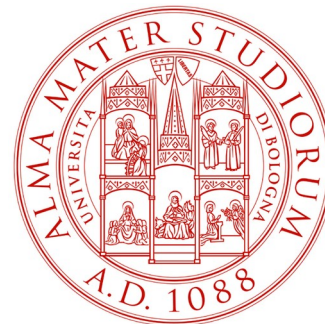




Update on Global Reconstruction with GENFIT

R. Zarrella and M. Franchini

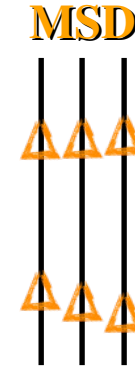
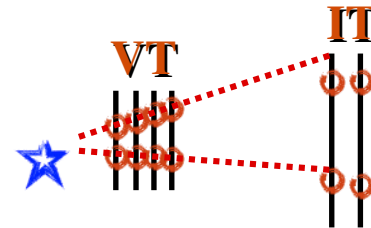
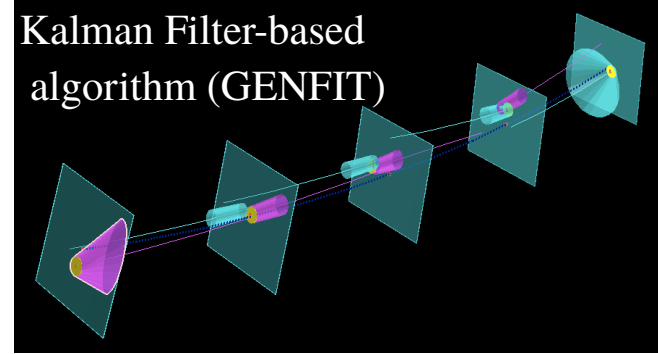
XI FOOT General Meeting

29-30/11/2021

Strategy

- Use info from trackers (VT, IT, MSD) and TW
- Reconstructed hits → **clusters**
- Track finding → **categorize**
 - 1) MC truth
 - 2) “Data-like”:
 - Start from VT tracklets
 - Projection to possible planes of IT

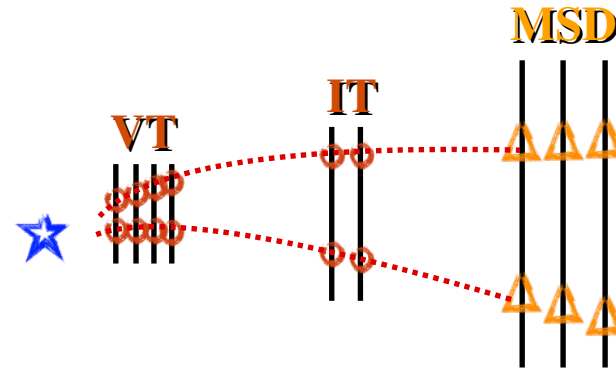
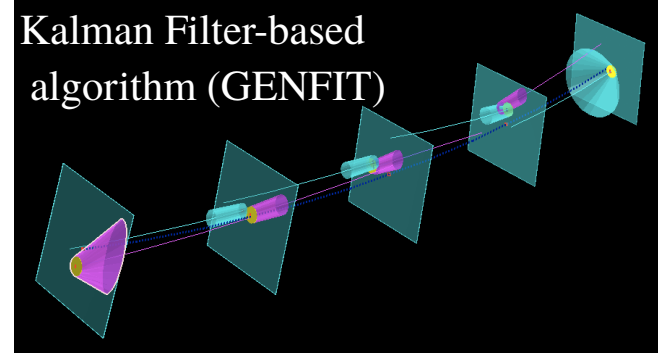
Kalman Filter-based
algorithm (GENFIT)



Strategy

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 - KF extrapolation to MSD

Kalman Filter-based
algorithm (GENFIT)

