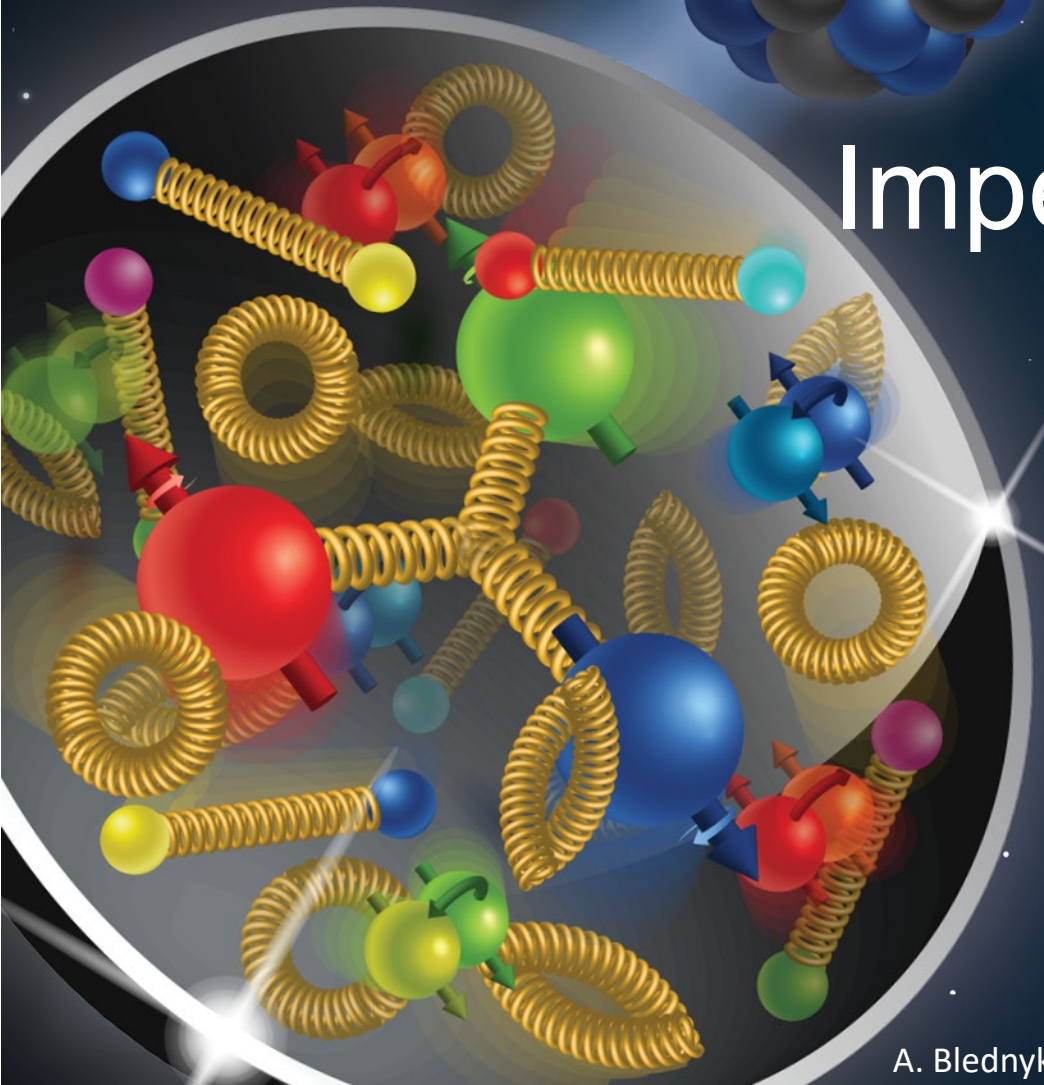

Impedance Optimization of the HSR Polarimeter

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EIC Polarimetry

May 3, 2023

Electron-Ion Collider

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Overview

- **HSR Polarimeters**

HSR Beam Intensity

	41 GeV	100 GeV / 110 GeV		275 GeV	
Bunch Length, σ_τ	250 ps	234 ps		200 ps	
Average Current, I_{av}	0.38 A	0.69 A	1 A	0.69 A	1A
Number of Bunches, M	1160	1160		290	1160
Single Bunch Current, $I_0 = \frac{Ne}{T_0}$	0.3 mA	0.6 mA	0.9 mA	2.4 mA	0.9 mA
Num. of electrons per bunch, N	2.6×10^{10}	4.8×10^{10}	6.9×10^{10}	19×10^{10}	6.9×10^{10}
Bunch Charge, Ne	4.2 nC	7.6 nC	11 nC	30.4 nC	11 nC
