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Accelerator Working Group Status and Plans for IDS-NF 6

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IDS plenary 6 and the IDR

- Sub groups present detailed plans for IDR.
- Updating baseline document, aim is writing of IDR -

  Who is responsible for which chapter

  What is the rough contents of each chapter
- How do we organize the decision making process ?
- How do we handle alternatives and fall back options ?
- For IDS “mixed” costing according to readiness of the hardware design (global to detailed)

30Oct10: Deadline for first drafts of principal sections to conveners;

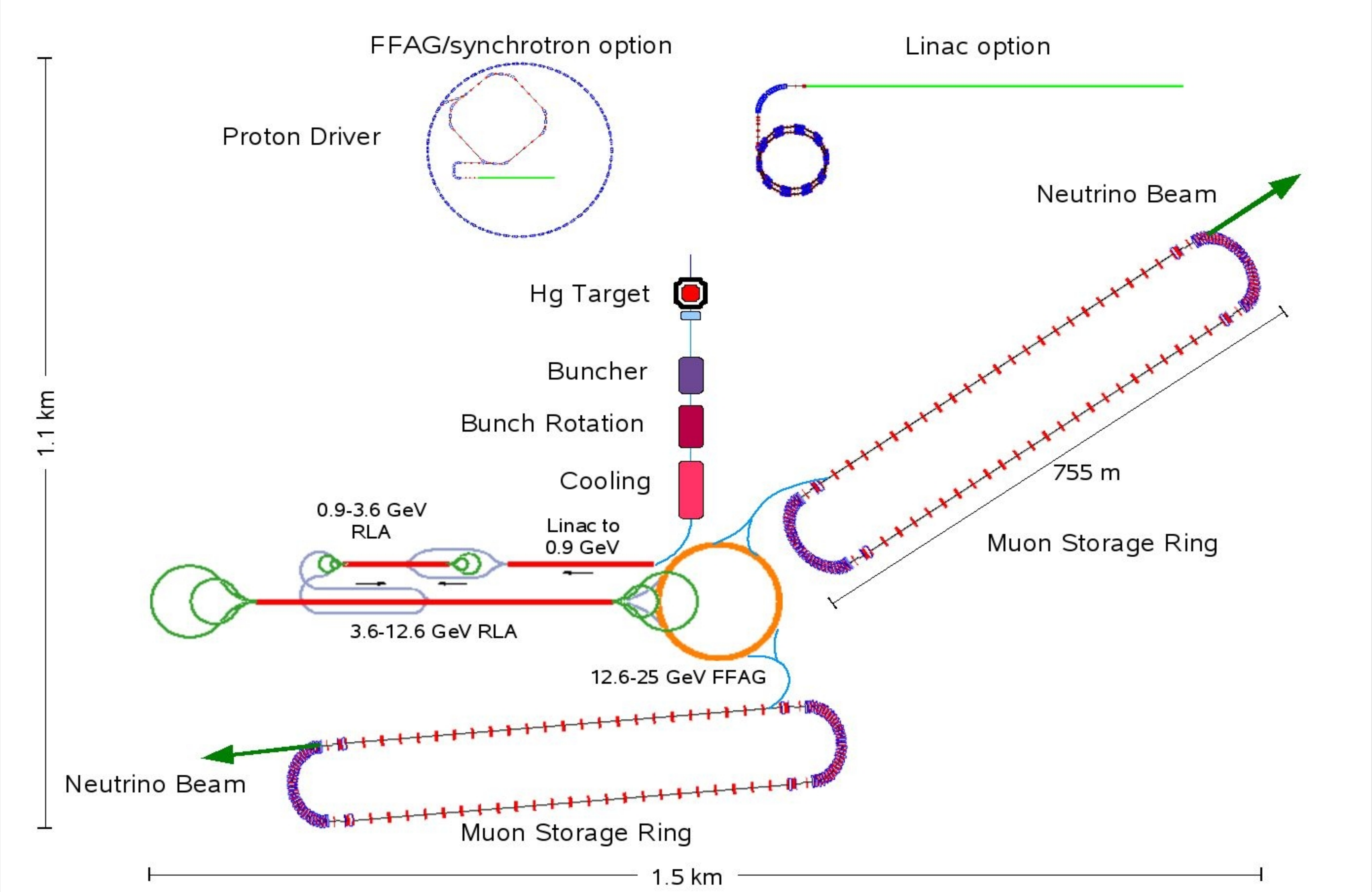
30Nov10: Sections from conveners to IDR editor (KL);

Writing workshops, concentrated working sessions aimed at completing the IDR

06-10Dec10: IDR 'writing workshop' #1

06-10Jan11: IDR 'writing workshop' #2

Overview



FFAG/synchrotron option
Linac option
Proton Driver
Neutrino Beam
Hg Target
Buncher
Bunch Rotation
Cooling
755 m
Muon Storage Ring
0.9-3.6 GeV RLA
Linac to 0.9 GeV
3.6-12.6 GeV RLA
12.6-25 GeV FFAG
Neutrino Beam
Muon Storage Ring
1.1 km
1.5 km

Web page information!

