

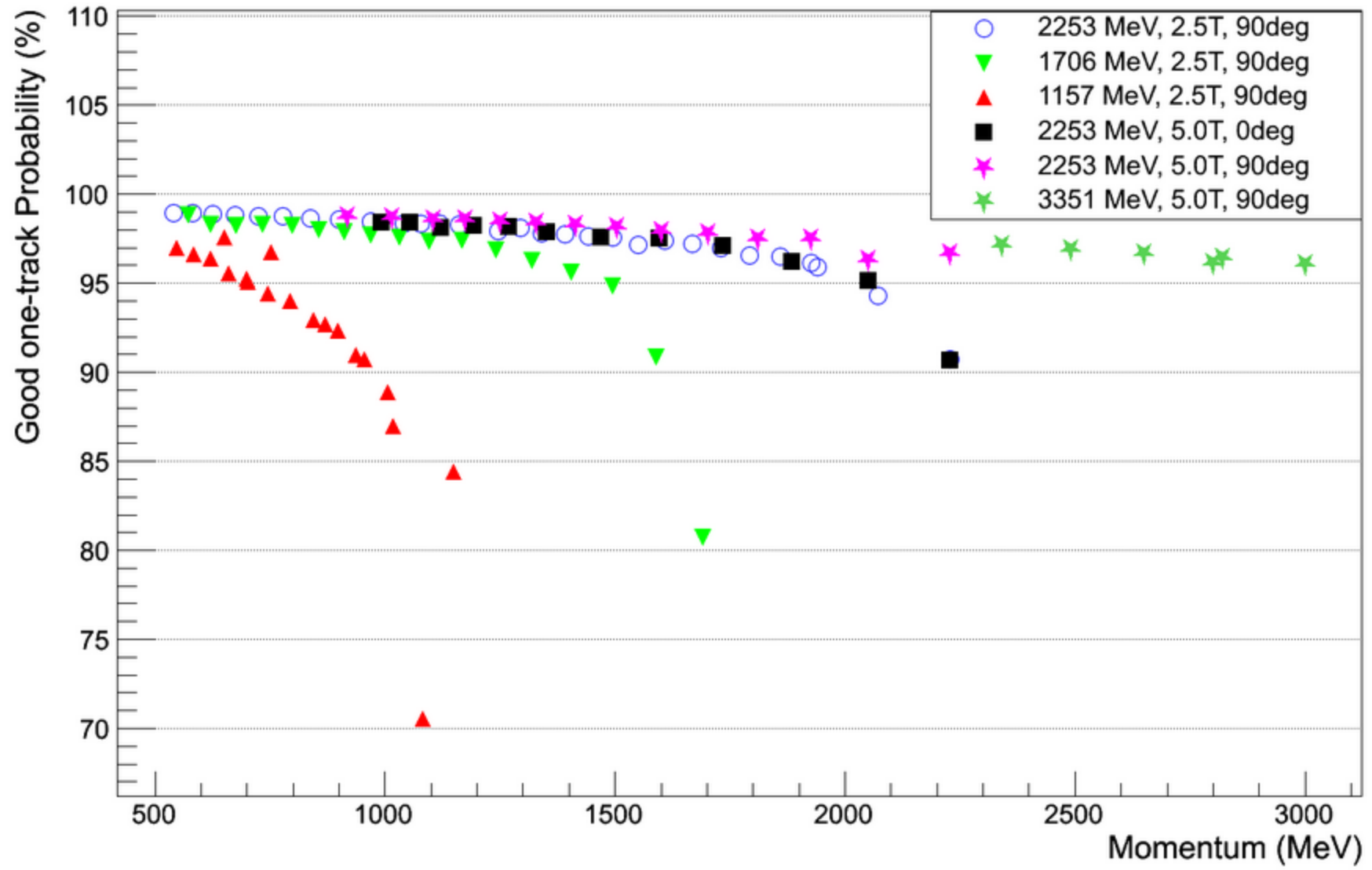
Multi-track efficiency

➤ Outline

- Review: VDC track efficiency up to 7-track events
- Now: systematic & statistic study