Peak Bunch Current, $I_p = \frac{Ne}{\sqrt{2\pi}\sigma_\tau}$	7 A	13 A	19 A	61 A	22 A

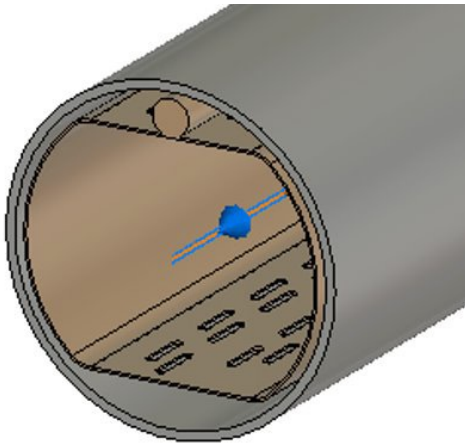
- Short-Range Wakefield
- Beam Induced Heating
- HOM
- Electron Clouds Effect

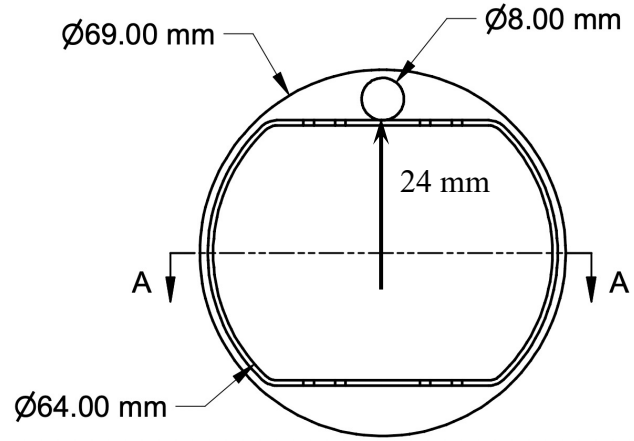
HSR Active Cooled Beam Screen

- Stainless steel ($t_{StSt} = 0.9\ mm$), Cu coated ($t_{Cu} = 0.1\ mm$) chamber with amorphous-carbon layer ($t_{aC} = 200\ nm$)
- Resistive wall and geometric impedance simulations are work in progress for centered and off centered beams, $\pm\boldsymbol{20\ mm}$.
- $W_{||}(s)$ is simulated for a $\bar{\sigma}_s = 4\ mm$ (Pseudo-Green Function)

Present Slot Dimensions

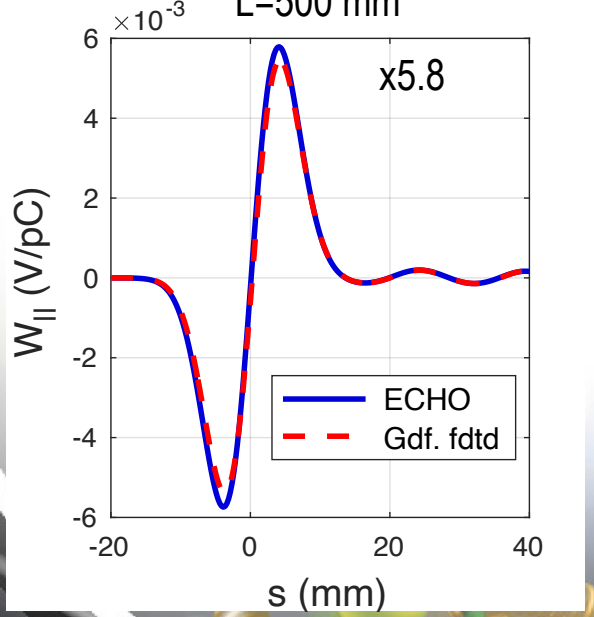
$t_s = 1\ mm, w_s = 2\ mm, l_s = 20\ mm$