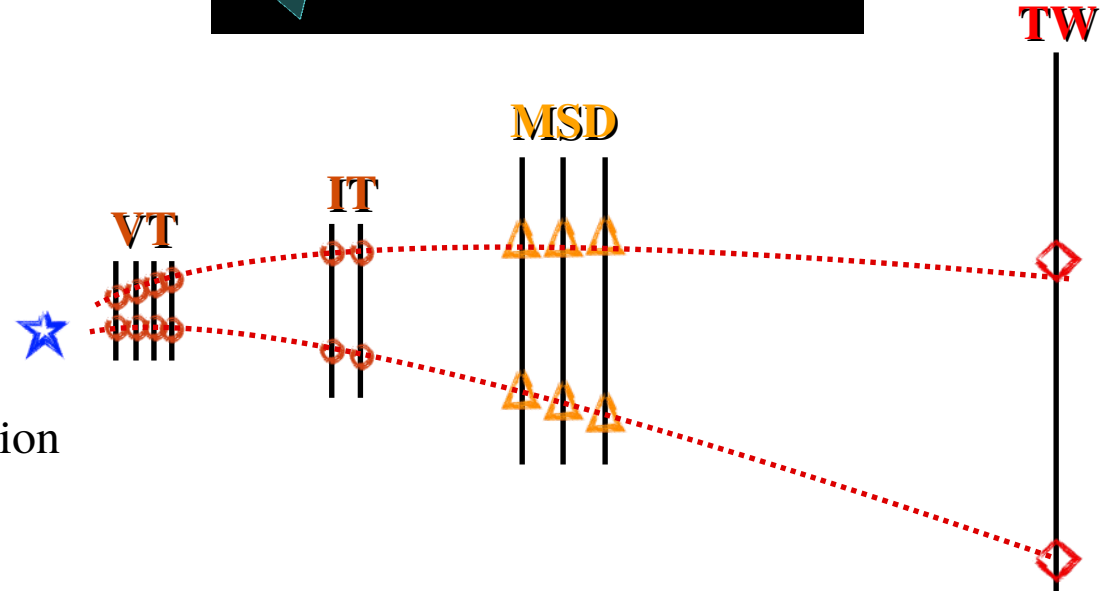
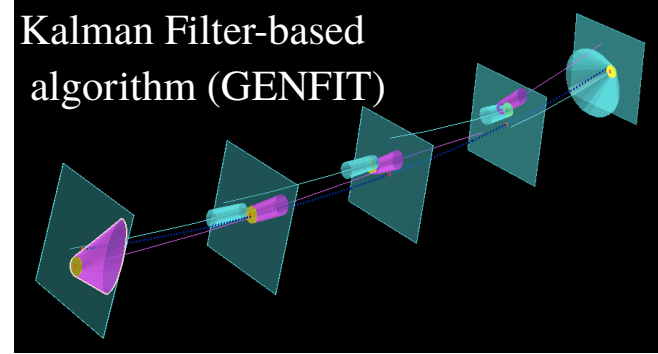


TW

Strategy

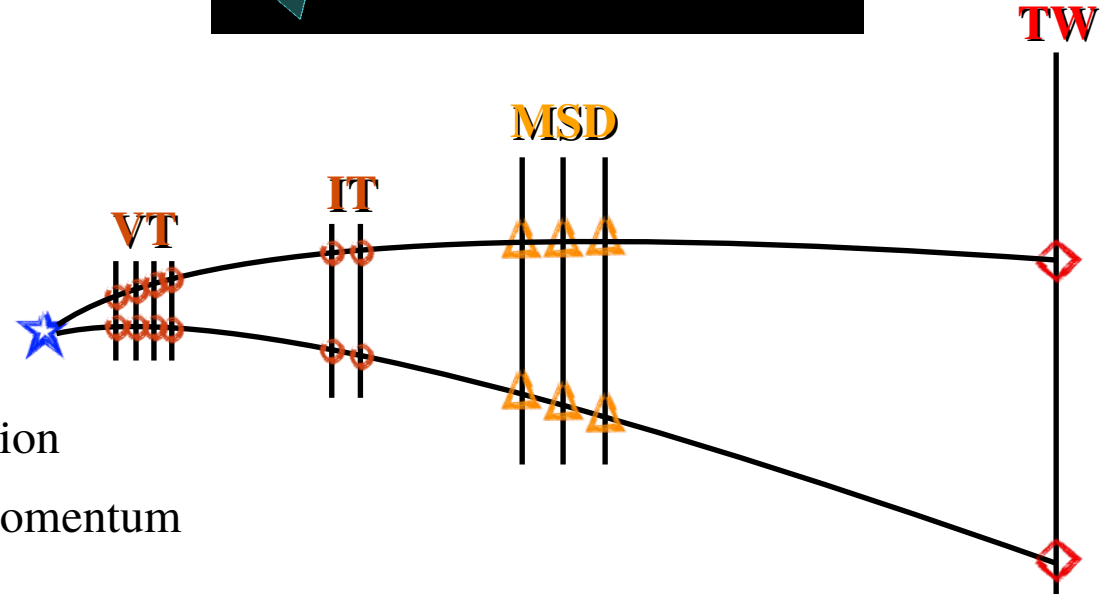
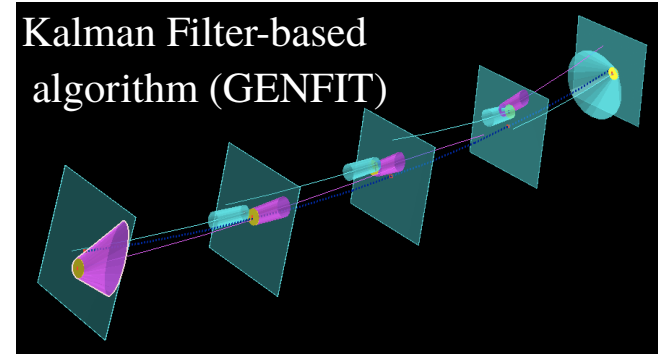
- Use info from trackers (VT, IT, MSD) and TW
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 - KF extrapolation to MSD
 - KF extrapolation to TW
 - Possible Z from TW → track representation

