β^* Measurement at D0

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Luminosity Meeting

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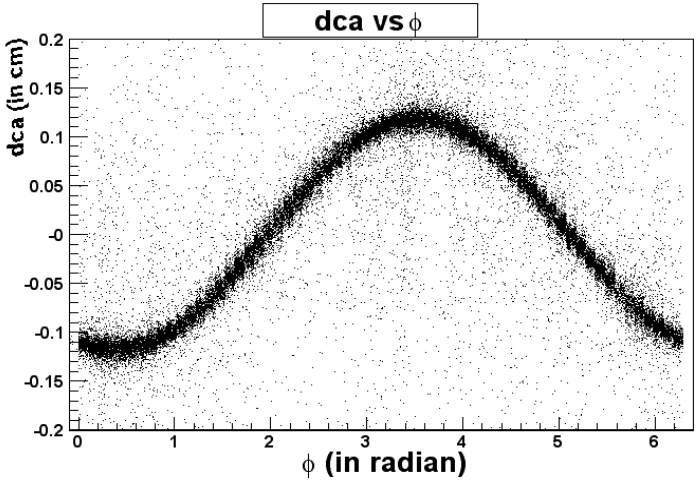
The Method

- Interaction region is from -40cm to +40cm on z-axis, dividing data in slices of 5 cm each on z-axis, total 16 division (say z-region)
- For each z-region, dca vs ϕ plot is of sinusoidal shape because of

$$dca = y_v \cos\phi - x_v \sin\phi$$



$$\langle d_1 d_2 \rangle = \tfrac{1}{2}\left(\sigma_2^2 - \sigma_1^2\right)\cos 2\Phi + \tfrac{1}{2}\left(\sigma_2^2 + \sigma_1^2\right)\cos\Delta\Phi - T\sin 2\Phi$$

where, σ_1 , σ_2 and T are parameters

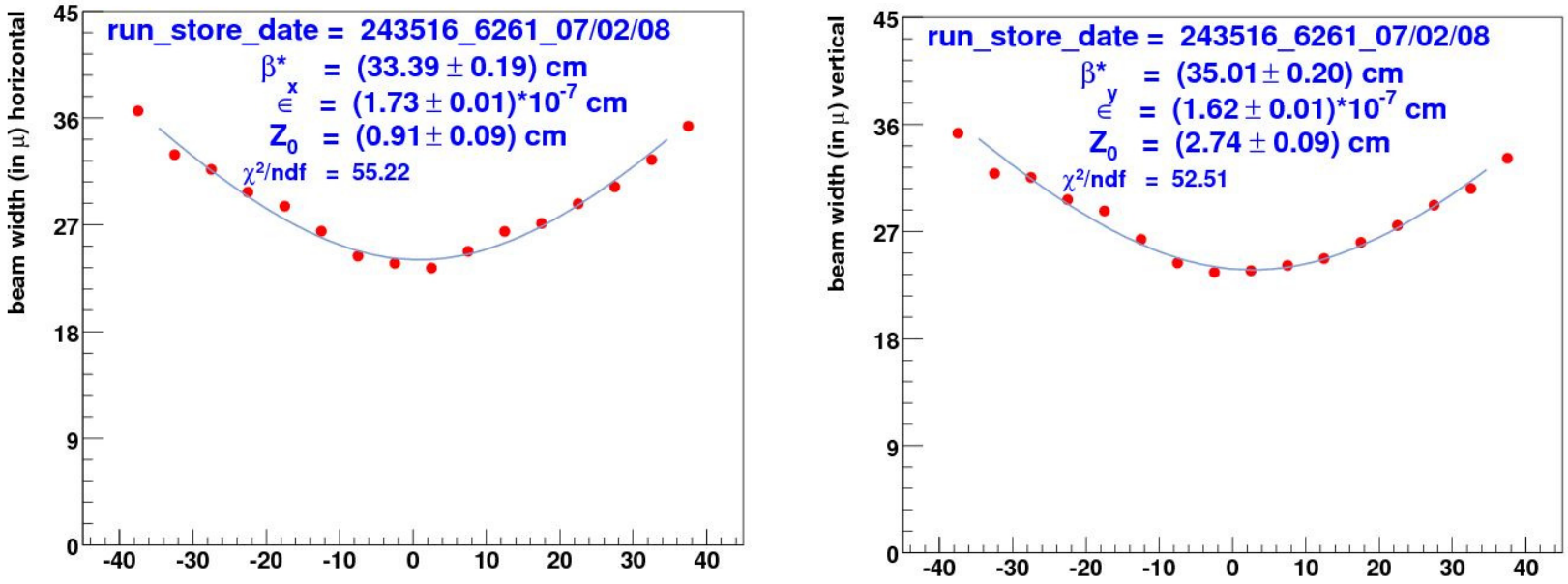
- x_v & y_v → (x, y) coordinate of the vertex
- d_1 & d_2 → impact parameter of two tracks from the same vertex
- σ_1 & σ_2 → beam width in horizontal and vertical plane
- T → correlation between σ_1 & σ_2