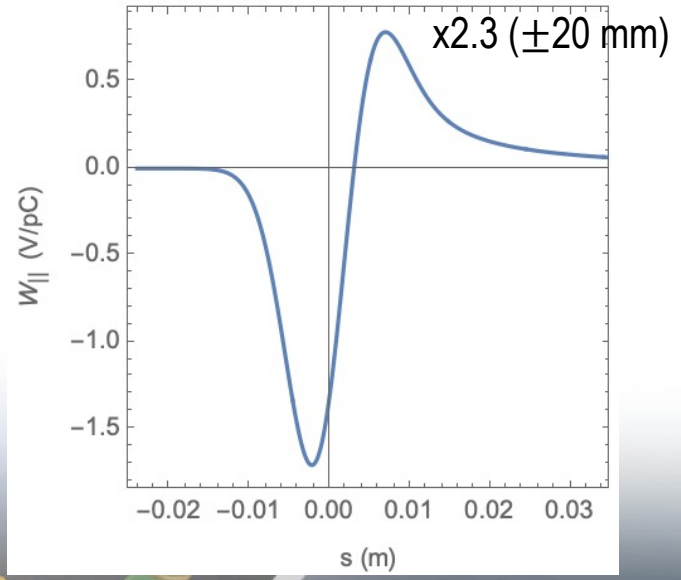
Geometric

L=500 mm



Resistive Wall

Arc: L=2880 mm of Cu with b=24mm



S. Verdu Andres
C. Hetzel
J. Tuozzolo
D. Holmes
B. Gallagher
G. Wang
M. Sangroula

Electrical Conductivity at 10K

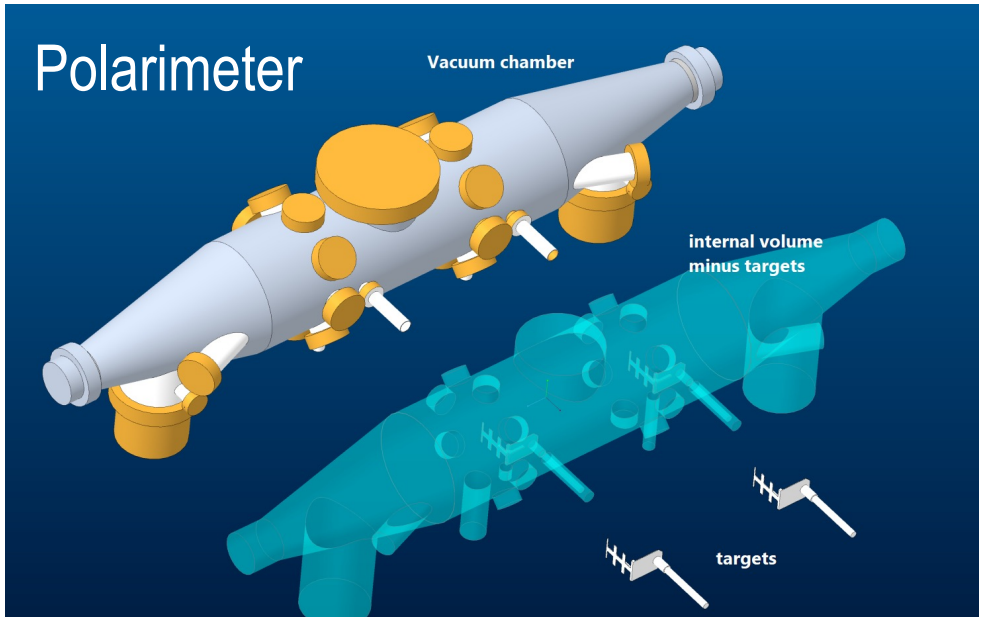
$\sigma_{aC} = 400\ S/m \rightarrow 200\ nm$
$\sigma_{Cu} = 6{\times}10^9\ S/m \rightarrow 100\ \mu m$
$\sigma_{StSt} = 2.0{\times}10^6\ S/m \rightarrow 900\ \mu m$