Kalman Filter-based
algorithm (GENFIT)



Strategy

- Use info from trackers (VT, IT, MSD) and TW
- Reconstructed hits → **clusters**
- Track finding → **categorize**
 - 1) MC truth
 - 2) “Data-like”:
 - Start from VT tracklets
 - Projection to possible planes of IT
 - KF extrapolation to MSD
 - KF extrapolation to TW
 - Possible Z from TW → track representation
- Fit the track candidates and extract particle momentum
(fit only uses **reconstructed quantities!**)





Preliminary tests

Both “track finding” algorithms tested on MC w/ full setup:

- 16O_C2H4_200_1.root (-exp 16O_200 -run 1)
- $\sim 3 \times 10^5$ events processed
- Efficiency and purity
- Momentum resolution

$$\sigma(p) = \sigma \left(\frac{p_{Reco} - p_{MC}}{p_{MC}} \right)$$



**CAVEAT: TW Z identification
considered perfect!!**

$$Efficiency(Z) = \frac{N_{Z,conv}}{N_{Z,tot}}$$

$$Purity(Z) = \frac{N_{Z,good}}{N_{Z,conv}}$$

$N_{Z,tot}$ = number of total tracks with certain Z hypo

$N_{Z,conv}$ = converged tracks with some Z hypo

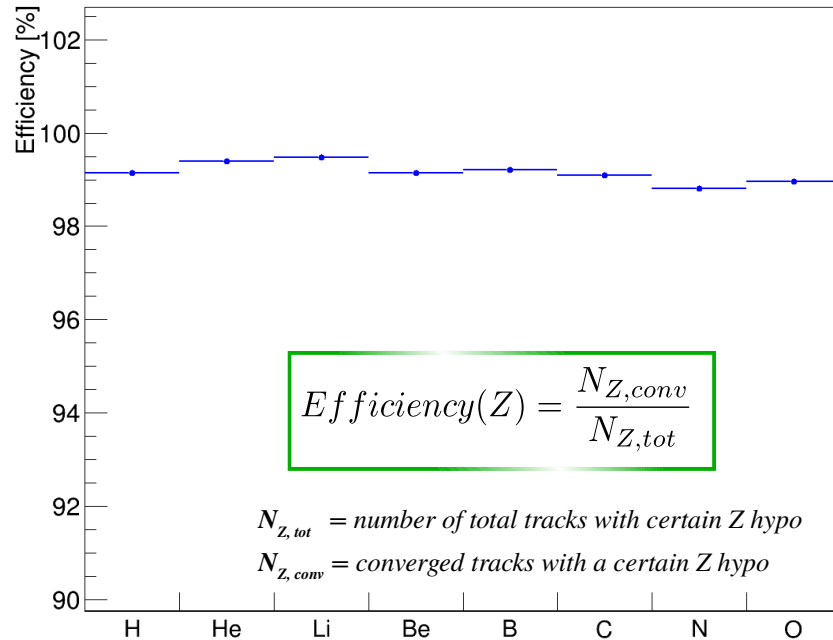
$N_{Z,good}$ = converged tracks with correct Z hypo
(checked with MC truth)



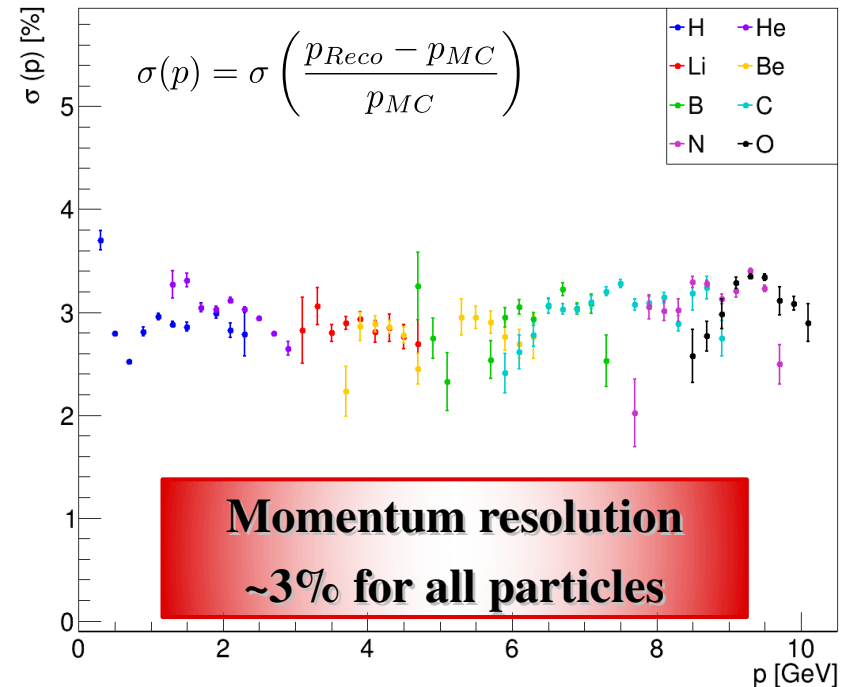
MC categorization – Efficiency and Momentum