The interaction region is a drift in the Tevatron, z dependence of beam width given by following formula

$$\sigma^2 = \varepsilon_{eff}\left[\beta^* + \frac{(z - z_0)^2}{\beta^*}\right]$$

$\sigma_i \rightarrow \beta^*_i$

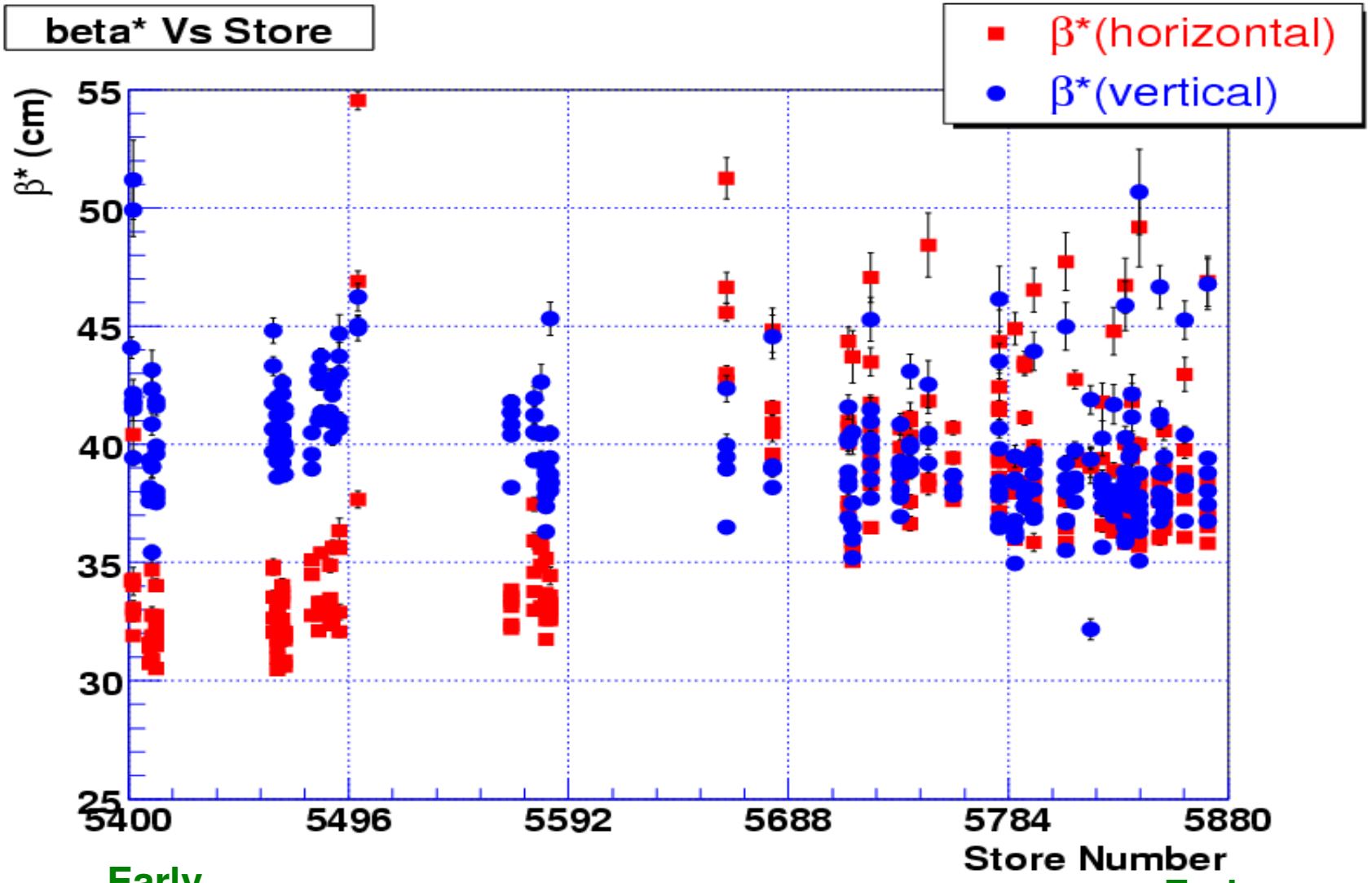
Red dots corresponds to beam width (in micron m)