Accelerator Baseline Specification 12 February 2008

Proton Driver	
Proton power	4 MW
Proton kinetic energy	5–15 GeV
Pulses per second	50
Bunches per pulse	3
Minimum time between bunches	17 μs
Maximum time for all bunches	40 μs
RMS proton bunch length	1–3 ns
Target	
MARS Files	Inputs: Target_MARS15_v1.zip Outputs: G8R0.4T78.13D18.55fort.81.zip
Material	Hg
Type	Liquid jet
Jet diameter	1 cm
Jet velocity	20 m/s
Jet angle to axis	100 mrad
Jet angle to proton beam	33 mrad
Proton beam angle to axis	67 mrad
Front End	
ICOOL input files	for001.dat for030.dat for031.dat
ICOOL beam files (from MARS output)	for003.zip

Web page !

Acceleration	
RF frequency	201.25 MHz
RF type	Superconducting
Total energy at injection	244 MeV
Transverse normalized acceptance at input	30 mm
Longitudinal normalized acceptance at input	150 mm
Stage 1, type	Linac
Stage 1, lattice cell	Solenoid FOFO
Stage 1, lattice files	linac_sol.opt linac_sol.mad
Total energy, stage 1–2 transition	0.9 GeV
Stage 2, type	Dogbone RLA
Stage 2, cavity aperture diameter	30 cm
Stage 2, energy gain per cavity cell	12.75 MV
Stage 2, lattice cell	FODO
Stage 2, linac passes	4.5
Total energy, stage 2–3 transition	3.6 GeV
Stage 3, type	Dogbone RLA
Stage 3, cavity aperture diameter	30 cm
Stage 3, energy gain per cavity cell	12.75 MV
Stage 3, lattice cell	FODO
Stage 3, linac passes	4.5
Total energy, stage 3–4 transition	12.6 GeV
Stage 4, type	Linear non-scaling FFAG
Stage 4, cavity aperture diameter	30 cm
Stage 4, energy gain per cavity cell	12.75 MV
Stage 4, lattice cell	FODO
Stage 4, cavity cells per lattice cell	2

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Proton driver status

- Green field proton driver lattice design ready
- CERN option : SPL detailed design and costing available, lattice design for compressor/holding rings available.
- Project X : Lattice designs available
- RAL-ISIS upgrade : Lattice designs available, more detailed designs and costing started.

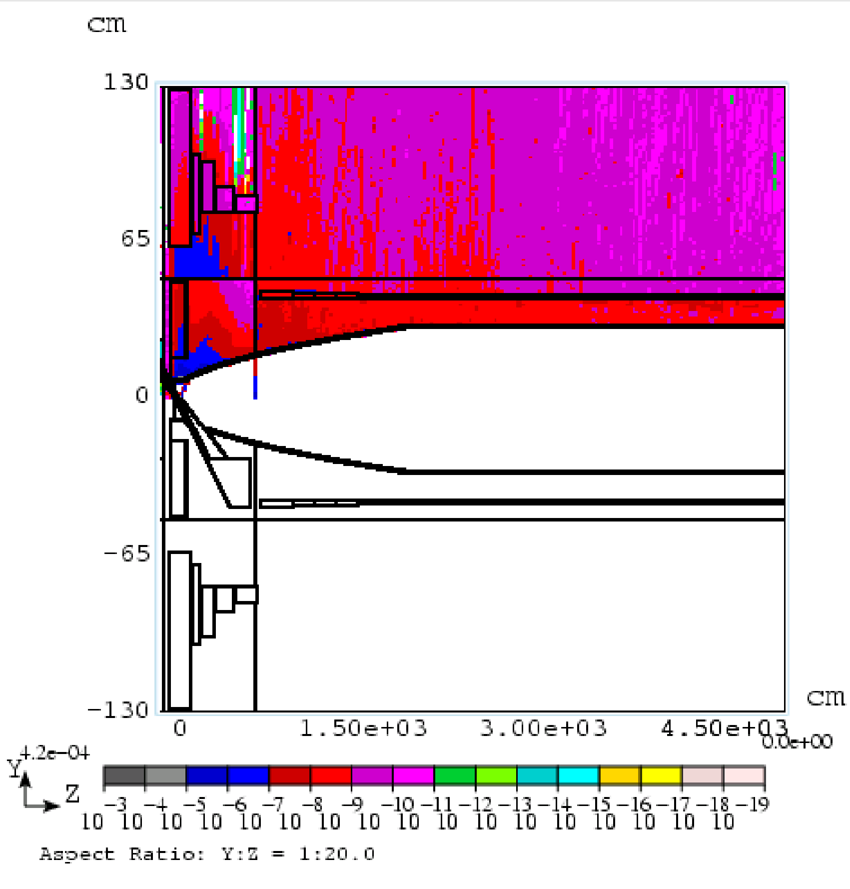
- How do we ensure comparability in terms of performance and costs ?
- How do we organise writing of greenfield/lab PD solutions ?