Track fitting closure test:

- Track points and hypothesis from MC
- Purity is 1 by definition
- Check efficiency of GENFIT fit algorithm



**Fit efficiency above 99%
for all fragments**



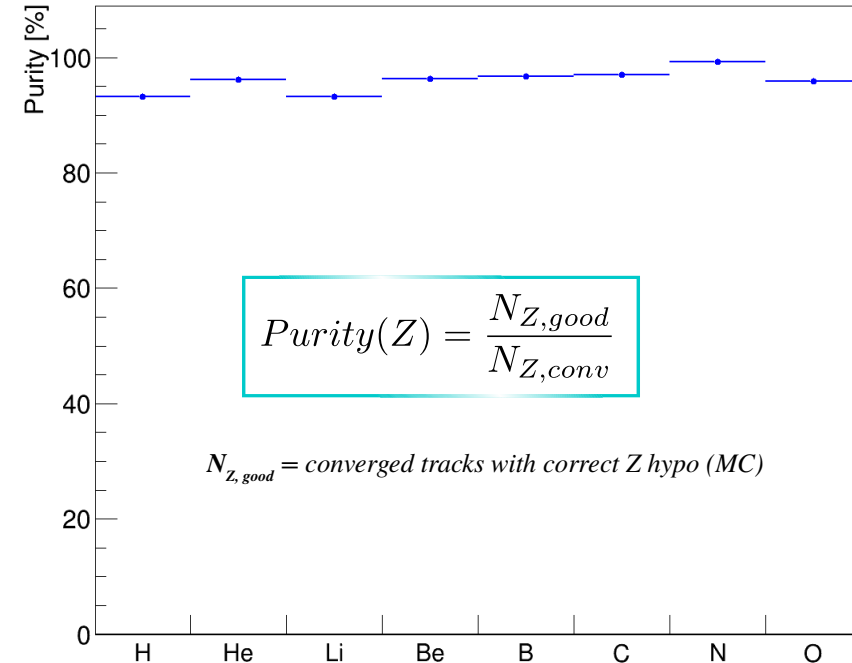
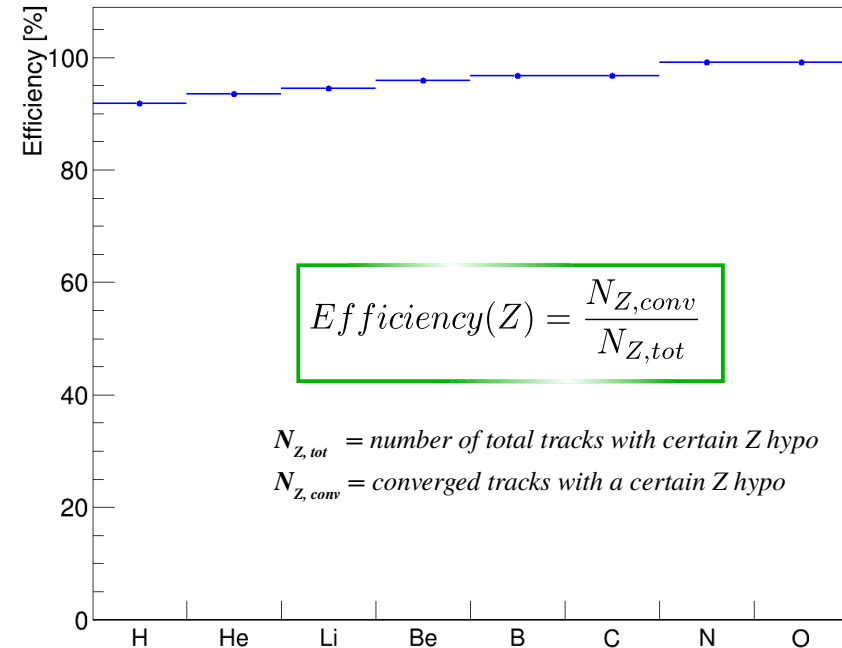


Data-Like track finding – Efficiency and Purity

Data-Like selection:

- Evaluate hit selection performances
- Check efficiency of fit algorithm
- Check purity of fitted tracks