Z-axis (cm)

$$\sigma^2 = \varepsilon_{eff}\left[\beta^* + \frac{(z - z_0)^2}{\beta^*}\right]$$

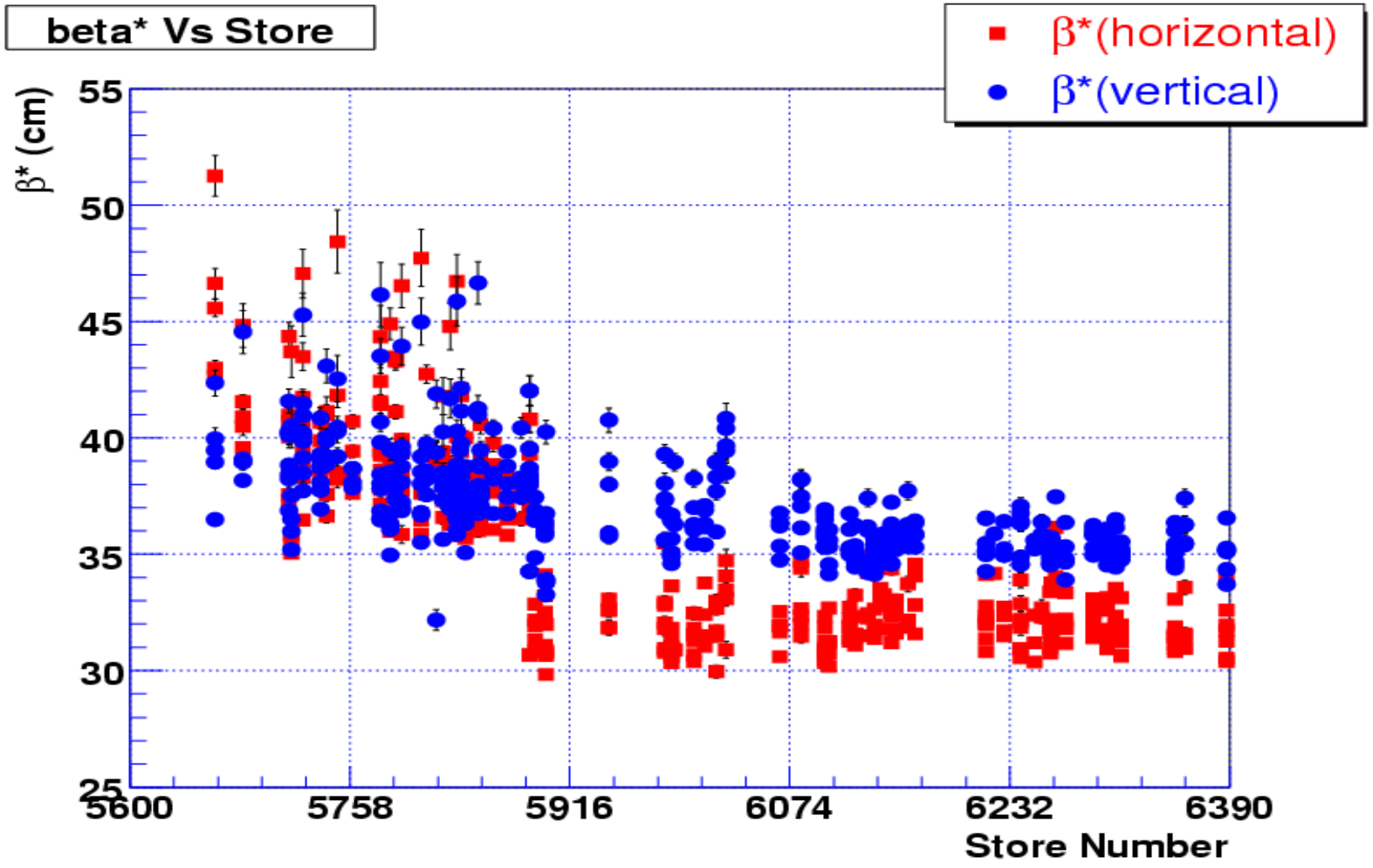
From last meeting



Early May'07