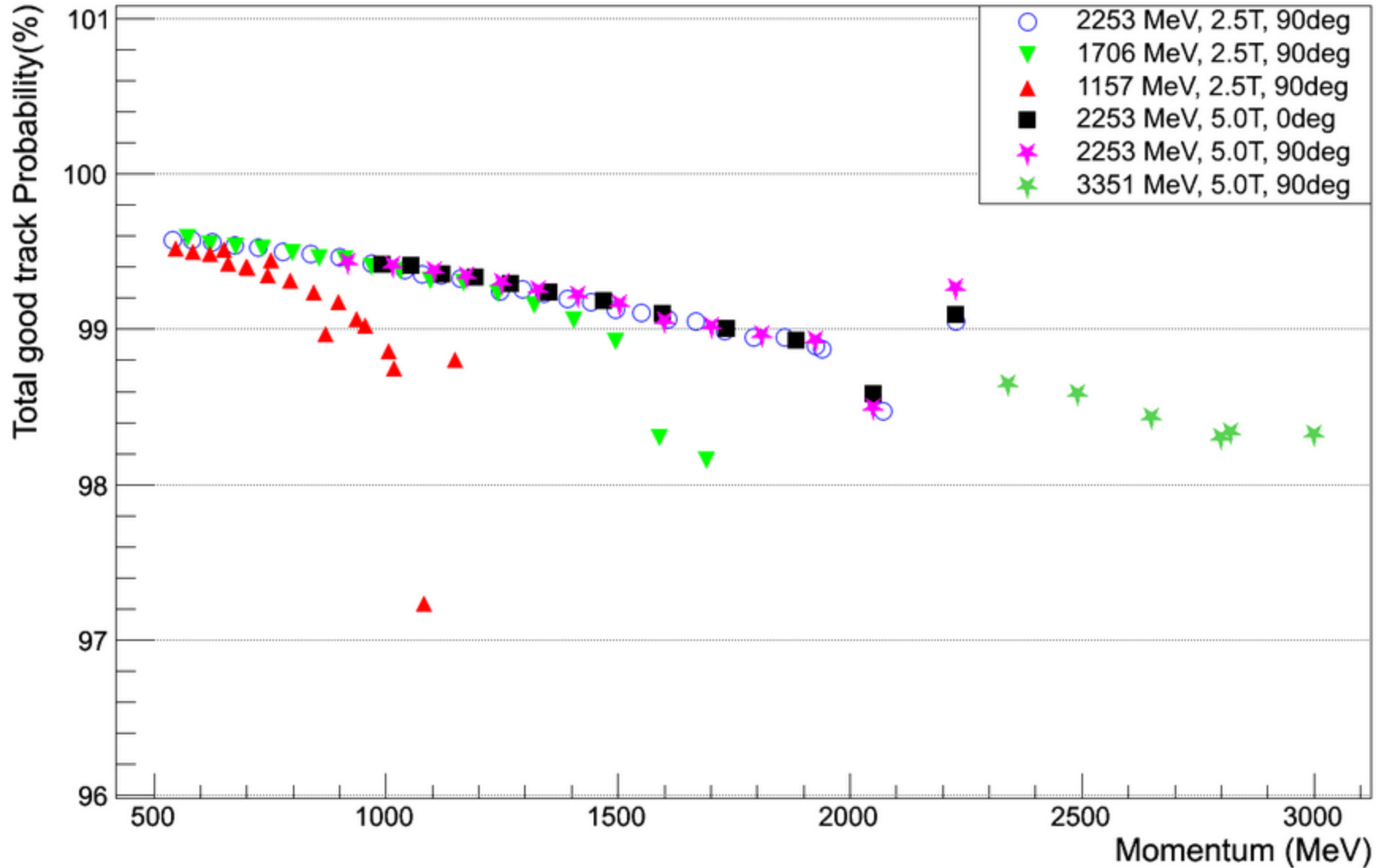
LHRS VDC efficiency (1 good)

Good one-track probability versus LHRS spectrometer momentum



LHRS VDC efficiency (1 & 2 & 3 & 4 & 5 & 6 & 7 good)

Total good tracks (one & two & three & four & five & six & seven tracks) probability versus LHRS spectrometer momentum