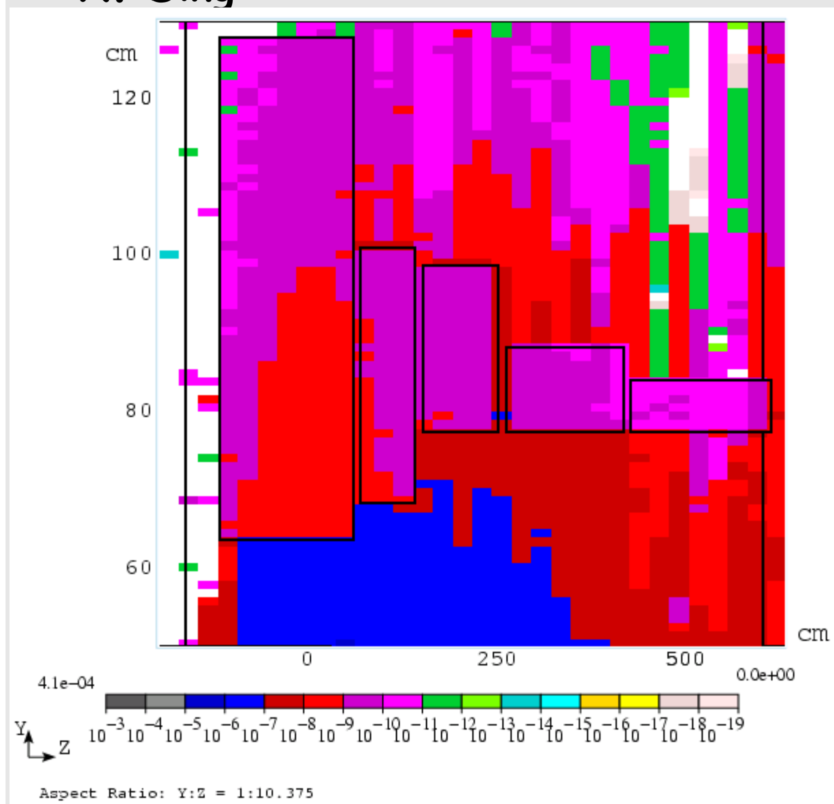
Target status

- Liquid mercury target is baseline.
- Liquidised power is a variation of liquid mercury target mainly to mitigate the mercury risks
- Solid target wheel is progressing well, shock seems to be less of a risk, progressing towards engineering design.

- How do we handle engineering and technical risk (energy deposition, lifetime of nozzle, and costing?
- Liquid Mercury target as baseline (adding LPJ) and solid target in annex ?

Liquid mercury target -Energy deposition in the target area





Enhanced shield can decrease the power deposition in SC1 coil from 22.1kW to 4.8kW. By replacing the Res Sol by WC shield, the power deposition in SC1 coil can be decreased further to 1.3kW.

Front end status

- How to handle uncertainties in yield determination ?
- Short bunch train now baseline ?!
- Baseline high filed lattice is still baseline - how do we argue with the technical risk and handle the alternatives
  - **low gradient lattice**
  - **high pressure gas filled cavities**
- Proton beam handling ?
- How do we handle engineering and technical risk and costing?

