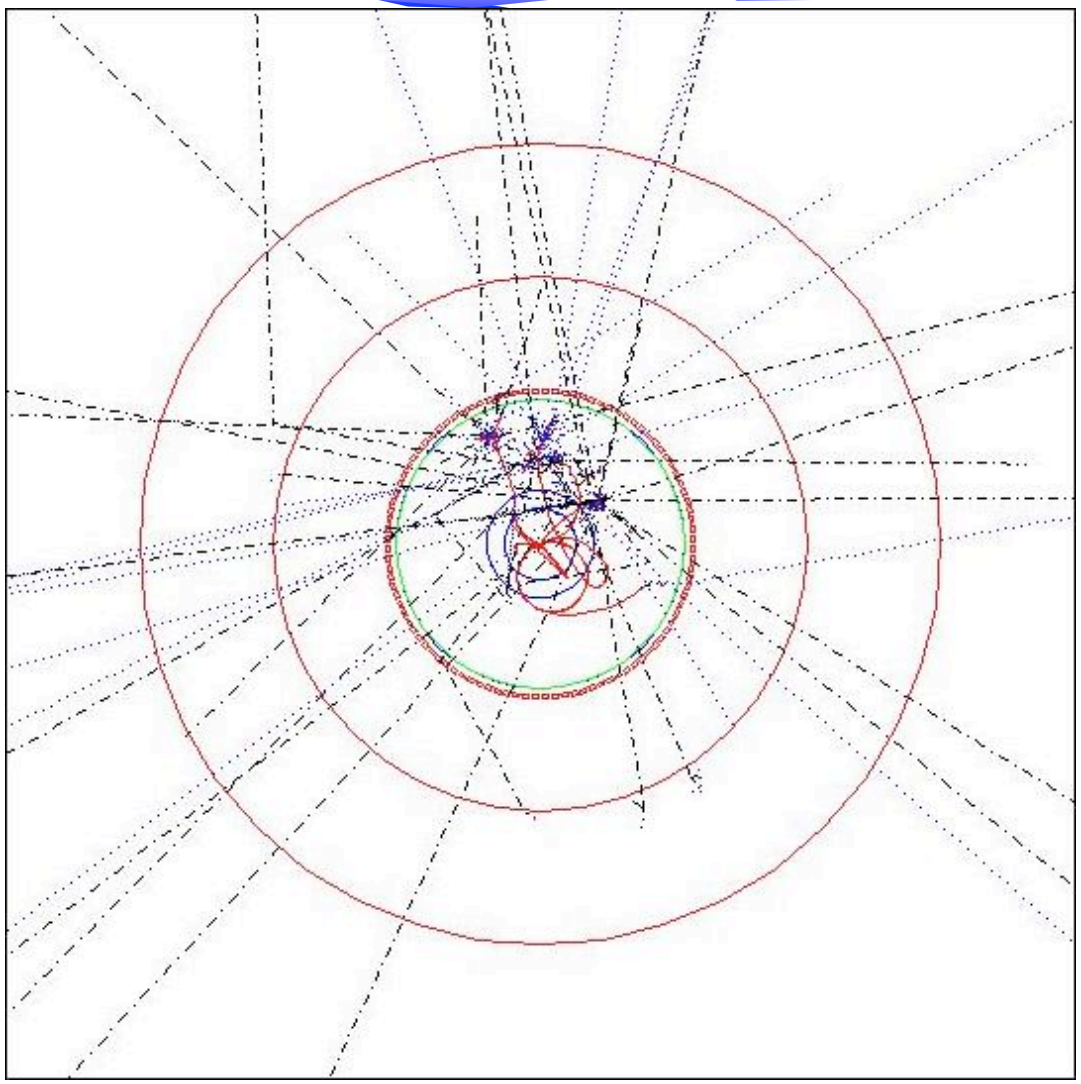