Settings: E=1157MeV P=809MeV

- Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T

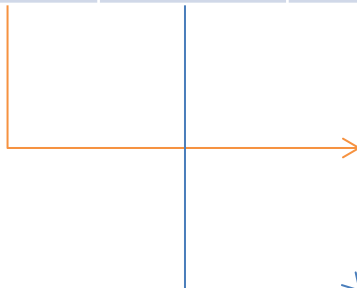
Number of tracks	0	1	2	3	4	5	6	7	More than 6
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003

- Not good multi-track probability, just track probability
- Analyze all the production runs in these momentum setting

Settings: E=1157MeV P=809MeV

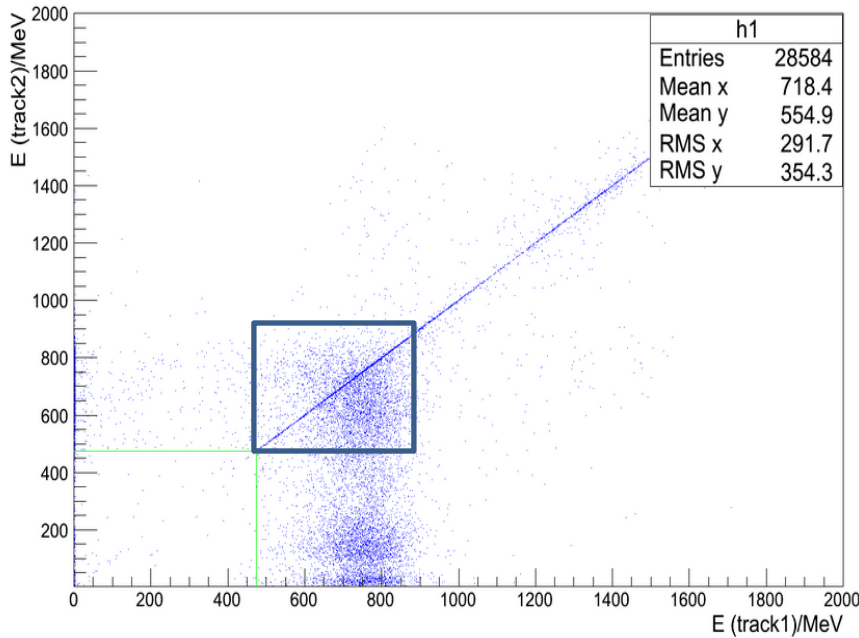
- Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	0	1	2	3	4	5	6	7	More than 7
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003

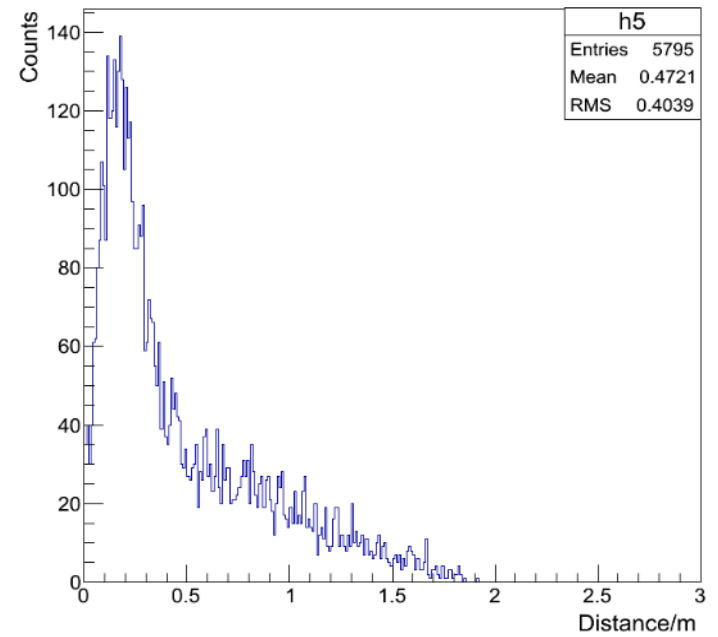
 **Zero track:** consider as inefficiency, put into uncertainty
 $0.00046(\text{sys.}) \pm 0.00004(\text{stat.})$

One track: uncertainty comes from statistic
 $0(\text{sys.}) \pm 0.0035(\text{stat.})$