Harp data comparison

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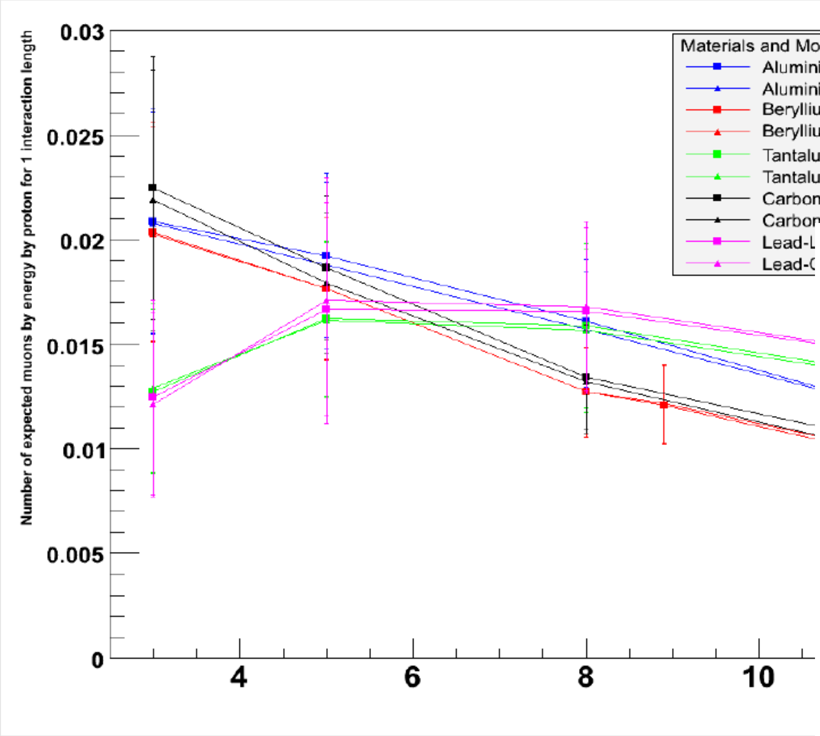
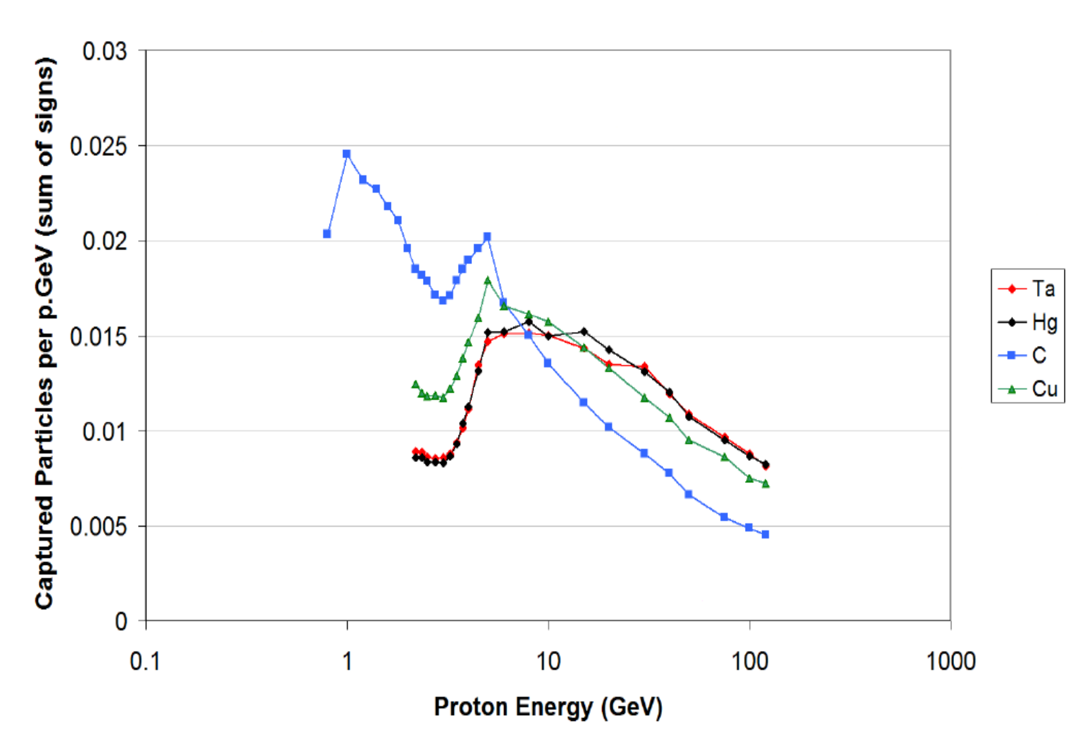
Reweighted Harp results



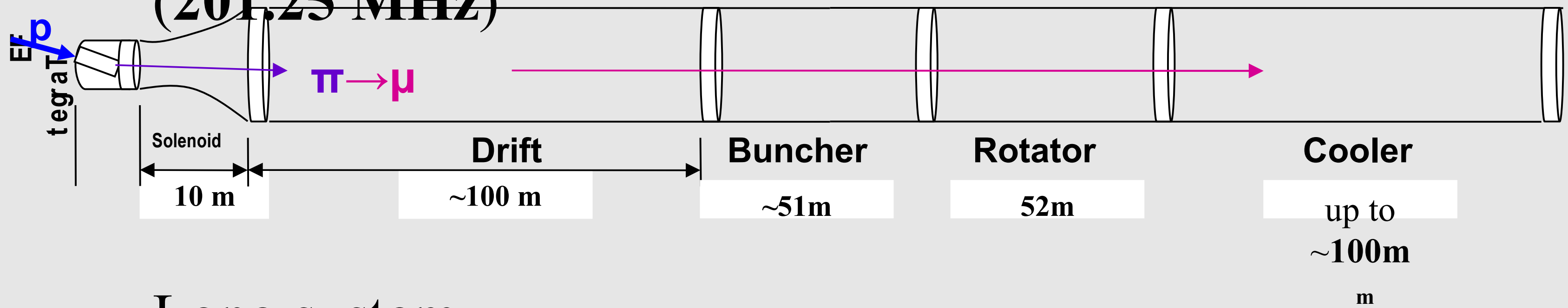
Includes NF muon aceptance!