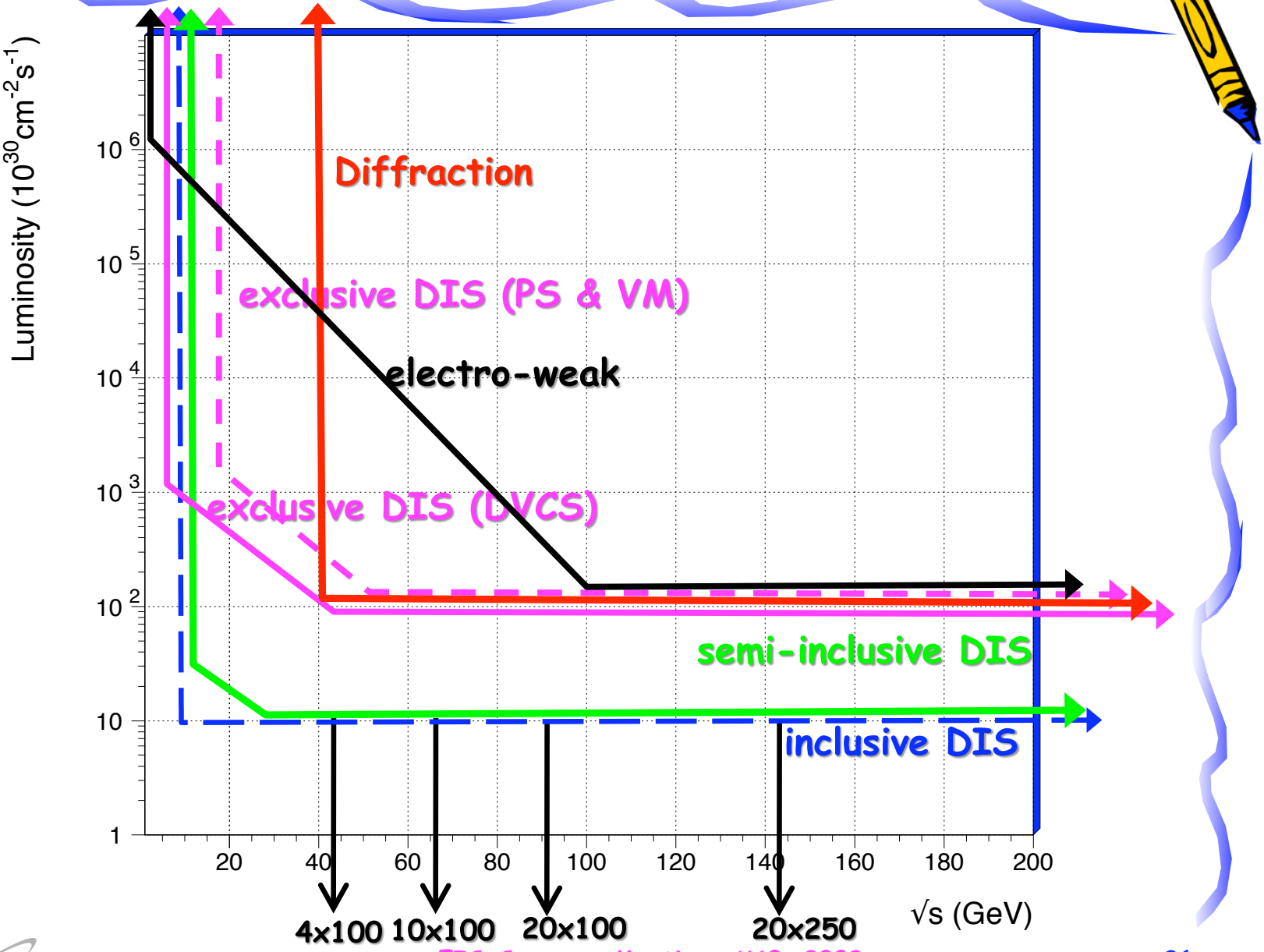
HITS DATA FROM A MYLAR TRACKING DETECTOR