**Both efficiency and purity
> 90% for all fragments!**

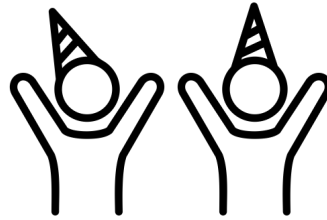




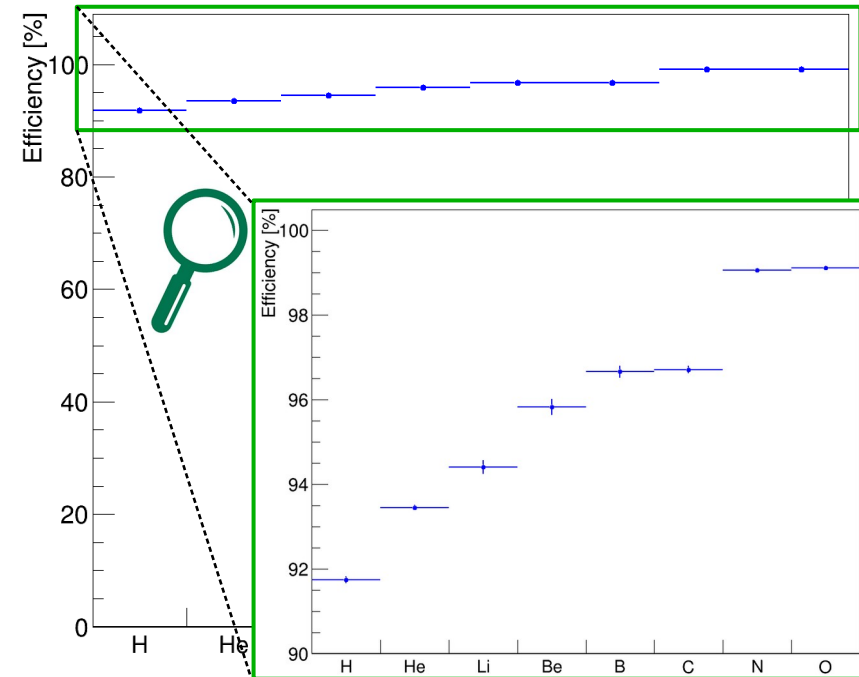
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- Evaluate hit selection performances
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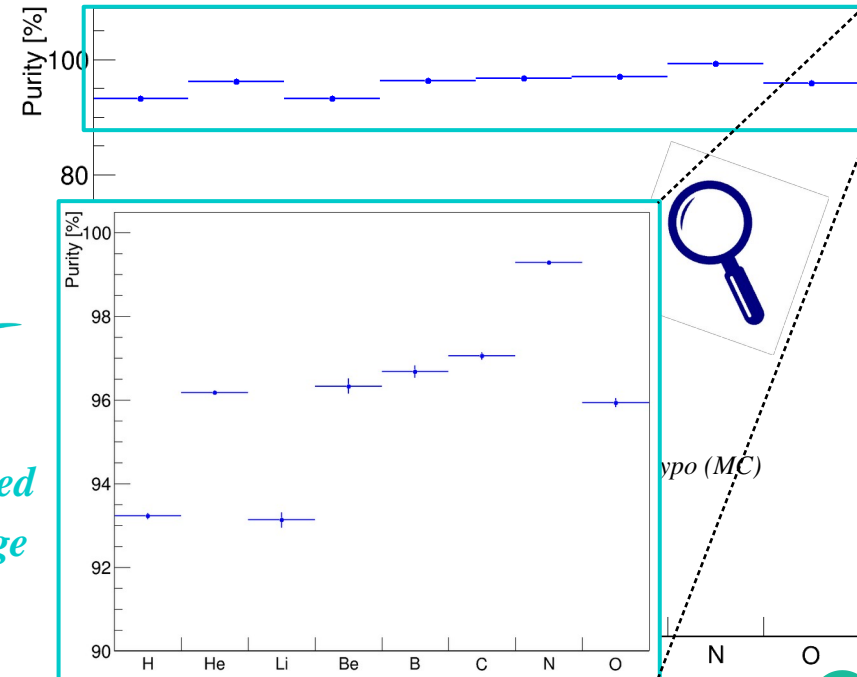