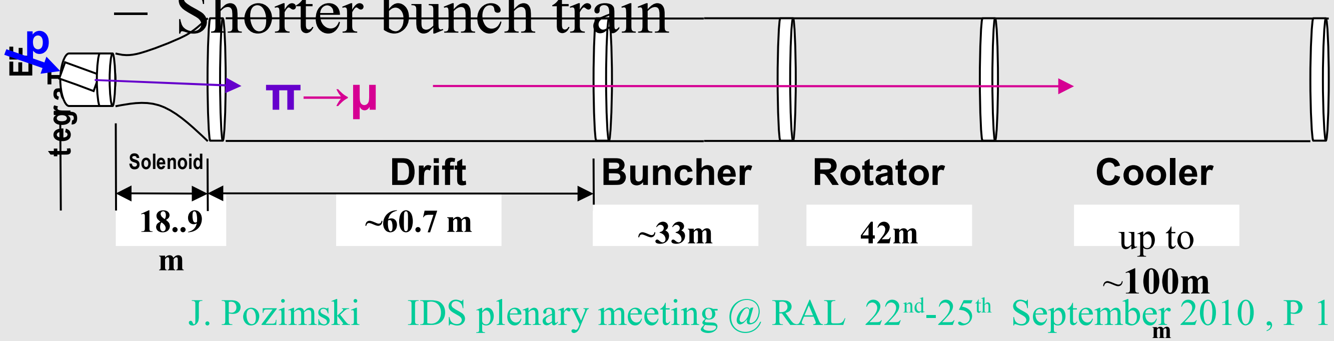
Comparison to MARS simulations (S.Brooks)

Muon front end

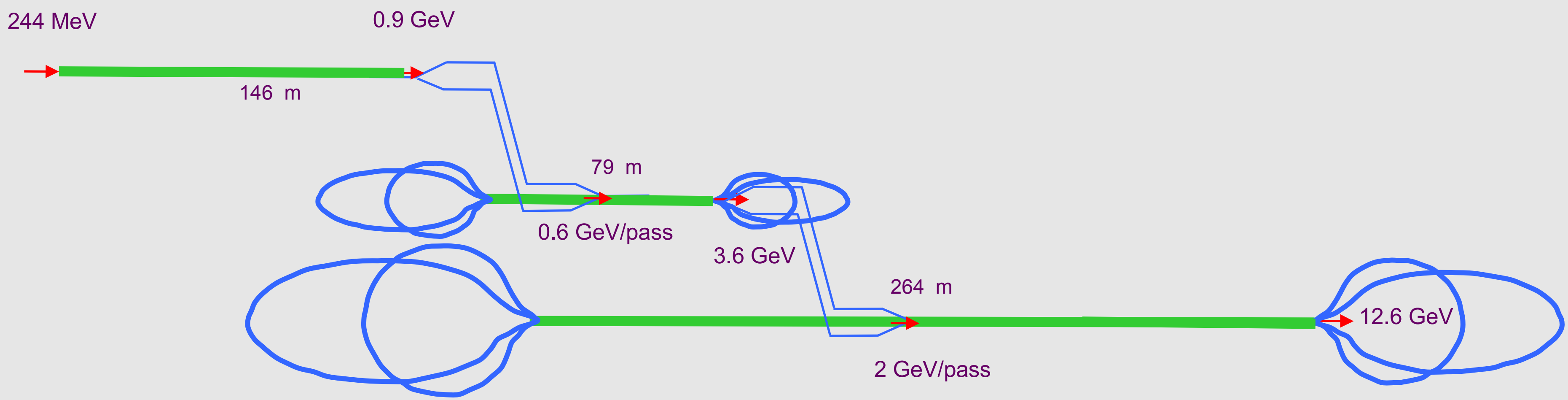
- ISS study based on $n_B = 18$ (280 MeV/c to 154 MeV/c)
  - Buncher 0 to 12MV/m; Rotator 12.5MV/m, B=1.75T **(201.25 MHz)**



  - Long system,
- Try shorter version - $n_B = 10$ (233 MeV/c to 154 MeV/c)
  - slightly lower fields (1.5T, 15MV/m)
  - Buncher 0 to 9 MV/m, Rotator 12MV/m
  - Shorter bunch train



Linac & RLA's status



- IDS Goals:
  - Define beamlines/lattices for all components
  - Resolve physical interferences, beamline crossings etc
  - Error sensitivity analysis
  - **End-to-end simulation (machine acceptance) -**
  - Component count and costing
  - Scaling FFAG alternative design in annex