anders@rssh02:~

====> HITS IN DETECTOR ** TRDS ** OF SET ** EDIH ** <====

HITS	TRACK	TRAW	TRDR	X	Y	Z	PX	PY	PZ	ETOT	ELOS	PHI	THET
1	6	1	1	17.5	31.5	5.000E-02	-0.130	0.209	0.188	0.341	1.921E-06	1.06	0.311
2	6	1	2	17.0	32.2	5.000E-02	-0.139	0.203	0.188	0.341	2.037E-06	1.09	0.311
3	6	1	3	16.5	33.0	5.000E-02	-0.148	0.197	0.188	0.341	3.434E-06	1.11	0.311
4	6	1	4	15.9	33.8	5.000E-02	-0.157	0.191	0.188	0.341	2.619E-06	1.13	0.311
5	6	1	5	15.4	34.5	5.000E-02	-0.163	0.185	0.188	0.341	1.222E-06	1.15	0.311
6	6	1	6	14.8	35.0	5.000E-02	-0.172	0.175	0.188	0.341	2.154E-06	1.17	0.311
7	6	1	7	14.1	35.7	5.000E-02	-0.179	0.169	0.188	0.341	2.154E-06	1.20	0.311
8	6	2	1	-16.1	33.5	5.000E-02	-0.154	-0.194	0.188	0.341	1.688E-06	2.02	0.311
9	6	2	2	-16.6	32.8	5.000E-02	-0.145	-0.200	0.188	0.341	1.222E-06	2.04	0.311
10	6	2	3	-17.1	32.2	5.000E-02	-0.136	-0.206	0.188	0.341	1.804E-06	2.06	0.311
11	6	2	4	-17.6	31.4	5.000E-02	-0.127	-0.212	0.188	0.341	4.016E-06	2.08	0.311
12	6	2	5	-18.1	30.5	5.000E-02	-0.117	-0.218	0.188	0.341	1.572E-06	2.11	0.311
13	6	2	6	-18.5	29.8	5.000E-02	-0.108	-0.221	0.188	0.341	1.222E-06	2.13	0.311
14	6	2	7	-19.0	29.0	5.000E-02	-9.918E-02	-0.227	0.188	0.341	2.154E-06	2.15	0.311
15	6	4	1	20.5	20.9	5.000E-02	-1.524E-03	0.249	0.188	0.341	2.037E-06	0.792	0.311
16	6	4	2	20.5	21.8	5.000E-02	-1.373E-02	0.246	0.188	0.341	1.339E-06	0.814	0.311
17	6	4	3	20.5	22.6	5.000E-02	-2.289E-02	0.246	0.188	0.341	2.037E-06	0.836	0.311
18	6	4	4	20.4	23.5	5.000E-02	-3.509E-02	0.246	0.188	0.341	2.154E-06	0.858	0.311
19	6	4	5	20.2	24.5	5.000E-02	-4.425E-02	0.243	0.188	0.341	1.804E-06	0.879	0.311
20	6	4	6	20.0	25.4	5.000E-02	-5.646E-02	0.240	0.188	0.341	2.154E-06	0.901	0.311
21	6	4	7	19.9	26.2	5.000E-02	-6.561E-02	0.240	0.188	0.341	1.455E-06	0.923	0.311

The √s vs. luminosity landscape



Existing Experiment Luminosities

- Hera :
  - H1 and Zeus:
    - 10^{31}cm-2s-1
    - 27GeV e+/e- 920GeV p $\sqrt{s}$ = 320GeV
    - did measure:
      - inclusive & semi-inclusive DIS
      - exclusive reactions (DVCS)
      - diffractive physics
      - electro-weak
  - Hermes:
    - fixed target 27GeV e+/e- $\sqrt{s}$=7.2GeV
    - polarised: 5×10^{31}cm^{-2}s^{-1}; unpol: 10^{32-33}cm^{-2}s^{-1};
    - did measure:
      - inclusive & semi-inclusive DIS
      - exclusive reactions (DVCS, pS, VM)
      - spin physics

Existing Experiment Luminosities

- CERN
  - Compass
    - fixed target 160GeV m+/m- $\sqrt{s}$=17GeV
    - polarised: ~$10^{31}cm^{-2}s^{-1}$; unpol: $10^{32-33}cm^{-2}s^{-1}$;
    - did measure:
      - inclusive & semi-inclusive DIS
      - exclusive reactions (VM)
      - spin physics
    - plan to measure:
      - exclusive reactions (DVCS, PS)
      - Drell Yan
  - SMC, NMC and EMC very similar, with different beam energies