**Both efficiency and purity
> 90% for all fragments!**



*Track reconstruction
mostly successful*

*Fragments associated
with the right charge*

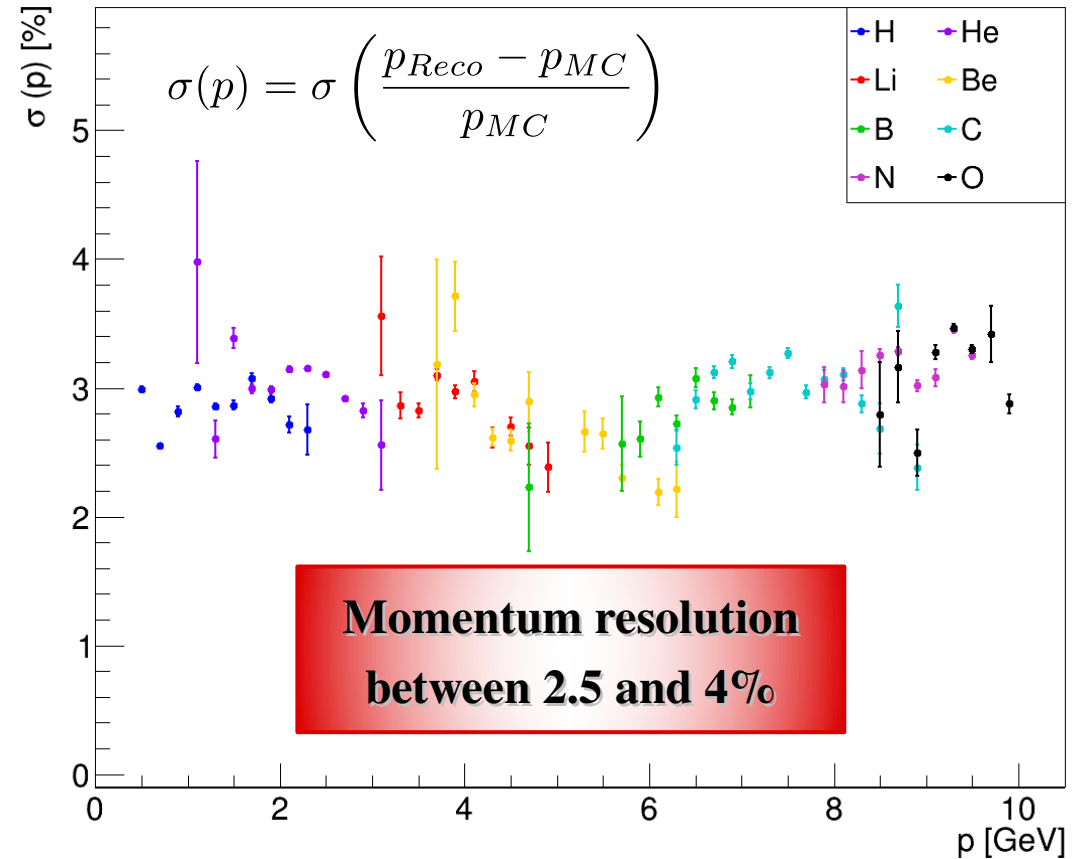
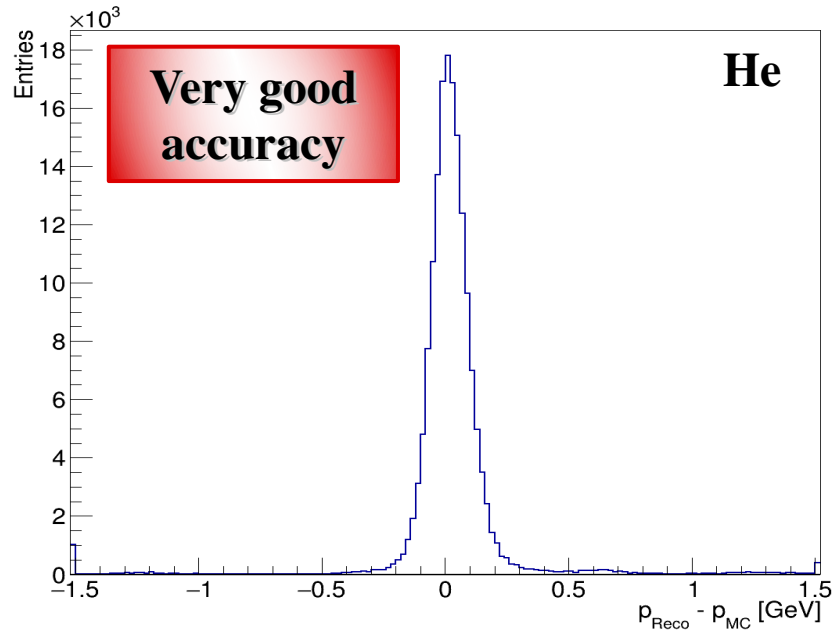




Data-Like track finding – Momentum

Momentum at the target:

- Extracted from track fit
- Checked with MC



Tests on GSI2021 Data

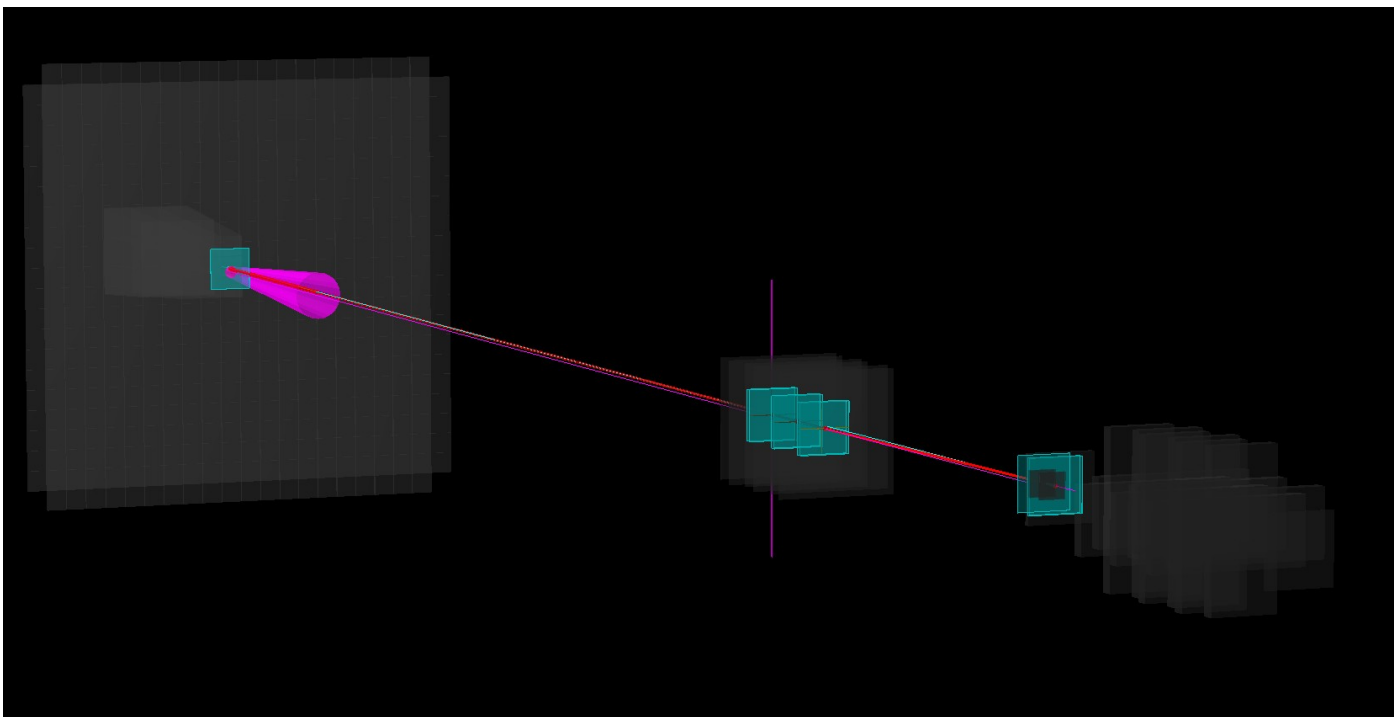


Tracking w/out B field applied to GSI data



Algorithm worked!! 🎉

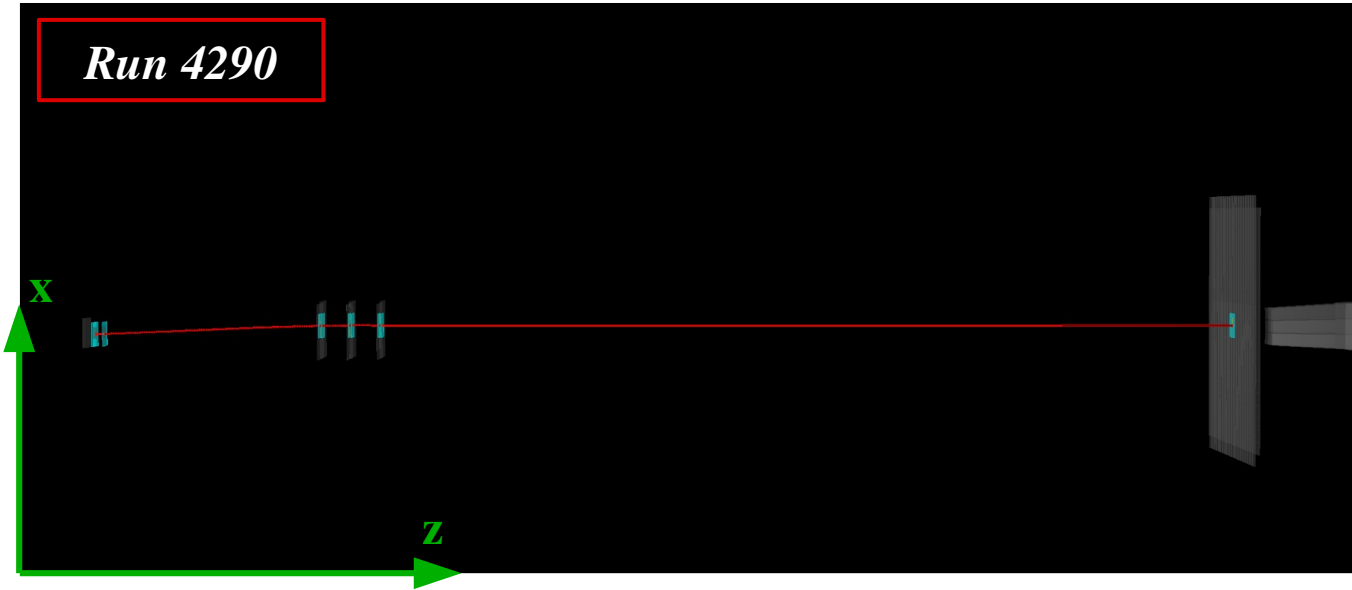
- ✓ We can run on MC and data w/out major issues
- ✓ Track finding OK
- ⚠ Check TW calibration for:
 - Z identification
 - Position reconstruction
- ⚠ Additional faster algorithm for linear tracking almost ready



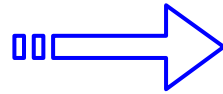


To do list: Alignment

Run 4290



Caveat: Alignment still ongoing



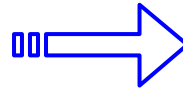
- MB run: mostly primaries
- VT and MSD tracks don't seem parallel (tilt?)
- New alignment still to be tested
(sorry Chris!)