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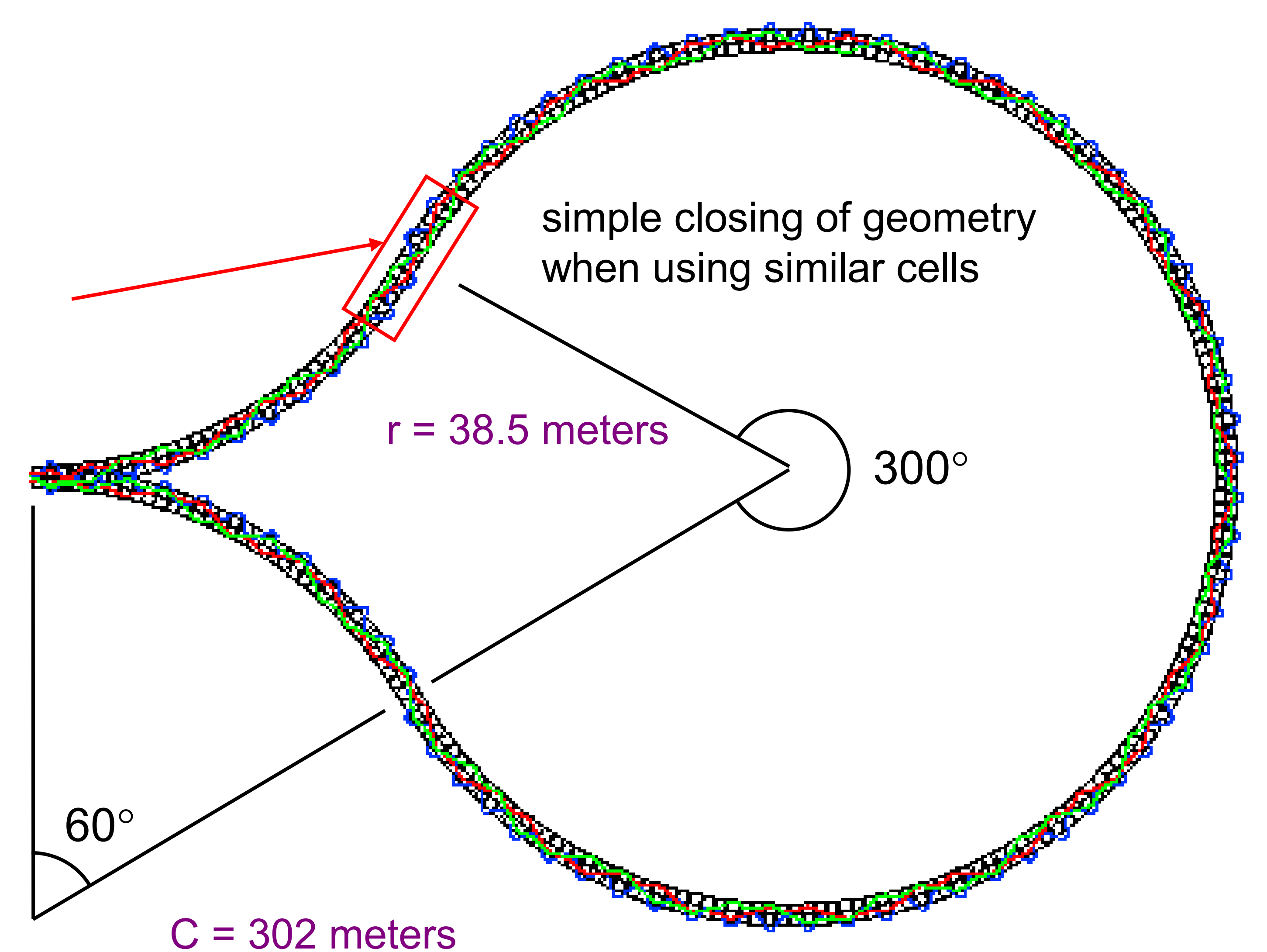
Multipass FFAG arc



Status of FFAG work

- Definition of baseline lattice
- Handling of Cromaticity corrections and insertions.
- Multiparticle tracking in fieldmaps under way – ready for IDR ?
- First Kicker designs (mechanical and electronics) available