End Jan'08

β^* vs. recent stores

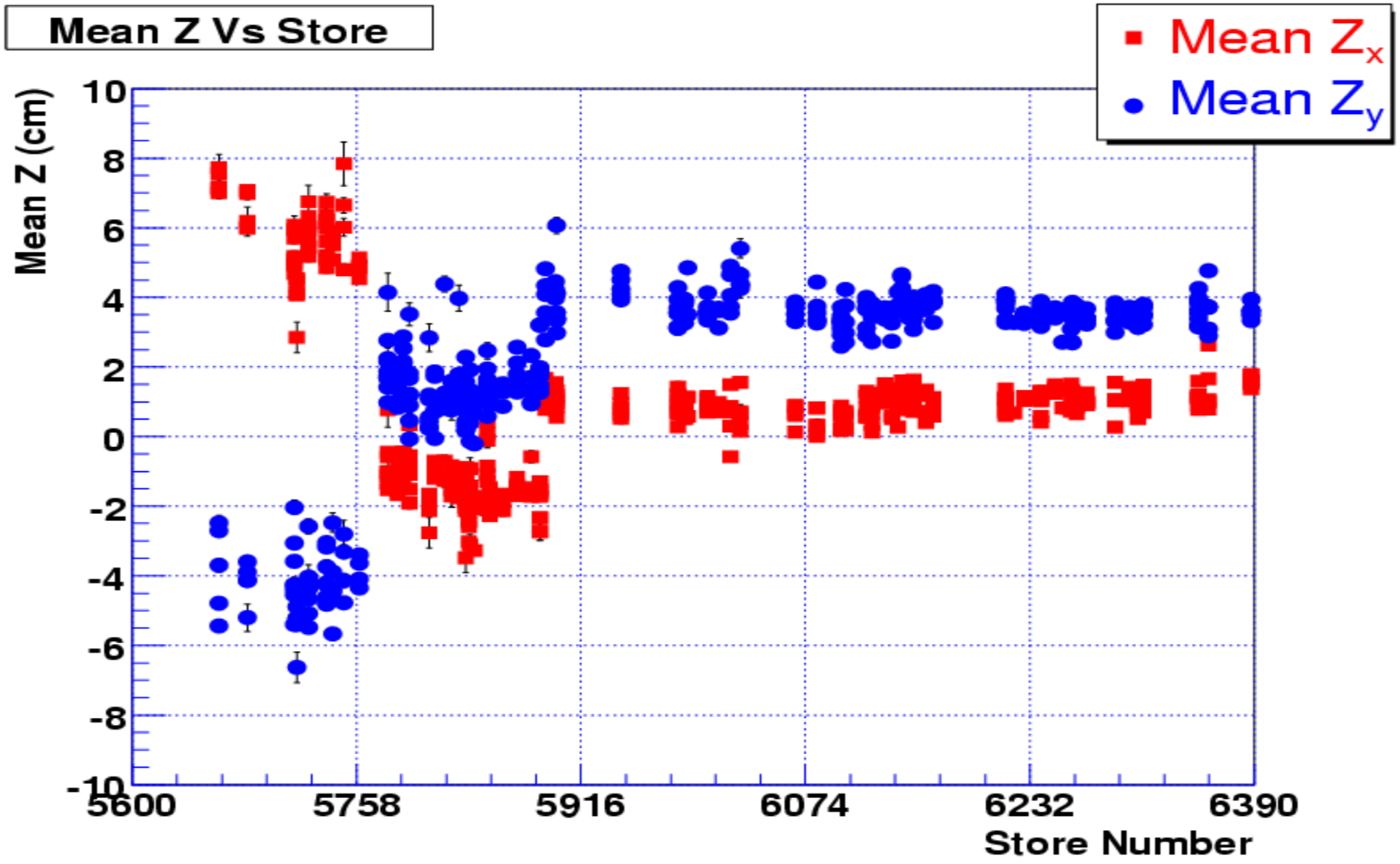


Early
Nov'07

Mid
Apr'08

End
Aug'08

Z_i vs. recent stores



Early
Nov'07

Mid
Apr'08

End
Aug'08