Electron-Ion Collider

HSR Detector Related Diagnostic

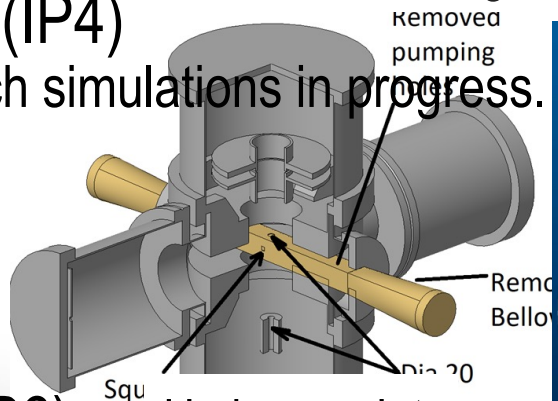
- Polarimeter
  - Single-Bunch - **Ok**
  - HOM → Pumping ports requires RF shielding.
  - Simulations with targets are the next step
  - Targets – aC (graphite)

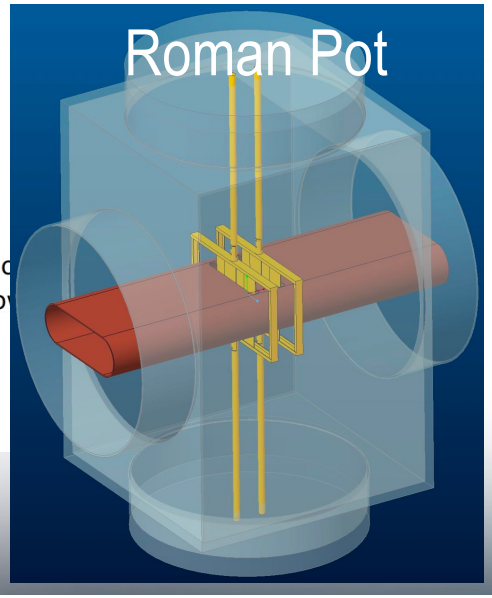
K. Hamdi
E. Aschenauer
W. Schmidke
C. Hetzel
R. Lassiter
Y. Furletova
G. Mahler