To do list: VT pile-up

Run 4306

Caveat: VT pile-up



- Many “parallel” tracks in the VT
- Not recognized by our algorithm
- More reconstructed tracks
- Should be fixed in new version of SHOE

Conclusions and Future

Global reconstruction algorithm tested:

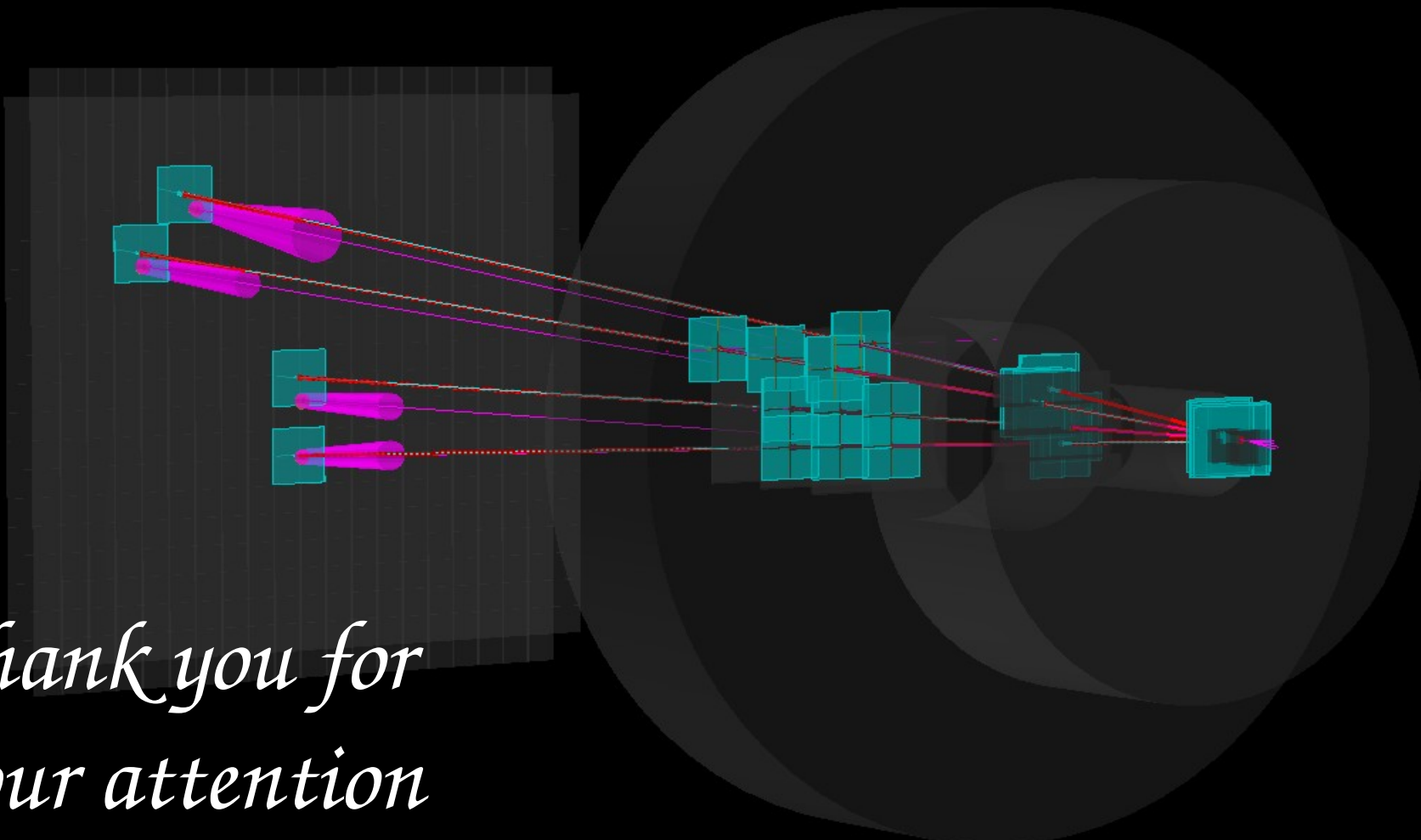
- ✓ MC: Very high efficiency and purity → solid particle identification
- ✓ MC: Extracted momentum resolution $\sim 2.5\text{-}4\%$
- ✓ Still some work to do for data but algorithm works
- ✓ GENFIT and TOE outputs finally match! (thanks everyone)



Future developments:

- 💡 Test on MC simulations w/ misaligned detectors
- 💡 Application of new alignment to data
- 💡 Development of new track finding algorithms
- 💡 Overall improvement of the code → **debug!**





*Thank you for
your attention*