High luminosity stores

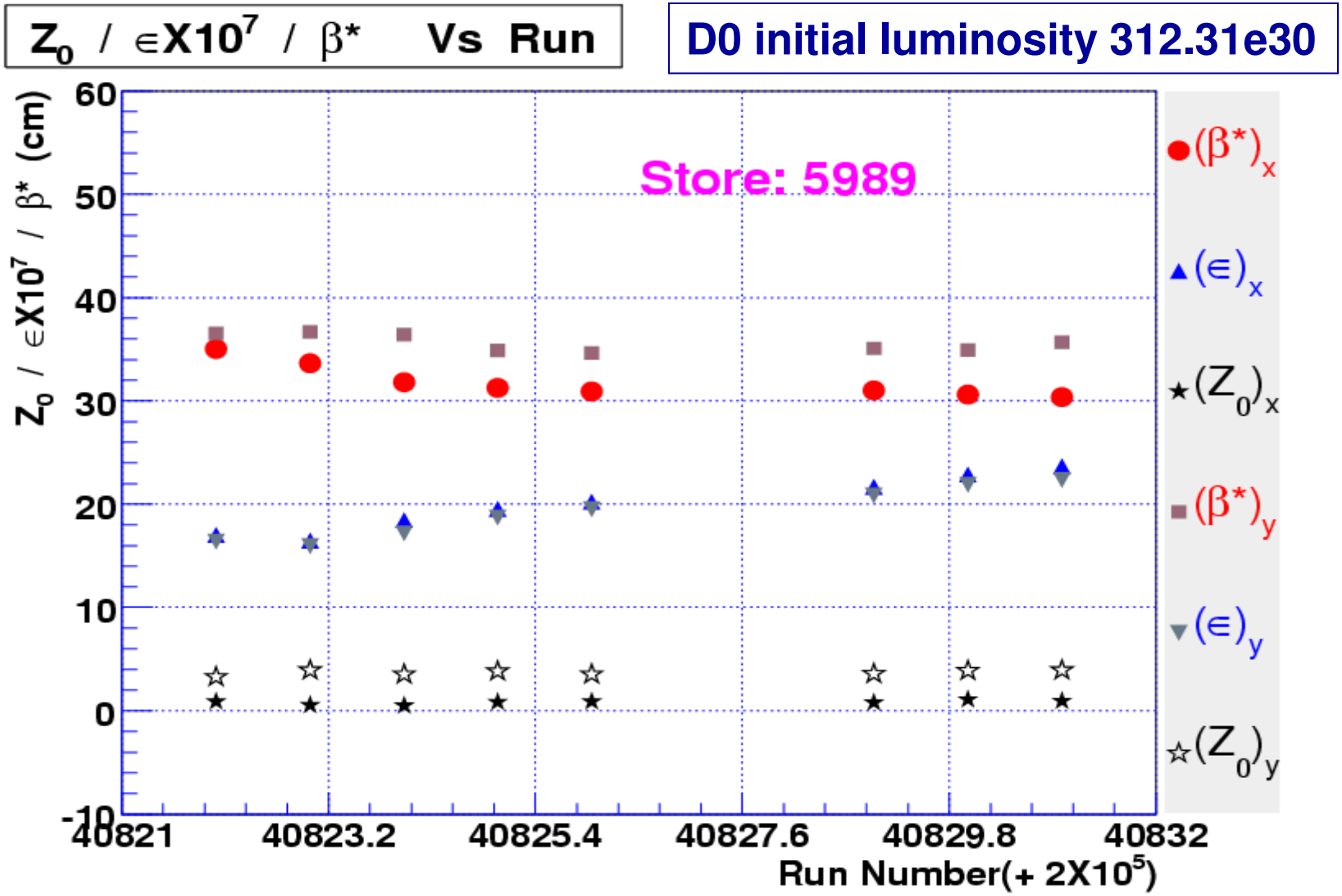
High luminosity store list was provided by Vaia
http://www-bd.fnal.gov/SDAMisc/new_supertableIV_top10ilum.html