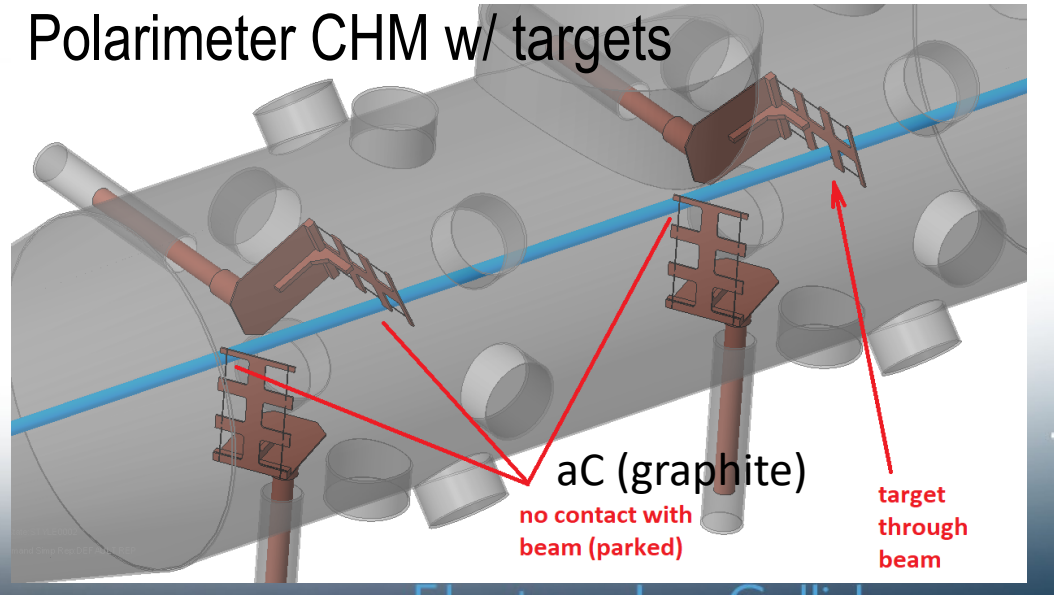


- During most beam operation, the targets are 'parked' at a small distance from the beam.

- Hydrogen Jet (IP4)
  - Single-Bunch simulations in progress.