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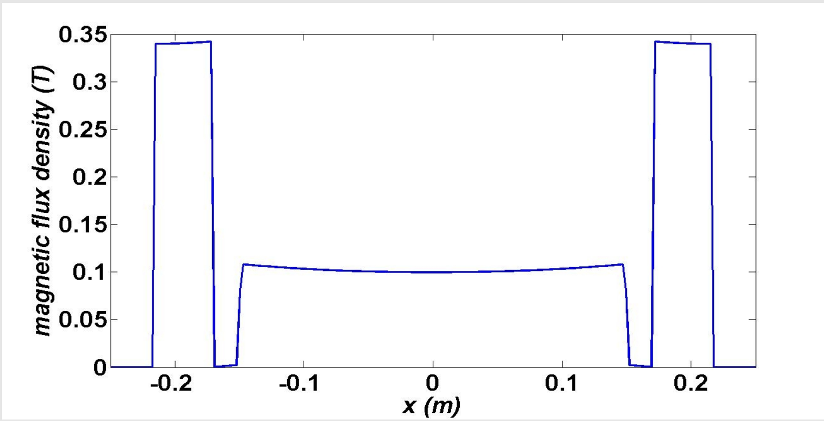
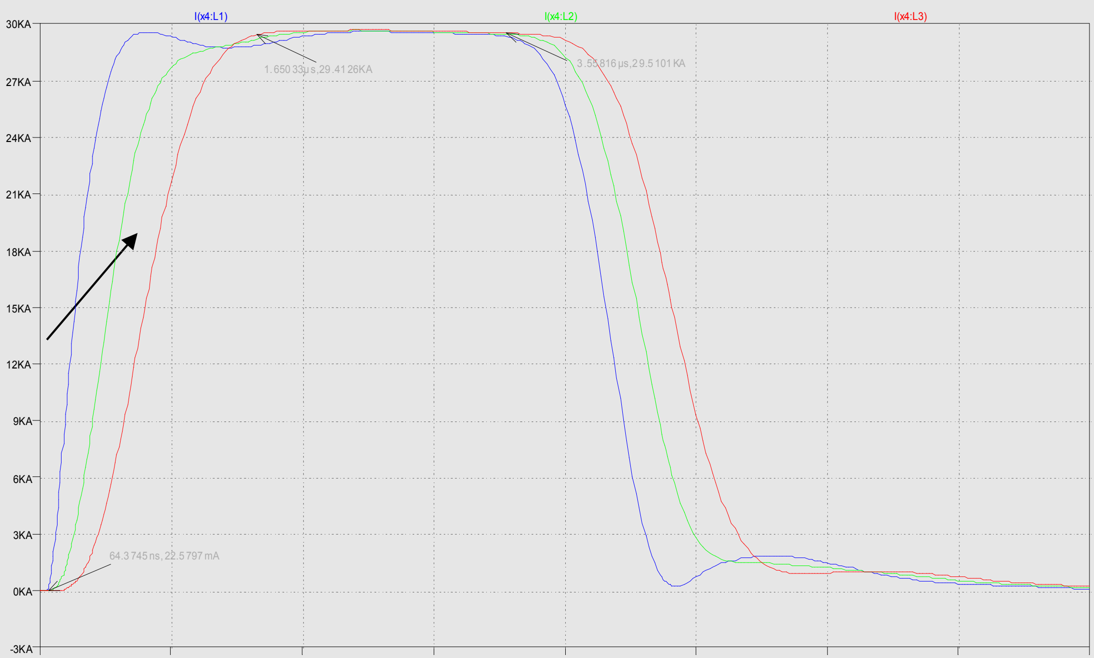
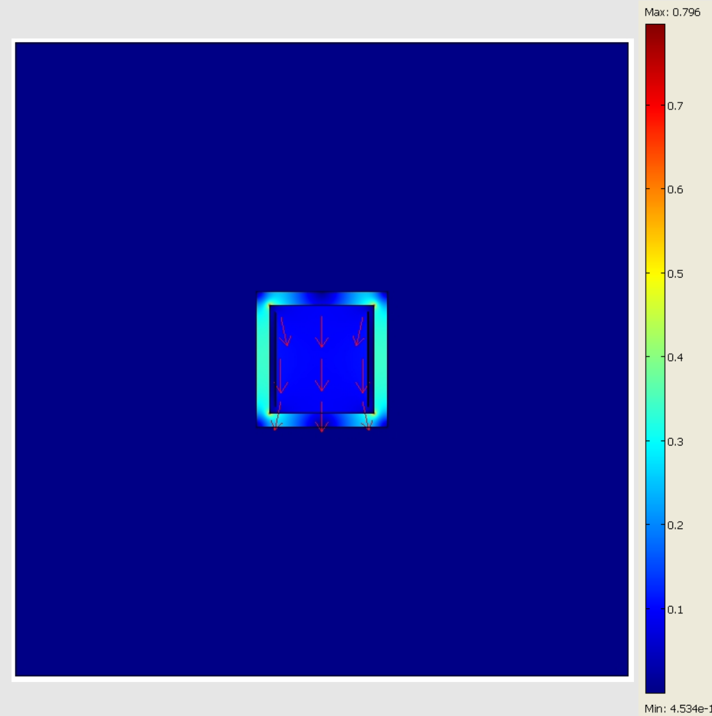
FFAG Kickers