# 0 Store	# 1 time started set up	# 2 time proton load	# 3 time pbar load	# 4 time HEP	# 5 date/ time end store	# 6 store length (hours)	# 7 how store ended	# 8 Comments.	# 9 Shot type	# 10 MCR CDF initial lum - default (1E30)	# 11 MCR D0 initial lum - default (1E30)
6266	07/05/2008 02:31:00	07/05/2008 03:44:06	07/05/2008 04:10:09	07/05/2008 04:55:02	07/05/2008 07:52:22	2.05	Abort	no comment yet	Rec. only	322.76	314.22
5989	03/17/2008 04:29:29	03/17/2008 04:58:58	03/17/2008 05:14:38	03/17/2008 06:03:56	03/18/2008 03:11:50	21.00	Not Completed	New Record Initial Luminosity of 315.55 1/ub	Rec. only	318.79	312.31
6265	07/04/2008 10:38:14	07/04/2008 11:17:14	07/04/2008 11:34:20	07/04/2008 12:15:39	07/05/2008 02:21:06	14.22	Normal	no comment yet	Rec. only	314.93	306.39
6299	07/15/2008 12:19:08	07/15/2008 12:58:38	07/15/2008 13:30:14	07/15/2008 14:14:34	07/16/2008 03:20:05	13.29	Normal	no comment yet	Rec. only	314.93	301.40
6261	07/02/2008 17:20:44	07/02/2008 17:48:50	07/02/2008 18:05:47	07/02/2008 18:48:52	07/03/2008 11:04:02	16.42	Normal	no comment yet	Rec. only	311.82	304.31
6367	08/18/2008 18:30:59	08/18/2008 19:13:12	08/18/2008 19:29:22	08/18/2008 20:16:49	08/19/2008 19:33:35	23.53	Normal	no comment yet	Rec. only	309.33	305.36
6262	07/03/2008 11:13:56	07/03/2008 12:00:01	07/03/2008 12:25:51	07/03/2008 13:08:10	07/04/2008 05:19:00	15.64	LowBetaQuench	no comment yet	Rec. only	312.13	302.08
6323	07/28/2008 17:31:00	07/28/2008 18:04:30	07/28/2008 18:18:39	07/28/2008 19:03:34	07/29/2008 09:53:56	15.02	Normal	no comment yet	Rec. only	312.41	298.99