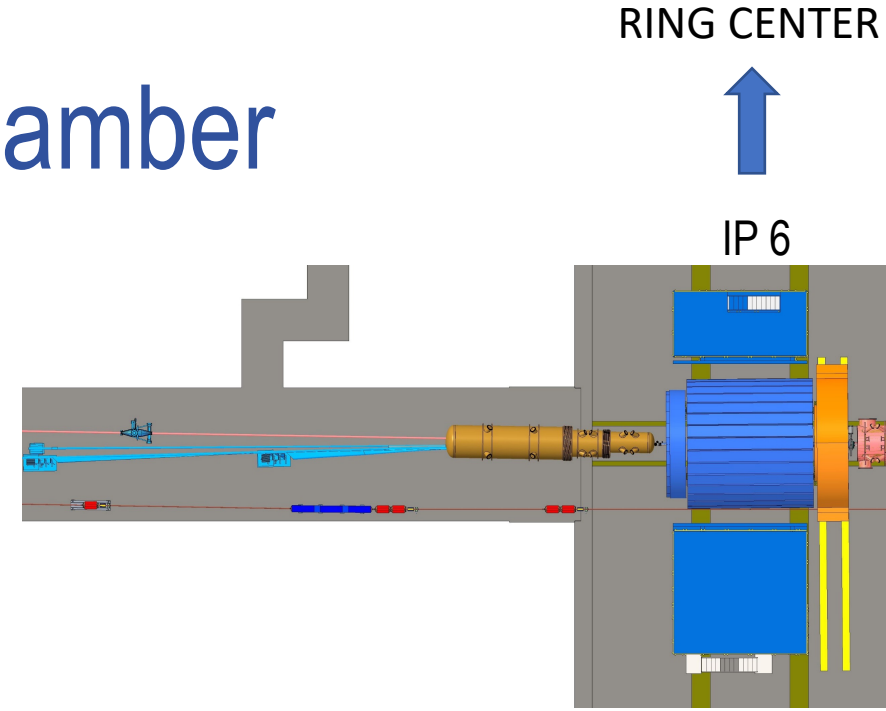


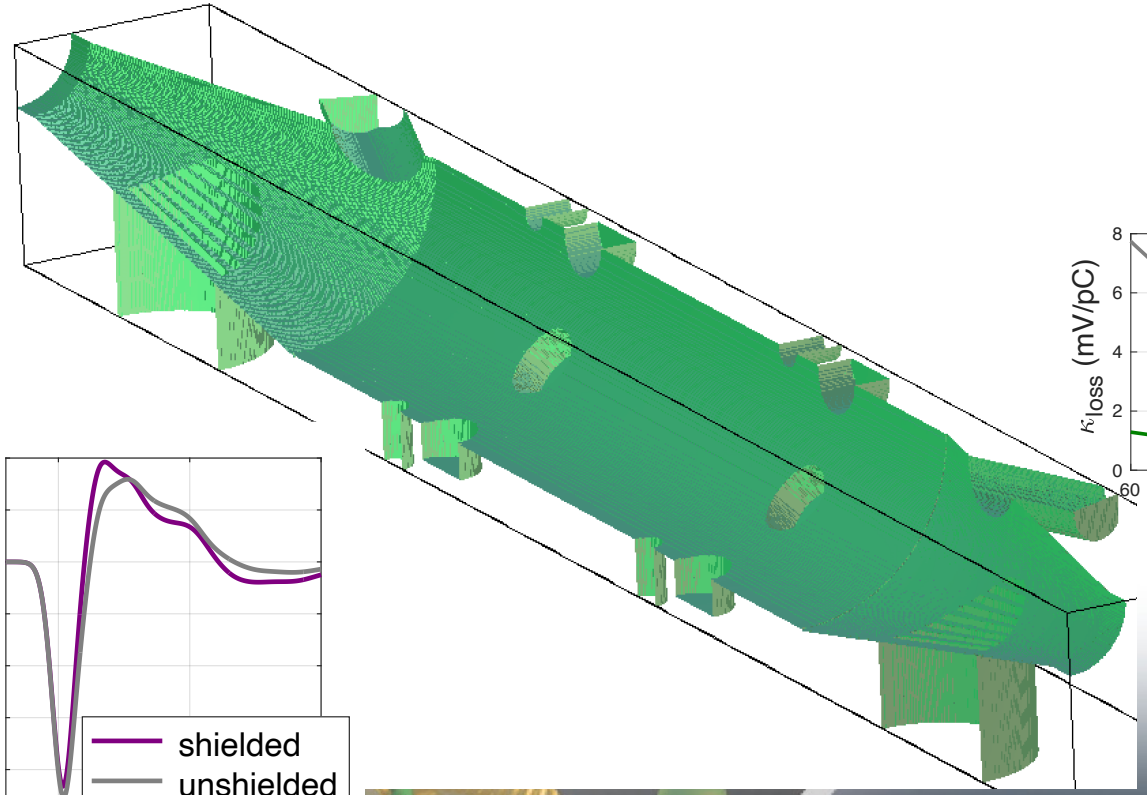
- Roman Pot (IP6)
  - Silicon panels close to the beam
  - More iterations on design optimization are required

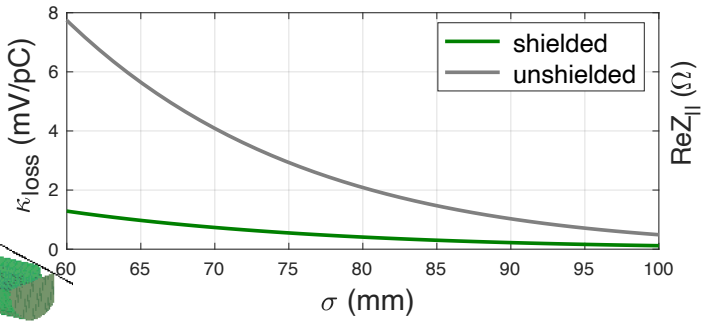
- During polarimeter measurements, only one target is passed through the beam

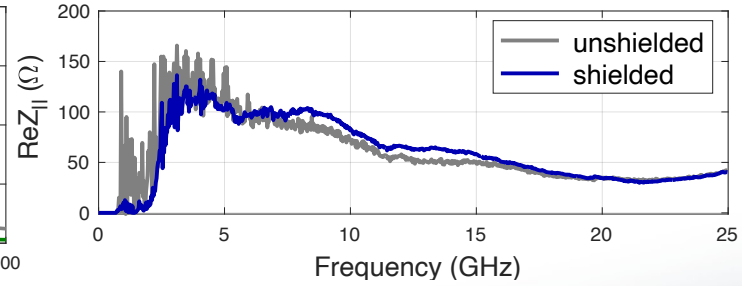
HSR Polarimeter Chamber

- RF shielding implemented for pumping ports
- Beam pipe diameter is 123.7mm
- Location: IP6 ?