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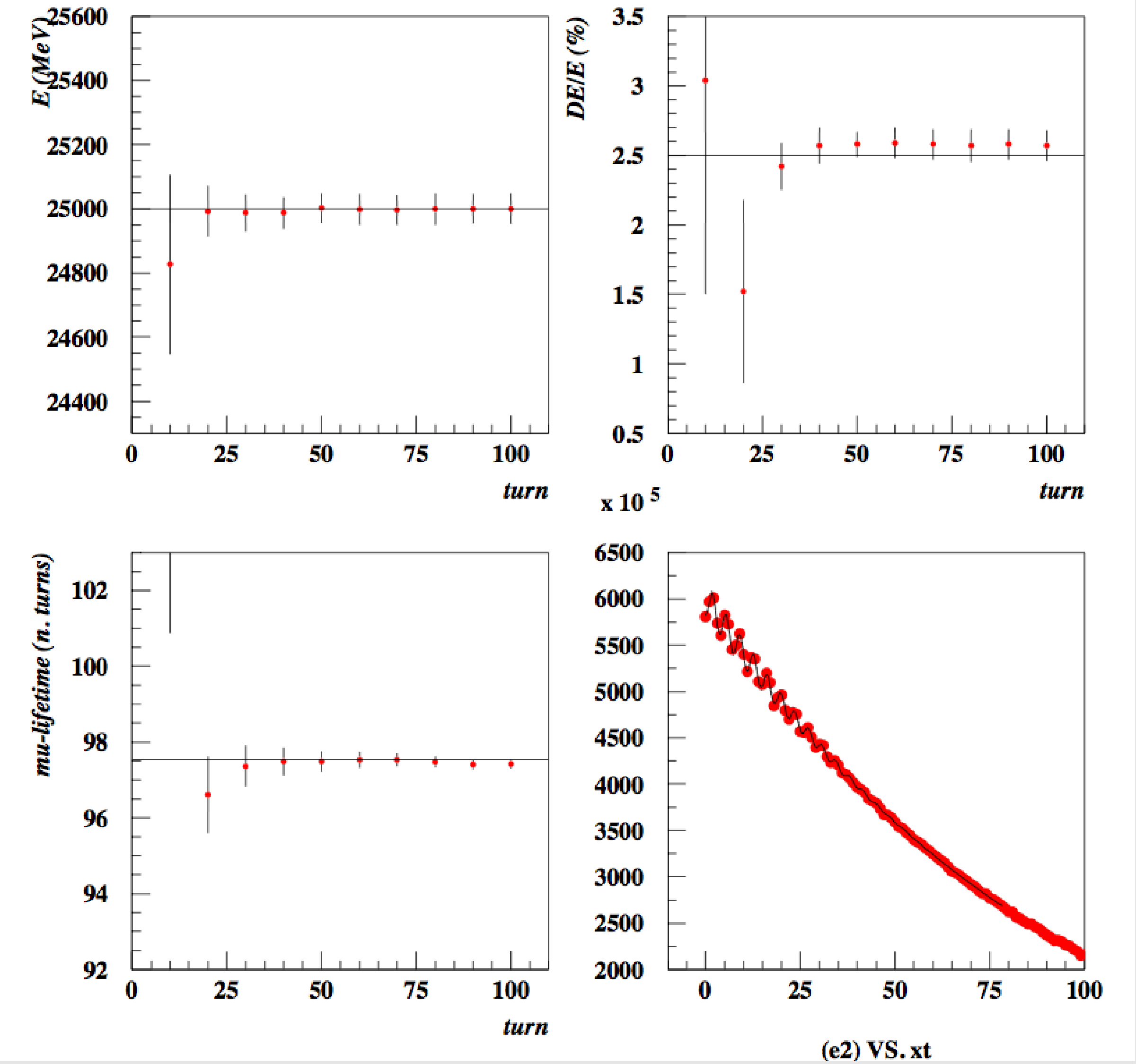
Status of decay rings

- Lattice design or high energy finished
- Lattice design for LENF still missing
- Design of ring instrumentation progressing

- How do we progress from here towards engineering, technical risk mitigation and costing?

Simulation results for energy monitor



IDR preparations

- Need to prepare and agree on extended Baseline document to ensure consistance.
- Baseline document should include
  Lattice description
  Description of interfaces
  Descriptions of main components (Magnets, RF, Tunnel length) to enable costing
  Technical drawings when available (extend what is available on web)
- Define responsibilities for sub chapters
- Define responsibilities for writing on transferlines, e2e status etc.

Other Hardware design

Parameter	$\beta_{geom} = 1$	$\beta_{geom} = 0.9$ (a)	$\beta_{geom} = 0.9$ (b)	Study II
l_{cav} [m]	0.7448	0.67034	0.67034	0.8282
r [m]	0.6854	0.7042	0.6804	0.6641
f_0 [MHz]	201.247	201.251	201.255	198.575
Q $[10^9]$	24.67	19.6	18.8	26.7
T	0.650	0.716	0.726	0.591
$\hat{E}$ [MV/m]	26.17	27.19	27.83	26.38
$\bar{E}$ [MV/m]	20.62	20.81	20.53	20.42
$\|E\|^{max}_{surface}$ [MV/m]	21.70	24.87	29.45	19.75
$\|H\|^{max}_{surface}$ [kA/m]	48.06	58.53	61.92	45.00
U [J]	712	772	797	747
$\int_{-\infty}^{+\infty} E(0,z)\cos[\omega\, t(z)]dz$	8.6142	9.0081	9.1336	8.8466
$\int_{-l_{cav}/2}^{+l_{cav}/2} E(0,z)\cos[\omega\, t(z)]dz$	10.0000	10.0000	9.9999	10.0000
$\int_{+l_{cav}/2}^{+\infty} E(0,z)\cos[\omega\, t(z)]dz$	-0.69204	-0.49594	-0.43320	-0.75676
correction [%]	-13.841	-9.9188	-8.6639	-15.135