E (track1) VS. E (track2) sample for p0=809.4MeV #5176

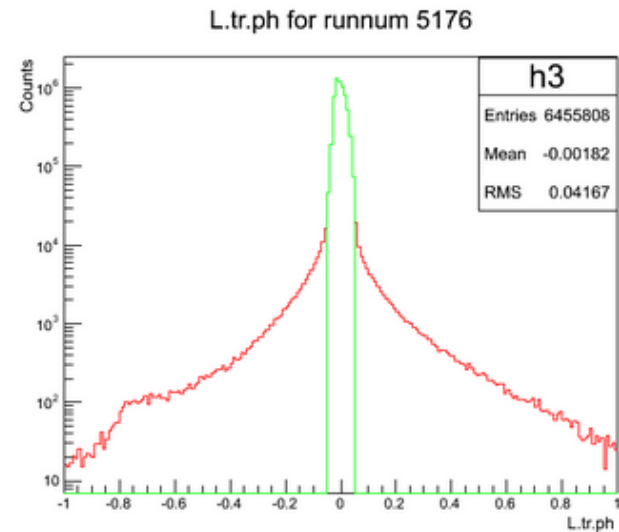
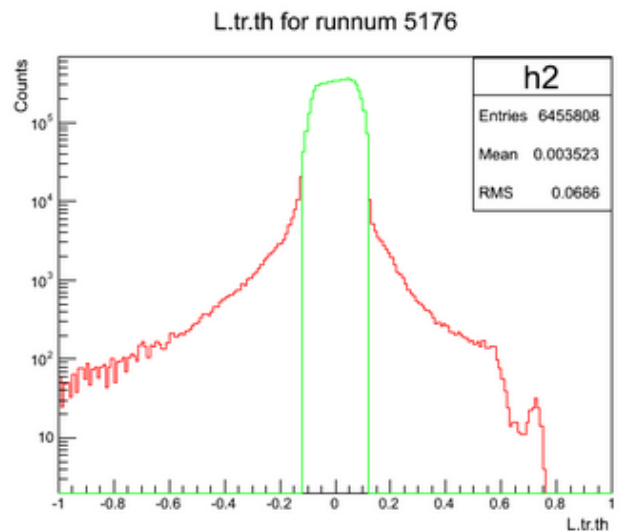
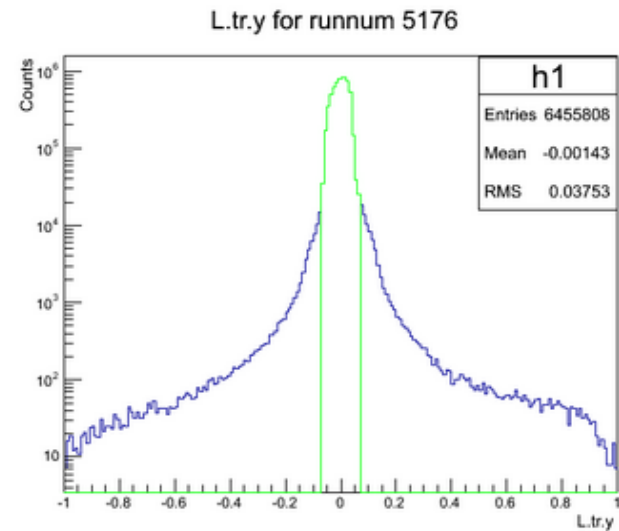
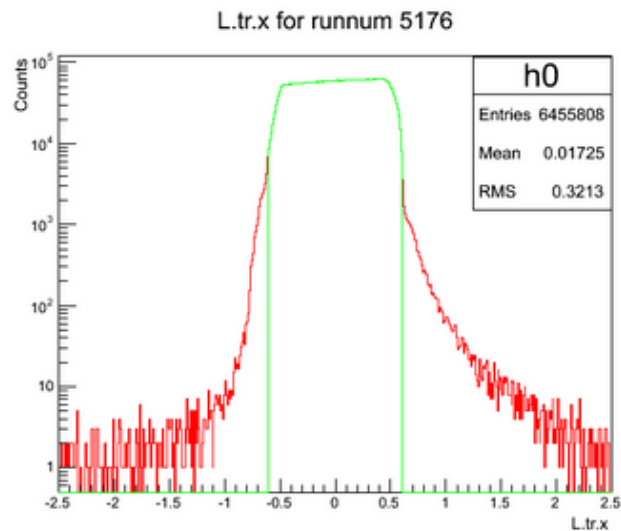