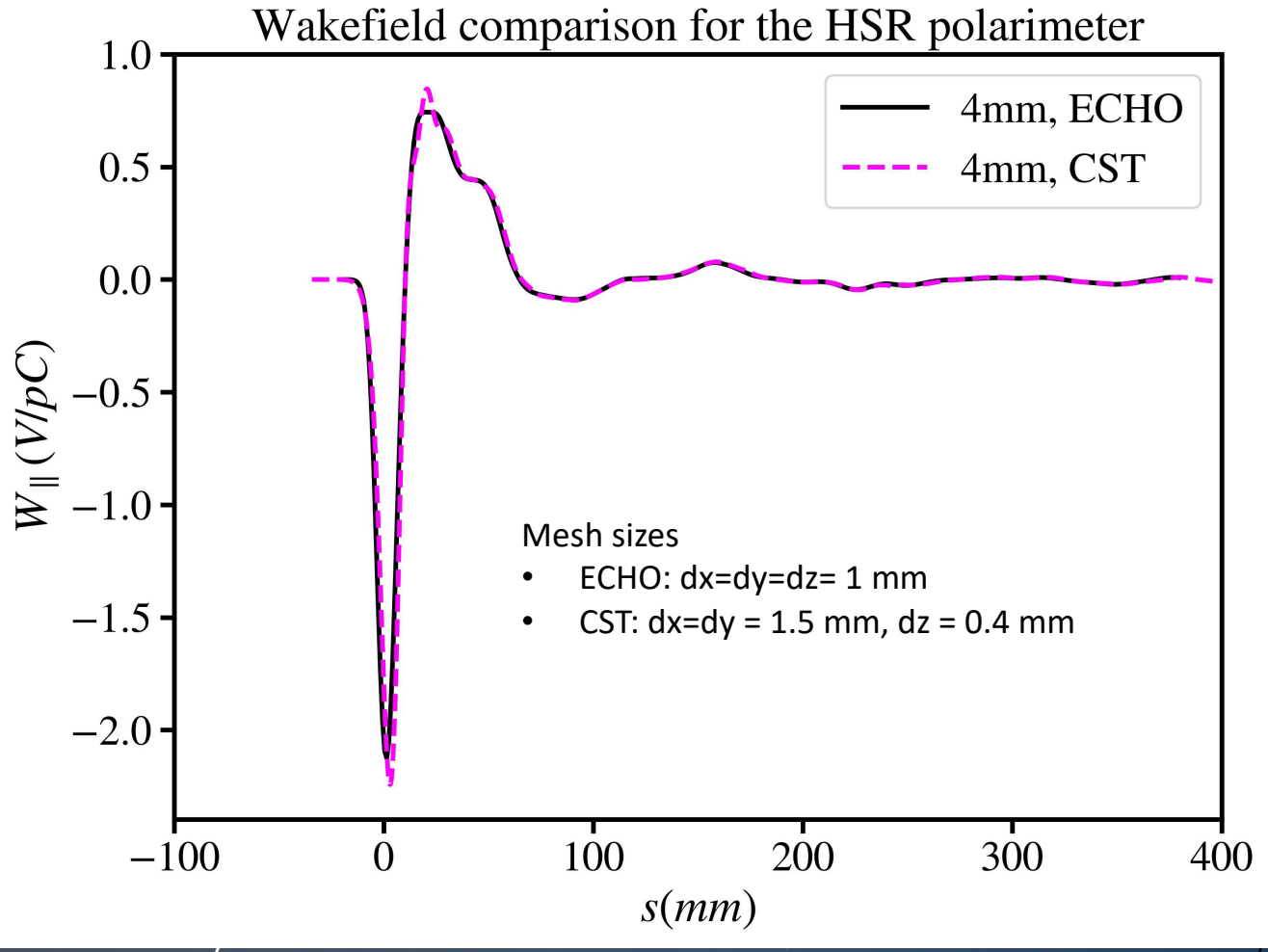




HSR Polarimeter CHM (Continued)