Store 5989

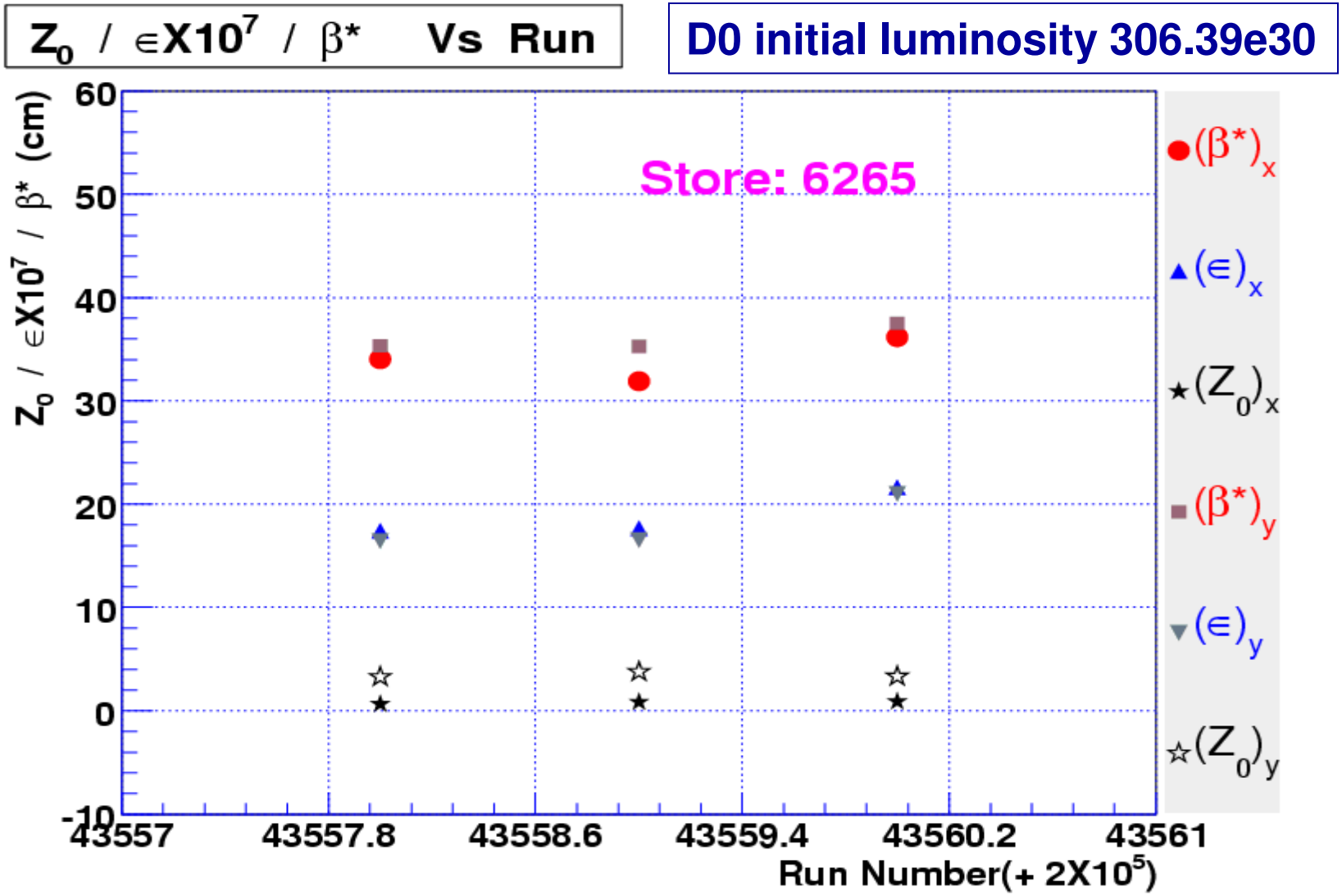
Mar 03, 08

D0 initial luminosity 312.31e30



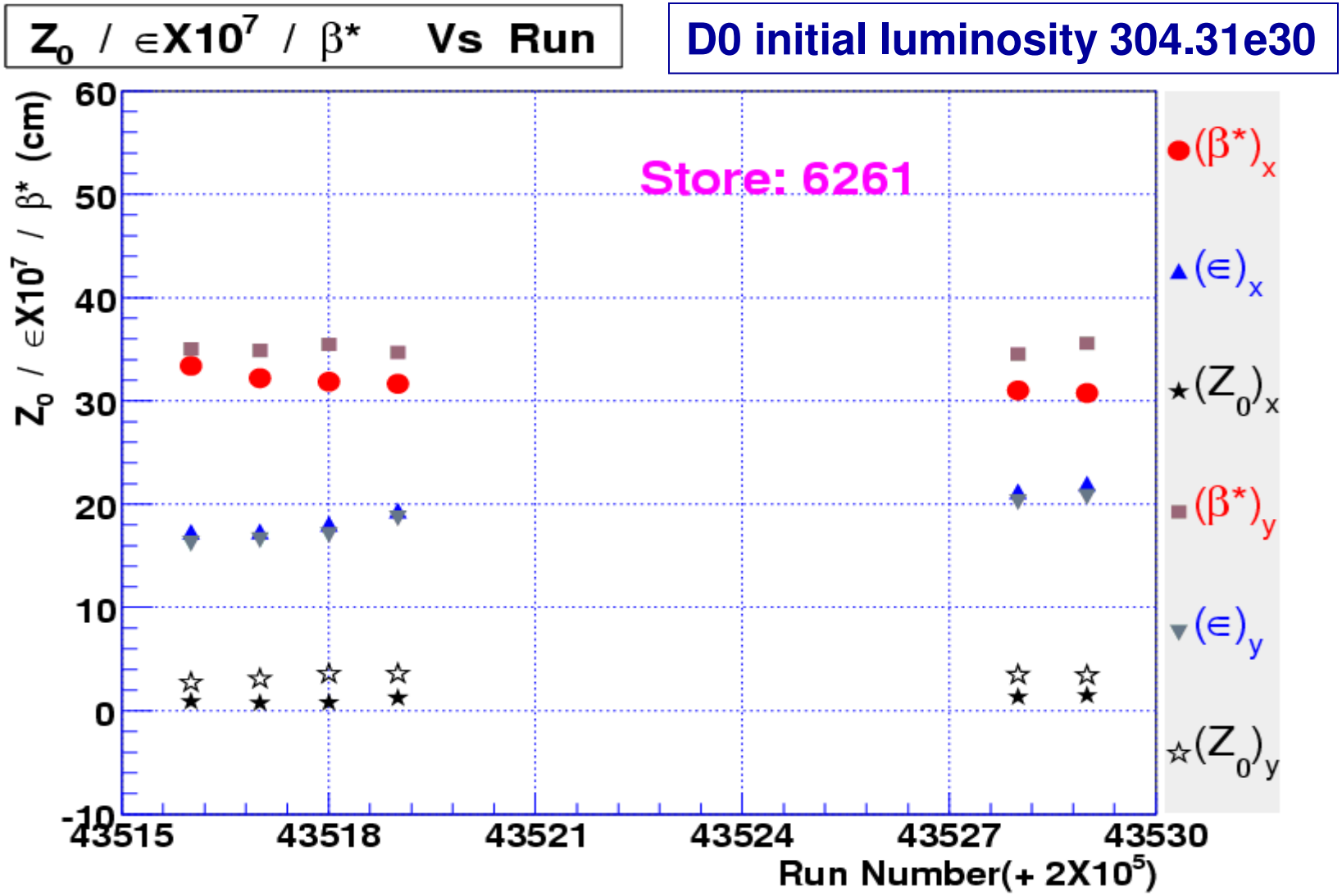
Store 6265

Jul 04, 08



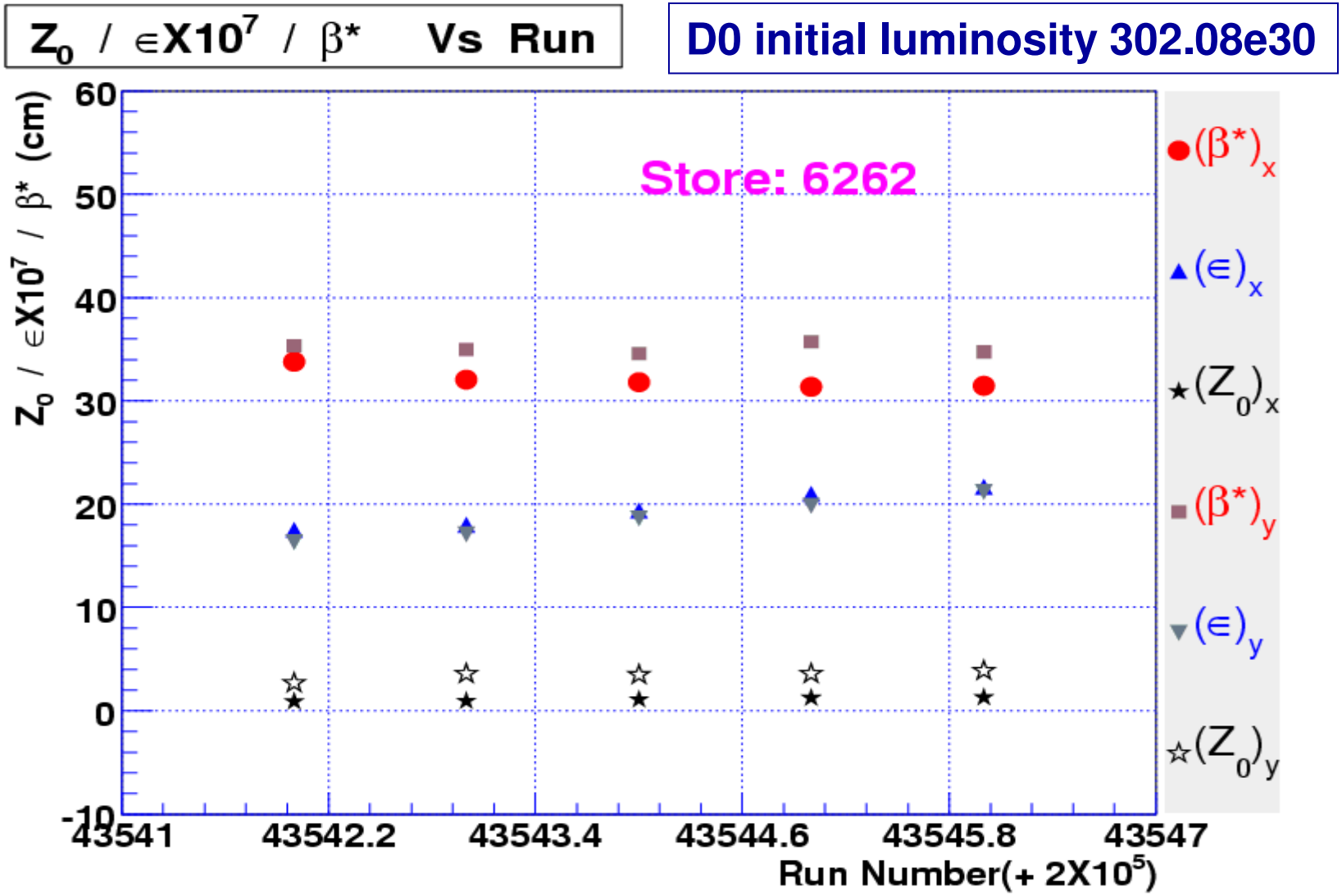
Store 6261

Jul 02, 08



Store 6262

Jul 03, 08



Summary

- Measurement shows that β^*_x and β^*_y not changed from last reported measurement.
- Mean Z_0 and beam position are near to 0 with some small fluctuation in Y-coordinate.
- The average value of β^*_x ~32cm and β^*_y ~36cm with some variations per store.
- Updated results are available at:

  http://www-clued0.fnal.gov/~avdhesh/Beam_main.html