Distance distribution for E_track1~P,E_track2~P at pr1 for p0=809.4MeV #5176



- Consider two tracks are very close and within one block distance (14.5cm), put into uncertainty \longrightarrow **Method 1**

Method 2: Two tracks are close but at least one-track within acceptance cuts, can let the distance cut to be a little away (two blocks distance 29cm)



Settings: E=1157MeV P=809MeV

- Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	0	1	2	3	4	5	6	7	More than 7
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003



- These two methods applied to **two-track and three-track** events:
- Method1** uncertainty: $0.00304(\text{sys.}) \pm 0.00015(\text{stat.})$
- Method2** uncertainty: $0.00066(\text{sys.}) \pm 0.00007(\text{stat.})$

- **Four-Track** events distribution for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	E000	0E00	00E0	000E	0000	2E00	3E00	4E00
LHRS	0.51909	0.05124	0.03207	0.01725	0.23078	0.11614	0.02668	0.00675

- “2E00” means two tracks in the four-track events satisfy electron cut
- “3E00” means three tracks in the four-track events satisfy electron cut
- “4E00” means four tracks in the four-track events satisfy electron cut

- **Five-Track** events distribution for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	E0000	0E000	00E00	000E0	0000E	00000	2E000	3E000	4E000	5E000
LHRS	0.61118	0.04936	0.02101	0.01626	0.01125	0.18153	0.08983	0.01752	0.00178	0.00028

- **Six-Track** events distribution for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	E00000	0E0000	00E000	000E00	0000E0	00000E	000000	2E000	3E000	4E000	5E000	6E0000
LHRS	0.58563	0.05163	0.01767	0.01624	0.01535	0.00814	0.19175	0.09661	0.01483	0.00213	0	0

- **Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T**

Number of tracks	0	1	2	3	4	5	6	7	More than 7
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003



- If all the good track are within 2 blocks distance, count as uncertainty:
- **Four & five & six track** events uncertainty: $0.00054(sys.) \pm 0.00006(stat.)$

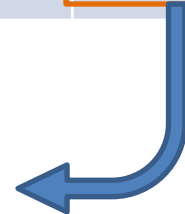
- Seven-Track events distribution for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	E000000	0E00000	00E0000	000E000	0000E00	00000E0	000000E	0000000	2E	3E	4E	5E	6E	7E
LHRS	0.59508	0.04916	0.01222	0.00683	0.01185	0.00941	0.00340	0.18779	0.11015	0.01596	0.00155	0	0	0

- Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	0	1	2	3	4	5	6	7	More than 7
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003

- If have more than one track satisfy electron cuts, count as uncertainty:
- **Seven track** events uncertainty: $0.000002(\text{sys.}) \pm 0.000004(\text{stat.})$

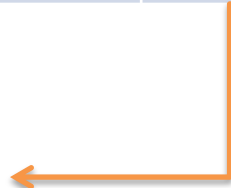


Settings: E=1157MeV P=809MeV

- Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	0	1	2	3	4	5	6	7	More than 7
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003

Unanalyzed track: consider as inefficiency, put into uncertainty
 $0.000003(\text{sys.}) \pm 0.000004(\text{stat.})$



Settings: E=1157MeV P=809MeV

- Track probability in electron sample for 1.157GeV, 0.809GeV, 2.5T

Number of tracks	0	1	2	3	4	5	6	7	More than 7
LHRS	0.000460	0.961542	0.031276	0.006062	0.000495	0.000126	0.000026	0.000010	0.000003

- Total Events Efficiency & uncertainty:**

- 99.4%(*eff*) \pm 0.4%(*sys.*) \pm 0.4%(*stat.*) Method1 used

- 99.4%(*eff*) \pm 0.2%(*sys.*) \pm 0.4%(*stat.*) Method2 used:

- The code was applied for all production runs. It is already running for several days.
- Together with the data quality check
- Expected to get all momentum settings output from ifarm in 3~4 days.