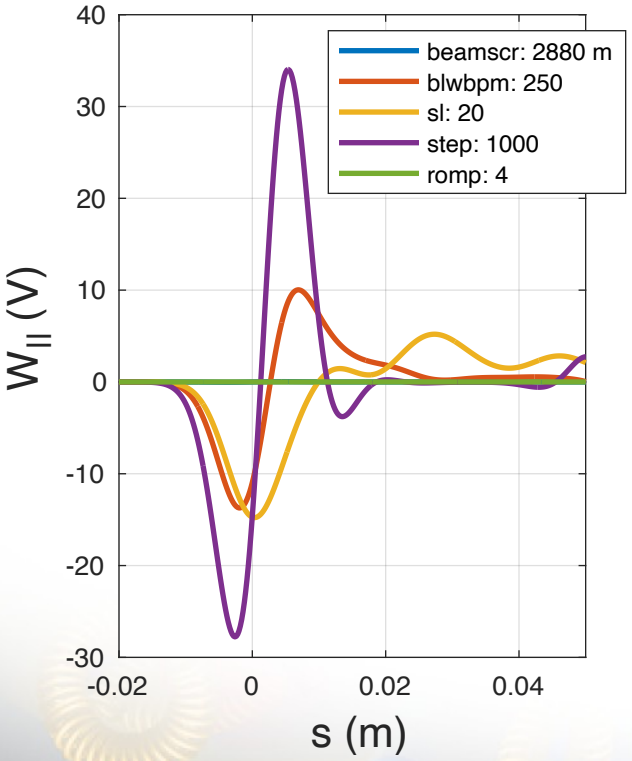
M. Sangroula
G. Wang

- Compared wakefield simulations for $\sigma = 4\ \mathrm{mm},\ Q_b = 30.5\ \mathrm{nC}$
- Reasonable agreement between two codes.

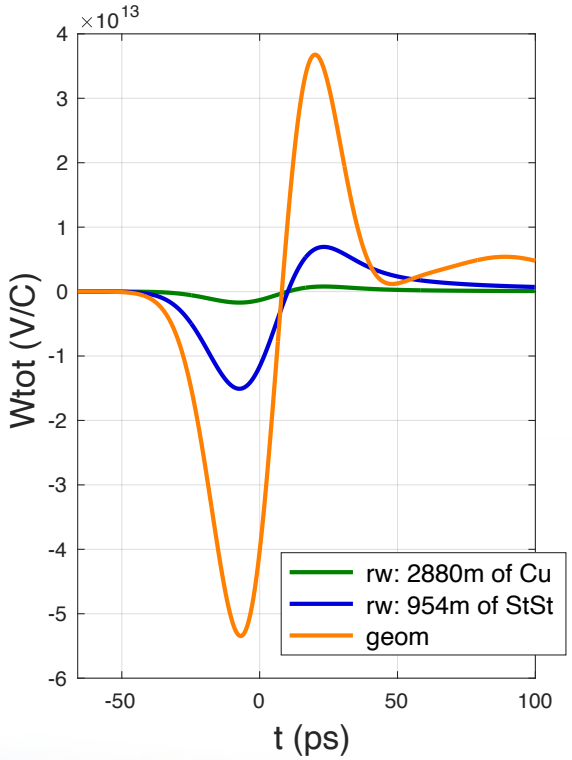


Longitudinal Impedance Budget at 41 GeV

$\bar{\sigma}_s$=4mm



Geometric wakefield



Geometric and RW wakefields

- Need to add the following components:
  - Beam Screen
  - Cold BLW + BPM: 250
  - Cold BLW + Pump Ports: 250
  - Warm BLW: 200
  - Arcs: 2880m of Cu
  - Warm Straight Sections: 120mm diam StSt with NEG coating (1um), L=954m
  - RF System + Tapered Transitions: ?
  - Collimators: 3
  - Septums: 2 low Energy by-pass, 4 SHC, 1 Inj. 1 Extraction
  - Flange Joints (Steps): 1000
  - IR: 1
  - Abort Kickers: 5
  - Injection Kickers (SL): 20
  - Polarimeters: 2 pCarbon & hJet
  - Roman Pots: 4
  - Tune Monitors: Bunch-by-Bunch Feedback 1H&1V
  - GV: ?

Summary

- **Work on Impedance Budget for ESR and HSR is continued.**